

Using Microsoft Access to Explore the SES Database

Introduction

The LOIS SES database contains a significant proportion of the project data set. The CD-ROM includes two copies of the database in different variants of the Microsoft JET format. Also included is a copy of the Microsoft Access run-time edition software, which may be freely distributed providing it is accompanied by an Access database.

The database may be found in the DBJET directory on Disk 1 of the SES CD-ROM package. There are two copies in different JET format variants, named SESV7.MDB (JET 3.0) and SES97.MDB (JET 3.5). The Access and JET variants are discussed more fully in the next section, but the following summary table of which file to use with which software may prove helpful.

Access 7.0	SESV7.MDB
BODC Database Explorer	SESV7.MDB
Access97	SES97.MDB
Run-time Access supplied	SESV7.MDB

Access Versions

At the time of writing, four versions of Microsoft Access have been released. The first of these, version 1.0, was current for a very short period of time and was not widely adopted. Access 2.0 was the main version used under Windows 3.n. Two versions, 7.0 and Access97 (sometimes called Access 8.0), have been available for Windows95, Windows98 and NT 4.n. A new version is expected to be released in 2000.

The database variants supplied on the SES CD-ROM cover Access 7.0 and Access97. Previous BODC Access database releases have also covered Access 2.0 but this is now considered obsolete.

Each version of Access has its own version of the JET database format associated with it thus:

Access 1.0	JET 2.0	Access 2.0	JET 2.5
Access 7.0	JET 3.0	Access97	JET 3.5

Each of these formats is different and there is only limited compatibility between versions. One would expect that earlier versions of the software

would not be able to read later versions of the format. However, whilst the later versions of the software are able to read earlier versions of the format, their functionality is limited. It is possible to use objects, such as forms, to retrieve data and to modify the data held in tables, but it is not possible to modify the design of objects or to create additional objects.

There is an additional compatibility problem for databases on CD-ROM. The later versions of *Access* insist on placing some information into earlier version database files the first time they are opened by the later version software. CD-ROM is a read-only medium. Consequently, when one tries to open a JET 3.0 database on CD-ROM with a later version of *Access*, the result is a fatal error. It is therefore important to use the correct copy of the database to match the version of *Access* being used.

Some users may wish to copy the database from CD-ROM onto their hard disk. Modern hard disks have much faster seek times and higher data transfer rates than the fastest CD-ROM drive. This results in significantly improved performance when using the database.

Copies of the database on hard disk may be modified by the user. This may be desirable. For example, users might wish to add their own data into the database. However, a word of caution is required. The forms provided in the database have been built on the assumption that the database contents will be protected by the fact that CD-ROM is a read-only medium. Without this protection, it is possible to modify the data held in the database by simply typing something into a form field. This is surprisingly easy to do in *Access*. If you wish to guard against this possibility simply set the 'read-only' attribute for the database file using *Windows Explorer* or *File Manager*.

Users with some experience of *Access* may find it helpful to set up additional queries, forms, reports or even *Visual Basic* applications (modules). These will allow output from the database to be tailored precisely to the user's requirements.

Access Objects

When a database is opened using *Access*, a dialog box is usually presented offering a choice of the objects available. However, the SES database has been set up so that the only object that is visible is the switchboard form. To see the database in all its glory simply press the *F11* key.

There are six types of object: tables, queries, forms, reports, macros and modules. Users of the SES database as supplied need only be concerned about the first three of these. The type of object required is selected by clicking one of the tabs on the top of the dialog. This presents a list of the available objects of that type. The desired object is simply highlighted by

clicking on it and then opened by clicking on the 'Open' button. Alternatively, an object may be opened by double clicking on it.

Table objects, as their name suggests, are the actual tables of data that make up the relational database. Opening a table object provides a listing of the table contents as a data grid. The tables may also be opened in design mode, which allows their detailed structure to be seen or, providing a full version of *Access* is installed, modified.

Within the data grid, the fields and records visible may be adjusted by using the horizontal and vertical scroll-bar controls. Any subset of rows and columns may be highlighted by dragging the mouse cursor over them and then transferred to other applications via the clipboard. However, as individual tables from a relational database are rarely self-contained, this may be of limited value.

Query objects, or 'views' as they are known in other relational database systems, may be thought of as additional table objects, which combine several base tables together, filter their contents or sort the data into a specified order. Their main reason for being is to underpin form objects. However, users may find them convenient for exporting some types of data into other applications. Like table objects, opening a query object causes its contents to be listed in the form of a data grid. Alternatively, the query may be opened in design mode, which provides a clear indication of the fields, source tables, sort keys and filter criteria that comprise the query. For those averse to GUI displays, the query may also be viewed as a native SQL statement.

The most important object type for those wishing to interrogate the database is the form object. These provide an interface to data from several tables combined in such a way that the user is provided with all the information necessary to make use of the data. Forms may be used to simply step through data records or display data as a data grid. However, when used in conjunction with *Access* 'find' and 'filter' tools, the forms provide a powerful and flexible mechanism for searching the database.

Using Access Forms

When an *Access* form is opened, the information is presented in what is termed 'form view' which looks like this:

The screenshot shows an Access form window titled "14C Data". The form contains several sections of data entry fields:

- Event:** 200290, **Gear:** BOTTLE, **Cruise:** VLD137
- Start:** 03/07/93 04:15:00, **End:** 03/07/93 04:45:00, **Originator's reference:** 310
- Latitude:** 49.333, **Latitude variation:** (empty), **Site:** (empty)
- Longitude:** -12.5, **Longitude variation:** (empty), **Water Depth:** 1220

Below these fields are three main sections:

- Water Collection Information:** (empty)
- Incubation Information:** **Experiment:** V1C004, **Type:** IS, **Start:** 03/07/93 05:00:00, **Duration (hr):** 24, **Comment:** (empty)
- Size Fraction Definitions:** **Microplankton:** >5 um, **Nanoplankton:** 2-5 um, **Picoplankton:** 0.2-2 um

Summary statistics are shown below:

- Microplankton Uptake:** 189.21, **Nanoplankton Uptake:** 69.3, **Picoplankton Uptake:** 182.37
- Integration Depth (m):** 40, **Total Uptake:** 440.88

The bottom section is a table titled "Integrated 14C Uptake (mg C/m2/incubation duration)":

Experiment	Inc Depth	Coll Depth	Rel Light	Abs Light	Microplankton	SD Microplankton	Nanoplankton	SD Nanoplankton
V1C004	1	1			4.443	0.565	1.888	
V1C004	5	5			5.087	0.6	1.86	
V1C004	10	10			5.985	0.766	2.36	
V1C004	15	15			4.279	2.254	2.998	
V1C004	20	20			3.075	0.392	0.832	

Navigation controls at the bottom show "Record: 1 of 9" and "Record: 4 of 33".

The information presented is from a single database record, in this case a ^{14}C incubation experiment. The header information is displayed in discrete labelled boxes. In addition, there is a second embedded form that displays the data from child records (the individual sample bottles involved in the experiment) owned by the experiment record.

The record displayed may be changed using the 'video' control in the bottom left-hand corner of the window to step one record forwards, one record backwards or to jump directly to the first or last record.

For a form such as this to be of practical use there are two things that the user needs to be able to do. First, the user must be able to find the record or records of interest. Secondly, the user must be able to get the information from those records into another application such as a spreadsheet.

One method for locating the record or records of interest is to use the video controls to single step through the records until a record of interest is encountered. This is a perfectly satisfactory method for forms containing up to 100 records. However, many of the forms contain a significantly larger number of records and so more powerful tools are required.

The first tool provided by *Access* is the 'find' tool that may be found in the 'Edit' pull-down menu or invoked using the button on the toolbar with the

binocular icon. This tool can be used to search for a given string in either a single field (selected by clicking in the appropriate form box) or all fields. It is particularly useful for finding related records in other forms by searching for the BODC Event Number.

The most powerful tool provided by *Access* is the form filter. This allows the creation of a copy of the current form that contains a user-specified subset of records. The filter criteria are set up using the 'Edit filter/sort' option in the 'Records' menu, or as a button on the toolbar. Invoking this sets up a query design box displaying all the form fields into which the selection criteria are entered. The field names are dragged from the list provided. Sort criteria are simply selected from the list box.

However, the specification of the selection criteria is a little less straightforward. *Access* requires the information to include in the where clause of an SQL query and a rudimentary knowledge of SQL is definitely a help in giving it what it requires. However, the program is far from pedantic about syntax and usually accepts the obvious (e.g. =50, >50 or <50).

Tips. To select data values within a range use the syntax 'between value and value'. To match part of a string use the syntax 'like "wild-card string"'. The *Access* wild cards are '.' for a single character and '*' for any number of characters.

Access 7.0 and later include an alternative filtering interface termed 'Filter by Form'. In this, the filter criteria are entered into the boxes on the form rather than through a query design form. Whilst this is a much more convenient interface, it adds little to the power of the tool.

Once the filter criteria have been set up, the 'Apply filter/sort' option is invoked from the 'Records' menu or using the toolbar button. The result is a form of identical appearance to the original except for the number of records it contains.

Having identified a record of interest in an *Access* form, the next problem to address is how to get the information from that record into another application such as *Excel*. The best way of doing this by far is to copy the data over the Windows clipboard. To do this, click on 'Select Record' in the 'Edit' menu followed by 'Copy'. The record, including column names based on table field names, may then be pasted into *Excel*.

Providing the form doesn't contain a sub-form, that's all there is to it. However, most of the forms present in the SES database include sub-forms. The data from these must be copied over in a separate operation. Select the sub-form data by clicking on the small box in its top left-hand corner. Then, simply click 'Copy' in the 'Edit' menu and paste the data into a convenient empty cell in the *Excel* spreadsheet.

This section has presented a very brief digest on how to use the forms included in the SES database. Access is both intuitive to use and includes extensive documentation. The more one learns about the program, the more one can get out of it. Use this section as a starting point but please do not regard it as an exclusive alternative to the documentation provided by Microsoft.

SES Database Forms

Several forms have been created to allow the contents of individual tables or groups of tables to be conveniently viewed. These forms may be accessed through the 'Database Switchboard' form that appears when the database is opened. This contains a series of buttons. Pressing one of these opens another Switchboard page, which contains a further set of buttons. The bottom one of these returns to the main Switchboard page. The others open data forms.

The Database Switchboard offers the following pages:

Inventories and Parameter Dictionary

Profiles

Currents

Benthic Data

SVT, Trap and Production Data

Please note that it is possible to use the Switchboard to open more than one form simultaneously. This is particularly useful for forms that display parameter codes (open the Parameter Dictionary to find out what they mean) or for the inter-comparison of different types of data.

Bug Fix. The forms in the SES database have been built on a computer with *Windows* large fonts selected for the screen display. Due to a bug in some versions of *Access*, viewing the forms on a system with small fonts selected causes some of the form field labels to be truncated. If this problem is encountered, it may be rectified in seconds by converting to a large font display.

Inventories and Parameter Dictionary

This switchboard page offers the following forms:

Cruises

This form presents information on all the cruises included in the database. These include Continuous Plankton Recorder tows, mooring deployment or recovery cruises and SESAME cruises in addition to the cruises dedicated to SES.

Events

This form provides access to the information held on data events. The form is divided into four sections. The top two sections display information common to all events and their associated cruise. The lower sections provide information specific to point events or traverse events. One or other of these will be blank, depending upon the type of event currently selected.

Browsing this form can quickly provide an overview of the scope of the oceanographic measurements held in the database.

Note that most of the events in the database are underway ADCP profiles. If these are not of interest, applying an appropriate filter (Not "ADCP" in the Gear box) makes the data set much more manageable, reducing the record count by a factor of 10.

Moored Instruments

This form provides an index to the moored instrument records provided on the CD-ROM. The form is in two sections. The upper part provides information about the mooring, such as position and deployment/recovery times. The lower section supplies information about an individual instrument deployed on the rig.

The BODC Series Reference field is more useful than one might think as it is used as part of the data filename. For example, the data for BODC Series Reference 427378 will be found in file MOORINGS\MET\B0427378.LST on Disk 2 of the CD-ROM. Although the rules for deriving the full pathname from the Series Reference are not obvious, the relevant file may be easily found using wild-cards with the *Windows Explorer* 'Find' tool.

The embedded form in the lower section simply provides the definitions of the one-character parameter codes that appear in the box above it.

Parameter Dictionary

This form provides the definitions of the BODC parameter codes, which are used extensively in the SES database. Its primary purpose is to allow the meaning of a parameter code to be obtained. If using a form that includes a parameter code, it may be convenient to also have the Parameter Dictionary form open at the same time. Codes are most conveniently located by using the 'Find' tool on the 'Parameter Code' box.

Profiles

CTD Data

This form provides access to all the CTD profiles held in the database. The header information (date/time, position, etc.) is in the upper section of the form. The profile itself is presented in the embedded form in the lower section.

Filtering this form (e.g. by cruise or site) is advisable as it contains over 1600 records.

SeaSoar Data

This form presents the SeaSoar data as a series of discrete profiles. It should be regarded as an extension of the CTD Data form as it contains the same type of data in a similar format.

Marine Snow Profiler Data

This form presents the particle abundance and volume data collected using the CTD-mounted camera system. Form and sub-form format is used to display the header information and datacycles.

Miscellaneous Instrument Profiles

This form provides access to the data collected by XBTs, profiling radiometers, sound velocity profilers and the FLY turbulence probe.

The form is divided into three sections. The upper left section provides information on when and where the profile was collected. The lower left section supplies information concerning the type of instrument used and the scientist who supplied the data.

The profile data themselves are displayed in the embedded form on the right-hand side. The profile for each measured parameter, including the independent variable (depth or pressure) is listed sequentially. This is not the most convenient form for the data, but it is all that is possible within the cross-tabulation rules imposed by *Access*. Users may either transpose the data into a conventional grid by cutting and pasting in a spreadsheet or obtain data grids directly with the BODC Database Explorer software.

Users interested in optics profiles should remember that some of the CTD profiles include downwelling and upwelling PAR scalar irradiance channels.

Water Bottle Data

This table presents water sample data. Each record displayed by the form represents a sample collection event. Consequently, all depths sampled by a CTD rosette are included as one record.

The embedded sub-form displays the profile for each parameter measured sequentially because of the cross-tabulation constraints imposed by *Access*. This is adequate for either a quick look at the data or if a small number of parameters are of interest. However, it is cumbersome if a significant number of parameters are required.

If a grid format with several parameters in each row is required, then use the BODC Database Explorer software to retrieve the data.

Currents

Underway ADCP

This form presents the underway Acoustic Doppler Current Profiler data. At the top of the form there are three sections specifying the profile header information, the acquisition/processing methods and the calibrations applied.

The embedded form displays the profile datacycles, including signal amplitude, which provides semi-quantitative information on zooplankton biomass distribution.

Drifter Data

The Drifter Data form presents the tracks of drifting buoys. The main body of the form provides deployment information. The track co-ordinates are listed in the embedded sub-form. Temperatures and pressure from the buoy sensors are included. However, these are generally of poor quality and should only be used with care.

Tidal Constituents

This form presents the results of a series of tidal analyses done on the SES moored ADCP records. The form is in three sections. The top section provides information on the ADCP deployment. The mid-section gives information about the tidal analysis, including the depth of the bin to which it applies. The embedded form below this delivers the tidal constituents generated by the analysis.

Benthic Data

Core Profiles

The Core Profiles form gives access to a wide range of parameters measured as profiles along cores. The form is divided into three sections. The top section displays information on the coring time and position. The middle section provides additional information for the sub-core on which the profile was measured.

The bottom section is an embedded sub-form that lists the profiles for each parameter measured sequentially. If a grid format with several parameters in each row is required, then use the Database Explorer software to retrieve the data.

Whole Core Data

This form displays measurements made on a whole core, sub-core or grab sample. The form is in three sections. The top section displays information on the coring event. Below this is additional information on the individual sub-core used. The third section is a sub-form containing one record for each parameter measured.

The whole core data in the SES database include relatively small numbers of parameters. Consequently, the form display provides adequate access to the data. However, if the parameters are required listed in grid format, the Database Explorer software may be used instead.

SVT, Trap and Production Data

Settling Velocity Tube Data

This form provides the data from settling velocity tube experiments. The form is in three sections. The tabular form at the top supplies the information on when and where the SVT was fired.

Below this are two embedded forms. The upper form contains the 'derived parameter' data resulting from analysis of a cumulative frequency curve generated from the raw time series. The lower form displays the raw time series from which these parameters were computed.

Sediment Trap Data

This form displays sediment trap data and includes four sections. The top section provides trap deployment information common to all trap types. Below this are two sections, which display trap position information appropriate to moored traps (on the left) or drifting traps. Further information on drifting trap courses may be obtained using the Drifter Data form. However, it should be noted that this is a general-purpose form and all trap data included in the SES database were from moored traps.

The fourth section is a sub-form displaying each parameter profile time series sequentially. If a grid format with several parameters in each row is required, then use the Database Explorer software.

Production Data

This form presents data from ^{14}C incubation experiments. The data included here are from long-term experiments where it is inappropriate to normalise the data in terms of uptake per hour. Note that P:I parameters are included as water bottle parameters and may be obtained using either the Water Bottle Data form or the Database Explorer software.

The form contains five sections. The top section displays information on where, when and how the water used in the experiment was collected. Below this are sections presenting information on the incubation conditions and the size fraction definitions. The fourth section displays column integrated uptake data. The fifth section is a sub-form that presents the uptake rates for the individual samples incubated during the experiment.