HLY-04-04 Service Group Bottle Data Documentation

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Dutch Harbor, Alaska to Nome, Alaska

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Data Set Overview

A post-cruise review of the data by L.A. Codispoti suggests that the bottle data are of generally high quality, but in a few cases, insufficient bottle flushing or other factors caused discrepancies between bottle salinities and CTD salinities that produce apparent depth offsets of >5 m. We have attempted to flag bottle data when such discrepancies were noted, but the user interested in fine scale vertical data for variables/parameters determined from Niskin bottle samples is advised to compare bottle and CTD salinity data when both are available to assess the potential impact of insufficient bottle flushing. This post-cruise review of the bottle data also revealed a few suspicious nutrient and dissolved oxygen values that were double-checked by SIO/ODF personnel and flagged as appropriate.

A total of 157 CTD stations with bottom depths ranging from 30m-–2300m were collected from the Chukchi and western Beaufort Seas. Water samples were taken at 117 of these stations. Water sample measurements typically included dissolved oxygen, salinity, nutrients, chlorophyll and phyopigments. In addition, O18, dissolved organic carbon, particulate organic carbon, total CO2, alkalinity, and radium samples were collected during particular sections. CTD casts typically went to within 5m of the ocean floor; however, during the eddy survey and on comparison casts for the mooring sensors, it was not necessary to take the CTD to the ocean bottom.

Instrumentation

CTD Package

At the time of finalizing this report, the post cruise CTD report was unavailable from Pickard, WHOI. The instrumentation information here is summarized from shipboard notes by Zimmermann. CTD and water sample data were collected using the USCGC Healy's Seabird 911+ system operating at 24Hz scan rate, with a 24 position rosette package and 24 12-liter Niskin bottles. In addition to a dual set of pumped temperature and conductivity sensors, the CTD had a SBE43 oxygen sensor pumped in-line with the primary temperature and conductivity sensors, a WetLabs CST transmissometer, an Aquatraka fluorometer, and a Benthos altimeter. Fortunately, a backup frame, CTD and auxiliary sensors were also provided because we were required to change out the CTD and the altimeter during the cruise. See the appendix for sensor serial numbers, calibration dates and position on frame.

CTD Data Acquisition and Processing Procedures

Upon reaching the station, the rosette was brought out of the hanger, the CTD was powered on and data acquisition started. The transmissometer and fluorometer windows were cleaned immediately before each deployment. The sensors were soaked for three minutes at 10m after the pumps turned on. The CTD frame was then raised back to the near−surface (between 2m and 5m) and lowered at 30m/min to 100m and then at 60m/min. The descent rate was slowed to 30m/min approximately 60m off the ocean floor, and slowed further at 10m off the bottom. Depending on sea state, maximum CTD depths were within 1 to 5m of the ocean bottom. The bottom bottle was fired immediately and subsequent bottles were closed after waiting 30 seconds at each stop. The 'surface' bottle was taken at 10m to avoid the extremely large surface gradients and the change in water properties due to ship's presence (for example, the propeller wash). The CTD was turned off after the package was landed on deck, the water sampler rinsed with fresh water and the package returned to the heated hanger for sampling.

The CTD data were acquired and processed with Seabird software on a PC platform with further processing using Matlab-based routines. Acquisition occurred real -time through a conducting cable from the CTD to a PC running Seasave-Win32_V5_31a. The ship's GPS position was added to each data scan via the NMEA interface. Upon completion of the station, the data were copied via the ship's network to the processing PC. Seabird's windows based processing software, SBEDataProcessing-Win32_V5_29b, was then used to produce 1db averaged downcast and upcast profiles. The standard processing steps followed at sea were: sensor alignment through advancing conductivity; spike removal; a correction for the thermal mass of the temperature sensors; filtering; removal of pressure reversals; calculation of oxygen; averaging to 1 db levels; calculation of other derived properties; and the file separation between downcast and upcast profiles.

Final processing was completed using Matlab to calibrate, plot and remove spikes in the data. Both conductivity sensors and the oxygen sensor were calibrated to the water samples and the calibration applied to the down and upcasts. The data were plotted

station by station and density inversions in the downcast identified. A 0.004 kg/m3 criteria was used to identify density inversions at depths over 10m. The top 10m were not examined for density inversions. The inversions were interpolated over in the primary temperature and conductivity sensor data, and the derived properties (salinity, density, theta) were recalculated. The interpolations are listed in the appendix. The fluorometer and transmissometer are unprocessed.

CTD Data Quality

Overview/Highlights

The CTD, rosette and niskin bottles performed well. The CTD temperature and conductivity sensors performed to their specified accuracy. The only equipment problems experienced were with leaks in the connections, and the failure of the first altimeter. The auxiliary-4 CTD bulkhead connector leaked repeatedly even after the cable was changed out. Due to this, the CTD body was swapped out before station 61, but all the sensors were kept in their same configuration and plugged into the spare CTD. Removing the CTD with the bad auxillary-4 connector revealed the modem bulkhead connector also had a slow leak. These connectors were replaced although we never needed to switch back to this CTD. The altimeter was changed out shortly afterwards for station 64. It was not reading full scale (~98.5m) when it was over 100m from the ocean floor and during the bottom approach of station 63 the altimeter was reading 4m as the package touched the bottom. The altimeter base appeared damaged although we had not experienced any event that would have caused this damage. Perhaps the damage had been received earlier but only now, cycling in the cold and to greater pressure, it became affected by the damage?

- The CTD wire was reterminated once, after station 83. The CTD had swung strongly in the block and in addition to this high-tension event there was an earlier kink in the wire. As a safety measure it was decided to reterminate the wire.
- The CTD touched the bottom during stations 63 and 77, both at slow speed and without any change to the calibrations.
- The pumps were frozen at the start of station 111, cast 2. The CTD was recovered and the pumps thawed before redeployment. After this the hangar door was lowered further and the gap between door and floor was covered to try and keep the floor at a warmer temperature. The pumps did not freeze again.

These were the major issues for the CTD, however, the complete list of station comments is included in the appendix.

Pressure

On deck pressure was examined for stations 1 to 49 to determine if a mean pressure offset existed. Typically there was an offset of 0.3db before the cast and –0.2db after the cast. The CTD is powered up just before the cast, and typically the CTD pressure drifts from 0.4 towards 0 during the pre-cast time on deck. Based on this, it appears a longer warm-up period could be used and that there is no pressure bias.

Temperature

The primary and secondary temperature sensors were compared using the data from the bottle stops. They show a mean difference of less than 0.0005 degC. This inter-

comparison supports the stated instrument accuracy of 0.001degC without requiring a post-cruise calibration.

Conductivity

The conductivity sensors were very stable, requiring only one calibration during the cruise and providing the stated accuracy of 0.002 psu. Stations 1 to 111 were used in the fit. Surface values were used in the fit to obtain a slope over the range of conductivities; however, the majority of observations discarded by the iterative fitting routine (acceptable residual criteria was less than 2.5 x STD) were from the high salinity gradient water in the upper 50m.

Sensor	Slope	Bias	STD mS/cm	Number of Obs
Primary	1.00016	-0.00358	0.0012	306 of 555
Secondary	0.99959	0.01003	0.0011	284 of 555

Oxygen

The oxygen sensor was also quite stable with one calibration performed for the cruise. The data were calibrated to the water samples, using stations 1 to 96. The calibration method followed the Seabird Application Note Number 64-2. This method determines two of the six coefficients, Soc and Voffset. The other coefficients were left at their laboratory calibration settings. All water samples were used in an iterative fitting routine (acceptable residual criteria was less than 2.5 x STD). The standard deviation of the calculated oxygen (using the same observations that passed the fitting criteria) was 0.05 ml/l.

Sensor	Soc	Voffset	STD	Number of Obs
Oxygen	4.0268e-01	–0.4434	0.006 oxy/phi	422 out of 560
			0.05 ml/l	422 out of 560

Fluorometer

The fluorometer data were not processed.

Transmissometer

The transmissometer data were not processed. A log of the full scale in-air and blocked in-air readings were measured from 7 September to 16 September. They show little change over this period. The full scale in-air reading had a range from 4.56 to 4.8 volts with a more consistent reading after the transmissometer had been powered on for a few minutes. The blocked reading had a range of 0.048 to 0.056 volts. The window was cleaned with de-ionized water prior to each cast.

CTD Data Footnoting
WHP water bottle quality flags were assigned as defined in the WOCE Operations Manual (Joyce and Corry, 1994). These flags and interpretation are tabulated in the CTD and Bottle Data Distribution, Quality Flags section of this document.

Bottle Data

There were two generic types of casts performed with differing sampling protocols. Generally speaking, the samplings associated with these casts were as follows, but there is some cast-to-cast variation.

- **Hydrographic**
  - ***Oxygen***
  - ***Total CO2***
  - ***Total Alkalinity***
  - ***Nutrients***
  - ***Chlorophyll/Phaeophytin***
  - ***Salinity***
  - ***O18/O16***
  - ***Dissolved Organic Matter/Particulate Organic Matter***
- **Radium**
  - ***Radium***
  - ***Salinity***
  - ***O18/O16***

The correspondence between individual sample containers and the rosette bottle from which the sample was drawn was recorded on the sample log for the cast. This log also included any comments or anomalous conditions noted about the rosette and bottles.

Normal sampling practice included opening the drain valve before the air vent on the bottle, to check for air leaks. This observation together with other diagnostic comments (e.g., "lanyard caught in lid", "valve left open") that might later prove useful in determining sample integrity was noted on the sample log.

Bottle Data Processing

After the samples were drawn and analyzed, the next stage of processing involved merging the different data streams into a common file. The rosette cast and bottle numbers were the primary identification for all ODF-analyzed samples taken from the bottle, and were used to merge the analytical results with the CTD data associated with that bottle.

Diagnostic comments from the sample log, and notes from analysts and/or bottle data processors were entered into a computer file associated with each station (the "quality" file) as part of the quality control procedure. WHP water sample codes were selected to indicate the reliability of the individual parameters affected by the comments. WHP bottle codes were assigned where evidence showed the entire bottle was affected, as in the case of a leak, or a bottle trip at other than the intended depth. Data comments are included in Appendix A: Bottle Quality Comments.

Specific data processing and techniques and additional quality control are included with the parameter write-up.

Pressure and Temperatures
All pressures and temperatures for the bottle data tabulation were obtained by averaging CTD data for a brief interval at the time the bottle was closed and then applying the appropriate calibration data.

The temperatures are reported using the International Temperature Scale of 1990.

Salinity
766 salinity samples were analyzed, including thermosalinograph check samples.

Sampling and Data Processing

Salinity samples were drawn into 200 ml high alumina borosilicate bottles, which were rinsed three times with sample prior to filling. The bottles were sealed with custom-made plastic insert thimbles and Nalgene screw caps. This container provides very low container dissolution and sample evaporation.

Equipment and Techniques

A Guildline Autosal 8400B #65-715, standardized with IAPSO Standard Seawater (SSW) batch P-144, was used to measure the salinities. Prior to the analyses, the samples were stored to permit equilibration to laboratory temperature, usually 8-20 hours. The salinometer was outfitted with an Ocean Scientific International interface for computer-aided measurement. The salinometer was standardized with a fresh vial of standard seawater (SSW) at the beginning of each analysis run. Instrument drift was determined by running a SSW vial after the last sample was run through the autosal. The salinometer cell was flushed until two successive readings met software criteria for consistency; these were then averaged for a final result. The estimated accuracy of bottle salinities run at sea is usually better than 0.002 PSU relative to the particular standard seawater batch used.

Laboratory Temperature

The temperature stability in the salinometer laboratory was moderate; variation was no more than 3° C during a run of samples. The laboratory temperature was generally 2-3ºC lower than the Autosal bath temperature.

Oxygen
790 samples were analyzed for oxygen.

Sampling and Data Processing

Samples were collected for dissolved oxygen analyses as the first sample after the rosette was brought on board. Using a Tygon drawing tube, nominal 125ml volume-calibrated iodine flasks were rinsed three times then filled and allowed to overflow for approximately three flask volumes. The sample draw temperature was measured with a small platinum resistance thermometer embedded in the drawing tube. Reagents were added to fix the oxygen before stoppering. The flasks were shaken twice to assure thorough dispersion of the precipitate, once immediately after drawing, and then again

after about 20 minutes. The samples were usually analyzed within several hours of collection. Thiosulfate normalities were calculated from each standardization and corrected to 20ºC. Periodically, the 20ºC normalities and the blanks were plotted versus time and were reviewed for possible problems. New thiosulfate normalities were recalculated as a linear function of time, if warranted. The oxygen data were recalculated using the smoothed normality and an averaged reagent blank. Oxygens were converted from milliliters per liter to micromoles per kilogram using the sampling draw temperature and the sample's salinity.

It was noted part way through the cruise that sample draw temperatures were not being reported as negative. Sample draw temperatures were plotted versus CTD bottle temperatures and "sign"-corrected where appropriate for stations 00601 through 07801. Sample draw temperatures after 07801 were read and recorded correctly on the sample log sheets.

Equipment and Techniques

Dissolved oxygen analyses were performed with an ODF-designed automated oxygen titrator using photometric end-point detection based on the absorption of 365nm wavelength ultra-violet light. The titration of the samples and the data logging were controlled by PC software. Thiosulfate was dispensed by a Dosimat 665 buret driver fitted with a 1.0 ml buret. The ODF method used a whole-bottle modified-Winkler titration following the technique of Carpenter (1965) with modifications by Culberson (1991), but with higher concentrations of potassium iodate standard (approximately 0.012N) and thiosulfate solution (55 g/l). Standard KIO3 solutions prepared ashore were run at the beginning of each run. Reagent and distilled water blanks were determined, to account for presence of oxidizing or reducing materials.

Volumetric Calibration

Oxygen flask volumes were determined gravimetrically with degassed deionized water to determine flask volumes at ODF's chemistry laboratory. This was done once before using flasks for the first time and periodically thereafter when a suspect bottle volume was detected. The volumetric flasks used in preparing standards were volume-calibrated by the same method, as was the 10 ml Dosimat buret used to dispense standard iodate solution.

Standards

Potassium iodate was obtained from Johnson Matthey Chemical Co. and was reported by the supplier to be >99.4% pure.

Nutrients

849 samples were analyzed for nutrients.

Sampling and Data Processing

Nutrient samples were drawn into 45 ml polypropylene, screw-capped "oak-ridge type" centrifuge tubes. The tubes were rinsed with 10% HCl and then with sample three times before filling. Standardizations were performed at the beginning and end of each group of

analyses (10-36 samples) with an intermediate concentration of mixed nutrient standard in a low nutrient seawater matrix. This standard was prepared from a secondary standard immediately prior to each run. The secondary standards were prepared aboard ship by dilution from primary standard solutions. Dry standards were pre-weighed at the laboratory at ODF, and transported to the vessel for dilution to the primary standard. Sets of 7 different standard concentrations covering the range of sample concentrations were analyzed periodically to determine the deviation from linearity, if any, as a function of absorbance for each nutrient analysis. A correction for non-linearity was applied to the final nutrient concentrations when necessary. After each group of samples was analyzed, the raw data file was processed to produce another file of response factors, baseline values, and absorbances. Suspect values were checked for accuracy against values taken from strip chart recordings.

Nutrients, when reported in micromoles per kilogram, were converted from micromoles per liter by dividing by sample density calculated at 1 atm pressure (0 db), *in situ* salinity, and the sample temperature measured at the time of analysis.

Equipment and Techniques

Nutrient analyses (nitrate+nitrite, nitrite, phosphate, and silicate) were performed on an ODF-modified 4-channel Technicon AutoAnalyzer II, generally within a few hours after sample collection. The samples were kept in the dark by covering with tin foil or refrigerated at 4(C, if necessary, but brought to within 5(C of lab temperature before analysis. The analog outputs from each of the six channels were digitized and logged automatically by computer (PC) at 2-second intervals.

A modification of the Armstrong et al. (Armstrong 1967) procedure was used for the analysis of nitrate and nitrite. For the nitrate plus nitrite analysis, the seawater sample was passed through a cadmium reduction column where nitrate was quantitatively reduced to nitrite. The stream was then passed through a 15mm flowcell and the absorbance measured at 540nm. The same technique was employed for nitrite analysis, except the cadmium column was bypassed, and a 50mm flowcell was used for measurement. Periodic checks of the column efficiency were made by running alternate equal concentrations of NO2 and NO3 through the NO3 channel to ensure that column efficiencies were high (> 95%). Nitrite concentrations were subtracted from the nitrate+nitrite values to obtain nitrate concentrations.

Phosphate was analyzed using a modification of the Bernhardt and Wilhelms [Bernhardt 1967.] technique. The reaction product was heated to ~55ºC to enhance color development, then passed through a 50mm flowcell and the absorbance measured at 820m.

Silicate was analyzed using the technique of Armstrong et al., (Armstrong, 1967). The sample was passed through a 15mm flowcell and the absorbance measured at 660nm.

Nutrient Standards

Primary standards for nitrate (KNO3), nitrite (NaNO2), and phosphate (KH2PO4) were obtained from Johnson Matthey Chemical Company, and the supplier reported purities of

99.999%, 97%, and 99.999%, respectively. Na2SiF6, the silicate primary standard, was obtained from Johnson Matthey Company and Fisher Scientific and was reported by the suppliers to be >98% pure.

Bottle Data Footnoting

WHP water bottle quality flags were assigned as defined in the WOCE Operations Manual [Joyce]. These flags and interpretation are tabulated in the Data Distribution, Bottle Data, Quality Flags section of this document.

Data Distribution

The CTD and bottle data can be obtained through NCAR's Earth Observing Laboratory (EOL) web site, http://www.eol.ucar.edu/projects/sbi/. The data are reported using the WHP-Exchange (WOCE Hydrographic Program) format and the quality coding follows those outlined by the WOCE program (Joyce, 1994). In addition, the format can be obtained through the CLIVAR and Carbon Hydrographic Data Office, http://cchdo.ucsd.edu. The descriptions in this document have been edited from the reference to annotate the format specific to this data distribution. ASCII files for each station were created with comments recorded on the CTD Station Logs during data acquisition. These ASCII files include data processing comments noting any problems, their resolution, and footnoting that may have occurred. A separate ASCII file was also created with the comments from the Sample Log Sheets that include problems with the Niskin bottles that could compromise the samples. Comments arising from inspection and checking of the data are also included in the ASCII file. These comment files are also in the EOL database. Raw (unprocessed) CTD data files are archived in the EOL database. The file hly0403_ctd_raw.zip contains ssscc.cfg, ssscc.con, ssscc.dat and ssscc.hdr (where sss = station number and cc = cast number) files as acquired by the SeaBird SeaSave acquisition program, sbscan.sum file and calibration information for all sensors. The *.cfg file is datcnv.cfg with the beginning scan number and *.con files may include a correction based on the bottle salinity samples. The sbscan.sum file is a list of stations and beginning scan number. Configuration files for the various SeaBird CTD processing programs are also included where applicable.

General rules for WHP-exchange:

1. Each line must end with a carriage return or end-of-line.
2. With the exception of the file type line, lines starting with a "#" character, or including and following a line which reads "END_DATA", each line in the file must have exactly the same number of commas as do all other lines in that file.
3. The name of a quality flag always begins with the name of the parameter with which it is associated, followed by an underscore character, followed by "FLAG", followed by an underscore, and then followed by an alphanumeric character, W.
4. The "missing value" for a data value is always defined as -999, but written in the decimal place format of the parameter in question. For example, a missing salinity would be written -999.0000 or a missing phosphate -999.00.

5. The first four characters of the EXPOCODE are the U.S. National Oceanographic Data Center (NODC) country-ship code, then followed by up to an 8 characters expedition name of cruise number, i.e. 32H1HLY0403.

CTD Data

CTD data was acquired and processed by the Woods Hole Oceanographic Institution (WHOI) Pickard group. WHOI CTD files were reformatted by the Oceanographic Data Facility (ODF) to comply with WHP-Exchange format standards. WHP-Exchange formatted CTD data is located in file 32H1hly0404_ct1.zip. This file contains ssscc_ct1.csv files for each station and cast where sss=3 digit station identifier and cc=2 digit cast identifier.

Description of ssscc_ct1.csv file layout.

1st line	File type, here CTD, followed by a comma and a DATE_TIME stamp YYYYMMDDdivINSwho YYYY 4 digit year MM 2 digit month DD 2 digit day div division of Institution INS Institution name who initials of responsible person
# lines	A file may include 0-N optional lines at the start of a data file, each beginning with a "#" character and each ending with carriage return or end-of-line. Information relevant to file change/update history may be included here, for example.
2nd line	NUMBER_HEADERS = n (n = 10 in this table and the example_ct1.csv file.)
3rd line	EXPOCODE = [expocode] The expedition code, assigned by the user.
4th line	SECT_ID = [section] The SBI station specification. *Optional*.
5th line	STNNBR = [station] The originator's station number
6th line	CASTNO = [cast] The originator's cast number
7th line	DATE = [date] Cast date in YYYYMMDD integer format.
8th line	TIME = [time] Cast time that CTD was at the deepest sampling point.
9th line	LATITUDE = [latitude] Latitude as SDD.dddd where "S" is sign (blank or missing is positive), DD are degrees, and dddd are decimal degrees. Sign is positive in northern hemisphere, negative in southern hemisphere
10th line	LONGITUDE = [longitude] Longitude as SDDD.dddd where "S" is sign (blank or missing is positive), DDD are degrees, and dddd are decimal degrees. Sign is positive for "east" longitude, negative for "west" longitude
11th line	DEPTH = [bottom] Reported depth to bottom. Preferred units are "meters" and should be specified in Line 2. In general, corrected depths are preferred to uncorrected depths. Documentation accompanying data

	includes notes on methodology of correction. *Optional.*
next line	Parameter headings.
next line	Units.
data lines	A single _ct1.csv CTD data file will normally contain data lines for one CTD cast.
END_DATA	The line after the last data line must read END_DATA, and be followed by a carriage return or end of line.
other lines	Users may include any information they wish in 0-N optional lines at the end of a data file, after the END_DATA line.

Parameter names, units, format, and comments

Parameter	Units	Format	Comments
CTDPRS	DB	F7.1	CTD pressure, decibars
CTDPRS_FLAG_W		I1	CTDPRS quality flag
CTDTMP	ITS-90	F8.3	CTD temperature, degrees C (ITS-90)
CTDTMP_FLAG_W		I1	CTDTMP quality flag
CTDSAL		F8.3	CTD salinity
CTDSAL_FLAG_W		I1	CTDSAL quality flag
CTDOXY	UMOL/KG	F7.1	CTD oxygen, micromoles/kilogram
CTDOXY_FLAG_W		I1	CTDOXY quality flag
STHETA		F8.3	Sigma Theta
STHETA_FLAG_W		I1	Sigma Theta quality flag
XMISS	%TRANS	F7.1	Transmissivity, percent transmittance
XMISS_FLAG_W		I1	XMISS quality flag
FLUOR	ug/L	F8.3	Fluorometer, voltage
FLUOR_FLAG_W		I1	Fluorometer quality flag

Quality Flags

CTD data quality flags were assigned to the CTDTMP (CTD temperature), CTDSAL (CTD salinity) and XMISS (Transmissivity) parameters as follows:

2 Acceptable measurement.

3 Questionable measurement. *The data did not fit the station profile or adjacent station comparisons (or possibly bottle data comparisons). The data could be acceptable, but are open to interpretation.*

4 Bad measurement. *The CTD data were determined to be unusable.*

5 Not reported. *The CTD data could not be reported, typically when CTD salinity is flagged 3 or 4.*

9 Not sampled. *No operational sensor was present on this cast*

WHP CTD data quality flags were assigned to the CTDOXY (CTD O_2), FLUORO (Fluorometer), PAR (PAR), SPAR (Surface PAR), and HAARDT (Haardt Fluorometer CDOM) parameter as follows:

1 Not calibrated. *Data are uncalibrated*.

9 Not sampled. *No operational sensor was present on this cast. Either the sensor cover was left on or the depth rating necessitated removal.*

Bottle Data

Description of 32H1HLY0404_hy1.csv file layout.

1st line	File type, here BOTTLE, followed by a comma and a DATE_TIME stamp YYYYMMDDdivINSwho YYYY 4 digit year MM 2 digit month DD 2 digit day div division of Institution INS Institution name who initials of responsible person
#lines	A file may include 0-N optional lines, typically at the start of a data file, but after the file type line, each beginning with a "#" character and each ending with carriage return or end-of-line. Information relevant to file change/update history of the file itself may be included here, for example.
2nd line	Column headings.
3rd line	Units.
data lines	As many data lines may be included in a single file as is convenient for the user, with the proviso that the number and order of parameters, parameter order, headings, units, and commas remain absolutely consistent throughout a single file.
END_DATA	The line after the last data line must read END_DATA.
other lines	Users may include any information they wish in 0-N optional lines at the end of a data file, after the END_DATA line.

Header columns

Parameter	Format	Description notes
EXPOCODE	A12	The expedition code, assigned by the user.
SECT_ID	A7	The SBI station specification. *Optional*.
STNNBR	A6	The originator's station number.
CASTNO	I3	The originator's cast number.
BTLNBR	A7	The bottle identification number.
BTLNBR_FLAG_W	I1	BTLNBR quality flag.
DATE	I8	Cast date in YYYYMMDD integer format.
TIME	I4	Cast time (UT) as HHMM
LATITUDE	F8.4	Latitude as SDD.dddd where "S" is sign (blank or missing is positive),

		DD are degrees, and dddd are decimal degrees. Sign is positive in northern hemisphere, negative in southern hemisphere
LONGITUDE	F9.4	Longitude as SDDD.dddd where "S" is sign (blank or missing is positive), DDD are degrees, and dddd are decimal degrees. Sign is positive for "east" longitude, negative for "west" longitude
DEPTH	I5	Reported depth to bottom. Preferred units are "meters" and should be specified in Line 2. In general, corrected depths are preferred to uncorrected depths. Documentation accompanying data includes notes on methodology of correction. *Optional.*

Parameter names, units, and comments:

Parameter	Units	Format	Comments
CTDPRS	DB	F9.1	CTD pressure, decibars
CTDPRS_FLAG-W		I1	CTDPRS quality flag
SAMPNO		A7	Cast number *100+BTLNBR. *Optional*
CTDTMP	ITS-90	F9.4	CTD temperature, degrees C, (ITS-90)
CTDTMP_FLAG_W		I1	CTDTMP quality flag
CTDCOND	MS/CM	F9.4	CTD Conductivity, milliSiemens/centimeter
CTDCOND_FLAG_W		I1	CTDCOND quality flag
CTDSAL		F9.4	CTD salinity
CTDSAL_FLAG_W		I1	CTDSAL quality flag
SALNTY		F9.4	bottle salinity
SALNTY_FLAG_W		I1	SALNTY quality flag
SIGMA	THETA	F9.4	Sigma Theta
SIGMA_FLAG_W		I1	Sigma Theta quality flag
CTDOXY	UMOL/KG	F9.1	CTD oxygen, micromoles/kilogram
CTDOXY_FLAG_W		I1	CTDOXY quality flag
CTDOXY	ML/L	F9.3	CTD oxygen, milliliters/liter
CTDOXY_FLAG_W		I1	CTDOXY quality flag
OXYGEN	UMOL/KG	F9.1	bottle oxygen
OXYGEN_FLAG_W		I1	OXYGEN quality flag
OXYGEN	ML/L	F9.3	bottle oxygen, milliliters/liter
OXYGEN_FLAG_W		I1	OXYGEN quality flag
O2TEMP	DEGC	F6.1	Temperature of water from spigot during oxygen draw, degrees C
O2TEMP_FLAG_W		I1	O2TEMP quality flag
SILCAT	UMOL/KG	F9.2	SILICATE, micromoles/kilogram

SILCAT_FLAG_W		I1	SILCAT quality flag
SILCAT	UMOL/L	F9.2	SILCATE, micromoles/liter
SILCAT_FLAG_W		I1	SILCAT quality flag
NITRAT	UMOL/KG	F9.2	NITRATE, micromoles/kilogram
NITRAT_FLAG_W		I1	NITRAT quality flag
NITRAT	UMOL/L	F9.2	NITRATE, micromoles/liter
NITRAT_FLAG_W		I1	NITRAT quality flag
NITRIT	UMOL/KG	F9.2	NITRITE, micromoles/kilogram
NITRIT_FLAG_W		I1	NITRIT quality flag
NITRIT	UMOL/L	F9.2	NITRITE, micromoles/liter
NITRIT_FLAG_W		I1	NITRIT quality flag
PHSPHT	UMOL/KG	F9.2	PHOSPHATE, micromoles/kilogram
PHSPHT_FLAG_W		I1	PHSPHT quality flag
PHSPHT	UMOL/L	F9.2	PHOSPHATE, micromoles/liter
PHSPHT_FLAG_W		I1	PHSPHT quality flag
FLUORO	VOLTS	F8.3	Fluorometer, voltage
FLUORO_FLAG_W		I1	Fluorometer quality flag
CHLORO	UG/L	F8.2	Chlorophyll, micrograms/liter
CHLORO_FLAG_W		I1	Chlorophyll quality flag
PHAEO	UG/L	F8.2	Phaeophytin, micrograms/liter
PHAEO_FLAG_W		I1	Phaeophytin quality flag
BTL_DEP	METERS	F5.0	bottle depth, meters
BTL_LAT		F8.4	Latitude at time of bottle trip, decimal degrees
BTL_LONG		F9.4	Longitude at time of bottle trip, decimal degrees
JULIAN		F8.4	Julian day and time as fraction of day of the bottle trip.

Quality Flags

CTD data quality flags were assigned to CTDPRS (CTD pressure), CTDTMP (CTD temperature), CTDCOND (CTD Conductivity), and CTDSAL (CTD salinity) as defined in Data Distribution, CTD Data, Quality Flags section of this document. CTDOXY (CTD O_2), FLUORO (Fluorometer), PAR (PAR), and SPAR (Surface PAR) parameters are flagged with either a 2, acceptable or 9, not drawn.

Bottle quality flags were assigned to the BTLNBR (bottle number) as defined in the WOCE Operations Manual [Joyce] with the following additional interpretations:

2 No problems noted.

3 Leaking. *An air leak large enough to produce an observable effect on a sample is identified by a flag of 3 on the bottle and a flag of 4 on the oxygen.*

(Small air leaks may have no observable effect, or may only affect gas samples.)

4 Did not trip correctly. *Bottles tripped at other than the intended depth were assigned a flag of 4. There may be no problems with the associated water sample data.*

9 The samples were not drawn from this bottle.

WHP water sample quality flags were assigned to the water samples using the following criteria:

1 The sample for this measurement was drawn from the water bottle, but the results of the analysis were not (*yet*) received.

2 Acceptable measurement.

3 Questionable measurement. *The data did not fit the station profile or adjacent station comparisons (or possibly CTD data comparisons). No notes from the analyst indicated a problem. The data could be acceptable, but are open to interpretation.*

4 Bad measurement. *The data did not fit the station profile, adjacent stations or CTD data. There were analytical notes indicating a problem, but data values were reported. Sampling and analytical errors were also flagged as 4.*

5 Not reported. *The sample was lost, contaminated or rendered unusable.*

9 The sample for this measurement was not drawn.

Not all of the quality flags are necessarily used on this data set.

References

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Bernhardt, Wilhelms A., "The continuous determination of low level iron, soluble phosphate and total phosphate with the AutoAnalyzer", *Technicon Symposia*, **I**, pp. 385-389 (1967).

Carpenter, J. H., "The Chesapeake Bay Institute technique for the Winkler dissolved oxygen method," *Limnology and Oceanography*, 10, pp. 141-143 (1965).

Culberson, C. H., Knapp, G., Stalcup, M., Williams, R.T., and Zemlyak, F., "A comparison of methods for the determination of dissolved oxygen in seawater," Report WHPO 91-2, WOCE Hydrographic Programme Office (Aug 1991).

Joyce, T. ed., and Corry, C. ed., "Requirements for WOCE Hydrographic Programme Data Reporting," Report WHPO 90-1, WOCE Report No. 67/91 3.1, pp. 52-55, WOCE Hydrographic Programme Office, Woods Hole, MA, USA (May 1994, Rev. 2), UNPUBLISHED MANUSCRIPT

APPENDIX A: Bottle Quality Comments

Remarks for deleted samples, missing samples, PI data comments, and WOCE codes other than 2 from HLY0404 USCGC Healy. Comments from the Sample Logs and the results of ODF's investigations are included in this report. Investigation of data may include comparison of bottle salinity and oxygen data with CTD data, review of data plots of the station profile and adjoining stations, and rereading of charts (i.e. nutrients). Units stated in these comments are degrees Celsius for temperature, Practical Salinity Units for salinity, and unless otherwise noted, milliliters per liter for oxygen and micromoles per liter for Silicate, Nitrate, Nitrite, Phosphate and Urea and Ammonium, if appropriate. The first number before the comment is the cast number (CASTNO) times 100 plus the bottle number (BTLNBR).

Station 002.002
201 SampleLog: "Lanyard hooked over bottle, did not trip." No samples drawn.
201-217 Oxygen and nutrients not drawn, Radium cast.
202,204,206 Salinity, oxygen and nutrients not drawn.
208,210,212 Salinity, oxygen and nutrients not drawn.
214 SampleLog: "Tugging on line, caused bottle to close." No samples drawn.
216 Salinity, oxygen and nutrients not drawn.
Station 004.002
201-224 Oxygen and nutrients not drawn, Radium cast.
202,204,206 Salinity oxygen and nutrients not drawn.
208,210,212 Salinity oxygen and nutrients not drawn.
214,216,218 Salinity oxygen and nutrients not drawn.
217 Pooragreement between CTD and bottle salinity and resulting density inversion indicates
bad salinity sample. Analyst notes no problems.
220,222,224 Salinity oxygen and nutrients not drawn.
Station 005.001
101 Oxygen: black ppt in flask; unable to find endpoint; sample lost.
Station 006.002
201 Nosamples drawn, prematuraly tripped.
201-224 Oxygen and nutrients not drawn, Radium cast.
203,205,207 Salinity, oxygen and nutrients not drawn.
209,211,213 Salinity, oxygen and nutrients not drawn.
215,217,219 Salinity, oxygen and nutrients not drawn.
221,223,224 Salinity, oxygen and nutrients not drawn.
Station 006.003
301-319 Oxygen and nutrients not drawn, Radium cast.
302,304,306 Salinity, oxygen and nutrients not drawn.
308,310,312 Salinity, oxygen and nutrients not drawn.
314,316,318 Salinity, oxygen and nutrients not drawn.
Station 007.001
Cast 1 Sample log: "Oxygen trace on downcast noisy in upper 80m."
Station 007.002
201-219 Oxygen and nutrients not drawn, Radium cast.

202,203,205 Salinity, oxygen and nutrients not drawn.
206,208,209 Salinity, oxygen and nutrients not drawn.
211,212,214 Salinity, oxygen and nutrients not drawn.
215,217,218 Salinity, oxygen and nutrients not drawn.

Station 007.003

301-324 Oxygen and nutrients not drawn, Radium cast.
302,303,305 Salinity, oxygen and nutrients not drawn.
306,308,309 Salinity, oxygen and nutrients not drawn.
311,312,314 Salinity, oxygen and nutrients not drawn.
315,317,318 Salinity, oxygen and nutrients not drawn.
320,321 Salinity, oxygen and nutrients not drawn.
323,324 Salinity, oxygen and nutrients not drawn.

Station 008.001

103 Oxygenand nutrients not drawn.
Cast 1 CTD bulkhead connectors checked. Sample log: "All looked good, except oxygen connector may have leaked. Oxygen cable rerouted."

Station 009.002

201 Samplelog: "Pump did not turn on initially. Removed and restarted cast."
201-219 Oxygen and nutrients not drawn, Radium cast.
202,203,205 Salinity not drawn.
206,208,209 Salinity not drawn.
211,212,214 Salinity not drawn.
215,217,218 Salinity not drawn.

Station 009.003

301-324 Oxygen and nutrients not drawn, Radium cast.
302,303,305 Salinity, oxygen and nutrients not drawn.
306,308,309 Salinity, oxygen and nutrients not drawn.
311,312,314 Salinity, oxygen and nutrients not drawn.
315,317,318 Salinity, oxygen and nutrients not drawn.
320,321 Salinity, oxygen and nutrients not drawn.
323,324 Salinity, oxygen and nutrients not drawn.

Station 010.001

101 Sample log: "Alttimeter was shifting between 30m and offscale readings. Seabeam depth was shifting between about 1055 and 995m, so stopped at 1000m."
102 Oxygenand nutrients not drawn.
104 Oxygenand nutrients not drawn.
106 Oxygenand nutrients not drawn.
110-118 Salinity not drawn.

Station 011.001

101-103 Sample log: "Extra salinity samples."
102-103 Oxygen and nutrients not drawn.
105 Oxygenand nutrients not drawn.
107 Oxygenand nutrients not drawn.
109 Oxygenand nutrients not drawn
114-115 Salinity not drawn.
117-119 Salinity not drawn.

Station 012.001
102 Didnot trip.
103-104 Oxygen and nutrients not drawn.
106,108,110 Oxygen and nutrients not drawn.
114-121 Salinity not drawn.
Station 013.001
102-105 Oxygen and nutrients not drawn.
107-109 Oxygen and nutrients not drawn.
Station 014.001
102-105,107 Oxygen and nutrients not drawn.
109,111 Oxygen and nutrients not drawn.
112-121 Salinity not drawn.
114 Bottle appears to have mis-fired. No salinity drawn, oxygen and nutrients indicates surface sample.
Station 015.001
101 Noendpoint found due to precipitate in flask. Code oxygen lost.
102-106,108 Oxygen and nutrients not drawn.
110 Oxygenand nutrients not drawn.
111-122 Salinity not drawn.
112 Nosamples drawn.
Station 015.002
201-224 Oxygen and nutrients not drawn, Radium cast.
202,203,205 Salinity, oxygen and nutrients not drawn.
206,208,209 Salinity, oxygen and nutrients not drawn.
211,212,214 Salinity, oxygen and nutrients not drawn.
215,217,218 Salinity, oxygen and nutrients not drawn.
220,221 Salinity, oxygen and nutrients not drawn.
223-224 Salinity, oxygen and nutrients not drawn.
Station 015.003
301-320 Oxygen and nutrients not drawn, Radium cast.
302-304 Salinity, oxygen and nutrients not drawn.
306-308 Salinity, oxygen and nutrients not drawn.
310-312 Salinity, oxygen and nutrients not drawn.
314-316 Salinity, oxygen and nutrients not drawn.
318-320 Salinity, oxygen and nutrients not drawn.
Station 023.001
102 Salinity not drawn.
103 Noendpoint due to ppt in flask. Oxygen lost.
Station 024.001
103-104 Salinity not drawn.
Station 025.001
101 Density inversion and poor agreement with CTD indicates bad bottle salinity value. Code salinity bad.
102-103 Salinity not drawn.
Station 026.001
102-103 Salinity not drawn.

Station 027.001
102-103 Salinity not drawn.
Station 028.001
103-104 Salinity not drawn.
Station 029.001
103-104 Salinity not drawn.
Station 030.001
101,104 Salinity not drawn.
102 Didnot wait 30 sec before tripping; not sampled.
103 Problems with endpoint due to precipitate in oxygen flask. Code oxygen lost.
Station 031.001
101,103 Salinity not drawn.
Station 033.001
103-104 Salinity not drawn.
Station 034.001
103-104 Salinity not drawn.
Station 035.001
103-104 Salinity not drawn.
Station 036.001
103-104 Salinity not drawn.
Station 037.001
103-105 Salinity not drawn.
Station 038.001
101 Poor agreement between CTD and bottle salinity and oxygen, density inversion and nutrient profile indicate mis-trip. Code bottle did not trip as scheduled and samples bad.
103-105 Salinity not drawn.
Station 039.001
101 Deployed with bottom cap closed. No samples drawn.
104-106 Salinity not drawn.
Station 040.001
101 Poor agreement between CTD and bottle salinity and oxygen, density inversion and nutrient profile indicate bottle mis-trip. Code bottle did not trip as scheduled, samples bad.
102-104 Salinity not drawn.
Station 041.001
101 Salinity not drawn.
104-106 Salinity not drawn.
Station 042.001
103-105 Salinity not drawn.
Station 043.001
101 Salinity not drawn.
104-105 Salinity not drawn.
Station 044.001
103 Salinity not drawn.
104-105 Salinity and oxygen not drawn.

106 Salinity not drawn.
Station 044.002
201-222 Oxygen and nutrients not drawn, Radium cast.
202-203 Salinity, oxygen and nutrients not drawn.
205-206 Salinity, oxygen and nutrients not drawn.
208-209 Salinity, oxygen and nutrients not drawn.
211-212 Salinity, oxygen and nutrients not drawn.
214-215 Salinity, oxygen and nutrients not drawn.
217-218 Salinity, oxygen and nutrients not drawn.
220-221 Salinity, oxygen and nutrients not drawn.
Station 045.001
102 Salinity not drawn.
105-106 Salinity not drawn.
Station 046.001
103-106 Salinity not drawn.
104-105 Oxygen not drawn.
Station 047.001
102-104 Salinity not drawn.
Station 047.002
201-220 Oxygen and nutrients not drawn. Radium cast.
202-203 Salinity, oxygen and nutrients not drawn.
205-206 Salinity, oxygen and nutrients not drawn.
208-209 Salinity, oxygen and nutrients not drawn.
211-212 Salinity, oxygen and nutrients not drawn.
214-215 Salinity, oxygen and nutrients not drawn.
217-218 Salinity, oxygen and nutrients not drawn.
220 Salinity, oxygen and nutrients not drawn.
Station 048.001
102-103 Salinity not drawn.
Station 049.001
102 Salinity not drawn.
Station 049.002
201-220 Oxygen and nutrients not drawn, Radium cast.
202-203 Salinity, oxygen and nutrients not drawn.
205-206 Salinity, oxygen and nutrients not drawn.
208-209 Salinity, oxygen and nutrients not drawn.
211-212 Salinity, oxygen and nutrients not drawn.
214-215 Salinity, oxygen and nutrients not drawn.
217-218 Salinity, oxygen and nutrients not drawn.
220 Salinity, oxygen and nutrients not drawn.
Station 050.001
101 Salinity not drawn.
Station 051.001
102-103 Salinity not drawn.
Station 052.001
101 Bottle did not trip, no samples.

102-103 Salinity not drawn.
Station 053.001
102 Salinity not drawn.
104-105 Salinity not drawn.
Station 054.001
101 Salinity not drawn.
104-106 Salinity not drawn.
Station 054.002
201 Pooragreement between CTD and bottle salinity. Code salinity questionable.
201-220 Oxygen and nutrients not drawn, Radium cast.
202-203 Salinity, oxygen and nutrients not drawn.
204 Pooragreement between CTD and bottle salinity. Code salinity questionable.
205-206 Salinity, oxygen and nutrients not drawn.
208-209 Salinity, oxygen and nutrients not drawn.
211-212 Salinity, oxygen and nutrients not drawn.
214-216 Salinity, oxygen and nutrients not drawn.
218-219 Salinity, oxygen and nutrients not drawn.
Station 055.001
102-104 Salinity not drawn.
106-107 Salinity not drawn.
Station 056.001
101 O2lower than CTD bottle tag. Analyst notes no problems. Code oxygen questionable.
Salinity not drawn.
103-108 Salinity not drawn.
Station 056.002
201-220 Oxygen and nutrients not drawn, Radium cast.
202-203 Salinity, oxygen and nutrients not drawn.
205-206 Salinity, oxygen and nutrients not drawn.
208-209 Salinity, oxygen and nutrients not drawn.
211-212 Salinity, oxygen and nutrients not drawn.
214-215 Salinity, oxygen and nutrients not drawn.
217-218 Salinity, oxygen and nutrients not drawn.
220 Salinity, oxygen and nutrients not drawn.
Station 056.003
301-320 Oxygen and nutrients not drawn, Radium cast.
302-303 Salinity, oxygen and nutrients not drawn.
305-306 Salinity, oxygen and nutrients not drawn.
308-309 Salinity, oxygen and nutrients not drawn.
311-312 Salinity, oxygen and nutrients not drawn.
314-315 Salinity, oxygen and nutrients not drawn.
317-318 Salinity, oxygen and nutrients not drawn.
320 Salinity, oxygen and nutrients not drawn.
Station 057.001
101 Salinity not drawn.
103-105 Salinity not drawn.

Station 058.001
103-105 Salinity not drawn.
Station 059.001
102-103 Salinity not drawn.
Station 060.001
101 Nutrients drawn incorrectly, nutrients lost.
102-103 Salinity not drawn.
Station 061.001
102-103 Salinity not drawn.
Station 062.001
102-103 Salinity not drawn.
Station 063.001
101 Salinity not drawn.
Station 064.001
102-104 Salinity not drawn.
Station 065.001
102 Salinity not drawn.
Station 066.001
102-103 Salinity not drawn.
Station 067.001
102-104 Salinity not drawn.
Station 068.001
102-105 Salinity not drawn.
Station 069.001
102-106 Salinity not drawn.
Station 069.002
201 Pooragreement between CTD and bottle salinity. Code bottle salinity questionable.
201-220 Oxygen and nutrients not drawn, Radium cast.
202-203 Salinity, oxygen and nutrients not drawn.
204 Pooragreement between CTD and bottle salinity. Code bottle salinity questionable.
205-206 Salinity, oxygen and nutrients not drawn.
207 Pooragreement between CTD and bottle salinity. Code bottle salinity questionable.
208-209 Salinity, oxygen and nutrients not drawn.
210 Pooragreement between CTD and bottle salinity. Code bottle salinity questionable.
211-215 Salinity, oxygen and nutrients not drawn.
217-219 Salinity, oxygen and nutrients not drawn.
Station 069.003
301-324 Oxygen and nutrients not drawn, Radium cast.
302-303 Salinity, oxygen and nutrients not drawn.
305-306 Salinity, oxygen and nutrients not drawn.
308-309 Salinity, oxygen and nutrients not drawn.
311-312 Salinity, oxygen and nutrients not drawn.
314-315 Salinity, oxygen and nutrients not drawn.
317-318 Salinity, oxygen and nutrients not drawn.
320-321 Salinity, oxygen and nutrients not drawn.
323-324 Salinity, oxygen and nutrients not drawn.

Station 070.001
102-107 Salinity not drawn.
Station 071.001
103-108 Salinity not drawn.
Station 072.001
102-108 Salinity not drawn.
109 Nutrients drawn incorrectly, code nutrients lost.
Station 073.001
103-109 Salinity not drawn.
Station 074.001
101 Salinity not drawn.
103-106 Salinity not drawn.
108-110 Salinity not drawn.
Station 075.001
101 Salinity not drawn.
103-106 Salinity not drawn.
108-110 Salinity not drawn.
Station 076.001
101 Salinity not drawn.
103 Nosamples drawn per sampling schedule.
104-110 Salinity not drawn.
112-114 Salinity not drawn.
Station 077.001
106-114 Salinity not drawn.
Station 078.001
109-113 Salinity not drawn.
115-117 Salinity not drawn.
Station 079.001
101-102 Oxygen and nutrients not drawn.
Station 080.001
101-102 Oxygen and nutrients not drawn.
Station 081.001
102 Salinity not drawn.
Station 082.001
102 Salinity not drawn.
Station 083.001
102-105 Salinity not drawn.
Station 083.004
403-406 Salinity not drawn.
Station 084.001
103-105 Salinity not drawn.
Station 085.001
103-105 Salinity not drawn.
Station 085.002
201-221 Oxygen and nutrients not drawn, Radium cast.
202-203 Salinity, oxygen and nutrients not drawn.

205-206 Salinity, oxygen and nutrients not drawn.
208-209 Salinity, oxygen and nutrients not drawn.
211-212 Salinity, oxygen and nutrients not drawn.
214-215 Salinity, oxygen and nutrients not drawn.
217-218 Salinity, oxygen and nutrients not drawn.
220-221 Salinity, oxygen and nutrients not drawn.

Station 086.001

102-103 Salinity not drawn.
105-106 Salinity not drawn.

Station 087.001

102-105 Salinity not drawn.

Station 088.001

103-106 Salinity not drawn.

Station 089.001

101 Salinity not drawn.
103-104 Salinity, oxygen and nutrients not drawn.
103-120 Oxygen and nutrients not drawn.
106-107 Salinity, oxygen and nutrients not drawn.
109-110 Salinity, oxygen and nutrients not drawn.
112-113 Salinity, oxygen and nutrients not drawn.
115-116 Salinity, oxygen and nutrients not drawn.
118-119 Salinity, oxygen and nutrients not drawn.
122-124 Salinity not drawn.

Station 089.002

201-224 Oxygen and nutrients not drawn, Radium cast.
202-203 Salinity, oxygen and nutrients not drawn.
205-206 Salinity, oxygen and nutrients not drawn.
208-209 Salinity, oxygen and nutrients not drawn.
211-212 Salinity, oxygen and nutrients not drawn.
214-215 Salinity, oxygen and nutrients not drawn.
217-218 Salinity, oxygen and nutrients not drawn.
220-221 Salinity, oxygen and nutrients not drawn.
223-224 Salinity, oxygen and nutrients not drawn.

Station 090.001

101 Accidental trip. No samples.
103-105 Salinity not drawn.
106 Nosamples drawn.
107 Salinity not drawn.

Station 091.001

103-105 Salinity not drawn.
104 Salinity, oxygen and nutrients not drawn.

Station 092.001

102-105 Salinity not drawn.
104 Salinity, oxygen and nutrients not drawn.

Station 093.001

102-104 Salinity not drawn.

105 Salinity, oxygen and nutrients not drawn.
106 Salinity not drawn.
Station 094.001
102-105 Salinity not drawn.
Station 095.001
102-106 Salinity not drawn.
Station 096.001
102-106 Salinity not drawn.
107 Salinity, oxygen and nutrients not drawn.
108 Salinity not drawn.
Station 100.001
101-102 Oxygen and nutrients not drawn.
Station 101.001
102-106 Salinity not drawn.
Station 102.001
102-106 Salinity not drawn.
Station 103.001
102-107 Salinity not drawn.
Station 104.001
102-108 Salinity not drawn.
Station 105.001
103-109 Salinity not drawn.
Station 106.001
103-110 Salinity not drawn.
Station 107.001
103 Oxygenand nutrients not drawn.
106-113 Salinity not drawn.
Station 108.001
102 Oxygenand nutrients not drawn.
104 Oxygenand nutrients not drawn.
106 Oxygenand nutrients not drawn.
108 Oxygenand nutrients not drawn.
109-117 Salinity not drawn.
114 CTDand bottle data comparison and nutrient profile indicate mis-trip. Code bottle did
not trip as scheduled and samples bad.
Station 109.001
102-104 Oxygen and nutrients not drawn.
106 Oxygenand nutrients not drawn.
108 Oxygenand nutrients not drawn.
110 Oxygenand nutrients not drawn.
111 Nosamples drawn.
112-116 Salinity not drawn.
118-120 Salinity not drawn.
Station 110.001
102-105 Oxygen and nutrients not drawn.

104 Bottle salinity appears to have been drawn from adjacent bottle (5). Code salinity bad.
107 Oxygenand nutrients not drawn.
109 Nosamples drawn.
111 Nosamples drawn.
112-113 Salinity not drawn.
115-116 Salinity not drawn.
118-122 Salinity not drawn.

Station 111.001

104-112 Nutrients not drawn.

Station 111.002

201-224 Oxygen and nutrients not drawn, Radium cast.
202-203 Salinity, oxygen and nutrients not drawn.
205-206 Salinity, oxygen and nutrients not drawn.
208-209 Salinity, oxygen and nutrients not drawn.
211-212 Salinity, oxygen and nutrients not drawn.
214-215 Salinity, oxygen and nutrients not drawn.
217-218 Salinity, oxygen and nutrients not drawn.
220-221 Salinity, oxygen and nutrients not drawn.
223-224 Salinity, oxygen and nutrients not drawn.

Station 121.001

102 Salinity and oxygen not drawn.
104 Salinity and oxygen not drawn.
107 Salinity and oxygen not drawn.
109 Salinity and oxygen not drawn.
110 Salinity, oxygen and nutrients not drawn.
112 Salinity, oxygen and nutrients not drawn.
114 Salinity, oxygen and nutrients not drawn.

Station 121.002

201-222 Oxygen and nutrients not drawn, Radium cast.
203-205 Salinity, oxygen and nutrients not drawn.
207-209 Salinity, oxygen and nutrients not drawn.
211-213 Salinity, oxygen and nutrients not drawn.
215-217 Salinity, oxygen and nutrients not drawn.
219-221 Salinity, oxygen and nutrients not drawn.

Station 122.001

102 Salinity and oxygen not drawn.
104 Salinity and oxygen not drawn.
107 Salinity and oxygen not drawn.
109 Salinity and oxygen not drawn.
110 Salinity, oxygen and nutrients not drawn.
112 Salinity, oxygen and nutrients not drawn.
114 Salinity, oxygen and nutrients not drawn.

Station 123.001

102 Salinity and oxygen not drawn.
104 Salinity and oxygen not drawn.

107 Salinity and oxygen not drawn.
109 Salinity and oxygen not drawn.
110 Salinity, oxygen and nutrients not drawn.
112 Salinity, oxygen and nutrients not drawn.
114 Salinity, oxygen and nutrients not drawn.

Station 123.002

201-222 Oxygen and nutrients not drawn, Radium cast.
203-205 Salinity, oxygen and nutrients not drawn.
207-209 Salinity, oxygen and nutrients not drawn.
211-213 Salinity, oxygen and nutrients not drawn.
215-217 Salinity, oxygen and nutrients not drawn.
219-221 Salinity, oxygen and nutrients not drawn.

Station 124.001

102 Nosamples drawn.
104 Salinity, oxygen and nutrients not drawn.
107 Salinity and oxygen not drawn.
109 Salinity and oxygen not drawn.
110 Salinity, oxygen and nutrients not drawn.
112 Salinity and oxygen not drawn.
114 Salinity and oxygen not drawn.

Station 125.001

102 Nosamples drawn.
103 CTD and bottle comparison and density inversion indicate bottle salinity may have been drawn from adjacent bottle. Code salinity bad.
104 Salinity, oxygen and nutrients not drawn.
107 Salinity and oxygen not drawn.
109 Salinity and oxygen not drawn.
110 Oxygenand nutrients not drawn.
112 Salinity and oxygen not drawn.
114 Salinity and oxygen not drawn.

Station 125.002

201-224 Oxygen and nutrients not drawn, Radium cast.
203-204 Salinity, oxygen and nutrients not drawn.
206-207 Salinity, oxygen and nutrients not drawn.
209-210 Salinity, oxygen and nutrients not drawn.
212 Salinity, oxygen and nutrients not drawn.
213-214 No samples drawn. Wire angle increased and no longer at sampling depth.
216-217 Salinity, oxygen and nutrients not drawn.
219-220 Salinity, oxygen and nutrients not drawn.
222-223 Salinity, oxygen and nutrients not drawn.

Station 126.001

102 Salinity and oxygen not drawn.
104 Salinity and oxygen not drawn.
107 Salinity and oxygen not drawn.
109-110 Salinity and oxygen not drawn.
112 Salinity and oxygen not drawn.

114 Salinity and oxygen not drawn.

Station 127.001

102 Salinity and oxygen not drawn.
104 Salinity and oxygen not drawn.
107 Salinity and oxygen not drawn.
109 Salinity and oxygen not drawn.
110 Salinity, oxygen and nutrients not drawn.
112 Salinity, oxygen and nutrients not drawn.
114 Salinity, oxygen and nutrients not drawn.

Station 127.002

201-224 Oxygen and nutrients not drawn.
203-204 Salinity, oxygen and nutrients not drawn.
206-207 Salinity, oxygen and nutrients not drawn.
215-216 Salinity, oxygen and nutrients not drawn.
218-219 Salinity, oxygen and nutrients not drawn.
221 Salinity, oxygen and nutrients not drawn.

Station 128.001

102 Salinity and oxygen not drawn.
104 Salinity and oxygen not drawn.
107 Salinity and oxygen not drawn.
109 Salinity and oxygen not drawn.
110 Nosamples drawn.
112 Salinity, oxygen and nutrients not drawn.
113 CTD and bottle comparison and density inversion indicate incorrect bottle salinity value. Code salinity bad.
114 Salinity, oxygen and nutrients not drawn.

Station 129.001

102 Salinity and oxygen not drawn.
104 Salinity and oxygen not drawn.
107 Salinity and oxygen not drawn.
109 Salinity and oxygen not drawn.
110 Nosamples drawn.
112 Salinity, oxygen and nutrients not drawn.
114 Salinity, oxygen and nutrients not drawn.

Station 129.002

201-222 Oxygen and nutrients not drawn, Radium cast.
203-205 Salinity, oxygen and nutrients not drawn.
207-208 Salinity, oxygen and nutrients not drawn.
210 Bottle leaking, salinity drawn from 9.
211-213 Salinity, oxygen and nutrients not drawn.
215-217 Salinity, oxygen and nutrients not drawn.
219-221 Salinity, oxygen and nutrients not drawn.

Station 130.001

102 Salinity and oxygen not drawn.
104 Salinity and oxygen not drawn.
105 Poor agreement with CTD oxygen. Analyst notes no problems. Code bottle oxygen

questionable.
107 Salinity and oxygen not drawn.
109 Salinity and oxygen not drawn.
110 Salinity, oxygen and nutrients not drawn.
112 Salinity, oxygen and nutrients not drawn.
114 Salinity, oxygen and nutrients not drawn.

Station 131.001

102 Salinity and oxygen not drawn.
104 Salinity and oxygen not drawn.
107 Salinity and oxygen not drawn.
109 Salinity and oxygen not drawn.
110 Nosamples drawn.
112 Nosamples drawn.
114 Nosamples drawn.

Station 131.002

201-222 Oxygen and nutrients not drawn, Radium cast.
203-205 Salinity, oxygen and nutrients not drawn.
207-209 Salinity, oxygen and nutrients not drawn.
211-213 Salinity, oxygen and nutrients not drawn.
215-217 Salinity, oxygen and nutrients not drawn.
219-221 Salinity, oxygen and nutrients not drawn.

Station 132.001

101-102 Oxygen and nutrients not drawn.

Station 133.001

101-102 Salinity not drawn.

Station 134.001

101 Salinity not drawn.

Station 135.001

102 Salinity not drawn.

Station 136.001

102 Salinity not drawn.