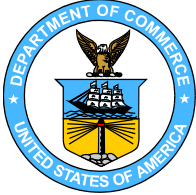


National Oceanographic Data Center Internal Report 16



# **WORLD OCEAN DATABASE 2001 CD-ROM Data Set Documentation**

*Ocean Climate Laboratory*  
National Oceanographic Data Center

Silver Spring, MD  
March, 2002

**U.S. DEPARTMENT OF COMMERCE**  
National Oceanic and Atmospheric Administration  
National Environmental Satellite Data and Information Service

## National Oceanographic Data Center

Additional copies of this publication, as well as information about NODC data holdings, and services, are available on request directly from NODC. NODC information and data are also available over the Internet through the NODC World Wide Web site.

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**For updates on the data, documentation and additional information about the WOD01 please refer to:**

<http://www.nodc.noaa.gov>

**click on: Ocean Climate Laboratory**  
**click on: Products**

**The WOD01 should be cited as follows based on a companion atlas describing this product:**

M. E. Conkright, J.I. Antonov, O. Baranova, T. P. Boyer, H.E. Garcia, R. Gelfeld, D. Johnson, R.A. Locarnini, P.P. Murphy, T.D. O'Brien, I. Smolyar, C. Stephens, 2002: *World Ocean Database 2001*, Volume 1: Introduction. Ed: Sydney Levitus, NOAA Atlas NESDIS 42, U.S. Government Printing Office, Washington, D.C., 167 pp.

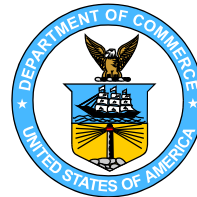
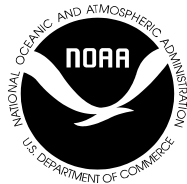
# ***WORLD OCEAN DATABASE 2001***

## CD-ROM Data Set Documentation

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Silver Spring, MD  
March, 2002



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## GETTING STARTED

This section outlines the steps and information needed to start using the *World Ocean Database 2001* (WOD01) data. The data are organized across eight CDs; seven contain the observed level data and one contains all the standard level data (Table 18 lists the standard depth levels and depths). The contents of each CD are listed in Table 13. A full description of the contents is found in section II of this document.

Each CD contains directories (in bold) with the following information: documentation files (**DOC**), description of metadata codes (**CODES**), utilities used to decompress the data (**UTILS**), sample programs for reading the data (**PROGRAMS**), the software program Ocean Data View for extracting and viewing the data (**ODV**), and a data directory (**DATA**). A complete description of the data format is found in Table 14 and the file *format.pdf* and *format.htm* found in the **DOC** directory of each CD.

The Ocean Climate Laboratory is publishing a series of *World Ocean Database 2001* NOAA Atlases fully describing the source and contents of WOD01. The WOD01 should be cited as follows:

M. E. Conkright, J.I. Antonov, O. Baranova, T.P. Boyer, H.E. Garcia, R. Gelfeld, D. Johnson, R.A. Locarnini, P.P. Murphy, T.D. O'Brien, I. Smolyar, C. Stephens, 2002: *World Ocean Database 2001*, Volume 1: Introduction. Ed: Sydney Levitus, NOAA Atlas NESDIS 42, U.S. Government Printing Office, Wash., D.C., 167 pp.

### A. DECOMPRESSING AND READING DATA FROM WORLD OCEAN DATABASE 2001

#### 1. GZIP Directory

The **UTILS** directory of each CD-ROM contains a **GZIP** directory with two files used for decompressing the data on the WOD01 CD-ROMs. The first (*gzip124.exe*) is a self-extracting DOS executable file and the second *gzip124.tar* is a tar'd file containing source code for UNIX users. To decompress the WOD01 files, it is recommended to first copy the files to a hard disk. Use gzip to decompress selected files, or a directory and all of its subdirectories, with one command (see section IV, A6 of this documentation for further details). Additional information may be found at: <http://www.gzip.org>.

#### Special Note for UNIX Users

The DOS CR-LF (Carriage Return-Line Feed) indicates the end of a record and may cause problems when working in a UNIX environment. Many systems have a "dos2unix" program which removes these characters from an ASCII file. Files can also be changed by transferring from DOS/ WINDOWS using FTP (File Transfer Protocol). The UNIX "tr" or "perl" utilities will also remove the CR-LF (see section IV, A6 of this documentation for further details).

#### 2. Software Directory (PROGRAMS)

The software directory (**PROGRAMS**) of each CD-ROM contains FORTRAN and C sample



programs for reading the data and writing the output in various formats.

### **3. Ocean Data View (ODV) Directory**

The **ODV** directory contains the Ocean Data View software (for PCs only) developed by Dr. Reiner Schlitzer from the Alfred Wegener Institute. This software will decompress selected files and offers the users several options for viewing the WOD01 data. For more information, please refer to <http://www.awi-bremerhaven.de/GEO/ODV>.

Ocean Data View can be used and distributed for non-commercial research and teaching purposes. If you use Ocean Data View for your scientific work, you must reference it in your publications as follows:

Schlitzer, R., Ocean Data View,  
<http://www.awi-bremerhaven.de/GEO/ODV>, 2002.

Commercial Use:

If you plan to use Ocean Data View or any of its components for commercial applications and products, you need to obtain a software licence. Please contact the address below for further information:

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## **B. ADDITIONS AND CHANGES SINCE WOD98**

The Ocean Climate Laboratory continues to expand the data and information about the data (metadata) released as part of the World Ocean Database products. Some of these changes include the following:

- (1) addition and specification of data from undulating oceanographic recorders (e.g. towed CTDs), profiling floats, drifting buoys, moored buoys, surface only data, and autonomous pinniped bathythermograph data (see Table 2 for a complete listing);
- (2) addition of carbon variables to the database (see Tables 4 and 5 for a complete listing);
- (3) submitter defined data quality flags received as part of data submissions are now kept in the database;

- (4) modifications to the format:
  - (a) the first byte in the OCL format will now be used to identify the various releases of the World Ocean Database series; beginning with WOD01, this byte is “A” (see section IV, Table 14, or files *format.pdf* and *format.html* for more details),
  - (b) addition of variable specific metadata such as method and units (see Table 8 for a complete listing);
  - (c) addition of a byte to accommodate originator’s flags associated with depth and each individual measurement;
- (5) online documentation of changes to data released as part of WOD98:  
we have included, as part of the online data documentation, a file called *comments.changes*. This file describes all changes which have been made to data released since WOD98. These changes fall under the following categories: duplicate station/deletion, data change, date/time changes, and position changes. These changes are based on the OCL unique station number which have remained the same since the release of WOD98 and will not be changed in future releases;
- (6) new file structure on the CDs:  
the data directory structure in WOD01 is based on instrument type rather than WMO as in WOD98. Each instrument type directory will contain all the WMOs;
- (7) NODC and project data combined into one file:  
WOD98 separated data from the NODC databases and data acquired from projects (such as the Global Oceanographic Data Archaeology and Rescue project). These files have been combined into one. Data from the NODC databases may still be identified by the Second header code 91 (NODC Database);
- (8) Nitrite data which were included in WOD98 are not included in WOD01 as those data were not examined to ensure their quality.

## ACKNOWLEDGMENTS

The NODC/OCL is supported by the NOAA Climate and Global Change program, the NOAA Environmental Science Data and Information Management program (ESDIM), and the joint NOAA/NASA Global Change element, to produce scientifically quality-controlled oceanographic databases, to produce objectively analyzed global fields of oceanographic variables, and to perform diagnostic studies based on these databases.

The Intergovernmental Oceanographic Commission (IOC) initiated the Global Oceanographic Data Archaeology and Rescue project (GODAR) which has resulted in the rescue of much historical ocean data. In particular, Dr. Iouri Oliouline has shared the enthusiasm for this project and has been critical to its success. The OCL expresses its

thanks to all those who provided comments and helped develop an improved product. Special thanks to Dr. Reiner Schlitzer for the development of Ocean Data View and for allowing us to make this software available as part of WOD01.

Thanks to the outstanding help from Carla Forgy, Alexandra Grodsky, Igor Smolyar, Mike Chepurin, Igor Minin, Dan Smolyar, and Fedor Sychev, the OCL was able to improve on the quality of the data through their examination of problems associated with date, time, position, and ship errors from individual cruises; and their search on the web for missing metadata. In addition, they were part of the team rescuing data through digitization of data manuscripts.

We appreciate the efforts of many data users who have identified problems in WOD98 and have therefore helped us improve on the quality of the data. We are especially grateful to Thomas Whitworth (Texas A&M University) for information on database problems in the Indian Ocean Sector. We thank Roy Lowry (British Oceanographic Data Center - BODC) for providing and helping with the BODC project data. Steve Worley (National Center for Atmospheric Research - NCAR) and Steve Hankin (Pacific Marine Environmental Laboratory - PMEL) kindly consented to review this product and provide helpful comments.

The OCL acknowledges the help received over the years from our colleagues in the other divisions here at NODC, particularly Francis Mitchell (assistance with all the code lists and accessions), Robert VanWie (information on the archived NODC files), Melanie Hamilton (GTSP data), Andy Allegra (CDs and web pages), Charlotte Sazama (assistance in locating data for rescue in the WDC for Oceanography, Silver Spring archives), Steve Rutz, Mike Ford, Shelley Tomlinson, Don Collins (assistance with acquisition of data and metadata), Mary Hollinger and Patricia Kirk (distribution of this product).

*World Ocean Database 2001* would not be possible without the efforts of all scientists who have collected and submitted data to the National Oceanographic Data Center and the World Data Center for Oceanography, Silver Spring.

## I. INTRODUCTION

The *World Ocean Database 2001* (WOD01) CD-ROM's, containing observed and standard level profile, plankton and surface data, represent an update of the World Ocean Database products first released as *World Ocean Atlas 1994* (WOA94), and followed by *World Ocean Database 1998* (WOD98). WOD01 expands on WOD98 by including new variables and data types. During the past three years, the number of data sets received at NODC/WDC, Silver Spring (National Oceanographic Data Center/World Data Center for Oceanography, Silver Spring) has increased (see Table 1) as a result of projects such as the Intergovernmental Oceanographic Commission (IOC)/NODC Global Oceanographic Data Archaeology and Rescue project (GODAR), (Levitus *et al.*, 1998, Levitus *et al.*, 1994), NODC Global Ocean Database project, IOC World Ocean Database project, Global Temperature-Salinity Profile Project (GTSP), World Ocean Circulation Experiment (WOCE), Joint Global Ocean Flux Studies (JGOFS), Ocean Margin Experiment (OMEX), and many others. The figures in Table 1 show the increase in data from 1982 to 2001. NOAA atlases describing the distribution of the WOD01 data have been prepared as part of WOD01 (Conkright *et al.*, 2002).

**Table 1. Comparison of the number of stations in WOD01 with previous world ocean databases.**

Data type	Climatological Atlas of the World Ocean (1982)	WOA94	WOD98	WOD01
Station data and low resolution C/STD profiles	425,000	1,194,407	1,373,440	2,121,042
High resolution CTD profiles	na	89,000	189,555	311,943
MBT profiles	775,000	1,922,170	2,077,200	2,376,206
XBT profiles	290,000	1,281,942	1,537,203	1,743,590
Moored Buoys	na	na	107,715	297,936
Drifting Buoys	na	na	na	50,549
Profiling Floats	na	na	na	22,637
Undulating Oceanographic Recorders	na	na	na	37,645
Autonomous Pinniped Bathythermograph	na	na	na	75,665
<b>Total Stations</b>	<b>1,490,000</b>	<b>4,487,519</b>	<b>5,285,113</b>	<b>7,037,213</b>
Surface only data* (cruises)	na	na	na	4,743*

\* Surface data are represented differently in the database - all observations in a single cruise have been combined into one "station" with depth, value of variable measured and latitude, longitude, and julian year-day to identify data and position of individual observations.

The data format used in WOD01 is slightly different from the format in WOD98:

(1) we have added a byte to identify the various versions of World Ocean Database (first byte of a profile - a complete description can be found in Table 14 and files format.pdf and format.html in the **DOC** directory). Beginning with WOD01, the first byte is "A";

(2) we represent surface only data based on the cruise as a station rather than representing every observation as an individual station;

(3) we have added a section for variable-specific metadata;

(4) we have included originator's data quality flags.

These changes were made to accommodate the increased amount of information, and to augment the metadata contained in WOD01. The CD-ROMs are formatted according to the ISO 9660 standard. Data are stored in ASCII format by instrument type and are sorted geographically by World Meteorological Organization (WMO) squares. The data on the CD-ROMs are compressed using the universal "gzip" UNIX compression utility. This utility is provided on each CD-ROM under the directory "**UTILS/GZIP**" for both UNIX and DOS operating systems.

## **ABOUT THIS PRODUCT**

The NODC/OCL has been expanding the *World Ocean Database* products since their first release as *World Ocean Atlas 1994*. As can be seen from Table 1, the size of the database has increased greatly. The OCL has attempted to ensure that the conversion from originator to OCL format was accurate, that duplicates were removed, and that "questionable" data were flagged. This last task is an ongoing effort. Every effort was made to identify and correct errors in the database. As scientists and data managers utilize the WOD01, and errors are identified, they will be corrected. Some data flagged as "questionable" may not deserve this designation. The OCL requires the help of users of this product in identifying data which need to be flagged as being "questionable", and data which were flagged and should not have been. As we receive input from users, corrections to the database will be placed online each month at:

<http://www.nodc.noaa.gov/OC5/>

If any errors are found, either in the data or the flags assigned to the data, please contact the OCL and we will correct these problems. The OCL is committed to providing the highest quality oceanographic data and will continue to work toward reaching this goal.

Included as part of this release is software which can be used as examples of how to read the data into different formats. These programs continue to be improved. Any comments and suggestions for additional programs, which will increase the number of users who can benefit from this product, would be appreciated. Updates will be posted in the NODC/OCL World Wide Web site at: <http://www.nodc.noaa.gov/OC5/>

## II. CD-ROM DISC CONTENTS

### A. DATA TYPES AND SOURCES

The data used in this project are all the data found in the NODC archives as of the first quarter of 1994 as well as some of the data submitted to NODC since 1994. In addition, data gathered as a result of the IOC/IODE GODAR project, the NODC Global Ocean Database project, the IOC World Ocean Database project, and the IOC Global Temperature Salinity Profile Project (GTSP) project, were included in this study.

WOD01 comprises eight CD-ROMs, 7 contain the observed depth profile, surface, and plankton data (WOD01-01 through WOD01-07), and one contains all the standard depth data (WOD01-08). The CD-ROM contents are organized according to the different instruments (probes) used to sample data (XBT, MBT, High Resolution CTD, Bottle and Low Resolution CTD, Surface only, Undulating Oceanographic Recorders, Floats, Buoys, and Continuous measurements). Within each instrument directory, the data are separated into files based on the WMO squares. Table 2 presents the different instrument types which are described in the following section.

**Table 2. Instrument types in the WOD01**

<b>INSTRUMENT</b>	<b>SOURCE</b>
OSD	Bottle, low resolution CTD, and plankton data
CTD	High resolution Conductivity-Temperature-Depth data
MBT	Mechanical Bathythermograph data
XBT	Expendable Bathythermograph data
SURF	Surface only data
APB	Autonomous Pinniped Bathythermograph
MRB	Moored buoy data
PFL	Profiling float data
DRB	Drifting buoy data
UOR	Undulating Oceanographic Recorder

Table 3 is an inventory of the data found in each of the directories described. The WOD01 contains a total of 7,037,213 stations, of which 148,243 contain plankton observations. In addition, the database contains 4,743 cruises with 1,810,639 surface only observations.

**Table 3. Inventory of Data for Each Probe**

VARIABLES	OSD	CTD	MBT	XBT	SURF*	APB	MRB	PFL	DRB	UOR
Temperature	1,951,150	311,011	2,376,206	1,743,590	1,392	75,665	297,936	22,637	50,549	37,631
Salinity	1,767,283	304,242			4,675			4,288	3	35,917
Oxygen	586,277	47,627								361
Phosphate	373,141									
Silicate	261,774									
Nitrate	208,573									
pH	130,863				1					
Chlorophyll	128,558	12,002			1,232					11,198
Plankton	148,243									
Alkalinity	22,268				1					
pCO <sub>2</sub>	2,159				10					
tCO <sub>2</sub>	6,018									
Nitrate+Nitrite	9,382									
Pressure	57,748	178,569								37,645
CO <sub>2</sub> warming					61					
CO <sub>2</sub> atm					158					
Air pressure					154					
<b>TOTAL</b>	<b>2,121,042</b>	<b>311,943</b>	<b>2,376,206</b>	<b>1,743,590</b>	<b>4,743</b>	<b>75,665</b>	<b>297,936</b>	<b>22,637</b>	<b>50,549</b>	<b>37,645</b>

\* Surface data are represented differently in the database - all observations in a single cruise have been combined into one "station" with depth, value of variable measured and latitude, longitude, and julian year-day to identify data and position of individual observations. Values given in table are for the total number of cruises, 4,743, which represent 1,810,639 observations.

Data types on the CD-ROM series include:

**1. Ocean Station Data (OSD)**

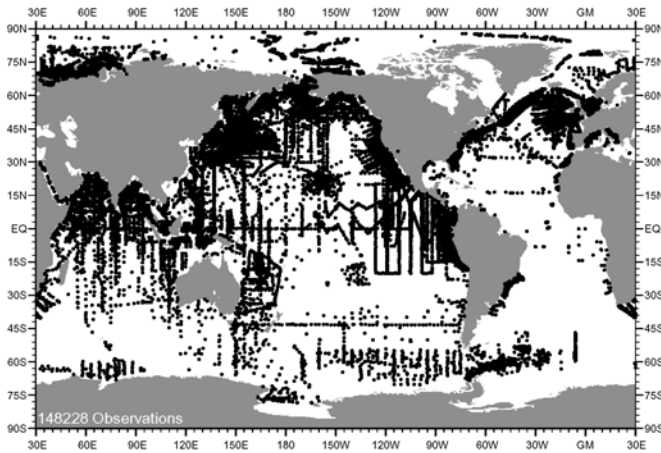


Figure 1. Distribution of Plankton Data in the Ocean Station Data files

*Description:* this file includes all bottle data, STD (Salinity/Temperature with Depth), low resolution CTD data, some surface only data, and plankton taxonomic and biomass measurements. Figure 1 shows the distribution of the phytoplankton and zooplankton data;

*Source:* data from the NODC archives through 1994, from data management projects such as GODAR, and from observational programs such as the Joint Global Ocean Flux Studies (JGOFS), and World Ocean Circulation Experiment (WOCE);

*Variables:* Bottle data may have one or more of the variables listed in Table 4:

**Table 4. Variables in the Ocean Station Data files (OSD)**

CODE	VARIABLE	UNIT/SCALE
1	Temperature ( <i>in situ</i> )	°C
2	Salinity	PSS
3	Oxygen	ml l <sup>-1</sup>
4	Phosphate	µM
6	Silicate	µM
8	Nitrate	µM
9	pH	unitless
11	Chlorophyll	mg m <sup>-3</sup>
17	Alkalinity	meq l <sup>-1</sup>
20	pCO <sub>2</sub>	µatm
21	TCO <sub>2</sub>	mmol l <sup>-1</sup>
23	NO <sub>2</sub> +NO <sub>3</sub>	µM
25	Pressure	decibar
also included in this file are Plankton/Biomass data with various units		

**2. High Resolution CTD Data (CTD)**

*Description:* data from a Conductivity, Temperature, Depth instrument as well as STD data;

*Source:* NODC archives up to 1994 and project data; the data distribution is global;

*Variables:* temperature, salinity, oxygen, chlorophyll, pressure

**3. Mechanical Bathythermograph Data (MBT)**

*Description:* Data from Mechanical Bathythermographs including Selected Level Bathythermograph (SBT) and Digital Bathythermograph (DBT) data; the data distribution is global;

*Source:* NODC archives up to 1994 and project data;

*Variable:* Temperature

**4. Expendable Bathythermograph Data (XBT)**

*Description:* data from Expendable Bathythermographs including Selected Bathythermograph;

*Source:* mostly NODC archives up to 1994 and Global Temperature-Salinity Profile Program (GTSP) data; the data distribution is global;

*Variable:* Temperature



## 5. Surface Only Data (SURF)

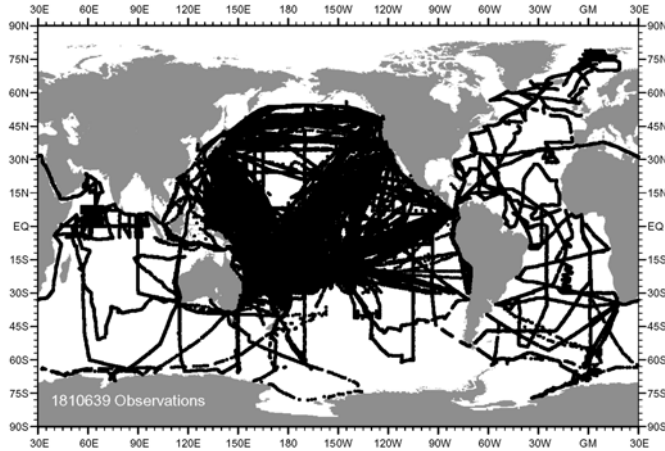


Figure 2. Distribution of Surface Only (SURF) Data

*Description:* surface only data. Each cruise is considered a station, therefore each measurement will have an associated latitude, longitude, and julian year-day within the station;

*Source:* underway or ship of opportunity data;

*Variables:* Table 5 lists all the possible variables which are found in the SURF file.

**Table 5. Variables in the Surface Only Data Files (SURF)**

CODE	VARIABLE	UNIT/SCALE
1	Temperature ( <i>in situ</i> )	°C
2	Salinity	PSS
9	pH	unitless
11	Chlorophyll	mg m <sup>-3</sup>
17	Alkalinity	meq l <sup>-1</sup>
20	pCO <sub>2</sub>	µatm
27	CO <sub>2</sub> warming	°C
28	xCO <sub>2</sub> atmosphere	ppm
29	Air Pressure	mbar
30	Latitude	degrees
31	Longitude	degrees
32	Julian Year-Day*	day

\* Julian year-day is the decimal day for the year in which the first observation was made (see section II, B7 for definition and example)

## 6. Autonomous Pinniped Bathythermograph Data (APB)

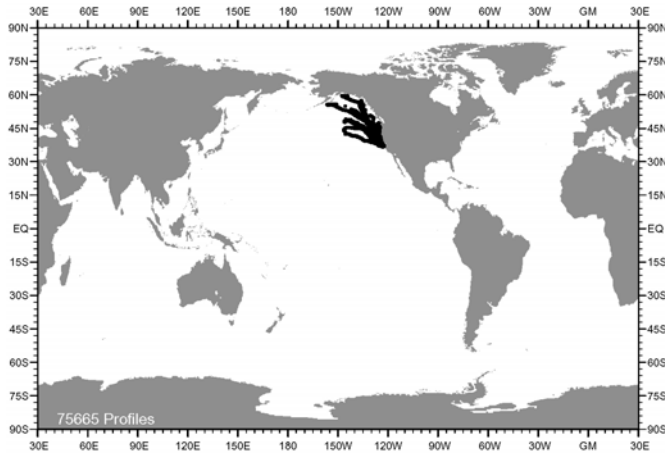


Figure 3. Distribution of Autonomous Pinniped Bathythermograph (APB) Data

*Description:* Time-Temperature Depth recorders attached to elephant seals;

*Source:* Pacific Fisheries data off of California and Washington state (Boehlert *et al.*, 2001)

*Variable:* Temperature.

## 7. Moored Buoy Data (MRB)

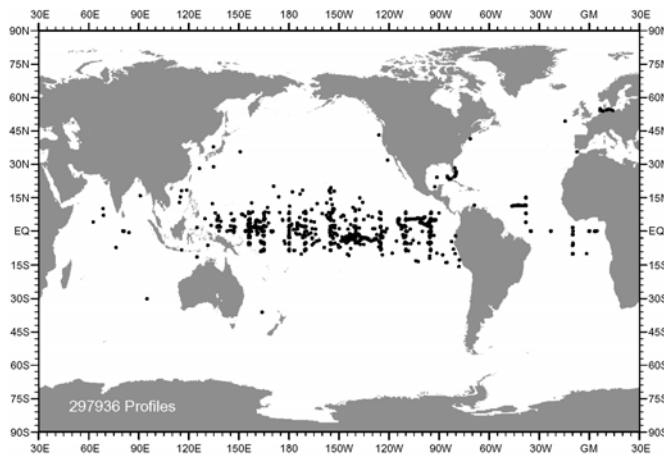


Figure 4. Distribution of Moored Buoy (MRB) Data

*Description:* moored buoy arrays mostly TAO (Tropical Atmosphere-Ocean), PIRATA (moored array in the tropical Atlantic), MARNET, and TRITON (Japan-JAMSTEC)

*Source:* data from GTSPP;

*Variables:* Temperature and salinity.

## 8. Profiling Float Data (PFL)

*Description:* data from drifting profiling floats such as Profiling Autonomous Lagrangian Circulation Explorer (P-ALACE), subsurface drifting floats; PROVOR (free-drifting hydrographic profiler), SOLO (Sounding Oceanographic Lagrangian Observer), and APEX (Autonomous Profiling Explorer);

*Source:* mostly the GTSPP project;  
*Variables:* Temperature and salinity.

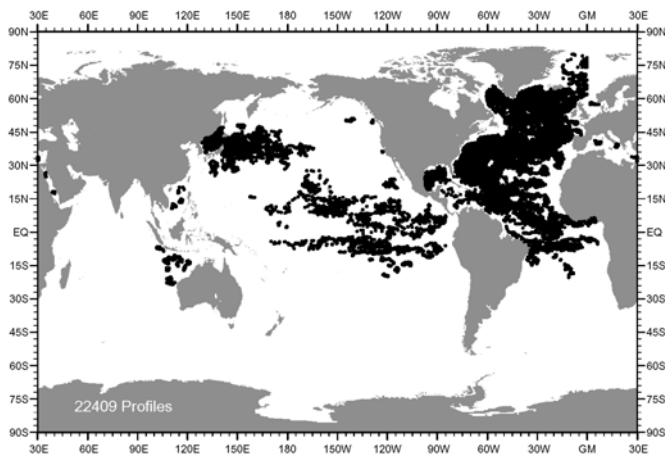


Figure 5. Distribution of Profiling Float (PFL) Data

### 9. Drifting Buoy Data (DRB)

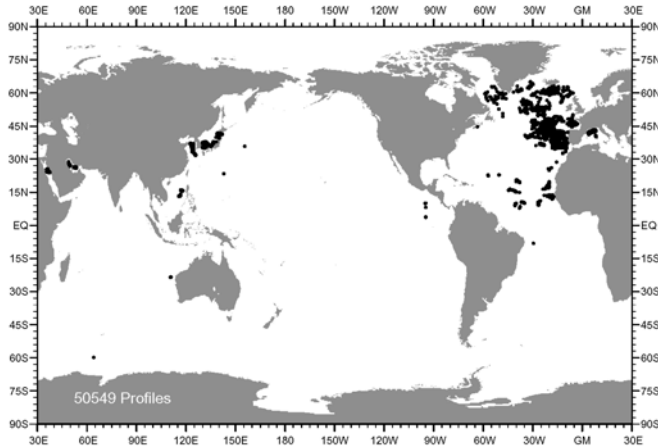


Figure 6. Distribution of Drifting Buoy (DRB) Data

*Description:* data from surface drifting buoys with thermister chains;

*Source:* the GTSPP project;

*Variable:* Temperature.

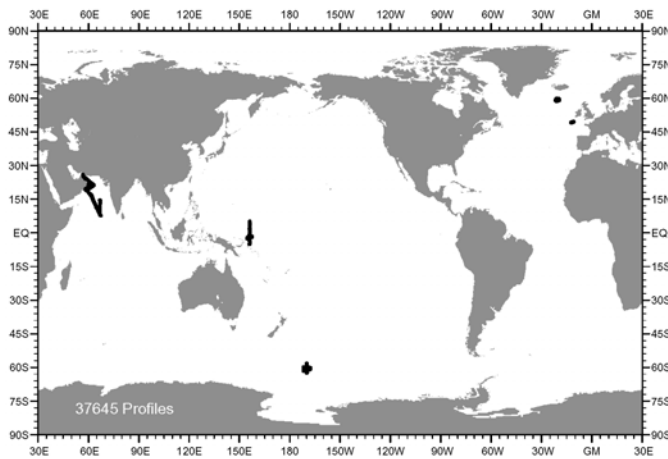


Figure 7. Distribution of Undulating Oceanographic Recorder (UOR) Data

### 10. Undulating Oceanographic Recorder (UOR)

*Description:* data from a Conductivity/Temperature/Depth probe mounted on a towed undulating vehicle;

*Source:* data from TOGA, JGOFS, PRIME and OMEX projects;

*Variables:* Table 6 lists the variables found in the UOR data files. A description of the different types of UOR vehicles included in the database can be found in Appendix 2R.

**Table 6. Variables in the Undulating Oceanographic Recorder Data Files (UOR)**

CODE	VARIABLE	UNIT/SCALE
1	Temperature ( <i>in situ</i> )	°C
2	Salinity	PSS
3	Oxygen	ml l <sup>-1</sup>
11	Chlorophyll	mg m <sup>-3</sup>
25	Pressure	decibar
30	Latitude	degrees
31	Longitude	degrees
32	Julian Year-Day*	day

\* Julian year-day is the decimal day for the year in which the first observation was made (see section II, B7 for definition and example)

## **B. STATION DESCRIPTION**

In WOD01, a station is comprised of as many as seven parts:

**(1) Primary Header:** contains all information vital to the identification of an individual profile, such as date, time, location, NODC country code, cruise code, and a unique station number;

**(2) Secondary Header:** contains information such as meteorological data, water column characteristics (such as depth to bottom ), information about the instrument used, ship, institute, and project;

**(3) Variable-specific second header:** contains information specific to each individual variable such as originator's units and methods;

**(4) Character Data:** includes originator's cruise codes, originator's station codes, and Principal Investigator integer code;

**(5) Biological Header:** contains information necessary to understand how biological data were sampled. "Biological" data are arbitrarily defined as plankton biomass (weights or volumes) and taxa-specific observations. It does not include chlorophyll data;

**(6) Taxa-specific and Biomass Data:** contains plankton weights, volumes, and/or concentrations, for an entire sample (biomass) or for individual groups of organisms (taxa-specific);

**(7) Measured Variables:** temperature, salinity, oxygen, phosphate, silicate, nitrate, pH, chlorophyll, alkalinity,  $p\text{CO}_2$ ,  $\text{TCO}_2$ , nitrate+nitrite, and pressure data vs. depth. In addition, the following data types required additional manipulations so as to fit in the OCL format:

**(7a) Surface only Data:** each cruise, sampling surface only variables, is treated as a station with a depth, value of variable, latitude, longitude, and julian year-day.

**(7b) Autonomous Pinniped Bathythermograph Data:** up and down profiles were constructed based on the ARGOS position fix.

**(7c) Undulating Oceanographic recorder Data:** continuous measurements during ascents and descents of towed vehicles were broken up into up and down profiles.

### **1. Primary Header**

The primary header contains information about the number of bytes in the station, a unique

OCL number which identifies each station, the NODC country code (see code list in Appendix 1), a cruise number, date, time, position, and the number and type of variables in the station. Please note that some data have been submitted with a day of “0” and we have kept these in the database. Time and location are all written in the same format:

- a) number of significant digits
- b) total digits
- c) precision of measurement
- d) data value

Total digits will be one more than significant digits if the value is a negative number. Total digits will also be different than significant digits if a value has been converted or identified as a trace value. The station type identifies whether the data are at observed depth levels (0) or standard levels (1). The number and type of variables identifies the depth dependent variables in a station. Depth-dependent variables are listed in Tables 4 and 5 with the numerical code which identifies them.

## 2. Secondary Header

The secondary header contains metadata (information about the data) and meteorological information associated with each station. Table 7 lists the different types of secondary header data included for each station, when the information is available.

Many of the meteorological variables have World Meteorological Organization (WMO) code tables associated with them (see section VI for a list of acronyms used in this document). These code tables are grouped together in Appendix 2 and are also individually listed in the **CODES** directory. The second header listings of accession number (code 1), project (code 2), platform (code 3), and institution (code 4) are quite large and therefore are placed in individual files in the **CODES** directory and are not included in the appendices. A description of all OCL second headers is provided below. The OCL secondary header information is always in numeric form, whereas some of the NODC codes are alphanumeric. Therefore, some of the code tables will have an OCL code and the equivalent NODC code.

**Table 7. List of secondary header variables in WOD01.** The “App.” column indicates the Appendix where the code list is found or if it is included in a separate file in the **CODES** directory (listed in file = *secondh.txt*); the ID column represents the code number assigned to each second header.

ID	DESCRIPTION	App.	ID	DESCRIPTION	App.
1	NODC Accession Number	file	33	Depth fix	none
2	NODC Project Code	file	34	Bottom Hit	none
3	OCL Platform Code	file	35	BT Digitization Method (NODC 0612)	2M
4	NODC Institution Code	file	36	BT Digitization Interval (NODC 0613)	2N

ID	DESCRIPTION	App.	ID	DESCRIPTION	App.
5	Cast/Tow number	none	37	BT Data Treatment and Storage Method (NODC 0614)	2O
7	Originator's station number	none	38	BT Depth Correction	none
9	Ocean Weather Station Code	2A	39	BT Temperature Correction	none
10	Bottom Depth (meters)	none	40	Instrument for reference temperature (NODC 0615)	2P
11	Cast Duration (hours)	none	41	Horizontal visibility (WMO Code 4300)	2Q
12	Cast Direction (down assumed)	2B	45	Absolute Humidity (g/m <sup>3</sup> )	none
13	High resolution pairs	none	46	Reference/Sea Surface Temperature	none
14	Water Color	2C	47	Sea Surface Salinity	none
15	Water Transparency (Secchi disk)	none	71	Radio signal	none
16	Wave Direction (WMO 0877 or NODC 0110)	2D	72	XBT Wait	none
17	Wave Height (WMO 1555 or NODC 0104)	2E	73	XBT Frequency	none
18	Sea State (WMO 3700 or NODC 0109)	2F	74	Oceanographic measuring vehicle	2R
19	Wind Force (Beaufort scale or NODC 0052)	2G	77	xCO <sub>2</sub> in atmosphere (ppm)	none
20	Wave Period (WMO 3155 or NODC 0378)	2H	84	ARGOS fix code	2S
21	Wind Direction (WMO 0877 or NODC 0110)	2D	85	ARGOS time (hours) from last fix	none
22	Wind Speed (knots)	none	86	ARGOS time (hours) to next fix	none
23	Barometric Pressure (millibars)	none	87	Height (meters) of XBT launch	none
24	Dry Bulb Temperature (°C)	none	88	Depth of sea surface sensor	none
25	Wet Bulb Temperature (°C)	none	91	NODC database ID	none
26	Weather Conditions (WMO 4501/4677)	2I	92	UKHO Bibliographic Reference Number	2T
27	Cloud Type (WMO 0500 or NODC 0053)	2J	93	Consecutive profile in a tow segment	none
28	Cloud Cover (WMO 2700 or NODC 0105)	2K	94	WMO Identification Code	none
29	T-S Probe (Temperature/Salinity probe)	3	95	Depth unit - set to 83 if original units are feet	none
30	Calibration Depth	none	96	Identification of Originator's flags	4
31	Calibration Temperature	none	98	ARGOS ID number	none
32	BT recorder (WMO 4770)	2L			

The following is an explanation of the secondary header codes listed in Table 7:

- Code 1 NODC accession number: number assigned by NODC to each batch of data

received (filename: *accession.txt*). Please note that all real-time GTSP data received after 1999 will have an accession number of 0. An accession is assigned to GTSP data when it is replaced by delayed mode data;

- Code 2 NODC project code: identifies projects associated with the data (filename: *projects.txt*);
- Code 3 Platform: code list identifies the platforms associated with the data. It should be noted that the database contains negative platform codes which were assigned to unidentified ships from Russian and Ukrainian institutes for which we expect to receive information. Negative platforms are unique only to the accession number where found (filename: *shipname.txt*);
- Code 4 Institution: code identifying the institution which sampled the data (filename: *inst.txt*);
- Code 5 Cast/Tow Number: sequential number representing each over-the-side operation or discrete sampling at a station or section in the cast of a tow;
- Code 7 Originator's station number: numeric station number assigned by the data submitter or data originator;
- Code 9 Ocean Weather Station: codes assigned to identify data from the various ocean weather stations (Appendix 2A);
- Code 10 Bottom depth: depth from water surface to sediment-water interface, in meters;
- Code 11 Cast duration: duration of the cast, in hours;
- Code 12 Cast Direction: down assumed, description found in Appendix 2B;
- Code 13 High resolution pairs: unique station number identifying where HCTD and Bottle data were sampled at the same station;
- Code 14 Water Color: description of codes found in Appendix 2C. Codes in the database and Appendix 2C include values that are not in the Forel-Ule Scale, namely values higher than 21;
- Code 15 Water transparency: Secchi depth, in meters;
- Code 16 Wave Direction (WMO 0877): description of codes found in Appendix 2D;
- Code 17 Wave Height (WMO 1555): description of codes found in Appendix 2E;
- Code 18 Sea State (WMO 3700): description of codes found in Appendix 2F;
- Code 19 Wind Force (Beaufort Scale): description of codes found in Appendix 2G;
- Code 20 Wave Period (WMO 3155 or NODC 0378): description of codes found in Appendix 2H; note that NODC code 0378 is not equivalent to WMO 3155, therefore these data need to be used with caution unless the users can identify which code is being reported;
- Code 21 Wind Direction (WMO 0877): description of codes found in Appendix 2D;
- Code 22 Wind speed: surface or near-surface wind speed, in knots;
- Code 23 Barometric pressure: the atmospheric pressure at sea level due to the gravitational force on the column of air above it (millibar);
- Code 24 Dry bulb temperature: identical to air temperature, in °C;
- Code 25 Wet bulb temperature: the temperature a parcel of air would have if it were cooled adiabatically with no heat transfer, in °C;
- Code 26 Weather (WMO 4501 and WMO 4677): description of codes found in Appendix 2I;

- Code 27 Cloud Type (WMO 500): description of codes found in Appendix 2J;
- Code 28 Cloud Cover (WMO 2700): description of codes found in Appendix 2K;
- Code 29 T-S probe type (temperature-salinity) listed in Appendix 3 and **CODES/tsprobe.txt** in the CD-ROMs;
- Code 30 Calibration depth: deviation on an XBT from the zero depth. This difference between points was used to adjust the profile when it was digitized;
- Code 31 Calibration temperature: deviation on an XBT from a 16.7°C reference point. This difference between points was used to adjust the profile when it was digitized;
- Code 32 BT Recorder Type (WMO 4770): description of codes found in Appendix 2L;
- Code 33 Depth fix: a one (1) is assigned if a depth correction was applied to XBT using recalculated drop rate;
- Code 34 Bottom hit: a one (1) is assigned if the probe hits the bottom;
- Code 35 BT Digitization Method (NODC 0612): description of codes found in Appendix 2M;
- Code 36 BT Digitization Interval (NODC 0613): description of codes found in Appendix 2N;
- Code 37 BT Data Treatment And Storage (NODC 0614): description of codes found in Appendix 2O;
- Code 38 BT Depth correction: average difference between the surface trace and the surface depth line of the grid for a BT;
- Code 39 BT Temperature correction (°C): correction for difference between reference temperature and BT reading or correction to the original data by the submittor - in some cases the correction has already been applied;
- Code 40 Instrument For Reference Temperature (NODC 0615): description of codes found in Appendix 2P;
- Code 41 Horizontal Visibility (WMO 4300): description of codes found in Appendix 2Q;
- Code 45 Absolute Humidity (g/m<sup>3</sup>): sometimes referred to as the vapor density because it is the ratio of the mass of water vapor present to the volume occupied by the moist air mixture present in the atmosphere;
- Code 46 Reference/Sea Surface Temperature: temperature used to check the probe or a separate measure of sea surface temperature;
- Code 47 Sea Surface Salinity: the salinity of the layer of sea water nearest to the atmosphere;
- Code 71 Radio signal: identifies data received from a radio signal (real time data), identified with a one (1);
- Code 72 XBT Wait: Wait is the time difference between the launch of the probe and the time it begins recording data;
- Code 73 XBT Frequency: Frequency is the sampling rate of the recorder;
- Code 74 Oceanographic Measuring Vehicle: Appendix 2R lists the different types of vehicles which carry oceanographic instruments. Also listed in **CODES/uvehicle.txt** in the CD-ROMs.
- Code 77 xCO<sub>2</sub> in atmosphere (ppm): mole fraction of CO<sub>2</sub> in dry gas sample;
- Code 84 ARGOS Fix Code: ARGOS satellite fix and location accuracy, description of codes found in Appendix 2S;



- Code 85 ARGOS time (hours) from last fix: used to calculate position of APB;
- Code 86 ARGOS time (hours) to next fix: used to calculate position of APB;
- Code 87 Height (meters) of XBT launch;
- Code 88 Depth of sea surface sensor (meters);
- Code 91 Identifies NODC database: (1) original NODC archive; (2) GTSP database;
- Code 92 UKHO Bibliographic Reference number: source for digitized cards from the United Kingdom Hydrographic Office (vessels, institutes, sea area). Description of codes in Appendix 2T;
- Code 93 Consecutive profile in tow segment: used to identify segments in underway data;
- Code 94 WMO Identification code: code assigned to buoys or profiling floats by WMO;
- Code 95 Depth unit: set to 83 if original units are feet;
- Code 96 Originator's flags: Appendix 4 lists the data quality flags submitted by the data originator. Also listed in **CODES/origflag.txt** in the CD-ROMs. These flags are assigned only to the observed depth data. If this code is absent, there are no originator's flags.
- Code 98 ARGOS ID number: assigned by the Argos project office.

### 3. Variable-specific Secondary Header

The variable-specific second header contains metadata (information about the data) specifically associated with each variable. Table 8 lists the different types of variable-specific second header data we include for each station, when the information is available; the ID column represents the code number assigned to each variable specific second header.

**Table 8. List of Variable-Specific Second Headers**

ID	Description	Appendix	ID	Description	Appendix
1	Accession number	file	11	Filter type and size	5D
4	Institution	file	12	Incubation time	none
5	Instrument	file	13	CO <sub>2</sub> sea warming	none
6	Method	5A	15	Analysis temperature	none
8	Originator's units	5B	16	Uncalibrated	none
10	Equilibrator type	5C			

The following is an explanation of the variable-specific second header codes listed in Table 8:

- Code 1 NODC accession number: number assigned by NODC to each batch of data received (filename: *accession.txt*). Sometimes the variables for a station are

received at different times or from different sources and therefore may have different accession numbers. We have attempted to merge these stations together and tried to keep its source intact;

- Code 4 Institution: code identifying institution associated with the investigator who sampled the specific variable (filename: *inst.txt*);
- Code 5 listed in Appendix 3 and **CODES**/*tsprobe.txt* in the CD-ROMs. Used to identify instrument used;
- Code 6 Method: Appendix 5A lists the methods associated with each variable measured. This list represent the methods reported with the data submitted and is not a comprehensive list of variable methods. Also listed in **CODES**/*methods.txt* in the CD-ROMs;
- Code 8 Originator's units: Appendix 5B lists the units codes which identify the submittor's original units. Also listed in **CODES**/*units.txt* in the CD-ROMs.
- Code 10 Equilibrator type: codes describe the design of the equilibrator used for equilibrating seawater with air in preparation for measuring CO<sub>2</sub> concentrations (Appendix 5C);
- Code 11 Filter type and size: Appendix 5D;
- Code 12 Incubation time: in hours where 25 is dawn to noon, 26 is noon to dusk;
- Code 13 CO<sub>2</sub> sea warming: temperature change in transporting water from the sea surface to the CO<sub>2</sub> analysis site;
- Code 15 Analysis temperature: temperature of seawater at the time of CO<sub>2</sub> analysis;
- Code 16 Uncalibrated: set to 1 if instrument is uncalibrated.

#### 4. Character Data

Character data are used to report the originator's cruise identification and the originator's station identification, if provided. Under this heading, the Principal Investigators (PI) are also identified by numeric code and by variable code. The Principal Investigator is the person responsible for collecting the data and is included whenever available. A list of the numeric codes associated with each PI can be found in the **CODES** directory of each CD-ROM (file: *pinames.txt*). For the purpose of assigning PI codes, plankton data are identified as variable 14 for all plankton, -5002 for zooplankton, and -5006 for phytoplankton.

#### 5. Biological Header

The biological header section contains information on the sampling methods used for collecting taxonomic and biomass measurements. Table 9 lists the different types of biological header data included for each station, if the information was available. Similar to the secondary header information, much of the information is represented by code lists. Appendix 6 includes these lists.

**Table 9. List of biological header variables.** All code tables are listed in Appendix 6 (the biological headers are listed in file = *bioheadr.txt*); the ID column represents the code number assigned to each biological header.

ID	DESCRIPTION	App.	ID	DESCRIPTION	App.
1	Water volume filtered (m <sup>3</sup> )	none	14	Tow distance (meters)	none
2	Sampling duration (minutes)	none	15	Average towing speed (knots)	none
3	Mesh size (µm)	none	16	Sampling start time (GMT)	none
4	Type of tow	6A	18	Flowmeter type	6B
5	Large removed volume (ml)	none	19	Flowmeter calibration	6F
6	Large plankters removed	none	20	Counting institution	file
7	Gear code	6B	21	Voucher Institution	file
8	Sampler volume (liters)	none	22	Wire angle start (degrees)	none
9	Net mouth area (m <sup>2</sup> )	none	23	Wire angle end (degrees)	none
10	Preservative	6C	24	Depth determination method	6G
11	Weight method	6D	25	Volume method	6H
12	Large removed length (cm)	none	30	Accession number for the biology	file
13	Count method	6E			

The following is a description of the biological header codes listed in Table 9:

- Code 1 Water volume filtered: total volume of water filtered by the sampling gear, in m<sup>3</sup>;
- Code 2 Sampling duration: time over which the sampling gear was towed, in minutes;
- Code 3 Mesh size: pore size of the sampling device, in micrometers;
- Code 4 Type of tow: towing method used (e.g., horizontal, vertical, oblique) - Appendix 6A;
- Code 5 Large removed volume: the minimum volume criteria for removing large plankters, in ml, see also code 12;
- Code 6 Large plankters removed: if large plankters were specified as being removed (1) or not removed (2), this code is added. See also codes 5 and 12;
- Code 7 Gear code: type of gear used (e.g., plankton net, bottle, MOCNESS) - Appendix 6B;
- Code 8 Sampler volume: internal volume of the sampling gear (e.g., volume of Niskin bottle), in liters;
- Code 9 Net mouth area: mouth or opening area of the sampling gear, in m<sup>2</sup>. If mouth diameter was provided, area was calculated (area =  $\pi$  (diameter ÷ 2)<sup>2</sup>);
- Code 10 Preservative: type of preservative used to preserve the plankton sample (Appendix 6C);
- Code 11 Weight method: method used for weighing the plankton sample (Appendix 6D);
- Code 12 Large removed length: the minimum size/length criteria for removing large

- plankters, in cm, see also code 5;
- Code 13 Count method: method used for counting the plankton sample (Appendix 6E);
- Code 14 Tow distance: distance over which sampling gear was used, in meters;
- Code 15 Average tow speed: average speed used to tow the sampling gear, in knots;
- Code 16 Sampling start time: in GMT;
- Code 18 Flowmeter type: the brand and/or model of the flowmeter employed (Appendix 6B);
- Code 19 Flowmeter calibration: the calibration frequency for the flowmeter (Appendix 6F);
- Code 20 Counting Institution: the institution responsible for identifying and counting the taxa-specific sample (see file **CODES/inst.txt**);
- Code 21 Voucher Institution: the location (institution) of the taxa-specific sample voucher (see file **CODES/inst.txt**);
- Code 22 Wire angle start: wire angle of the towing apparatus at sampling start, in degrees;
- Code 23 Wire angle end: wire angle of the towing apparatus at sampling end, in degrees.
- Code 24 Depth determination method: a code indicating that depth was calculated from wire angle and length or a PI-specific “target depth” (Appendix 6G);
- Code 25 Volume method: the method used for measuring the volume of the plankton sample (Appendix 6H);
- Code 30 Accession number for biology: NODC data set identification for the biological component of the current station (see file **CODES/accesion.txt**);

## 6. Taxa-specific and Biomass Data

The Taxa-specific and Biomass Data section contains each plankton observation (measurement) taken at a station. Unlike the depth-dependent variable data (e.g., temperature, oxygen, nitrate, etc.), taxa-specific and biomass data are stored in individual sets of unique observations, called “taxa-sets”. Each taxa-set contains a taxonomic description of the original plankton observation, the upper and lower depth range of that observation, the original measurement (e.g., count, mass, or volume), and any of the other associated information required to represent that plankton observation (e.g., lifestage, sex, size range).

Each unique taxonomic description, depth range, or measurement has its own taxa-set. For example:

- Biomass (displacement volume) measured from 0-100m, and 200-500m, will have two taxa-sets, one for each depth range.
- Biomass (displacement volume and wet weight) measured from 0-250m will have two taxa-sets, one for each type of biomass measurement.

- A taxa-specific measurement of a single species, counted at five bottle depths, will have five taxa-sets, one for each depth.
- A taxa-specific measurement of ten species, counted at five bottle depths, will have 50 taxa-sets, five depths × ten species.

Note that taxa with different taxonomic descriptors (e.g., life stage, sex code, etc.) are treated as a different unique taxonomic description, and are stored in different taxa-sets. For example: *Calanus* eggs, *Calanus* juveniles, *Calanus* adults (male), and *Calanus* adults (female) would be stored as four separate observations, each with the same genus, but differing in their taxon life stage and/or taxon sex values.

Table 10 lists the different types of taxa-specific and biomass data fields for each taxa-set, if the information is available. Each station can have multiple taxa-sets, and each taxa-set can contain any of the fields in Table 10. Similar to the biological header information, much of the information is represented by code lists. Appendix 7 includes these lists.

**Table 10. List of biomass and taxa-specific variables.** Code tables for these variables are listed in Appendices 5B, and 6-8 (biomass and taxa variables are listed in file = *taxvar.txt*); the ID column represents the code number assigned to each biomass and taxa-specific variable.

ID	DESCRIPTION	App	ID	DESCRIPTION	App
1	Parameter number (>0 ITIS tax code, < 0 WOD01 tax or group code)	file	15	Taxon ash-free weight (mg or ng/UNIT)	none
2	Upper depth (meters)	none	16	Taxon feature	7F
3	Lower depth (meters)	none	17	Taxon modifier	7G
4	Biomass value	7H	18	Size min (mm)	file
5	Taxon lifestage	7A	19	Size max (mm)	none
6	Taxon sex code	7B	20	Unit	5B
7	Taxon present	7C	21	Taxon radius (µm)	none
8	Taxon trophic mode	7D	22	Taxon length (µm)	none
9	Taxon realm	7E	23	Taxon width (µm)	none
10	Taxon count (count of taxon / UNIT)	none	25	Taxon carbon content (mg or ng/UNIT)	none
11	Sample-specific sample volume (m <sup>3</sup> or ml per UNIT)	none	26	Special count method	6E
12	Taxon volume (ml or pl/UNIT)	none	27	WOD01 Comparable Biological Value (CBV)	7H
13	Taxon wet weight (g or µg/UNIT)	none	28	WOD01 CBV calculation method	7I
14	Taxon dry weight (g or µg/UNIT)	none	30	WOD01 Biological Grouping Code (BGC)	8

The following is a description of biomass and taxa-specific variables listed in Table 10:

- Code 1 Parameter number: a code for the type of taxon or biomass sampled. See Table 11 for a breakdown of these codes and the file names;
- Code 2 Upper depth: the upper depth sampled, in meters;

- Code 3 Lower depth: the lower depth sampled, in meters;
- Code 4 Biomass value: contains biomass value measured, units are specified by the biomass parameter code (Table 11 and Appendix 7H);
- Code 5 Taxon lifestage: a specific lifestage indicated for a taxonomic observation (e.g., *Calanus finmarchicus* nauplii) - Appendix 7A;
- Code 6 Taxon sex code: a specific sex indicated for a taxonomic observation (e.g., *Calanus finmarchicus* adult females) - Appendix 7B;
- Code 7 Taxon present: a non-numeric, relative abundance, presence indicator (e.g. “rare”, “common”, “dominant”) - Appendix 7C;
- Code 8 Taxon trophic mode: a specific trophic description for a taxonomic observation (e.g., “autotrophic picoplankton”) - Appendix 7D;
- Code 9 Taxon realm: a specific realm description for a taxonomic observation (e.g., “unknown bathypelagic fish”) - Appendix 7E;
- Code 10 Taxon count: the number of an individual taxon counted, in count per unit (as specified by code 20);
- Code 11 Sample-specific sample volume: used only when each sample within a tow has a different sample volume (e.g., the different volumes filtered by each net of a MOCNESS net). If the value is > 0, the units are “m<sup>3</sup> per UNIT”. If the value is < 0, the units are “ml per UNIT”, where UNIT is specific by code 20;
- Code 12 Taxon volume: the volume of an individual taxon counted. If the value is > 0, the units are “ml per UNIT”. If the value is < 0, the units are “nl per UNIT”, where UNIT is specific by code 20;
- Code 13 Taxon wet weight: the wet weight of an individual taxon counted. If the value is > 0, the units are “g per UNIT”. If the value is < 0, the units are “mg per UNIT”, where UNIT is specific by code 20;
- Code 14 Taxon dry weight: the dry weight of an individual taxon counted. If the value is > 0, the units are “g per UNIT”. If the value is < 0, the units are “mg per UNIT”, where UNIT is specific by code 20;
- Code 15 Taxon ash-free dry weight: the ash-free dry weight of an individual taxon counted. If the value is > 0, the units are “mg per UNIT”. If the value is < 0, the units are “ng per UNIT”, where UNIT is specific by code 20;
- Code 16 Taxon feature: a specific feature or shape indicated in a taxonomic observations (e.g., “athecate dinoflagellate”) - Appendix 7F;
- Code 17 Taxon modifier: a specific taxonomic identity description for a taxonomic observation (e.g., *Calanus spp.*, *Ceratium sp. A*, *Ceratium sp. B*, *Ceratium spp. other*) - Appendix 7G;
- Code 18 Minimum size range description: the smaller size range used in a taxonomic description. If the value is > 0, the units are “mm”. If the value is < 0, it is a code (-1 = *small*, -2 = *medium*, -3 = *large*, -4 = *very small*, as provided in the original taxonomic description - see file **CODES/taxsize.txt**);
- Code 19 Maximum size range description: the larger size range used in a taxonomic description, in mm;
- Code 20 Unit: additional unit identifier for biomass and taxa-specific measurements (listed in Appendix 5B);

- Code 21 Taxon radius description: the radius (diameter ÷ 2) size used in a taxonomic description, in  $\mu\text{m}$ ;
- Code 22 Taxon length description: the length or height used in a taxonomic description, in  $\mu\text{m}$ ;
- Code 23 Taxon width description: the width or shortest-dimension used in a taxonomic description, in  $\mu\text{m}$ ;
- Code 25 Taxon carbon content: the carbon content of the individual taxon counted. If the value is  $> 0$ , the units are “g per UNIT”. If the value is  $< 0$ , the units are “mg per UNIT”, where UNIT is specific by code 20;
- Code 26 Special measurement method: used only when multiple methods are used within a single measurement (e.g., to distinguish bacterial groups discerned and counted by different staining and/or fluorescent techniques within a single sample);
- Code 27 Comparable Biological Value (CBV): a common unit plankton count or biomass value (see Appendix 7H);
- Code 28 CBV calculation method: method used for calculating the CBV (see section Appendix 7I);
- Code 30 Biological Grouping Code (BGC): an ancillary taxonomic group which identifies each taxon into broader groupings (e.g., *diatoms*, *copepods*, *phytoplankton*). See Appendix 8.

Scientific taxa names in the plankton description were translated using ITIS (Integrated Taxonomic Information System, <http://www.itis.usda.gov>) as an authority list, and are represented in WOD01 under the proper ITIS taxonomic serial number (see file **CODES/tax\_itis.txt**). This procedure was not possible for all plankton descriptions. For example, non-scientific descriptions such as “gelatinous organisms”, combinations of multiple species in a single description, and “total haul biomass” measurements cannot be represented via ITIS. Ancillary codes were developed to preserve these original descriptions. See Table 11 for a description and value ranges for all *Parameter number* code values present in WOD01.

**Table 11. Summary of *Parameter number* Codes**

Parameter Value Range	DESCRIPTION	FILE
1 to 700000	Official ITIS Code (Full taxonomic detail available at <a href="http://www.itis.usda.gov">http://www.itis.usda.gov</a> )	<i>tax_itis.txt</i>
-201 to -210	WOD01 Biomass Code (e.g., <i>Total Displacement Volume</i> , <i>Total Wet Mass</i> )	<i>tax_biom.txt</i>
-1000 to -1999	WOD01 “Failed ITIS Review” Code (ITIS was unable to verify its validity. Description may be non-existent, non-taxonomic, or unidentified)	<i>tax_1000.txt</i>
-5000 to -5999	WOD01 “Non-taxonomic Group” Code (e.g., “gelatinous organisms”)	<i>tax_5000.txt</i>
-6000 to -6999	WOD01 “Multiple taxa group” Code (e.g., “Foraminifera & Radiolaria”)	<i>tax_6000.txt</i>

Parameter Value Range	DESCRIPTION	FILE
-7000 to -9999	WOD01 "Pending ITIS Review" Code (ITIS verification in-progress as of WOD01 release)	tax_7000.txt

In addition to the original plankton descriptions, each taxa-set also contains a WOD01 grouping index, **Biological Grouping Code (BGC)**, code 30. The BGC is an additional taxonomic classification which places the plankton description into broader groups (e.g., "phytoplankton", "diatoms", "zooplankton", "copepods"). This feature allows the database user to select the hundreds of diatom species present in WOD01 (each with a unique ITIS code) by using a single BGC code. Appendix 8 lists the BGC groups and codes available in WOD01.

*BGC Example: Calanus finmarchicus*

4	2	8	2	0	0	0
<b>PRIMARY</b>	<b>SECONDARY</b>		<b>TERTIARY</b>			

The BGC groups are divided into Primary (e.g., *Bacteria*, *Phytoplankton*, *Zooplankton*), Secondary (e.g., *cyanobacteria*, *diatoms*, *crustaceans*), and Tertiary Groups (e.g., *copepods*). For example, the copepod *Calanus finmarchicus* has a BGC code of

"4282000", specifying that it is in Primary Group "4" (zooplankton), Secondary Group "28" (crustaceans), and Tertiary Group "2000" (Copepods). Using the BGC code requires the application of simple math (division) to the BGC code value, outlined in Table 12, to specify the exact grouping level desired (e.g., "all zooplankton", "all crustaceans", or "all copepods").

**Table 12. Operational example of the Biological Grouping Code**

DESIRED GROUP	BGC VALUE	DIVIDE BY	RESULT	BGC EQUIVALENT (see Appendix 12)
PRIMARY GROUP	4282000 4310000 2010000	1000000	4 4 2	zooplankton zooplankton phytoplankton
SECONDARY GROUP	4282000 4310000 2010000	10000	428 431 228	crustacean chaetognath diatom
TERTIARY GROUP	4282000 4310000 2010000	100	42820 43100 20100	copepods chaetognaths diatom

Plankton counts and biomass measurements are stored with originator's units in WOD01 (e.g., counts in units of "number per m<sup>3</sup>", "count per m<sup>2</sup>", "count per haul", "count per ml"). To make comparison of different units easier, each count or biomass measurement has been calculated into a common units named **Common Biological Value (CBV)**, code 27.



The CBV value has a quality control flag associated with it (see Table 16 for a definition of the flags). The calculation method used to create the CBV is stored in the *CBV calculation method* field, code 28, and detailed in Appendix 7I. The CBV unit is dependent on the major taxonomic group of the measurement, as classified in the *Biological Grouping Code* for that observation. For example, bacteria, phytoplankton, and protist counts are units of “count per ml”, whereas zooplankton and ichthyoplankton counts are in units of “count per m<sup>3</sup>”. The CBV units for taxonomic counts and various biomass measurements are detailed in Appendix 7H.

## 7. Measured Variables

The number of variables and the type of variable are identified in the primary header, as well as a quality control flag for each variable (if all values of that variable have been flagged for that station). Tables 4 and 5 list the variables and their identifying codes. Table 16 lists the flags assigned to each variable.

Stations with data on pressure surfaces have their depths computed, so depth is always present and the pressure value is stored. Some data were reported with both depth and pressure in which case both are stored. Similarly, stations which come in with conductivity readings have salinity computed. Some stations may be reported on standard depth levels (see Table 18) such as most of the Japanese and Former Soviet Union (F.S.U.) data. It is uncertain whether these data were originally measured at standard levels or interpolated to standard depth levels.

### 7a. Surface only Variables (SURF)

Surface only variables are treated differently from profile data in the database. For surface only data, each cruise is treated as though it were a single station with depth, latitude, longitude, and julian year-day associated with each measurement value. The Julian year-day 0.00 is defined as time 0.00 on January 1<sup>st</sup> of the year of the first measurement. For cases in which the measurements span 2 calendar years, the year-day is consecutive. For example, if a measurement was taken at time 0:00 on 31 Dec. 1965 (not a leap year), the year day for that observation is 365.00. If the last measurement on the same cruise was taken at time 12:00 on 1 January 1966, the year-day is 366.5. An example of a surface station is shown below:

Longitude	Latitude	Year	Month	Day	Time	Cruise#	CC	Prof_#
-30.026	62.666	1991	9	3	20.33	9810	06	7819341

Num	Depth	Temp	Sal	pCO2	Lat	Lon	Jday
1	0.00	9.130	34.940	294.300	62.666	-30.026	245.847
2	0.00	9.300	34.930	303.400	62.660	-30.057	245.851
3	0.00	9.400	34.913	305.300	62.640	-30.151	245.861
4	0.00	9.370	34.927	307.900	62.655	-30.088	245.854
5	0.00	9.400	34.915	306.600	62.648	-30.120	245.858

**STATION CONTINUES WITH A TOTAL OF 2097 OBSERVATIONS**

Access# 113

Platform	335
Institution	388
pCO2 Instrument	8.000
pCO2 Method	1233.000
pCO2 Orig_Units	81.000
pCO2 Equilib_Type	1650.000

Note that the header information contains the same longitude, latitude and date/time information as the first observation in the listing.

## **7b. Autonomous Pinniped Bathythermograph (APB)**

Autonomous Pinniped Bathythermograph (APB) is the name given to temperature data recorded by northern elephant seals instrumented with time-temperature-depth recorders (TTDR) and ARGOS position transmitters.

Depth and temperature were recorded by the TTDR as the elephant seals ascended and descended through the water column while foraging for food. When the seals return to the surface to rest, the ARGOS unit transmitted their position. During their multi-month migration, the seals dove continuously, night and day, capturing thousands of “profiles” along their migration route.

To fit this data type into the OCL format, the foraging dives were broken into distinct up and down profiles, with any long resting periods at the surface (depth = 0) removed. When an ARGOS fix was made, the ARGOS-assigned quality flag for that fix (determined by the number of satellites receiving the signal) was stored along with the profile. Otherwise, the time intervals between the last and next ARGOS fixes were stored with the profile (second headers 84-86).

Full details on the instrumentation and methods use for these data are available in *Boehlert et al. (2001)*.

## **7c. Undulating Oceanographic Recorder (UOR)**

Undulating Oceanographic Recorder (UOR) is the generic name given to towed vehicles carrying measuring devices (usually CTDs) which ascend and descend through the water column in a more or less regular pattern, giving a two-dimensional view of the water column along the path in which the vehicle is towed.

UOR measurements are usually very close together, and are continuous, with no stop at the top of the ascent or at the bottom of the descent. To fit this data type into the OCL format, the undulations are broken into distinct up and down profiles, and all the measurements between the breaks are averaged on a minimum 1.0 decibar increments. The latitude and longitude are also averaged for each measurement, as is the date/time (preserved as julian year-day). This averaged measurement is kept with each oceanographic variable measurements. The position in the header is the position of the

portion of the tow when the vehicle is at the exact middle of its ascent or descent (based on the averaged decibar increments). Some of the data received was already processed to some extent and did not include latitude, longitude, or julian year-day.

A tow can be broken into either a few up or down segments or thousands. The tow number (second header 5) along with the Segment Number (second header 93) can be used to follow the progression of a tow in time, as the segment numbers correspond to the sequence of up or down undulations.

### III. CD-ROM DISC STRUCTURE

The WOD01 is comprised of eight CD-ROMs containing profile, surface only, and plankton/biomass data in compressed format. WOD01-01 through WOD01-07 contain observed level data, WOD01-08 contains all the standard level data.

WOD01-01 contains bottle and surface only data for all basins. The bottle data are divided into three subdirectories, one for the North Atlantic (NATL), North Pacific (NPAC) and the Southern Hemisphere and Indian (SHIN) basins. Within these subdirectories, the data are organized by ten-degree latitude-longitude squares numbered using the WMO ten-degree square numbering scheme (illustrated in Appendices 9A-9B). Stations in each file are sorted by date. The surface data are all in one directory (SURF) and in one file (*SURF\_ALL.GZ*) since many of the cruises cut across different basins.

WOD01-02 through WOD01-04 contain CTD/UOR data for the North Atlantic (0°-90°N), North Pacific (0°-90°N) and the Southern Hemisphere and Indian Ocean. WOD01-05 through WOD01-07 contain XBT/MBT/APB/MRB/PFL/DRB data for the North Atlantic (0°-90°N), North Pacific (0°-90°N) and the Southern Hemisphere and Indian Ocean. The subdirectories in WOD01-02 through WOD01-07 identify the different instrument types. Table 13 shows the contents of WOD01-01 - WOD01-08.

All the standard level data are on WOD01-08. **Please note there are no standard levels for SURFACE ONLY data.** As with the observed level data, the data are organized by instrument/probe type. Within each instrument/probe directory, the files are named based on the WMO square where the data are located.

**WMOs 7007, 7008, 7108 and 7109 are duplicated on any CD-ROMs containing the North Pacific (NPAC) and North Atlantic (NATL) since these WMOs include portions of the North Atlantic and North Pacific Oceans.**

Note: Some of the WMO files listed in the CD-ROMs contain no data since they correspond to land areas. There are some WMO's which contain data on land. These are obviously position errors which are included in the database with the expectation that these will be identified by data collectors or users and the correct positions submitted to the OCL. Note that data from lakes and inland seas are included in this product.

A positive longitude in the data denotes the Eastern Hemisphere, a negative longitude denotes the Western Hemisphere, a positive latitude denotes the Northern Hemisphere, and a negative latitude denotes the Southern Hemisphere.

Appendices 10A-10D show an inventory of the contents in each instrument type.

**Table 13. Contents of the WOD01-01 through WOD01-08**

CD-ROM	DIRECTORIES
WOD01-01 Bottle/Surface only data for all ocean basins	NATL NPAC SHIN SURF
WOD01-02 CTD/UOR data for the North Atlantic 0°-90° N	CTD UOR
WOD01-03 CTD/UOR data for the North Pacific 0°-90°N	CTD UOR
WOD01-04 CTD/UOR data for the Southern Hemisphere and Indian Ocean	CTD UOR
WOD01-05 XBT/MBT/APB/MRB/PFL/DRB data for: North Atlantic 0°-90° N	XBT MBT APB MRB PFL DRB
WOD01-06 XBT/MBT/APB/MRB/PFL/DRB data for the North Pacific 0° N-90°N	XBT MBT APB MRB PFL DRB
WOD01-07 XBT/MBT/APB/MRB/PFL/DRB data for the Southern Hemisphere and Indian Ocean	XBT MBT APB MRB PFL DRB

CD-ROM	DIRECTORIES
WOD01-08 Standard level data for all instruments for all ocean basins	NATL OSD CTD UOR XBT MBT APB MRB PFL DRB NPAC OSD CTD UOR XBT MBT APB MRB PFL DRB SHIN OSD CTD UOR XBT MBT APB MRB PFL DRB

#### IV. FILE STRUCTURE/FORMAT

All observed and standard level data files are written as a series of 80 character length ASCII records. For UNIX users, note that the ASCII records contain a DOS CR-LF (Carriage Return-Line Feed) end-of-record marker which may need to be stripped (see section V - *Special Note for UNIX Users*).

A detailed record layout for the data can be found in Table 14. There is a carriage return after each 80 bytes (CR-LF). Each station begins on a new line. Starting with WOD01, the first byte in a station will be one character which identifies the World Ocean Database version. If the first byte is character "A", it refers to WOD01; if the first byte is numeric, it identifies WOD98. Each section of a station (e.g., primary header and variable-specific second header, character data, secondary header, biological header) begins with a total byte count for that section. If there are no data for that section, the byte count is zero. If there are data for that section, the byte count can be used to skip over sections which are of no interest to the user.

The header includes the NODC country code (see Appendix 1 for a listing of these codes), cruise number, position, date, time, OCL unique station number, the number of observed or standard depth levels, an identifier for observed or standard level data, number of variables, variable codes, originator's flag for observed level data only, and a flag if all of a variable's data in that station fails a quality control check (see Table 16 for a description of the flags). Appendix 11 shows the byte count for each probe type.

Appendix 12 shows sample data output from OCL Station 67064 (using the program wodFOR.f), found on the WOD01-01 CD-ROM in file *WOD01-01/DATA/NPAC/OSDO7617*. This file contains temperature, salinity, oxygen, phosphate, silicate, and taxonomic/biomass data ("f" denotes the flag assigned to the variable and "o" denotes the originator's quality flag); numbers in parenthesis represent the number of significant digits in the value; "VarFlag" identifies whole profile flags for each variable).

For compactness, each variable (other than most in the first header), is written in this fashion: STPVVVVV[F][O]

where:

- S = Number of significant digits in a value;
- T = Total number of digits in a value. This is usually the same as [S], but can vary in cases of negative numbers, converted values, and data in which the values are reported with more precision than an instrument is capable of recording;
- P = Precision of a variable (number of places to the right of the decimal point);
- V = The actual value. This is read in using [T] and [P];
- F = OCL quality control flag. This is not used for all variables;
- O = Originators flag.

For example: A salinity value, written as  
[5533389100]

means that S = 5, T = 5, P = 3. Using this information, there are five bytes in the salinity reading, with a precision of three, so V(sal) = 33.891, F = 0, O = 0.

A missing value in this data format is always represented with an S = '-' (the minus character). That is, when the number of significant digits in read in, the character encountered will be a negative sign. This tells the user that no value was recorded and to skip to the next value. The file naming convention is redundant so that files downloaded from the CD-ROM to DOS or UNIX storage devices can be completely identified from their names. For example, an OSD (Bottle data) file from the North Atlantic will have a fully qualified name such as: */DATA/NATL/OSDO5008.gz* (if observed level data)  
*/DATA/NATL/OSD/OSDS5008.gz* (if standard level data).

**Table 14. OCL ASCII FORMAT FOR PRIMARY HEADER**

FIELD	LENGTH	FORMAT	DESCRIPTION
1. WOD Version identifier	1	A1	Identifies WOD version - if field is numeric, format is for WOD98, field "A" is WOD01
2. Bytes in next field	1	I1	
3. Bytes in profile	from (2)	Integer	
4. Bytes in next field	1	I1	
5. OCL unique station number	from (4)	Integer	OCL station identification
6. Country code	2	A2	NODC country codes (Appendix 2A)
7. Bytes in next field	1	I1	
8. Cruise number	from (7)	Integer	NODC/OCL
9. Year	4	I4	
10. Month	2	I2	
11. Day	2	I2	may have a zero value
12. Time - if time is missing it's denoted as (-) in the Sig.Fig. field - if so, skip to (13)			
a. Sig. figures	1	I1	(-)if time missing
b. Total figures	1	I1	not present if (a) is negative
c. Precision	1	I1	not present if (a) is negative
d. Value	based on (b)	based on (a-c)	not present if (a) is negative
13. Latitude - if latitude is missing it's denoted as (-) in the Sig.Fig. field - if so, skip to (14)			
a. Sig. figures	1	I1	(-)if missing
b. Total figures	1	I1	not present if (a) is negative
c. Precision	1	I1	not present if (a) is negative
d. Value	based on (b)	based on (a-c)	not present if (a) is negative
14. Longitude - if longitude is missing it's denoted as (-) in the Sig.Fig. field - if so, skip to (15)			
a. Sig. figures	1	I1	(-)if missing
b. Total figures	1	I1	not present if (a) is negative
c. Precision	1	I1	not present if (a) is negative
d. Value	based on (b)	based on (a-c)	not present if (a) is negative
15. Bytes in next field	1	I1	
16. Number of Levels ( <b>L</b> )	from (15)	Integer	Number of depths
17. Profile type	1	I1	(0)Observed (1)Standard level
18. # Variables in profile ( <b>N</b> )	2	I2	
<i>Next section repeated based on number of variables in the profile (read fields 19-23 <b>N</b> times)</i>			
19. Bytes in next field	1	I1	read fields 19-23 <b>N</b> times
20. Variable code	from (19)	Integer	OCL variable codes (Tables 4-6)
21. Quality control flag for variable	1	I1	see Table 16
22. Bytes in next field	1	I1	
23. Number of Variable-specific metadata ( <b>M</b> )	from (22)	Integer	if zero go to 19, otherwise read fields 24-25 <b>M</b> times
<i>Next section repeated based on number of variable specific metadata (read fields 24-25 <b>M</b> times for each variable (<b>N</b>))</i>			
24. Bytes in next field	1	I1	if zero go to 19
25. Variable-specific code	from (24)	Integer	see Table 8
a. Sig. figures	1	I1	(-)if missing
b. Total figures	1	I1	not present if (a) is negative
c. Precision	1	I1	not present if (a) is negative
d. Value	based on (b)	based on (a-c)	not present if (a) is negative

**OCL ASCII FORMAT FOR CHARACTER DATA, SECONDARY AND BIOLOGICAL HEADER**

FIELD	LENGTH	FORMAT	DESCRIPTION
<b>CHARACTER DATA AND PRINCIPAL INVESTIGATOR</b> - entries 4-9 repeated based on number read in (3)			
1. Bytes in next field	1	I1	if "0" go to Second Header
2. Total bytes for character data	from (1)	Integer	
3. Number of entries <b>(C)</b>	1	I1	
IF FIELD (4) IS 1=Originators Cruise, OR 2=Originators station code (read fields 4-6 <b>C</b> times)			
4. <i>Type of data</i>	1	I1	(1)orig. cruise (2)orig. station
5. <i>Bytes in next field</i>	2	I2	
6. <i>Character data</i>	from (5)	A	
IF FIELD (4) IS 3=Principal investigator			
4. <i>Type of data</i>	1	I1	always 3
5. Number of P.I. names <b>(P)</b>	2	I2	read fields 6-9 <b>P</b> times
6. <i>Bytes next field</i>	1	I1	
7. <i>Variable code</i>	from (6)	Integer	OCL code (see Table 4-6)
8. <i>Bytes in next field</i>	1	I1	
9. <i>P.I. code</i>	based on (8)	Integer	OCL code (see file <i>pinames.txt</i> )
<b>SECONDARY HEADER</b> -entries 5-10 repeated based on number read in (4)			
1. Bytes in next field	1	I1	if "0" go to Biological Header
2. Total bytes for second headers	based on (1)	Integer	
3. Bytes in next field	1	I1	
4. Number of entries <b>(S)</b>	based on (3)	Integer	read fields 5-10 <b>S</b> times
5. <i>Bytes in next field</i>	1	I1	
6. <i>Second header code</i>	based on (5)	Integer	
7. <i>Significant figures</i>	1	I1	
8. <i>Total figures</i>	1	I1	
9. <i>Precision of value</i>	1	I1	
10. <i>Value</i>	based on (8)	based on (7-9)	
<b>BIOLOGICAL HEADER</b> - entries 5-10 repeated based on number read in (4)			
1. Bytes in next field	1	I1	if "0" go to Profile Data
2. Total bytes for biology	based on (1)	Integer	
3. Bytes in next field	1	I1	
4. Number of entries <b>(B)</b>	based on (3)	Integer	read 5-10 <b>B</b> times
5. <i>Bytes in next field</i>	1	I1	
6. <i>Biological header code</i>	based on (5)	Integer	OCL code (see Table 9)
7. <i>Significant figures</i>	1	I1	
8. <i>Total figures</i>	1	I1	
9. <i>Precision of value</i>	1	I1	
10. <i>Value</i>	based on (8)	based on (7-9)	



**OCL ASCII FORMAT FOR INTEGRATED, TAXONOMIC, AND PROFILE DATA**

FIELD	LENGTH	FORMAT	DESCRIPTION
<b>TAXONOMIC DATA SETS AND INTEGRATED PARAMETERS</b> - entries 3-11 repeated based on number read in (2)			
1. Bytes in next field	1	I1	if "0" go to next to next section
2. Number of taxa sets (T)	based on (1)	Integer	
3. Bytes in next field	1	I1	read fields 3-11 T times
4. Number of entries for each taxa set (X)	based on (3)	Integer	
5. Bytes in next field	1	I1	read fields 5-11 X times
6. Taxa or integrated parameter code	based on (5)	Integer	OCL code (see Table 10)
7. Significant figures	1	I1	
8. Total figures	1	I1	
9. Precision	1	I1	
10. Value	based on (5)	based on (7-9)	
11. Quality control flag for value	1	I1	see Table 16
12. Originator's flag	1	I1	always "0" in WOD01
<b>PROFILE DATA</b> - all steps repeated based on number of levels (L) listed in the primary header			
1. Number depth sig. figs.	1	I1	
2. Total figures in depth	1	I1	
3. Precision of depth value	1	I1	
4. Depth value	based on (2)	based on (1-3)	
5. Depth error code	1	I1	see Table 16
6. Originator's depth error flag	1	I1	see flags associated with project (Appendix 4)
7. Value sig. figs.	1	I1	steps 7-12 repeated for each variable or N times
8. Total figures in value	1	I1	
9. Precision of value	1	I1	
10. Value	based on (8)	based on (7-9)	
11. Value quality control flag	1	I1	see Table 16
12. Originator's flag	1	I1	see flags associated with project (Appendix 4)

## A. DESCRIPTION OF THE CD-ROM DIRECTORIES AND FILES

Each CD-ROM contains two files *overview.pdf*, (describes the contents of the CD), *readadv.txt* (instructions on how to install Ocean Data View), and (c) six directories named:

- **CODES** - contains codes associated with the secondary header, variable specific header, biological header, and taxa data;
- **DATA** - contains the data;
- **DOC** - contains the documentation;
- **PROGRAMS** - contains sample FORTRAN and C programs for reading the data and allow the user to convert the data so it can be read into Matlab (or any other comma separated or tabular program);
- **UTILS** - contains the utilities necessary to convert from DOS to UNIX and to decompress the data.
- **ODV** - contains the Ocean Data View software for viewing the WOD01 data (developed by R. Schlitzer, AWI).

### 1. Codes (CODES)

The directory **CODES** contains all files describing the metadata in secondary header, variable specific header, biological header, and taxa data. All codes but *accession.txt*, *projects.txt*, *inst.txt*, and *shipname.txt* are listed in the appendices of this document. All files in this directory are in ASCII format.

Files in the directory **CODES** of every CD-ROM:

<i>codes.txt</i>	description of the files in this directory
<i>accession.txt</i>	list of accession numbers, submitting institutes, submitting investigator, date of receipt of data, and type of instrument - <b>Second header code 1</b>
<i>argosfix.txt</i>	code table identifying ARGOS satellite fix and location accuracy - <b>Second header code 84</b>
<i>bioheadr.txt</i>	code table identifying the biological headers
<i>castdir.txt</i>	code table identifying cast direction - <b>Second header code 12</b>
<i>cbv_meth.txt</i>	code table identifying the CBV methods - <b>Taxa header 28</b>
<i>cbv_unit.txt</i>	code table identifying the CBV units - <b>Taxa header 27</b>
<i>cloudcov.txt</i>	code table identifying the cloud cover (WMO-2700 or NODC-0052) - <b>Second header 28</b>
<i>cloudtyp.txt</i>	code table identifying the cloud type (WMO-0500 or NODC-0053) - <b>Second header 27</b>
<i>cntmeth.txt</i>	code table identifying the counting methods - <b>Biology header 13</b>
<i>country.txt</i>	code table identifying countries (NODC codes) - <b>Appendix 1</b>
<i>datatr.txt</i>	code table identifying data treatment (NODC-0614) - <b>Second header 37</b>

<i>depthdet.txt</i>	how the upper and lower depths were determined for biological observations - <b>Biological header 24</b>
<i>digitint.txt</i>	code table identifying the BT digitization interval (NODC-0613) - <b>Second header 36</b>
<i>digitmet.txt</i>	code table identifying the BT digitization method (NODC-0612) - <b>Second header 35</b>
<i>equitype.txt</i>	code table identifying the different types of equilibrators used in measuring CO <sub>2</sub> concentrations in seawater - <b>Variable specific header 10</b>
<i>filter.txt</i>	code table identifying filter codes - <b>Variable specific header 11</b>
<i>flags.txt</i>	code table identifying flags assigned to the data
<i>flowcal.txt</i>	code table identifying flowmeter calibration methods - <b>Biological header 19</b>
<i>gear.txt</i>	biological sampling gear and flowmeter types - <b>Biological header 7 and 18</b>
<i>inst.txt</i>	code table identifying institutes - <b>Second header 4</b>
<i>methods.txt</i>	code table identifying methods for the station data - <b>Variable specific header 6</b>
<i>origflag.txt</i>	list of data quality flags submitted by the data originator - <b>Second header 96</b>
<i>owscodes.txt</i>	code table identifying the ocean weather stations - <b>Second header 9</b>
<i>pinames.txt</i>	code table for identifying the principal investigator
<i>preserv.txt</i>	code table identifying sample preservatives used - <b>Biological header 10</b>
<i>projects.txt</i>	code table identifying projects - <b>Second header 2</b>
<i>recorder.txt</i>	code table identifying the BT recorder type (WMO-4770) - <b>Second header 32</b>
<i>reftype.txt</i>	code table identifying the instrument for temperature reference (WMO-0615) - <b>Second header 40</b>
<i>seastate.txt</i>	code table identifying the sea state (WMO-3700 or NODC-0109) - <b>Second header 18</b>
<i>secondh.txt</i>	code table identifying the secondary header variables
<i>shipname.txt</i>	code table identifying the ships - <b>Second header 3</b>
<i>tax_bgc.txt</i>	code table identifying the Biological Grouping Code (BGC) - <b>Taxa header 30</b>
<i>tax_biom.txt</i>	code table identifying the total plankton biomass parameter codes <b>Taxa header 1</b>
<i>tax_1000.txt</i>	code table identifying taxa-specific parameter codes in the -1000 to -1999 range - <b>Taxa header 1</b>
<i>tax_5000.txt</i>	code table identifying taxa-specific parameter codes in the -5000 to -5999 range - <b>Taxa header 1</b>
<i>tax_6000.txt</i>	code table identifying taxa-specific parameter codes in the -6000 to -6999 range - <b>Taxa header 1</b>

<i>tax_7000.txt</i>	code table identifying taxa-specific parameter codes in the -7000 to -9999 range - <b>Taxa header 1</b>
<i>tax_itis.txt</i>	Taxonomic serial numbers and associated names based on the ITIS taxonomic code list; parameter codes in the 1 to 700000 range - <b>Taxa header 1</b>
<i>taxabund.txt</i>	taxon presence, absence, and relative abundance terms - <b>Taxa header 7</b>
<i>taxfeatr.txt</i>	code table identifying taxon shape or other features - <b>Taxa header 16</b>
<i>taxlife.txt</i>	table identifying taxon life stages - <b>Taxa header 5</b>
<i>taxmodif.txt</i>	code table identifying the taxon modifying terms - <b>Taxa header 17</b>
<i>taxrealm.txt</i>	code table identifying the taxon realm - <b>Taxa header 9</b>
<i>taxsex.txt</i>	code table identifying the taxon sex - <b>Taxa header 6</b>
<i>taxsize.txt</i>	code table identifying the taxon size delimiters - <b>Taxa header 18</b>
<i>taxtroph.txt</i>	code table identifying the taxon trophic mode - <b>Taxa header 8</b>
<i>taxvar.txt</i>	code table listing the biomass/taxa-specific variable codes
<i>towtype.txt</i>	code table identifying the gear towing method - <b>Biological header 4</b>
<i>tsprobe.txt</i>	code table identifying the temperature/salinity instrument type- <b>Second header 29</b>
<i>ukhoref.txt</i>	code table identifying source for digitized cards from the United Kingdom Hydrographic Office (vessels, institutes, sea area) - <b>Second header 92</b>
<i>units.txt</i>	code table identifying originator's variable units - <b>Variable Specific header 8</b>
<i>uvehicle.txt</i>	code of oceanographic measuring vehicle - <b>Second header 74</b>
<i>varheadr.txt</i>	list of variable specific second header names and their numerical codes
<i>variable.txt</i>	code table identifying variable names
<i>visibil.txt</i>	code table identifying horizontal visibility (WMO-4300) - <b>Second header 41</b>
<i>volumeth.txt</i>	code table identifying volume determination methods - <b>Biological header 25</b>
<i>watercol.txt</i>	code table identifying water color - <b>Second header 14</b>
<i>wavehgt.txt</i>	code table identifying wave height (WMO-1555 or NODC-0104) - <b>Second header 17</b>
<i>waveper.txt</i>	code table identifying wave period (WMO-3155 or NODC-0378) - <b>Second header 20</b>
<i>weather1.txt</i>	code table identifying weather (WMO-4501) - <b>Second header 26</b>
<i>weather2.txt</i>	code table identifying weather (WMO-04677) - <b>Second header 26</b>
<i>windfor.txt</i>	code table identifying wind force (Beaufort scale or NODC-0052) - <b>Second header 19</b>
<i>winwaved.txt</i>	code table identifying wind/wave direction (WMO-0877 or NODC-0110) - <b>Second header 16</b>

*wtmeth.txt*

code table identifying weight determination methods - **Biological header 11**

## 2. Data (DATA)

The directory **DATA** contains data for the instruments listed in Table 2. Within each **DATA** directory, is a list of all WMO's corresponding to that directory. These files can be used to import multiple files into ODV. The file naming convention for these files is:

- (1) Instrument designator (OSD, CTD, XBT, APB, MRB, PFL, UOR, DRB)
- (2) O or S to denote Observed or Standard depths
- (3) Basin designator (NATL, NPAC, SHIN)
- (4) extension of *lst*

Examples are: *OSDONATL.lst*, *CTDONPAC.lst*, *PFLOSHIN.lst*

## 3. Documentation (DOC)

The directory **DOC** contains a copy of this document and a file describing the data format (both PDF and HTML formats).

Files in the directory **DOC** of every CD-ROM:

*format.htm* - HTML table describing the format of the data  
*format.pdf* - PDF table describing the format of the data  
*readme.pdf* - PDF version of this document

## 4. Programs (PROGRAMS)

The directory **PROGRAMS** contains sample programs on how to read the data in FORTRAN and C (*wodFOR.f*, *wodC.c*). Another FORTRAN program (*wodASC.f*) has an option to output the sample data in either column or comma delimited format which can be read by MATLAB, GRAPHER, or other graphical packages.

Files in the directory **PROGRAMS** of every CD-ROM:

**programs.txt** - description of the files in this directory

The following subdirectories containing sample converters from the OCL format to other formats, are included in this directory:

<i>readASC.txt</i>	describes the use of <i>wodASC.f</i>
<i>wodASC.f</i>	outputs a user selected variable in either tabular (columns) or comma separated columns
<i>sampASC.txt</i>	sample output data from <i>wodASC.f</i>
<i>wodFOR.f</i>	sample FORTRAN program for reading the data
<i>wodC.c</i>	sample C program for reading the data
<i>wodC.x</i>	executable for C program for Microsoft Windows environment
<i>readFOR.txt</i>	readme file describing the <i>wodFOR</i> programs
<i>sampFOR.txt</i>	sample of output from <i>wodFOR.f</i>

The program wodFOR.f has been tested on computers under Unix (Compaq/DEC and Sun/Solaris) using f77 and f90 compilers. The wodFOR.f code was also tested on a PC, running Windows 2000 professional, and using MS FORTRAN Power station 4.0.

## 5. Ocean Data View (ODV) Directory

The **ODV** directory contains the Ocean Data View (ODV) software for viewing the WOD01 data. This software was developed by Dr. Reiner Schlitzer, Alfred Wegener Institute, Germany. The version on the CD-ROMs is for PC's only. ODV will decompress selected files and offers the users several options for viewing the WOD01 data such as station, scatter, and property-property plots. ODV reads both the WOD98 and WOD01 formats and includes the OCL quality control flags. The current version of ODV, v5.6, will not read the following:

- ▶ surface only data;
- ▶ originator's flags;
- ▶ plankton biomass and taxonomic data.

ODV has four quality flags which translates the OCL flags as follows:

- (1) "Good": OCL flag 0;
- (2) "Unknown": missing value;
- (3) "Questionable": OCL flags 2-5 for entire profile or individual observations;
- (4) "Bad" flags: OCL flags 6-9.

In addition, since ODV does not have "entire profile" flags, the OCL "entire profile" flags are assigned to each depth and variable. Please note that data are sorted in ODV once read so depth inversions in the data will not be apparent without examination of the flags assigned to depth.

For more information, please refer to <http://www.awi-bremerhaven.de/GEO/ODV>. If you use Ocean Data View for your scientific work, please reference it in your publications as follows:

Schlitzer, R., Ocean Data View,  
<http://www.awi-bremerhaven.de/GEO/ODV>, 2001.

Subdirectories in the directory **ODV** of every CD-ROM:

The ODV directory contains readme.txt file with further instructions on content and installation instructions.

<i>odv5.6_base_w32.zip</i>	main ODV installation file set (compressed via zip)
<i>odvOP_coastGlobHR_w32.zip</i>	high-resolution global coastal topography
<i>odvOP_coastRegional_w32.zip</i>	high resolution regional coastal topography
<i>odvOP_ETOPO_w32.zip</i>	ETOPO (.25x.25) for sections
<i>PKUNZIP.EXE</i>	PC executable for unzipping the ODV5.6.ZIP

*readmeOdvHistory.txt*  
*readmeOptPackWIN32.txt*  
*readmeWIN32.txt*

file.  
history file of ODV development and versions  
installation instructions for topography files  
installation instructions for the ODV 5.6  
program.

## **6. Utilities directory (UTILS)**

The **UTILS** directory contains the utilities necessary to convert from DOS to UNIX and to decompress the data. It contains a **GZIP** directory with the files needed for decompressing the WOD01 data.

### **GZIP Directory**

Within the **UTILS** directory of each CD-ROM there is a **GZIP** directory which contains two files used for decompressing the data on the WOD01. The first (*gzip124.exe*) is a self-extracting DOS executable and the second (*gzip124.tar*) is a tar'd file containing source code for UNIX users.

#### *a. Installing gzip For the First Time*

DOS Users:

The file *gzip124.exe* is a self-extracting DOS executable. Copy *gzip124.exe* to your hard disk; preferably into a directory listed in your path. Run *gzip124.exe* and use the file *gzip.exe* to uncompress data from the WOD01 CD-ROMs as described below.

UNIX Users:

Copy *gzip124.tar* to your UNIX system. Run the following commands:

```
tar xvf gzip124.tar
```

These commands will create a directory named *gzip124* which include the *gzip* source code and documentation on copyrights, compression methods, and how to compile and install the *gzip* code. The *readme* file contains instruction on how to execute *gzip*.

#### *b. Decompressing Data From WOD01*

To decompress the WOD01 files, it is easier to copy the files to the hard disk. Use *gzip* to decompress selected files or a directory and all subdirectories with one command.

*gzip* has a limited help menu accessible with the *-h* option (*i.e.*, *gzip -h*)

To decompress a single file:

```
gzip -nd <filename>
```

To decompress the contents of a directory and all subdirectories:

```
gzip -dr <directoryname>
```

If an older version of gzip is used, the -n option is required in order to preserve the correct file names.

### **Special Note for UNIX Users**

The DOS CR-LF (Carriage Return-Line Feed) indicates the end of a record and may cause problems when working in a UNIX environment. Many systems have a “*dos2unix*” program which removes these characters from an ASCII file. Files can also be converted by transferring from DOS/WINDOWS using FTP (File Transfer Protocol). The UNIX “tr” or “perl” utilities will also remove the CR-LF.

a. *To use the UNIX translate utility, “tr”:*

```
tr -d '\r' < original_filename > new_filename
```

(Note that the “<” and “>” must be typed for this command to work).

(b) To use the UNIX perl utility:

```
perl -pi -e 's/\r\n/\n/g' filename
```

## **B. SYSTEM REQUIREMENTS**

The minimum hardware requirements for accessing data and information from the CD-ROMs are:

Microsoft MS-DOS Extensions for CD-ROM, Version 2.0 or higher for DOS machines;  
CD-ROM reader capable of accessing a disc formatted with the ISO 9660 standard.

Using the Ocean Data View 5.6 software, has additional requirements, which are addressed at the ODV web site: <http://www.awi-bremerhaven.de/GEO/ODV> .



## **V. QUALITY CONTROL PROCEDURES**

Data received by the National Oceanographic Data Center's Ocean Climate Laboratory (NODC/OCL), through the Global Ocean Data Archeology and Rescue (GODAR) project, the Global Ocean Database project, the Global Temperature and Salinity Pilot Project (GTSP), the US-NODC data archives, or other sources, are put through a set of quality control procedures to ensure that 1) the data are converted to the OCL format correctly, 2) the data format provided with the data is correct and the data itself has not been corrupted in transmission, 3) only one copy of data at each station is retained in the OCL format, and 4) the data, as initially collected and processed, are of good quality.

The OCL continues to quality control the data and requests input from the users as to possible problems identified when using the data. As these problems are corrected, the updated stations will be placed online and the changes documented.

Some data are included in WOD01 even though all the quality control steps were not applied. These are pCO<sub>2</sub>, TCO<sub>2</sub> (we are in the process of building up the database and have insufficient data to date), oxygen from CTD's (data not used in the objective analysis), and all UOR variables (data not used in the analysis). In addition, nitrite was excluded from the database since the data were not examined to ensure their quality. Air pressure, julian year-day, latitude, and longitude, included as variables for the sole purpose of identifying the surface only, APB and UOR data, were not quality controlled.

Quality control flags provided by data submitters (originator's flags) were recently included. However, originator's flags to data which had previously been submitted have not been added except for GTSP and WOCE flags. The only data sets with originator's flags are those associated with the GTSP, WOCE, OMEX and GEOSECS projects, as well as some smaller data sets (Appendix 4 lists the originator's flags and their associated project or accession number). The originator's flags were included with the observed level data only.

### **A. QUALITY CONTROL OF OBSERVED LEVEL DATA**

#### ***1. Format conversion***

When data are received at the OCL, the first step is to convert the data into the OCL format, using the format description provided by the data submitter. Some of the checks during format conversion may include calculation of the number of significant figures, identification of time used (GMT or local), and consistency in the originator's format. Additionally, where originator's units differ from the standard OCL units, data are converted to the standard OCL units (Tables 4-6) for each variable. After conversion to OCL format, data are spot checked and compared with the original data for accuracy in the data conversion.

## **2. Check position/date/time**

Data are checked for incorrect/missing latitudes, longitudes, time, and dates. Questionable values are compared with the original data to make sure problems are not due to a conversion error. If the incorrect datum is found in the original data, the data submitter is notified of the error and a correction is requested when possible.

## **3. Assignment of cruise numbers**

Once station positions and dates are checked, unique cruise numbers are assigned. In some cases, data cannot be clearly identified as having been collected on a single cruise (e.g., data collected by a single ship over a multi-year period). In these cases, cruises are defined by OCL (when not provided by the data originator). A general definition is that a cruise is comprised of stations for which the time difference between any two stations is <20 days. This definition is a guideline, as some data sets necessitate a smaller break period, and others a longer period. Some data, which have nonspecific platforms (e.g., airplane or ice camp), are not amenable to this treatment. If no platform or primary investigator information is provided, a cruise number of “zero” is assigned to denote no cruise information.

## **4. Speed check**

Following assignment of cruise numbers, the entire cruise is mapped out and the speed between stations is calculated. If the speed between adjoining stations is unrealistic, the date/time may be in error, the position may be wrong, or the station may not belong to this cruise. In many cases stations are attributed to the wrong ship. These problems, when encountered, were noted and the submitter contacted to decide on a course of action. Due to lack of time and resources, not every single cruise was checked and therefore some groupings of stations do not represent a cruise as defined here.

## **5. Duplicate checks**

Upon completion of these preliminary quality control checks, the OCL performs extensive self-duplicate checks (internal to the new data set), and checks for duplicates against the existing OCL database. Duplicates are a continuous problem with these databases. Whereas exact duplicate profiles are easy to identify and remove, “near” duplicates are more difficult. These can result from receiving the same data from different sources, where key variables such as latitude, longitude, or date/time were treated differently. As the procedures for identifying duplicate stations improve, more of these “near” duplicate stations continue to be identified.

Duplicate checks involve identifying stations with:

- same position/date/time
- position/date/time within some small offset

- same originator's station numbers within a cruise
- same profile data
- same taxonomic data

Below are the general types of duplicates which occur:

*Identical profiles* - two or more profiles which contain the same variables with identical values at each depth. Frequently, positions or times may be slightly different (depending on the accuracy to which latitude/longitude/time were provided in the original data submissions). Sometimes large differences in time, up to a one day offset, may also result when time is provided in GMT in one data set and not the other.

*Identical stations* - two or more stations from the same position, date and time, but with different variables or different values. When values are different, the stations may contain identical profiles that were handled differently by an intermediate data center or investigator (e.g., using different storage criteria with XBT's or CTD's, or interpolating the observed data to standard levels). When variables are different between two stations which are otherwise identical, this may be due to cases in which data were submitted separately. Therefore data from the stations are combined (see *Special Case: merging profiles* below).

*Overlapping Cruises* - two or more cruises with the same platform that overlap in their starting and ending dates. In most cases, the overlapping cruises are duplicated and have already been detected by the previous two checks. In others cases, the difference in positions is so great that the standard position check does not detect the duplicated stations (e.g., a missing "+/-" for latitude would give two stations, collected from the same platform with the same times and data values, in both the northern and southern hemispheres).

When duplicates are found, the "better" station is retained within the database, and the other station is removed. In general, the "better" station has more depth levels, additional variables, or data are stored at a higher precision. Preference is given to the original observed level data over interpolated data. Finally, OCL tries to give data obtained directly from the originator preference over data that has passed through many users, which has possibly lost precision or other information along the way.

### ***Special Case: merging profiles***

In some cases, different variables from the same oceanographic station have been submitted to the OCL at different times or from different sources. The most common example of this is when biological data (e.g., pigments, plankton measurements) are submitted for existing US-NODC ocean station data. Through the efforts of the GODAR project and the OCL Global Ocean Database project, many stations containing chlorophyll, nutrient, and plankton data have been acquired from the source institutes and/or digitized, and combined with existing data.

Information such as date, position, time, platform, and originator's station or cruise identifier is used to match up incoming stations with existing stations. Frequently, the match-up is obvious (e.g., the same ship is in the exact position on the same day, and the depth levels of the existing data correspond exactly to the incoming data). When the match-up is less obvious, effort is made to determine whether this match is appropriate or not by reviewing the documentation or comparing cruise tracks.

When an appropriate match is made, the stations are merged into one station which contains the combination of the previous two stations. The resulting station will have all of the data and metadata of the previous two stations. When a match is uncertain, but platform, position and dates are very close, the stations are left separate and assigned the same OCL cruise number so the data will at least remain grouped by cruise.

## **6. Depth inversion and depth duplication checks**

Depth inversions and duplication of depths were found to occur in some profiles. A depth inversion occurs when an observation has a shallower depth than the observation directly preceding it. A depth duplication is a reading which has the same depth as the reading before it. In either case the second observation was always flagged, rather than trying to evaluate the data. Table 16 lists the flags assigned to the data. If, after an inversion or duplication, the next two depth observations were still shallower than the first reading, this observation and all subsequent observations were flagged. This usually occurred when two or more profiles have been entered together into a digital file with no separating header information. Stations submitted with depths in reverse order (deeper depth first) were sorted so shallowest depth was first.

Depth error flags are assigned if:

- (A) the second of two successive depths is shallower than the first (a depth inversion), the second depth will be marked with a flag value = 1.
- (B) three successive depths are shallower than the first depth, every depth reading in the profile following the first will be marked with a flag value = 1.
- (C) two successive depth readings are equal, the second reading will be marked with a flag value = 1.

All correct depths are marked with a flag value = 0.

## **7. Range checks on observed level data**

Range checks are used to screen the data for extreme values. Broad ranges have been established as a function of depth and basin (basins are shown in Figure 8) for each variable. The range for a variable, in each region, is set large enough to encompass variations for all seasons and years. Ranges were determined using frequency distributions, statistical analysis, literature values and atlases (e.g., GEOSECS (Bainbridge, 1980; Craig *et al.*, 1981, Spencer *et al.*, 1982), Southern Ocean Atlas (Gordon *et al.*, 1982, Wyrski, 1971). Observed level data were compared with these ranges, and outliers were flagged with a range outlier flag. Table 15 lists the variables contained in the WOD01, the

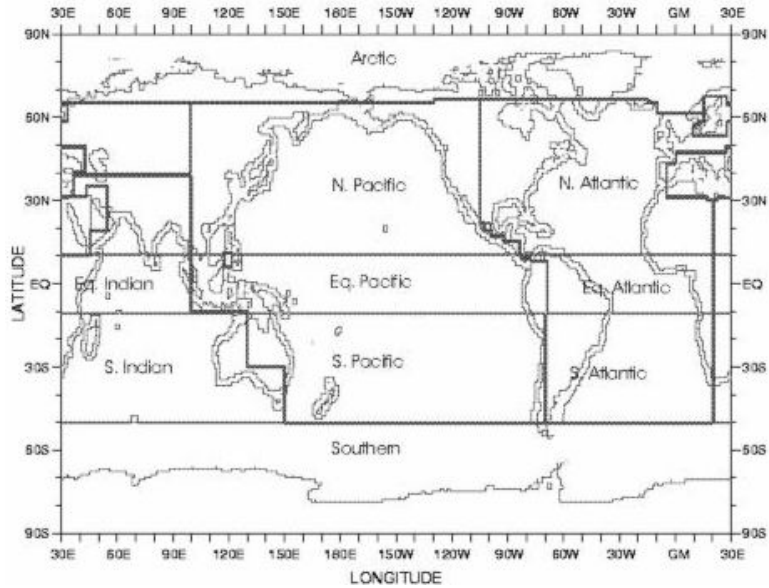


Figure 8. Definition of Ocean Basins

standard NODC/OCL units, and the Appendices containing the ranges set for these variables. The ranges in these appendices do not represent the minimum and maximum values in the basins, but rather the range of values beyond which the data are believed to be erroneous.

**Table 15. Quality Controlled Variables in WOD01**

CODE	VARIABLE	UNIT/SCALE	Range Appendix
1	Temperature ( <i>in situ</i> )	°C	17A
2	Salinity	PSS and ‰	17B
3	Oxygen	ml l <sup>-1</sup>	17C
4	Phosphate	μM	17D
6	Silicate	μM	17E
8	Nitrate	μM	17G
9	pH	unitless	17H
11	Chlorophyll	μg l <sup>-1</sup>	17I
17	Alkalinity	meq l <sup>-1</sup>	17J
20	pCO <sub>2</sub>	μatm	none
21	tCO <sub>2</sub>	mmol l <sup>-1</sup>	none

23	Nitrate+Nitrite	µM	17G
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**Table 16. Definition of OCL Quality Flags**

<b>(1) FLAGS FOR ENTIRE STATION (AS A FUNCTION OF VARIABLE)</b>	
0	accepted station
1	failed annual standard deviation check
2	two or more density inversions ( Levitus, 1982 criteria )
3	flagged cruise
4	failed seasonal standard deviation check
5	failed monthly standard deviation check
6	flag 1 and flag 4
7	bullseye from standard level data or failed annual and monthly standard deviation check
8	failed seasonal and monthly standard deviation check
9	failed annual, seasonal and monthly standard deviation check
<b>(2) FLAGS ON INDIVIDUAL OBSERVATIONS</b>	
<b>(a) Depth Flags</b>	
0	accepted value
1	duplicates or inversions in recorded depth ( same or less than previous depth )
2	density inversion
<b>(b) Observed Level Flags</b>	
0	accepted value
1	range outlier ( outside of broad range check )
2	failed inversion check
3	failed gradient check
4	observed level "bullseye" flag and zero gradient check
5	combined gradient and inversion checks
6	failed range and inversion checks
7	failed range and gradient checks
8	failed range and questionable data checks
9	failed range and combined gradient and inversion checks
<b>(c) Standard Level Flags</b>	

0	accepted value
1	bullseye marker
2	density inversion
3	failed annual standard deviation check
4	failed seasonal standard deviation check
5	failed monthly standard deviation check
6	failed annual and seasonal standard deviation check
7	failed annual and monthly standard deviation check
8	failed seasonal and monthly standard deviation check
9	failed annual, seasonal and monthly standard deviation check
<b>(d) Biological data flags</b> (applied only to Comparable Biological Value - CBV Taxa code 27)	
0	accepted value
1	range outlier ( outside of broad range check )
2	questionable value ( “bullseye flag” )
3	group was not reviewed
4	failed annual standard deviation check

### 8. Excessive gradient checks

For each variable in Table 15, a check was made for “excessive decreases and increases in a value over a depth”, or excessive gradients. A gradient was defined as

$$\mathbf{gradient} = \frac{v_2 - v_1}{z_2 - z_1} \quad (1)$$

where

- $v_1$  = the value of the variable at the current depth level
- $v_2$  = the value of the variable at the next depth level
- $z_1$  = the depth (meters) of the current depth level
- $z_2$  = the depth (meters) of the next depth level

Two types of gradients were checked, and marked as follows:

- Excessive Gradients - a negative gradient, *i.e.* an excessive decrease in the value over depth. The criteria used to define “excessive” for each variable are listed in Table17.

Any value which exceeded this "maximum gradient value" (MGV) was marked with a gradient flag.

- Excessive Inversions - a positive gradient, *ie.* an excessive increase in value over depth. These criteria are presented in Table 17. Data which exceeded the "maximum inversion value" (MIV), were marked with an inversion flag.

**Table 17. Maximum gradient and inversion factors used for WOD01**

VARIABLE	MIV (<400m)	MGV (<400m)	MIV (>400m)	MGV (>400m)	ZSI
Temperature	0.300	0.700	0.300	0.700	5.00
Salinity	9.000 <sup>1</sup>	9.000*	0.050	0.050	5.00
Oxygen	checks not applicable				yes <sup>2</sup>
Phosphate	1.000	1.000	0.500	0.500	2.50
Silicate	checks not applicable				yes
Nitrate	1.000	1.000	0.500	0.500	2.50
pH	0.400	0.400	0.200	0.200	2.00
Chlorophyll	checks not applicable				yes
Alkalinity	0.100	0.100	0.050	0.050	2.00

\* For all variables, the MGV/MIV ranges (<400m) were set high enough to exclude only values which are grossly incorrect. For salinity, these ranges are so large as to be nearly irrelevant for these checks.

MGV/MIV's were determined from literature and/or by objectively reviewing the trends of the variable within the data. To better accommodate the differences in gradient ranges between surface and deeper water (*e.g.*, due to physical or biological influence), a different set of MIV/MGV's were used for depths above and below 400 meters. When dealing with high resolution instruments (*e.g.*, HCTD, XBT), a minimum depth difference of 3.0 meters was used when calculating the gradients (in equation 1).

In addition, data were checked to distinguish *zero as a value* versus *zero as a missing-value-indicator*, particularly in the historical nutrient data. The zero sensitivity check will flag a zero value if a gradient decreases to zero at a rate greater than the MGV \* ZSI (zero sensitivity indicator). For example, if ZSI is 2.00, the gradient must be twice as large as the MGV for that depth range. These values were assigned a flag = 4, equivalent to an observed level flag.

### **9. Observed level density checks**

Density checks were run on the observed level data to locate density inversions. This check was not used to flag or eliminate data from subsequent quality control, but was used



to get an estimate of data quality prior to interpolation to standard levels. The check is the same as described in Section 11, *Standard level density check*, except the values are divided by the depth difference between adjacent levels unless the difference is less than 3 meters, in which case a difference of 3 meters is used.

### 10. Vertical interpolation method

Prior to the next step in the quality control procedure, the data are interpolated from observed levels to standard depth levels (listed in Table 18). Any data flagged as range outliers, excessive gradients, inversions, or depth errors were not interpolated to standard levels. For XBT data types, a drop rate correction (Hanawa *et al.*, 1994) was applied to any T4, T6, and T7 instrument measurements prior to standard level interpolation. When instrument model information was not provided with XBT data, profiles with all measurements shallower than 840 meters were assumed to need this correction (profiles with measurements deeper than this were assumed to be taken with a T5 instrument, which does not have a systematic error in its drop rate equation).

**Table 18. Standard levels and depths (meters)**

Depth	Level	Depth	Level	Depth	Level	Depth	Level
0	1	250	11	1200	21	4500	31
10	2	300	12	1300	22	5000	32
20	3	400	13	1400	23	5500	33
30	4	500	14	1500	24	6000	34
50	5	600	15	1750	25	6500	35
75	6	700	16	2000	26	7000	36
100	7	800	17	2500	27	7500	37
125	8	900	18	3000	28	8000	38
150	9	1000	19	3500	29	8500	39
200	10	1100	20	4000	30	9000	40

The interpolation scheme used is a modification from that described by Reiniger and Ross (1968) and noted by UNESCO (1991) as being in common usage. Their scheme uses four observed values surrounding the standard level in question - the two closest shallower values and the two closest deeper values. The closest shallower and deep values ("inside" values) and the two farthest shallow and deep values ("outside" values) must be within the depth difference criteria shown in Table 19. The first set of depths in this table is the maximum distance between the depths of the "inside values". The second set of depths applies to the maximum distance between the depths of the "outside values". This interpolation scheme has the advantage over three point Lagrangian interpolation of being

less susceptible to extremes when a large gradient is encountered since two separate three-point Lagrangian interpolations are averaged and then fit to a reference curve.

If all the above criteria are met, the variable value at the standard depth level is set by the Reiniger and Ross (1968) interpolation method. If there are not enough surrounding values within acceptable distances, three point Lagrangian interpolation is performed on the value above and two values below the level in question, or on the two values above and one value below.

Modifications to the Reiniger and Ross (1968) method are the following:

- a. If the Reiniger and Ross interpolated value does not fall between the observed values directly above and below it, linear interpolation is substituted;
- b. If any value is recorded within 5 meters of the surface, this value is directly used as the surface value;

Direct substitution (observed level depth equals the standard level depth) and the Reiniger and Ross interpolation account for most of the standard level values.

**Table 19. Acceptable depth differences ( meters) for "inside" and "outside" values used in the Reiniger-Ross scheme for interpolating observed level data to standard levels**

Standard Levels	Standard Depths	Acceptable depth differences for "inside values"	Acceptable depth differences for "outside values"
1	0	5	200
2	10	50	200
3	20	50	200
4	30	50	200
5	50	50	200
6	75	50	200
7	100	50	200
8	125	50	200
9	150	50	200
10	200	50	200
11	250	100	200
12	300	100	200
13	400	100	200
14	500	100	400
15	600	100	400
16	700	100	400
17	800	100	400

Standard Levels	Standard Depths	Acceptable depth differences for “inside values”	Acceptable depth differences for “outside values”
18	900	200	400
19	1000	200	400
20	1100	200	400
21	1200	200	400
22	1300	200	1000
23	1400	200	1000
24	1500	200	1000
25	1750	200	1000
26	2000	1000	1000
27	2500	1000	1000
28	3000	1000	1000
29	3500	1000	1000
30	4000	1000	1000
31	4500	1000	1000
32	5000	1000	1000
33+	5500+	1000	1000

## B. QUALITY CONTROL OF STANDARD LEVEL DATA

### 11. Standard level density check

A standard level density check was used to eliminate spurious inversions due to interpolation (Levitus *et al.* 1994). Each profile was checked for static stability using Hesselberg and Sverdrup’s (1914) definition. The computation is a local one in the sense that adiabatic displacements between adjacent temperature-salinity measurements in the vertical are considered rather than displacements to the sea surface. The procedure for stability ( $E$ ) computation follows that used by Lynn and Reid (1968):

$$E = \lim_{\rho_0 \rightarrow 0} \frac{1}{\rho_0} \frac{\delta \rho}{\delta z} \quad (2)$$

where  $\rho_0 = 1.02 \text{ g/cm}^3$  and  $z$  is depth in meters. As noted by Lynn and Reid the term is “the individual gradient defined by vertical displacement of a water parcel”. For discrete samples, the density difference ( $\delta\rho$ ) between two samples is taken after the deeper sample is adiabatically displaced to the standard level of the shallower depth.  $\delta\rho$  is then simply the displaced sample’s density minus the shallower sample’s density. Densities were calculated using the IGOSS standard density equation (1993) on interpolated temperature and salinity data. An inversion was defined as anywhere the  $\delta\rho$  was less than zero. For observations with a deeper sample depth of 30 meters or

less, an inversion of  $3 \times 10^{-5}$  g/cm<sup>3</sup> was considered an indication of problem with the data. The temperature and salinity at both of these depths were flagged. For observations with a deeper sample depth between 50 and 400 meters an inversion of  $2 \times 10^{-5}$  g/cm<sup>3</sup> was considered excessive. For depths greater than 400 meters any inversion greater than  $10^{-6}$  g/cm<sup>3</sup> was considered excessive. If two or more such density inversion were found in one profile, all temperature and salinity values were flagged as unusable for this profile.

## **12. Statistical analysis of data at standard depth levels**

Observed level data were interpolated to standard levels, averaged by five-degree-squares, and simple statistics (mean, standard deviation, and number of observations) were computed for each depth level. Each five degree square box was designated coastal, near coastal, or open ocean, depending on the number of one-degree by one-degree latitude-longitude grid boxes in the five-degree box which were land areas.

Standard level data were flagged as follows:

- a. Coastal: The standard level data value exceeds 5 standard deviations computed within the 5x5 grid in the upper 50 m;
- b. Near-coastal: The standard level data value exceeds 4 standard deviations computed for 5x5 the grid in the upper 50 m;
- c. Open ocean: The standard level data value exceeds three standard deviations computed for the 5x5 grid, except when a profile was at or below the average depth level for the one-degree box in which it was contained, or any of the adjacent one degree boxes, then 4 standard deviations were used;
- d. If a station contains two or more standard deviation failures, the whole station is flagged.

The reason for varying the standard deviation criterion is the expected high variability in shallow coastal areas due to river runoff and other factors. Also, high variability within a five-degree box near the ocean bottom can occur if the five-degree square box contains portions of two basins, e.g., the mid-Atlantic ridge separating east and west Atlantic waters. This check was only performed if there were five or more observations at this depth in the grid box. The standard deviation check was applied twice to the data and then new five-degree square statistics were computed to produce a new "clean" data set.

## **13. Objective analysis**

Following the statistical check, standard level data were averaged by one-degree squares for input to the objective analysis. The objective analysis is described by Boyer *et al.* (1998). The initial objective analyses for each variable at standard depth

levels usually contained some large-scale gradients over a small area, or “bullseyes”. These unrealistic features generally occurred because of the difficulty in identifying non-representative values in data sparse areas. “Bullseyes” and other questionable features are investigated and are flagged by identifying the profile or individual data points which created each unrealistic feature. In some cases, entire cruises were flagged. These flags were applied to both the observed and standard level data. “Bullseyes” were investigated using property-property plots (e.g. temperature against dissolved oxygen), or variable as a function of depth and season within regional basins.

## VI. LIST OF ACRONYMS AND WEB LINKS USED IN THE DOCUMENTATION

APB	Autonomous Pinniped Bathythermograph
APEX	Autonomous Profiling Explorer <a href="http://www.webbresearch.com/apex.html">http://www.webbresearch.com/apex.html</a>
Argos DCS	<a href="http://noaasis.noaa.gov/ARGOS/">http://noaasis.noaa.gov/ARGOS/</a>
Argo floats	<a href="http://www.argo.ucsd.edu/whatisargo.html">http://www.argo.ucsd.edu/whatisargo.html</a>
BT	Bathythermograph
BODC	British Oceanographic Data Center <a href="http://www.bodc.ac.uk">http://www.bodc.ac.uk</a>
CalCOFI	California Cooperative Oceanic Fisheries Investigation <a href="http://www-Mlrg.ucsd.edu/calcofi.html">http://www-Mlrg.ucsd.edu/calcofi.html</a>
CTD	Conductivity, Temperature, Depth probe
DBT	Digital Bathythermograph
DRB	OCL designation for drifting buoy data
ESDIM	Environmental Science Data and Information Management
FSU	Former Soviet Union
GODAR	Global Oceanographic Data Archaeology and Rescue project <a href="http://www.nodc.noaa.gov/General/NODC-dataexch/">http://www.nodc.noaa.gov/General/NODC-dataexch/</a>
GTSP	Global Temperature-Salinity Profile Project <a href="http://www.nodc.noaa.gov/GTSP/gtsp-home.html">http://www.nodc.noaa.gov/GTSP/gtsp-home.html</a>
ICES	International Council for the Exploration of the Seas <a href="http://www.ices.dk">http://www.ices.dk</a>
IGOSS	Integrated Global Ocean Services System
IOC	Intergovernmental Oceanographic Commission <a href="http://ioc.unesco.org/iocweb/">http://ioc.unesco.org/iocweb/</a>
IODE	International Ocean Data Exchange <a href="http://ioc.unesco.org/iode/">http://ioc.unesco.org/iode/</a>
ITIS	Integrated Taxonomic Information System <a href="http://www.itis.usda.gov">http://www.itis.usda.gov</a>
JGOFS	Joint Global Ocean Flux Studies <a href="http://ads.smr.uib.no/jgofs/jgofs.htm">http://ads.smr.uib.no/jgofs/jgofs.htm</a>
MRB	OCL designation for moored buoy data
MBT	Mechanical Bathythermograph
meq	Milli-equivalents
NCAR	National Center for Atmospheric Research <a href="http://www.ncar.ucar.edu">http://www.ncar.ucar.edu</a>
NMFS	National Marine Fisheries Service <a href="http://www.nmfs.noaa.gov">http://www.nmfs.noaa.gov</a>
NOAA	National Oceanic and Atmospheric Administration <a href="http://www.noaa.gov">http://www.noaa.gov</a>
NODC	National Oceanographic Data Center <a href="http://www.nodc.noaa.gov">http://www.nodc.noaa.gov</a>
OCL	Ocean Climate Laboratory <a href="http://www.nodc.noaa.gov/OC5">http://www.nodc.noaa.gov/OC5</a>

ODV	Ocean Data View <a href="http://www.awi-bremerhaven.de/GEO/ODV">http://www.awi-bremerhaven.de/GEO/ODV</a>
OMEX	Ocean Margin Exchange Project
OSD	Ocean Station Data
P-ALACE	Profiling Autonomous Lagrangian Circulation Explorer <a href="http://www.webbresearch.com/alace.htm">http://www.webbresearch.com/alace.htm</a>
PFL	OCL designation for profiling float data
PIRATA	<a href="http://www.pmel.noaa.gov/pirata">http://www.pmel.noaa.gov/pirata</a>
PMEL	Pacific Marine Environmental Laboratory <a href="http://www.pmel.noaa.gov">http://www.pmel.noaa.gov</a>
PRIME	Plankton Reactivity in the Marine Environment
PSS	Practical Salinity Scale
TSN	Taxonomic Serial Number
TOGA	Tropical Ocean-Global Atmosphere
TRITON	<a href="http://www.jamstec.go.jp/jamstec/OCEAN/TRITON">http://www.jamstec.go.jp/jamstec/OCEAN/TRITON</a>
SBT	Selected Bathythermograph
SOLO	Sounding Oceanographic Lagrangian Observer
STD	Salinity/Temperature with Depth
TAO	Tropical Atmosphere-Ocean <a href="http://www.pmel.noaa.gov/tao">http://www.pmel.noaa.gov/tao</a>
uM	Micromolar
UCAR	University Corporation for Atmospheric Research <a href="http://www.ucar.edu/ucar/">http://www.ucar.edu/ucar/</a>
UKHO	United Kingdom Hydrographic Office
UOR	Undulating Oceanographic Recorder
WOA94	World Ocean Atlas, 1994 <a href="http://www.nodc.noaa.gov/OC5/pr_woa4.html">http://www.nodc.noaa.gov/OC5/pr_woa4.html</a>
WOCE	World Ocean Circulation Experiment <a href="http://www.soc.soton.ac.uk/OTHERS/woceipo/ipo.html">http://www.soc.soton.ac.uk/OTHERS/woceipo/ipo.html</a>
WOD98	World Ocean Database 1998 <a href="http://www.nodc.noaa.gov/OC5/pr_wodv2.html">http://www.nodc.noaa.gov/OC5/pr_wodv2.html</a>
WOD01	World Ocean Database 2001
WDC	World Data Center for Oceanography, Silver Spring <a href="http://www.nodc.noaa.gov/General/NODC-dataexch/NODC-wdca.html">http://www.nodc.noaa.gov/General/NODC-dataexch/NODC-wdca.html</a>
WMO	World Meteorological Organization <a href="http://www.wmo.ch/indexflash.html">http://www.wmo.ch/indexflash.html</a>
XBT	Expendable Bathythermograph

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## APPENDIX 1. NODC COUNTRY CODES

CODE	COUNTRY	CODE	COUNTRY
06	GERMANY, FEDERAL REPUBLIC OF	62	PAKISTAN
07	GERMANY, DEMOCRATIC REPUBLIC OF	64	NETHERLANDS
08	ARGENTINA	65	PERU
09	AUSTRALIA	66	PHILIPPINES
10	AUSTRIA	67	POLAND
11	BELGIUM	68	PORTUGAL
12	BURMA	70	DOMINICAN REPUBLIC
13	BOLIVIA	72	ALBANIA
14	BRAZIL	73	ROMANIA
15	BULGARIA	74	UNITED KINGDOM
17	CAMEROON	75	EL SALVADOR
18	CANADA	76	CHINA, THE PEOPLES REPUBLIC OF
19	SRI LANKA	77	SWEDEN
20	CHILE	78	SWITZERLAND
21	TAIWAN	79	SURINAM
22	COLOMBIA	80	SYRIA
24	KOREA, REPUBLIC OF	86	THAILAND
26	DENMARK	87	TOGO
27	ARAB REPUBLIC OF EGYPT	88	TUNISIA
28	ECUADOR	89	TURKEY
29	SPAIN	90	UNION OF SOVIET SOCIALIST REPUBLICS
31	UNITED STATES	91	SOUTH AFRICA
32	UNITED STATES	92	URUGUAY
33	UNITED STATES	93	VENEZUELA
34	FINLAND	94	VIET-NAM
35	FRANCE	95	YUGOSLAVIA
36	GREECE	99	UNKNOWN
37	GUATEMALA	AG	ANTIGUA
38	HAITI	AL	ALGERIA
41	INDIA	AN	ANGOLA
42	INDONESIA	BA	BARBADOS
43	IRAQ	BH	BAHAMAS
44	IRAN	BN	BONAIRE
45	IRELAND	CA	CURACAO
46	ICELAND	CI	CAYMAN ISLANDS
47	ISRAEL	CR	COSTA RICA
48	ITALY	CU	CUBA
49	JAPAN	CV	CAPE VERDE
50	JORDAN	CY	CYPRUS
51	JAPAN	ES	ESTONIA
52	LEBANON	ET	ETHIOPIA
53	LIBYA	FJ	FIJI ISLANDS
54	LIBERIA	GA	GABON
55	MALAGASY REPUBLIC	GH	GHANA
56	MOROCCO	GM	GAMBIA
57	MEXICO	GN	GUINEA-BISSAU
58	NORWAY	GR	GRENADA
59	NEW CALEDONIA	GU	GUINEA
60	JAPAN	GY	GUYANA
61	NEW ZEALAND	HO	HONDURAS

HK HONG KONG  
IC IVORY COAST  
IN INTERNATIONAL  
JA JAMAICA  
KE KENYA  
KU KUWAIT  
LA LATVIA  
LT LITHUANIA  
MA MAURITIUS  
ML MALTA  
MO MONACO  
MS MALAYSIA  
MU MAURITANIA  
MZ MOZAMBIQUE  
NC NICARAGUA  
NI NIGERIA  
OM OMAN  
PA PANAMA  
QA QATAR  
RC CONGO  
RU RUSSIA  
SA SAUDI ARABIA

SC SEYCHELLES  
SE SENEGAL  
SI SINGAPORE  
SL SIERRA LEONE  
SM SOMALIA  
SO SOLOMON ISLANDS  
SU SUDAN  
SV SAINT VINCENT  
TN TONGA  
TT TRINIDAD/TOBAGO  
UA U. ARAB EMIRATES  
UR UKRAINE  
WS WESTERN SAMOA  
YM YEMEN  
ZA TANZANIA  
ZZ MISCELLANEOUS ORGANIZATIONAL  
U N I T S

**APPENDIX 2. NODC/OCL SECOND HEADER CODE TABLES.** The first column in the tables contains the code used by the OCL to identify the variable. Sometimes, the second column contains the code used by NODC. The final column contains the code description.

**2A. Ocean Weather Station - Second Header Code 9\***

<b>CODE</b>	<b>LETTER</b>	<b>1942-1952</b>	<b>1 Apr 1952- 29 Feb 1956</b>	<b>1 March 1956 - present</b>
1	A	Able	Alpha	Alpha
2	B	Baker	Bravo	Bravo
3	C	Charlie	Coca	Charlie
4	D	Dog	Delta	Delta
5	E	Easy	Echo	Echo
6	F	Fox	Foxtrot	Foxtrot
7	G	George	Golf	Golf
8	H	How	Hotel	Hotel
9	I	Item	India	India
10	J	Jig	Juliet	Juliet
11	K	King	Kilo	Kilo
12	L	Love	Lima	Lima
13	M	Mike	Metro	Mike
14	N	Nan	Nectar	November
15	O	Oboe	Oscar	Oscar
16	P	Peter	Papa	Papa
17	Q	Queen	Quebec	Quebec
18	R	Roger	Romeo	Romeo
19	S	Sugar	Sierra	Sierra
20	T	Taro	Tango	Tango
21	U	Uncle	Union	Uniform
22	V	Victor	Victor	Victor
23	W	William	Whiskey	Whiskey
24	X	Xray	Extra	Xray
25	Y	Yoke	Yankee	Yankee
26	Z	Zebra	Zulu	Zulu

\* from Lumby and Saelen, 1957 (Report on Oceanographical work from Ocean Weather Ships, Association D'Océanographie Physique, Publication Scientifique No. 16).

**2B. Cast Direction - Second Header Code 11**

OCL CODE	NODC CODE	DESCRIPTION
1	(U)	UPCAST
2	(A)	AVERAGE OF UP AND DOWN CASTS

**2C. Water Color - Second Header Code 14**

CODE	DESCRIPTION	CODE	DESCRIPTION
1	PERCENT YELLOW 0 FOREL-ULE SCALE I	15	PERCENT BROWN 14 FOREL-ULE SCALE XV
2	PERCENT YELLOW 2 FOREL-ULE SCALE II	16	PERCENT BROWN 20 FOREL-ULE SCALE XVI
3	PERCENT YELLOW 5 FOREL-ULE SCALE III	17	PERCENT BROWN 27 FOREL-ULE SCALE XVII
4	PERCENT YELLOW 9 FOREL-ULE SCALE IV	18	PERCENT BROWN 35 FOREL-ULE SCALE XVIII
5	PERCENT YELLOW 14 FOREL-ULE SCALE V	19	PERCENT BROWN 44 FOREL-ULE SCALE XIX
6	PERCENT YELLOW 20 FOREL-ULE SCALE VI	20	PERCENT BROWN 54 FOREL-ULE SCALE XX
7	PERCENT YELLOW 27 FOREL-ULE SCALE VII	21	PERCENT BROWN 65 FOREL-ULE SCALE XXI
8	PERCENT YELLOW 35 FOREL-ULE SCALE VIII	31	GREEN
9	PERCENT YELLOW 44 FOREL-ULE SCALE IX	32	BLUE
10	PERCENT YELLOW 54 FOREL-ULE SCALE X	33	GREY
11	PERCENT YELLOW 65 PERCENT BROWN 0 FOREL-ULE SCALE XI	34	RED
12	PERCENT BROWN 2 FOREL-ULE SCALE XII	35	CHALKY
13	PERCENT BROWN 5 FOREL-ULE SCALE XIII	36	BROWN
14	PERCENT BROWN 9 FOREL-ULE SCALE XIV	37	LUMINESCENT

**2D. Wind-Wave Direction (WMO-0877) - Second Header Code 16/21**

<b>CODE</b>	<b>DESCRIPTION</b>		
0	CALM (NO WAVES-NO MOTION)		
1	5 DEGREES - 14 DEGREES	19	185 DEGREES - 194 DEGREES
2	15 DEGREES - 24 DEGREES	20	195 DEGREES - 204 DEGREES
3	25 DEGREES - 34 DEGREES	21	205 DEGREES - 214 DEGREES
4	35 DEGREES - 44 DEGREES	22	215 DEGREES - 224 DEGREES
5	45 DEGREES - 54 DEGREES	23	225 DEGREES - 234 DEGREES
6	55 DEGREES - 64 DEGREES	24	235 DEGREES - 244 DEGREES
7	65 DEGREES - 74 DEGREES	25	245 DEGREES - 254 DEGREES
8	75 DEGREES - 84 DEGREES	26	255 DEGREES - 264 DEGREES
9	85 DEGREES - 94 DEGREES	27	265 DEGREES - 274 DEGREES
10	95 DEGREES - 104 DEGREES	28	275 DEGREES - 284 DEGREES
11	105 DEGREES - 114 DEGREES	29	285 DEGREES - 294 DEGREES
12	115 DEGREES - 124 DEGREES	30	295 DEGREES - 304 DEGREES
13	125 DEGREES - 134 DEGREES	31	305 DEGREES - 314 DEGREES
14	135 DEGREES - 144 DEGREES	32	315 DEGREES - 324 DEGREES
15	145 DEGREES - 154 DEGREES	33	325 DEGREES - 334 DEGREES
16	155 DEGREES - 164 DEGREES	34	335 DEGREES - 344 DEGREES
17	165 DEGREES - 174 DEGREES	35	345 DEGREES - 354 DEGREES
18	175 DEGREES - 184 DEGREES	36	355 DEGREES - 4 DEGREES
49	WAVES CONFUSED, DIRECTION INDETERMINATE (WAVES EQUAL TO OR LESS THAN 4 3/4 METERS)		
99	WAVES CONFUSED, DIRECTION INDETERMINATE (WAVES GREATER THAN 4 3/4 METERS) WINDS VARIABLE, OR ALL DIRECTIONS OR UNKNOWN		

**2E. Wave Height (WMO-1555) - Second Header Code 17**

<b>CODE</b>	<b>DESCRIPTION</b>	<b>CODE</b>	<b>DESCRIPTION</b>
0	CALM	14	7 METER
1	0.5 METER	15	7.5 METER
2	1 METER	16	8 METER
3	1.5 METER	17	8.5 METER
4	2 METER	18	9 METER
5	2.5 METER	19	9.5 METER
6	3 METER	20	10 METER
7	3.5 METER	21	10.5 METER
8	4 METER	22	11 METER
9	4.5 METER	23	11.5 METER
10	5 METER	24	12 METER
11	5.5 METER	25	12.5 METER
12	6 METER	26	13 METER
13	6.5 METER	27	> 13 METERS

**2F. Sea State (WMO3700) - Second Header Code 18**

<b>CODE</b>	<b>DESCRIPTION</b>
0	CALM-GLASSY 0 FT (0 METERS)
1	CALM-RIPPLED 0-1/3 FT (0-.1 METERS)
2	SMOOTH-WAVELET 1/3-1 2/3 FT (.1-.5 METERS)
3	SLIGHT 1 2/3 - 4 FT (.5-1.25 METERS)
4	MODERATE 4-8 FT (1.25-2.50 METERS)
5	ROUGH 8-13 FT (2.50-4.0 METERS)
6	VERY ROUGH 13-20 FT (4-6 METERS)
7	HIGH 20-30 FT (6-9 METERS)
8	VERY HIGH 30-45 FT (9-14 METERS)
9	PHENOMENAL >45 FT (>14 METERS)



**2G. Wind Force (Beaufort) - Second Header Code 19**

CODE	DESCRIPTION
0	Calm (mean velocity in knots <1; in meters/sec 0-0.2; in km/h <1; in m.p.h. <1) /wave ht < .25 ft
1	Light air (mean velocity in knots 1-3; meters/sec 0.3-1.5; km/h 1-5; m.p.h. 1-3) /wave ht= .25 ft
2	Light breeze (mean velocity in knots 4-6; meters/sec 1.6-3.3; km/h 6-11; m.p.h. 4-7) /wave ht = .5 ft
3	Gentle breeze (mean velocity in knots 7-10; meters/sec 3.4-5.4; km/h 12-19; m.p.h. 8-12) /wave ht = 2 ft
4	Moderate breeze (mean velocity in knots 11-16; meters/sec 5.5-7.9; km/h 20-28; m.p.h. 13-18) wave ht = 4 ft
5	Fresh breeze (mean velocity in knots 17-21; meters/sec 8.0-10.7; km/h 29-38; m.p.h. 19-24) wave ht = 6 ft
6	Strong breeze (mean velocity in knots 22-27; meters/sec 10.8-13.8; km/h 39-49; m.p.h. 25-31) /wave ht = 10ft
7	Near gale (mean velocity in knots 28-33; meters/sec 13.9-17.1; km/h 50-61; m.p.h. 32-38) /wave ht = 14 ft
8	Gale (mean velocity in knots 34-40; meters/sec 17.2-20.7; km/h 62-74; m.p.h. 39-46) /wave ht = 18 ft
9	Strong gale (mean velocity in knots 41-47; meters/sec 20.8-24.4; km/h 75-88; m.p.h. 47-54) /wave ht = 23 ft

**2H. Wave Period (WMO 3155) - Second Header Code 20**

NODC CODE 0378		WMO 3155	
CODE	DESCRIPTION	CODE	DESCRIPTION
0	20 OR 21 SECONDS	0	10 SECONDS
1	OVER 21 SECONDS	1	11 SECONDS
2	5 SECONDS OR LESS	2	12 SECONDS
3	6 OR 7 SECONDS	3	13 SECONDS
4	8 OR 9 SECONDS	4	14 SECONDS
5	10 OR 11 SECONDS	5	5 SECONDS OR LESS
6	12 OR 13 SECONDS	6	6 SECONDS
7	14 OR 15 SECONDS	7	7 SECONDS
8	16 OR 17 SECONDS	8	8 SECONDS
9	18 OR 19 SECONDS	9	9 SECONDS

**21a. Weather (WMO 4501) - Second Header Code 26 - (See below for WMO 4677 )**

<b>OCL CODE</b>	<b>NODC CODE</b>	<b>DESCRIPTION</b>
0		CLEAR (NO CLOUD AT ANY LEVEL)
-1	1	PARTLY CLOUDY (SCATTERED OR BROKEN)
-2	2	CONTINUOUS LAYER(S) OF CLOUD(S)
-3	3	SANDSTORM, DUST STORM, OR BLOWING SNOW
-4	4	FOG, THICK DUST OR HAZE
-5	5	DRIZZLE
-6	6	RAIN
-7	7	SNOW, OR RAIN AND SNOW MIXED
-8	8	SHOWER(S)
-9	9	THUNDERSTORM(S)

**2Ib. Weather (WMO 4677 ) - Second Header Code 26**

- 0 cloud develop. Not observed or not observable-char. change of the state of sky during past hour
- 1 clouds generally dissolving or becoming less developed-char. change of state of sky during past hr.
- 2 state of sky on the whole unchanged-char. change of the state of sky during the past hour
- 3 clouds generally forming or developing-char. change of the state of sky during the past hour
- 4 visibility reduced by smoke, e.g., veldt of forest fires, industrial smoke or volcanic ashes
- 5 haze
- 6 widespread dust in suspension in the air, raised by wind at or near time of obs.
- 7 dust or sand raised by wind at or near the station at the time of observation, but no well developed dust whirl(s) or sand whirl(s), and no dust storm or sandstorm seen
- 8 well developed dust whirl(s) or sand whirl(s) seen at or near station during the preceding hour or at the time of observation, but no dust storm or sand storm
- 9 dust storm or sand storm within sight at the time of observation, or at station during preceding hour
- 10 mist
- 11 patches of shallow fog or ice fog at the station, whether on land or sea, not deeper than about 2 meters on land or 10 meters at sea
- 12 more or less continuous shallow fog or ice fog at the station, whether on land or sea, not deeper than about 2 m on land or 10 m at sea
- 13 lightning visible, no thunder heard
- 14 precipitation within sight, not reaching the ground or the surface of the sea
- 15 precipitation within sight, reaching the ground or the surface of the sea, but distant(*i.e.*, estimated to be more than 5 km) from the station
- 16 precipitation within sight, reaching ground or surface of the sea, near to, but not at the station
- 17 thunderstorm, but no precipitation at the time of observation
- 18 squalls at or within sight of the station during the preceding hour or at time of observation
- 19 funnel cloud(s) at or within sight of station during preceding hour or at the time of observation
- 20 drizzle (not freezing) or snow grains - not falling as shower(s)
- 21 rain (not freezing) - not falling as shower(s)
- 22 snow - not falling as shower(s)
- 23 rain and snow or ice pellets, type (a) - not falling as shower(s)
- 24 freezing drizzle or freezing rain - not falling as shower(s)
- 25 shower(s) of rain - not falling as shower(s)
- 26 shower(s) of snow, or of rain and snow - not falling as shower(s)
- 27 shower(s) of hail, or of rain and hail - not falling as shower(s)
- 28 fog or ice fog - not falling as shower(s)
- 29 thunderstorm (with or without precipitation)
- 30 slight or moderate dust storm or sandstorm-has decreased during the preceding hour
- 31 slight or moderate dust storm or sandstorm-no appreciable change during the preceding hour
- 32 slight or moderate dust storm or sandstorm-has begun or has increased during the preceding hour
- 33 severe dust storm or sandstorm-has decreased during the preceding hour
- 34 severe dust storm or sandstorm-no appreciable change during the preceding hour
- 35 severe dust storm or sandstorm-has begun or has increased during the preceding hour
- 36 slight or moderate blowing snow-generally low (below eye level)
- 37 heavy drifting snow-generally low (below eye level)
- 38 slight or moderate blowing snow-generally high (above eye level)
- 39 heavy blowing snow-generally high (above eye level)
- 40 fog or ice fog at a distance at time of observation, but not at the station during the preceding hour, the fog or ice fog extending to a level above that of the observer
- 41 fog or ice fog in patches
- 42 fog or ice fog, sky visible-has become thinner during the preceding hour
- 43 fog or ice fog, sky invisible-has become thinner during the preceding hour
- 44 fog or ice fog, sky visible-no appreciable change during the preceding hour
- 45 fog or ice fog, sky invisible-no appreciable change during the preceding hour

**21b. Weather (WMO 4677 ) - continued**

- 46 fog or ice fog, sky visible-has begun or has become thicker during the preceding hour
- 47 fog or ice fog, sky invisible-has begun or has become thicker during the preceding hour
- 48 fog, depositing rime, sky visible
- 49 fog, depositing rime, sky invisible
- 50 drizzle, not freezing, intermittent-slight at time of observation
- 51 drizzle, not freezing, continuous-slight at time of observation
- 52 drizzle, not freezing, intermittent-moderate at time of observation
- 53 drizzle, not freezing, continuous-moderate at time of observation
- 54 drizzle, not freezing, intermittent-heavy (dense) at time of observation
- 55 drizzle, not freezing, continuous-heavy (dense) at time of observation
- 56 drizzle, freezing, slight
- 57 drizzle, freezing, moderate or heavy (dense)
- 58 drizzle and rain, slight
- 59 drizzle and rain, moderate or heavy
- 60 rain, not freezing, intermittent-slight at time of observation
- 61 rain, not freezing, continuous-slight at time of observation
- 62 rain, not freezing, intermittent-moderate at time of observation
- 63 rain, not freezing, continuous-moderate at time of observation
- 64 rain, not freezing, intermittent-heavy at time of observation
- 65 rain, not freezing, continuous-heavy at time of observation
- 66 rain, freezing, slight
- 67 rain, freezing, moderate or heavy
- 68 rain or drizzle and snow, slight
- 69 rain or drizzle and snow, moderate or heavy
- 70 intermittent fall of snow flakes-slight at time of observation
- 71 continuous fall of snow flakes-slight at time of observation
- 72 intermittent fall of snow flakes-moderate at time of observation
- 73 continuous fall of snow flakes-moderate at time of observation
- 74 intermittent fall of snow flakes-heavy at time of observation
- 75 continuous fall of snow flakes-heavy at time of observation
- 76 ice prisms (with or without fog)
- 77 snow grains (with or without fog)
- 78 isolated starlike snow crystals (with or without fog)
- 79 ice pellets, type (a)
- 80 rain shower(s), slight
- 81 rain shower(s), moderate or heavy
- 82 rain shower(s), violent
- 83 shower(s) of rain and snow mixed, slight
- 84 shower(s) of rain and snow mixed, moderate or heavy
- 85 snow shower(s), slight
- 86 show shower(s), moderate or heavy
- 87 shower(s) of snow pellets or ice pellets, type(b), with/without rain and snow mixed-slight
- 88 shower(s) of snow pellets or ice pellets, type(b), with/without rain or rain and snow mixed- moderate or heavy
- 89 shower(s) of hail, with or without rain or rain and snow mixed, not assoc. with thunder-slight
- 90 shower(s) of hail, with/without rain or rain and snow mixed, not assoc. w/thunder-moderate or heavy
- 91 slight rain at time of observation-thunderstorm during the preceding hour but not at time of obs.
- 92 moderate or heavy rain at time of observation.-thunderstorm during preceding hr. but not at time of obs.
- 93 slight snow, or rain and snow mixed or hail at time of observation.-thunderstorm during the preceding hour but not at time of observation
- 94 moderate or heavy snow, or rain and snow mixed or hail at time of observation-thunderstorm during the preceding hour but not at time of observation

- 95 thunderstorm, slight or moderate, without hail, but w/rain and/or snow at time of observation
- 96 thunderstorm, slight or moderate, with hail at time of observation
- 97 thunderstorm, heavy, without hail, but with rain and/or snow at time of observation
- 98 thunderstorm combined with dust storm or sandstorm at time of observation
- 99 thunderstorm, heavy, with hail at time of observation

**2J. Cloud Type (WMO500) - Second Header Code 27**

CODE	DESCRIPTION
0	CIRRUS (CI)
1	CIRROCUMULUS (CC)
2	CIRROSTRATUS (CS)
3	ALTOCUMULUS (AC)
4	ALTOSTRATUS (AS)
5	NIMBOSTRATUS (NS)
6	STRATOCUMULUS (SC)
7	STRATUS (ST)
8	CUMULUS (CU)
9	CUMULONIMBUS (CB)
10	CLOUD NOT VISIBLE OWING TO DARKNESS, FOG, DUST STORM, SANDSTORM, OR OTHER ANALOGOUS PHENOMENA

**2K. Cloud Cover (WMO2700) - Second Header Code 28**

<b>CODE</b>	<b>DESCRIPTION</b>
0	0 (ZERO)
1	1 OKTA OR LESS, BUT NOT ZERO (1/10 OR LESS, BUT NOT ZERO)
2	2 OKTAS or 2/10-3/10
3	3 OKTAS or 4/10
4	4 OKTAS or 5/10
5	5 OKTAS or 6/10
6	6 OKTAS or 7/10-8/10
7	7 OKTAS OR MORE, BUT NOT 8 OKTAS (9/10 OR MORE, BUT NOT 10/10)
8	8 OKTAS or 10/10
9	SKY OBSCURED, OR CLOUD AMOUNT CANNOT BE ESTIMATED

**2L. Recorder Type (BT - WMO-4770) - Second Header Code 32**

<b>CODE</b>	<b>DESCRIPTION</b>
1	SIPPICAN STRIP CHART RECORDER
2	SIPPICAN MK2A/SSQ-61
3	SIPPICAN MK-9
4	SIPPICAN AN/BHQ-7/MKS
5	SIPPICAN MK-12
6	MK5
7	MK8 LINEAR RECORDER
10	SPARTAN SOC-BT/SV PROCESSOR MODEL 100
20	ARGOS XBT-ST
21	CLS-ARGOS/PROTECNO XBT-ST MODEL 1
22	CLS-ARGOS/PROTECNO XBT-ST MODEL 2
30	BATHY SYSTEMS SA-810
31	SCRIPPS METROBYTE CONTROLLER
32	MURAYAMA DENKI Z-60-16 III
33	MURAYAMA DENKI Z-60-16 II
34	PROTECNO ETSM2
35	NAUTILUS MARINE SERVICE NMS-XBT
40	TSK MK-2A
41	TSK MK-2S
42	TSK MK-30
43	TSK MK-30N
45	TSK MK-100
46	TSK MK-130 compatible recorder for both XBT and XCTD
48	TSK AXBT receiver MK-300
50	JMA ASTOS
60	P-ALACE float, ARGOS communications, sampling on up transit
61	P-ALACE float, ARGOS communications, sampling on down transit
62	P-ALACE float, Orbcomm communications, sampling on up transit
63	P-ALACE float, Orbcomm communications, sampling on down transit

**2M. Digitization Method (NODC-0612) - Second Header Code 35**

CODE	DESCRIPTION
1	MANUAL
2	A-D CONVERSION FROM ORIGINAL
3	A-D CONVERSION FROM COPIES
4	OPTICAL SCANNING
5	DIRECT DIGITAL OUTPUT UNKNOWN
6	DIRECT DIGITAL OUTPUT BATHY
7	DIRECT DIGITAL OUTPUT SUTRON
8	DIRECT DIGITAL OUTPUT FROM SIPPICAN

**2N. Digitization Interval (NODC-0613) - Second Header Code 36**

LE = less than or equal to; GT = greater than; LT = less than; DEG C = degrees Celsius

CODE	DESCRIPTION
1	FIXED INTERVAL LE 0.1 METER AND LE 0.1 DEG C
2	FIXED INTERVAL GT 1 METER BUT LE 3 METERS AND LE 0.1 DEG C
3	FIXED INTERVAL GT 3 METERS BUT LE 6 METERS AND LE 0.1 DEG C
4	FIXED INTERVAL GT 6 METERS AND LE 0.1 DEG C
11	FIXED INTERVAL LE 1 METER AND LE 0.2 DEG C
12	FIXED INTERVAL GT 1 METER BUT LE 3 METERS AND LE 0.2 DEG C
13	FIXED INTERVAL GT 3 METERS AND LE 6 METERS AND LE 0.2 DEG
31	VARIABLE INTERVAL - MANUALLY DETERMINED
32	VARIABLE INTERVAL - STATISTICALLY DETERMINED
33	VARIABLE INTERVAL - PHYSICALLY DETERMINED
34	FIXED INTERVAL GT 3 METERS BUT LT 6 METERS AND LE 0.2 DEG C



**20. Data Treatment And Storage (NODC-0614) - Second Header Code 37**

<b>CODE</b>	<b>DESCRIPTION</b>
1	SINGLE DIGITIZATION; STORED AS DIGITIZED
2	SINGLE DIGITIZATION; COMPRESSION; FIT WITHIN 0.05 DEG C
3	SINGLE DIGITIZATION; COMPRESSION; FIT WITHIN 0.1 DEG C
4	SINGLE DIGITIZATION; COMPRESSION; FIT WITHIN 0.2 DEG C
5	SINGLE DIGITIZATION; COMPRESSION; FIT WITHIN 0.3 DEG C
6	SINGLE DIGITIZATION; COMPRESSION; FIT WITHIN 0.7 DEG C
7	UNKNOWN
21	DUAL DIGITIZATION AND AVERAGING; STORED AS DIGITIZED
22	DUAL DIGITIZATION AND AVERAGING; COMPRESSION; FIT WITHIN 0.05 DEG C
23	DUAL DIGITIZATION AND AVERAGING; COMPRESSION; FIT WITHIN 0.1 DEG C
24	DUAL DIGITIZATION AND AVERAGING; COMPRESSION; FIT WITHIN 0.2 DEG C
25	DUAL DIGITIZATION AND AVERAGING; COMPRESSION; FIT WITHIN 0.3 DEG C
26	DUAL DIGITIZATION AND AVERAGING; COMPRESSION; FIT WITHIN 0.5 DEG C
27	DATA POINTS AT FIXED INTERVALS OR SELECTED INTERVALS RETAINED AND STORED

**2P. Instrument For Reference Temperature (NODC-0615) - Second Header Code 40**

<b>CODE</b>	<b>DESCRIPTION</b>
1	BUCKET
2	INJECTION, OR UNVERIFIED BUCKET NOTATION, OR UNKNOWN
3	NANSEN CAST (REVERSING THERMOMETER)
4	THERMOGRAPH
5	SPECIAL CALIBRATION THERMOMETER OR EQUIPMENT
6	BT
7	STD
9	HULL CONTACT SENSOR
10	ENGINE INTAKE

**2Q. Horizontal Visibility (WMO-4300) - Second Header Code 41**

<b>CODE</b>	<b>DESCRIPTION</b>
0	LESS THAN 50 METERS
1	50 - 200 METERS
2	200 - 500 METERS
3	500 - 1000 METERS
4	1 - 2 KM
5	2 - 4 KM
6	4 - 10 KM
7	10 - 20 KM
8	20 - 50 KM
9	50 KM OR MORE

**2R. Oceanographic Measuring Vehicle - Second Header Code 74**

<b>CODE</b>	<b>DESCRIPTION</b>
1	UNDULATING OCEANOGRAPHIC RECORDER
2	SEASOAR
3	PROFILING FLOAT
4	SURFACE DRIFTER
302	PROVOR (free-drifting hydrographic profiler, IFREMER/MARTEC, France)
303	P-ALACE (Autonomous Lagrangian Circulation Explorer, Webb Research Corporation)
304	SOLO (Sounding Oceanographic Lagrangian Observer, SIO)
305	APEX (Autonomous Profiling Explorer, Webb Research Corporation)
306	R1 (Webb Research Corporation)

**2S. ARGOS Satellite Fix Code - Second Header Code 84**

<b>OCL Code</b>	<b>Argos Code</b>	<b>Error mean (km)</b>
1	B	0.8
2	A	1.4
3	0	2.7
4	1	9.3
5	2	28.3
6	3	48.4

**2T. Reference Code Table for the United Kingdom Hydrographic Office (UKHO) Profile Data**

<b>CODE</b>	<b>REFERENCE</b>
77- 107	ICES (1902-1914, 1919-1937)
381- 519	<i>No information provided</i>
522- 530	Japan (1923-1941)
531- 659	<i>No information provided</i>
2010- 3265	<i>No information provided</i>
3260	ICES (1938-1939)
3520 - 6652	<i>No information provided</i>
6752	DANISH LIGHT VESSELS (1932)
6790- 6865	<i>No information provided</i>
6944	DANISH LIGHT VESSELS (1938)
6945	DANISH LIGHT VESSELS (1945)
6961- 7065	<i>No information provided</i>
7110	<i>No information provided</i>
7138- 7337	<i>No information provided</i>
7410	DANISH LIGHT VESSELS (1946)
7635- 7838	<i>No information provided</i>
8125	DANISH LIGHT VESSELS (1947)
8313	<i>No information provided</i>
8470	DANISH LIGHT VESSELS (1948)
8471	DANISH LIGHT VESSELS (1949)
8517- 8562	<i>No information provided</i>
8567	DANISH LIGHT VESSELS (1950)
8568- 8823	<i>No information provided</i>
8888	DANISH LIGHT VESSELS (1951)
9349	<i>No information provided</i>
9357	<i>No information provided</i>
9448	DANISH LIGHT VESSELS (1953)
9554	DANISH LIGHT VESSELS (1952)
9580 -10383	<i>No information provided</i>
10477	DANISH LIGHT VESSELS (1939)

<b>CODE</b>	<b>REFERENCE</b>
10478	DANISH LIGHT VESSELS (1940)
10777	<i>No information provided</i>
10816	DANISH LIGHT VESSELS (1954)
10923-10940	<i>No information provided</i>
-1	ICES BULLETIN HYDROGRAPHIQUE
-2	NORWEGIAN RECORDS
-3, -4	ERNEST HOLT (1949 - 1958)
-5	SMED
-6	CASPIAN SEA
-7	CANADIAN OCEANOGRAPHIC DATA CENTER
-8	COEC
-9	EXPL. MER URSS
-10, -11	JOHAN HJORT (1900 - 1901)
-12, -13	DAMPIER (1965)
-14, -15	ALBATROSS (1948)
-16	GRAMPUS (1963)
-17	NARWHAL (1964)
-18	NC847
-19	VEIDING (1931)
-20	WMH
-21	ANALYSIS DE HYDROGRAPHIQUE
-22	NORTHERN WATERS
-23	BULLETIN RUSSIAN HYDROGRAPHIC INSTITUTE
-24	ZUBOV
-25	F14
-26	BPMR
-27	PALLISES
-28	ROSNELL
-29	OCEAN WEATHER STATION E
-30	OCEAN WEATHER STATION
-31	RUSSELL

-32	0 or 00
-33	ELBE 1
-34	ELBF 1/ELBF I
-35	ELSE 1
-36	ELBE 2
-37	WESER
-38	S2
-39	R74
-40	OCEAN WEATHER STATION J
-41	ONT
-42	DUNKIR
-43	Q
-44	PRISSEL
-45	BORKUMR
-46	368C
-47	368A
-48	DISCOVERY II (1955 - 1956)
-49	BUYAYED
-50	100T
-51	<i>No information provided</i>

If the UKHO originator's code was not numeric (e.g. text string), the OCL assigned a negative numeric code.

**APPENDIX 3. CODE TABLE FOR TEMPERATURE-SALINITY PROBES - SECOND HEADER CODE 29**  
 (BOTTLE is assumed if SECOND Header Code 29 is absent)

CODE	Instrument	Description
0	UNKNOWN	UNKNOWN
1	MBT	Mechanical Bathythermograph, TYPE UNKNOWN
2	XBT	Expendable Bathythermograph, TYPE UNKNOWN
3	DBT	Digital Bathythermograph, TYPE UNKNOWN
4	CTD	Conductivity/Temperature/Depth Profiler, TYPE UNKNOWN
5	STD	Salinity/Temperature/Depth Profiler, TYPE UNKNOWN
6	XCTD	Expendable Conductivity/Temperature/Depth Profiler, TYPE UNKNOWN
7	BOTTLE	Bottle, TYPE UNKNOWN
8	UNDERWAY	Underway Data Collection Instrument, TYPE UNKNOWN
207	XBT	T7 (SIPPICAN)
208	XBT	T4 (SIPPICAN)
209	XBT	T6 (SIPPICAN)
210	XBT	T5 (SIPPICAN)
211	XBT	T10 (SIPPICAN)
212	XBT	T11 (SIPPICAN)
213	XBT	FAST DEEP (SIPPICAN)
214	XBT	DEEP BLUE (SIPPICAN)
215	XBT	T4 (TSK - TSURUMI SEIKI Co.)
216	XBT	T6 (TSK - TSURUMI SEIKI Co.)
217	XBT	T7 (TSK - TSURUMI SEIKI Co.)
218	XBT	(MHI, Academy of Science, Ukraine)
219	XBT	T5 (TSK - TSURUMI SEIKI Co.)
220	XBT	T10 (TSK - TSURUMI SEIKI Co.)
221	XBT	XBT-1 (SPARTAN)
222	XBT	XBT-3 (SPARTAN)
223	XBT	XBT-4 (SPARTAN)
224	XBT	XBT-5 (SPARTAN)
225	XBT	XBT-5DB (SPARTAN)
226	XBT	XBT-6 (SPARTAN)
227	XBT	XBT-7 (SPARTAN)
229	XBT	XBT-10 (SPARTAN)
230	XBT	XBT-20 (SPARTAN)
401	CTD	SBE 9 (Deep ocean precision CTD, Sea-Bird Electronics, Inc.)
402	CTD	ISTOK-4 (Russia)
403	CTD	EG&G MARK III (EG&G Ocean products)
404	CTD	NEIL BROWN MARK IIIB
405	CTD	SEACAT, TYPE UNKNOWN (Sea-Bird Electronics, Inc.)
406	CTD	GUILDLINE, MODEL UNKNOWN
409	CTD	KROSSBIM STD ROSETTES

<b>CODE</b>	<b>Instrument</b>	<b>Description</b>
410	CTD	Sea-Bird Electronics, Inc., MODEL UNKNOWN
411	CTD	SBE 911plus (Sea-Bird Electronics, Inc.)
412	CTD	BISSETT-BERMAN, MODEL UNKNOWN
413	CTD	JASUS (by M. Du Chaffaut and T. Labadie)
414	CTD	PLESSEY 9040
415	CTD	PLESSEY 9400
416	CTD	PLESSEY 9041
417	CTD	PLESSEY 9060
418	CTD	NEIL BROWN MARK III
420	CTD	NEIL BROWN SMART CTD
421	CTD	PLESSEY, MODEL UNKNOWN
422	CTD	PLESSEY/GRUNDY, MODEL UNKNOWN
423	CTD	NEIL BROWN DRCM
424	CTD	SBE 102 (Sea-Bird Electronics, Inc.)
425	CTD	SBE 911 (Sea-Bird Electronics, Inc.)
426	CTD	OCEAN CASSETTE
427	CTD	NEIL BROWN, MODEL UNKNOWN
429	CTD	SBE 19 SEACAT profiler (Sea-Bird Electronics, Inc.)
432	CTD	GUILDLINE 8701 MODIFIED
438	CTD	GUILDLINE 8737 "WOCE" (WOCE-specifications)
439	CTD	FSI CTD (Falmouth Scientific, Inc.)
442	CTD	ZOND-BATHOMETER
446	CTD	SBE 25 SEALOGGER (Sea-Bird Electronics, Inc.)
447	CTD	NEIL BROWN MARK IV
448	CTD	NEIL BROWN MARK II
449	CTD	HYDROPLYTESTER/NEPHELOMETER ZULLIG
450	CTD	MEERESTECHNIK OTS-1200
451	CTD	SBE 9s (Sea-Bird Electronics, Inc.)
452	CTD	MODIFIED NEIL BROWN, PACODF CTD-O2
453	CTD	NEIL BROWN MARK V
454	CTD	CHELSEA INSTRUMENTS AQUALINK
455	CTD	OCEAN DATA EQUIPMENT (ODE) 302 CSTD
458	CTD	AIST (Russia)
459	CTD	FSI ICTD Profiler (Falmouth Scientific, Inc.)
460	CTD	OM-87 (Institut fuer Meereskunde Warnemuende, Germany)
501	STD	PLESSEY 9006
502	STD	PLESSEY 8400
503	STD	PLESSEY 9040
504	STD	PLESSEY 9041
505	STD	ED 9071
506	STD	APMCRO 12
508	STD	AML STD-12 (a.k.a. AML CTD-12)



<b>CODE</b>	<b>Instrument</b>	<b>Description</b>
510	STD	SALINOMETER GM 65
512	STD	APPLIED MICROSYSTEMS 12 PLUS
601	XCTD	STANDARD (SIPPICAN)
602	XCTD	DEEP (SIPPICAN)
603	XCTD	AXCTD (SIPPICAN)
604	XCTD	SXCTD (SIPPICAN)
701	BOTTLE	BATHOMETER (Russia)
702	BOTTLE	TRACE METAL FREE BOTTLE
703	BOTTLE	OPEN BUCKET
704		THERMISTER CHAIN
705	BOTTLE	WHOI-developed SEA SAMPLER (circa 1950 MBT on bottle rosette)
801	UNDERWAY	MK3 data recording tag (Wildlife Computers) mounted on elephant seal
802	UNDERWAY	THERMOSALINOGRAPH, UNKNOWN BRAND & MODEL
803	UNDERWAY	SEACAT Thermosalinograph SBE 21 (Sea-Bird Electronics, Inc.)

APPENDIX 4. CODES FOR ORIGINATOR'S FLAGS - SECOND HEADER 96

OCL Code	Project/Institute or Accession #	Description
1	(1) WOCE (analyst/sample collector flags)  (2) Accession: 0000192	<p><b>Water Sample Quality Flags</b>            2 - acceptable measurement            3 - questionable measurement            4 - bad measurement            6 - mean of replicate            7 - manual chromatographic peak measurement            8 - irregular digital chromatographic peak integration</p> <p><b>Water Bottle Quality Flags</b>            2 - no problem noted            3 - leaking            4 - did not trip correctly            6 - significant discrepancy between Gerard and Niskin bottles            7 - unknown problem            8 - pair did not trip correctly</p> <p><b>CTD Quality Flags</b>            2 - acceptable measurement            3 - questionable measurement            4 - bad measurement            6 - interpolated over &gt;2 dbar interval            7 - despiked</p>
3	GTSP	1 - good quality 2 - "probably" good quality 3 - "probably" bad quality 4 - bad quality 5 - data changed
5	GEOSECS	1 - data taken from CTD down trace 2 - temperature calculated from unprotected thermometer 3 - depth calculated from wire out 4 - data extracted from CTD records 5 - data appears to be in error, but verified by other means 6 - thermometric data (normally measured by CTD) 7 - known error 8 - pretrip or postrip 9 - uncertain data
6	CalCOFI	8 - suspect value
7	Wilkes Land Expedition	3 - unreliable value
8	OMEX	1 - suspect value
9	Accession: 0000440	1 - suspect value

## APPENDIX 5. CODES FOR VARIABLE SPECIFIC HEADERS

### 5A. Codes for Originator's Methods - Variable Specific Header 6

<b>PIGMENT (CHLOROPHYLL)</b>	
400	Spectrophotometric (manual methods)
413	Spectrophotometric [Jeffrey and Humphrey, 1975]
600	Fluorescence
601	Fluorescence ( <i>in-situ</i> - Turner Fluorometer) [Strickland and Parsons, 1972]
603	Fluorescence ( <i>in-situ</i> Fluorometer attached to CTD)
604	Fluorometric [Aiken, 1981]
605	Fluorometric (Chlorophyll-a assay Acetone extraction)
606	Fluorometric (Chlorophyll-a assay Methanol extraction)
700	HPLC (High Performance Liquid Chromatography)
800	Carbon-14 <i>in-situ</i> incubation
860	Van Dorn (Japanese)
<b>INORGANIC NUTRIENTS</b>	
400	Spectrophotometric [e.g., Strickland and Parsons, 1972]
401	Spectrophotometric (single solution) [Strickland and Parsons, 1972; Murphy and Riley, 1962]
407	Spectrophotometric (Cadmium reduction) [Morris and Riley, 1963; Wood et al., 1967]
500	Spectrophotometric (CFA - Continuous Flow Analyzer)
501	Spectrophotometric (CFA-Continuous Flow Analyzer - Technicon AutoAnalyzer)
505	Spectrophotometric (Nitrate+Nitrite, CFA - Continuous Flow Analyzer)
506	Gas chromatography (Sumigraph Analyzer)
<b>ALKALINITY</b>	
900	pH meter (potentiometric)
901	Modified Gran titration
910	Ruppin's method [referenced in Zubov, 1937]
<b>TCO<sub>2</sub></b>	
1300	pH meter (potentiometric)
1340	Coulometric
1343	Coulometric (CRM - Certified Reference Materials used)
1344	Coulometric (CRM - Certified Reference Materials used, SOMMA -Single Operator Multi-parameter Analyzer)
<b>pCO<sub>2</sub></b>	
1202	Gas chromatography (xCO <sub>2</sub> @analysis temperature)
1205	Gas chromatography (pCO <sub>2</sub> @ analysis temperature)
1233	Infra-red spectrometry pCO <sub>2</sub>
1262	Non-dispersive infra-red spectrometry (NDIR) - xCO <sub>2</sub> @ analysis temperature
1263	Non-dispersive infra-red spectrometry (NDIR) pCO <sub>2</sub>
<b>OXYGEN</b>	
300	Winkler method (including titrations of aliquots or whole bottle method)
301	Winkler method (manual titration) [Carpenter, 1965]

303	Winkler method (automated titration, Amperometric) [Culberson, 1991]
320	Polarographic Oxygen Sensor
321	Polarographic Oxygen Sensor (Beckman)
340	Chromatography
360	Spectrophotometric (Shibala method)
<b>SALINITY</b>	
201	Titration (Knudsen, 1902)
202	PSAL78 (Practical Salinity Scale 1978)
<b>TEMPERATURE</b>	
102	ITS-68 (International Temperature Scale 1968)
103	ITS-90 (International Temperature Scale 1990)
<b>pH</b>	
1400	Potentiometric (pH meter)
1450	Spectrophotometric

### 5B. Codes for Originator's Variable Units - Variable Specific Header 8

<b>Temperature [standard unit: °C - Degrees Centigrade]</b>		
82	°F	Degrees Fahrenheit
<b>Oxygen [standard unit: ml/l - milliliter per liter]</b>		
7	µmol/l	micromoles per liter
29	µmol/kg	micromoles per kilogram
32	mg/l	milligrams per liter
58	mg-at/kg	milligrams-atom per kilogram
107	µg-at/l	micrograms-atom per liter
<b>Inorganic nutrients [standard unit: µmol/l - micromoles per liter]</b>		
29	µmol/kg	micromoles per kilogram
32	mg/l	milligrams per liter
36	µg/l	micrograms per liter
37	mg-at/l	milligrams-atom per liter
107	µmol-at/l	micromoles-atom per liter
136	µg-at/l	micrograms-atom per liter
<b>Pigment (Chlorophyll) [standard unit: µg/l - micrograms per liter]</b>		
33	µg/kg	micrograms per kilogram
36	µg/l	micrograms per liter
39	ng/l	nanograms per liter
66	ng/kg	nanograms per kilogram
<b>Alkalinity [standard unit: meq/l - milliequivalents per liter]</b>		
7	µmol/l	micromoles per liter
29	µmol/kg	micromoles per kilogram
34	µeq/kg	microequivalents per kilogram
51	µeq/l	microequivalents per liter
54	meq/kg	milliequivalents per kilogram
61	mmol/kg	millimoles per kilogram
<b>pCO<sub>2</sub> [standard unit: µatm - microatmospheres]</b>		
48	µatm	microatmospheres
81	ppm	parts per million
<b>TCO<sub>2</sub> [standard unit: mmol/l - millimol per liter]</b>		
7	µmol/l	micromoles per liter
29	µmol/kg	micromoles per kilogram
32	mg/l	milligrams per liter
<b>Depth [standard unit: m - meters]</b>		
83	ft	Foot
<b>Biomass/taxonomic parameter data</b>		
68	per sample	Parameter per sample
69	per m <sup>2</sup>	Parameter per squared meter
70	per m <sup>3</sup>	Parameter per cubic meter
72	per ml	Parameter per milliliter
78	per l	Parameter per liter
84	per µl	Parameter per microliter

**5C. Codes for Equilibrator Type - Variable Specific Header 10**

1600	Showerhead design
1601	Showerhead, large volume >10L
1602	Showerhead, small volume <10L
1630	Laminar flow design
1640	Rotating disk design
1650	Bubbling design
1660	Tandem design (combined showerhead and bubbling)
1670	Membrane design
1680	Aspirator design
1690	Discrete sample closed loop equilibration

**5D. Filter Type and Size - Variable Specific Header 11**

<b>100 GLASS-FIBER FILTER</b>		
	101	Reeve Angel gf/f 984H
	102	Whatman gf/f 24
	103	Whatman gf/f 47 mm
	104	Gelman gf/f 0.45u
	105	Gelman gf/f 0.8u
	106	GF/C
<b>200 MILLIPORE</b>		
<b>300 NUCLEOPORE</b>		
	301	Nucleopore >10 micron
	302	Nucleopore 2-10 micron
	303	Nucleopore <2 micron
<b>400 PAPER FILTER</b>		
<b>500 UNSPECIFIED FILTER-TYPE</b>		
	501	>10 micron (unspecified type)
	502	2-10 micron (unspecified type)
	503	<2 micron (unspecified type)
<b>900 COMBINATION FILTER-TYPES</b>		
	901	Whatman GF/C and HA Millipore

**APPENDIX 6. BIOLOGICAL HEADER CODE TABLES**

**6A. Type of Tow - Biological Header 4**

<b>CODE</b>	<b>DESCRIPTION</b>	<b>CODE</b>	<b>DESCRIPTION</b>
1	HORIZONTAL	3	OTHER (oblique, double oblique)
2	VERTICAL	4	DEPTH STRATIFIED (e.g., MOCNESS)

**6B. Gear And Flowmeter Codes - Biological Header 7**

CODE	DESCRIPTION	CODE	DESCRIPTION
101	NORPAC Net	151	Plankton Trap (unspecified)
102	Plankton Net (Muslin)	152	NORPAC Net - Petersen (Closing)
103	Plankton Net (Silk)	153	NORPAC Net - Improved
104	Marutoku B Net	154	FLOWMETER: RGS (unknown model)
105	Juday Net (Tropical or Large)	155	FLOWMETER: type and model unknown
106	Juday Net (Oceanic or JOM)	156	6-FT IKMT; ISAACS KIDD MEDWATER TRAWL
107	Ring Net	157	10-FT IKMT; ISAACS KIDD MIDWATER TRAWL
108	Gulf IA Sampler	158	FLOWMETER: ATLAS
109	Gulf III Sampler	159	TUBE HAI: 200ms
110	Gulf II (on-board CPR)	160	Continuous Plankton Sampler (type unspecified)
111	Rectangular Midwater Trawl (RMT)	161	Double net (inner)
112	Plankton Net (type unknown)	162	Double net (outer)
113	Be' Multiple Plankton Sampler (MPS)	163	Jeddi Net (typo of Juday net ?)
114	Bathypelagic Plankton Sampler (BPS)	164	IMKT+EMPS (IKMT w/Electric Multi-layer Plankton Samplers)
115	Indian Ocean Standard Net (IOSN)	165	VMPS
116	Clarke-Bumpus Sampler	166	Tucker Trawl 3-net opening/closing
117	Neuston Net	167	Manta Net (neuston sampler)
118	Bongo Net	168	Double Bongo (combined as one sample)
119	Water Pump	169	CEPPELIN
120	MOCNESS Net	170	COPY NET
121	BR 80/113 Net	171	PLANKTON NET (GAS)
122	Continuous Plankton Recorder (Longhurst-Hardy)	172	FLOWMETER: RGS-236
123	Isaacs-Kidd Midwater Trawl (IKMT), depressor dimension unspecified	173	FLOWMETER: RGS-633
124	Midwater Trawl	174	NIO (National Institute of Ocg) NET
125	ORI Net	175	Vertical Closing Ringnet
126	Kitahara Net	176	Tucker Trawl
127	BOTTLE: (type unspecified)	177	Samiyoto Neuston Sampler
128	BOTTLE: Niskin	178	0.5 x 1 m MARMAP Neuston Net
129	Marutoku Net (type unspecified)	179	Epibenthic Sled w/2 Tucker Trawls
130	BOTTLE: (Go-Flos)	180	Tucker Trawl (2 nets)
131	CALCOFI Net	181	English Umbrella Net
132	WP-2 (UNESCO Working Party 2)	182	Gulf V Sampler (modified Gulf III, high speed)
133	Nansen Surface Net	183	Plummet Net
134	Heron Tranter Net	184	Pull Sled
135	N70 Net	185	Miller High-speed Sampler (model unspecified)
136	Organdie Net	186	Apstein Opening-closing Mesh Net (APNET)



<b>CODE</b>	<b>DESCRIPTION</b>	<b>CODE</b>	<b>DESCRIPTION</b>
137	75M25 Net	187	Longhurst-Hardy Plankton Recorder (LHPR)
138	FLOWMETER: TSK (model unknown)	188	Autosampling and Recording Instrument Environmental Sampling System (ARI)
139	Hensen Egg Net	189	Special BONGO (double WP-2 nets mounted on bongo frame)
140	Beam Trawl	190	Marine Lab Aberdeen PupNet (PUPNET)
141	Marushi Net	191	SAHFOS Continuous Plankton Recorder (CPR)
142	Foredeck Net	192	Special HYDRO-BIOs Multinet: Five sets of double HYDRO-BIOs Multinets
143	Motoda MTD Net	193	(like a SAHFOS CPR, with T,S and flow rate also measured)
144	BOTTLE: Van Dorn	194	Bucket (on a rope)
145	FLOWMETER: GOM 2030	195	FLOWMETER: RGS-233
146	POFI Net	196	Free-fall plankton net
147	Micro Net (unspecified)	197	Double MOCNESS
148	Open Net (unspecified)	198	FLOWMETER: General Oceanics model 2030R
149	Closing Net (Unspecified)	199	HYDRO-BIOs Multinet (64um mesh for taxa/200um mesh for biomass)
150	HIGH Speed Net (unspecified)	200	BIONESS (10-net oppenning & closing net

### 6C. Preservative Codes - Biological Header 10

CODE	DESCRIPTION
1	4-5% formalin, unbuffered
2	4-5% formalin, hexamine buffered
3	4-5% formalin, borax or borate buffered
4	10% formalin, seawater, buffered
5	4-5% formalin, seawater (buffered/unbuffered unspecified)
6	4-5% formalin, no ref. to water-type or buffering
7	4-5% formalin, buffered (buffer unspecified)
8	10% filtered paraformaldehyde
9	2-10% formalin, seawater, buffered (buffer unspecified)
10	5-10% formalin, seawater, buffered (buffer unspecified)
11	1% formalin, buffered (buffer unspecified)
12	2% formalin, buffered (buffer unspecified)
13	3-5% formalin, seawater, unbuffered
14	5% formalin, seawater, borax buffered
15	4-5% formalin, seawater, sodium bicarbonate buffered
16	Liquid nitrogen
17	Lugol's solution ("acidified Lugol's iodine")
18	Formalin, no info on: %, buffering ,water type
19	Preservative used, no additional information provided
20	10% buffered formalin
21	Formol-hexamine (5% concentration)
22	20% buffered formalin
23	20% buffered formalin + strontium chloride
24	1%-paraform + deep freeze (frozen in liquid nitrogen at -85 dec. C)
25	1%-glutaraldehyde + deep freeze (frozen in liquid nitrogen at -85 dec)

### 6D. Weight Method - Biological Header Code 11

CODE	DESCRIPTION	REFERENCE
1	TOTAL CATCH (wet weight of the total catch)	Bogorov, 1951. Trans. Inst. Oce. Acad. Sci. USSR 5:54-62.(Russian)
2	BOFS Mesoplankton Biomass Protocol	The BOFS North Atlantic Data Set, British Oceanographic Data Centre, 1994.

**6E. Count Method - Biological Header Code 13**

CODE	DESCRIPTION
1	COUNTING CHAMBER; counting chamber method
2	ACID LUGOLS STAIN; stained (acid Lugols and counted
3	AUTOFLUORESCENCE; autofluorescing/counted under microscope
4	DAPI; stained/counted using epifluorescence microscopy
5	MUD OR MPN (Method of Ultimate Dilution
6	MICROSCOPE; counted under a microscope
7	COMPLETE ENUMERATION; complete enumeration
8	FOLSOM SPLITTER; complete enumeration, using Folsom Spl
9	EPIFLOUR MICROSCOPIC; staining unspecified
10	CENTRIFUGE METHOD, centrifuge method (Gran, 1932)
11	ALIQOT AND FULL; counted aliquot, then counted FULL
12	COULTER COUNTER; counted with a coulter counter
13	INVERTED MICROSCOPE
14	BACTERIA Epiflour micrjscopy - Acrodine Orange stained
15	CELL CYTOMETRY
16	BACTERIA Epiflour micrjscopy - unspecified stained
17	OPTICAL PLANKTON COUNTER (OPC)
18	OPTICAL MIKROSCOPY with correction for cell lose during fixation
19	FMIAS; Flourescence microscope image analysis system
20	Monger & Landry cytometry via "Monger & Landry, 1993"
21	Olson & Sosik split beam cytometry (range 1-40 um)
22	Replicate aliquots were counted and averaged

**6F. Flowmeter Calibration - Biological Header Code 19**

CODE	DESCRIPTION
1	CRUISE START AND END
2	BY MANUFACTURER
3	SINGLE CALIBRATION TOW

**6G. Depth Determination - Biological Header Code 24**

CODE	DESCRIPTION
1	OCL CALCULATED (Calculated by OCL from wire out and wire angle)
2	FIXED (One target depth reported by originator for all samples)

## 6H. Volume Method - Biological Header Code 25

CODE	DESCRIPTION
1	Stored in 5% formalin solution, measured several months later after initial shrinkage occurred
2	WICKSTEAD (1965)
3	Settled 24 hrs in 50 ml graduated cylinder

## APPENDIX 7. TAXONOMIC DATA CODE TABLES

### 7A. Taxonomic Lifestages - Taxa Variable 5 (TSN = taxonomic serial)

CODE	DESCRIPTION
1	EGG/OVA code "gametes" below
2	NAUPLIUS default TSN = 83677 CRUSTACEA
3	ZOEAE default TSN = 83677 CRUSTACEA
4	MEGALOPA default TSN = 98276 BRACHYURA
5	VELIGER default TSN = 69459 GASTROPODA
6	LARVA
7	JUVENILE
8	ADULT
9	LARVA+JUV+ADULTS (6-8) equals LARVAL + POST-LARVAL
10	COPEPODITE V
11	POSTLARVAE (7-8)
12	CYPHONAUTES larva default TSN = 155469 BRYOZOA
13	PHYLLOSOMA larva default TSN = 97646 PALINURIDAE
14	PILIDIUM larva default TSN = 57411 NEMERTEA (NEMERTINEA)
15	TORNARIA larva default TSN = 158617 ENTEROPNEUSTA
16	TROCHOPHORE larva default TSN = -5002 ZOOPLANKTON
17	ARACHNACTIS larva def 51985 CERIANTHIDAE
18	ACTINOTROCHA larva def 155457 PHORONIDAE
19	EMBRYO example: sea urchin embryo
20	CYPRIS larva default TSN = 89433 CIRRIPIEDIA (barnacle)
21	BIPINNARIA larva default TSN = 156862 ASTEROIDEA
22	OPHIOPLUTEUS larva default TSN = 157325 OPHIUROIDEA
23	ECHINOPLUTEUS larva default TSN = 157821 ECHINOIDEA
24	hypnospires refers to "resting stages", "cysts", etc.
25	COPEPODITE I
26	COPEPODITE II
27	COPEPODITE III
28	COPEPODITE IV
29	COPEPODITE (without stage information)
30	CALYPTOPIS default TSN = 95496 EUPHAUSIACEA
31	FURCILIA default TSN = 95496 EUPHAUSIACEA

CODE	DESCRIPTION	
32	NAUPLIUS I	default TSN = 85257 COPEPODA
33	NAUPLIUS II	default TSN = 85257 COPEPODA
34	NAUPLIUS III	default TSN = 85257 COPEPODA
35	NAUPLIUS IV	default TSN = 85257 COPEPODA
36	NAUPLIUS V	default TSN = 85257 COPEPODA
37	METANAUPLIUS	default TSN = 85257 COPEPODA
38	POLYP	refers to Anthozoa, Scyphozoa, or Hydrozoa
39	MEDUSAE	if Genus not provided, code as "-5009"
40	INDETERMINABLE	
41	GAMETES	
42	ORTONAUPLIUS	
43	COPEPODITE I-V	all stages (1-5) were counted
44	DEAD or non-viable	
45	LIVING or viable	
46	MULLERS LARVA	default TSN = 53964 TURBELLARIA (class)
47	EGGS + LARVAE (1,6)	
48	N6: NAUPLIUS VI	
49	PLUTEUS Larva	(Echinodermata)
50	C3-4: COPEPODITE 3-4	stages (3-4) were counted in one ggroup groroup
51	C5-6: COPEPODITE 5-6	stages (5-6) were counted in one ggroup
52	C6: COPEPODITE YI	
53	N2-3: NAUPLII 2 - 3	
54	N3-4: NAUPLII 3 - 4	
55	N4-5: NAUPLII 4 - 5	
56	N5-6: NAUPLII 5 - 6	
57	C4-5: COPEPODITE 4 - 5	
58	N3-5: NAUPLII 3 - 5	
59	C1-2: COPEPODITE 1 - 2	
60	C2-3: COPEPODITE 2 - 3	
61	PURA	
62	NYMPH	
63	PROTOZOEAE	
64	MYSIS	
65	GLAUCOTHOE	
66	POLYGASTRIC PHASE	
67	EUDOXID PHASE	
71	MOLT STAGE 1	(decapods)
72	MOLT STAGE 2	(decapods)
73	MOLT STAGE 3	(decapods)
74	MOLT STAGE 4	(decapods)
75	MOLT STAGE 5	(decapods)
76	MOLT STAGE 6	(decapods)

CODE	DESCRIPTION
77	MOLT STAGE 7 (decapods)
78	MOLT STAGE 8 (decapods)
79	MOLT STAGE 9 (decapods)
80	C1-4: COPEPODITE 1 - 4
81	C1-6: COPEPODITE 1 - 6
82	N1-6: NAUPLII 1 - 6
83	ECHINOSPIRA veliger larva of <i>Lamellaria persicua</i>
84	MASTIGOPUS "first post-larval stage" of Shrimp (+crabs)

#### 7B. Taxonomic Sex Code - Taxa Variable 6

CODE	DESCRIPTION
1	MALE
2	FEMALE
3	HERMAPHRODITE
4	TRANSITIONAL
5	GROUPED, BOTH SEXES PRESENT
6	HERMAPHRODITIC, FUNCTIONAL FEMALE
7	HERMAPHRODITIC, FUNCTIONAL MALE
8	INDETERMINABLE
9	SEXUAL GENERATION
10	ASEXUAL GENERATION

#### 7C. Taxonomic Presence/abundance Codes - Taxa Variable 7

CODE	DESCRIPTION	EQUIVALENTS
1	PRESENT	(Present; +; some; also used for body parts, e.g., spicules)
2	ABSENT	(Absent; not found; -; not observed)
3	COMMON	(++; many)
4	ABUNDANT	(CC)
5	VERY ABUNDANT	(CCC; +++)
6	PREDOMINANT	(CCCC)
7	RARE	(R)
8	VERY RARE	(RR)
9	HIGHLY RARE	(RRR )
10	EXTREMELY RARE	(RRRR )
11	RED TIDE	(bloom)
12	EXCLUSIVELY	
13	X	from JGOFS ANT X/6 (exact translation unknown)
14	XX	from JGOFS ANT X/6
15	XXX	from JGOFS ANT X
16	O	from JGOFS ANT X/6
17	OO	from JGOFS ANT X/6

18	OOO	from JGOFS ANT X/6
----	-----	--------------------

#### 7D. Taxonomic Trophic Level - Taxa Variable 8

CODE	DESCRIPTION
1	AUTOTROPH (unspecified - also "holophytic")
2	AUTOTROPH-CHEMO
3	AUTOTROPH-PHOTO
4	HETEROTROPH (unspecified - also "holozoic")
5	HETEROTROPH-PARASITIC
6	HETEROTROPH-SAPROPHYTIC (obtains food by absorbing dissolved organics (decay))
7	PLASTIDIC (has plastids)
8	NON-PLASTIDIC (does not have plastids)
9	OLIGOTROPH

#### 7E. Taxonomic Realm - Taxa Variable 9

CODE	DESCRIPTION
1	BENTHIC
2	EPIBIONT (EPIZOIC, EPIPHYTIC, ...)
3	ENDOBIONT (Intestinal, ENDOZOIC, ...)
4	MEROPLANKTONIC (Adults are benthic or nektonic)
5	BATHYPELAGIC

#### 7F. Taxonomic Features - Taxa Variable 16

CODE	DESCRIPTION
1	SPHERICAL/COCCOID ball-shaped; 1-dimension; radius
2	ELLIPSOID ellipsoid; 2-dimensions; long = length, short = radius
3	BACILLUS/ROD-SHAPED long circular-column: 2-dimensions; long = length, short = radius
4	LENS-LIKE lentil-shaped: 2-dimensions; long = radius, short = length (thickness)
5	SPINDLE-LIKE needle-shaped; 2-3 dimensions; long = length, remaining = radius/width
6	TRUNCATED-CONICAL trunc-cone; 2 dimensions; usually long = length, short = radius
7	ARMORED/THECATE armoured, e.g., dinoflagellates
8	UNARMORED/ATHECATE unarmoured, e.g., naked dinoflagellates
9	HOLOCOCCOLITH-IC coccoliths made of same size/shape crystals
10	HETEROCOCCOLITH-IC coccoliths made of different size/shape crystals
11	FILAMENT algal filaments (rather than individual cells) the unit used
12	PAIRED SPHERE/COCCOID Paired ball-shaped; 1-dimension; radius
13	SINGLE CHLOROPLAST Has only one chloroplast, versus multiple
14	ARMOURED/ARMORED
15	UNARMOURED/UNARMORED

16	DOUBLE CONE
17	EUKARYOTE
18	PROKARYOTE
19	LORICATE
20	NON-LORICATE
21	COCCOID RODS
22	CURVED RODS
23	VIBRIO-LIKE
24	GOLD AUTOFLUORESCING
25	GREEN AUTOFLUORESCING
26	RED AUTOFLUORESCING
27	GOLD AUTOFLUORESCING + ROD-SHAPED (double-feature properties)



**7G. Taxonomic Modifiers - Taxa Variable 17**

CODE	DESCRIPTION
1	sp. single species
2	spp. multiple species
3	Other / unidentified / residue
4	sp. 1 originator designated
5	sp. 2 originator designated
6	sp. A or sp. 3 originator designated
7	sp. B or sp. 4 originator designated
8	sp. C or sp. 5 originator designated
9	sp. D or sp. 6 originator designated
10	sp. E or sp. 7
11	sp. F or sp. 8
12	sp. G or sp. 9
13	sp. H or sp. 10
14	
15	TOTAL (indicated taxa group is a sum of all members)
16	SAHFOS-CPR "traverse count" TOTAL
17	SAHFOS-SPR "eye count" TOTAL

**7H. Comparable Biological Value (CBV)**

BGC*	DESCRIPTION	COMMON UNITS
1000000	Bacterioplankton Counts	# / ul
2000000	Phytoplankton Counts	# / ml
3000000	Protozooplankton Counts	# / m <sup>3</sup>
4000000	Zooplankton Counts	# / m <sup>3</sup>
5000000	Ichthyoplankton Counts	# / m <sup>3</sup>
-201	Biomass: Total Displacement Volume	ml / m <sup>3</sup>
-202	Biomass: Total Settled Volume	ml / m <sup>3</sup>
-203	Biomass: Total Wet Mass	mg / m <sup>3</sup>
-204	Biomass: Total Dry Mass	mg / m <sup>3</sup>
-205	Biomass: Total Ashfree Dry Mass	mg / m <sup>3</sup>
-206	Biomass: Large-value Total Displacement Volume	m <sup>3</sup> / m <sup>3</sup>
-208	Biomass: Large-value Total Wet Mass	g / m <sup>3</sup>

\* BGC - "Biological Grouping Code", see Appendix 12

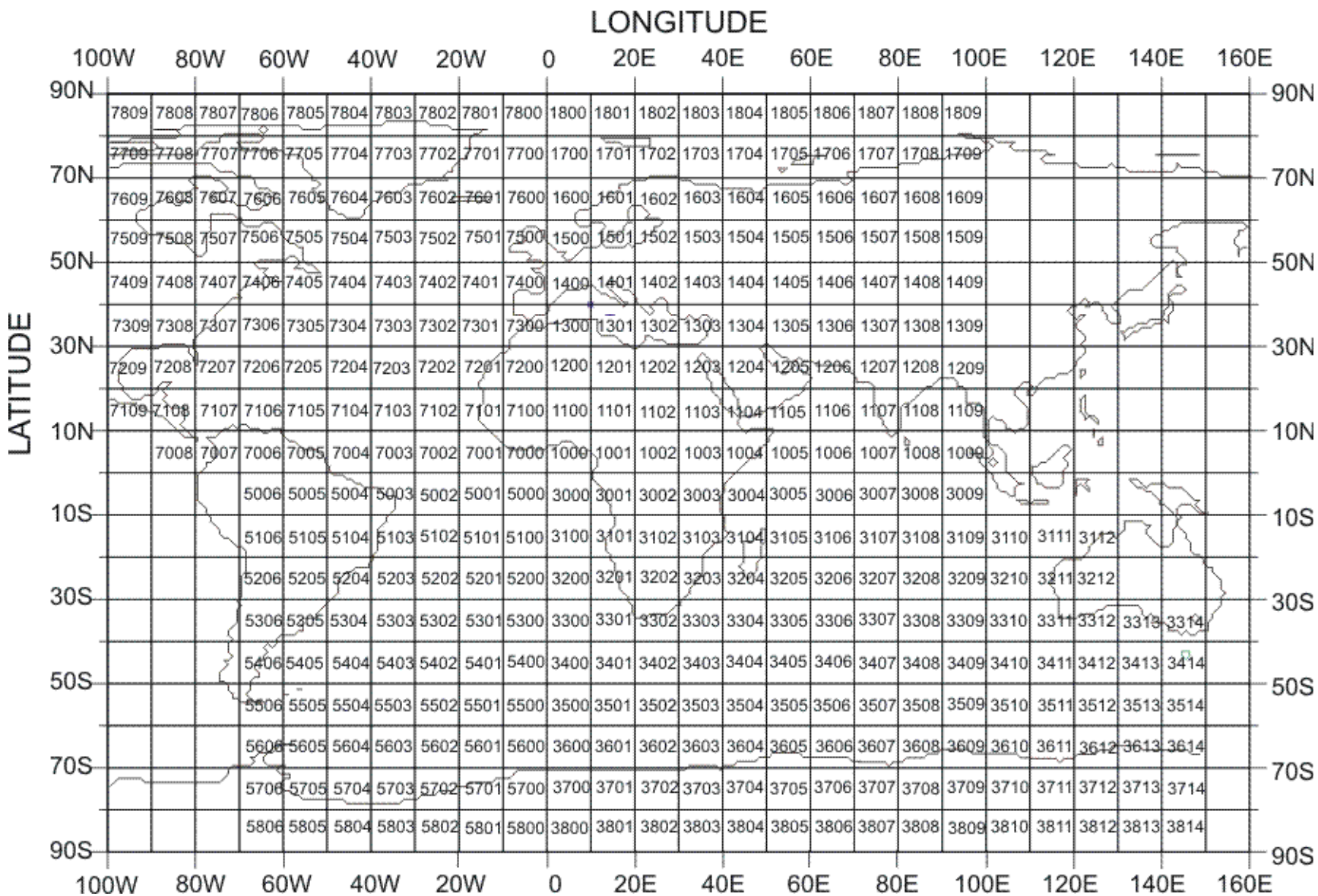
## 7I. CBV Calculation Method

CODE	DESCRIPTION
<b>Original measurement in units</b> ( simple multiplication or division by 1000 or 1000000 )	
70	Original measurement in units of "per m3".
72	Original measurement in units of "per ml".
78	Original measurement in units of "per liter".
84	Original measurement in units of "per ul"
<b>Original measurement in units of "per m2"</b> (must divide by "towing distance (in meters) to get "per m3")	
69.1	Vertical Tow: use (lower depth - upper depth) for "towing distance"
69.2	Horizontal Tow: use (tow distance) for "towing distance"
69.3	Horizontal Tow: use (tow speed * tow time) for "towing distance"
69.6	Other Tow: use (tow distance) for "towing distance"
69.7	Other Tow: use (tow speed * tow time) for "towing distance"
69.8	Other Tow: use (lower depth - upper depth) as "towing distance" * used only with careful consideration
-69	<b>Insufficient metadata available to convert "per haul" to "per m3"</b>
<b>Original measurement in units of "per haul", "per sample", or "per tow"</b> (must divide by "volume filtered (in m3) to get "per m3")	
68.1	Volume filtered used for "volume filtered"
68.2	Horizontal Tow: use (tow distance * mouth area) for "volume filtered"
68.3	Horizontal Tow: use (tow speed * tow time * mouth area) for "volume filtered"
68.4	Vertical Tow: use ((lower depth - upper depth) * mouth area) for "volume filtered"
68.5	Other Tow: use (tow distance * mouth area) for "volume filtered"
68.6	Other Tow: use (tow speed * tow time * mouth area) for "volume filtered"
68.7	Other Tow: use ((lower depth - upper depth) * mouth area) for "volume filtered" * used only with careful consideration
-68	<b>Insufficient metadata available to convert "per haul" to "per m3"</b>

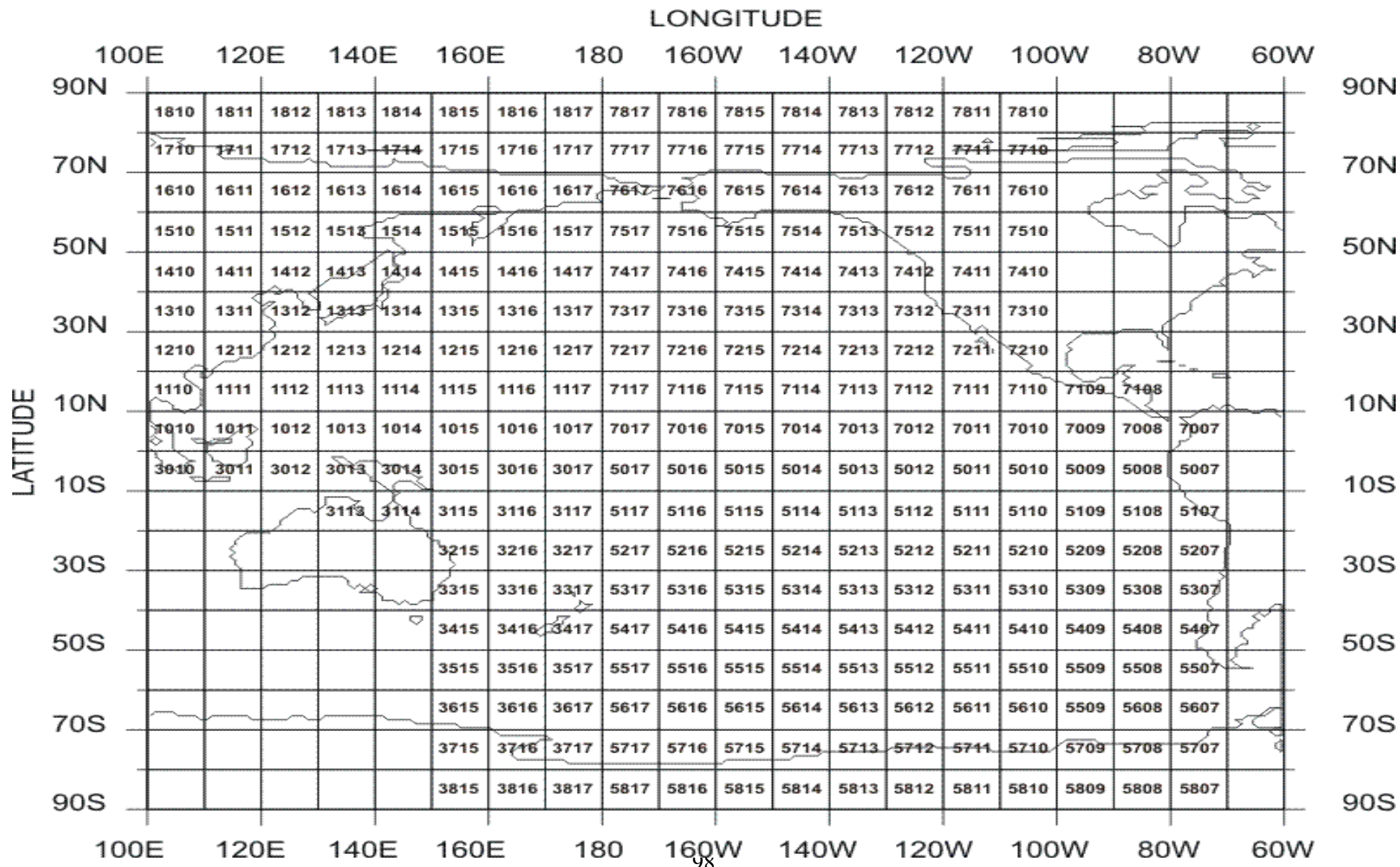
**APPENDIX 8. BIOLOGICAL GROUP CODES**

<b>CODE</b>	<b>DESCRIPTION</b>
<b>Original measurement in units</b> ( simple multiplication or division by 1000 or 1000000 )	
70	Original measurement in units of "per m3".
72	Original measurement in units of "per ml".
78	Original measurement in units of "per liter".
84	Original measurement in units of "per ul"
<b>Original measurement in units of "per m2"</b> (must divide by "towing distance (in meters) to get "per m3")	
69.1	Vertical Tow: use (lower depth - upper depth) for "towing distance"
69.2	Horizontal Tow: use (tow distance) for "towing distance"
69.3	Horizontal Tow: use (tow speed * tow time) for "towing distance"
69.6	Other Tow: use (tow distance) for "towing distance"
69.7	Other Tow: use (tow speed * tow time) for "towing distance"
69.8	Other Tow: use (lower depth - upper depth) as "towing distance" * used only with careful consideration
<b>-69</b>	<b>Insufficient metadata available to convert "per haul" to "per m3"</b>
<b>Original measurement in units of "per haul", "per sample", or "per tow"</b> (must divide by "volume filtered (in m3) to get "per m3")	
68.1	Volume filtered
68.2	Horizontal Tow: use (tow distance * mouth area) for volume filtered
68.3	Horizontal Tow: use (tow speed * tow time * mouth area) for volume filtered
68.4	Vertical Tow: use ((lower depth - upper depth) * mouth area) for volume filtered
68.5	Other Tow: use (tow distance * mouth area) for volume filtered
68.6	Other Tow: use (tow speed * tow time * mouth area) for volume filtered
68.7	Other Tow: use ((lower depth - upper depth) * mouth area) for volume filtered * used only with careful consideration
<b>-68</b>	<b>Insufficient metadata available to convert "per haul" to "per m3"</b>

APPENDIX 9A. WMO SQUARES FOR THE ATLANTIC AND INDIAN OCEANS



APPENDIX 9B. WMO SQUARES FOR THE PACIFIC OCEAN



**APPENDIX 10A. INVENTORY OF SECOND HEADERS**

ID	HEADERS	OSD	CTD	MBT	XBT	APB	MRB	PFL	DRB	SUR	UOR
1	Accession number	2121042	311943	2376206	1743590	75665	297936	22637	50549	4743	37645
2	Project	703595	125102	285489	341649	75665	215473	354		4	34092
3	Platform	1831543	259740	1991379	1516565		262786			395	37645
4	Institute	1196729	218156	1569747	9711266		89584	22258	9063	4743	34092
5	Cast/Tow Number	15902	22838								17619
7	Originator's Station #	1090004	245446	1284004	956761		297936	22283	50549	1	581
9	Ocean Weather Station			122222	163						
10	Bottom Depth	1135003	189226	601944	319419		1				5664
11	Cast Duration	75833	10960								
12	Cast Direction	888	780			37965					15184
13	High Resolution Pair	32985	32984								
14	Water Color	221811	181	12375	389						
15	Water Transparency	352872	94	12058	112						
16	Wave Direction	261293	379	20824	29189						
17	Wave Height	127043	1487	102961	15818						
18	Sea State	475862	19112	440666	19094						
19	Wind Force	415775	409	14438	1542						
20	Wave Period	91330	1017	33672	8895						
21	Wind Direction	861414	28905	668617	110088		24276	6	29393		
22	Wind Speed	440184	298905	660538	112311		24276	6	29393		
23	Barometric Pressure	591448	26401	325420	24309		18371		13677		
24	Dry Bulb Temperature	815552	29374	620122	94203		28347	1	8635		
25	Wet Bulb Temperature	216292	22313	485585	13783						
26	Weather Conditions	585163	20880	512490	7693						
27	Cloud Type	291047	14706	20846	1295						
28	Cloud Cover	540201	16832	519535	4061						
29	T-S Probe	197135	311920	2376206	1743590	75665	297936	22637	50549	3372	37632
30	Calibration depth				405245						
31	Calibration temperature			27398	666973						
32	BT recorder	12			187161		1	7983	9		
33	Depth fix	10369		5	104800		6993	7			
34	Bottom hit	14			86609						
35	BT Digitization method			4525	731026						

ID	HEADERS	OSD	CTD	MBT	XBT	APB	MRB	PFL	DRB	SUR	UOR
36	BT Digitization interval			214328	786423						
37	BT Data storage			4525	724609						
38	BT Depth correction			634890							
39	BT Temperature correction			792377	223						
40	Instrument for Reference Temperature			1237940	51950						
41	Horizontal Visibility	10808	15916	174537	67						
45	Absolute Humidity	25371	5	36							
46	Ref/Surf Temperature	24824	66	1172719	99388		24363	48	46902		
47	Sea Surface Salinity	2		2556	4						
71	Radio signal	11302		5	219110		7223				
72	XBT Wait				1238						
73	XBT Frequency				1238						
74	Oceanographic Measuring vehicle							22621	50549		37645
77	xCO <sub>2</sub> in atmosphere									20	
84	ARGOS fix code					1478					
85	ARGOS time from last fix					75665					
86	ARGOS time to next fix					75665					
87	Height of XBT Launch				40616						
88	Depth of Surface Sensor				33956						
91	Source of NODC data	629878	96512	1127251	1364681		297936	22637	50549	17	
92	UKHO Reference Number	31730									
93	Consecutive profile in a Tow segment										37645
94	WMO Identification Code						289592		50549		
95	Depth unit		380	69635							
96	Identification of originator's flags	17161	15736		246029		112102	51		17	
98	ARGOS ID Number							4563			

**APPENDIX 10B. INVENTORY OF VARIABLE-SPECIFIC SECONDS HEADERS**

<b>ID</b>	<b>VARIABLE</b>	<b>OSD</b>	<b>CTD</b>	<b>MBT</b>	<b>XBT</b>	<b>SUR</b>	<b>UOR</b>
<b>Temperature</b>							
1	Accession number	3192	19				
4	Institute	1548					
5	Instrument	11521					
6	Method	32239	8941		858		
8	Originator's units		380	45782			
16	Uncalibrated		195				
<b>Salinity</b>							
1	Accession number	4187	14				
4	Institute	1336					
5	Instrument	330					
6	Method	37713	3681				
16	Uncalibrated		49				
<b>Oxygen</b>							
1	Accession number	1406	70				
4	Institute	1171					
6	Method	24185	6342				637
8	Originator's units	62023	12143				361
16	Uncalibrated		773				
<b>Phosphate</b>							
1	Accession number	3405					
4	Institute	1380					
6	Method	28025					
8	Originator's units	43583					
<b>Silicate</b>							
1	Accession number	1932					
4	Institute	1393					
6	Method	13109					
8	Originator's units	37307					
<b>Nitrate</b>							
1	Accession number	1806					
4	Institute	1386					
6	Method	23017					
8	Originator's units	14736					
<b>pH</b>							
1	Accession number	3919					
5	Instrument					1	
6	Method	15573				1	
<b>Chlorophyll</b>							
1	Accession number	2460					
4	Institute	465					
6	Method	46701	6871			1	11209
8	Originator's units	1214					
11	Filter type/size	4805	25				
12	Incubation time	56					



ID	VARIABLE	OSD	CTD	MBT	XBT	SUR	UOR
16	Uncalibrated		43				
<b>Biochem</b>							
1	Accession number	1462					
<b>Alkalinity</b>							
1	Accession number	110					
4	Institute	369					
5	Instrument					1	
6	Method	2215				1	
8	Originator's units	4311				1	
<b>pCO<sub>2</sub></b>							
1	Institute	128					
5	Instrument					44	
6	Method	367				4	
8	Originator's units	55				35	
10	Equilibrator Type	504				1	
13	CO <sub>2</sub> sea warming	12					
15	analysis temp	239					
<b>tCO<sub>2</sub></b>							
1	Institute	312					
6	Method	1419					
8	Originator's units	4837					
<b>Nitrate + Nitrite</b>							
1	Accession number	78					
6	Method	2993					
8	Originator's units	3246					
<b>Pressure</b>							
1	Accession number	229	82				
4	Institute	1145					
5	Instrument	371					

**APPENDIX 10C. INVENTORY OF BIOLOGICAL HEADERS**

<b>ID</b>	<b>BIOLOGICAL HEADER</b>	<b>OSD</b>
1	Water volume	44431
2	Sampling duration	51867
3	Mesh size	114957
4	Type of tow	143103
5	Large removed volume	37743
6	Large plankters removed	52995
7	Gear code	137172
8	Sampler volume	1391
9	Net mouth area	98925
10	Preservation	54830
11	Weight method	1328
12	Large removed length	3303
13	Count method	4998
14	Tow distance	9445
15	Average towing speed	12981
16	Sampling start time (GMT)	121741
18	Flowmeter type	11205
19	Flowmeter calibration	6043
20	Counting institution	2393
21	Voucher institution	1123
22	Wire angle start	2309
24	Depth determination method	3029
25	Volume method	3321
30	Biology Accessions	144382

**APPENDIX 10D. INVENTORY OF TAXONOMIC HEADERS**

<b>ID</b>	<b>TAXONOMIC HEADER</b>	<b>OSD</b>
1	Parameter number	1599062
2	Upper depth	1549949
3	Lower depth	1545489
4	Biomass value	134303
5	Taxon lifestage	488283
6	Taxon sex code	99215
7	Taxon present	76207
8	Taxon trophic mode	17763
9	Taxon realm	2892
10	Taxon count	1355089
11	Taxaset Sample	82401
12	Taxon volume	3776
13	Taxon wet weight	6506
14	Taxon dry weight	578
15	Taxon ash free weight	18987
16	Taxon feature	8704
17	Taxon modifier	171924
18	Size min	43593
19	Size max	32948
20	Units	1523785
21	Taxon radius	1960
22	Taxon length	998
23	Taxon width	25
25	Taxon carbon content	2302
26	Special count method	13840
27	Comparable Biological Value	1468573
28	CBV calculation method	1481917
30	Biological Grouping Code	1598900

**APPENDIX 11A. TOTAL NUMBER OF KBYTES PER PROBE TYPE (prior to data compression)**

<b>PROBE (Instrument)</b>	<b>OBSERVED</b>	<b>STANDARD</b>
OSD	1248470	989887
CTD	5775499	139709
MBT	1275564	589620
XBT	4590187	516212
APB	70472	51207
MRB	99961	84930
PFL	33609	8953
DRB	20130	14446
UOR	370953	26105
TOTAL	13484845	2421069
SUR	90160	

**APPENDIX 11B. TOTAL NUMBER OF KBYTES BY REGION** (prior to data compression)

PROBE	OBSERVED	STANDARD	OBSERVED	STANDARD	OBSERVED	STANDARD
	North Atlantic (0°N - 90°N)		North Pacific (0°- 90°N)		Southern Hemisphere - Indian Ocean	
OSD	591708	434075	460247	395118	196515	160694
CTD	2472629	66021	1597703	45039	1705167	28649
MBT	559761	263821	531743	243983	184060	81816
XBT	1231360	185210	1444637	210367	1914190	120635
APB			70472	51207		
MRB	7109	5638	57406	50381	35446	28911
PFL	22610	5874	6495	1984	4504	1095
DRB	18673	13462	1098	761	359	223
UOR	1226	330	19602	1466	350125	24309
<i>TOTAL</i>	4905076	974431	4189403	1000306	4390366	446332
SUR	OBSERVED LEVEL ONLY - all basins - 90160					

**APPENDIX 12. SAMPLE OUTPUT FOR OBSERVED LEVEL DATA FROM WOD01/DATA/NPAC/OSD7617.gz  
STATION 67064**

A41398567064315112031934 8 744210374426193562-172271407110101201013011182205814  
 01118220291601118220291701118220291901024021 8STOCS85A3 410321510321610321721432  
 18254161177095001101233022413440142714330393172207621022060392418124421800132207  
 61411021733010319122052132201121644210372307709500110181911550852720012110000133  
 31250002101106002202206800227221480022844268400022911030023077042820100021011550  
 79118001211000013331250001511050021033022700220220680022744118160022844268400022  
 91103002307704205000002101155069459001211000013331250001511050021033011300220220  
 68002273319040022844268400022911030023077042025000021011660159668001211000013331  
 25000210220160021711010022022068002273311280022844268400022911030023077043375000  
 01911550888030012110000133312500021022016002202206800227331128002284426840002291  
 10300230770428204000210115508880300121100001333125000151102002103305350022022068  
 00227441428000228442684000229110300230770428204000210115508880300121100001333125  
 00015220430021022032002202206800227331256002284426840002291103002307704282040002  
 10115508537100121100001333125000151102002102201600220220680022733112800228442684  
 0002291103002307704282010001000033289600442309000332675002226500331205000330020  
 03328100022010003328950044230900033267000222710033112300033002003328100022025002  
 2290004423191003328620022290003311540003300200332810002205000342-123004423241003  
 32728003321170033125600222180033280500

OUTPUT FROM wodFOR.f for Station 67064

-----  
 Output from ASCII file, profile# 181  
 -----

CC cruise Latitde Longitde YYYY MM DD Time Station #levels  
 31 11203 61.930 -172.270 1934 8 7 10.37 67064 4

Number of variables in this profile: 6

Originators Cruise Code: STOCS85A

Primary Investigator: 215 ... for variable #: 0  
 Primary Investigator: 216 ... for variable #: 0  
 Primary Investigator: 217 ... for variable #: 0  
 Primary Investigator: 218 ... for variable #: 14

z	fo 1	fo 2	fo 3	fo 4	fo 6	fo 9	fo
0.0 00	8.960 (3) 00	30.900 (4) 00	6.750 (3) 00	0.650 (2) 00	20.500 (3) 00	8.100 (3) 00	
10.0 00	8.950 (3) 00	30.900 (4) 00	6.700 (3) 00	0.710 (2) 00	12.300 (3) 00	8.100 (3) 00	
25.0 00	0.900 (2) 00	31.910 (4) 00	8.620 (3) 00	0.900 (2) 00	15.400 (3) 00	8.100 (3) 00	
50.0 00	-1.230 (3) 00	32.410 (4) 00	7.280 (3) 00	1.170 (3) 00	25.600 (3) 00	8.050 (3) 00	

VARFLAG: 0 0 0 0 0 0 0

Secondary header # 1 9500110. (7)  
 Secondary header # 2 224. (3)  
 Secondary header # 3 1427. (4)  
 Secondary header # 4 393. (3)  
 Secondary header # 7 76. (2)  
 Secondary header # 10 60. (2)

Measured Variable # 3 Information Code # 8 58. (2)  
 Measured Variable # 4 Information Code # 8 29. (2)  
 Measured Variable # 6 Information Code # 8 29. (2)  
 Biological header # 2 18.000 (4)  
 Biological header # 3 76.000 (2)  
 Biological header # 4 2.000 (1)  
 Biological header # 7 103.000 (3)  
 Biological header # 9 0.050 (1)  
 Biological header # 13 11.000 (2)  
 Biological header # 16 10.370 (4)  
 Biological header # 30 9500110.000 (7)

Taxa-set 1 : Taxonomic Code [1]# 85272 (5)  
Code # 2 0.000 (1) 00  
Code # 3 25.000 (3) 00  
Code # 10 6.000 (1) 00  
Code # 20 68.000 (2) 00  
Code # 27 4.800 (2) 00  
Code # 28 68.400 (4) 00  
Code # 29 3.000 (1) 00  
Code # 30 4282010.000 (7) 00

Taxa-set 2 : Taxonomic Code [1]# 79118 (5)  
Code # 2 0.000 (1) 00  
Code # 3 25.000 (3) 00  
Code # 5 5.000 (1) 00  
Code # 10 227.000 (3) 00  
Code # 20 68.000 (2) 00  
Code # 27 181.600 (4) 00  
Code # 28 68.400 (4) 00  
Code # 29 3.000 (1) 00  
Code # 30 4205000.000 (7) 00

Taxa-set 3 : Taxonomic Code [1]# 69459 (5)  
Code # 2 0.000 (1) 00  
Code # 3 25.000 (3) 00  
Code # 5 5.000 (1) 00  
Code # 10 113.000 (3) 00  
Code # 20 68.000 (2) 00  
Code # 27 90.400 (3) 00  
Code # 28 68.400 (4) 00  
Code # 29 3.000 (1) 00  
Code # 30 4202500.000 (7) 00

Taxa-set 4 : Taxonomic Code [1]# 159668 (6)  
Code # 2 0.000 (1) 00  
Code # 3 25.000 (3) 00  
Code # 10 16.000 (2) 00  
Code # 17 1.000 (1) 00  
Code # 20 68.000 (2) 00  
Code # 27 12.800 (3) 00  
Code # 28 68.400 (4) 00  
Code # 29 3.000 (1) 00  
Code # 30 4337500.000 (7) 00

Taxa-set 5 : Taxonomic Code [1]# 88803 (5)  
Code # 2 0.000 (1) 00  
Code # 3 25.000 (3) 00  
Code # 10 16.000 (2) 00  
Code # 20 68.000 (2) 00  
Code # 27 12.800 (3) 00  
Code # 28 68.400 (4) 00  
Code # 29 3.000 (1) 00  
Code # 30 4282040.000 (7) 00

Taxa-set 6 : Taxonomic Code [1]# 88803 (5)  
Code # 2 0.000 (1) 00  
Code # 3 25.000 (3) 00  
Code # 5 2.000 (1) 00  
Code # 10 535.000 (3) 00  
Code # 20 68.000 (2) 00  
Code # 27 428.000 (4) 00  
Code # 28 68.400 (4) 00  
Code # 29 3.000 (1) 00  
Code # 30 4282040.000 (7) 00

Taxa-set 7 : Taxonomic Code [1]# 88803 (5)  
Code # 2 0.000 (1) 00

Code # 3	25.000 (3) 00
Code # 5	43.000 (2) 00
Code # 10	32.000 (2) 00
Code # 20	68.000 (2) 00
Code # 27	25.600 (3) 00
Code # 28	68.400 (4) 00
Code # 29	3.000 (1) 00
Code # 30	4282040.000 (7) 00

Taxa-set 8 : Taxonomic Code [1]# 85371 (5)

Code # 2	0.000 (1) 00
Code # 3	25.000 (3) 00
Code # 5	2.000 (1) 00
Code # 10	16.000 (2) 00
Code # 20	68.000 (2) 00
Code # 27	12.800 (3) 00
Code # 28	68.400 (4) 00
Code # 29	3.000 (1) 00
Code # 30	4282010.000 (7) 00



**APPENDIX 13. WOD01 OCL RANGES BY BASIN AS A FUNCTION OF DEPTH**

Appendix 13A: WOD01 Temperature (°C) Ranges by Basin as a Function of Depth

Depth (m)	North Atlantic		Coastal N. Atlantic		Equatorial Atlantic		Coastal Eq. Atlantic		South Atlantic		Coastal S. Atlantic		North Pacific		Coastal N. Pacific		Equatorial Pacific		Coastal Eq. Pacific	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0	-3.00	35.00	-3.00	35.00	5.00	35.00	5.00	35.00	0.00	32.00	-3.00	35.00	-3.00	35.00	-3.00	35.00	5.00	35.00	5.00	35.00
10	-3.00	35.00	-3.00	35.00	5.00	35.00	5.00	35.00	0.00	32.00	-3.00	35.00	-3.00	35.00	-3.00	35.00	5.00	35.00	5.00	35.00
20	-3.00	32.00	-3.00	35.00	5.00	35.00	5.00	35.00	0.00	32.00	-3.00	35.00	-3.00	35.00	-3.00	35.00	5.00	35.00	5.00	35.00
30	-3.00	32.00	-3.00	35.00	5.00	35.00	5.00	35.00	0.00	32.00	-3.00	35.00	-3.00	35.00	-3.00	35.00	5.00	35.00	5.00	35.00
50	-3.00	32.00	-3.00	35.00	5.00	35.00	5.00	35.00	0.00	32.00	-3.00	35.00	-3.00	35.00	-3.00	35.00	5.00	35.00	5.00	35.00
75	-2.00	30.00	-3.00	35.00	5.00	35.00	5.00	35.00	0.00	32.00	-3.00	35.00	-3.00	35.00	-3.00	35.00	5.00	35.00	5.00	35.00
100	-2.00	30.00	-3.00	30.00	5.00	30.00	5.00	30.00	0.00	32.00	-3.00	30.00	-3.00	30.00	-3.00	30.00	5.00	30.00	5.00	30.00
125	-2.00	28.00	-3.00	30.00	5.00	30.00	5.00	30.00	-1.50	30.00	-3.00	30.00	-3.00	30.00	-3.00	30.00	3.00	30.00	3.00	30.00
150	-2.00	28.00	-3.00	30.00	5.00	30.00	5.00	30.00	-1.50	30.00	-3.00	30.00	-3.00	30.00	-3.00	30.00	3.00	30.00	3.00	30.00
200	-2.00	28.00	-3.00	30.00	5.00	30.00	5.00	30.00	-1.50	30.00	-3.00	30.00	-3.00	30.00	-3.00	30.00	3.00	30.00	3.00	30.00
250	-1.70	28.00	-3.00	28.00	5.00	28.00	0.00	28.00	-1.50	28.00	-3.00	28.00	-3.00	28.00	-3.00	28.00	3.00	28.00	3.00	28.00
300	-1.70	28.00	-3.00	28.00	3.00	28.00	0.00	28.00	-1.50	28.00	-3.00	28.00	-3.00	28.00	-3.00	28.00	3.00	28.00	3.00	28.00
400	-1.50	20.00	-3.00	28.00	3.00	28.00	0.00	28.00	-1.50	28.00	-3.00	28.00	-3.00	28.00	-3.00	28.00	3.00	28.00	3.00	28.00
500	-1.50	20.00	-3.00	28.00	3.00	28.00	0.00	28.00	-1.50	28.00	-3.00	28.00	-3.00	28.00	-3.00	28.00	0.00	28.00	0.00	28.00
600	-1.50	20.00	-3.00	20.00	3.00	20.00	0.00	20.00	-1.50	20.00	-3.00	20.00	-3.00	20.00	-3.00	20.00	0.00	20.00	0.00	20.00
700	-1.50	20.00	-3.00	20.00	3.00	20.00	0.00	20.00	-1.50	20.00	-3.00	20.00	-3.00	20.00	-3.00	20.00	0.00	20.00	0.00	20.00
800	-1.50	20.00	-3.00	20.00	-0.50	20.00	0.00	20.00	-1.50	20.00	-3.00	20.00	-3.00	20.00	-3.00	20.00	0.00	20.00	0.00	20.00
900	-1.50	20.00	-3.00	20.00	-0.50	20.00	0.00	20.00	-1.50	20.00	-3.00	20.00	-3.00	20.00	-3.00	20.00	0.00	20.00	0.00	20.00
1000	-1.50	18.00	-3.00	18.00	-0.50	18.00	0.00	18.00	-1.50	18.00	-3.00	18.00	-3.00	18.00	-3.00	18.00	0.00	18.00	0.00	18.00
1100	-1.50	18.00	-3.00	18.00	-0.50	18.00	0.00	18.00	-1.50	18.00	-3.00	18.00	-3.00	18.00	-3.00	18.00	0.00	18.00	0.00	18.00
1200	-1.50	18.00	-3.00	18.00	-0.50	18.00	0.00	18.00	-1.50	18.00	-3.00	18.00	-3.00	18.00	-3.00	18.00	0.00	18.00	0.00	18.00
1300	-1.50	18.00	-3.00	18.00	-0.50	18.00	0.00	18.00	-1.50	18.00	-3.00	18.00	-3.00	18.00	-3.00	18.00	0.00	18.00	0.00	18.00
1400	-1.50	18.00	-3.00	18.00	-0.50	18.00	0.00	18.00	-1.50	18.00	-3.00	18.00	-3.00	18.00	-3.00	18.00	0.00	18.00	0.00	18.00
1500	-1.50	18.00	-3.00	18.00	-0.50	18.00	0.00	18.00	-1.50	18.00	-3.00	18.00	-3.00	18.00	-3.00	18.00	0.00	18.00	0.00	18.00
1750	-1.50	13.00	-3.00	13.00	-0.50	13.00	0.00	13.00	-1.50	13.00	-3.00	13.00	-3.00	13.00	-3.00	13.00	0.00	13.00	0.00	13.00
2000	-1.50	13.00	-3.00	13.00	-0.50	13.00	0.00	13.00	-1.50	13.00	-3.00	13.00	-3.00	13.00	-3.00	13.00	0.00	13.00	0.00	13.00
2500	-1.50	13.00	-3.00	13.00	-0.50	13.00	-1.00	13.00	-1.50	13.00	-3.00	13.00	-3.00	13.00	-3.00	13.00	0.00	13.00	0.00	13.00
3000	-1.50	7.00	-3.00	7.00	-0.50	7.00	-1.00	7.00	-1.50	7.00	-3.00	7.00	-3.00	7.00	-3.00	7.00	0.00	7.00	0.00	7.00
3500	-1.50	7.00	-3.00	7.00	-0.50	7.00	-1.00	7.00	-1.50	7.00	-3.00	7.00	-3.00	7.00	-3.00	7.00	0.00	7.00	0.00	7.00
4000	-1.50	7.00	-1.50	7.00	-0.50	7.00	-1.00	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00
4500	-1.50	7.00	-1.50	7.00	-0.50	7.00	-1.00	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00
5000	-1.50	7.00	-1.50	7.00	-0.50	7.00	-1.00	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00
5500+	-1.50	5.00	-1.50	3.00	-0.50	3.00	-1.00	3.00	-1.50	3.00	-1.50	3.00	-1.50	3.00	-1.50	3.00	-1.50	3.00	-1.50	3.00

Appendix 13A (cont.): WOD01 Temperature (°C) Ranges by Basin as a Function of Depth

Depth (m)	South Pacific		Coastal S. Pacific		North Indian		Coastal N. Indian		Equatorial Indian		Coastal Eq. Indian		South Indian		Coastal S. Indian		Antarctic		Arctic Ocean	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0	-2.00	32.00	-3.00	35.00	3.00	35.00	-3.00	35.00	5.00	35.00	5.00	35.00	0.00	35.00	-3.00	35.00	-3.00	15.00	-3.00	20.00
10	-2.00	32.00	-3.00	35.00	3.00	35.00	-3.00	35.00	5.00	35.00	5.00	35.00	0.00	35.00	-3.00	35.00	-3.00	15.00	-3.00	20.00
20	-2.00	32.00	-3.00	35.00	3.00	35.00	-3.00	35.00	5.00	35.00	5.00	35.00	0.00	35.00	-3.00	35.00	-3.00	15.00	-3.00	20.00
30	-2.00	32.00	-3.00	35.00	3.00	35.00	-3.00	35.00	5.00	35.00	5.00	35.00	0.00	35.00	-3.00	35.00	-3.00	15.00	-3.00	14.00
50	-2.00	32.00	-3.00	35.00	3.00	35.00	-3.00	35.00	5.00	35.00	5.00	35.00	0.00	35.00	-3.00	35.00	-3.00	15.00	-3.00	14.00
75	-2.00	32.00	-3.00	35.00	3.00	35.00	-3.00	35.00	5.00	35.00	5.00	35.00	0.00	35.00	-3.00	35.00	-3.00	15.00	-3.00	14.00
100	-2.00	30.00	-3.00	30.00	3.00	30.00	-3.00	30.00	5.00	30.00	5.00	30.00	0.00	30.00	-3.00	30.00	-3.00	15.00	-3.00	14.00
125	-2.00	30.00	-3.00	30.00	3.00	30.00	-3.00	30.00	3.00	30.00	3.00	30.00	0.00	30.00	-3.00	30.00	-3.00	15.00	-3.00	14.00
150	-2.00	30.00	-3.00	30.00	3.00	30.00	-3.00	30.00	3.00	30.00	3.00	30.00	0.00	30.00	-3.00	30.00	-3.00	15.00	-3.00	10.00
200	-2.00	30.00	-3.00	30.00	3.00	30.00	-3.00	30.00	3.00	30.00	3.00	30.00	0.00	30.00	-3.00	30.00	-3.00	15.00	-3.00	10.00
250	-2.00	28.00	-3.00	28.00	3.00	28.00	-3.00	28.00	3.00	28.00	3.00	28.00	0.00	28.00	-3.00	28.00	-3.00	15.00	-3.00	10.00
300	-2.00	28.00	-3.00	28.00	3.00	28.00	-3.00	28.00	3.00	28.00	3.00	28.00	0.00	28.00	-3.00	28.00	-3.00	15.00	-3.00	10.00
400	-2.00	28.00	-3.00	28.00	3.00	28.00	-3.00	28.00	3.00	28.00	3.00	28.00	0.00	28.00	-3.00	28.00	-3.00	15.00	-3.00	10.00
500	-2.00	28.00	-3.00	28.00	3.00	28.00	-3.00	28.00	0.00	28.00	0.00	28.00	0.00	28.00	-3.00	28.00	-3.00	15.00	-3.00	10.00
600	-2.00	20.00	-3.00	20.00	0.00	20.00	-3.00	20.00	0.00	20.00	0.00	20.00	0.00	20.00	-3.00	20.00	-3.00	10.00	-3.00	9.00
700	-2.00	20.00	-3.00	20.00	0.00	20.00	-3.00	20.00	0.00	20.00	0.00	20.00	0.00	20.00	-3.00	20.00	-3.00	10.00	-3.00	9.00
800	-2.00	20.00	-3.00	20.00	0.00	20.00	-3.00	20.00	0.00	20.00	0.00	20.00	0.00	20.00	-3.00	20.00	-3.00	10.00	-3.00	9.00
900	-2.00	20.00	-3.00	20.00	0.00	20.00	-3.00	20.00	0.00	20.00	0.00	20.00	0.00	20.00	-3.00	20.00	-3.00	10.00	-3.00	9.00
1000	-2.00	18.00	-3.00	18.00	0.00	18.00	-3.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00	-3.00	18.00	-3.00	10.00	-3.00	8.00
1100	-2.00	18.00	-3.00	18.00	0.00	18.00	-3.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00	-3.00	18.00	-3.00	10.00	-3.00	8.00
1200	-2.00	18.00	-3.00	18.00	0.00	18.00	-3.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00	-3.00	18.00	-3.00	7.00	-3.00	8.00
1300	-2.00	18.00	-3.00	18.00	0.00	18.00	-3.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00	-3.00	18.00	-3.00	7.00	-3.00	8.00
1400	-2.00	18.00	-3.00	18.00	0.00	18.00	-3.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00	-3.00	18.00	-3.00	7.00	-3.00	8.00
1500	-2.00	18.00	-3.00	18.00	0.00	18.00	-3.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00	-3.00	18.00	-3.00	7.00	-3.00	8.00
1750	-2.00	13.00	-3.00	13.00	0.00	13.00	-3.00	13.00	0.00	13.00	0.00	13.00	0.00	13.00	-3.00	13.00	-3.00	7.00	-3.00	8.00
2000	-2.00	13.00	-3.00	13.00	0.00	13.00	-3.00	13.00	0.00	13.00	0.00	13.00	0.00	13.00	-3.00	13.00	-3.00	7.00	-3.00	8.00
2500	-2.00	13.00	-3.00	13.00	0.00	13.00	-3.00	13.00	0.00	13.00	0.00	13.00	0.00	13.00	-3.00	13.00	-3.00	3.00	-3.00	8.00
3000	-2.00	7.00	-3.00	7.00	0.00	7.00	-3.00	7.00	0.00	7.00	0.00	7.00	0.00	7.00	-3.00	7.00	-3.00	3.00	-3.00	7.00
3500	-2.00	7.00	-3.00	7.00	0.00	7.00	-3.00	7.00	0.00	7.00	0.00	7.00	0.00	7.00	-3.00	7.00	-3.00	3.00	-3.00	7.00
4000	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	3.00	-1.50	7.00
4500	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	3.00	-1.50	7.00
5000	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	7.00	-1.50	3.00	-1.50	7.00
5500+	-1.50	3.00	-1.50	3.00	-1.50	3.00	-1.50	3.00	-1.50	3.00	-1.50	3.00	-1.50	3.00	-1.50	3.00	-1.50	3.00	-1.50	3.00

Appendix 13A (cont.): WOD01 Temperature (°C) Ranges by Basin as a Function of Depth

Depth (m)	Mediterranean		Black Sea		Baltic Sea		Persian Gulf		Red Sea		Sulu Sea	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0	0.00	34.00	0.00	27.00	-2.00	25.00	-3.00	35.00	14.00	35.00	0.00	35.00
10	0.00	34.00	0.00	27.00	-2.00	25.00	-3.00	35.00	14.00	35.00	0.00	35.00
20	0.00	34.00	0.00	27.00	-2.00	25.00	-3.00	35.00	14.00	34.00	0.00	35.00
30	3.00	30.00	0.00	27.00	-2.00	25.00	-3.00	35.00	14.00	34.00	0.00	35.00
50	3.00	30.00	3.00	30.00	-2.00	25.00	-3.00	35.00	13.00	32.00	0.00	35.00
75	3.00	28.00	3.00	30.00	-2.00	25.00	-3.00	35.00	13.00	30.00	0.00	35.00
100	3.00	26.00	3.00	30.00	-2.00	25.00	-3.00	32.00	13.00	30.00	0.00	30.00
125	3.00	26.00	3.00	30.00	-2.00	25.00	-3.00	32.00	13.00	30.00	0.00	30.00
150	3.00	26.00	5.00	30.00	-2.00	25.00	-3.00	32.00	13.00	30.00	0.00	30.00
200	3.00	22.00	5.00	30.00	-2.00	16.00	-3.00	32.00	13.00	28.00	0.00	30.00
250	3.00	22.00	5.00	25.00	-2.00	16.00	-3.00	32.00	13.00	28.00	0.00	28.00
300	3.00	22.00	5.00	25.00	-2.00	16.00	-3.00	32.00	10.00	28.00	0.00	28.00
400	3.00	20.00	5.00	20.00	-2.00	16.00	-3.00	32.00	10.00	28.00	0.00	28.00
500	3.00	20.00	5.00	20.00	-2.00	16.00	-3.00	32.00	10.00	28.00	0.00	28.00
600	3.00	20.00	5.00	17.00	-2.00	16.00	-3.00	32.00	10.00	26.00	0.00	20.00
700	3.00	20.00	5.00	17.00	-2.00	16.00	-3.00	32.00	10.00	26.00	0.00	20.00
800	3.00	20.00	5.00	17.00	-2.00	16.00	-3.00	32.00	10.00	26.00	0.00	20.00
900	3.00	20.00	5.00	16.00	-2.00	16.00	-3.00	32.00	10.00	26.00	0.00	20.00
1000	3.00	20.00	5.00	16.00	-2.00	16.00	-3.00	32.00	10.00	23.00	0.00	18.00
1100	3.00	20.00	5.00	16.00	-2.00	16.00	-3.00	32.00	10.00	23.00	0.00	18.00
1200	3.00	18.00	5.00	16.00	-2.00	16.00	-3.00	32.00	10.00	23.00	0.00	18.00
1300	3.00	18.00	5.00	16.00	-2.00	16.00	-3.00	32.00	10.00	23.00	0.00	18.00
1400	3.00	18.00	5.00	16.00	-2.00	16.00	-3.00	32.00	10.00	23.00	0.00	18.00
1500	3.00	18.00	5.00	16.00	-2.00	16.00	-3.00	32.00	10.00	23.00	0.00	18.00
1750	3.00	16.00	5.00	16.00	-2.00	16.00	-3.00	32.00	10.00	34.00	0.00	13.00
2000	3.00	16.00	5.00	16.00	-2.00	16.00	-3.00	32.00	10.00	34.00	0.00	13.00
2500	3.00	16.00	5.00	16.00	-2.00	16.00	-3.00	32.00	10.00	34.00	0.00	13.00
3000	3.00	16.00	5.00	16.00	-2.00	16.00	-3.00	13.00	10.00	34.00	0.00	12.00
3500	3.00	16.00	5.00	16.00	-2.00	16.00	-3.00	13.00	10.00	20.00	0.00	12.00
4000	3.00	16.00	5.00	16.00	-2.00	16.00	-1.50	7.00	10.00	20.00	-1.50	12.00
4500	3.00	16.00	5.00	16.00	-2.00	16.00	-1.50	7.00	10.00	20.00	-1.50	12.00
5000	3.00	16.00	5.00	16.00	-2.00	16.00	-1.50	7.00	10.00	20.00	-1.50	12.00
5500+	3.00	16.00	5.00	16.00	-2.00	16.00	-1.50	7.00	10.00	20.00	-1.50	12.00

Appendix 13B: WOD01 Salinity (PSS) Ranges by Basin as a Function of Depth

Depth (m)	North Atlantic		Coastal N. Atlantic		Equatorial Atlantic		Coastal Eq. Atlantic		South Atlantic		Coastal S. Atlantic		North Pacific		Coastal N. Pacific		Equatorial Pacific		Coastal Eq. Pacific	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0	0.00	40.00	0.00	40.00	0.00	40.00	0.00	40.00	0.00	40.00	0.00	40.00	0.00	40.00	0.00	40.00	0.00	40.00	0.00	40.00
10	27.00	38.20	0.00	40.00	20.00	37.60	0.00	40.00	28.00	38.50	0.00	40.00	25.00	37.00	0.00	40.00	28.60	37.00	0.00	40.00
20	28.30	38.20	0.00	40.00	28.00	37.40	0.00	40.00	28.00	38.00	0.00	40.00	30.00	36.50	0.00	40.00	29.00	37.00	0.00	40.00
30	28.50	38.20	0.00	40.00	31.00	37.40	0.00	40.00	30.60	38.00	0.00	40.00	30.00	36.50	0.00	40.00	29.60	37.00	0.00	40.00
50	28.90	38.00	20.00	40.00	31.40	37.40	20.00	40.00	31.00	38.00	20.00	40.00	31.00	36.00	20.00	40.00	30.20	37.00	20.00	40.00
75	28.90	38.00	20.00	40.00	31.80	37.40	20.00	40.00	31.20	38.00	20.00	40.00	31.00	36.00	20.00	40.00	31.00	37.00	20.00	40.00
100	29.40	38.00	20.00	40.00	31.80	37.40	20.00	40.00	31.40	38.00	20.00	40.00	31.50	36.00	26.00	40.00	31.50	37.00	30.00	40.00
125	29.40	38.00	20.00	40.00	31.80	37.40	20.00	40.00	31.40	37.80	20.00	40.00	31.50	36.00	26.00	40.00	31.50	36.80	30.00	40.00
150	29.60	37.60	20.00	40.00	31.80	37.20	20.00	40.00	31.40	37.40	20.00	40.00	32.00	35.80	26.00	40.00	31.50	36.80	30.00	40.00
200	29.90	37.40	20.00	40.00	31.80	37.00	30.00	40.00	31.40	36.60	30.00	40.00	32.00	35.80	26.00	40.00	31.50	36.70	30.00	40.00
250	30.30	37.10	30.00	40.00	32.00	37.00	30.00	40.00	31.40	36.20	30.00	40.00	32.00	35.80	26.00	40.00	31.80	36.30	30.00	40.00
300	30.80	36.80	30.00	40.00	32.20	36.80	30.00	40.00	31.60	36.00	30.00	40.00	32.00	35.80	30.00	40.00	31.80	36.30	30.00	40.00
400	30.80	36.70	33.00	40.00	32.40	36.60	33.00	40.00	32.00	35.80	33.00	40.00	32.20	35.50	30.00	40.00	31.80	36.20	33.00	40.00
500	31.20	36.60	33.00	40.00	33.70	36.50	33.00	40.00	34.00	35.50	33.00	40.00	32.40	35.25	30.50	40.00	32.75	36.10	33.00	40.00
600	32.20	36.60	33.00	40.00	33.70	36.00	33.00	40.00	34.10	35.10	33.00	40.00	32.60	35.25	30.50	40.00	33.00	36.00	33.00	40.00
700	33.00	36.60	33.00	40.00	33.60	35.80	33.00	40.00	34.10	35.10	33.00	40.00	32.60	35.25	32.00	40.00	33.00	35.90	33.00	40.00
800	33.00	36.60	33.00	40.00	33.60	35.60	33.00	40.00	34.10	35.00	33.00	40.00	33.20	35.25	33.00	40.00	33.75	35.80	33.00	40.00
900	33.00	36.60	33.00	40.00	33.60	35.60	33.00	40.00	34.10	34.90	33.00	40.00	33.60	35.25	33.00	40.00	33.80	35.50	33.00	40.00
1000	33.00	36.60	33.00	40.00	33.60	35.40	33.00	40.00	34.20	34.90	33.00	40.00	33.70	35.15	33.00	40.00	34.20	35.30	33.00	40.00
1100	33.00	36.60	33.00	38.00	33.60	35.40	33.00	38.00	34.20	34.90	33.00	38.00	33.70	35.15	33.00	38.00	34.20	35.30	33.00	38.00
1200	33.00	36.60	33.00	38.00	33.60	35.40	33.00	38.00	34.20	34.90	33.00	38.00	33.70	35.15	33.00	38.00	34.20	35.30	33.00	38.00
1300	33.00	36.60	33.00	38.00	33.60	35.40	33.00	38.00	34.30	34.90	33.00	38.00	33.70	35.15	33.00	38.00	34.20	35.30	33.00	38.00
1400	33.00	36.60	33.00	38.00	33.60	35.40	33.00	38.00	34.30	35.00	33.00	38.00	33.70	35.15	33.00	38.00	34.20	35.20	33.00	38.00
1500	33.00	36.60	33.00	38.00	33.80	35.40	33.00	38.00	34.40	35.00	33.00	38.00	33.80	35.00	33.00	38.00	34.40	35.20	33.00	38.00
1750	33.00	36.60	33.00	38.00	34.60	35.20	33.00	38.00	34.50	35.00	33.00	38.00	33.80	35.00	33.00	38.00	34.40	35.20	33.00	38.00
2000	33.00	36.00	33.00	38.00	34.70	35.15	33.00	38.00	34.60	35.00	33.00	38.00	34.00	35.00	33.00	38.00	34.40	35.10	33.00	38.00
2500	34.70	35.50	33.00	35.50	34.80	35.10	33.00	35.50	34.60	35.00	33.00	35.50	34.00	35.00	33.00	35.50	34.40	35.10	33.00	35.50
3000	34.80	35.40	33.00	35.50	34.80	35.10	33.00	35.50	34.66	35.00	33.00	35.50	34.00	35.00	33.00	35.50	34.20	35.10	33.00	35.50
3500	34.80	35.40	33.00	35.50	34.70	35.10	33.00	35.50	34.64	35.00	33.00	35.50	34.00	35.00	33.00	35.50	34.00	35.10	33.00	35.50
4000	34.80	35.40	33.00	35.50	34.50	35.10	33.00	35.50	34.62	35.00	33.00	35.50	34.00	35.00	33.00	35.50	34.00	35.50	33.00	35.50
4500	34.80	35.40	33.00	35.50	34.50	35.10	33.00	35.50	34.62	35.00	33.00	35.50	34.00	35.00	33.00	35.50	34.00	35.50	33.00	35.50
5000	34.80	35.40	33.00	35.50	34.50	35.10	33.00	35.50	34.62	35.00	33.00	35.50	34.00	35.00	33.00	35.50	34.00	35.50	33.00	35.50
5500+	34.80	35.40	34.30	35.50	34.50	35.10	34.30	35.50	34.62	35.00	34.30	35.50	34.00	35.00	34.30	35.50	34.00	35.50	34.30	35.50

Appendix 13B (cont.): WOD01 Salinity (PSS) Ranges by Basin as a Function of Depth

Depth (m)	South Pacific		Coastal S. Pacific		North Indian		Coastal N. Indian		Equatorial Indian		Coastal Eq. Indian		South Indian		Coastal S. Indian		Antarctic		Arctic Ocean	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0	0.00	40.00	0.00	40.00	0.00	40.00	0.00	40.00	0.00	40.00	0.00	40.00	0.00	40.00	0.00	40.00	0.00	40.00	0.00	40.00
10	28.00	37.00	0.00	40.00	28.00	38.00	0.00	40.00	26.00	38.00	0.00	40.00	30.00	36.40	0.00	40.00	26.00	36.75	0.00	40.00
20	28.00	37.00	0.00	40.00	29.80	38.00	0.00	40.00	31.00	37.40	0.00	40.00	31.40	36.40	0.00	40.00	28.00	36.75	0.00	40.00
30	29.00	37.00	0.00	40.00	30.20	38.00	0.00	40.00	31.20	37.00	0.00	40.00	31.60	36.40	0.00	40.00	29.00	36.50	0.00	40.00
50	30.00	36.70	20.00	40.00	31.20	38.00	20.00	40.00	31.60	36.80	20.00	40.00	31.90	36.30	20.00	40.00	30.00	36.50	0.00	40.00
75	31.00	36.70	20.00	40.00	32.20	38.00	20.00	40.00	31.60	36.80	20.00	40.00	32.00	36.30	20.00	40.00	30.50	36.50	0.00	40.00
100	31.00	36.70	30.00	40.00	32.40	37.00	30.00	40.00	31.80	36.60	20.00	40.00	32.00	36.20	30.00	40.00	30.50	36.50	26.00	38.00
125	31.00	36.70	30.00	40.00	32.40	37.00	30.00	40.00	31.80	36.50	20.00	40.00	32.00	36.20	30.00	40.00	30.50	36.50	26.00	38.00
150	31.00	36.70	30.00	40.00	32.60	37.00	30.00	40.00	31.80	36.40	20.00	40.00	32.00	36.10	30.00	40.00	31.00	36.50	26.00	38.00
200	31.20	36.00	30.00	40.00	33.40	37.00	30.00	40.00	31.80	36.40	30.00	40.00	32.00	36.00	30.00	40.00	31.00	36.25	26.00	38.00
250	31.50	36.00	30.00	40.00	33.60	37.00	30.00	40.00	32.00	36.30	30.00	40.00	32.20	36.00	30.00	40.00	31.00	36.00	26.00	38.00
300	32.00	36.00	30.00	40.00	33.70	37.00	30.00	40.00	32.00	36.20	30.00	40.00	32.20	35.80	30.00	40.00	31.00	36.00	30.00	38.00
400	32.00	36.00	33.00	40.00	34.00	36.50	33.00	40.00	32.40	36.20	33.00	40.00	32.40	35.60	33.00	40.00	31.50	35.75	33.00	37.00
500	34.20	35.50	33.00	40.00	34.60	36.50	33.00	40.00	34.30	36.00	33.00	40.00	34.10	35.40	33.00	40.00	32.00	35.50	33.00	37.00
600	34.20	35.25	33.00	40.00	34.85	36.30	33.00	40.00	34.40	36.00	33.00	40.00	34.15	35.30	33.00	40.00	33.00	35.50	33.00	37.00
700	34.20	35.00	33.00	40.00	34.85	36.30	33.00	40.00	34.40	35.75	33.00	40.00	34.20	35.20	33.00	40.00	33.80	35.25	33.00	37.00
800	34.20	35.00	33.00	40.00	34.85	36.20	33.00	40.00	34.45	35.75	33.00	40.00	34.20	35.00	33.00	40.00	33.80	35.00	33.00	37.00
900	34.20	35.00	33.00	40.00	34.85	36.00	33.00	40.00	34.45	35.75	33.00	40.00	34.20	35.00	33.00	40.00	34.00	35.00	33.00	37.00
1000	34.20	35.00	33.00	40.00	34.85	36.00	33.00	40.00	34.50	35.75	33.00	40.00	34.25	34.90	33.00	40.00	34.00	35.00	33.00	37.00
1100	34.30	35.00	33.00	38.00	34.80	35.90	33.00	38.00	34.50	35.75	33.00	38.00	34.25	34.90	33.00	38.00	34.00	35.00	33.00	36.00
1200	34.30	34.70	33.00	38.00	34.80	35.80	33.00	38.00	34.50	35.75	33.00	38.00	34.25	34.90	33.00	38.00	34.00	35.00	33.00	36.00
1300	34.30	34.70	33.00	38.00	34.80	35.60	33.00	38.00	34.55	35.60	33.00	38.00	34.30	34.90	33.00	38.00	34.00	34.90	33.00	36.00
1400	34.40	34.70	33.00	38.00	34.80	35.60	33.00	38.00	34.55	35.30	33.00	38.00	34.30	34.90	33.00	38.00	34.30	34.90	33.00	36.00
1500	34.40	34.80	33.00	38.00	34.75	35.60	33.00	38.00	34.55	35.20	33.00	38.00	34.35	34.90	33.00	38.00	34.30	34.90	33.00	36.00
1750	34.40	34.80	33.00	38.00	34.75	35.50	33.00	38.00	34.57	35.10	33.00	38.00	34.45	34.90	33.00	38.00	34.40	34.90	33.00	36.00
2000	34.40	34.80	33.00	38.00	34.70	35.40	33.00	38.00	34.60	35.00	33.00	38.00	34.55	34.90	33.00	38.00	34.40	34.90	33.00	36.00
2500	34.50	34.80	33.00	35.50	34.65	35.40	33.00	35.50	34.60	35.00	33.00	35.50	34.60	34.90	33.00	35.50	34.40	34.90	33.00	35.50
3000	34.50	34.80	33.00	35.50	34.65	35.40	33.00	35.50	34.60	35.00	33.00	35.50	34.60	34.90	33.00	35.50	34.40	34.90	33.00	35.50
3500	34.60	34.80	33.00	35.50	34.60	35.40	33.00	35.50	34.60	35.00	33.00	35.50	34.60	34.90	33.00	35.50	34.40	34.90	33.00	35.50
4000	34.60	34.80	33.00	35.50	34.60	35.40	33.00	35.50	34.60	35.00	33.00	35.50	34.60	34.90	33.00	35.50	34.40	34.90	33.00	35.50
4500	34.60	34.80	33.00	35.50	34.60	35.40	33.00	35.50	34.60	35.00	33.00	35.50	34.60	34.90	33.00	35.50	34.40	34.90	33.00	35.50
5000	34.60	34.80	33.00	35.50	34.60	35.40	33.00	35.50	34.60	35.00	33.00	35.50	34.60	34.90	33.00	35.50	34.40	34.90	33.00	35.50
5500+	34.60	34.80	34.30	35.50	34.60	35.40	34.30	35.50	34.60	35.00	34.30	35.50	34.60	34.90	34.30	35.50	34.40	34.90	34.30	35.50

Appendix 13B (cont.): WOD01 Salinity (PSS) Ranges by Basin as a Function of Depth

Depth (m)	Mediterranean		Black Sea		Baltic Sea		Persian Gulf		Red Sea		Sulu Sea	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0	0.00	40.00	0.00	25.00	0.00	35.00	0.00	42.00	0.00	44.00	0.00	40.00
10	0.00	40.00	0.00	25.00	0.00	35.00	0.00	42.00	0.00	44.00	0.00	40.00
20	0.00	40.00	0.00	25.00	0.00	35.00	0.00	42.00	0.00	44.00	0.00	40.00
30	0.00	40.00	0.00	25.00	0.00	35.00	0.00	42.00	0.00	44.00	0.00	40.00
50	12.00	40.00	10.00	40.00	0.00	35.00	20.00	42.00	20.00	43.00	20.00	40.00
75	12.00	40.00	10.00	40.00	0.00	35.00	20.00	42.00	20.00	43.00	20.00	40.00
100	31.00	40.00	12.00	40.00	0.00	35.00	30.00	42.00	30.00	43.00	30.00	40.00
125	31.00	40.00	12.00	40.00	0.00	35.00	30.00	42.00	30.00	43.00	30.00	40.00
150	31.00	40.00	12.00	40.00	0.00	35.00	30.00	42.00	30.00	43.00	30.00	40.00
200	31.00	40.00	12.00	40.00	1.00	25.00	30.00	42.00	30.00	43.00	30.00	40.00
250	31.00	40.00	12.00	40.00	1.00	25.00	30.00	42.00	30.00	43.00	30.00	40.00
300	31.00	40.00	12.00	35.00	1.00	25.00	30.00	42.00	30.00	43.00	30.00	40.00
400	31.00	40.00	12.00	33.00	1.00	25.00	33.00	42.00	33.00	43.00	33.00	40.00
500	31.00	40.00	12.00	30.00	1.00	25.00	33.00	42.00	33.00	43.00	33.00	40.00
600	33.00	40.00	12.00	30.00	1.00	25.00	33.00	42.00	33.00	43.00	33.00	40.00
700	33.00	40.00	15.00	30.00	1.00	25.00	33.00	42.00	33.00	43.00	33.00	40.00
800	33.00	40.00	15.00	28.00	1.00	25.00	33.00	42.00	33.00	43.00	33.00	40.00
900	33.00	40.00	15.00	28.00	1.00	25.00	33.00	42.00	33.00	43.00	33.00	40.00
1000	33.00	40.00	15.00	28.00	1.00	25.00	33.00	42.00	33.00	43.00	33.00	40.00
1100	33.00	40.00	18.00	25.00	1.00	25.00	33.00	42.00	33.00	43.00	33.00	38.00
1200	33.00	40.00	18.00	25.00	1.00	25.00	33.00	42.00	33.00	43.00	33.00	38.00
1300	33.00	40.00	18.00	25.00	1.00	25.00	33.00	42.00	33.00	43.00	33.00	38.00
1400	33.00	40.00	18.00	25.00	1.00	25.00	33.00	42.00	33.00	43.00	33.00	38.00
1500	33.00	40.00	18.00	25.00	1.00	25.00	33.00	42.00	33.00	43.00	33.00	38.00
1750	33.00	40.00	18.00	25.00	1.00	25.00	33.00	42.00	33.00	50.00	33.00	38.00
2000	33.00	40.00	18.00	25.00	1.00	25.00	33.00	42.00	33.00	50.00	33.00	38.00
2500	33.00	40.00	18.00	25.00	1.00	25.00	33.00	42.00	33.00	50.00	33.00	35.50
3000	33.00	40.00	18.00	25.00	1.00	25.00	33.00	42.00	33.00	50.00	33.00	35.50
3500	33.00	40.00	18.00	25.00	1.00	25.00	33.00	35.50	33.00	50.00	33.00	35.50
4000	33.00	40.00	18.00	25.00	1.00	25.00	33.00	35.50	33.00	50.00	33.00	35.50
4500	33.00	40.00	18.00	25.00	1.00	25.00	33.00	35.50	33.00	50.00	33.00	35.50
5000	33.00	40.00	18.00	25.00	1.00	25.00	33.00	35.50	33.00	50.00	33.00	35.50
5500+	34.30	40.00	18.00	25.00	1.00	25.00	34.30	35.50	34.30	50.00	34.30	35.50

Appendix 13C: WOD01 Oxygen (ml/l) Ranges by Basin as a Function of Depth

Depth (m)	North Atlantic		Coastal N. Atlantic		Equatorial Atlantic		Coastal Eq. Atlantic		South Atlantic		Coastal S. Atlantic		North Pacific		Coastal N. Pacific		Equatorial Pacific		Coastal Eq. Pacific	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0	0.00	11.00	0.00	10.00	0.00	7.00	0.00	9.00	0.00	9.00	0.00	9.00	0.00	10.00	0.00	10.00	0.00	8.00	0.00	7.00
10	0.00	11.00	0.00	10.00	0.00	7.00	0.00	9.00	0.00	9.00	0.00	9.00	0.00	10.00	0.00	10.00	0.00	8.00	0.00	7.00
20	0.00	11.00	0.00	10.00	0.00	7.00	0.00	9.00	0.00	9.00	0.00	9.00	0.00	10.00	0.00	10.00	0.00	8.00	0.00	7.00
30	0.00	11.00	0.00	10.00	0.00	7.00	0.00	9.00	0.00	9.00	0.00	9.00	0.00	10.00	0.00	10.00	0.00	8.00	0.00	7.00
50	0.00	11.00	0.00	9.00	0.00	6.00	0.00	9.00	0.00	9.00	0.00	8.00	0.00	10.00	0.00	8.00	0.00	8.00	0.00	6.00
75	0.00	11.00	0.00	9.00	0.00	6.00	0.00	6.00	0.00	9.00	0.00	8.00	0.00	9.00	0.00	8.00	0.00	8.00	0.00	6.00
100	0.00	10.00	0.00	9.00	0.00	6.00	0.00	6.00	0.00	8.00	0.00	8.00	0.00	9.00	0.00	8.00	0.00	6.00	0.00	6.00
125	0.00	10.00	0.00	9.00	0.00	6.00	0.00	6.00	0.00	8.00	0.00	8.00	0.00	9.00	0.00	8.00	0.00	6.00	0.00	6.00
150	0.00	10.00	0.00	9.00	0.00	6.00	0.00	6.00	0.00	8.00	0.00	8.00	0.00	8.00	0.00	8.00	0.00	6.00	0.00	5.00
200	0.00	10.00	0.00	9.00	0.00	6.00	0.00	6.00	0.00	8.00	0.00	8.00	0.00	8.00	0.00	8.00	0.00	5.00	0.00	5.00
250	0.00	10.00	0.00	8.00	0.00	6.00	0.00	6.00	0.00	8.00	0.00	8.00	0.00	8.00	0.00	8.00	0.00	5.00	0.00	5.00
300	0.00	9.00	0.00	8.00	0.00	5.00	0.00	6.00	0.00	8.00	0.00	7.00	0.00	7.00	0.00	8.00	0.00	5.00	0.00	5.00
400	0.00	9.00	0.00	8.00	0.00	5.00	0.00	6.00	0.00	8.00	0.00	7.00	0.00	7.00	0.00	8.00	0.00	5.00	0.00	5.00
500	0.00	9.00	0.00	8.00	0.00	5.00	0.00	6.00	0.00	8.00	0.00	7.00	0.00	7.00	0.00	8.00	0.00	5.00	0.00	5.00
600	0.00	9.00	0.00	8.00	0.00	5.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	5.00	0.00	5.00
700	0.00	9.00	0.00	8.00	0.00	5.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	6.00	0.00	7.00	0.00	5.00	0.00	5.00
800	0.00	9.00	0.00	8.00	0.00	5.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	6.00	0.00	7.00	0.00	5.00	0.00	5.00
900	0.00	9.00	0.00	8.00	0.00	5.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	6.00	0.00	7.00	0.00	5.00	0.00	5.00
1000	0.00	9.00	0.00	8.00	0.00	6.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	6.00	0.00	7.00	0.00	5.00	0.00	5.00
1100	0.00	9.00	0.00	8.00	0.00	6.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	6.00	0.00	7.00	0.00	5.00	0.00	5.00
1200	0.00	9.00	0.00	8.00	0.00	6.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	6.00	0.00	7.00	0.00	5.00	0.00	5.00
1300	0.00	9.00	0.00	8.00	0.00	6.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	6.00	0.00	7.00	0.00	5.00	0.00	5.00
1400	0.00	9.00	0.00	8.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	6.00	0.00	7.00	0.00	5.00	0.00	5.00
1500	0.00	9.00	0.00	8.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	6.00	0.00	7.00	0.00	5.00	0.00	5.00
1750	3.00	9.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	6.00	0.00	7.00	0.00	5.00	0.00	5.00
2000	3.00	9.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	6.00	0.00	7.00	0.00	5.00	0.00	5.00
2500	3.00	8.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	6.00	0.00	7.00	0.00	5.00	0.00	5.00
3000	3.00	8.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	6.00	0.00	7.00	0.00	5.00	0.00	4.00
3500	3.00	8.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	6.00	0.00	7.00	0.00	5.00	0.00	4.00
4000	3.00	8.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	6.00	0.00	7.00	0.00	6.00	0.00	5.00	0.00	5.00	0.00	4.00
4500	3.00	8.00	0.00	7.00	0.00	6.00	0.00	7.00	0.00	6.00	0.00	7.00	0.00	6.00	0.00	5.00	0.00	5.00	0.00	4.00
5000	3.00	8.00	0.00	7.00	0.00	6.00	0.00	7.00	0.00	6.00	0.00	7.00	0.00	6.00	0.00	5.00	0.00	5.00	0.00	4.00
5500+	3.00	8.00	0.00	7.00	0.00	6.00	0.00	7.00	0.00	6.00	0.00	7.00	0.00	6.00	0.00	5.00	0.00	5.00	0.00	4.00



Appendix 13C (cont.): WOD01 Oxygen (ml/l) Ranges by Basin as a Function of Depth

Depth (m)	South Pacific		Coastal S. Pacific		North Indian		Coastal N. Indian		Equatorial Indian		Coastal Eq. Indian		South Indian		Coastal S. Indian		Antarctic		Arctic Ocean	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0	0.00	8.00	0.00	8.00	0.00	7.00	0.00	7.00	0.00	10.00	0.00	6.00	0.00	10.00	0.00	9.00	5.50	11.00	0.00	11.00
10	0.00	8.00	0.00	8.00	0.00	7.00	0.00	7.00	0.00	10.00	0.00	6.00	0.00	10.00	0.00	9.00	5.50	10.50	0.00	11.00
20	0.00	8.00	0.00	8.00	0.00	7.00	0.00	7.00	0.00	10.00	0.00	6.00	0.00	10.00	0.00	9.00	5.50	10.00	0.00	11.00
30	0.00	8.00	0.00	8.00	0.00	7.00	0.00	7.00	0.00	10.00	0.00	6.00	0.00	10.00	0.00	9.00	5.00	10.00	0.00	11.00
50	0.00	8.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	10.00	0.00	6.00	0.00	10.00	0.00	9.00	4.00	10.00	0.00	11.00
75	0.00	8.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	10.00	0.00	6.00	0.00	8.00	0.00	9.00	3.75	9.50	0.00	10.00
100	0.00	8.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	7.00	0.00	6.00	0.00	8.00	0.00	9.00	3.50	9.25	0.00	10.00
125	0.00	8.00	0.00	7.00	0.00	5.00	0.00	5.00	0.00	7.00	0.00	5.00	0.00	8.00	0.00	9.00	3.50	9.00	0.00	10.00
150	0.00	8.00	0.00	7.00	0.00	5.00	0.00	5.00	0.00	7.00	0.00	5.00	0.00	8.00	0.00	9.00	3.50	8.75	0.00	10.00
200	0.00	7.00	0.00	7.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	8.00	0.00	9.00	3.50	8.50	0.00	10.00
250	0.00	7.00	0.00	7.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	8.00	0.00	7.00	3.50	8.25	0.00	10.00
300	0.00	7.00	0.00	7.00	0.00	5.00	0.00	4.00	0.00	5.00	0.00	5.00	0.00	7.00	0.00	7.00	3.50	8.00	0.00	10.00
400	0.00	7.00	0.00	7.00	0.00	5.00	0.00	4.00	0.00	5.00	0.00	5.00	0.00	7.00	0.00	7.00	3.50	8.00	0.00	10.00
500	0.00	7.00	0.00	7.00	0.00	5.00	0.00	4.00	0.00	5.00	0.00	5.00	0.00	7.00	0.00	7.00	3.50	7.75	0.00	10.00
600	0.00	7.00	0.00	7.00	0.00	5.00	0.00	4.00	0.00	5.00	0.00	5.00	0.00	7.00	0.00	6.00	3.50	7.75	0.00	9.00
700	0.00	7.00	0.00	6.00	0.00	5.00	0.00	4.00	0.00	5.00	0.00	5.00	0.00	7.00	0.00	6.00	3.50	7.75	0.00	9.00
800	0.00	7.00	0.00	6.00	0.00	5.00	0.00	4.00	0.00	5.00	0.00	3.00	0.00	6.00	0.00	6.00	3.50	7.75	0.00	9.00
900	0.00	7.00	0.00	6.00	0.00	5.00	0.00	4.00	0.00	5.00	0.00	3.00	0.00	6.00	0.00	6.00	3.50	7.50	0.00	9.00
1000	0.00	6.00	0.00	6.00	0.00	5.00	0.00	4.00	0.00	5.00	0.00	3.00	0.00	6.00	0.00	6.00	3.50	7.50	0.00	9.00
1100	0.00	6.00	0.00	5.00	0.00	5.00	0.00	4.00	0.00	5.00	0.00	3.00	0.00	6.00	0.00	6.00	3.25	7.50	0.00	9.00
1200	0.00	6.00	0.00	5.00	0.00	5.00	0.00	4.00	0.00	5.00	0.00	3.00	0.00	6.00	0.00	6.00	3.25	7.25	0.00	9.00
1300	0.00	6.00	0.00	5.00	0.00	5.00	0.00	4.00	0.00	5.00	0.00	3.00	0.00	6.00	0.00	6.00	3.00	7.25	0.00	9.00
1400	0.00	6.00	0.00	5.00	0.00	5.00	0.00	4.00	0.00	5.00	0.00	5.00	0.00	6.00	0.00	6.00	3.00	7.25	0.00	9.00
1500	0.00	5.00	0.00	5.00	0.00	5.00	0.00	4.00	0.00	5.00	0.00	5.00	0.00	6.00	0.00	6.00	3.00	7.25	0.00	9.00
1750	0.00	5.00	0.00	5.00	0.00	5.00	0.00	4.00	0.00	5.00	0.00	5.00	0.00	6.00	0.00	6.00	3.00	7.25	0.00	9.00
2000	0.00	5.00	0.00	5.00	0.00	5.00	0.00	4.00	0.00	5.00	0.00	5.00	0.00	6.00	0.00	6.00	3.00	7.25	0.00	9.00
2500	0.00	5.00	0.00	5.00	0.00	5.00	0.00	4.00	0.00	5.00	0.00	5.00	0.00	6.00	0.00	6.00	3.25	7.25	0.00	9.00
3000	0.00	5.00	0.00	5.00	0.00	5.00	0.00	4.00	0.00	5.00	0.00	5.00	0.00	6.00	0.00	6.00	3.50	7.25	0.00	9.00
3500	0.00	5.00	0.00	5.00	0.00	5.00	0.00	4.00	0.00	5.00	0.00	5.00	0.00	6.00	0.00	6.00	3.75	7.00	0.00	9.00
4000	0.00	5.00	0.00	5.00	0.00	5.00	0.00	4.00	0.00	5.00	0.00	5.00	0.00	6.00	0.00	6.00	4.00	6.50	0.00	9.00
4500	0.00	5.00	0.00	5.00	0.00	5.00	0.00	4.00	0.00	5.00	0.00	5.00	0.00	6.00	0.00	6.00	4.00	6.50	0.00	9.00
5000	0.00	5.00	0.00	5.00	0.00	5.00	0.00	4.00	0.00	5.00	0.00	5.00	0.00	6.00	0.00	6.00	4.25	6.50	0.00	9.00
5500+	0.00	5.00	0.00	5.00	0.00	5.00	0.00	4.00	0.00	5.00	0.00	5.00	0.00	6.00	0.00	6.00	4.50	6.50	0.00	9.00

Appendix 13C (cont.): WOD01 Oxygen (ml/l) Ranges by Basin as a Function of Depth

Depth (m)	Mediterranean		Black Sea		Baltic Sea		Persian Gulf		Red Sea		Sulu Sea	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0	0.00	8.00	0.00	10.00	0.00	12.00	0.00	12.00	0.00	12.00	0.00	5.00
10	0.00	8.00	0.00	10.00	0.00	12.00	0.00	12.00	0.00	12.00	0.00	5.00
20	0.00	8.00	0.00	10.00	0.00	12.00	0.00	12.00	0.00	12.00	0.00	5.00
30	0.00	8.00	0.00	10.00	0.00	12.00	0.00	12.00	0.00	12.00	0.00	5.00
50	0.00	8.00	0.00	10.00	0.00	12.00	0.00	12.00	0.00	12.00	0.00	5.00
75	0.00	7.00	0.00	8.00	0.00	9.50	0.00	9.50	0.00	9.50	0.00	5.00
100	0.00	7.00	0.00	8.00	0.00	9.50	0.00	9.50	0.00	9.50	0.00	4.00
125	0.00	7.00	0.00	8.00	0.00	9.50	0.00	9.50	0.00	9.50	0.00	4.00
150	0.00	7.00	0.00	8.00	0.00	9.50	0.00	9.50	0.00	9.50	0.00	4.00
200	0.00	7.00	0.00	5.00	0.00	9.00	0.00	9.00	0.00	9.00	0.00	3.00
250	0.00	7.00	0.00	5.00	0.00	9.00	0.00	9.00	0.00	9.00	0.00	3.00
300	0.00	7.00	0.00	5.00	0.00	8.00	0.00	8.00	0.00	8.00	0.00	3.00
400	0.00	7.00	0.00	2.00	0.00	8.00	0.00	8.00	0.00	8.00	0.00	3.00
500	0.00	7.00	0.00	2.00	0.00	8.00	0.00	8.00	0.00	8.00	0.00	3.00
600	0.00	7.00	0.00	2.00	0.00	7.10	0.00	7.10	0.00	7.10	0.00	3.00
700	0.00	7.00	0.00	2.00	0.00	7.10	0.00	7.10	0.00	7.10	0.00	3.00
800	0.00	7.00	0.00	2.00	0.00	7.10	0.00	7.10	0.00	7.10	0.00	3.00
900	0.00	7.00	0.00	2.00	0.00	7.10	0.00	7.10	0.00	7.10	0.00	3.00
1000	0.00	6.00	0.00	2.00	0.00	7.10	0.00	7.10	0.00	7.10	0.00	3.00
1100	0.00	6.00	0.00	2.00	0.00	7.10	0.00	7.10	0.00	7.10	0.00	3.00
1200	0.00	6.00	0.00	2.00	0.00	7.10	0.00	7.10	0.00	7.10	0.00	2.00
1300	0.00	6.00	0.00	2.00	0.00	7.10	0.00	7.10	0.00	7.10	0.00	2.00
1400	0.00	6.00	0.00	2.00	0.00	7.10	0.00	7.10	0.00	7.10	0.00	2.00
1500	0.00	6.00	0.00	2.00	0.00	7.10	0.00	7.10	0.00	7.10	0.00	2.00
1750	0.00	6.00	0.00	2.00	0.00	7.10	0.00	7.10	0.00	7.10	0.00	2.00
2000	0.00	6.00	0.00	2.00	0.00	7.10	0.00	7.10	0.00	7.10	0.00	2.00
2500	0.00	6.00	0.00	2.00	0.00	7.10	0.00	7.10	0.00	7.10	0.00	2.00
3000	0.00	6.00	0.00	2.00	0.00	7.10	0.00	7.10	0.00	7.10	0.00	2.00
3500	0.00	6.00	0.00	2.00	0.00	7.10	0.00	7.10	0.00	7.10	0.00	2.00
4000	0.00	6.00	0.00	2.00	0.00	7.10	0.00	7.10	0.00	7.10	0.00	2.00
4500	0.00	6.00	0.00	2.00	0.00	6.00	0.00	6.00	0.00	6.00	0.00	2.00
5000	0.00	6.00	0.00	2.00	0.00	6.00	0.00	6.00	0.00	6.00	0.00	2.00
5500+	0.00	6.00	0.00	2.00	0.00	6.00	0.00	6.00	0.00	6.00	0.00	2.00





Appendix 13D (cont.): WOD01 Phosphate ( $\mu\text{M}$ ) Ranges by Basin as a Function of Depth

Depth (m)	Mediterranean		Black Sea		Baltic Sea		Persian Gulf		Red Sea		Sulu Sea	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50
10	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50
20	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50
30	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50
50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50
75	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50
100	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50
125	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50
150	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50
200	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50
250	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50
300	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50
400	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50
500	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50	0.00	4.50
600	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50
700	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50
800	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50
900	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50
1000	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50
1100	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50
1200	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50
1300	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50
1400	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50
1500	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50
1750	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50
2000	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50
2500	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50
3000	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50
3500	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50
4000	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50
4500	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50
5000	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50
5500+	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50	0.01	4.50

Appendix 13E: WOD01 Silicate ( $\mu\text{M}$ ) Ranges by Basin as a Function of Depth

Depth (m)	North Atlantic		Coastal N. Atlantic		Equatorial Atlantic		Coastal Eq. Atlantic		South Atlantic		Coastal S. Atlantic		North Pacific		Coastal N. Pacific		Equatorial Pacific		Coastal Eq. Pacific	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0	0.00	150.00	0.00	250.00	0.00	80.00	0.00	250.00	0.00	150.00	0.00	250.00	0.00	100.00	0.00	250.00	0.00	150.00	0.00	250.00
10	0.00	150.00	0.00	250.00	0.00	80.00	0.00	250.00	0.00	150.00	0.00	250.00	0.00	100.00	0.00	250.00	0.00	150.00	0.00	250.00
20	0.00	150.00	0.00	250.00	0.00	80.00	0.00	250.00	0.00	150.00	0.00	250.00	0.00	100.00	0.00	250.00	0.00	150.00	0.00	250.00
30	0.00	150.00	0.00	250.00	0.00	80.00	0.00	250.00	0.00	150.00	0.00	250.00	0.00	100.00	0.00	250.00	0.00	150.00	0.00	250.00
50	0.00	150.00	0.00	250.00	0.00	80.00	0.00	250.00	0.00	150.00	0.00	250.00	0.00	100.00	0.00	250.00	0.00	150.00	0.00	250.00
75	0.00	150.00	0.00	250.00	0.00	80.00	0.00	250.00	0.00	150.00	0.00	250.00	0.00	100.00	0.00	250.00	0.00	150.00	0.00	250.00
100	0.00	150.00	0.00	250.00	0.00	80.00	0.00	250.00	0.00	150.00	0.00	250.00	0.00	100.00	0.00	250.00	0.00	150.00	0.00	250.00
125	0.00	150.00	0.00	250.00	0.00	80.00	0.00	250.00	0.00	150.00	0.00	250.00	0.00	100.00	0.00	250.00	0.00	150.00	0.00	250.00
150	0.00	150.00	0.00	250.00	0.00	80.00	0.00	250.00	0.00	150.00	0.00	250.00	0.00	110.00	0.00	250.00	0.00	150.00	0.00	250.00
200	0.01	150.00	0.01	250.00	0.01	80.00	0.01	250.00	0.01	150.00	0.01	250.00	0.01	120.00	0.01	250.00	0.00	150.00	0.01	250.00
250	0.01	150.00	0.01	250.00	0.01	80.00	0.01	250.00	0.01	150.00	0.01	250.00	0.01	125.00	0.01	250.00	0.01	150.00	0.01	250.00
300	0.01	150.00	0.01	250.00	0.01	80.00	0.01	250.00	0.01	150.00	0.01	250.00	0.01	130.00	0.01	250.00	0.01	150.00	0.01	250.00
400	0.01	150.00	0.01	250.00	0.01	80.00	0.01	250.00	0.01	150.00	0.01	250.00	0.01	140.00	0.01	250.00	0.01	150.00	0.01	250.00
500	0.01	150.00	0.01	250.00	0.50	80.00	0.01	250.00	0.50	150.00	0.01	250.00	0.50	150.00	0.01	250.00	0.50	150.00	0.01	250.00
600	0.01	150.00	0.01	250.00	1.00	80.00	0.01	250.00	2.50	150.00	0.01	250.00	5.00	160.00	0.01	250.00	2.00	150.00	0.01	250.00
700	0.01	150.00	0.01	250.00	2.00	80.00	0.01	250.00	5.00	150.00	0.01	250.00	5.00	165.00	0.01	250.00	5.00	150.00	0.01	250.00
800	0.01	150.00	0.01	250.00	2.00	80.00	0.01	250.00	5.00	150.00	0.01	250.00	5.00	170.00	0.01	250.00	5.00	155.00	0.01	250.00
900	0.01	150.00	0.01	250.00	5.00	80.00	0.01	250.00	10.00	150.00	0.01	250.00	10.00	175.00	0.01	250.00	5.00	160.00	0.01	250.00
1000	2.50	150.00	1.00	250.00	5.00	80.00	1.00	250.00	10.00	150.00	1.00	250.00	10.00	<b>180.00</b>	1.00	250.00	5.00	165.00	1.00	250.00
1100	2.50	150.00	1.00	250.00	5.00	80.00	1.00	250.00	10.00	150.00	1.00	250.00	10.00	190.00	1.00	250.00	10.00	165.00	1.00	250.00
1200	2.50	150.00	1.00	250.00	5.00	80.00	1.00	250.00	10.00	150.00	1.00	250.00	20.00	200.00	1.00	250.00	10.00	170.00	1.00	250.00
1300	2.50	150.00	1.00	250.00	5.00	80.00	1.00	250.00	10.00	150.00	1.00	250.00	20.00	200.00	1.00	250.00	10.00	170.00	1.00	250.00
1400	2.50	150.00	1.00	250.00	5.00	80.00	1.00	250.00	10.00	150.00	1.00	250.00	20.00	200.00	1.00	250.00	10.00	170.00	1.00	250.00
1500	5.00	150.00	1.00	250.00	5.00	80.00	1.00	250.00	10.00	150.00	1.00	250.00	20.00	225.00	1.00	250.00	10.00	175.00	1.00	250.00
1750	5.00	150.00	1.00	250.00	5.00	80.00	1.00	250.00	10.00	150.00	1.00	250.00	20.00	225.00	1.00	250.00	10.00	180.00	1.00	250.00
2000	5.00	150.00	1.00	250.00	10.00	80.00	1.00	250.00	10.00	150.00	1.00	250.00	20.00	250.00	1.00	250.00	10.00	200.00	1.00	250.00
2500	5.00	150.00	1.00	250.00	10.00	80.00	1.00	250.00	10.00	150.00	1.00	250.00	20.00	250.00	1.00	250.00	10.00	200.00	1.00	250.00
3000	5.00	150.00	1.00	250.00	10.00	80.00	1.00	250.00	10.00	150.00	1.00	250.00	20.00	250.00	1.00	250.00	10.00	200.00	1.00	250.00
3500	5.00	150.00	1.00	250.00	10.00	150.00	1.00	250.00	10.00	150.00	1.00	250.00	20.00	250.00	1.00	250.00	10.00	200.00	1.00	250.00
4000	5.00	150.00	1.00	250.00	10.00	150.00	1.00	250.00	10.00	150.00	1.00	200.00	20.00	200.00	1.00	250.00	10.00	200.00	1.00	250.00
4500	10.00	150.00	1.00	250.00	10.00	150.00	1.00	250.00	10.00	150.00	1.00	200.00	20.00	200.00	1.00	250.00	10.00	200.00	1.00	250.00
5000	10.00	150.00	1.00	250.00	10.00	160.00	1.00	250.00	10.00	150.00	1.00	190.00	20.00	200.00	1.00	250.00	10.00	200.00	1.00	250.00
5500+	15.00	150.00	1.00	250.00	10.00	160.00	1.00	250.00	10.00	150.00	1.00	180.00	20.00	200.00	1.00	250.00	10.00	200.00	1.00	250.00



Appendix 13E (cont.): WOD01 Silicate ( $\mu\text{M}$ ) Ranges by Basin as a Function of Depth

Depth (m)	Mediterranean		Black Sea		Baltic Sea		Persian Gulf		Red Sea		Sulu Sea	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00
10	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00
20	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00
30	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00
50	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00
75	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00
100	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00
125	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00
150	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00	0.00	250.00
200	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00
250	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00
300	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00
400	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00
500	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00
600	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00
700	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00
800	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00
900	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00	0.01	250.00
1000	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00
1100	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00
1200	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00
1300	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00
1400	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00
1500	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00
1750	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00
2000	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00
2500	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00
3000	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00
3500	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00
4000	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00
4500	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00
5000	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00
5500+	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00	1.00	250.00



Appendix 13F: WOD01 Nitrate ( $\mu\text{M}$ ) Ranges by Basin as a Function of Depth

Depth (m)	North Atlantic		Coastal N. Atlantic		Equatorial Atlantic		Coastal Eq. Atlantic		South Atlantic		Coastal S. Atlantic		North Pacific		Coastal N. Pacific		Equatorial Pacific		Coastal Eq. Pacific	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
	<b>0</b>	0.00	18.00	0.00	500.00	0.00	18.00	0.00	30.00	0.00	22.00	0.00	60.00	0.00	26.00	0.00	50.00	0.00	22.00	0.00
<b>10</b>	0.00	18.00	0.00	500.00	0.00	18.00	0.00	30.00	0.00	26.00	0.00	60.00	0.00	26.00	0.00	50.00	0.00	22.00	0.00	100.00
<b>20</b>	0.00	18.00	0.00	500.00	0.00	18.00	0.00	30.00	0.00	26.00	0.00	60.00	0.00	26.00	0.00	50.00	0.00	22.00	0.00	100.00
<b>30</b>	0.00	18.00	0.00	500.00	0.00	18.00	0.00	30.00	0.00	30.00	0.00	60.00	0.00	30.00	0.00	50.00	0.00	26.00	0.00	100.00
<b>50</b>	0.00	26.00	0.00	500.00	0.00	26.00	0.00	30.00	0.00	30.00	0.00	60.00	0.00	30.00	0.00	50.00	0.00	34.00	0.00	100.00
<b>75</b>	0.00	30.00	0.00	500.00	0.00	30.00	0.00	30.00	0.00	34.00	0.00	60.00	0.00	34.00	0.00	50.00	0.00	34.00	0.00	100.00
<b>100</b>	0.00	30.00	0.00	500.00	0.00	30.00	0.00	30.00	0.00	34.00	0.00	60.00	0.00	34.00	0.00	50.00	0.00	34.00	0.00	100.00
<b>125</b>	0.00	30.00	0.00	500.00	0.00	30.00	0.00	40.00	0.00	34.00	0.00	60.00	0.00	42.00	0.00	50.00	0.00	34.00	0.00	100.00
<b>150</b>	0.00	30.00	0.00	500.00	0.00	30.00	0.00	40.00	0.00	34.00	0.00	60.00	0.00	42.00	0.00	50.00	0.00	38.00	0.00	100.00
<b>200</b>	0.00	30.00	0.00	500.00	0.00	30.00	0.00	40.00	0.00	38.00	0.00	60.00	0.00	46.00	0.00	50.00	0.00	38.00	0.00	100.00
<b>250</b>	0.00	34.00	0.00	500.00	0.00	34.00	0.00	45.00	0.00	38.00	0.00	60.00	0.00	46.00	0.00	75.00	0.00	42.00	0.00	100.00
<b>300</b>	0.00	34.00	0.00	500.00	0.00	34.00	0.00	45.00	0.00	38.00	0.00	60.00	0.00	46.00	0.00	75.00	0.00	42.00	0.00	100.00
<b>400</b>	0.00	42.00	0.00	500.00	0.00	42.00	0.00	45.00	2.00	42.00	0.00	60.00	2.00	46.00	0.00	75.00	2.00	42.00	0.00	100.00
<b>500</b>	0.00	42.00	0.00	500.00	0.00	42.00	0.00	45.00	2.00	46.00	0.00	60.00	2.00	46.00	0.00	75.00	2.00	46.00	0.00	100.00
<b>600</b>	0.00	42.00	0.00	500.00	0.00	42.00	0.00	45.00	2.00	46.00	0.00	60.00	2.00	50.00	0.00	75.00	2.00	46.00	0.00	100.00
<b>700</b>	6.00	46.00	0.00	500.00	0.00	46.00	0.00	45.00	2.00	46.00	0.00	60.00	2.00	50.00	0.00	75.00	2.00	50.00	0.00	75.00
<b>800</b>	6.00	46.00	0.00	500.00	0.00	46.00	0.00	45.00	2.00	46.00	0.00	60.00	2.00	54.00	0.00	75.00	2.00	56.00	0.00	75.00
<b>900</b>	6.00	46.00	0.00	500.00	0.00	46.00	0.00	45.00	2.00	46.00	0.00	60.00	2.00	54.00	0.00	75.00	2.00	56.00	0.00	75.00
<b>1000</b>	6.00	46.00	0.00	500.00	0.00	46.00	0.00	40.00	2.00	46.00	0.00	60.00	2.00	54.00	0.00	75.00	2.00	56.00	0.00	75.00
<b>1100</b>	6.00	46.00	0.00	500.00	0.00	46.00	0.00	40.00	2.00	46.00	0.00	60.00	2.00	54.00	0.00	75.00	2.00	56.00	0.00	75.00
<b>1200</b>	6.00	48.00	0.00	500.00	0.00	48.00	0.00	40.00	6.00	42.00	0.00	60.00	2.00	54.00	0.00	75.00	2.00	56.00	0.00	75.00
<b>1300</b>	6.00	48.00	0.00	500.00	0.00	48.00	0.00	40.00	6.00	42.00	0.00	60.00	2.00	54.00	0.00	75.00	2.00	50.00	0.00	75.00
<b>1400</b>	6.00	48.00	0.00	500.00	6.00	48.00	0.00	40.00	6.00	42.00	0.00	60.00	2.00	54.00	0.00	75.00	2.00	50.00	0.00	75.00
<b>1500</b>	6.00	48.00	0.00	500.00	6.00	48.00	0.00	40.00	6.00	42.00	0.00	60.00	2.00	54.00	0.00	75.00	2.00	50.00	0.00	75.00
<b>1750</b>	6.00	48.00	0.00	500.00	6.00	48.00	0.00	40.00	6.00	42.00	0.00	60.00	2.00	54.00	0.00	75.00	2.00	50.00	0.00	75.00
<b>2000</b>	6.00	48.00	0.00	500.00	6.00	48.00	0.00	40.00	6.00	42.00	0.00	60.00	2.00	54.00	0.00	75.00	2.00	50.00	0.00	75.00
<b>2500</b>	6.00	48.00	0.00	500.00	6.00	48.00	0.00	40.00	6.00	42.00	0.00	60.00	2.00	54.00	0.00	75.00	2.00	50.00	0.00	75.00
<b>3000</b>	6.00	48.00	0.00	500.00	6.00	48.00	0.00	40.00	6.00	42.00	0.00	60.00	2.00	50.00	0.00	75.00	2.00	46.00	0.00	75.00
<b>3500</b>	10.00	48.00	0.00	500.00	10.00	48.00	0.00	40.00	6.00	42.00	0.00	60.00	2.00	46.00	0.00	75.00	2.00	46.00	0.00	75.00
<b>4000</b>	10.00	48.00	0.00	500.00	10.00	48.00	0.00	40.00	6.00	42.00	0.00	60.00	2.00	46.00	0.00	75.00	2.00	46.00	0.00	75.00
<b>4500</b>	10.00	46.00	0.00	500.00	10.00	46.00	0.00	40.00	6.00	42.00	0.00	60.00	2.00	42.00	0.00	75.00	2.00	46.00	0.00	75.00
<b>5000</b>	10.00	44.00	0.00	500.00	10.00	44.00	0.00	40.00	10.00	42.00	0.00	60.00	10.00	42.00	0.00	75.00	2.00	46.00	0.00	75.00
<b>5500+</b>	14.00	42.00	0.00	500.00	14.00	42.00	0.00	40.00	14.00	34.00	0.00	60.00	14.00	42.00	0.00	75.00	2.00	46.00	0.00	75.00

Appendix 13F (cont.): WOD01 Nitrate ( $\mu\text{M}$ ) Ranges by Basin as a Function of Depth

Depth (m)	South Pacific		Coastal S. Pacific		North Indian		Coastal N. Indian		Equatorial Indian		Coastal Eq. Indian		South Indian		Coastal S. Indian		Southern Ocean		Arctic Ocean	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0	0.00	18.00	0.00	40.00	0.00	14.00	0.00	30.00	0.00	4.00	0.00	35.00	0.00	18.00	0.00	50.00	0.00	46.00	0.00	18.00
10	0.00	18.00	0.00	40.00	0.00	18.00	0.00	30.00	0.00	6.00	0.00	35.00	0.00	18.00	0.00	50.00	0.00	46.00	0.00	18.00
20	0.00	18.00	0.00	40.00	0.00	18.00	0.00	30.00	0.00	6.00	0.00	35.00	0.00	18.00	0.00	50.00	0.00	46.00	0.00	18.00
30	0.00	22.00	0.00	40.00	0.00	18.00	0.00	30.00	0.00	14.00	0.00	35.00	0.00	18.00	0.00	50.00	0.00	46.00	0.00	18.00
50	0.00	26.00	0.00	40.00	0.00	30.00	0.00	30.00	0.00	18.00	0.00	35.00	0.00	18.00	0.00	50.00	0.00	46.00	0.00	18.00
75	0.00	30.00	0.00	40.00	0.00	30.00	0.00	40.00	0.00	26.00	0.00	35.00	0.00	22.00	0.00	50.00	0.00	46.00	0.00	18.00
100	0.00	30.00	0.00	40.00	0.00	30.00	0.00	40.00	0.00	30.00	0.00	45.00	0.00	22.00	0.00	50.00	0.00	46.00	0.00	22.00
125	0.00	30.00	0.00	40.00	0.00	42.00	0.00	40.00	0.00	34.00	0.00	45.00	0.00	26.00	0.00	50.00	0.00	46.00	0.00	22.00
150	0.00	30.00	0.00	40.00	0.00	42.00	0.00	40.00	0.00	34.00	0.00	45.00	0.00	30.00	0.00	50.00	0.00	46.00	0.00	22.00
200	0.00	38.00	0.00	40.00	0.00	42.00	0.00	40.00	0.00	38.00	0.00	45.00	0.00	30.00	0.00	50.00	0.00	46.00	0.00	26.00
250	0.00	38.00	0.00	40.00	2.00	42.00	0.00	40.00	2.00	38.00	0.00	50.00	0.00	30.00	0.00	50.00	0.00	46.00	0.00	26.00
300	0.00	38.00	0.00	60.00	2.00	50.00	0.00	40.00	2.00	46.00	0.00	50.00	0.00	30.00	0.00	50.00	0.00	46.00	0.00	26.00
400	4.00	42.00	0.00	60.00	2.00	50.00	0.00	40.00	2.00	46.00	0.00	50.00	0.00	34.00	0.00	50.00	4.00	46.00	0.00	28.00
500	6.00	46.00	0.00	60.00	2.00	50.00	0.00	40.00	2.00	46.00	0.00	50.00	0.00	34.00	0.00	50.00	6.00	46.00	0.00	28.00
600	6.00	50.00	0.00	60.00	2.00	50.00	0.00	40.00	2.00	46.00	0.00	50.00	0.00	38.00	0.00	50.00	6.00	46.00	0.00	32.00
700	6.00	50.00	0.00	60.00	2.00	54.00	0.00	40.00	2.00	54.00	0.00	50.00	0.00	46.00	0.00	50.00	6.00	46.00	0.00	32.00
800	10.00	50.00	0.00	60.00	2.00	54.00	0.00	40.00	2.00	54.00	0.00	50.00	0.00	46.00	0.00	50.00	14.00	46.00	0.00	42.00
900	10.00	50.00	0.00	60.00	2.00	54.00	0.00	40.00	2.00	54.00	0.00	50.00	0.00	46.00	0.00	50.00	14.00	46.00	0.00	42.00
1000	10.00	50.00	0.00	60.00	2.00	54.00	0.00	40.00	2.00	54.00	0.00	50.00	0.00	46.00	0.00	50.00	14.00	50.00	0.00	46.00
1100	10.00	50.00	0.00	60.00	2.00	54.00	0.00	40.00	2.00	54.00	0.00	50.00	0.00	46.00	0.00	50.00	14.00	50.00	0.00	46.00
1200	10.00	54.00	0.00	60.00	2.00	54.00	0.00	40.00	2.00	54.00	0.00	50.00	0.00	46.00	0.00	50.00	14.00	50.00	0.00	46.00
1300	10.00	54.00	0.00	60.00	2.00	54.00	0.00	40.00	2.00	54.00	0.00	50.00	0.00	46.00	0.00	50.00	14.00	50.00	0.00	50.00
1400	10.00	54.00	0.00	60.00	2.00	54.00	0.00	40.00	2.00	54.00	0.00	50.00	0.00	46.00	0.00	50.00	14.00	50.00	0.00	50.00
1500	10.00	54.00	0.00	60.00	20.00	54.00	0.00	40.00	2.00	54.00	0.00	50.00	2.00	46.00	0.00	50.00	14.00	50.00	0.00	50.00
1750	10.00	54.00	0.00	60.00	20.00	54.00	0.00	40.00	2.00	54.00	0.00	50.00	2.00	46.00	0.00	50.00	14.00	50.00	0.00	50.00
2000	10.00	54.00	0.00	60.00	20.00	54.00	0.00	40.00	2.00	54.00	0.00	50.00	2.00	46.00	0.00	50.00	14.00	50.00	0.00	54.00
2500	10.00	54.00	0.00	60.00	20.00	54.00	0.00	40.00	2.00	54.00	0.00	50.00	2.00	46.00	0.00	50.00	14.00	50.00	0.00	54.00
3000	10.00	54.00	0.00	60.00	20.00	54.00	0.00	40.00	2.00	46.00	0.00	50.00	2.00	46.00	0.00	50.00	14.00	50.00	0.00	54.00
3500	10.00	54.00	0.00	60.00	20.00	46.00	0.00	40.00	2.00	46.00	0.00	50.00	2.00	46.00	0.00	50.00	14.00	46.00	2.00	54.00
4000	10.00	54.00	0.00	60.00	20.00	46.00	0.00	40.00	2.00	46.00	0.00	50.00	2.00	46.00	0.00	50.00	14.00	46.00	2.00	46.00
4500	10.00	42.00	0.00	60.00	20.00	46.00	0.00	40.00	2.00	46.00	0.00	50.00	2.00	46.00	0.00	50.00	14.00	42.00	2.00	46.00
5000	10.00	38.00	0.00	60.00	20.00	46.00	0.00	40.00	2.00	46.00	0.00	50.00	2.00	46.00	0.00	50.00	14.00	42.00	2.00	46.00
5500+	14.00	38.00	0.00	60.00	20.00	46.00	0.00	40.00	2.00	46.00	0.00	50.00	10.00	46.00	0.00	50.00	18.00	42.00	2.00	46.00

Appendix 13F (cont.): WOD01 Nitrate ( $\mu\text{M}$ ) Ranges by Basin as a Function of Depth

Depth (m)	Mediterranean		Black Sea		Baltic Sea		Persian Gulf		Red Sea		Sulu Sea	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0	0.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00
10	0.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00
20	0.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00
30	0.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00
50	0.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00
75	0.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00	0.00	18.00
100	0.00	22.00	0.00	22.00	0.00	22.00	0.00	22.00	0.00	22.00	0.00	22.00
125	0.00	22.00	0.00	22.00	0.00	22.00	0.00	22.00	0.00	22.00	0.00	22.00
150	0.00	22.00	0.00	22.00	0.00	22.00	0.00	22.00	0.00	22.00	0.00	22.00
200	0.00	26.00	0.00	26.00	0.00	26.00	0.00	26.00	0.00	26.00	0.00	26.00
250	0.00	26.00	0.00	26.00	0.00	26.00	0.00	26.00	0.00	26.00	0.00	26.00
300	0.00	26.00	0.00	26.00	0.00	26.00	0.00	26.00	0.00	26.00	0.00	26.00
400	0.00	28.00	0.00	28.00	0.00	28.00	0.00	28.00	0.00	28.00	0.00	28.00
500	0.00	28.00	0.00	28.00	0.00	28.00	0.00	28.00	0.00	28.00	0.00	28.00
600	0.00	32.00	0.00	32.00	0.00	32.00	0.00	32.00	0.00	32.00	0.00	32.00
700	0.00	32.00	0.00	32.00	0.00	32.00	0.00	32.00	0.00	32.00	0.00	32.00
800	0.00	42.00	0.00	42.00	0.00	42.00	0.00	42.00	0.00	42.00	0.00	42.00
900	0.00	42.00	0.00	42.00	0.00	42.00	0.00	42.00	0.00	42.00	0.00	42.00
1000	0.00	46.00	0.00	46.00	0.00	46.00	0.00	46.00	0.00	46.00	0.00	46.00
1100	0.00	46.00	0.00	46.00	0.00	46.00	0.00	46.00	0.00	46.00	0.00	46.00
1200	0.00	46.00	0.00	46.00	0.00	46.00	0.00	46.00	0.00	46.00	0.00	46.00
1300	0.00	50.00	0.00	50.00	0.00	50.00	0.00	50.00	0.00	50.00	0.00	50.00
1400	0.00	50.00	0.00	50.00	0.00	50.00	0.00	50.00	0.00	50.00	0.00	50.00
1500	0.00	50.00	0.00	50.00	0.00	50.00	0.00	50.00	0.00	50.00	0.00	50.00
1750	0.00	50.00	0.00	50.00	0.00	50.00	0.00	50.00	0.00	50.00	0.00	50.00
2000	0.00	54.00	0.00	54.00	0.00	54.00	0.00	54.00	0.00	54.00	0.00	54.00
2500	0.00	54.00	0.00	54.00	0.00	54.00	0.00	54.00	0.00	54.00	0.00	54.00
3000	0.00	54.00	0.00	54.00	0.00	54.00	0.00	54.00	0.00	54.00	0.00	54.00
3500	2.00	54.00	2.00	54.00	2.00	54.00	2.00	54.00	2.00	54.00	2.00	54.00
4000	2.00	46.00	2.00	46.00	2.00	46.00	2.00	46.00	2.00	46.00	2.00	46.00
4500	2.00	46.00	2.00	46.00	2.00	46.00	2.00	46.00	2.00	46.00	2.00	46.00
5000	2.00	46.00	2.00	46.00	2.00	46.00	2.00	46.00	2.00	46.00	2.00	46.00
5500+	2.00	46.00	2.00	46.00	2.00	46.00	2.00	46.00	2.00	46.00	2.00	46.00

Appendix 13G: WOD01 pH Ranges by Basin as a Function of Depth

Depth (m)	North Atlantic		Coastal N. Atlantic		Equatorial Atlantic		Coastal Eq. Atlantic		South Atlantic		Coastal S. Atlantic		North Pacific		Coastal N. Pacific		Equatorial Pacific		Coastal Eq. Pacific	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0	7.50	8.70	6.30	9.20	7.30	8.50	6.20	8.70	7.40	8.50	7.10	8.80	7.30	8.60	7.00	8.90	7.30	8.60	6.00	8.80
10	7.50	8.70	6.60	9.00	7.30	8.50	6.20	8.70	7.40	8.50	7.10	8.80	7.30	8.60	7.00	8.80	7.30	8.60	6.00	8.90
20	7.50	8.70	6.80	9.00	7.30	8.50	6.60	8.70	7.40	8.50	7.10	8.80	7.30	8.60	7.00	8.80	7.30	8.60	6.00	9.00
30	7.50	8.70	6.80	9.00	7.30	8.50	6.60	8.70	7.40	8.50	7.10	8.80	7.30	8.60	7.00	8.80	7.30	8.60	6.00	9.00
50	7.50	8.70	6.80	9.00	7.30	8.50	7.20	8.70	7.40	8.50	7.10	8.80	7.30	8.60	7.00	8.80	7.30	8.60	6.00	9.00
75	7.50	8.70	7.00	9.00	7.30	8.50	7.40	8.70	7.40	8.50	7.10	8.80	7.30	8.60	7.00	8.80	7.30	8.60	6.00	9.00
100	7.50	8.70	7.00	8.80	7.30	8.50	7.40	8.70	7.40	8.50	7.10	8.80	7.30	8.60	7.00	8.80	7.30	8.60	6.00	9.00
125	7.50	8.70	7.00	8.80	7.30	8.50	7.40	8.70	7.40	8.50	7.10	8.80	7.30	8.60	7.00	8.80	7.30	8.60	7.00	8.70
150	7.50	8.70	7.00	8.80	7.30	8.50	7.40	8.70	7.40	8.50	7.20	8.80	7.30	8.60	7.00	8.70	7.30	8.60	7.00	8.70
200	7.50	8.70	7.00	8.80	7.30	8.50	7.50	8.70	7.40	8.50	7.30	8.80	7.30	8.60	7.00	8.60	7.30	8.60	7.00	8.70
250	7.50	8.70	7.00	8.80	7.30	8.50	7.50	8.70	7.40	8.50	7.40	8.80	7.30	8.60	7.00	8.60	7.30	8.60	7.00	8.70
300	7.50	8.70	7.00	8.80	7.30	8.50	7.50	8.70	7.40	8.50	7.40	8.80	7.30	8.60	7.00	8.50	7.30	8.60	7.00	8.70
400	7.50	8.70	7.10	8.80	7.30	8.50	7.50	8.70	7.40	8.50	7.40	8.80	7.30	8.60	7.00	8.50	7.30	8.60	7.00	8.50
500	7.30	8.50	7.10	8.80	7.20	8.40	7.50	8.70	7.30	8.40	7.40	8.60	7.20	8.50	7.00	8.50	7.20	8.30	7.00	8.50
600	7.30	8.50	7.10	8.80	7.20	8.40	7.50	8.70	7.30	8.40	7.40	8.60	7.20	8.50	7.00	8.50	7.20	8.30	7.00	8.50
700	7.30	8.50	7.20	8.80	7.20	8.40	7.50	8.70	7.30	8.40	7.40	8.60	7.20	8.50	7.00	8.50	7.20	8.30	7.00	8.40
800	7.30	8.50	7.20	8.80	7.20	8.40	7.60	8.70	7.30	8.40	7.40	8.60	7.20	8.50	7.10	8.50	7.20	8.30	7.00	8.40
900	7.30	8.50	7.20	8.80	7.20	8.40	7.60	8.70	7.30	8.40	7.40	8.50	7.20	8.50	7.20	8.50	7.20	8.30	7.00	8.40
1000	7.30	8.50	7.20	8.60	7.20	8.40	7.60	8.70	7.30	8.40	7.50	8.50	7.20	8.50	7.20	8.50	7.20	8.30	7.00	8.40
1100	7.30	8.50	7.20	8.60	7.20	8.40	7.60	8.70	7.30	8.40	7.50	8.40	7.20	8.50	7.20	8.40	7.20	8.30	7.10	8.40
1200	7.30	8.50	7.20	8.50	7.20	8.40	7.60	8.70	7.30	8.40	7.50	8.40	7.20	8.50	7.20	8.40	7.20	8.30	7.10	8.30
1300	7.30	8.50	7.70	8.50	7.20	8.40	7.60	8.70	7.30	8.40	7.50	8.40	7.20	8.50	7.20	8.20	7.20	8.30	7.10	8.30
1400	7.30	8.50	7.70	8.50	7.20	8.40	7.60	8.70	7.30	8.40	7.50	8.40	7.20	8.50	7.20	8.20	7.20	8.30	7.20	8.30
1500	7.30	8.50	7.70	8.50	7.20	8.40	7.60	8.70	7.30	8.40	7.50	8.40	7.20	8.50	7.20	8.20	7.20	8.30	7.20	8.30
1750	7.30	8.50	7.70	8.50	7.20	8.40	7.60	8.70	7.30	8.40	7.50	8.40	7.20	8.50	7.20	8.20	7.20	8.30	7.30	8.30
2000	7.30	8.50	7.70	8.50	7.20	8.40	7.60	8.70	7.30	8.40	7.50	8.40	7.20	8.50	7.40	8.20	7.20	8.30	7.40	8.30
2500	7.30	8.50	7.80	8.50	7.20	8.40	7.60	8.70	7.30	8.40	7.50	8.40	7.20	8.50	7.40	8.20	7.20	8.30	7.40	8.30
3000	7.30	8.50	7.80	8.40	7.20	8.40	7.60	8.70	7.30	8.40	7.50	8.40	7.20	8.50	7.40	8.20	7.20	8.30	7.40	8.30
3500	7.30	8.50	7.80	8.30	7.20	8.40	7.60	8.70	7.30	8.40	7.50	8.40	7.20	8.50	7.40	8.20	7.20	8.30	7.40	8.30
4000	7.30	8.50	7.80	8.30	7.20	8.40	7.60	8.70	7.30	8.40	7.50	8.40	7.20	8.50	7.40	8.20	7.20	8.30	7.40	8.30
4500	7.30	8.50	7.80	8.30	7.20	8.40	7.60	8.70	7.30	8.40	7.50	8.40	7.20	8.50	7.40	8.20	7.20	8.30	7.40	8.30
5000	7.30	8.50	7.80	8.30	7.20	8.40	7.60	8.70	7.30	8.50	7.50	8.40	7.20	8.50	7.40	8.20	7.20	8.30	7.40	8.30
5500+	7.30	8.50	7.80	8.30	7.20	8.40	7.60	8.70	7.30	8.50	7.50	8.40	7.20	8.50	7.40	8.20	7.20	8.30	7.40	8.30

Appendix 13G (cont.): WOD01 pH (unitless) Ranges by Basin as a Function of Depth

Depth (m)	South Pacific		Coastal S. Pacific		North Indian		Coastal N. Indian		Equatorial Indian		Coastal Eq. Indian		South Indian		Coastal S. Indian		Antarctic		Arctic Ocean	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0	7.30	8.60	7.30	9.00	7.30	8.60	7.10	8.80	7.50	8.50	7.20	8.90	7.30	8.40	7.30	8.50	7.30	8.40	7.20	8.60
10	7.30	8.60	7.30	9.00	7.30	8.60	7.10	8.80	7.50	8.50	7.20	8.90	7.30	8.40	7.30	8.50	7.30	8.40	7.20	8.60
20	7.30	8.60	7.30	9.00	7.30	8.60	7.10	8.80	7.50	8.50	7.20	8.80	7.30	8.40	7.30	8.50	7.30	8.40	7.20	8.60
30	7.30	8.60	7.30	9.00	7.30	8.60	7.10	8.80	7.50	8.50	7.20	8.60	7.30	8.40	7.30	8.50	7.30	8.40	7.20	8.60
50	7.30	8.60	7.30	9.00	7.30	8.60	7.10	8.70	7.50	8.50	7.20	8.60	7.30	8.40	7.40	8.50	7.30	8.40	7.20	8.60
75	7.30	8.60	7.30	8.90	7.30	8.60	7.10	8.70	7.50	8.50	7.20	8.50	7.30	8.40	7.40	8.50	7.30	8.40	7.20	8.60
100	7.30	8.60	7.30	8.90	7.30	8.60	7.10	8.60	7.50	8.50	7.20	8.50	7.30	8.40	7.40	8.50	7.30	8.40	7.20	8.60
125	7.30	8.60	7.30	8.90	7.30	8.60	7.10	8.40	7.50	8.50	7.20	8.40	7.30	8.40	7.40	8.50	7.30	8.40	7.20	8.60
150	7.30	8.60	7.30	8.90	7.30	8.60	7.10	8.40	7.50	8.50	7.20	8.30	7.30	8.40	7.40	8.50	7.30	8.40	7.20	8.60
200	7.30	8.60	7.30	8.70	7.30	8.60	7.10	8.40	7.50	8.50	7.20	8.30	7.30	8.40	7.40	8.50	7.30	8.40	7.20	8.60
250	7.30	8.60	7.30	8.70	7.30	8.60	7.10	8.40	7.50	8.50	7.20	8.30	7.30	8.40	7.40	8.50	7.30	8.40	7.20	8.60
300	7.30	8.60	7.30	8.70	7.30	8.60	7.10	8.40	7.50	8.50	7.20	8.30	7.30	8.40	7.40	8.50	7.30	8.40	7.20	8.60
400	7.30	8.60	7.30	8.70	7.30	8.60	7.10	8.40	7.50	8.50	7.20	8.30	7.30	8.40	7.40	8.50	7.30	8.40	7.20	8.60
500	7.20	8.40	7.40	8.60	7.20	8.30	7.10	8.30	7.40	8.40	7.40	8.30	7.20	8.30	7.60	8.40	7.20	8.30	7.50	8.30
600	7.20	8.40	7.50	8.60	7.20	8.30	7.10	8.30	7.40	8.40	7.40	8.30	7.20	8.30	7.60	8.40	7.20	8.30	7.50	8.30
700	7.20	8.40	7.50	8.50	7.20	8.30	7.10	8.30	7.40	8.40	7.40	8.30	7.20	8.30	7.60	8.40	7.20	8.30	7.50	8.30
800	7.20	8.40	7.50	8.50	7.20	8.30	7.10	8.30	7.40	8.40	7.40	8.30	7.20	8.30	7.60	8.30	7.20	8.30	7.50	8.30
900	7.20	8.40	7.50	8.50	7.20	8.30	7.30	8.30	7.40	8.40	7.50	8.30	7.20	8.30	7.60	8.30	7.20	8.30	7.50	8.30
1000	7.20	8.40	7.50	8.40	7.20	8.30	7.30	8.30	7.40	8.40	7.50	8.30	7.20	8.30	7.60	8.30	7.20	8.30	7.50	8.30
1100	7.20	8.40	7.50	8.40	7.20	8.30	7.30	8.30	7.40	8.40	7.50	8.30	7.20	8.30	7.60	8.30	7.20	8.30	7.50	8.30
1200	7.20	8.40	7.50	8.30	7.20	8.30	7.40	8.30	7.40	8.40	7.50	8.30	7.20	8.30	7.60	8.30	7.20	8.30	7.50	8.30
1300	7.20	8.40	7.50	8.30	7.20	8.30	7.40	8.30	7.40	8.40	7.60	8.30	7.20	8.30	7.60	8.30	7.20	8.30	7.50	8.30
1400	7.20	8.40	7.50	8.30	7.20	8.30	7.40	8.30	7.40	8.40	7.60	8.30	7.20	8.30	7.60	8.30	7.20	8.30	7.50	8.30
1500	7.20	8.40	7.60	8.30	7.20	8.30	7.40	8.30	7.40	8.40	7.60	8.30	7.20	8.30	7.60	8.30	7.20	8.30	7.50	8.30
1750	7.20	8.40	7.60	8.30	7.20	8.30	7.40	8.30	7.40	8.40	7.60	8.30	7.20	8.30	7.60	8.30	7.20	8.30	7.50	8.30
2000	7.20	8.40	7.60	8.30	7.20	8.30	7.40	8.30	7.40	8.40	7.60	8.30	7.20	8.30	7.60	8.30	7.20	8.30	7.50	8.30
2500	7.20	8.40	7.60	8.30	7.20	8.30	7.60	8.30	7.40	8.40	7.60	8.30	7.20	8.30	7.60	8.30	7.20	8.30	7.50	8.30
3000	7.20	8.40	7.60	8.30	7.20	8.30	7.60	8.30	7.40	8.40	7.60	8.30	7.20	8.30	7.60	8.30	7.20	8.30	7.50	8.30
3500	7.20	8.40	7.60	8.30	7.20	8.30	7.60	8.30	7.40	8.40	7.60	8.30	7.20	8.30	7.60	8.30	7.20	8.30	7.50	8.30
4000	7.20	8.40	7.60	8.30	7.20	8.30	7.60	8.30	7.40	8.40	7.60	8.30	7.20	8.30	7.60	8.30	7.20	8.30	7.50	8.30
4500	7.20	8.40	7.60	8.30	7.20	8.30	7.60	8.30	7.40	8.40	7.60	8.30	7.20	8.30	7.60	8.30	7.20	8.30	7.50	8.30
5000	7.20	8.40	7.60	8.30	7.20	8.30	7.60	8.30	7.40	8.40	7.60	8.30	7.20	8.30	7.60	8.30	7.20	8.30	7.50	8.30
5500+	7.20	8.40	7.60	8.30	7.20	8.30	7.60	8.30	7.40	8.40	7.60	8.30	7.20	8.30	7.60	8.30	7.20	8.30	7.50	8.30

Appendix 13G (cont.): WOD01 pH (unitless) Ranges by Basin as a Function of Depth

Depth (m)	Mediterranean		Black Sea		Baltic Sea		Persian Gulf		Red Sea		Sulu Sea	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0	7.40	8.70	7.00	9.00	6.70	9.20	6.00	9.30	7.40	8.50	7.60	8.40
10	7.40	8.70	7.00	8.90	6.70	9.20	6.00	9.30	7.40	8.50	7.60	8.40
20	7.40	8.70	7.00	8.90	6.70	9.20	6.00	9.30	7.40	8.50	7.60	8.40
30	7.40	8.70	7.10	8.90	6.70	9.20	6.00	9.30	7.40	8.50	7.60	8.40
50	7.40	8.70	7.10	8.80	6.70	9.20	6.00	9.30	7.40	8.50	7.60	8.40
75	7.40	8.70	7.10	8.50	6.70	9.00	6.00	9.30	7.40	8.50	7.60	8.40
100	7.40	8.70	7.10	8.50	6.70	8.60	6.00	9.30	7.40	8.50	7.60	8.40
125	7.40	8.60	7.10	8.40	6.70	8.60	6.00	8.60	7.40	8.50	7.60	8.40
150	7.40	8.60	7.10	8.40	6.70	8.60	6.00	8.60	7.40	8.40	7.60	8.40
200	7.40	8.60	7.10	8.30	6.70	8.40	6.00	8.60	7.40	8.40	7.60	8.40
250	7.40	8.60	7.20	8.30	6.70	8.40	6.70	8.20	7.40	8.40	7.60	8.40
300	7.40	8.60	7.20	8.30	6.70	8.40	6.70	8.20	7.40	8.40	7.60	8.40
400	7.40	8.60	7.20	8.30	6.70	8.40	6.70	8.20	7.40	8.40	7.60	8.40
500	7.40	8.60	7.20	8.30	7.50	8.40	6.70	8.20	7.40	8.40	7.60	8.40
600	7.40	8.60	7.20	8.30	7.50	8.40	7.50	8.40	7.40	8.40	7.60	8.40
700	7.40	8.50	7.20	8.30	7.50	8.40	7.50	8.40	7.40	8.40	7.60	8.40
800	7.40	8.50	7.20	8.30	7.50	8.40	7.50	8.40	7.40	8.40	7.60	8.40
900	7.40	8.50	7.20	8.30	7.50	8.40	7.50	8.40	7.40	8.40	7.60	8.40
1000	7.40	8.50	7.20	8.30	7.50	8.40	7.50	8.40	7.60	8.40	7.60	8.40
1100	7.40	8.50	7.40	8.30	7.50	8.40	7.50	8.40	7.60	8.40	7.60	8.40
1200	7.40	8.50	7.40	8.30	7.50	8.40	7.50	8.40	7.60	8.40	7.60	8.40
1300	7.40	8.50	7.40	8.30	7.50	8.40	7.50	8.40	7.60	8.40	7.60	8.40
1400	7.40	8.50	7.40	8.30	7.50	8.40	7.50	8.40	7.60	8.40	7.60	8.40
1500	7.40	8.50	7.40	8.30	7.50	8.40	7.50	8.40	7.60	8.40	7.60	8.40
1750	7.40	8.50	7.40	8.30	7.50	8.40	7.50	8.40	7.60	8.40	7.60	8.40
2000	7.40	8.40	7.40	8.30	7.50	8.40	7.50	8.40	7.60	8.40	7.60	8.20
2500	7.40	8.40	7.40	8.30	7.50	8.40	7.50	8.40	7.60	8.40	7.70	8.20
3000	7.40	8.40	7.40	8.30	7.50	8.40	7.50	8.40	7.60	8.40	7.70	8.20
3500	7.40	8.30	7.40	8.30	7.50	8.40	7.50	8.40	7.60	8.40	7.70	8.20
4000	7.40	8.30	7.40	8.30	7.50	8.40	7.50	8.40	7.60	8.40	7.70	8.20
4500	7.40	8.30	7.40	8.30	7.50	8.40	7.50	8.40	7.60	8.40	7.70	8.20
5000	7.40	8.30	7.40	8.30	7.50	8.40	7.50	8.40	7.60	8.40	7.70	8.20
5500+	7.40	8.30	7.40	8.30	7.50	8.40	7.50	8.40	7.60	8.40	7.70	8.20

Appendix 13H: WOD01 Chlorophyll ( $\mu\text{g/l}$ ) Ranges by Basin as a Function of Depth

Depth (m)	North Atlantic		Coastal N. Atlantic		Equatorial Atlantic		Coastal Eq. Atlantic		South Atlantic		Coastal S. Atlantic		North Pacific		Coastal N. Pacific		Equatorial Pacific		Coastal Eq. Pacific	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0	0.00	3.00	0.00	50.00	0.00	1.50	0.00	50.00	0.00	1.00	0.00	50.00	0.00	1.50	0.00	50.00	0.00	1.00	0.00	50.00
10	0.00	3.00	0.00	50.00	0.00	1.00	0.00	50.00	0.00	1.00	0.00	50.00	0.00	1.50	0.00	50.00	0.00	1.00	0.00	50.00
20	0.00	3.00	0.00	50.00	0.00	1.00	0.00	50.00	0.00	1.00	0.00	50.00	0.00	1.50	0.00	50.00	0.00	1.00	0.00	50.00
30	0.00	2.50	0.00	50.00	0.00	1.00	0.00	50.00	0.00	0.80	0.00	50.00	0.00	1.50	0.00	50.00	0.00	1.00	0.00	50.00
50	0.00	2.00	0.00	50.00	0.00	1.00	0.00	50.00	0.00	0.80	0.00	50.00	0.00	1.00	0.00	50.00	0.00	0.75	0.00	50.00
75	0.00	1.50	0.00	50.00	0.00	0.80	0.00	50.00	0.00	0.50	0.00	50.00	0.00	1.00	0.00	50.00	0.00	0.60	0.00	50.00
100	0.00	1.00	0.00	50.00	0.00	0.60	0.00	50.00	0.00	0.50	0.00	50.00	0.00	1.00	0.00	50.00	0.00	0.50	0.00	50.00
125	0.00	0.50	0.00	50.00	0.00	0.40	0.00	50.00	0.00	0.50	0.00	50.00	0.00	0.75	0.00	50.00	0.00	0.40	0.00	50.00
150	0.00	0.50	0.00	50.00	0.00	0.20	0.00	50.00	0.00	0.40	0.00	50.00	0.00	0.75	0.00	50.00	0.00	0.40	0.00	50.00
200	0.00	0.50	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.50	0.00	50.00	0.00	0.40	0.00	50.00
250	0.00	0.50	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.50	0.00	50.00	0.00	0.10	0.00	50.00
300	0.00	0.40	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.40	0.00	50.00	0.00	0.10	0.00	50.00
400	0.00	0.40	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.40	0.00	50.00	0.00	0.10	0.00	50.00
500	0.00	0.40	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.20	0.00	50.00	0.00	0.05	0.00	50.00
600	0.00	0.40	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.20	0.00	50.00	0.00	0.05	0.00	50.00
700	0.00	0.40	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.20	0.00	50.00	0.00	0.05	0.00	50.00
800	0.00	0.40	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.05	0.00	50.00
900	0.00	0.40	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.05	0.00	50.00
1000	0.00	0.40	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.05	0.00	50.00
1100	0.00	0.40	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.05	0.00	50.00
1200	0.00	0.40	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.05	0.00	50.00
1300	0.00	0.40	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.05	0.00	50.00
1400	0.00	0.40	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.05	0.00	50.00
1500	0.00	0.40	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.05	0.00	50.00
1750	0.00	0.40	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00
2000	0.00	0.40	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00
2500	0.00	0.40	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00
3000	0.00	0.30	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00
3500	0.00	0.30	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00
4000	0.00	0.30	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00
4500	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00
5000	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00
5500+	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00

Appendix 13H (cont.): WOD01 Chlorophyll ( $\mu\text{g/l}$ ) Ranges by Basin as a Function of Depth

Depth (m)	South Pacific		Coastal S. Pacific		North Indian		Coastal N. Indian		Equatorial Indian		Coastal Eq. Indian		South Indian		Coastal S. Indian		Antarctic		Arctic Ocean	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0	0.00	0.80	0.00	50.00	0.00	1.00	0.00	50.00	0.00	1.00	0.00	50.00	0.00	0.50	0.00	50.00	0.00	4.50	0.00	15.00
10	0.00	0.50	0.00	50.00	0.00	1.00	0.00	50.00	0.00	1.00	0.00	50.00	0.00	0.50	0.00	50.00	0.00	4.50	0.00	15.00
20	0.00	0.50	0.00	50.00	0.00	1.00	0.00	50.00	0.00	1.00	0.00	50.00	0.00	0.50	0.00	50.00	0.00	4.50	0.00	15.00
30	0.00	0.50	0.00	50.00	0.00	1.00	0.00	50.00	0.00	1.00	0.00	50.00	0.00	0.50	0.00	50.00	0.00	4.50	0.00	15.00
50	0.00	0.50	0.00	50.00	0.00	1.00	0.00	50.00	0.00	1.00	0.00	50.00	0.00	0.50	0.00	50.00	0.00	4.50	0.00	15.00
75	0.00	0.50	0.00	50.00	0.00	1.00	0.00	50.00	0.00	1.00	0.00	50.00	0.00	0.50	0.00	50.00	0.00	2.00	0.00	15.00
100	0.00	0.50	0.00	50.00	0.00	0.50	0.00	50.00	0.00	0.75	0.00	50.00	0.00	0.50	0.00	50.00	0.00	0.50	0.00	15.00
125	0.00	0.40	0.00	50.00	0.00	0.50	0.00	50.00	0.00	0.50	0.00	50.00	0.00	0.40	0.00	50.00	0.00	0.50	0.00	4.00
150	0.00	0.30	0.00	50.00	0.00	0.40	0.00	50.00	0.00	0.30	0.00	50.00	0.00	0.40	0.00	50.00	0.00	0.50	0.00	4.00
200	0.00	0.20	0.00	50.00	0.00	0.40	0.00	50.00	0.00	0.20	0.00	50.00	0.00	0.40	0.00	50.00	0.00	0.50	0.00	4.00
250	0.00	0.10	0.00	50.00	0.00	0.40	0.00	50.00	0.00	0.10	0.00	50.00	0.00	0.20	0.00	50.00	0.00	0.50	0.00	4.00
300	0.00	0.10	0.00	50.00	0.00	0.40	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.20	0.00	50.00	0.00	0.50	0.00	4.00
400	0.00	0.10	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.20	0.00	50.00	0.00	0.50	0.00	4.00
500	0.00	0.10	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.20	0.00	50.00	0.00	0.50	0.00	4.00
600	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.50	0.00	4.00
700	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.50	0.00	4.00
800	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.50	0.00	4.00
900	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.50	0.00	4.00
1000	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.50	0.00	4.00
1100	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.50	0.00	4.00
1200	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.50	0.00	4.00
1300	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.50	0.00	4.00
1400	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.50	0.00	4.00
1500	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.50	0.00	4.00
1750	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.50	0.00	4.00
2000	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.50	0.00	4.00
2500	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.50	0.00	4.00
3000	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.50	0.00	4.00
3500	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.50	0.00	4.00
4000	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.50	0.00	4.00
4500	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.50	0.00	4.00
5000	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.50	0.00	4.00
5500+	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.05	0.00	50.00	0.00	0.50	0.00	4.00



Appendix 13H (cont.): WOD01 Chlorophyll ( $\mu\text{g/l}$ ) Ranges by Basin as a Function of Depth

Depth (m)	Mediterranean		Black Sea		Baltic Sea		Persian Gulf		Red Sea		Sulu Sea	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0	0.00	5.00	0.00	5.00	0.00	12.00	0.00	5.00	0.00	5.00	0.00	5.00
10	0.00	5.00	0.00	5.00	0.00	12.00	0.00	5.00	0.00	5.00	0.00	5.00
20	0.00	5.00	0.00	5.00	0.00	12.00	0.00	5.00	0.00	5.00	0.00	5.00
30	0.00	5.00	0.00	5.00	0.00	8.00	0.00	5.00	0.00	5.00	0.00	5.00
50	0.00	5.00	0.00	5.00	0.00	8.00	0.00	5.00	0.00	5.00	0.00	5.00
75	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
100	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
125	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
150	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
200	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
250	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
300	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
400	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
500	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
600	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
700	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
800	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
900	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
1000	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
1100	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
1200	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
1300	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
1400	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
1500	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
1750	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
2000	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
2500	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
3000	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
3500	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
4000	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
4500	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
5000	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00
5500+	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00	0.00	5.00





Appendix 13I (cont.): WOD01 Alkalinity (meq/l) Ranges by Basin as a Function of Depth

Depth (m)	Mediterranean		Black Sea		Baltic Sea		Persian Gulf		Red Sea		Sulu Sea	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
0	1.80	3.10	0.0	2.80	0.40	2.80	2.00	2.80	2.00	2.80	0.40	2.80
10	1.80	3.10	0.0	2.80	0.40	2.80	2.00	2.80	2.00	2.80	0.40	2.80
20	1.80	3.10	0.0	2.80	0.40	2.80	2.00	2.80	2.00	2.80	0.40	2.80
30	1.80	3.10	0.0	2.80	0.40	2.80	2.00	2.80	2.00	2.80	0.40	2.80
50	1.80	3.10	0.0	2.80	0.40	2.80	2.00	2.80	2.00	2.80	0.40	2.80
75	2.00	3.10	0.0	2.80	0.40	2.80	2.00	2.80	2.00	2.80	0.40	2.80
100	2.00	3.10	0.0	2.80	0.40	2.80	2.00	2.80	2.00	2.80	0.40	2.80
125	2.00	3.10	0.0	2.80	0.40	2.80	2.00	2.80	2.00	2.80	0.40	2.80
150	2.00	3.10	0.0	2.80	0.40	2.80	2.00	2.80	2.00	2.80	0.40	2.80
200	2.00	3.10	0.0	2.80	0.40	2.80	2.00	2.80	2.00	2.80	0.40	2.80
250	2.00	3.10	0.0	2.80	0.40	2.80	2.00	2.80	2.00	2.80	0.40	2.80
300	2.00	3.10	0.0	2.80	0.40	2.80	2.00	2.80	2.00	2.80	0.40	2.80
400	2.00	3.10	0.0	2.80	0.40	2.80	2.00	2.80	2.00	2.80	0.40	2.80
500	2.00	3.10	0.0	2.80	1.70	2.80	2.00	2.80	2.00	2.80	1.70	2.80
600	2.00	3.10	0.0	2.80	1.70	2.80	2.00	2.80	2.00	2.80	1.70	2.80
700	2.00	3.10	0.0	2.80	1.70	2.80	2.00	2.80	2.00	2.80	1.70	2.80
800	2.00	3.10	0.0	2.80	1.70	2.80	2.00	2.80	2.00	2.80	1.70	2.80
900	2.00	3.10	0.0	2.80	1.70	2.80	2.00	2.80	2.00	2.80	1.70	2.80
1000	2.00	3.10	0.0	2.80	1.70	2.80	2.00	2.80	2.00	2.80	1.70	2.80
1100	2.00	3.10	0.0	2.80	1.70	2.80	2.00	2.80	2.00	2.80	1.70	2.80
1200	2.00	3.10	0.0	2.80	1.70	2.80	2.00	2.80	2.00	2.80	1.70	2.80
1300	2.00	3.10	0.0	2.80	1.70	2.80	2.00	2.80	2.00	2.80	1.70	2.80
1400	2.00	3.10	0.0	2.80	1.70	2.80	2.00	2.80	2.00	2.80	1.70	2.80
1500	2.00	3.10	0.0	2.80	1.70	2.80	2.00	2.80	2.00	2.80	1.70	2.80
1750	2.00	3.10	0.0	2.80	1.70	2.80	2.00	2.80	2.00	2.80	1.70	2.80
2000	2.00	3.10	0.0	2.80	1.70	2.80	2.00	2.80	2.00	2.80	1.70	2.80
2500	2.00	3.10	0.0	2.80	1.70	2.80	2.00	2.80	2.00	2.80	1.70	2.80
3000	2.00	3.10	0.0	2.80	2.00	2.80	2.00	2.80	2.00	2.80	2.00	2.80
3500	2.00	3.10	0.0	2.80	2.00	2.80	2.00	2.80	2.00	2.80	2.00	2.80
4000	2.00	3.10	0.0	2.80	2.00	2.80	2.00	2.80	2.00	2.80	2.00	2.80
4500	2.00	3.10	0.0	2.80	2.00	2.80	2.00	2.80	2.00	2.80	2.00	2.80
5000	2.00	3.10	0.0	2.80	2.00	2.80	2.00	2.80	2.00	2.80	2.00	2.80
5500+	2.00	3.10	0.0	2.80	2.00	2.80	2.00	2.80	2.00	2.80	2.00	2.80