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OceanPC Manual

Software for Management and International
Exchange of Oceanographic Data

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Intergovernmental Oceanographic Commission

**United Nations Educational, Scientific,
and Cultural Organization**

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Additional copies of this manual and the OceanPC software files may be obtained at the following address:

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RECOMMENDED CITATION

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INTRODUCTION

OVERVIEW

OceanPC is an Intergovernmental Oceanographic Commission (IOC) project to organize a system of free or inexpensive software for processing of oceanographic data (principally oceanographic profile data) on IBM-compatible microcomputers. Using OceanPC, you can:

- 1) Key enter various types of oceanographic observations from your own files;
- 2) Merge your own data with historical data from other ships and nations to create a local or regional Oceanographic Atlas;
- 3) Analyze, display, print, and plot the merged data; and
- 4) Exchange data with oceanographers and National Data Centers around the world.

OCEAN-PC accommodates the wide diversity of data types, formats, and applications of oceanographic data. A wide variety of improvements to OCEAN-PC are desirable, particularly more flexible interfacing between large, "standard" systems. Users are encouraged to contact IOC if they have special needs for software or data sets, or can contribute software to the system. Within the original project constraint of providing a reasonably sized, low cost system, the project team will work toward incorporating additional components into succeeding versions of OceanPC.

ACKNOWLEDGMENTS

The following people participated in the assembly of the OceanPC system:

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SYSTEM INFORMATION

HARDWARE

OCEAN-PC has been designed for low cost operation on XT and AT microcomputers with the MS-DOS operating system (Versions 3.x and higher). All but one of the utilities has been written to run on a CGA monitor (or a monochrome monitor running in CGA-emulation mode). Only the GENERAL OCEAN MAPPING utility is written to require an EGA monitor (or better). A desirable optional hardware item is a CD-ROM reader for access to large data sets.

SOFTWARE

The system assumes only that the user has MS-DOS, but the following software additions are desirable:

QUICKBASIC Version 4.5 - To enable the user to modify existing utilities or create new ones compatible with OceanPC code. The QBASIC Interpreter that is included with DOS 5.1 is also useful.

SURFER - A commercial gridding and contouring program; can accept oceanographic data and coastline geographic data files from OceanPC utilities (Golden Software, Inc. 1990).

ATLAST - The public domain oceanographic data analysis package (Rhines 1991) available from the Jet Propulsion Laboratory in California.

Any word processing program that can import HPGL plotter files into documents, such as WordPerfect. This allows the user to produce publication-quality graphics from the GENERAL OCEAN MAPPING utility.

SECONDARY DISTRIBUTION

The complete OceanPC system is being distributed as both executable codes and source codes (see below). The IOC requests that primary users share the system with secondary users ONLY if the programs have remained unchanged. If primary users have changed any of the programs, they are asked to refer potential new users to the IOC OceanPC Program Officer (see above) for system diskettes, or to the INTERNET locale for file downloading.

SYSTEM ARCHITECTURE

The OceanPC system is provided as a set of executable programs, source codes, and a menu program. Using the installation procedures provided below, the system will install as follows:

Hard Disk , e.g. C:

*		
.)) OCEAN PC		Executable menu program & ASCII program manual
*		
*		
/) \EXEC		All executable programs except OPCPLOT
*		
*		
/) \BAS		All program source codes
*		
/) \DATA		Data files for OceanPC
*		
/) \ROSC		Digital ROSCOP data
*		
.) \OPCPLOT		Program and files for GENERAL OCEAN MAPPING utility

BASIC CONCEPTS

OceanPC's WORKING DATA FORMATS

ICES FORMAT OCEAN-PC performs all of its display and analysis functions (for oceanographic data) using a single standard format at the heart of the system. At present, that format is the fixed-record ("punch card"), ASCII format used by the International Council for the Exploration of the Seas (ICES), called **ICES Standard Profile Format**, referred to throughout this manual as ICES FORMAT (see Appendix F). To use OceanPC, it is required that existing data be converted to ICES Format, and that new data be entered into the system in ICES Format.

ICES Format has been used for many years, so it has some older features, such as overpunches for negative temperatures and redundant information for each depth level. However, many useful software programs are available which require ICES Format, and the format is suitable for many types of ocean station data, including water temperature, salinity, oxygen and nutrients. Data in ICES Format are in fixed positions and thus easily sorted, extracted, and output for use in other programs. Being a fixed format, however, ICES Format is not flexible for use with all types of oceanographic variables, such as chlorophyll, noble gases or trace elements. A standard convention in OceanPC and all ICES software programs is that ICES Format files have the filename extension .ICE.

To distinguish all those data formats outside the OceanPC system, the common phrase "stranger data" or "stranger formats" will be used. Importing stranger data into OceanPC is an important activity dealt with

BLUEPRINT '86 FORMAT The Blueprint '86 Format (see Appendix A) is a more modern format for oceanographic data, designed for greater flexibility for many types of ocean observations. Blueprint '86 Format has a table at the beginning of the record that contains the names of the variables: a "Blueprint" of what follows. The oceanographic parameter codes used by Blueprint '86 Format are the same as those used by the IODE General Format 3, or "GF3" (IOC 1991b). Blueprint '86 Format can thus contain a virtually unlimited variety of oceanographic variables but at the price of more complicated software than a fixed format, such as ICES Format. Blueprint '86 Format files usually have the filename extension ".BLU".

DIGITAL ROSCOP FORMAT In 1990 the IOC developed the Cruise Summary Report III (formerly known as the Report of Observations/Samples Collected from Oceanographic Platform) for reporting the locations of measurements and samples collected at sea (IOC 1991b). ICES, on the other hand, has pioneered in the development of a digital version of ROSCOP, parallel in content to ROSCOP III. In digital ROSCOPS, the report from a cruise would be a single record (in a larger ASCII file) describing an oceanographic data collection effort. A file of some 15,000 digital ROSCOP entries for historical oceanographic cruises in the North Atlantic is available from ICES, from the late 1960's to the present. ICES receives about 500 additional digital ROSCOP cruise entries per year. The US National Oceanographic Data Center (NODC) is in the process of providing 6000 additional ROSCOP entries to be digitized.

The combined ICES+NODC file of ROSCOP cruise reports represents only a small portion of the total number of historical oceanographic cruises. However, only about 15%-20% of the cruises documented by ROSCOPS have resulted in nationally or internationally available data. Indeed, a major objective of the OCEAN-PC project is to encourage users to report their cruises in digital ROSCOP form, and later to report the observations to National Oceanographic Data Centers and World Data Centers for international exchange. digital ROSCOP files have the filename extension .INF.

GEOGRAPHIC COORDINATES

Geographic coordinates should be entered at the various screen prompts by three different methods:

GENERAL OCEAN MAPPING UTILITY: This program complies with the new U.S. Federal Information Processing Standard for geo-referenced data, in that the coordinates are given in signed decimal degrees. For example, 56 degrees 30 minutes North would be input as 56.5; 112 degrees 45 minutes West would be input as -112.75.

MAKE COASTLINE UTILITY: Geographic coordinates are supplied to this program as whole-number degrees, followed by N, E, S, or W as appropriate, e.g. 40 S.

ALL OTHER UTILITIES: The "right-handed system" (RHS) is used to respond to all other system program prompts. In the RHS all latitudes are input as DDMM where D=degrees and M=minutes; northern hemisphere latitudes are positive and southern hemisphere latitudes are negative. All longitudes are input as DDDMM; western hemisphere longitudes are negative and eastern hemisphere longitudes are positive. For example, 56 degrees 8 minutes North would be input as 5608; 112 degrees 40 minutes West would be input as -11240.

If the user examines the contents of any data files in the OceanPC system, caution should be observed in reading the geographic coordinates due to differences in the file storage formats, which can be quite different from the keyboard input methods described above.

KEY ENTRY AND FILENAME CONVENTIONS

A convention used in this Manual is the use of < and > to bracket specific keystrokes in the examples quoted in the Manual, e.g. <ENTER> means a single stroke on the ENTER key (also called the CARRIAGE RETURN key, or <CR>).

For example, if the utility instructions tell the user to supply the input file *.ICE, then the following key sequence would be a valid response:

GY3536.ICE<ENTER>

Where GY3536 is the filename of a data file that does exist, and its filename extension is ".ICE".

Likewise, if the Manual remarks that, based on the above entry, a file *.ERR will be created, the user knows its complete filename will be:

GY3536.ERR

To avoid constant repetition of format names, the Manual frequently uses a simple shorthand based on the filename extension, for example:

"*.ICE" = a file in the ICES Format

"*.BLU" = a file in the Blueprint '86 Format

Etc. [Where * is the user-provided filename.]

A later section provides a description of the various file types, listed by their usual filename extensions.

OVERVIEW OF COMPONENTS

CAPTURE OCEANOGRAPHIC & ROSCOP DATA

OceanPC provides the user with a wide range of options for capturing data. Methods encompass

New "hard-copy" data from the ship or lab,

The user's existing digital data, and

International and regional digital data available from Oceanographic Data Centers and other sources.

OceanPC deals with each of these categories of information employing utility programs described below:

MANUAL DATA ENTRY

The first way to enter your marine data or "index" information into the system is by manual key entry. There are two utilities in OCEAN PC that allow you to do this:

ENTER OCEANOGRAPHIC DATA A utility is provided that allows the user to enter directly from the keyboard the data from oceanographic casts (or, of course, selected values from STD/CTD casts) into an intermediate format with a filename extension of .DAT.

CONVERT *.DAT TO *.ICE, OR *.BLU, OR *.NOD Immediately after using the above utility, the user can employ this utility to convert the intermediate *.DAT file to any of the following formats: ICES Format, Blueprint '86 Format, or NODC SD1 Format.,

ENTER DIGITAL ROSCOP's An ICES utility is provided that allows the user to manually create the international standard index form called a "digital ROSCOP III" . The digital ROSCOP forms created by ENTER digital ROSCOP are the basis for index searches with another utility named SEARCH digital ROSCOP's. Through digital ROSCOP searching, the user can locate vessels, institutions, and researchers where particular data may reside. This utility creates an intermediate file, with filename *.OUR, containing the key-entered information.

IMPORT & EXPORT STRANGER FORMATS

Another way to enter data into the system is by means of a set of data conversion utilities already provided in OceanPC. The OceanPC Working Group will continue to improve the system by adding necessary conversion routines. The following conversion utilities are provided.

IMPORT NODC SD1/SD2 DATA A utility is provided that converts the National Oceanographic Data Center SD1 AND SD2 data formats to the ICES Format. This is a useful utility for importing into OceanPC any part of the extensive NODC data holdings in these formats, described in Appendix H. The utility automatically recognizes which format (SD1 or SD2) in which the incoming data are stored.

The Standard Profile and NODC formats are the most widely used oceanographic data formats in the world today. The current holdings go back to 1902, the date of the establishment of the Standard Seawater Service in Copenhagen. The present formats were devised in the early 1960s. At that time US needs and ICES needs differed slightly, and as a result, although structurally similar, Standard Profile and SD1/SD2 differ in both concept and parameters.

It is intended that this utility be used in conjunction with the EXPORT NODC SD1 DATA utility which performs the opposite conversion. The two utilities allow the user to take advantage of various PC-based oceanographic data display products available for either format.

[In mid-1993, the NODC is releasing CD-ROM NODC-20 containing many long-term transect and long-term station data in SD2 format. This special CD should not be confused with the "NODC CD-ROM DATA" discussed below.]

EXPORT NODC SD1 DATA A utility is provided that converts the ICES Format to NODC SD1 format. The ICES Format contains a number of chemical parameters additional to those in the NODC format. Whenever this utility encounters such parameters, it stores them in a separate file (*.SUP) where they are identified by the 4-digit GF3 code.

IMPORT CD-ROM DATA A utility is provided that converts data from the U.S. National Oceanographic Data Center CD-ROM's NODC-02 and NODC-03 (see Appendix G) and the World Ocean Atlas 1994 CD-ROM data to ICES Format. The first two of these CD's are derived from the NODC SD2 format files, but they contain only salinity and temperature data with necessary station "header" information.

[CD-ROM NODC-01, which covered only the Pacific Ocean, may also be available to the user, but it is not convertible with this utility. When future CD-ROM sets may become available, their formats may be different again, requiring additional conversion utilities. Further complicating the issue of data formats will be the release in 1994 or early

1995 of updates to CD-ROM's NODC-02 and NODC-03, including nutrient data. These updates will have new CD numbers, and they will have a different format from SD1, SD2, and the abridged data format used on NODC-02 and NODC-03.]

IMPORT BLUEPRINT DATA A utility is provided that converts Blueprint '86 Format to ICES Format. Although most users will want to create data in ICES Format immediately, using the ENTER Oceanographic DATA utility, this routine is also provided for pre-existing Blueprint '86 Format files or other specialized uses.

EXPORT COMMA-SEPARATED DATA A utility is provided to convert ICES Format files to a much more easily read comma-separated version. The resulting "flat files" are immediately usable by most spreadsheet programs and some database management programs. This conversion utility is also provided for any data the user wishes to further transform to the SURFER and ATLAST display and analysis programs.

CONVERT COMMA-SEPARATED DATA TO SURFER FORMAT A utility is provided to translate comma-separated data (created by the above utility) to simpler 2-column or 3-column data files that can be used by the SURFER gridding and contouring program. SURFER expects geo-referenced parameter data, i.e. X-Y-Parameter, and can produce a wide variety of screen, printer, and plotter analyses where data contouring or X-Y graphs are needed.

CONVERT COMMA-SEPARATED DATA TO ATLAST FORMAT A utility is provided to export data to ATLAST. ATLAST is a public-domain program that creates color-coded station profiles of oceanographic data, within an extremely flexible menu environment. ATLAST is provided by the Jet Propulsion Laboratory (Rhines 1993) with a global data set, but the ability to provide additional data from OceanPC should be a significant improvement. Conversely, visualization of OceanPC cruise data with ATLAST should improve data quality control.

QUALITY CONTROL & UTILITIES

A major function of any environmental data management system is quality control. Decades of experience with marine data have led ICES to the development of the utilities included below. Through various sorting and display methods, the user can visualize and organize the data in ways that emphasize inconsistencies or specific patterns indicative of error. There is no general "plan" that will always identify erroneous data, rather the user is advised to become familiar with these utility programs and to try them out on a test data in order to recognize the formats and usages of the outputs.

LIST FILES A utility is provided that lists the files in the current directory.

SORT DATA A utility is provided that performs hierarchical sorting of a ICES Format file to a new (user-named) file. Sorting can occur by year, country, ship, date, time, or station number). Files with up to 15,000 stations can be handled (irrespective of station size)

INDEX DATA A utility is provided that can create an index to a Standard Profile file. This is useful in speeding up the EXTRACT DATA utility described below.

SUMMARIZE STATIONS IN FILE A utility is provided that summarizes (station by station) the contents of a Standard Profile file and checks the structure of the file for consistency. Appropriate screen warning messages are issued if a problem is encountered. A report file is also produced summarizing the "cruises" by different ships, etc.

SUMMARIZE DATA IN FILE A utility is provided that produces a detailed summary of all the data in a Standard Profile file, down to the individual parameters measured at each station/depth. Optionally, it can also produce a report file summarizing the "cruises" by different ships, and/or an automatic digital ROSCOP III file.

CHECK DATA A utility is provided that checks for a number of common errors and problems. This utility produces an output file (*.ERR) compatible with the system file editor (see **EDIT A FILE** below). Thus records failing the tests can be corrected or flagged as necessary.

PLOT X-Y DATA A utility is provided that lets the user examine one or more scatter plots, to see patterns in the data. Depending on the options employed, the user can flag "outlier" data points for later examination by an edit utility.

EDIT DATA A utility is provided that edits ICES Format data records. To use this utility, the user must already know the record number(s) of questionable data. This can be obtained by use of any of the following other OceanPC utilities:

PLOT X-Y DATA - Use of this utility results in a *.ERR error file that "flags" suspect data.

CHECK DATA - Use of this utility results in a *.ERR error file that "flags" suspect data.

SUMMARIZE STATIONS IN FILE and **SUMMARIZE DATA IN FILE** - Use of this either of these utilities allows the user to visually spot questionable data records.

Using the *.ERR error tag file as a guide, the user can examine, correct, or discard the questionable oceanographic data in a ICES Format file.

EXTRACT DATA A utility is provided that allows the user to extract a subset from any ICES Format file, based on year, position, or location within a user-defined "corridor." This later concept is important in creating synthetic data sections, for instance to be used by the ATLAST program described below.

DISPLAY DATA OceanPC provides several methods to display the oceanographic data, as station maps, oceanographic profiles, or contoured property plots.

GENERAL OCEAN MAPPING A multi-purpose marine mapping utility named OPCPlot is provided. The utility uses ASCII data files in a simple format that resembles a ship's log. The utility also recognizes ICES Format files and many other ASCII and binary data formats, drawing maps of the ocean or analytical results. The maps can contain notations and symbols depicting the locations of sampling sites or cruises, as well as ocean fronts, buoy trajectories, and other useful information. Because the plottable files can be posted on electronic bulletin boards, the utility offers a way to communicate maps of marine research activities and of important ocean features to the scientific community.

ICES - DATA DISPLAY

FORMATED DATA LIST A utility is provided that reformats a *.ICE file into a visually pleasing form for subsequent printing or publication.

FIND DATA LIMITS A utility is provided to examine an ICES Format file to determine the minimum and maximum values for the geographic coordinates and for all of the parameters present in the data.

MAKE COASTLINE FILE A utility is provided that allows the user to create a coastline file in the SURFER format, for use with the MAKE STATION MAP utility, below.

MAKE STATION MAP A utility is provided that allows the user to create screen maps of the station locations in ICES Format data file. Coastlines can be drawn on the maps, using the SURFER coastline data format (see above) and the relevant geographic limits (see above). This

program includes a facility to mark individual stations and to save to a station error file.

SEARCH DIGITAL ROSCOP's A utility is provided that allows users to search for the existence of historical oceanographic cruises of interest. Figure 3 shows an example listing from SEARCH DIGITAL ROSCOP's for cruises that took carbon dioxide measurements. Files of digital ROSCOP entries for the years 1980-1989 are included in the OCEAN-PC system. Additional ROSCOP entries can be obtained through INTERNET, as described above.

DATA FILE TYPES

The following listing shows all of the many different file types that the user may eventually find in the OceanPC subdirectories, depending on which utilities he uses. With few exceptions, they are distinguishable by their filename extensions. Reference to this listing should facilitate occasional "housecleaning" of the file, or re-locating previously created files. The first section (ICES software components) lists files that could be found anywhere; the second section (OPCPLOT program) lists files that would be found only in the OPCPLOT subdirectory.

FILE TYPES IN ICES SOFTWARE COMPONENTS:

COAST.BLN A coastline file for use by either the MAKE STATION CHART utility or the SURFER program, produced by the MAKE COASTLINE FILE utility from the master coastline file WORLD.WDB in the OPCPLOT subdirectory.

***.BLU** The Blueprint '86 Format used as an intermediate data storage medium during the keyboard entry of oceanographic data. The user can convert *.BLU files to ICES Format by the IMPORT BLUEPRINT DATA utility. Alternately, the user can avoid any use of *.BLU files by specifying that the output from the INPUT OCEANOGRAPHIC DATA utility be in ICES format.

***.CSV** A comma-separated data file converted from a ICES format file by the EXPORT COMMA-SEPARATED DATA utility. *.CSV files are found in two different versions: a 12-parameter short version, and a 24-parameter long version.

***.DAT** A file that records the user's key entry information during the use of the INPUT OCEANOGRAPHIC DATA utility.

[By chance, binary data files utilized by the ATLAST program also use the filename convention *.DAT. Many *.DAT file come with ATLAST, but new ones can be created by (a) converting a standard profile file to comma-separated format with the EXPORT COMMA-SEPARATED DATA UTILITY, then (b) using the CONVERT COMMA-SEPARATED DATA TO ATLAST FORMAT utility to complete the conversion. The 8th character in the ATLAST filenames should be a digit from 1-4, to indicate the specific ATLAST format. The OceanPC utility always assigns the digit "3".]

[By chance, data files in NODC SD2 format from CD-ROM NODC-20 also use the filename convention *.DAT.]

- *.ERL A log of changes made whilst editing with ICE-EDIT are stored here.
- *.ERR A file that lists the record numbers of suspect data in a Standard Profile file. The *.ERR files are created by the CHECK DATA FAST! utility.
- *.EST Individual stations saved using the STAPLOT interactive editing facility are stored in files of this extension.
- *.EXT An extract of data in ICES format from another, larger *.ICE file. The *.EXT file has been created by the EXTRACT DATA utility.
- *.FLT A file of selected data values taken from a comma-separated data file. The data are separated by a space or any user-specified character in a *.FLT file, and it has only 2 or 3 parameters per record (as opposed to the 24 parameters in the long version of a *.CSV file). These 2 or 3 parameters are specially selected by the user for export to SURFER. 2 parameters are used by SURFER's graphics utility, and 3 parameters (latitude, longitude, and an oceanographic variable) are used for data gridding and contouring.
- *.ICE The Standard Profile format for oceanographic data designed and used by the International Council for the Exploration of the Seas (ICES). This format is also the central standard format for the OceanPC system, which borrows many of the ICES data management programs.
- *.IND An index file to a ICES Format file. Each record in the *.IND file contains information about a single station contained in a *.ICE file. The availability of an index file greatly speeds up the EXTRACT DATA utility.
- *.INF A file of digital ROSCOP information searchable by the SEARCH digital ROSCOP's utility:
- ROS???.INF - One of the annual summary files of digital ROSCOP entries supplied with OceanPC, where ?? stands for the calendar year, e.g. ROS88.INF for 1988.
- ROSIN.INF - A new searchable file of digital ROSCOP information created by the user through key entry with the ENTER DIGITAL ROSCOP's utility, followed by using the CONVERT *.OUR TO *.INF utility.
- ROSDA.INF - The unique file automatically created by the STASUM utility to describe the cruise (or cruises) contained in a *.ICE file.

- *.LST A specially formatted listing of the data in a ICES Format file, wherein all the data items and fields are clearly labelled for easy visual inspection, created by the FORMATTED DATA LIST utility.
- *.LIM This small file is generated by the FIND DATA LIMITS utility. It contains data on the maximum and minimum values of all parameters in the file, and on the geographic coordinates. This file is used by the PLOT X-Y DATA utility.
- *.NOD A file in National Oceanographic Data Center "SD1" format created from an ICES Format file by the EXPORT NODC SD1 DATA utility.
- *.OUR The file created by the INPUT DIGITAL ROSCOP's utility. It can be submitted directly to a National Ocean Data Center, or can be converted to searchable digital ROSCOP format with the CONVERT *.OUR TO *.INF utility.
- *.OUT A family of "output" files in various formats produced as reports by utilities in the system:
- FISUM.OUT - A text file created by the FISUM utility that summarizes the contents of a *.ICE file in terms of vessels, years, stations, and cruises represented.
- ROS-STA.OUT - A text file created by the STASUM utility. The entries in the file describe the numbers of stations for each parameter in each Marsden Square.
- ROS1.OUT - A text file created by the SEARCH DIGITAL ROSCOP's utility, containing the extracted ROSCOP forms.
- ROS2.OUT - A text file created by the SEARCH DIGITAL ROSCOP's utility, containing cruise headers and information on the availability of the data.
- STASUM.OUT - A text file created by the STASUM utility that summarizes all the parameters at each oceanographic station.
- *.STO When the user has completed a session with the MAKE X-Y PLOT utility, one option offered by the program is the creation of a "quick look" file that contains the essential information to re-create the left-hand scatter plot (of the 3 plots usually made). The *.STO file is created to contain screen coordinates of the data points and appropriate data pointers.
- *.SUP When the EXPORT NODC SD2 DATA utility creates a *.NOD file from a *.ICE file, there may be items of data which cannot be

accommodated in the *.NOD file. The EXPORT utility also creates a *.SUP file to contain these extra data, formatted similar to Blueprint '86 Format.

*.SUS A file of minimum and maximum values (and their record numbers) identified during the use of the PLOT X-Y DATA utility.

FILE TYPES IN OPCPLOT COMPONENT:

*.FLL A short file containing the screen coloring instructions for any "standard" map selected by the user from the DEFINE A MAP menu.

*.HPG A plotter file in Hewlett-Packard Graphics Language (conforming to the 7475A Plotter specification), containing all OPCPLOT-drawn figures (except screen REPLAY images). The *.HPG files can be imported into WordPerfect documents.

*.LST A file that accompanies any *.WDB file (see above) containing a list of all the maps that have been defined from the *.WDB file. The entries in the list consists of the names of the index files that contain the addresses of the segments in *.WDB needed to make a map, and information about the boundaries of the map.

*.NDX An index file that contains the addresses of all the segments of data in a *.WDB file needed to draw a single map.

WORLD.WDB A coastline file in Micro-WORLD DATA BANK II (MWDB2) format used by either the MAKE COASTLINE utility or the GENERAL OCEAN MAPPING utility. OceanPC is supplied with WORLD.WDB which contains the world's coastlines and major islands. The GENERAL OCEAN MAPPING utility, however, has a function that allows the user to substitute any geo-referenced data base in *.WDB format.

The complete MWDB2 system consists of 1200 indexed line segments in 6 different categories (land, islands, rivers, lakes, countries, states), at 5 levels of resolution (ranging from a few km's to about 200 km's).

BRIEF DESCRIPTION OF RELATED SOFTWARE

THE "SHOEBOX" (IOC 1991a)

The Intergovernmental Oceanographic Commission has assembled a catalogue of useful "stand alone" software programs for marine scientists that can be used in conjunction with OceanPC. This catalogue, nicknamed "The Shoebox", can be obtained from:

Ocean PC Project Officer
Intergovernmental Oceanographic Commission
UNESCO
1 rue Miollis
75732 Paris cedex
FRANCE

MICRO WORLD DATA BANK-II (Popeschil and Riveria ND)

Based on the much larger World Data Bank II, available from the U.S. National Technical Information Service, this microcomputer version contains digital coastline, island, country, (U.S) state, river, and lake boundaries. The MWDBII system was used as the source for the WORLD.WDB file used by several utilities.

SEASPECT (Lascaratos et al 1990)

"SEASPECT is a software package specially designed for oceanographic time series analysis. It contains five main programs...which perform data handling and manipulation, univariate and rotary spectral analysis. The package has initially been developed by, and installed at the Department of Applied Physics (Laboratory of Meteorology and Oceanography) of the University of Athens, Greece."

SURFER (Golden Software, Inc. 1990)

A commercially purchased data gridding and contouring program in wide use by meteorologists, oceanographers, and biologists. Oceanographic "data triplets" (see the Appendices) can be exported from OceanPC to SURFER for gridding, and the gridded data can be contoured by either SURFER or the GENERAL OCEAN MAPPING utility.

ATLAST (Rhines 1993)

The ATLAST program is an extremely flexible, public-domain oceanographic sectioning utility. Using files of nutrient data from actual historic cruises or artificially constructed sections from general archives (for details, see the EXTRACT DATA utility), the program draws a number of instructive vertical property-property plots. The utility of the program ranges from basin-scale visualization of water masses to bottle-by-bottle examination of the specific data points. A separate Manual is available.

INSTALLING THE SYSTEM

CONTENTS OF THE OceanPC DISKETTES

The OCEAN-PC system is distributed:

On 2 1.4 MB 3 ½ inch floppy diskettes, or

Over Internet, as 3 files (in compressed format), and a READ.ME instructional file.

The diskettes/files are as follows:

Diskette 1: File OPC1.EXE, OPCINST.EXE

Diskette 2: File OPC2.EXE

OPC1.EXE and OPC2.EXE are self-extracting PKZIP compressed files. Please use the installation program OPCINST.EXE to unpack the above files. If you do not want to install in this way, then please make sure that the files are loaded into the correct directories. This can be done by typing:

```
OPC1 -d
OPC2 -d
```

Contents of File OPC1.EXE:

All executable programs (*.EXE) and source codes (*.BAS) used in OceanPC, with the exception of the OPCPLOT system.

Contents of File OPC2.EXE

Sample hydrochemistry data files, digital ROSCOP files, and the OPCPLOT system files.

There are two sample hydrochemistry data files supplied with OceanPC. These will help you get started, and allow you to see the capabilities of OceanPC. These data files are:

OPC1.ICE - this is a section from 20° W worked by the Dutch Research vessel "TYRO" during a World Ocean Circulation Experiment (WOCE) cruise in 1990.

OPC2.ICE - this is a survey conducted by the English Research Vessel "CHALLENGER" during the United Kingdom North Sea Project in 1988.

INSTALLATION PROCEDURES FOR OceanPC

When you install the system by using the program OPCINST.EXE, the following directories will be created on the drive you specify:

\ocean_pc with sub directories [opcplot, rosc, exec, bas, data]

NOTE: You will need about 4 MB of free disk space for this installation.

INSTALLATION FROM FLOPPY DISKETTE

To allow the installation to proceed you need to input the drive letters for your floppy drive, and the hard disk drive to which you want to install OceanPC. If you press <RETURN>, floppy drive **A:** and hard disk **C:** will be assumed as the source and destination, respectively.

INSTALLATION PROCEDURE

The installation process is started by loading Disk 1 in your computer (e.g., in drive **A:**) and typing:

A:OPCINST<ENTER>

The contents of the diskettes/files are unpacked into the appropriate directories by the installation program. A prompt is given when you need to change diskettes (if in fact installation is from diskette). On completion of the installation, the installation program loads the OceanPC menu program IOCOPC which is placed in directory \OCEAN_PC. On future sessions of OceanPC, then you may start up by changing to this directory, and type IOCOPC. Alternatively you may place IOCOPC.EXE in a directory included in your PATH. IOCOPC will then automatically find the correct directory, if on the current drive. If not, you will have to specify this.

INSTALLATION FROM HARD DISK (VIA INTERNET)

If you have downloaded your OceanPC files by file transfer protocol over INTERNET then the "floppy disk" is any drive on which the installation files are resident. For example, if you have copied your files to the drive **C:** (hard disk) then this is your "floppy disk". However please note that the installation files **MUST** be in the root directory of the required drive, otherwise you will get FILE NOT FOUND messages.

OBTAINING OceanPC THROUGH INTERNET

OceanPC is maintained on the Public Unix server on the ICES computer in Copenhagen, and is therefore retrievable over INTERNET - anonymous file transfer protocol (ftp). To obtain OceanPC by this means, the following procedure is recommended, but note that all instructions are case sensitive:

```
ftp server.ices.inst.dk
      or
ftp 129.142.180.10
USER: ftp
PASSWORD: [your mail address]
ftp> cd /dist/oceanpc
ftp> binary
ftp> ls
ftp> prompt off
ftp> mget * [where * is/are the desired file(s)]
ftp> bye
```

The full ICES digital ROSCOP data set is also available from this server. To obtain this, follow the above instructions, change to directory /dist/roscop rather than /dist/oceanpc.

OBTAINING THE GENERAL OCEAN MAPPING UTILITY THROUGH INTERNET

The GENERAL OCEAN MAPPING UTILITY (which is included in the entire OceanPC package, described above) may also be obtained by itself. The executable program code OPCPLOT.EXE, the manual (Wordperfect 5.1 or ASCII version), and sample files may be obtained through anonymous file transfer protocol over INTERNET, as follows:

Access INTERNET by the usual means; use lower-case letters, except as shown.

```
ftp atlantic.ocean.fsu.edu
Name: anonymous
Password: [your internet address]
("readme" file appears)
      ftp> binary
      ftp> cd /pub/Opcplot
      ftp> ls (lists the files)
      ftp> mget readme.doc opcunpak.exe
      ftp> bye
```

On your own computer create the directory OPCPLOT, copy OPCUNPAK.EXE to it, then type OPCUNPAK<RETURN> to initiate the unpacking of the files. OPCUNPAK.EXE can be deleted after you're sure that OPCPLOT has been successfully installed and is running.

REFERENCES

Brown, M.L. 1993. OPCPLOT: Oceanographic Mapping Software for the World's Seas, Version 1.7, June 1993. OCS Report/MMS 93-0020. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico Regional Office, New Orleans, LA. 65 pp.

Golden Software, Inc. 1993. SURFER User Manual. Boulder, Colorado.

IOC. 1991a. OCEAN-PC; Inventory of Software and Products for the Display and Analysis of Marine Data; The "Shoebox". IOC/INF - 878. 13 April 1991. Intergovernmental Oceanographic Commission, UNESCO, Paris. 37 pp.

IOC. 1991b. Manual on International Oceanographic Data Exchange, Manual and Guides 9, Revised Edition. Intergovernmental Oceanographic Commission, UNESCO, Paris.

Lascaratos A., J. Daskalakis, L. Perivoliotis and N. Vlastos 1990. SEASPECT: A software package for Oceanographic Time Series Analysis. University of Athens.

NODC, 1991. CD-ROMs NODC-02 and NODC-03: Global Ocean Temperature and Salinity Profiles. National Oceanographic Data Center, Washington, DC. July 1991. 14 pp documentation and CD's.

Pospeschil, F. and Riveria, A. Micro World Data Bank II. Global coastline and political boundary data for use on PC microcomputers. For information, contact: Fred Pospeschil, 3108 Jackson St., Bellevue, NE. 68005. Telephone number 402-291-0795 (6-9 PM Central Time).

Rhines, P. B. 1992. ATLAST Release 3.5: A World-Ocean Atlas of Hydrography, Nutrients and Chemical Tracers. University of Washington, School of Oceanography. Technical Report 91-1. Release 3.5 vi 10/92. 41 pp.

To obtain a copy of the ATLAST software, please contact:

NASA PODAAC
MF 300/323
Attention: Ms. Ruby Lassanyi
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91109
USA

Telephone: 818 354 0906
Omnet: PO.DAAC.JPL
Internet: RAL@stans.span.nasa.gov

Technical questions regarding ATLAST applications should be addressed to:

Dr. Peter Rhines
School of Oceanography, WB-10
University of Washington
Seattle, WA 98195
USA

Telephone: 206 543 0593
Omnet: P.RHINES
Internet: rhines@ocean.washington.edu

FIGURES

APPENDIX A. MANUAL DATA ENTRY

ENTER OCEANOGRAPHIC DATA

EXECUTABLE PROGRAM NAME: ENTICE.EXE

FUNCTION: This utility provides you with the means to enter oceanographic/chemistry data into a structured computer file. Most parameters normally collected at profile stations are included.

It is ergonomically designed to help data entry personnel to reach maximum speed efficiently, and is particularly suitable for digitizing large data sets.

INPUT SOURCE/FORMAT INFORMATION: Manually enter the oceanographic data for each station (location, time, temperature, salinity, and "nutrients"), using original cruise reports, logs, data sheets, or other historical data.

OUTPUT FORMAT AND USAGE: Each use of this utility produces ASCII files that "record" your key entries, which have an extension *.DAT, where the * refers to the originators 4-character station number.

One *.DAT file is produced for every station. This file can be re-read by ENTICE, allowing you to make corrections or additions, if necessary. Once you have completed your data entry session, you may erase the *.DAT files, but first REMEMBER to convert them to a standard format in one file using DATCONV.

DATCONV is accessible from ENTICE, and converts your entered data to any of three formats: ICES profile, Blueprint '86, and NODC-SD1.

PROCEDURAL NOTES:

1. The utility checks the keyed data for consistency as it is entered and places the data in an intermediate format (Blueprint '86 Format) that precedes conversion to the selected final output format.

2. Quick guide to Function Keys:

F1	Master record
F2	Data cycles 1 to 22 - first 11 parameters
shift-F2	Data cycles 1 to 22 - last 4 parameters (depth for info only)
F3	Data cycles 22 to 44 - first 11 parameters
shift-F3	Data cycles 22 to 44 - last 4 parameters (depth for info only)

shift-F4	Doubtful data quality marker - point to field before pressing
F10	Completes this session; saves data into Blueprint '86 Format file readable by ENTICE
Esc	Press two (or three) times to abort without save
Cursors	Use cursor keys to navigate to fields
Tab	Press to move to beginning of next column
Ctrl-D	Delete entry and shuffle fields up.
Ctrl-E	Expand, i.e. create a space and shuffle fields down
Others	All numeric keys plus delete, < , . , and - are permissible (assuming permitted by the data entry checks)

4. Hints:

a. Once a field is filled, the cursor moves to the next field. Alternatively, if you do not want to use all available decimal positions in a field, terminate the entry by pressing <Enter>.

b. Type "." to avoid typing leading zeros (eg 7. gives 07)

5. Beeps: Your computer will beep if you enter a number that is not within the allowed range. The greatest control occurs in the depth field; these must be entered before any other parameter, and must be entered in increasing order.

ENTER DIGITAL ROSCOPS

EXECUTABLE PROGRAM NAME: ROSIN.EXE

FUNCTION: This utility is a user-friendly form-filler for IOC's digital ROSCOP III cruise summaries, allowing the user to enter information about a single oceanographic cruise. It is completely self-contained with built-in "touch-and-select" maps of Marsden squares (to the 1-degree level), and lists of digital ROSCOP parameter codes. Since digital ROSCOP's are basically free-text, there are minimal quality checks on each item entered by the user.

INPUT SOURCE/FORMAT INFORMATION: The user provides information by direct key entry, in some cases by pointing to lists or maps.

OUTPUT FORMAT AND USAGE: ROSIN's *.OUR output files are convertible to .INF files (Program OUR2INF.EXE), which are identical to the archive of digital ROSCOP files provided with the OceanPC system. The user can easily set up a searchable data set extending the OceanPC digital ROSCOP collection.

If you make use of this utility you may send your output on diskette or electronic mail to ICES or your National or World Data Centre who will check and edit the information. Information sent to ICES will be merged with its existing cruise information data bank, which is used in conjunction with the SEARCH digital ROSCOP's utility in this system.

PROCEDURAL NOTES:

1. Start by looking at the various pages. These are accessible by pressing the function keys listed on the bottomline of each page. Try the 4 cursor, and the HOME and END keys.
2. Once you start entering information into a field you must complete your entry by pressing <RETURN>. Until you do this you will find that the cursor and function keys (not F10) respond only with a BEEP.
3. Corrections to your entries may be done using text editor facilities available from F5. Text strings of maximum length=79 may be entered. Use the editor if you wish to exceed the designated field length.
4. When you have entered the cruise information you should make a backup of your file(s) and send a copy on diskette either directly to ICES or through your national data center. If you send directly to ICES, a hard copy of the information will be passed to your National Oceanographic Data Center and ICES will return your diskette with the latest digital ROSCOP information.

APPENDIX B. IMPORT AND EXPORT DATA

IMPORT NODC SD1/SD2 DATA

EXECUTABLE PROGRAM NAME : NODC-ICE.EXE

FUNCTION: To import any National Oceanographic Data Center (NODC) oceanographic data file in SD1 or SD formats (CD-ROM NODC-20) to ICES Format

INPUT SOURCE/FORMAT INFORMATION: The user specifies an input file, which must be in the NODC SD1 or SD2 formats.

OUTPUT FORMAT AND USAGE: On the same directory location where the input SD1/SD2 file was located, the utility creates the new ICES Format file:

*.ICE.

PROCEDURAL NOTES:

Conversion is direct without intermediate formats.

EXPORT NODC SD1 DATA

EXECUTABLE PROGRAM NAME: ICE-NODC.EXE

FUNCTION: To export data from OceanPC (ICES Format) to the NODC-SD1 format used by the U.S. National Oceanographic Data Center.

INPUT SOURCE/FORMAT INFORMATION: The user specifies a Standard Profile file to be converted to SD1 format:

*.ICE

OUTPUT FORMAT AND USAGE: The utility exports a file in NODC SD1 format:

*.NOD

The utility also exports a secondary file that contains any data in the OceanPC data file that could not be contained in the data fields of the SD1 format (for example Total Nitrogen, chlorophyll 'a'):

*.SUP

The *.SUP file is similar in format to Blueprint '86 Format or the GF3 Format.

PROCEDURAL NOTES:

Conversion is direct without intermediate formats.

IMPORT NODC CD-ROM DATA

EXECUTABLE PROGRAM NAME: CD-ICE.EXE

FUNCTION: The utility allows the user to import salinity/temperature data files from the U.S. National Oceanographic Data Center CD-ROM set entitled "Global Ocean Temperature and Salinity Profiles" (CD-ROM's NODC-02 and NODC-03) and for the "World Ocean Atlas 1994" CD-ROM set.

INPUT SOURCE/FORMAT INFORMATION: Use the software that accompanies the CD-ROM to download selected 15° square and nutrient files to a hard disk. This utility will then convert the CD-ROM data to ICES Format.

The data on the CD-ROM's are grouped in 6 different types of files:

1. T-S data from Nansen casts; these data are called "SD2" on the CD, but they are not the same format as the real SD2 data also available at the NODC. SD2 data from NODC can also be imported into OceanPC with a different utility program (NODC-ICE.EXE). In the case of the World Ocean Atlas CD-ROM which includes nutrient data, the data are stored in another format.
2. T-S data from low-resolution conductivity/salinity-temperature-depth data profiles (STD). Additional high resolution CTD data are provided in the "World Ocean Atlas CD-ROM.
3. Four different types of bathythermograph data (MBT, XBT, SBT, and IGT).

Of these, only the first two data types can be imported with this utility, i.e. only the T-S data, not temperature-only data. These first two data types have identical formats. In the case of the World Ocean Atlas CD-ROM all data types can be converted.

OUTPUT FORMAT AND USAGE: The user specifies the filename for the new ICES Format data file:

*.ICE

which will be placed in the same hard disk directory where the input file was located.

PROCEDURAL NOTES:

1. The NODC CD-ROM's 2 and 3 contain only salinity and/or temperature data, by location, date/time, and depth. The data are derived from the much larger "SD2" data files, but the nutrient data are omitted.
2. The CD-ROM NODC-01, which covered only the Pacific Ocean, may also be available to the user, but it is not convertible with this utility.

IMPORT BLUEPRINT DATA

EXECUTABLE PROGRAM NAME: BLU-ICE.EXE

FUNCTION: To import Blueprint '86 Format oceanographic data into OceanPC. This conversion is the bridge between Blueprint files created by the **ENTER OCEANOGRAPHIC DATA** function (if the user did not elect to create *.ICE files initially) and the rest of the OceanPC system (which requires *.ICE files).

INPUT SOURCE/FORMAT INFORMATION: The user specifies the name of the Blueprint '86 Format file to be converted:

*.BLU

OUTPUT FORMAT AND USAGE: The utility creates the ICES Format data file:

*.ICE

which is now available for all quality-control, display, and mapping functions in OceanPC.

PROCEDURAL NOTES:

1. No further use of the Blueprint format is made in OCEANPC, but it is presented here as a demonstration what a user-specified format accommodating any desired parameter may look like. The structure of this format is basically that used in ICES for contaminant data storage. This format is also in use for flexible data management purposes in some institutions where the ability to expand data types without resorting to format re-design was an important criterion.

EXPORT COMMA-SEPARATED DATA

EXECUTABLE PROGRAM NAME: ICE-CSV.EXE

FUNCTION: The utility converts OceanPC standard profile format data to a comma-separated version, for

Easier visual inspection

Direct import into many spreadsheet programs, and

For the CONVERT COMMA-SEPARATED DATA TO SURFER FORMAT utility

As with most data formats, the Standard Profile format is not well-suited to use in commercial data base managers or spreadsheet programs. Software to read data in this structure has to be fairly sophisticated. ICES-CSV.EXE helps you to circumvent this difficulty, by converting Standard Profile format to a flat ascii file of data whose field separator is a comma (by default). Any character produced by the keyboard may be used as a field separator (see below)

INPUT SOURCE/FORMAT INFORMATION: The user specifies the OceanPC data file to be converted:

*.ICE

OUTPUT FORMAT AND USAGE: The utility creates a new file:

*.CSV

wherein each data line contains a sequence of either 12 or 24 (see Procedural Note 2) comma-separated data fields, as follows:

<1> Country/ship	<13> Oxygen
<2> Station No.	<14> Phosphate
<3> Latitude (decimal degrees)	<15> Total Phosphorus
<4> Longitude (decimal degrees)	<16> Silicate
<5> Year (e.g. 9)	<17> Nitrate
<6> Month	<18> Nitrite
<7> Day	<19> Ammonium
<8> Time	<20> Total Nitrogen
<9> Sounding	<21> Hydrogen Sulphide
<10> Observation depth	<22> pH
<11> Temperature	<23> Alkalinity
<12> Salinity	<24> Chlorophyll a

The units of measurement are described in Appendix F. Any "missing values" in the original file are represented in the *.CSV file by "-9".

PROCEDURAL NOTES:

1. When the opening "title page" of the utility appears, the user can use the F5 key to:
 - a. See a listing of the data fields that will be in the new CSV file (the same listing shown above). The left-hand 12 fields can be considered the "short form" of the CSV, while all 24 fields can be considered the "long form."
 - b. Change the fields separator from a comma to any other ASCII character. Whichever key the user hits when leaving the above Table is subsequently used by utility as the fields separator in the output file.
2. After the user specifies the .ICE file to be converted to CSV, he is given the choice between a "short form" output and a "long form" output, referring to 12 vs. 24 output fields. In responding:
 - a. <ENTER> = "short form" output
 - b. <ANY OTHER KEY> = "long form" output

CONVERT COMMA-SEPARATED DATA TO SURFER OR SPREADSHEET FORMAT

EXECUTABLE PROGRAM NAME: CSV-SUR.EXE

FUNCTION: To select information from a comma-separated file and to convert it to a "flat file" compatible with the SURFER program, or to spreadsheet program or a database management program. This selection process is much more detailed and user-controllable than the rudimentary selection options offered by the EXPORT COMMA-SEPARATED DATA utility.

INPUT SOURCE/FORMAT INFORMATION: The user specifies the file (already produced by the EXPORT COMMA-SEPARATED DATA utility) from which data will be selected and converted:

*.CSV

OUTPUT FORMAT AND USAGE: Based on the user's specifications for selecting data from the CSV file, the utility creates a new file:

*.FLT

in either of two different formats:

1. If the user is selecting data to use with the SURFER gridding and contouring program, then a "triplet" of data is required for each record. A "triplet" consists of a Latitude, and Longitude, and any one of the measured parameters, e.g. salinity. These values are separated in the output file only by a space.
2. If the user is selecting data to use with a spreadsheet program or a database management program, for instance to make a graph or to perform other statistical analysis, then a "doublet" of data is required for each record. A "doublet": consists of any pair of measured parameters, e.g. salinity & temperature. These values are separated in the output file only by a space.

PROCEDURAL NOTES:

1. The program first checks to make sure the input file is a 24-field *.CSV format, rather than the alternate 12-field format. Processing will abort here if the file is not a 24-field *.CSV file.
2. It is common practice to consider data doublets as consisting of an independent variable (the "x value" or abscissa) and a dependant variable (the "y value" or ordinate). This notation is used by the utility when the user is selecting data for use with a spreadsheet or database manager program.
3. When selecting either doublets or triplets, the user is given the following capabilities:

- a. Choice of selecting winter (December to March) data only.
 - b. Choice of selecting only data within a certain depth band relative to the surface.
 - c. Choice of selecting only data within a certain depth band relative to the bottom.
4. When selecting data doublets, the following automatic data management functions can be selected by the user:
- a. Summation of nitrite and nitrate.
 - c. Grouping of independent variable values into specific intervals, for instance to create a "bar graph" where the abscissa plots the midpoints of the intervals and the ordinate plots the average values of the dependant values.
 - d. Pick the upper limit of the highest abscissa interval, i.e. put an upper limit on the abscissa of a bar graph.

CONVERT COMMA-SEPARATED DATA TO ATLAST FORMAT

EXECUTABLE PROGRAM NAME: CSV-ATL.EXE

FUNCTION: To convert a comma-separated data file (*.CSV) to the ATLAST format.

INPUT SOURCE/FORMAT INFORMATION: The code inputs a *.CSV file created by prior use of the EXPORT COMMA-SEPARATED DATA function. Due to a small limitation on the filenames in the ATLAST program the user must also enter a separate filename for the new data file.

OUTPUT FORMAT AND USAGE: There are 4 different data formats in the ATLAST system (Rhines 1992), indicated for each file by a single digit in the 8th place of the filename (hence a 7-character limit on the user-selectable filename); the filename extension is usually .DAT. The output from CSV-ATL.EXE corresponds ONLY to Format No. 3, so the resulting filename is:

*3.DAT

The ATLAST file contains the following variables in random access basic binary format: station, latitude, longitude, pressure, temperature, salinity, oxygen, sigma-0, sigma-2, sigma-4, nitrate, phosphate, and silicate. The *.CSV file from which it was converted contains everything except pressure, sigma-0, sigma-2, and sigma-4. Pressure in decibars is estimated as the depth of the observation in meters; sigma-0 is calculated from the salinity; oxygen in micromoles per kilogram is calculated from oxygen in milliliters per liter and sigma-0. After these substitutions, any other missing values are represented by a value of binary zero.

PROCEDURAL NOTES:

1. The program first checks to make sure the input file is a 24-field *.CSV format, rather than the alternate 12-field format. Processing will abort here if the file is not a 24-field *.CSV file.

CONVERT *.OUR TO *.INF

EXECUTABLE PROGRAM NAME: OUR2INF.EXE

FUNCTION: To convert the individual files generated by the ENTER DIGITAL ROSCOP utility into one file in the format required by the SEARCH DIGITAL ROSCOP utility.

OUTPUT FORMAT AND USAGE:

The default output file is ROSIN.INF, but the user may specify the alternative. The output format is compatible with the SEARCH DIGITAL ROSCOP's utility, but please be aware of the naming convention required by this utility, i.e. the name must be of the form ROS??.INF.

PROCEDURAL NOTES:

The .OUR files must be present in the current directory. Ensure that only those files that require conversion are present.

CONVERT *.DAT TO *.ICE

EXECUTABLE PROGRAM NAME: DATCONV.EXE

FUNCTION: To convert the individual files generated by the ENTER OCEANOGRAPHIC DATA utility into one of three standard data exchange formats, ICES Format, NODC SD1 Format, or Blueprint '86 Format.

INPUT SOURCE/FORMAT INFORMATION: The Input *.DAT files must be on the current directory. The utility gathers these files together, and sorts them. The utility aborts if any of these files are in the incorrect format.

OUTPUT FORMAT AND USAGE: The default output file is ENTICE.???, where ??? may be NOD, ICE or BLU, but the user may specify an alternative. The output format is in the exchange format specified (.NOD - NODC-SD1, .ICE - ICES profile (OceanPC compatible), and .BLU (Blueprint '86)).

PROCEDURAL NOTES: The *.DAT files must be present in the current directory. Ensure that only those files that require conversion are present.

APPENDIX C. DATA QUALITY CONTROL AND UTILITIES

SORT DATA

EXECUTABLE PROGRAM NAME: ICESORT.EXE

FUNCTION: To sort an existing data file to a new data file.

INPUT SOURCE/FORMAT INFORMATION: The user specifies the input file name:

*.ICE

OUTPUT FORMAT AND USAGE: Because the output file is also in OceanPC format the user must specify a **new** filename to avoid overwriting the old file.

PROCEDURAL NOTES:

1. The utility allows the user to specify any or all of the following fields to sort on:

- Station number
- Country
- Ship
- Year (2-digit, e.g. 88 not 1988)
- Month
- Day
- Hour

2. Because the program makes use of SORT.EXE which is supplied with DOS, this must be available (either in current directory, or in path). It also means that there is an upper limit to the number of stations that can be sorted. For sorting on only 2 keys, approximately 15,000 stations may be sorted.

INDEX DATA

EXECUTABLE PROGRAM NAME: INDEX.EXE

FUNCTION: To create an ASCII index file to the locations of records in a data file. Although not required, if the user subsequently uses the EXTRACT DATA function, then the index file created here will speed up the extraction process.

INPUT SOURCE/FORMAT INFORMATION: The user specifies a data file to be indexed:

*.ICE

OUTPUT FORMAT AND USAGE: The utility creates a new ASCII file that indexes the user-specified data file:

*.IND

An ASCII file containing the year, geographic location, and Standard Profile data segment location for every station in *.ICE.

SUMMARIZE STATIONS IN FILE

EXECUTABLE PROGRAM NAME: FISUM.EXE

FUNCTION: Examine a data file and prepare a brief summary of all the stations in that file. FISUM summarizes the contents of your data set, generating one line of output whenever station number or time/date ceases to be incrementing. A line of output is also triggered by a change in ship/platform, and a new year. This utility is also useful for detecting incorrect entries following data entry with the ENTER OCEANOGRAPHIC DATA utility.

For example, and incorrectly entered country code will be singled out by this utility.

Other information in the output shows the number of stations with oceanographic profile data records (03), chemistry records (56 or 76) or records with very high levels of nutrients (P6) . These numbers are the various record identifiers used in the ICES format.

INPUT SOURCE/FORMAT INFORMATION: The user specifies the data file to be summarized:

*.ICE

OUTPUT FORMAT AND USAGE: The utility generates two forms of information useful to the user:

A set of warning messages are issued to the screen (if appropriate) concerning the structure of the examined file.

An ASCII file containing a summary of the "cruises" in the file, based on the activity of different ships:

FISUM.OUT

This file also contains the range of record numbers for each cruise, which the user could subsequently employ with the EXTRACT DATA function to extract any particular cruise, or the EDIT DATA function to make corrections.

SUMMARIZE DATA IN FILE

EXECUTABLE PROGRAM NAME: STASUM.EXE

FUNCTION: To prepare an extended summary of all the data in a file, including the presence/absence of all data types at all station/depth locations. The summary displays the contents of each station, showing which of the 17 parameters were measured. Contents of each master record are also shown, as are the maximum observed depths, and the number of observations. The utility also produces a summary for each 'cruise', showing the distribution of stations by marsden square, and the number of stations in terms of ROSCOP parameters. One of the files generated by the utility produces a cruise summary that is compatible with the format produced by ROSEARCH.

INPUT SOURCE/FORMAT INFORMATION: The user specifies a data file to be summarized:

*.ICE

OUTPUT FORMAT AND USAGE: Depending on the options selected by the user, the utility can provide:

1. ASCII table summarizing all the data in the file, including the presence/absence of each oceanographic parameter at each depth at each station:

STASUM.OUT

2. ASCII cruise summary (where the utility divides data from specific vessels into "cruises" based on assumptions provided by the user about the length of time between periods of at-sea activity:

ROS-OUT.DAT

3. digital ROSCOP file:

ROSDA.INF

PROCEDURAL NOTES:

1. Enter the filename with extension.
2. The screen prompt "text for output report" refers to a user-supplied word or phrase that will appear in the output report, for ease of later identification.
3. The screen prompt referring to "<A>" means that if the user types in "A" at this point, then the output will be formatted for an A4 paper, otherwise A5 will be assumed.

QUALITY CHECK DATA

EXECUTABLE PROGRAM NAME: ICESQC.EXE

FUNCTION: To perform a fast quality control check of a data file.

As its name suggests, this utility carries out basic quality control of Standard Profile data files.

INPUT SOURCE/FORMAT INFORMATION: The user specifies the data file to be examined:

*.ICE

OUTPUT FORMAT AND USAGE: The utility creates an ASCII file that notes (on a record-by-record basis) all of the suspect records:

*.ERR

Subsequently, if the utility **EDIT DATA** is being used, this *.ERR file can be used to "point toward" the suspect values for individual correction or flagging, as necessary.

PROCEDURAL NOTES:

1. ICESQC.EXE checks for the following problems:

- a. Illegal record types,
- b. Illegal record lengths (must be 80 characters),
- c. Minutes values greater or equal to 60,
- d. Ship speed checks. The ICESQC utility flags negative shipspeeds, suspect speeds (greater than 20 and less than 40 knots), and gross speed errors (greater than 40 knots). Ship speed checks require that the data be sorted by ship and time (using ICESORT). For this consistent station numbering in a data set is encouraged as a redundant checking parameter. This procedure often reveals points on land, but is double-checked using the STAPLOT, which produces a track map.
- e. Decreasing depth of observations at a single station. This is often a symptom of merging several stations under the one header, a common error for data exported from a data base table.
- f. Sounding is greater than the deepest observation depth. Assumes units are meters and decibars respectively.

- g. Warnings of density instabilities are given if option <G> is given on startup. The flags are for:
 - (1) Slight instabilities (greater than 0.1 and less than 0.5) and
 - (2) Large instabilities (greater than 0.5).
 - h. It checks that minutes do not exceed 60, or months do not exceed 12.
2. Many other profile consistency checks are possible, including checks for unrealistic oxygen saturation.

PLOT X-Y DATA

EXECUTABLE PROGRAM NAME: TSLOOK.EXE

FUNCTION: To examine a set of X-Y, X-Pressure, and Y-Pressure monitor screen scatter plots (where X and Y are any two parameters in a file selected by the user), and to flag suspect data points for subsequent closer examination by the **EDIT DATA** function. The following screen types are supported CGA/EGA/MCGA/VGA

INPUT SOURCE/FORMAT INFORMATION: The user specifies a data file from which the three scatter plots will be created:

*.ICE

OUTPUT FORMAT AND USAGE:

1. The utility creates two files containing suspect data:

a. An ASCII file containing data identified by the user as suspect during viewing of X-Y scatter plots:

*.ERR

The *.ERR file is also sent to the originator for confirmation of any corrections made.

b. An ASCII file *.SUS is automatically made by the utility, containing all maximum and minimum data values (along with their record number):

*.SUS

c. The *.SUS file also contains the record of the entire station that has a suspect value (if so selected).

2. The utility also creates an ASCII file that contains the information contained in the basic X-Y plot:

*.STO

In subsequent sessions with the **X-Y DATA PLOT** utility, this *.STO file can be specified instead of the *.ICE file, for more rapid display of the X-Y plot. In this case, however, the other plots are not provided, but on pointing to individual dots, a listing of the displayed parameters in the station, centered on the values of this point, are printed on the screen..

PROCEDURAL NOTES:

1. When the opening "title screen" is presented on the screen, the user can enter F5 to be presented with several operating choices. The following information summarizes these choices:

- <E> If the user exits the F5 help screen by hitting E, then the utility will subsequently draw all three scatter plots of the data, i.e. X-Y, X-Pressure, and Y-Pressure. After the plots have been drawn, a cursor appears for individual data point examination.
- <S> If the user exits the F5 help screen by hitting S, then the utility just replays a saved X-Y plot from a *.STO file.
- <ANY OTHER KEY> If the user exits the F5 help screen by hitting any other key than E or S, then the utility draws the same three scatter plots as for E, but no cross-hair cursor is provided. This option is for simple viewing purposes only.

2. (If the E or S options has been chosen) inconsistent patterns or outliers can be pointed to in the X-Y portion of the plot with the cross-hair cursor, and saved in the *.ERR file. These points can therefore be corrected or flagged with the **EDIT DATA** function.

3. When exiting this function, the user will be given the option of saving the X-Y plot to a *.STO file for re-viewing at a later stage. This is particularly useful if several pairs of parameters have to be viewed.

4. When running the utility, you will notice that progress through the data file is continuous. To stop on each station press the spacebar; press any other key to return to continuous processing of the data file.

5. When using the E operating choice (see above) the cursor appears on the screen after the plots are drawn and <ESCAPE> has been pressed. It will appear only on the left-hand, X-Y plot. This enables the user, by means of the cursor keys, to locate the actual record and station pertaining to any particular "dot" in the X-Y plot.

- a. Pressing <ENTER> stores a single record in *.SUS.

- b. Pressing <TAB> stores the whole station in *.SUS.

6. No matter which operating options have been selected (E, S, or "any other key"), the next user action after help screen F5 is the specification of the data filename.

7. If you are unsure of the data ranges applicable to your data set, use either the default values, and examine the .SUS file on completion to ascertain if any data are out of range. Alternatively, you may first run LIMITS, and answer the relevant prompt when invited to do so.

8. When using operating options E or S, memory limitations dictate that the vertical resolution is reduced to that of CGA.

EDIT DATA

EXECUTABLE PROGRAM NAME: ICE-EDT.EXE

FUNCTION: To perform data editing on OceanPC standard profile format files, using error reports and suspect-data lists generated by other quality control routines.

INPUT SOURCE/FORMAT INFORMATION: the user selects a ICES Format file to be edited:

*.ICE

OUTPUT FORMAT AND USAGE: Based on the corrections made by the user at the keyboard, the utility automatically updates the specified data file.

PROCEDURAL NOTES:

1. ICE-EDT.EXE operates in random access mode on the ASCII ICES Format data files. This is possible due to the fixed length of the ICES Format records. You can make changes on data files of any length, and changes are recorded without the need to re-save the file. The changes are made immediately to the selected file, and there is automatic backup, so BE CAREFUL.
2. The user will be prompted for the record number(s) of the suspect data. Useful information about record numbers (and ranges of record numbers) can be obtained from the files FISUM.OUT and STASUM.OUT, if they have been generated for the data file. FISUM.OUT is generated by the **SUMMARIZE STATIONS IN FILE** utility; STASUM.OUT is generated by the **SUMMARIZE ALL DATA IN FILE** utility.
3. Instead of designating a specific data record number for editing, the user can respond:

?<ENTER>

The utility will automatically open the appropriate *.ERR file (if it exists) for the *.ICE file, and begin stepping through the suspect data records listed in *.ERR.

4. Changes to entries in any Master Record are automatically made in all individual data records associated with that Master Record.
5. If the value you wish to enter to a field is larger than the field, this requires an "overpunch" which is generated by entering a "+" instead of the first number. For example, if the user wants to enter:

1232

in a field with a width of:

...

then at the keyboard he must enter:

+232

so that:

K32

appears in the file. If, however, the first character in a field that must be "overpunched" is greater than 1, then "overpunching" by the ICES algorithm won't work; the value is too large. In such a case, enter:

R99

6. Records may be stepped through one at a time by pressing ENTER at the record number prompt. Press `r' to reverse direction.

7. To examine the contents of the error log file (.ERL), press "d" when cursor is at the record number prompt.

EXTRACT DATA

EXECUTABLE PROGRAM NAME: ICE-EXT.EXE

FUNCTION: To extract a subset of a ICES Format data file, based on year, geographic position, country/ship, month, day, or user-specified oceanographic "section."

INPUT SOURCE/FORMAT INFORMATION:

1. The user specifies the ICES Format data file from which data will be extracted:

*.ICE

Immediately after the input filename is supplied, the program checks to see if *.ICE exists. If so, then processing proceeds. The program also checks to see if an index file (*.IND) has already been created for *.ICE with the INDEX DATA utility. Although an index file is optional, its existence speeds up the extraction process. Following this, the program searches for and extracts data matching the user's criteria.

OUTPUT FORMAT AND USAGE: The subset of data extracted from the *.ICE file(s) will be contained in a new ICES Format file:

*.EXT

PROCEDURAL NOTES:

1. There are some undocumented, advanced features in the EXTRACT DATA utility that are reflected in screen prompts that refer to a file named MASTER.SEL and ZIP files. These screen prompts should be ignored by the user.
2. The user is initially given a choice between using this program with or without an index file (previously created with the INDEX DATA utility). If the user selects not to use an index file, then the following Notes should be read as if no index file existed.
3. If an index file exists, the user can extract only for:
 - a. Year, specified as a 2-digit number, such as 88 (=1988).
 - b. Geographic position, specified within maximum and minimum latitudes (N and S, respectively), and maximum and minimum longitudes (E and W, respectively).
 - c. A oceanographic section, specified within 1st and 2nd latitudes, and 1st and 2nd longitudes (describing "endpoints" of the section), and a vertical offset (nautical miles) from the center line between the endpoints. The section must be principally oriented east-west; if oriented directly north-south, no data will be extracted, due to the simplicity of the algorithm employed.

4. If the user is extracting data by "position" (Option PN) or "section" (Option SN) then the geographic coordinates must be input in the "right-handed system" (RHS). All latitudes are input as DDMM where D=degrees and M=minutes; northern hemisphere latitudes are positive and southern hemisphere latitudes are negative. All longitudes are input as DDDMM; western hemisphere longitudes are negative and eastern hemisphere longitudes are positive. For example, 56 degrees 8 minutes North would be input as 5608; 112 degrees 40 minutes West would be input as -11240.

5. If no index file exists, then the user can also extract for:

- a. Country or ship name.
- b. Month, specified as an integer.
- c. Day, specified as an integer.

APPENDIX D. DISPLAY DATA

GENERAL OCEAN MAPPING

EXECUTABLE PROGRAM NAME: OPCPLOT.EXE

INPUT SOURCE/FORMAT INFORMATION: The program recognizes data files in its own OPCPLOT format, ICES Format files, and a number of ASCII and binary data files produced by other oceanographic analysis programs (including ATLAST and SURFER). The OPCPLOT format resembles a "ship's log" so that the files can be read and recognized visually by the user even before plotting.

OUTPUT FORMAT AND USAGE: On the video monitor, the code draws maps of various ocean regions allowed by a menu system. The menu can be expanded by the user. Direct hard-copy plotting capability (via HPGL-format plotting files) is provided; screen images can also be captured with a provided command function, for later replay with a "slideshow" utility.

PROCEDURAL NOTES: OPCPLOT is essentially an electronic sketchpad that the user operates interactively. Usually the screen consists of a map (either in the process of being drawn or just finished) surmounted by a command line prompt. When some commands are answered, the command line is replaced by specific questions relating to that command. Other commands cause the screen to go blank while various text messages and additional questions scroll by. A detailed description of OPCPLOT is contained in the OPCPLOT Manual, a separate volume included with the OceanPC documentation. The following brief descriptions of all the principal OPCPLOT commands is an overview of program structure.

DRAW MAP: To set up the geographic dimensions of a map to be drawn. A menu of standard maps will be offered, but the user can also define a "non-standard" map within the limits of any of the standard maps. Once the answers to a few questions have been supplied, the map will be drawn on the screen.

ZOOM: To select a rectangular subarea from the map on the screen so that it can be expanded to fill the screen.

PLOT: To name a particular OPCPLOT data file to be drawn on a map. This command cannot be used until a base map has been drawn on the screen with either the DRAW Map command or the REPLAY command. OPCPLOT recognizes about 40 different data file formats selected from major oceanographic programs or systems.

GRID: To draw a latitude-longitude graticule on a map.

KEY: To display a set of map boundaries corresponding to the various regional maps available through the DRAW Command

TITLE: To write a title in a frame at the bottom of the map.

SAVE: To save the map on the screen to disk. (The **REPLAY** command can subsequently be used to recall the map to the screen.)

REPLAY: To recall to the screen a previously **SAVED** screen.

UTILITY: A set of short, useful programs for creating, converting, or listing **OPCPLOT** files.

MAKE FILE: A set of routines that allow the user to place labels or user-specified figures in existing files or in new files. When a data file has been plotted to the screen, the user could, for instance, use **MAKE** options to add more information to the same file. **MAKE** is a powerful and flexible part of **OPCPLOT**, that can be used to increase the readability of various files, or to enhance the resulting maps for purposes of publishing.

COLOR: To fill the various land and water boundary polygons with appropriate colors.

END: To exit the **OPCPLOT** utility and return to the operating system. The user is also offered the option here to re-name the Hewlett-Packard Graphics Language plotter file (extension **.HGL**) that has been created in background, or to send the **.HGL** file to a plotter.

OPCPLOT COORDINATE SYSTEM. **OPCPLOT** uses latitude and longitude in "decimal degrees" format, for instance -93.34478 is an acceptable longitude value in the western hemisphere. Further, the **OPCPLOT** globe extends (left to right) from -180 to +180, and (top to bottom) from +90 (north pole) to -90 (south pole).

Even for those data sets which may wrap over the International Date Line (where longitudes -180 and +180 coincide) the above conventions must be observed; the internal logic of the **OPCPLOT** code recognizes and handles the special transformations required, and no substitutions or coordinate conversions by the user are expected.

Please see the **OPCLOT** Manual for a detailed description of the **OPCPLOT** format and of the other data file formats recognized by **OPCPLOT**.

FIND DATA RANGES

EXECUTABLE PROGRAM NAME: LIMITS.EXE

FUNCTION: To examine an ICES Data file and report the extreme latitudinal and longitudinal limits of the stations.

INPUT SOURCE/FORMAT INFORMATION: The code inputs an ICES Data file name.

OUTPUT FORMAT AND USAGE: Northern-most and southern-most latitudes; eastern-most and western-most longitudes. In addition, the maximum and minimum values of all observed parameters in the data file are reported, including information on which parameters are not included. Output is in a

*.LIM

file, which can be utilised by both STAPLOT and TSLOOK to enable automatic scaling features.

PROCEDURAL NOTES:

1. Although used for automatic range purposes, the utility also serves as a useful check on extreme outliers. The record numbers of all maximum values are also reported, thus allowing convenient identification using ICE-EDT.EXE

MAKE COASTLINE FILE

EXECUTABLE PROGRAM NAME: WDB.EXE

FUNCTION: To create a coastline file named WORLD.BLN in SURFER format for use with either SURFER or the MAKE STATION PLOT utility.

INPUT SOURCE/FORMAT INFORMATION: Based on latitude-longitude limits supplied by the user, the utility examines the master coastline file WORLD.WDB located in the OPCPLOT subdirectory and extracts only those segments of the data needed to draw the needed coastline.

5 levels of resolution can be chosen, but the invitation to provide data on state boundaries and rivers should be ignored as this is not available in the version of world.wdb provided with OceanPC.

OUTPUT FORMAT AND USAGE: An ASCII coastline file in SURFER format. Output is in a file named COAST.BLN, which is the default file name assumed by STAPLOT.

PROCEDURAL NOTES: Latitude and longitude limits for the new map are supplied by the user.

MAKE STATION MAP

EXECUTABLE PROGRAM NAME: STAPLOT.EXE

FUNCTION: To create a map of all the stations in a ICES Format data file, with an optional coastline.

INPUT SOURCE/FORMAT INFORMATION:

1. The user specifies a ICES Format file to be mapped:

*.ICE

2. If the option to interactively edit stations is chosen, it is possible to save individual stations to station files (.EST) or error files (.ERR). It is also possible to observe station details on the screen by pointing to them.

3. If a file named WORLD.BLN (optionally created by the user with the MAKE COASTLINE FILE utility) then the coastline is also drawn on the map.

OUTPUT FORMAT AND USAGE: On the video monitor, the code draws a geographic coordinate map of the locations of stations contained in the file. If available a coastline is drawn. No direct hard-copy plotting capability is provided, but the user can use a screen-capture facility to transfer the screen image to a word-processing program.

PROCEDURAL NOTES:

1. The user will be prompted for the geographic limits of the map of stations (which can easily obtained by using the FIND GEOGRAPHIC RANGE utility). In all cases, default values corresponding to the North Atlantic Ocean will also be offered. If the user does not want the North Atlantic defaults, the geographic coordinates must be input in the "right-handed system" (RHS). All latitudes are input as DDMM where D=degrees and M=minutes; northern hemisphere latitudes are positive and southern hemisphere latitudes are negative. All longitudes are input as DDDMM; western hemisphere longitudes are negative and eastern hemisphere longitudes are positive. For example, 56 degrees 8 minutes North would be input as 5608; 112 degrees 40 minutes West would be input as -11240.

2. The coastline is plotted after all the ocean stations have been plotted, by pressing <SPACE> when the stations are finished. Otherwise, press <ESCAPE> to skip the coastlines and to leave the utility program.

APPENDIX E. SEARCH DIGITAL ROSCOPS

EXECUTABLE PROGRAM NAME: ROSEARCH.EXE

FUNCTION: This is a utility to make selections of Cruise Summary Reports (digital ROSCOP's) based on user specified search criteria. Ten years of cruises (the 1980's) is supplied with OCEANPC. Data for other periods can be supplied on request.

INPUT SOURCE/FORMAT INFORMATION:

1. The code searches existing digital ROSCOP data files created by the CREATE digital ROSCOP utility. The set of digital ROSCOP's provided with OceanPC is contained in files named:

ROS???.INF

where the wildcards (??) identify the year. Thus the file ROS87.INF is the file containing digital ROSCOP's for the year 1987.

2. However, if the user has previously used ROSEARCH.EXE, then he also has a digital ROSCOP-format file with filename:

ROSXX.INF

containing the results of that search. This file is also searchable by ROSEARCH.EXE, giving the possibility of iterative searches.

OUTPUT FORMAT AND USAGE: ROSEARCH creates an ASCII file named

ROSXX.INF

in the same directory as the (1 or more) digital ROSCOP files that are being searched. The contents and size of ROSXX.INF are variable, based on switches described below.

PROCEDURAL NOTES: There are four screens in ROSEARCH:

1. The first screen is a menu to allow you to enter your search identifiers. By pointing to a field and pressing <ESC>, you get lists of keywords for field you are pointing to. In the case 3 of the fields (Country, Area and digital ROSCOP parameter). You can enter the criteria being pointed to directly to your list of Search criteria.
2. The second screen reviews what you have done, and gives you chance to change your mind.

3. The third screen displays the names of the data files available to you. Select the ones you want.
4. The fourth screen requests information concerning the volume of output. There are 3 possibilities:
 - a. Full digital ROSCOP information, including number of stations
 - b. Brief information, providing a compact layout, and
 - c. A summary of the extracted forms.

You can make extracts of the digital ROSCOP files based on any or all of the 11 fields of the digital ROSCOP form, and within each field searches are by free text. Don't worry about upper and lower case. Searches using OR, AND, NOT statements are possible -- the menu shows you the defaults. HELP is accessible from the Selection Menu and will give you more information about this.

Also accessible from the Selection Menu are lists of digital ROSCOP parameters, and the means to view Marsden squares from maps of the World. Digital ROSCOP parameters and Marsden squares are both used extensively in the data set, so if you are not familiar with them, you will get more enjoyment from this utility if you take a look at the lists/maps.

APPENDIX F: ICES OCEANOGRAPHIC DATA CENTRE DATA EXCHANGE FORMATS

**ICES
BLUEPRINT '86 FORMAT**

APPENDIX G: CD-ROM NODC-02 & -03 FORMAT DOCUMENTATION

APPENDIX H: NODC SD1 & SD2 FORMAT DOCUMENTATION

