A Synthesis of Simple Empirical Models to Predict Fish Yields in Tropical Lakes and Reservoirs

(R. 6178)

Database User Manual

Contents

Introduction

LAKESDB is a relational database for storing and extracting references and data concerning fisheries in lakes, reservoirs and coastal lagoons from Africa, Asia and Latin America. Data in the database is organised into seven primary data tables and one secondary summary table.

The seven primary data tables hold the following data (the figures in brackets detailing the number of entries in each table);

- References;   (440)
- Water Bodies;   (2481)
- Location and Morphology;   (3018)
- Hydrology and Climate;   (941)
- Chemical and Biological Features;   (1750)
- Fish and Fisheries;   (2754)
- Demography and Land Use;   (392)

The data in the primary tables above provide information on 2481 different water bodies, of which 526 are present in the summary table and have been used in the analysis.

A simple user interface is provided for users to add, view, edit and print selected references and associated data. As the potential users of the database are likely to undertake a wide variety of analyses on the data in the database there has been no attempt to build a complex data extraction facility into the application. To provide easy access to the data each of the data tables has been constructed using a standard dBase[1] format, which can be accessed from a wide variety of commercially available database and spreadsheet packages. The application providing the user interface to the database is written using R:BASE. (A copy of R:BASE RunTime is provided with the database)[2].

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[1]   dBase is a registered trademark of Borland Inc.

[2]   R:Base and R:Base RunTime are registered trademarks of Microrim Inc.

System Requirements

The database has the following requirements;

- An IBM PC or 100% compatible with at least an 80286 processor, (an 80386 or higher recommended);

- 640 K RAM with 465 K available for the database software. The database software can use expanded memory to a limit of 2 MB;

- A hard disk with approximately 10 MB available for the database software and data files, and a 3½" floppy disk drive for installing the software; (The database can be supplied on 5¼" floppy on request); NB: The amount of disk space required will depend on the amount of new data likely to be added.

- DOS 3.1 or later;

- CGA screen or better;

- A mouse or other pointing device may also be used for selecting menus.

Installation and Getting Started

The XTLDB database cannot be used from floppy drives; it must be installed onto a hard disk drive.

To install the database follow the simple instructions below;

1   Put the **Database Installation Disk** into a floppy drive and change to that drive (i.e. if your 3½" drive is drive A:, type A: [ENTER] and the A: prompt will appear.

2   Type INSTDB [ENTER] to start the database installation program.

3   The database installation program will copy the necessary files into a directory called LAKESDB on your hard disk.

4   The database installation program will then prompt you to insert the **Software**. Replace the **Database Installation Disk** with the **Software Installation Disk** in the a: drive.

5   Type INSTSOFT [ENTER] to start the software installation program.

6   When the installation is finished the installation program will return you to the A: prompt. The database is then ready for use.

7   To run the database is simple. Just change to the directory in which the database is stored by using the command CD C:\LAKESDB [ENTER] then type LAKESDB [ENTER]. After a few moments the main menu of the database will appear.

User Interface

The user interface for the XTLDB database has been designed using a combination of menus and forms for entering, editing and viewing data.

Menus

Three different types of menu have been used in this database, but the same principles apply to all three types. The active option in each menu is always highlighted. To change the active option use the up and down arrow keys [↑] & [↓], most menus will return you to the top of the menu list if you scroll off the bottom of the list and *vice versa*. To select the highlighted option press [ENTER]. If you have a mouse it is possible to change to an option by simply clicking the left mouse button whilst the cursor is over the required option. To select the option press the left mouse button again.

Other short-cuts are available on some menus. For instance the main menu is numbered 1 to 9. To select an option just press the required number. In the subsidiary menus pressing the first highlighted letter of the menu option will take you to that option. If more than one option starts with the same letter pressing the letter will take you to the next menu option starting with that letter.

In many of the forms POP-UP menus are available for some fields. These are accessed by pressing the [SHIFT] and [F3] keys simultaneously. Simply select the required option with the arrow keys and then press [ENTER], this value will then be entered into the appropriate field.

In all menus pressing the [ESC] key will abort the current menu and return you to the previous level. If you press the [ESC] key at the main menu, you will exit the database as if you had selected option '9 - EXIT'.

Forms

When you are entering or editing information in the database, the information is presented on the screen as a form with a menu bar on the top line and a status line on the bottom. The [ALT] key will move you to the menu bar, where you can select options using the arrow keys as for menus. Pressing the [ALT] key a second time will return you to the form. The menu bar can also be accessed by using the mouse, clicking the left mouse button over the appropriate option on the menu bar.

The menu options that will be available will differ depending on whether you are entering new data or browsing / editing previously entered data. When you are entering data the menu bar will contain the following options - **Add/Discard**, **Go To** and **Exit**. Under **Add/Discard** the following options will be available, **Discard Row** and **Add Row and Exit**. Selecting **Discard Row** will clear the form removing any data you have just entered; **Add Row and Exit** will save the current row to the database table and return you to the previous menu. The **Go To** option does not have any use whilst you are adding data. Selecting **Exit** will quit the form and return you to the previous menu without saving the data. When you are editing data there are the same three options as before. Under the **Add/Discard** option the following options will be available, **Add Row**, **Discard Row**, **Delete Row**, **Save Changes**, **Add Row and Exit**. All changes to the database should be saved using **Save Changes** before exiting the form, if modifications have been made and you attempt to EXIT then a message will appear prompting you whether or not you wish to save the changes that you have made.

The **Go To** menu option, has the following options, **Next Row** and **Previous Row**, (the **Next Section** / **Previous Section** options are not used in this application). These options will move you to the next / previous rows in the database. NB: **[F7]** and **[F8]** can be used as short cut keys for **Next Row** / **Previous Row** respectively.

To move between fields on a form press [ENTER] or [TAB] to move forward one field, [SHIFT][TAB] to move backward one field.

Often the forms will occupy more than one page. To move between the pages, use the [PgUp] and [PgDn] keys, or if you are on the last field of the current page press the [TAB] key to move to the next field, (conversely, if you are on the first field of the screen you can use [SHIFT]{TAB} to move back one page.

The Main Menu

Figure 1 shows the main database menu that you are presented with on starting the application. Each of the functions is described below.


```
┌─── Simple Empirical Models to Predict Yields in Tropical Lakes ───┐
│              (1)   References and Water Bodies                      │
│              (2)   Location and Morphology Data                     │
│              (3)   Hydrology and Climate Data                       │
│              (4)   Chemical and Biological Data                     │
│              (5)   Fisheries Data                                   │
│              (6)   Demographic Data                                 │
│              (7)   Summary Data                                     │
│              (8)   Database Utilities                               │
│              (9)   EXIT                                             │
└────────────────────────────────────────────────────────────────────┘

Database: xtldb
```
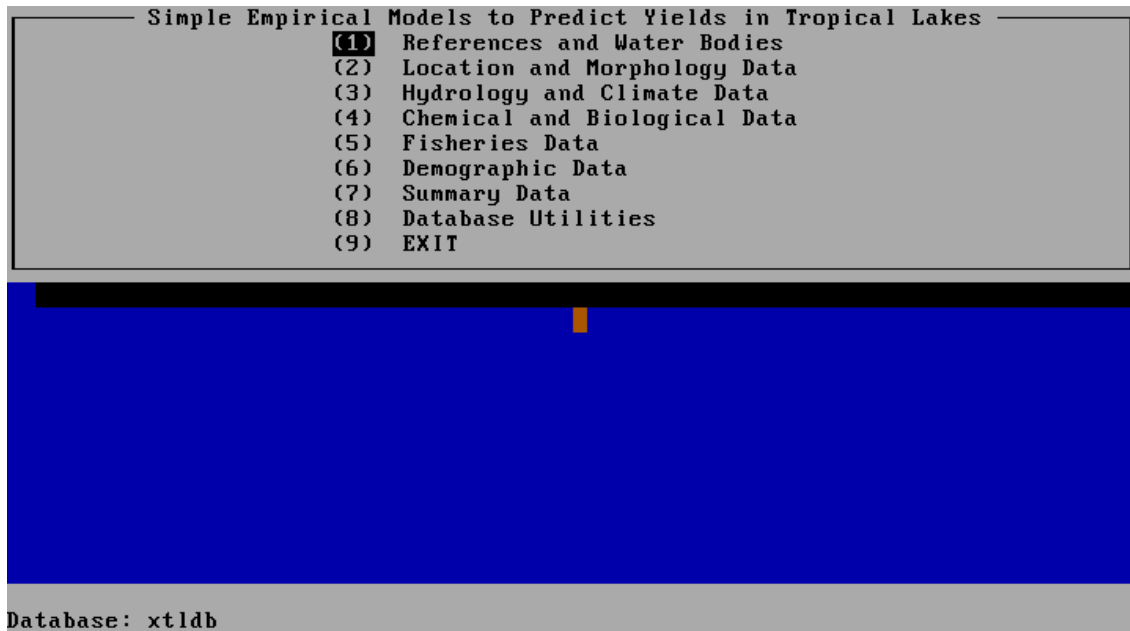
Figure 1   Screen Capture of the XTLDB database main menu screen

References and Water Bodies

This option allows the user to enter the key data that must be entered before any other data on a new reference or water body can be entered.

Selecting this menu option from the main menu will bring up the following options;

- **Add New Reference**

   This option will allow the user to enter a new reference into the database. The database will automatically allocate a unique reference number to each new reference added to the database. A description of each field can be found in Appendix I. NB: The main referencing field that is used is **ref_name**, which should have the general structure a follows;

Single Author	SURNAME1, YEAR
Two Authors	SURNAME1 & SURNAME2, YEAR
Three Authors	SURNAME1, SURNAME2 & SURNAME3, YEAR
More than three authors	SURNAME1 *et al.*, YEAR

   The user should check before entering a new reference that the reference has not previously been entered. This can be done through either **Edit All References** or **Browse References (Table)** described below.

- **Edit All References**

   This option brings up the reference form, and all the references currently stored in the database. These will be sorted alphabetically on the **ref_name** field, i.e. alphabetically on the surname of the first author.

   The references entry and editing screen can be seen in Figures 2 & 3.

- **Browse References (Table)**

   This option brings up the references table in a tabular form to allow easier browsing of the whole data set. An example of the browse screen for the references can be seen in Figure 4.

- **Add New Water Body**

   Selecting this option will allow the user to enter the name of a new water body. No other data apart from the name is required for this option. NB: The user should check using Edit Existing Water Bodies that the water body has not previously been entered.

- **Edit Existing Water Bodies**

   Selecting this option will bring up a form that will allow the user to modify any names of waterbodies that exist in the database. This should only be done to names that have previously been entered with spelling mistakes, and those names of waterbodies already in the database should not be altered.

Figure 2   Screen Capture showing the reference entry and editing screen (page 1)

Figure 3   Screen Capture showing the reference entry and editing screen (page 2)

Figure 4 **Screen capture showing the screen format displayed when the Browse References option is selected**

Entering and Editing Other Primary Data

Selecting any of the five options for the primary data tables (excluding references & water bodies), will bring up a standard menu. This menu has two options **Add New Reference** and **Edit Existing References**.

On selecting the Add New References option the user will bring onto the screen the appropriate form for the data table selected. The user will then be presented with a list of all the water bodies in the database and should choose the appropriate one. After choosing the water body to which the data applies the user should then choose a reference from a similar list. (NB: The water body name and reference should have been entered previously.) The user can then enter the appropriate data.

Each of the data entry and editing forms accessible through options 2 to 6, are shown on the following pages. Also within each section is a list of the fields for which pop-up menus are available (press <SHIFT><F3> to bring up the pop-up menu).

Location and Morphology Data

List of Pop-Up Menus

The only pop-up menu available for this form is for Water Body type. Pressing <SHIFT><F3> will bring up a menu listing all the water body types that have already been used in the database. If however you feel that the water body does not fit into one of these types, simply press <ESC> to return you to the form without selecting any option and then type the water body type in the field directly.

```
 Edit  Go to  Exit

        Location and Morphology Data Entry and Editing Screen    Page 1/3

 Water Body : Aba River

 Reference  : Vanden Bossche & Bernacsek, 1990b

 Location Data

 Country    : Nigeria              International :     0

 Altitude   :             m AMSL   Source Year   :

 Latitude   :                      Longitude     :

 Morphological Data

 Area       : Mean Surface Area   : 0.01        km²
              Area for Nigeria    : 0.01        km²
              Area (Minimum)      :             km²
              Area (Maximum)      :             km²


 Form: morpholo   Table: morpholo          Field: COUNTRY          Page: 1
```

Figure 5   **Screen capture showing the data entry and editing screen for location and morphology data (page 1).**

Figure 6 Screen capture showing the data entry and editing screen for location and morphology data (page 2).

Figure 7 Screen capture showing the data entry and editing form for location and morphology data (page 3).

Hydrology and Climate Data

List of Pop-Up Menus

The only pop-up menu available for this form is for stratification classes. Pressing <SHIFT><F3> will bring up a menu listing all the stratification classes that have already been used in the database. If however you feel that the water body does not fit into one of these types, simply press <ESC> to return you to the form without selecting any option and then type the water body type in the field directly.

```
 Edit  Go to  Exit

       Hydrology and Climate Data Entry and Editing Form      Page 1/1

 Water Body : Abaya

 Reference  : Kebede et al., 1994

 Country    : Ethiopia                   Source Year :

 Temperature : Annual Mean    :     °C  Stratification : Type    :
               Annual Minimum :     °C                   Period  :
               Annual Maximum :     °C                   Start   :
                                                         End     :
                                                         Depth   :          m
 Rainfall    : Year (s)           :
               Annual Mean        : 1000.    mm
               Wet Season Start :       End :      Duration :      months
 Mean Residence Time             :          months

 Notes       :


Form: hydrolog   Table: hydrolog              Field: COUNTRY           Page: 1
```

Figure 8   **Screen capture showing the data entry and editing form for climatic and hydrological data**

Chemical and Biological Data

List of Pop-Up Menus

The only pop-up menu available for this form is for the dominant phytoplankton type ot types in the water body. Pressing <SHIFT><F3> will bring up a menu listing all the entries of dominant phytoplankton types that have already been used in the database.

```
 Edit  Go to  Exit
┌──────────────────────────────────────────────────────────────────────┐
│     Chemical and Biological Features Data Entry and Editing Form   Page 1/3 │
│  Water Body  : Abaya                                                    │
│                                                                        │
│  Reference   : Kebede et al., 1994                                     │
│                                                                        │
│  Chemical Data                                                         │
│                                                                        │
│  Country     : Ethiopia             Source Year    : 1991.00           │
│                                                                        │
│  TDS         :            mg/l      Conductivity    : 925.   µS/cm @ 25°C │
│                                                                        │
│  Salinity    : Low :         High :                                    │
│                                                                        │
│  pH          : 8.65                 Alkalinity      : 9.37   meq/l      │
│                                                                        │
│  Phosphorous : 237.       µg/l      Nitrogen        :        µg/l       │
│                                                                        │
│  Secchi Disk : 0.43 Transparency (m) Suspended Solids :        mg/l     │
│                                                                        │
└──────────────────────────────────────────────────────────────────────┘
Form: chembiol   Table: chembiol          Field: S_SOLIDS          Page: 1
```

Figure 9   Screen capture of the data entry and editing screen for Chemical and Biological data (page 1)

```
 Edit  Go to  Exit
┌──────────────────────────────────────────────────────────────────────┐
│     Chemical and Biological Data Entry and Editing Form        Page 2/3 │
│  Water Body  : Abaya                                                    │
│                                                                        │
│  Reference   : Kebede et al., 1994                                     │
│                                                                        │
│  Biological Data                                                       │
│                                                                        │
│  Chlorophyll a Conc.          : 5.         µg/l                         │
│  No. months Chl. a measured   : 1.         months                      │
│  Area Chlorophyll a           :            mg/m²                        │
│                                                                        │
│  Dominant phytoplankton       :                                        │
│  Macrophyte biomass           :            g dwt/m²                     │
│  Periphyton / benthic biomass :            g dwt/m²                     │
│                                                                        │
│  Gross photosynthesis         :            g Oxygen /m²/y               │
│  Net phytonplankton production :           g C /m²/y                    │
│  Macropyhte production        :            g C /m²/y                    │
│  Periphyton & benthic production :         g C /m²/y                    │
│                                                                        │
└──────────────────────────────────────────────────────────────────────┘
Form: chembiol   Table: chembiol          Field: SURF_CHL          Page: 2
```

Figure 10   Screen capture of the data entry and editing screen for Chemical and Biological data (page 2)

```
  Edit  Go to  Exit
┌──────────────────────────────────────────────────────────────────┐
│      Chemical and Biological Data Entry and Editing Form  Page 3/3 │
├──────────────────────────────────────────────────────────────────┤
│ Water Body  : Abaya                                                │
│                                                                    │
│ Reference   : Kebede et al., 1994                                  │
├──────────────────────────────────────────────────────────────────┤
│ Biological Data cont.                                              │
│                                                                    │
│ Zooplankton biomass          :  ▭▭▭▭▭▭▭  g dwt /m²                 │
│ Zooplankton production       :            g dwt /m²/y              │
│                                       ▐                            │
│ Macrozoobenthos biomass      :            g dwt /m²                │
│ Macrozoobenthos production   :            g dwt /m²/y              │
├──────────────────────────────────────────────────────────────────┤
│ Notes : Stable colloidal silt suspension impart high turbidity     │
│                                                                    │
│                                                                    │
│                                                                    │
└──────────────────────────────────────────────────────────────────┘
 Form: chembiol   Table: chembiol          Field: ZOO_BIOM      Page: 3
```

Figure 11   **Screen capture of the data entry and editing screen for Chemical and Biological data (page 3)**

Fisheries Data

List of Pop-Up Menus

Three pop-up menus are available for the fisheries data entry and editing form. The fields are boat type on page 1 and origin of the fishery and fish type (main type of fish exploited by the fishery), on page 2.

```
 Edit  Go to  Exit

        Fisheries Data Entry and Editing Form          Page 1/2

  Water Body :  Abaya

  Reference  :  Vanden Bossche & Bernacsek, 1991

  Country    :  Ethiopia              International :      0

  Source Year : 1975.00        Biomass      :
  Catch       :                Production   :
  Fishermen   : 250.           Stocking     :
  No.of Boats : 100.           Aquaculture  :
  Boat Type   :

  Fishery Type:

  No. of Spp. : 25.
  Catch Spp.  :
  Intro. Spp. :
  Year Intro. :

Form: fisherie   Table: fisherie          Field: COUNTRY          Page: 1
```

Figure 12   Screen capture of the data entry and editing screen for Fisheries data (page 1)

```
  Edit  Go to  Exit

        Fisheries Data Entry and Editing Form          Page 2/2

  Water Body :  Abaya

  Reference  :  Vanden Bossche & Bernacsek, 1991

  Origin    :
  Fish Type :

  Catch Composition

  Detritivores      :
  Phytophagous      :
  Zooplankivourous  :
  Piscivorous       :

  Notes     :  probably under-fished, potential for much greater level of
               exploitation

Form: fisherie   Table: fisherie          Field: ORIGIN_F          Page: 2
```

Figure 13   Screen capture of the data entry and editing screen for Fisheries data (page 2)

Demographic Data

List of Pop-Up Menus

The only pop-up menus available for this form are for water use type and pollution type both on page 2 of the form.

```
  Edit   Go to   Exit

          Demographic & Land Use Data Editing Form       Page 1/2

   Water Body : Albert Falls

   Reference  : Archibald et al., 1980a

   Country    : South Africa            Source Year : 1967.

   Catchment Population     : 20000.
   Fishing Population       :
   Population in 1° industry :          █
   Urban Population         :
   Per Capita Fish consumption :              kg ww /y

   Land Use Rainforest :         %   Mountain   :           %
            Forest     :         %   Arable     : 50.       %
            Scrub      : 15.     %   Pasture    : 10.       %
            Grass      : 10.     %   Plantation : 10.       %
            Swamp      :         %   Urban      : 5.        %
            Desert     :         %

 Form: demograp   Table: demograp        Field: COUNTRY        Page: 1
```

Figure 14   **Screen capture of the data entry and editing screen for Demographic and Land Use data (page 1)**

```
  Edit   Go to   Exit

          Demographic & Land Use Data Editing Form       Page 2/2

   Water Body : Albert Falls

   Reference  : Archibald et al., 1980a

   Water Use  :              m^3/y
        Type  : Domestic/Recreation

   Pollution  : 0.
        Type  :                          █

   Notes      : % land use estimated from general statements in text.  Diverse
                agriculture including sugar-cane and forestry plantations.

 Form: demograp   Table: demograp        Field: W_USE         Page: 2
```

Figure 15   **Screen capture of the data entry and editing screen for Demographic and Land Use data (page 2)**

Entry and Editing of Summary Data

The entry and editing of summary data for a particular water body is....

List of Pop-Up Menus

Pop-up menus available in the summary form are as described in the individual data forms. They are as follows; Water body type, Stratification type, Dominant Phytoplankton, Boat Type, Fishery Type, Origin of the fishery, Dominant fish types, Water use type and Pollution type.

```
 Edit  Go to  Exit

            Summary Information Table Editing Form        Page 1/3

 Water Body : Abaya                                       6

 Location & Morphology              Hydrology & Climate

 Continent  : AFRICA                Mean Temp.    : 25.       °C
 Type       : Lake                  Min. Temp.    : 22.       °C
 Country    : Ethiopia              Max. Temp.    : 28.       °C
 Altitude   : 1285.        m        Stratification :
 Latitude   : 06°19'N              Days Mixed    :           days
 Area       : 1162.       km²       Mixing Depth  :           m
 Shoreline  : 225.        km        Rainfall (Mean): 1000.    mm/y
 Max. Depth : 13.         m         Rain Duration :           months
 Mean Depth : 7.1         m         Residence Time :          months
 Depth Fluc.:             m
 Volume     :             m^3
 Catchment  : 17300.      km²
 Const. Date:
 Perm. Open :


 Form: secondar   Table: SECONDAR        Field: CONTINEN       Page: 1
```

Figure 16   Screen capture of the data entry and editing screen for the summary data (page 1)

```
 Edit  Go to  Exit

            Summary Information Table Editing Form        Page 2/3

 Water Body : Abaya                                       6

 Chemical Features                  Biological Features

 TDS                : 517.   mg/l   Surface Chl.a : 37.       µg/l
 Conductivity       : 925.2  µS/cm  Area Chl.a    :           mg/m²
 pH                 : 8.82          Dom. Phytop.  : Cyanophyta
 Alkalinity         : 8.44   meq/l  Macro. Biomass:           g dwt/m²
 Phosphorus         : 272.33 µg/l   Peri. Biomass :           g dwt/m²
 Nitrogen           : 650.   µg/l   Gross Photosy.:           g O2/m²/y
 Secchi disk trans.: 0.43    m      Net.Phyt.Prod.:           g C/m²/y
 Suspended Solids   :        mg/l   Macro. Prod.  :           g C/m²/y
                                    Peri.  Prod.  :           g C/m²/y
                                    Zoopl. Biomass:           g dwt/m²
                                    Zoopl. Prod.  :           g dwt/m²/y
                                    Benth. Biomass:           g dwt/m²
                                    Benth. Prod.  :           g dwt/m²/y


 Form: secondar   Table: SECONDAR        Field: TDS            Page: 2
```

Figure 17   Screen capture of the data entry and editing screen for the summary data (page 2)

```
 Edit  Go to  Exit
┌──────────────────────────────────────────────────────────────────────┐
│         Summary Information Table Editing Form        Page 3/3         │
│──────────────────────────────────────────────────────────────────────│
│  Water Body : Abaya                                          6         │
│──────────────────────────────────────────────────────────────────────│
│  Fisheries Data                  Demographic Data                     │
│  Catch          : 128.    mt ww/y  Catchment Population :             │
│  No. Fishers    : 250.             Fishing Population   :             │
│  No. Boats      : 100.             No. in 1° Industry   :             │
│  Boat Type      :                  Urban               :             │
│  Fish Biomass   :         kg/ha    Per Capita Fish Cons.:      kg/y   │
│  Fish Production :        kg/ha/y  Land Use (Percentages)            │
│  Stocking       :                     Forest          :             │
│  Aquaculture    :                     Savannah        :             │
│  Fishery Type   :                     Mountain/Desert:             │
│  No. Species    : 25.                 Arable          :             │
│  Catch Species  :                     Urban           :             │
│  Intro. Species :                  Water Use          :      m^3/y   │
│  Origin Fishery :                  Water Use Type     :             │
│  Fish Types     :                  Pollution          :             │
│  Trophic Level  :                  Pollution Type     :             │
└──────────────────────────────────────────────────────────────────────┘
 Form: secondar   Table: SECONDAR          Field: CATCH          Page: 3
```

Figure 18   Screen capture of the data entry and editing screen for the summary data (page 3)

Database Utilities

Under this menu option two options are available.

The first option, '**About this database**' brings up a screen (see Figure 19), detailing the current number of entries in each of the database tables.
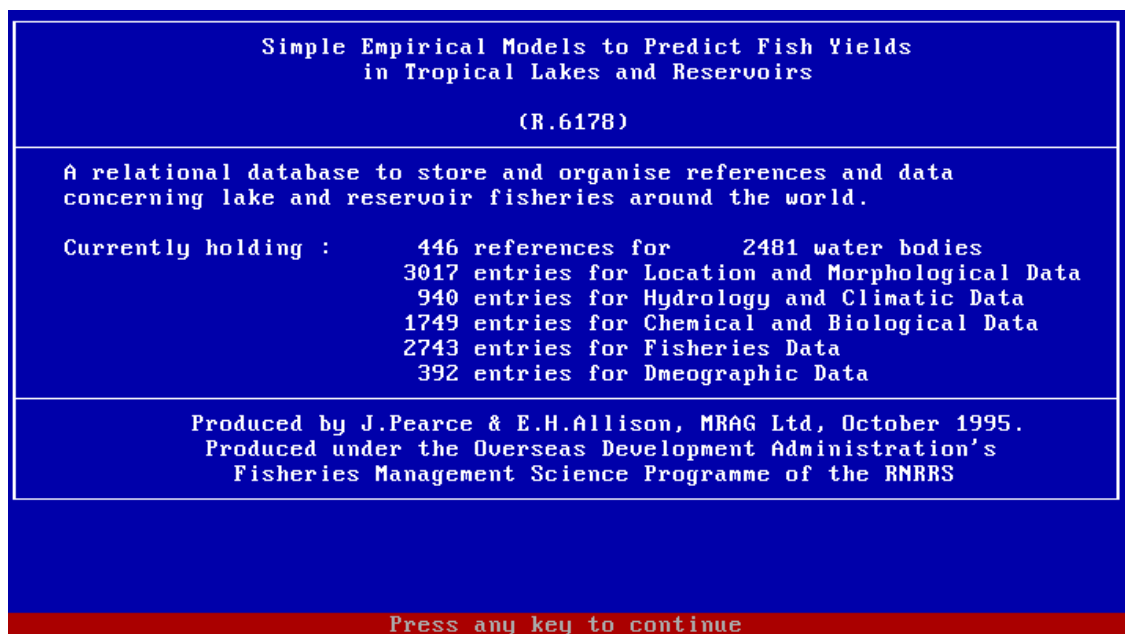


```
          Simple Empirical Models to Predict Fish Yields
                   in Tropical Lakes and Reservoirs

                            (R.6178)

     A relational database to store and organise references and data
     concerning lake and reservoir fisheries around the world.

     Currently holding :      446 references for     2481 water bodies
                             3017 entries for Location and Morphological Data
                              940 entries for Hydrology and Climatic Data
                             1749 entries for Chemical and Biological Data
                             2743 entries for Fisheries Data
                              392 entries for Dmeographic Data

               Produced by J.Pearce & E.H.Allison, MRAG Ltd, October 1995.
                Produced under the Overseas Development Administration's
                 Fisheries Management Science Programme of the RNRRS


                          Press any key to continue
```

Figure 19   **Screen capture of the database "About Screen" showing information on the current level of storage for each data table in the database**

The second option, '**Run Database Checking Utility**' runs a short subroutine that checks the internal integrity of the database. This routine should only take a few minutes to run. It is **very important** that while this routine is running that the computer is **not interrupted**, i.e. do not press <CTRL><ALT><DEL> or attempt to break into the routine with either <CTRL><C> or <CTRL><BREAK>. If there are no problems with the database structure then the application will prompt the user to press any key to continue. If problems appear the user will be prompted to contact MRAG immediately.

Database Backups

If new data is to be entered into the database it is advised that regular backups of the data tables (*.DBF) are made. It is advised that you do not overwrite the original diskette supplied as this can be used to recreate the original database if need arises.

Appendix 1 - Entity Relationship Diagram

The XTLDB database is a simple relational database with relatively few tables. The entity - relationship diagram in Figure 20 shows the relationships between the data tables along with the key fields for each of the tables.

Figure 20   Entity-Relationship Diagram for the XTLDB Database

Appendix 2 - Data Dictionary

List of Tables in the XTL Database

Summary of Tables in the XTLDB Database

Name	Description	Format
xtldbcol	Summary of columns in database (For internal use only)	RBase
summary	Summary information in database (For internal use only)	RBase
secondar	Secondary data table	dBase - "secondar.dbf"
xtlref	References table	DBase - "xtlref.dbf"
chembiol	Chemical and Biological data	DBase - "chembiol.dbf"
fisherie	Fisheries data	DBase - "fisherie.dbf"
demograp	Demographic and Land Use data	DBase - "demograp.dbf"
morpholo	Location and Morphology data	DBase - "morpholo.dbf"
hydrolog	Hydrological data	DBase - "hydrolog.dbf"
water_bo	Water bodies reference table	DBase - "water_bo.dbf"
notes	General Notes table (For internal use only)	RBase
codes	Database codes table (For internal use only)	RBase

Details of Data Tables in the XTLDB Database

Water Bodies

```
No. Column Name      Attributes
--- ---------------- --------------------------------------------------------
  1 WB_NAME          Type  : TEXT 50
  2 WB_NR            Type  : INTEGER
```

Climate & Hydrology

```
No. Column Name      Attributes
--- ---------------- --------------------------------------------------------
  1 CONTINEN         Type  : TEXT 9
  2 W_TYPE           Type  : TEXT 9
```

```
 3 INT_W         Type  : TEXT 5
 4 COUNTRY        Type  : TEXT 17
 5 YEAR_T        Type  : TEXT 15
 6 S_TEMP         Type  : DOUBLE
 7 T_MIN         Type  : DOUBLE
 8 T_MAX          Type  : DOUBLE
 9 STRAT         Type  : TEXT 9
10 DAYS_MIX        Type  : DOUBLE
11 MIX_STAR        Type  : TEXT 3
12 MIX_END         Type  : TEXT 5
13 Z_MIX         Type  : DOUBLE
14 YEAR_RAI        Type  : TEXT 15
15 RAINFALL        Type  : DOUBLE
16 RN_START        Type  : TEXT 4
17 RN_END         Type  : TEXT 10
18 RN_DURAT        Type  : DOUBLE
19 W_RESID         Type  : DOUBLE
20 NOTES_3        Type  : TEXT 232
21 REF_NR         Type  : INTEGER
22 WB_NR          Type  : INTEGER
```

Location and Morphological Data Table

```
 No. Column Name     Attributes
--- ----------------- -------------------------------------------------------
 1 CONTINEN        Type  : TEXT 9
 2 W_TYPE         Type  : TEXT 9
 3 INT_W         Type  : TEXT 5
 4 COUNTRY         Type  : TEXT 17
 5 ALTITUDE        Type  : DOUBLE
 6 LATITUDE        Type  : TEXT 7
 7 LONGITUD        Type  : TEXT 8
 8 YEAR_MD         Type  : TEXT 20
 9 AREA         Type  : DOUBLE
10 AREA_PAR        Type  : DOUBLE
11 AREA_MIN        Type  : DOUBLE
12 AREA_MAX        Type  : DOUBLE
13 MAX_L         Type  : DOUBLE
14 MAX_W          Type  : DOUBLE
15 SHORE          Type  : DOUBLE
16 Z_MAX          Type  : DOUBLE
17 Z_MEAN         Type  : DOUBLE
18 Z_FLUCT         Type  : DOUBLE
19 VOLUME_L        Type  : DOUBLE
20 RIVER_IN        Type  : TEXT 89
21 RIVER_OU        Type  : TEXT 50
22 CATCHMEN        Type  : DOUBLE
23 CONST_DA        Type  : DOUBLE
24 PERM_OPE        Type  : TEXT 5
25 NOTES_2        Type  : TEXT 243
26 REF_NR         Type  : INTEGER
27 WB_NR          Type  : INTEGER
```

Land Use and Demographic Data Table

```
No. Column Name      Attributes
--- ----------------- ---------------------------------------------------------
  1 CONTINEN         Type  : TEXT 9
  2 W_TYPE           Type  : TEXT 9
  3 INT_W            Type  : TEXT 5
  4 COUNTRY          Type  : TEXT 17
  5 YEAR_DD          Type  : DOUBLE
  6 CMT_POP          Type  : DOUBLE
  7 POP_FISH         Type  : DOUBLE
  8 POP_PRI          Type  : DOUBLE
  9 POP_URB          Type  : DOUBLE
 10 PC_FISHC         Type  : DOUBLE
 11 RFOREST          Type  : DOUBLE
 12 FOREST           Type  : DOUBLE
 13 SCRUB            Type  : DOUBLE
 14 GRASS            Type  : DOUBLE
 15 SWAMP            Type  : DOUBLE
 16 MOUNT            Type  : DOUBLE
 17 DESERT           Type  : DOUBLE
 18 ARABLE           Type  : DOUBLE
 19 PASTURE          Type  : DOUBLE
 20 PLANT            Type  : DOUBLE
 21 URBAN            Type  : DOUBLE
 22 W_USE            Type  : DOUBLE
 23 W_USETYP         Type  : TEXT 62
 24 POLLUTIO         Type  : DOUBLE
 25 POLL_TYP         Type  : TEXT 26
 26 NOTES_6          Type  : TEXT 223
 27 REF_NR           Type  : INTEGER
 28 WB_NR            Type  : INTEGER
```

Fisheries data table

```
No. Column Name      Attributes
--- ----------------- ---------------------------------------------------------
  1 CONTINEN         Type  : TEXT 9
  2 W_TYPE           Type  : TEXT 9
  3 INT_W            Type  : TEXT 5
  4 COUNTRY          Type  : TEXT 17
  5 YEAR_FD          Type  : TEXT 20
  6 CATCH            Type  : DOUBLE
  7 NR_FISHE         Type  : DOUBLE
  8 NR_BOATS         Type  : DOUBLE
  9 BOAT_TYP         Type  : TEXT 22
 10 F_BIOMAS         Type  : DOUBLE
 11 F_PROD           Type  : DOUBLE
 12 STOCKING         Type  : TEXT 5
 13 AQUACULT         Type  : TEXT 5
 14 FY_TYPE          Type  : TEXT 27
 15 NO_SPP           Type  : DOUBLE
 16 CATCH_SP         Type  : DOUBLE
 17 INTRO_SP         Type  : DOUBLE
 18 YR_INTRO         Type  : TEXT 15
 19 ORIGIN_F         Type  : TEXT 30
 20 FISH_TYP         Type  : TEXT 24
 21 F_DET            Type  : DOUBLE
 22 F_PLANTS         Type  : DOUBLE
```

```
23 F_ZOOPL      Type  : DOUBLE
24 F_PISC_M     Type  : DOUBLE
25 NOTES_5      Type  : TEXT 254
26 REF_NR       Type  : INTEGER
27 WB_NR        Type  : INTEGER
```

Chemical and Biological Data Table

```
No. Column Name     Attributes
--- ---------------- --------------------------------------------------------
  1 CONTINEN      Type  : TEXT 9
  2 W_TYPE        Type  : TEXT 9
  3 INT_W         Type  : TEXT 5
  4 COUNTRY       Type  : TEXT 17
  5 YEAR_CD       Type  : TEXT 15
  6 TDS           Type  : DOUBLE
  7 COND          Type  : DOUBLE
  8 SALIN_L       Type  : DOUBLE
  9 SALIN_H       Type  : DOUBLE
 10 PH            Type  : DOUBLE
 11 ALK           Type  : DOUBLE
 12 TOT_P         Type  : DOUBLE
 13 TOT_N         Type  : DOUBLE
 14 SECCHI        Type  : DOUBLE
 15 S_SOLIDS      Type  : DOUBLE
 16 SURF_CHL      Type  : DOUBLE
 17 NM_CHLA       Type  : DOUBLE
 18 AREAL_CH      Type  : DOUBLE
 19 DOM_PHYT      Type  : TEXT 24
 20 MACRO_BI      Type  : DOUBLE
 21 PERI_BIO      Type  : DOUBLE
 22 GR_PHOT       Type  : DOUBLE
 23 NET_PH_P      Type  : DOUBLE
 24 MACRO_PD      Type  : DOUBLE
 25 PERI_PD       Type  : DOUBLE
 26 ZOO_BIOM      Type  : DOUBLE
 27 ZOO_PD        Type  : DOUBLE
 28 MBTHOS_B      Type  : DOUBLE
 29 MBTHOS_P      Type  : DOUBLE
 30 NOTES_4       Type  : TEXT 254
 31 REF_NR        Type  : INTEGER
 32 WB_NR         Type  : INTEGER
```

References Table

```
No. Column Name     Attributes
--- ---------------- --------------------------------------------------------
  1 REF_TYPE      Type  : TEXT 1
  2 IDNUM         Type  : TEXT 8
  3 AUTHORS       Type  : TEXT 100
  4 TITLE         Type  : TEXT 200
  5 EDITORS       Type  : TEXT 75
  6 ED2           Type  : TEXT 100
  7 JOURNAL       Type  : TEXT 100
  8 CONF_DAT      Type  : TEXT 8
  9 CONF_WHE      Type  : TEXT 50
 10 CITY          Type  : TEXT 50
 11 WHO           Type  : TEXT 50
```

```
   12 YEAR          Type  : TEXT 8
   13 VOLUME         Type  : TEXT 20
   14 ISSUE          Type  : TEXT 8
   15 PAGES          Type  : TEXT 8
   16 SERIES_E       Type  : TEXT 40
   17 SERIES_T       Type  : TEXT 50
   18 SERIES_N       Type  : TEXT 8
   19 NOTES          Type  : TEXT 85
   20 KEYWORDS        Type  : TEXT 254
   21 REF_NAME       Type  : TEXT 50
   22 REF_NR         Type  : INTEGER
```

Summary Information Table

```
No. Column Name      Attributes
--- ----------------- --------------------------------------------------------
  1 CONTINEN        Type  : TEXT 9
  2 WB_TYPE         Type  : TEXT 9
  3 COUNTRY         Type  : TEXT 17
  4 ALTITUDE        Type  : DOUBLE
  5 LATITUDE        Type  : TEXT 7
  6 AREA           Type  : DOUBLE
  7 SHORE          Type  : DOUBLE
  8 Z_MAX          Type  : DOUBLE
  9 Z_MEAN          Type  : DOUBLE
 10 Z_FLUCT         Type  : DOUBLE
 11 VOLUME          Type  : TEXT 20
 12 CATCHMEN         Type  : DOUBLE
 13 CONST_DA         Type  : DOUBLE
 14 PERM_OPE         Type  : TEXT 5
 15 S_TEMP          Type  : DOUBLE
 16 T_MIN          Type  : DOUBLE
 17 T_MAX          Type  : DOUBLE
 18 STRAT          Type  : TEXT 9
 19 DAYS_MIX         Type  : DOUBLE
 20 Z_MIX          Type  : DOUBLE
 21 RAINFALL         Type  : DOUBLE
 22 RN_DURAT         Type  : DOUBLE
 23 W_RESID         Type  : DOUBLE
 24 TDS           Type  : DOUBLE
 25 COND           Type  : DOUBLE
 26 SALIN_L         Type  : DOUBLE
 27 SALIN_H         Type  : DOUBLE
 28 PH            Type  : DOUBLE
 29 ALK           Type  : DOUBLE
 30 TOT_P          Type  : DOUBLE
 31 TOT_N          Type  : DOUBLE
 32 SECCHI          Type  : DOUBLE
 33 S_SOLIDS         Type  : DOUBLE
 34 SURF_CHL         Type  : DOUBLE
 35 AREAL_CH         Type  : DOUBLE
 36 DOM_PHYT         Type  : TEXT 24
 37 MACRO_BI         Type  : DOUBLE
 38 PERI_BIO        Type  : DOUBLE
 39 GR_PHOT         Type  : DOUBLE
 40 NET_PH_P         Type  : DOUBLE
 41 MACRO_PD         Type  : DOUBLE
 42 PERI_PD         Type  : DOUBLE
 43 ZOO_BIOM         Type  : DOUBLE
 44 ZOO_PD          Type  : DOUBLE
```

```
45 MBTHOS_B       Type  : DOUBLE
46 MBTHOS_P       Type  : DOUBLE
47 YEAR_FD       Type  : TEXT 20
48 CATCH         Type  : DOUBLE
49 NR_FISHE       Type  : DOUBLE
50 NR_BOATS       Type  : DOUBLE
51 BOAT_TYP       Type  : TEXT 22
52 F_BIOMAS       Type  : DOUBLE
53 F_PROD        Type  : DOUBLE
54 STOCKING       Type  : TEXT 5
55 AQUACULT       Type  : TEXT 5
56 FY_TYPE        Type  : TEXT 27
57 NO_SPP        Type  : DOUBLE
58 CATCH_SP       Type  : DOUBLE
59 INTRO_SP       Type  : DOUBLE
60 ORIGIN_F       Type  : TEXT 30
61 FISH_TYP       Type  : TEXT 24
62 TL_FY        Type  : TEXT 20
63 CMT_POP        Type  : DOUBLE
64 POP_FISH       Type  : DOUBLE
65 POP_PRI        Type  : DOUBLE
66 POP_URB        Type  : DOUBLE
67 PC_FISHC       Type  : DOUBLE
68 FOREST        Type  : DOUBLE
69 SAVAN         Type  : TEXT 20
70 SWAMP         Type  : DOUBLE
71 MOUNT_DE        Type  : TEXT 20
72 ARABLE        Type  : DOUBLE
73 URBAN         Type  : DOUBLE
74 W_USE         Type  : DOUBLE
75 W_USETYP        Type  : TEXT 62
76 POLLUTIO       Type  : DOUBLE
77 POLL_TYP       Type  : TEXT 26
78 WB_NR         Type  : INTEGER
```

List of Forms

Form Name	Driving Table	Description
chembiol	chembiol	Chemical and Biological Data Editing Form
demograp	demograp	Demographic & Land Use Data Editing Form
echem	chembiol	Chemical and Biological Features Editing Form
edemo	demograp	Demographic and Land Use Data Editing Form
efish	fisherie	Fisheries Data Entry Form
ehydr	hydrolog	Hydrology and Climate Data Entry Form
emorp	morpholo	Location and Morphology Data Entry Form
esecond	secondar	Secondary Database Summary Entry Form
ewaterbo	water_bo	Edit Waterbodies form
fisherie	fisherie	Fisheries Data Editing Form
hydrolog	hydrolog	Hydrology and Climate Data Editing Form
morpholo	morpholo	Location and Morphology Data Editing Form
refentry	xtlref	Reference Entry Form
refsedit	xtlref	Reference Editing Form
secondar	SECONDAR	Secondary Database Summary Editing Form
waterbod	water_bo	New Waterbody form

Appendix 3 - Database Application Source Code

The following code is the source code for the RBase Application that provides the user interface for the XTLDB database. This information will be of limited use to the end user and is provided more as a technical reference for those who wish to develop the database and application further.

```
$COMMAND
XTLAPPL
DISCONNECT
SET QUOTE = '
SET VAR SAVE_MESSAGES = (CVAL('MESSAGES'))
SET VAR SAVE_ERROR = (CVAL('ERROR'))
SET MESSAGES OFF
SET STATICDB OFF
SET ROWLOCKS ON
DEBUG SET MESSAGES ON
RUN STARTUP IN XTLAPPL.APX
SET ERROR MESSAGES OFF
DEBUG SET ERROR MESSAGES ON
NEWPAGE
SET COLOR WHITE ON BLUE
SET BELL OFF
LABEL LBEG1
 NEWPAGE
 CHOOSE PICK1 FROM Main IN XTLAPPL.APX  BLACK ON GRAY
 IF PICK1 = 0 THEN
   GOTO LEND1
 ENDIF
 SWITCH (.PICK1)
 CASE 1
   SET VAR LEVEL2 INT = 1
   WHILE LEVEL2 = 1     THEN
     NEWPAGE
     CHOOSE PICK2 FROM refmenu IN XTLAPPL.APX AT 4 13 BLACK ON GRAY
     IF PICK2 = '[ESC]' THEN
       BREAK
     ENDIF
     SWITCH (.PICK2)
     CASE 'Add new Reference'
       RUN addref   IN XTLAPPL.APX
       BREAK
     CASE 'Edit all references'
       EDIT USING  refsedit  +
       ORDER BY +
        REF_NAME ASC
       BREAK
     CASE 'Browse references (Table)'
       RUN browrefs IN XTLAPPL.APX
       BREAK
     CASE 'Add new waterbody'
       RUN enter_wb IN XTLAPPL.APX
       BREAK
     CASE 'Edit all waterbodies'
       EDIT USING  waterbod  +
```

```
      ORDER BY +
        WB_NAME ASC
      BREAK
    ENDSW
  ENDWHILE
  CLEAR VAR VCASCADE
  CLEAR VAR LEVEL2
  CLEAR VAR PICK2
  BREAK
 CASE 2
  SET VAR LEVEL2 INT = 1
  WHILE LEVEL2 = 1    THEN
    NEWPAGE
    CHOOSE PICK2 FROM morpmenu IN XTLAPPL.APX AT 7 19 BLACK ON GRAY
    IF PICK2 = '[ESC]' THEN
      BREAK
    ENDIF
    SWITCH (.PICK2)
    CASE 'Add new entry'
      RUN newmorp  IN XTLAPPL.APX
      BREAK
    CASE 'Edit current entries'
      SET VAR LEVEL3 INT = 1
      WHILE LEVEL3 = 1    THEN
        NEWPAGE
        CHOOSE PICK3 FROM editmorp IN XTLAPPL.APX AT 6 20 BLACK ON GRAY
        IF PICK3 = '[ESC]' THEN
          BREAK
        ENDIF
        SWITCH (.PICK3)
        CASE 'Edit all data'
          EDIT USING  morpholo  +
          ORDER BY +
            WB_NR ASC,REF_NR ASC
          BREAK
        CASE 'Edit for a particular reference'
          RUN edmorprf IN XTLAPPL.APX
          BREAK
        CASE 'Edit for a particular water body'
          RUN edmorpwb IN XTLAPPL.APX
          BREAK
        CASE 'Edit for a particular country'
          RUN edmorpcn IN XTLAPPL.APX
          BREAK
        ENDSW
      ENDWHILE
      CLEAR VAR VCASCADE
     CLEAR VAR LEVEL3
      CLEAR VAR PICK3
      BREAK
    ENDSW
  ENDWHILE
  CLEAR VAR VCASCADE
  CLEAR VAR LEVEL2
  CLEAR VAR PICK2
  BREAK
 CASE 3
  SET VAR LEVEL2 INT = 1
  WHILE LEVEL2 = 1    THEN
    NEWPAGE
```

```
CHOOSE PICK2 FROM hydrmenu IN XTLAPPL.APX AT 7 21 BLACK ON GRAY
IF PICK2 = '[ESC]' THEN
  BREAK
ENDIF
SWITCH (.PICK2)
CASE 'Add new entry'
  RUN newhydr  IN XTLAPPL.APX
  BREAK
CASE 'Edit current entries'
  SET VAR LEVEL3 INT = 1
  WHILE LEVEL3 = 1    THEN
   NEWPAGE
   CHOOSE PICK3 FROM edhydrme IN XTLAPPL.APX AT 8 21 BLACK ON GRAY
   IF PICK3 = '[ESC]' THEN
    BREAK
   ENDIF
   SWITCH (.PICK3)
   CASE 'Edit all entries'
    EDIT USING  hydrolog  +
    ORDER BY +
     WB_NR ASC,REF_NR ASC
    BREAK
   CASE 'Edit for a particular reference'
    RUN edhydrrf IN XTLAPPL.APX
    BREAK
   CASE 'Edit for a particular water body'
    RUN edhydrwb IN XTLAPPL.APX
    BREAK
   CASE 'Edit for a particular country'
    RUN edhydrcn IN XTLAPPL.APX
    BREAK
   ENDSW
  ENDWHILE
  CLEAR VAR VCASCADE
 CLEAR VAR LEVEL3
  CLEAR VAR PICK3
  BREAK
 ENDSW
ENDWHILE
CLEAR VAR VCASCADE
CLEAR VAR LEVEL2
CLEAR VAR PICK2
BREAK
CASE 4
 SET VAR LEVEL2 INT = 1
 WHILE LEVEL2 = 1    THEN
  NEWPAGE
  CHOOSE PICK2 FROM chemmenu IN XTLAPPL.APX AT 9 21 BLACK ON GRAY
  IF PICK2 = '[ESC]' THEN
   BREAK
  ENDIF
  SWITCH (.PICK2)
  CASE 'Add new entry'
   RUN newchem  IN XTLAPPL.APX
   BREAK
  CASE 'Edit current entries'
   SET VAR LEVEL3 INT = 1
   WHILE LEVEL3 = 1    THEN
    NEWPAGE
    CHOOSE PICK3 FROM edchemmn IN XTLAPPL.APX AT 8 25 BLACK ON GRAY
```

```
     IF PICK3 = '[ESC]' THEN
       BREAK
     ENDIF
     SWITCH (.PICK3)
     CASE 'Edit all references'
       EDIT USING  chembiol  +
       ORDER BY +
         WB_NR ASC,REF_NR ASC
       BREAK
     CASE 'Edit for a particular reference'
       RUN edchemrf IN XTLAPPL.APX
       BREAK
     CASE 'Edit for a particular water body'
       RUN edchemwb IN XTLAPPL.APX
       BREAK
     CASE 'Edit for a particular country'
       RUN edchemcn IN XTLAPPL.APX
       BREAK
     ENDSW
    ENDWHILE
    CLEAR VAR VCASCADE
  CLEAR VAR LEVEL3
    CLEAR VAR PICK3
    BREAK
  ENDSW
 ENDWHILE
 CLEAR VAR VCASCADE
 CLEAR VAR LEVEL2
 CLEAR VAR PICK2
 BREAK
CASE 5
 SET VAR LEVEL2 INT = 1
 WHILE LEVEL2 = 1     THEN
  NEWPAGE
  CHOOSE PICK2 FROM fishmenu IN XTLAPPL.APX AT 8 17 BLACK ON GRAY
  IF PICK2 = '[ESC]' THEN
    BREAK
  ENDIF
  SWITCH (.PICK2)
  CASE 'Add new entry'
   RUN newfish  IN XTLAPPL.APX
   BREAK
  CASE 'Edit current entries'
   SET VAR LEVEL3 INT = 1
   WHILE LEVEL3 = 1     THEN
    NEWPAGE
    CHOOSE PICK3 FROM edfishmn IN XTLAPPL.APX AT 6 14 BLACK ON GRAY
    IF PICK3 = '[ESC]' THEN
      BREAK
    ENDIF
    SWITCH (.PICK3)
    CASE 'Edit all fisheries data'
      EDIT USING  fisherie  +
      ORDER BY +
        WB_NR ASC,REF_NR ASC
      BREAK
    CASE 'Edit for a particular reference'
      RUN edfishrf IN XTLAPPL.APX
      BREAK
    CASE 'Edit for a particular waterbody'
```

```
        RUN edfishwb IN XTLAPPL.APX
        BREAK
      CASE 'Edit for a particular country'
        RUN edfishcn IN XTLAPPL.APX
        BREAK
      ENDSW
    ENDWHILE
    CLEAR VAR VCASCADE
   CLEAR VAR LEVEL3
    CLEAR VAR PICK3
    BREAK
   ENDSW
 ENDWHILE
 CLEAR VAR VCASCADE
 CLEAR VAR LEVEL2
 CLEAR VAR PICK2
 BREAK
CASE 6
 SET VAR LEVEL2 INT = 1
 WHILE LEVEL2 = 1     THEN
   NEWPAGE
   CHOOSE PICK2 FROM demomenu IN XTLAPPL.APX AT 9 21 BLACK ON GRAY
   IF PICK2 = '[ESC]' THEN
     BREAK
   ENDIF
   SWITCH (.PICK2)
   CASE 'Add new entry'
     RUN newdemo  IN XTLAPPL.APX
     BREAK
   CASE 'Edit current entries'
     SET VAR LEVEL3 INT = 1
     WHILE LEVEL3 = 1     THEN
       NEWPAGE
       CHOOSE PICK3 FROM eddemomn IN XTLAPPL.APX AT 7 22 BLACK ON GRAY
       IF PICK3 = '[ESC]' THEN
         BREAK
       ENDIF
       SWITCH (.PICK3)
       CASE 'Edit all demographic data'
         EDIT USING  demograp  +
         ORDER BY +
          WB_NR ASC,REF_NR ASC
         BREAK
       CASE 'Edit for a particular reference'
         RUN eddemorf IN XTLAPPL.APX
         BREAK
       CASE 'Edit for a particular water body'
         RUN eddemowb IN XTLAPPL.APX
         BREAK
       CASE 'Edit for a particular country'
         RUN eddemocn IN XTLAPPL.APX
         BREAK
       ENDSW
     ENDWHILE
     CLEAR VAR VCASCADE
    CLEAR VAR LEVEL3
     CLEAR VAR PICK3
     BREAK
   ENDSW
 ENDWHILE
```

```
 CLEAR VAR VCASCADE
 CLEAR VAR LEVEL2
 CLEAR VAR PICK2
 BREAK
CASE 7
 SET VAR LEVEL2 INT = 1
 WHILE LEVEL2 = 1    THEN
  NEWPAGE
  CHOOSE PICK2 FROM summmenu IN XTLAPPL.APX AT 7 17 BLACK ON GRAY
  IF PICK2 = '[ESC]' THEN
   BREAK
  ENDIF
  SWITCH (.PICK2)
  CASE 'Enter New Summary Data for a Waterbody'
   RUN newsec   IN XTLAPPL.APX
   BREAK
  CASE 'Edit Current Data'
   SET VAR LEVEL3 INT = 1
   WHILE LEVEL3 = 1    THEN
    NEWPAGE
    CHOOSE PICK3 FROM editseco IN XTLAPPL.APX AT 8 17 BLACK ON GRAY
    IF PICK3 = '[ESC]' THEN
     BREAK
    ENDIF
    SWITCH (.PICK3)
    CASE 'Edit all summary information'
     EDIT USING  secondar  +
     ORDER BY +
      WB_NR ASC
     BREAK
    CASE 'Edit summary info. for a waterbody'
     RUN editsec  IN XTLAPPL.APX
     BREAK
    ENDSW
   ENDWHILE
   CLEAR VAR VCASCADE
  CLEAR VAR LEVEL3
   CLEAR VAR PICK3
   BREAK
  ENDSW
 ENDWHILE
 CLEAR VAR VCASCADE
 CLEAR VAR LEVEL2
 CLEAR VAR PICK2
 BREAK
CASE 8
 SET VAR LEVEL2 INT = 1
 WHILE LEVEL2 = 1    THEN
  NEWPAGE
  CHOOSE PICK2 FROM utilmenu IN XTLAPPL.APX AT 7 13 BLACK ON GRAY
  IF PICK2 = '[ESC]' THEN
   BREAK
  ENDIF
  SWITCH (.PICK2)
  CASE 'About this database'
   RUN aboutrep IN XTLAPPL.APX
   BREAK
  CASE 'Run Database Checking Routine'
   RUN lakeschk IN XTLAPPL.APX
   BREAK
```

```
    ENDSW
   ENDWHILE
   CLEAR VAR VCASCADE
   CLEAR VAR LEVEL2
   CLEAR VAR PICK2
   BREAK
  CASE 9
   GOTO LEND1
   BREAK
 ENDSW
 GOTO LBEG1
LABEL LEND1
CLEAR VAR PICK1
SET MESSAGES .SAVE_MESSAGES
SET ERROR MESSAGES .SAVE_ERROR
CLEAR VAR SAVE_MESSAGES, SAVE_ERROR
NEWPAGE
RUN CLEANUP IN XTLAPPL.APX
RETURN
$MENU
Main
COLUMN |Simple Empirical Models to Predict Yields in Tropical Lakes|
|References and Water Bodies|
|Location and Morphology Data|
|Hydrology and Climate Data|
|Chemical and Biological Data|
|Fisheries Data|
|Demographic Data|
|Summary Data|
|Database Utilities|
|EXIT|
ENDC
$MENU
refmenu
POPUP |Reference Menu|
|Add new Reference|
|Edit all references|
|Browse references (Table)|
|Add new waterbody|
|Edit all waterbodies|
ENDC
$MENU
morpmenu
POPUP |Location and Morphology Menu|
|Add new entry|
|Edit current entries|
ENDC
$MENU
hydrmenu
POPUP |Hydrology and Climate Menu|
|Add new entry|
|Edit current entries|
ENDC
$MENU
chemmenu
POPUP |Chemical and Biological Data Menu|
|Add new entry|
|Edit current entries|
ENDC
$MENU
```

fishmenu
POPUP |Fisheries Menu|
|Add new entry|
|Edit current entries|
ENDC
$MENU
demomenu
POPUP |Demographic Data Menu|
|Add new entry|
|Edit current entries|
ENDC
$MENU
summmenu
POPUP |Summary Data Menu|
|Enter New Summary Data for a Waterbody|
|Edit Current Data|
ENDC
$MENU
utilmenu
POPUP |Database Utilities Menu|
|About this database|
|Run Database Checking Routine|
ENDC
$MENU
editmorp
POPUP |Edit Location and Morphological Data Menu|
|Edit all data|
|Edit for a particular reference|
|Edit for a particular water body|
|Edit for a particular country|
ENDC
$MENU
edhydrme
POPUP |Edit Hydrological Data Menu|
|Edit all entries|
|Edit for a particular reference|
|Edit for a particular water body|
|Edit for a particular country|
ENDC
$MENU
edchemmn
POPUP |Edit Chemical and Biological Menu|
|Edit all references|
|Edit for a particular reference|
|Edit for a particular water body|
|Edit for a particular country|
ENDC
$MENU
edfishmn
POPUP |Edit Fisheries Data Menu|
|Edit all fisheries data|
|Edit for a particular reference|
|Edit for a particular waterbody|
|Edit for a particular country|
ENDC
$MENU
eddemomn
POPUP |Edit Demographic Data Menu|
|Edit all demographic data|
|Edit for a particular reference|

```
|Edit for a particular water body|
|Edit for a particular country|
ENDC
$MENU
editseco
POPUP |Edit Summary Data Menu|
|Edit all summary information|
|Edit summary info. for a waterbody|
ENDC
$COMMAND
STARTUP
CONNECT xtldb
$COMMAND
CLEANUP
RETURN
$COMMAND
edmorprf
choose vchoice1 from #values for distinct ref_name,ref_nr from xtlref +
 where ref_nr in (sel ref_nr from morpholo) order by ref_name asc +
 at 5 10 title 'References'
write 'Selecting References'
edit using morpholo where ref_nr = .vchoice1 order by wb_nr asc
$COMMAND
edmorpwb
choose vchoice1 from #values for distinct wb_name,wb_nr from water_bo +
 where wb_nr in (sel wb_nr from morpholo) order by wb_name asc +
 at 5 10 title 'Water Bodies'
write 'Selecting References'
edit using morpholo where wb_nr = .vchoice1 order by ref_nr asc
$COMMAND
edmorpcn
choose vchoice1 from #values for distinct COUNTRY from morpholo +
 order by country asc  at 5 10 title 'Countries'
write 'Selecting References'
edit using morpholo where country = .vchoice1 order by wb_nr asc
$COMMAND
edhydrrf
choose vchoice1 from #values for distinct ref_name,ref_nr from xtlref +
 where ref_nr in (sel ref_nr from hydrolog) order by ref_name asc +
 at 5 10 title 'References'
write 'Selecting References'
edit using hydrolog where ref_nr = .vchoice1 order by wb_nr asc
$COMMAND
edhydrwb
choose vchoice1 from #values for distinct wb_name,wb_nr from water_bo +
 where wb_nr in (sel wb_nr from hydrolog) order by wb_name asc +
 at 5 10 title 'Water Bodies'
write 'Selecting References'
edit using hydrolog where wb_nr = .vchoice1 order by ref_nr asc
$COMMAND
edhydrcn
choose vchoice1 from #values for distinct COUNTRY from hydrolog +
 order by country asc  at 5 10 title 'Countries'
write 'Selecting References'
edit using hydrolog where country = .vchoice1 order by wb_nr asc
$COMMAND
edchemrf
choose vchoice1 from #values for ref_name,ref_nr from xtlref +
 where ref_nr in (sel ref_nr from chembiol) order by ref_name asc +
 at 5 10 title 'References'
```

```
write 'Selecting References'
edit using chembiol where ref_nr = .vchoice1 order by wb_nr asc
$COMMAND
edchemwb
choose vchoice1 from #values for distinct wb_name,wb_nr from water_bo +
 where wb_nr in (sel wb_nr from chembiol) order by wb_name asc +
 at 5 10 title 'Water Bodies'
write 'Selecting References'
edit using chembiol where wb_nr = .vchoice1 order by ref_nr asc
$COMMAND
edchemcn
choose vchoice1 from #values for distinct COUNTRY from chembiol +
 order by country asc at 5 10 title 'Countries'
write 'Selecting References'
edit using chembiol where country = .vchoice1 order by wb_nr asc
$COMMAND
edfishrf
choose vchoice1 from #values for distinct ref_name,ref_nr from xtlref +
 where ref_nr in (sel ref_nr from fisherie) order by ref_name asc +
 at 5 10 title 'References'
write 'Selecting References'
edit using fisherie where ref_nr = .vchoice1 order by wb_nr asc
$COMMAND
edfishwb
choose vchoice1 from #values for distinct wb_name,wb_nr from water_bo +
 where wb_nr in (sel wb_nr from fisherie) order by wb_name asc +
 at 5 10 title 'Water Bodies'
write 'Selecting References'
edit using fisherie where wb_nr = .vchoice1 order by ref_nr asc
$COMMAND
edfishcn
choose vchoice1 from #values for distinct COUNTRY from fisherie +
 order by country asc at 5 10 title 'Countries'
write 'Selecting References'
edit using fisherie where country = .vchoice1 order by wb_nr asc
$COMMAND
eddemorf
choose vchoice1 from #values for distinct ref_name,ref_nr from xtlref +
 where ref_nr in (sel ref_nr from demograp) order by ref_name asc +
 at 5 10 title 'References'
write 'Selecting References'
edit using demograp where ref_nr = .vchoice1 order by wb_nr asc
$COMMAND
eddemowb
choose vchoice1 from #values for distinct wb_name,wb_nr from water_bo +
 where wb_nr in (sel wb_nr from demograp) order by wb_name asc +
 at 5 10 Title 'Wate Bodies'
write 'Selecting References'
edit using demograp where wb_nr = .vchoice1 order by ref_nr asc
$COMMAND
eddemocn
choose vchoice1 from #values for distinct COUNTRY from demograp +
 order by country asc at 5 10 title 'Countries'
write 'Selecting References'
edit using demograp where country = .vchoice1 order by wb_nr asc
$COMMAND
addref
*( Add new reference to XTLREF )
compute vnextref as maximum ref_nr from xtlref
set var vnextref = (.vnextref+1)
```

```
enter using refentry
return
$COMMAND
browrefs
browse REF_NAME,REF_NR,AUTHORS,TITLE,EDITORS,ED2,JOURNAL,CONF_DAT,CONF_WHE, +
 CITY,WHO,YEAR,VOLUME,ISSUE,PAGES,SERIES_E,SERIES_T,SERIES_N,NOTES,KEYWORDS +
 from xtlref order by ref_name asc nochg noqbe
$COMMAND
enter_wb
compute vnext_wb as maximum wb_nr from water_bo
set var vnext_wb =(.vnext_wb + 1)
enter using ewaterbo
$COMMAND
newmorp
choose vnew_wb from #values for wb_name,wb_nr from water_bo order by +
 wb_name asc at 5 5 title 'Water bodies'
choose vnew_ref from #values for ref_name, ref_nr from xtlref order by +
 ref_name asc at 5 5 title 'References'
enter using emorp
$COMMAND
newhydr
choose vnew_wb from #values for wb_name,wb_nr from water_bo order by +
 wb_name asc at 5 5 title 'Water bodies'
choose vnew_ref from #values for ref_name, ref_nr from xtlref order by +
 ref_name asc at 5 5 title 'References'
enter using ehydr
$COMMAND
newchem
choose vnew_wb from #values for wb_name,wb_nr from water_bo order by +
 wb_name asc at 5 5 title 'Water bodies'
choose vnew_ref from #values for ref_name, ref_nr from xtlref order by +
 ref_name asc at 5 5 title 'References'
enter using echem
$COMMAND
newfish
choose vnew_wb from #values for wb_name,wb_nr from water_bo order by +
 wb_name asc at 5 5 title 'Water bodies'
choose vnew_ref from #values for ref_name, ref_nr from xtlref order by +
 ref_name asc at 5 5 title 'References'
enter using efish
$COMMAND
newdemo
choose vnew_wb from #values for wb_name,wb_nr from water_bo order by +
 wb_name asc at 5 5 title 'Water bodies'
choose vnew_ref from #values for ref_name, ref_nr from xtlref order by +
 ref_name asc at 5 5 title 'References'
enter using edemo
$COMMAND
editsec
choose vnew_wb from #values for wb_name,wb_nr from water_bo +
 where wb_nr in (sel wb_nr from secondar ) order by +
 wb_name asc at 5 5 title 'Water bodies'
edit using secondar where wb_nr = .vnew_wb
$COMMAND
newsec
choose vnew_wb from #values for wb_name,wb_nr from water_bo +
 where wb_nr not in (sel wb_nr from secondar ) order by +
 wb_name asc at 5 5 title 'Water bodies'
enter using esecond
$COMMAND
```

```
aboutrep
cls
set feedback off
print xtltitle
pause 1
set feedback on
return
$COMMAND
lakeschk
write 'Connecting to Lakes Database'
set feedback off
connect xtldb
write 'Please do not interrupt this process'
write 'Making temporary backup copy of Lakes Database'
reload xtlload with user case

*( Update column counts)

compute vno_refs as count ref_nr from xtlref
update summary set no_refs = .vno_refs
compute vno_wb as count wb_nr from water_bo
update summary set no_wb   = .vno_wb
compute vno_loc as count ref_nr from morpholo
update summary set no_loc  = .vno_loc
compute vno_hyd as count ref_nr from hydrolog
update summary set no_hyd  = .vno_hyd
compute vno_che as count ref_nr from chembiol
update summary set no_che  = .vno_che
compute vno_fis as count ref_nr from fisherie
update summary set no_fis  = .vno_fis
compute vno_dem as count ref_nr from demograp
update summary set no_dem  = .vno_dem

disconnect

write 'Checking Lakes Database for Errors.'
set error variable evar
zip autochk xtlload -n
set variable e1 = .evar



if e1 > 40 then
   erase xtlload.rb?
   write 'Errors have been found in the database!'
   write 'Everything has been left as it originally was in database files.'
   write 'Please revert to previous backup copy'
   beep
endif

if e1 = 0 then
   write 'No errors have been found in the database.'
   write 'Temporary backup has been deleted.'
   erase xtldb.rb?
   rename xtlload.rb? xtldb.rb?
endif

pause 2
clear variables e1
connect xtldb
```

set feedback on
return