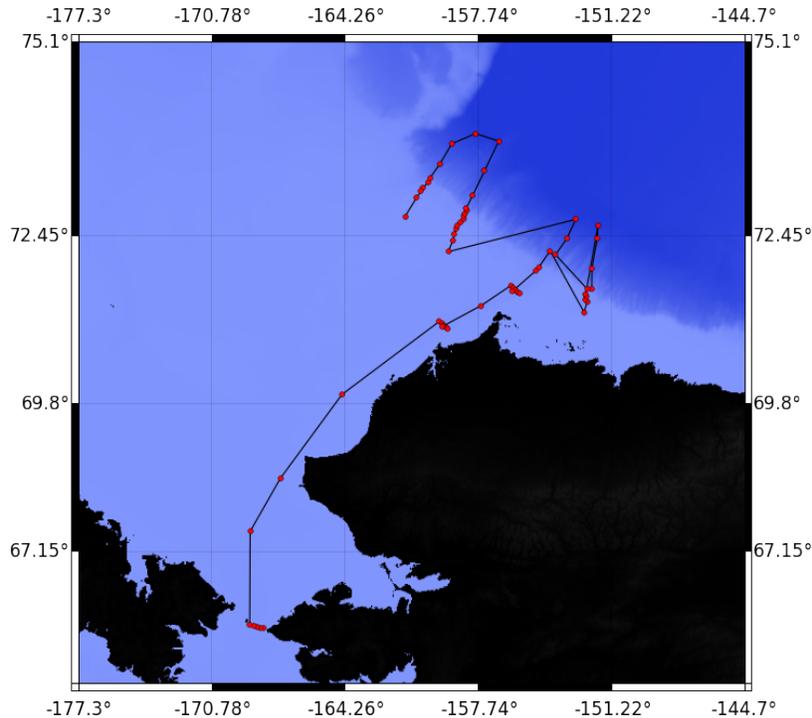


# CRUISE REPORT: HLY0403

(Updated FEB 2014)



## Highlights

### Cruise Summary Information

WOCE Section Designation	<b>HLY0403</b>
Expedition designation (ExpoCodes)	<b>32H120040718</b>
Chief Scientists	<b>Dr. James Swift</b> <b>Dr. Louis Codispoti</b>
Dates	2004 JUL 18 -- 2004 AUG 26
Ship	<i>USCGC Healy</i>
Ports of call	Nome, Alaska to Nome, Alaska
Geographic Boundaries	73° 54' N 168° 54' 10.8" W      151° 52' 1" W 65° 39' 36" N
Stations	60
Floats and drifters deployed	0
Moorings deployed or recovered	0

### Contact Information:

Dr. James Swift  
Scripps Institution of Oceanography  
9500 Gilman Rd. MC 0214 • La Jolla, CA 92093-0214  
Tel: 858.534.3387 • Email: jswift@ucsd.edu

Dr. Louis Codispoti  
Horn Point Laboratory  
PO Box 775 • Cambridge, MD 21613  
Tel: 410.221.8479 • Email: codispot@hpl.umces.edu

## Links To Select Topics

Shaded sections are not relevant to this cruise or were not available when this report was compiled.

<b>Cruise Summary Information</b>	<b>Hydrographic Measurements</b>
Description of Scientific Program	<b>CTD Data:</b>
<a href="#">Geographic Boundaries</a>	<a href="#">Acquisition</a>
Cruise Track (Figure): <a href="#">PI</a> <a href="#">CCHDO</a>	<a href="#">Processing</a>
Description of Stations	<a href="#">Calibration</a>
<a href="#">Description of Parameters Sampled</a>	<a href="#">Temperature</a> <a href="#">Pressure</a>
<a href="#">Bottle Depth Distributions (Figure)</a>	<a href="#">Salinities</a> <a href="#">Oxygens</a>
Floats and Drifters Deployed	<b>Bottle Data</b>
Moorings Deployed or Recovered	<a href="#">Salinity</a>
	<a href="#">Oxygen</a>
<a href="#">Principal Investigators</a>	<a href="#">Nutrients</a>
Cruise Participants	<a href="#">Carbon System Parameters</a>
	<a href="#">CFCs</a>
<a href="#">Problems and Goals Not Achieved</a>	<a href="#">Helium / Tritium</a>
<a href="#">Other Incidents of Note</a>	<a href="#">Radiocarbon</a>
<b>Underway Data Information</b>	<b>References</b>
<a href="#">Navigation</a> <a href="#">Bathymetry</a>	
<a href="#">Acoustic Doppler Current Profiler (ADCP)</a>	
<a href="#">Thermosalinograph</a>	
<a href="#">XBT and/or XCTD</a>	
<a href="#">Meteorological Observations</a>	<b>Acknowledgments</b>
<a href="#">Atmospheric Chemistry Data</a>	
<b>Data Processing Notes</b>	

## **HLY-04-03 Service Group Bottle Data Documentation**

18 July to 26 August 2004  
Nome, Alaska to Nome, Alaska

Dr. Louis Codispoti, (on board PI)  
Horn Point Laboratory  
PO Box 775  
2020 Horn Pt. Rd.  
Cambridge, MD 21613  
410.221.8479 phone  
codispot@hpl.umces.edu

Dr. James Swift (PI)  
Scripps Institution of Oceanography  
Oceanographic Data Facility  
9500 Gilman Rd. MC 0214  
La Jolla, CA 92093-0214  
858.534.3387 phone  
jswift@ucsd.edu

On board team: Kristin Sanborn, Rebekah Duncan, Dan Schuller, Erik Quiroz,  
Robert Palomares

Other team members: Berit Rabe (ADCP), Dean Stockwell (Chlorophyll)

Funded by National Science Foundation OPP0125399

### **Data Set Overview**

184 CTD casts on 60 stations were attempted. 4 of these were aborted, with no CTD data and no water samples. These casts were Station 022 Cast 01, Station 022 Cast 03, Station 022 Cast 04, and Station 049 Cast 01.

### **Instrumentation**

CTD casts were performed with a rosette system consisting of a 12-place rosette frame with 30 liter bottles and a 12-place SBE-32 Carousel pylon. Underwater electronic components consisted of:

- Sea-Bird Electronics, Inc. (SBE) 911plus CTD,
- WETLabs C-Star transmissometer with a 25cm path length and 660nm wavelength,
- Biospherical Instruments, Inc. Photosynthetically Active Radiation (PAR) sensor,
- Chelsea MkIII Aquatracka fluorometer, and
- Simrad, 5 volt – 2-500 meter altimeter.

Additionally, a Dr. Haardt fluorometer designed to detect colored organic matter (CDOM) and a Secchi disk were mounted on the CTD package. The CTD, transmissometer, and the two fluorometers were mounted horizontally along the bottom of the rosette frame. The PAR sensor was located at the top of the rosette. The surface PAR sensor was located on a newly installed I-beam antenna support atop the helicopter shack. All sensors except the Secchi disk were interfaced with the CTD system. This instrument package provided pressure, dual temperature and dual

conductivity channels as well as light transmissivity and fluorometric signals at a sample rate of 24 scans per second.

The bottles on the rosette were General Oceanic 30 liter bottles. The bottles were equipped with internal nylon coated springs and silicone o-rings which are used to minimize toxicity to the sample. Bottle numbering is 1 to 12 with 1 tripped first usually at the deepest sampling level and 12 tripped last at the shallowest sampling level. The rosette system was suspended from a standard UNOLS 3 conductor 0.322” electromechanical cable.

The CTD used was serial number 09P24152-0638 and the sensor’s model and serial numbers are listed in Table 1. At Station 022, cast 1, the CTD failed when three connectors were found flooded. The CTD was replaced with 09P24152-0639. After cast 8 at Station 022, it was also determined that the Haardt fluorometer was damaged and it was removed from service. This data from Station 022 has been deleted.

**TABLE 1.** Instrument/Sensor Serial Numbers

Primary Temperature	Primary Conductivity	Secondary Temperature	Secondary Conductivity	Pressure	Transmissometer
SBE 3plus	SBE 4C	SBE 3plus	SBE 4C	401K-105	C-Star
03-2796	04-2545	03-2824	04-2568	83009	CST-390DR

Oxygen	Fluorometer	PAR	Surface PAR	Altimeter
SBE 43	Aqua 3	QSP-2300	QSR-240	807
0459	088233	4643	6367	9711090

**Equipment Positions**

**TABLE 2.** Instrument mounting heights in reference to the bottom of the rosette frame.

Sensor	Height above base of rosette	Sensor	Height above base of rosette
Altimeter	2 cm	Pressure	19cm
Transmissometer	8 cm	T (pri)	10 cm
Fluorometer (Chelsea)	10 cm		
Fluorometer (Haardt)	8 cm	Par	215cm Sta. < 2000 m

The distance of the mid-points of the 30 L Niskin bottles from the bottom-mounted sensors was ~1.19m. The 30 Liter Niskin bottles are ~1.0 m long. The secchi disk was mounted 2.2m above the bottom of the rosette frame.

## **Problems and/or Procedural changes**

At times small areas of the nylon coating on the Niskin bottle springs broke down so there may be some minor iron contamination in some samples. HLY0403 rosette operations were continually beset by problems with bottle leaks caused by Niskin bottle end o-rings falling out of position. Typically, each cast had one such occurrence. Data from leaking bottles were carefully assessed by comparing CTD oxygen and salinity data against bottle salinities and temperatures and it was found that spigot leaks normally did not compromise sample quality. Samples were usually not taken from bottles with severe leaks caused by poorly sealed bottom end-caps, and in other cases data from leaking bottles were noted as being questionable. Thus, the main effect of the leaking bottles was to increase the sample spacing of good data on some casts. Some bottles were more prone than others to o-ring problems, but no clear-cut patterns emerged except that there seemed to be more problems on deeper casts which would implicate a pressure effect or prolonged exposure to low temperatures. Since both the bottles and o-rings were purchased just before the two 2004 Healy cruises, we suspect a manufacturing defect or change in either the bottles or o-rings. Some of the problems were gross, i.e. the o-ring would be visible out the side of the end cap, but others were more subtle. Every time an o-ring problem was suspected, the o-ring was carefully inspected, and replaced if necessary. Also, at several points during the cruise all o-rings were inspected. During the spring expedition, HLY-04-02, the contents of various packages of spare o-rings were measured to locate 'large' or 'small' o-rings (within the manufacturer's tolerance), and a remedial 'large' set was installed. Another time Coast Guard personnel replaced all the o-rings from their own supply. Yet all these remedial attempts were to no particular avail. A different batch of o-rings were procured prior to this cruise (HLY-04-03) but they made minimal difference vis a vis bottle leaks.

## **CTD Data**

### **CTD Laboratory Calibration Procedures**

Pre-cruise laboratory calibrations of CTD pressure, temperature and conductivity sensors were used to generate coefficients for the calculation of these parameters from their respective sensor frequencies. The temperature, conductivity and oxygen sensors were recalibrated prior to the HLY-04-3 expedition. The temperature, conductivity and oxygen calibrations were performed at Sea-Bird Electronics, Inc. in Bellevue, Washington. Calibration of the pressure sensor was performed prior to the HLY0402 spring cruise by Scripps Institution of Oceanography, Shipboard Technical Support/Oceanographic Data Facility (SIO/STS/ODF) personnel. The Sea-Bird laboratory temperature calibrations were referenced to the International Temperature Scale of 1990 (ITS-90).

### **CTD Data Acquisition**

The CTD 911plus was operated generally as suggested in the Sea-Bird CTD Operating and Repair Manual, which contains a description of the system, its operation and functions (Sea-Bird Electronics, Inc., 2002). One difference from Sea-Bird's operation is that data acquisition was started on deck. This procedure allows a check of the pressure offset and an unblocked reading of the transmissometer. The Seasoft acquisition program as described in the CTD Data Acquisition Software Manual (Sea-Bird Electronics, Inc., 2001) provided a real-time graphical display of selected parameters adequate to monitor CTD performance and information for the selection of bottle-tripping depths. Raw data from the CTD were archived on the PC's hard disk at the full 24 Hz sampling rate.

A CTD Station Sheet form was filled in for each deployment, providing a record of times, positions, bottom depth, bottle sampling depths, and every attempt to trip a bottle, as well as any

pertinent comments. When the equipment and personnel were ready, data acquisition was started. The CTD operator pressed a control key (flag), which appends a summary line into the files created for “inventory” files. This file contains a summary of the time, ship’s position, and current scan number each time the control key is pressed. They are used as a reference to mark important events during the cast, such as on deck pressure, when the lowering was initiated, when the package was at the bottom, when bottles were tripped and the on-deck pressure with ending position. After the initial flag, the rosette/CTD system was lowered into the water and held at 5 meters wire out for 3-5 minutes to permit activation of the CTD pumps and equilibration of the sensors. Then, the operator had the CTD raised to the surface, again created a flag, and simultaneously directed the winch operator to begin lowering. The operator created a flag at the deepest point of the cast. Bottom depths were calculated by combining the distance above bottom, reported by the altimeter, and the maximum depth of the CTD package when bottom altimeter readings were available. If there was no altimeter reading, then the bottom depth is reported from the ship’s Bathy 2000 or Knudsen model 320B/R depth recorder. These data, corrected for the draft of the transducer, were logged in uncorrected meters (assuming a sound velocity of 1500 m/sec). If the altimeter and depth recorder data were unavailable, the final resort was to use depth data from the SeaBeam system (corrected sound velocities).

The wire out corresponding to each bottle trip was written on the station log and the trips were electronically flagged in the data file. The performance of all sensors was monitored during the cast. After the rosette recovery, the operator created a final flag denoting the end of the cast. Any faulty equipment or exceptionally noisy data were noted on the log sheet.

## **CTD Data Processing**

### **Pressure**

CTD values determined on deck before and after each cast were compared to determine a pressure offset correction. The comparison suggested that no pressure offset was necessary.

### **Temperature**

The temperature sensors were calibrated in July 2004. The dual temperature sensors were monitored during the expedition and exhibited good agreement. It appears that no additional corrections need to be applied. A post-cruise calibration will be performed.

### **Conductivity**

The conductivity sensors were calibrated in July 2004. Corrected CTD pressure and temperature values were used with bottle salinities to back-calculate bottle conductivities. Comparison of these bottle values with the CTD primary conductivity values indicated no additional offset needed to be applied to the data.

### **Transmissometer**

A WETLabs calibrated transmissometer was utilized throughout the cruise. An on deck calibration check was performed and even though there was little degradation from the last calibration, the new coefficients were applied to the data set.

### **Oxygen, Fluorometer, and PAR**

The CTD oxygen data are only intended for qualitative use. The oxygen sensor was calibrated in July 2004. Similarly, the fluorometric and PAR data are not calibrated.

## Data Processing

Sea-Bird Seasoft CTD processing software was employed. The processing programs are outlined below. A more complete description may be found in the Sea-Bird Software Manual which is available from the Sea-Bird website ([www.seabird.com](http://www.seabird.com)).

The sequence of programs that were run in processing CTD data from this cruise are as follows:

- ***DATCNV*** - Converts data from raw frequencies and voltages to corrected engineering units
- ***WILDEDIT*** - Eliminates large spikes
- ***CELLTM*** - Applies conductivity cell thermal mass correction
- ***FILTER*** – A low pass filter to smooth pressure for LOOPEDIT
- ***LOOPEDIT*** - Marks scans where velocity is less than selected value to avoid pressure reversals from ship roll, or during bottle flushing.
- ***DERIVE*** - Computes calculated parameters
- ***BINAVG*** - Average data into desired pressure bins

The quality control steps included:

- ***Sensor verification*** After the CTD was set up and sensor serial numbers and sensor location entered into the computer, another check was made to verify that there were no tabulation errors.
- ***Seasoft Configuration File*** was reviewed to verify that individual sensors were represented correctly, with the correct coefficients.
- ***Temperature*** was verified by comparing primary and secondary sensor data.
- ***Conductivity*** was checked by comparison of the two sensors with each other and with bottle salinity samples.
- ***Position Check*** A chart of the ship's track was produced and reviewed for any serious problems. The positions were acquired from the ship's GPS (P-code) navigation system.
- ***Visual Check*** Plots of each usable cast were produced and reviewed for any noise and spikes that may have been missed by the processing programs.
- The density profile was checked for inversions that might have been produced by sensor noise or response mismatches.

## 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.

## Data Comments

Fine structure including minor density inversions that may appear in the upper ~ 10 m of the profiles is most likely caused by ship discharges/turbulence. To minimize the ship effect, engine cooling water discharges were restricted to the port side of the Healy. A “yo yo” procedure was adopted to induce bottle flushing whenever waves and ship motion were weak. This procedure was employed for all bottle trips under quiescent conditions except for productivity casts, and for

surface and bottom bottles that were usually kept at depth for ~2 minutes before tripping whereas the yo yo procedure generally involved a ~30 second wait, a yo yo and another ~30 second wait. Regardless of the procedure employed, the CTD operators were instructed to wait for at least 1 minute (typically > 1.5 minutes) before tripping the bottle.

All salinity, nutrient and dissolved oxygen data collected by the “service” team have gone through several stages of editing and are not likely to change significantly. The chlorophyll observations reported here may undergo further editing. **Please note that changes in the refractive index of samples with salinity, baseline issues, temperature effects, etc. can cause variability in the ammonium and urea methods that is not reflective of changes in ambient concentrations. Differences of < ~ 0.15  $\mu$ M should be treated with caution. Please contact L. A. Codispoti, if you wish to interpret small differences in ammonium and urea data (Codispoti@hpl.umces.edu)** The other nutrient data meet WOCE/JGOFS standards.

## Bottle Data

There were five 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 CO<sub>2</sub>*,
  - *Total Alkalinity*,
  - *Nutrients*
  - *Chlorophyll/Phaeophytin*
  - *Phytoplankton*
  - *Salinity*
  - *O18/O16*
  - *Benthic*
  - *Dissolved Organic Matter/Particulate Organic Matter*
  - *Thorium-234*
  - *C13/N15*
- **Productivity/Zooplankton**
  - *Oxygen*
  - *Oxygen Respiration*
  - *Productivity*
  - *Nutrients*
  - *Chlorophyll*
  - *HPLC*
  - *Bacteria*
  - *Micro Zooplankton*
  - *Particulate Organic Matter*
  - *Dissolved Organic Matter/Lignin*
  - *Bio-Optics*
  - *Taxonomy*
  - *C13/N15*
- **Bio-Markers**

- *Nutrients*
- *Particulate Organic Matter*
- *Dissolved Organic Matter/Lignin*
- *C13/N15*
- **Radium**
  - *Nutrients*
  - *Radium*
  - *C13/N15*
- **Zooplankton**
  - *Nutrients*
  - *Micro Zooplankton*
  - *C13/N15*

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 concerning 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 and other diagnostic comments (e.g., "lanyard caught in lid", "valve left open") that might later prove useful in determining sample integrity were routinely 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. Sample data from bottles suspected of leaking were checked to see if the properties were consistent with the profile for the cast, with adjacent stations, and, where applicable, with the CTD data. Direct inspection of the tabular data, property-property plots and vertical sections were all employed to check the data. Revisions were made whenever there was an objective reason to delete, annotate or re-calculate a datum. 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.

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**

337 salinity samples were analyzed in 13 analyses runs.

### **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 Autosol 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 autosol. 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 2-3°C lower than the Autosol bath temperature.

## **Oxygen**

974 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 then filled and allowed to overflow for approximately 3 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 20°C. Periodically, the 20°C 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.

## **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 KIO<sub>3</sub> 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**

1567 samples were analyzed for nutrients in 70 analyses runs. 68 of these samples were checks of the system and 177 were for 5 of the ancillary shipboard programs.

## **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 (4-38 samples) with an intermediate concentration mixed nutrient standard, which was prepared prior to each run from a secondary standard in a low-nutrient seawater matrix. 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. Sargasso Sea Water and deep seawater were run occasionally to check ammonium and urea baselines and assess system performance in all six nutrient channels.

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.

Also reported is  $N^{**}$ , a parameter calculated from nitrate, nitrite, ammonium and phosphate concentrations. This parameter is defined as  $N^{**} = ((N-16P + 2.98)\mu M) 0.87$ , where P = the phosphate concentration in  $\mu M$ , and N = (nitrate+nitrite+ammonium in  $\mu M$ ). This parameter is quite similar to the original  $N^*$  parameter defined by Gruber and Sarmiento (1997) except that we include ammonium concentrations because of the high ammonium concentrations that can occur in the SBI region. The underlying premise of both  $N^*$  and  $N^{**}$  is that the N/P atomic regeneration ratio in seawater is normally close to the 16/1 N/P Redfield ratio. The assumption is that deviations from this ratio in N/P ratios in a water mass arise primarily from nitrogen fixation which produces organic matter with N/P ratios in excess of 16/1, or denitrification which consumes nitrate and other forms of fixed nitrogen and converts these forms into elemental dinitrogen gas. Values less than 2.98 suggest that a water mass has experienced net denitrification and higher values suggest net nitrogen fixation. The factors 2.98 and 0.87 are explained by Gruber and Sarmiento (1997), and there is some debate about whether they should be included, but we do so in order to facilitate comparison with the distributions presented by Gruber and Sarmiento (1997).

### Equipment and Techniques

Nutrient analyses (nitrate+nitrite, nitrite, phosphate, silicate, ammonium, and urea) were performed on an ODF-modified 6-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 NO<sub>2</sub> and NO<sub>3</sub> through the NO<sub>3</sub> 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 ~55°C 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.

Ammonium was determined by the Berthelot reaction (Patton and Crouch 1977) in which sodium hypochlorite and phenol react with ammonium ion to produce indophenol blue, a blue compound. The solution was heated to 55°C and passed through a 50mm flowcell at 640nm.

Urea was analyzed via a modification of the method of Rahmatullah and Boyde (1980), which is based on the classic diacetyl monoxime method. A solution of diacetyl monoxime,

thiosemicarbazide and acetone is followed by the addition of ferric chloride, which acts as a catalyst. The resultant solution was heated to 90°C and passed through a 50mm flowcell. The absorbance was measured at 520nm.

### **Nutrient Standards**

Na<sub>2</sub>SiF<sub>6</sub>, the silicate primary standard, was obtained from Johnson Matthey Company and Fisher Scientific and was reported by the suppliers to be >98% pure. Primary standards for nitrate (KNO<sub>3</sub>), nitrite (NaNO<sub>2</sub>), and phosphate (KH<sub>2</sub>PO<sub>4</sub>) were obtained from Johnson Matthey Chemical Company, and the supplier reported purities of 99.999%, 97%, and 99.999%, respectively. Ammonia, (NH<sub>4</sub>(SO<sub>4</sub>)<sub>2</sub>), and Urea primary standards were obtained from Fisher Scientific and reported to be >99% 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 website, [www.eol.ucar.edu/projects/sbi](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 WOCE Hydrographic Program website, [WHPO.ucsd.edu](http://WHPO.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/JOSS database. Raw (unprocessed) CTD data files are archived in the EOL/JOSS 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 is located in file 32H1hly0403\_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	VOLTS	F8.3	Fluorometer, voltage
FLUOR_FLAG_W		I1	Fluorometer quality flag
PAR	VOLTS	F8.3	PAR, voltage
PAR_FLAG_W		I1	PAR quality flag
SPAR	VOLTS	F8.3	Surface PAR, voltage
SPAR_FLAG_W		I1	Surface PAR quality flag
FLCDOM	VOLTS	F8.3	CDOM Fluorometer, voltage
FLCDOM_FLAG_W		I1	CDOM Fluorometer quality flag
DEPTH	METERS	F8.0	Depth

**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<sub>2</sub>), 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 32H1HLY0403\_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. <i>Optional.</i>
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. <i>Optional.</i>

**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. <i>Optional</i>
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
NH4	UMOL/KG	F9.2	AMMONIUM, micromoles/kilogram
NH4_FLAG_W		I1	NH4 quality flag
NH4	UMOL/L	F9.2	AMMONIUM, micromoles/liter
NH4_FLAG_W		I1	NH4 quality flag
UREA	UMOL/KG	F9.2	UREA, micromoles/kilogram
UREA_FLAG_W		I1	UREA quality flag
UREA	UMOL/L	F9.2	UREA, micromoles/liter
UREA_FLAG_W		I1	UREA quality flag
FLUORO	VOLTS	F8.3	Fluorometer, voltage
FLUORO_FLAG_W		I1	Fluorometer quality flag
PAR	VOLTS	F8.3	PAR, voltage
PAR_FLAG_W		I1	PAR quality flag
SPAR	VOLTS	F8.3	Surface PAR, voltage
SPAR_FLAG_W		I1	Surface PAR quality flag
HAARDT	VOLTS	F8.3	CDOM Fluorometer, voltage
HAARDT_FLAG_W		I1	CDOM Fluorometer quality flag
N**	UMOL/L	F9.2	N**, micromoles/liter
N**_FLAG_W		I1	N** 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<sub>2</sub>), 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

- Armstrong, F. A. J., Stearns, C. R., and Strickland, D. H., "The measurement of upwelling and subsequent biological processes by means of the Technicon AutoAnalyzer and associated equipment," *Deep-Sea Research*, 14, pp. 381-389, (1967).
- 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).
- Gordon, L.I., Jennings, J.C., Ross, A.A. and J.M. Krest, "A Suggested Protocol for Continuous Flow Automated Analysis of Seawater Nutrients in the WOCE Hydrographic Program and the Joint Global Ocean Fluxes Study". 1993. WOCE Hydrographic Programs Office, Methods Manual WHPO 91-1.
- Gruber, N. and J.L. Sarmiento, "Global patterns of marine nitrogen fixation and denitrification." *Global Biogeochem. Cycles*, 11(2), pp. 235-266, (1997).
- Intergovernmental Oceanographic Commission, Scientific Committee on Oceanic Research Manual and Guides 29 Protocols for the Joint Global Ocean Flux Study (JGOFS) Core Measurements. UNESCO, 170pp., (1994).
- 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
- Macdonald, R.W., F. A. McLaughlin and C.S. Wong, "The storage of reactive silicate samples by freezing," *Limnology and Oceanography*, 31, pp. 1139-1142 (1986).
- Patton, C.J. and Crouch, S.R., "Spectrophotometric and kinetics investigation of the Berthelot reaction for the determination of ammonia," *Analytical Chemistry*, 49(3), pp.464-469 (1977).
- Rahmatullah, Mohammed, and Boyde, T.R.C, "Improvements in the determination of urea using diacetyl monoxime; methods with and without deproteinisation," *Clinica Chimica Acta*, 107, pp.3-9 1980.
- Sea-Bird Electronics, Inc, CTD Data Acquisition Software Manual, March 2001.
- Sea-Bird Electronics, Inc., CTD Operating and Repair Manual, February 2002.

## **APPENDIX A: Bottle Quality Comments**

Remarks for deleted samples, missing samples, PI data comments, and WOCE codes other than 2 from HLY0403 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 001.001**

101 Sample Log: "Leak from bottom cap after O2 drawn." Oxygen as well as other data are acceptable.

102 Oxygen and salinity not drawn.

103 Sample Log: "Slight spit from spigot before top vented." Oxygen as well as other data are acceptable.

104 Sample Log: "Spigot leak when spigot pushed in before venting." Oxygen as well as other data are acceptable.

105-111 Salinity not drawn.

106 Sample Log: "Slight spigot leak before venting; rotated spigot smaller leak." Oxygen as well as other data are acceptable.

107 SampleLog: "Oxygen not drawn."

112 Salinity: "Three readings to obtain two good readings." First reading 0.0005 higher than average, okay as is. PI: "Bottle salinity greater than CTD, would expect the opposite." Density inversion, 0.01, in the CTD down trace. However the sensor pairs agree with one another. Leave as is.

### **Station 002.001**

102 SampleLog: "Oxygen and nutrients not drawn."

103 Oxygen: "Overtitrated and backtitrated; no endpoint found."

103-107 Sample Log: "Salinity not drawn."

104 SampleLog: "Spigot leak before venting."

105 SampleLog: "Oxygen redrawn."

106 SampleLog: "Oxygen redrawn."

107 SampleLog: "Spigot leak spigot, before venting."

108 SampleLog: "Salinity, oxygen and nutrients not drawn." Sampled for POM.

109 SampleLog: "Salinity, oxygen and nutrients not drawn." Sampled for C13/N15.

110-111 Sample Log: "Salinity not drawn."

112 PI: "There is a tendency for surface bottle salinity to be a tad higher than CTD salinity." Comparison of the pair of sensors shows fairly good agreement. Leave as is

### **Station 003.001**

102 Samples taken for POM only, DOM/Lignin only.

104-111 Sample Log: "Salinity not drawn."

108 Samples taken for POM only, DOM/Lignin only.

109 Sample Log: "Bottom cap leak when vented, stopped during sampling." Samples taken for C13/N15 only.

112 CTD vs. bottle salinity difference large. Primary and secondary sensors also show a fairly large difference. Ship's influence apparent in the CTD down trace and even greater in the up trace. Footnote CTD temperature and salinity questionable.

**Station 004.001**

101 SampleLog: "Leaking from bottom cap after oxygen drawn." Data are acceptable.

102 Samples taken for POM only.

104 SampleLog: "Spigot leak when vented."

105-107 Salinity not drawn.

107 SampleLog: "Spigot leaking before vented."

108 Samples taken for POM only.

109 Nosamples drawn.

110-111 Salinity not drawn.

**Station 005.001**

102 Oxygen and salinity not drawn.

103 SampleLog: "Oxygen redraw."

103-105 Salinity not drawn.

104 Oxygen not drawn. Oxygen is acceptable.

106 Sample Log: "Leaking from bottom, bottom cap ajar (o-ring popped out). No samples taken.

107 SampleLog: "Spigot leak." Data are acceptable.

107-108 Salinity not drawn.

108 See 110 CTD comments. Footnote CTD temperature and salinity questionable.

109-110 Oxygen and salinity not drawn.

110 Density inversion at 6 meters. CTD salinity is low compared to bottle. Density inversion also seen in CTD down trace, probably ship's effect. Difference, 0.1, between primary and secondary temperatures. Footnote CTD temperature and salinity questionable.

111 Oxygen not drawn.

**Station 006.001**

101 SampleLog: "Bottom cap not seated properly-readjusted then okay."

102 No samples drawn per sampling strategy.

104-108 Salinity not drawn.

106 Samples taken for C13/N15 only.

107 No samples drawn per sampling strategy.

109 Sample Log: "Large leak from bottom cap, o-ring popped out." Nutrients are reasonable, okay as is. Salinity not drawn.

110 Difference, 0.1, between primary and secondary temperatures. Footnote CTD temperature and salinity questionable. Salinity not drawn.

111 Salinity not drawn.

**Station 006.002**

201 Sample Log: "Bottom cap leak." Oxygen not drawn per sampling schedule. Nutrients are acceptable.

202 Salinity, oxygen and nutrients not drawn, sampled for Bacteria, POM and DOM/Lignin only.

204 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

206 Salinity, oxygen and nutrients not drawn, samples for O2 incubation and taxonomy.

207 Difference between CTD oxygen and bottle could be explained by 1 meters offset

between bottle and probe, strong oxygen gradient.

208 Salinity, oxygen and nutrients not drawn, sampled for POM and DOM/Lignin and O18.

212 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

Cast 2 Salinity not drawn, Productivity cast.

**Station 006.003**

305 Nutrients drawn per sampling schedule, Radium cast.

Cast 3 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 007.001**

102 Salinity and oxygen not drawn.

103-108 Salinity not drawn.

104 SampleLog: "Small spigot leak." Oxygen as well as other data are acceptable.

105 CTDLog: "Did not yo-yo, ship rolling some." Data are acceptable.

107 SampleLog: "Small spigot leak." Oxygen as well as other data are acceptable.

109 Salinity and oxygen not drawn.

110 Salinity and oxygen not drawn.

112 SampleLog: "Possible bottom leak." Oxygen as well as other data are acceptable.

Cast 1 Sample Log: "Problem with NaOH dispenser. Lots of jellyfish tentacles." Oxygen dispenser fixed before cast, data are acceptable.

**Station 008.001**

102-104 No samples were drawn.

105 Salinity not drawn.

106 Oxygen and salinity were not drawn.

107 Salinity not drawn.

108-109 No samples were drawn.

110 Salinity not drawn.

111 Sample Log: "Air vent found open." Oxygen as well as other data are acceptable.

Salinity not drawn.

112 Large difference between CTD and bottle salinity. Gradient at the surface; could be the 1 meter difference between bottle and CTD. Primary and secondary sensor agreement, 0.007. Okay as is.

Cast 1 Oxygen temperature probe failure, water in connection and battery low. No oxygen draw temperature.

**Station 008.002**

201 Salinity, oxygen and nutrients not drawn, sampled taken for POM and DOM/Lignin.

202 Salinity, oxygen and nutrients not drawn, sampled taken for POM only.

203 Salinity, oxygen and nutrients not drawn, sampled taken for O2 incubation only.

206 Salinity, oxygen and nutrients not drawn, sampled taken for O2 incubation only.

206-212 Biological fouling in primary CTD sensors. CTD oxygen is bad; reporting temperature, conductivity/salinity from secondary sensors.

208 Salinity, oxygen and nutrients not drawn, sampled taken for POM and DOM/Lignin.

212 Salinity, oxygen and nutrients not drawn, sampled taken for O2 incubation only.

Cast 2 Salinity not drawn, Productivity cast.

**Station 009.001**

102-106 Salinity not drawn.

104 SampleLog: "Small spigot leak." Data are acceptable.

107 SampleLog: "Bad small spigot leak." Data are acceptable.

**Station 010.001**

103 SampleLog: "Oxygen redrawn." Oxygen is acceptable.

104 SampleLog: "Small spigot leak."

106-102 Salinity not drawn.

107 SampleLog: "Leaking before venting, sampled from bottle 8."

108 Salinity difference, 0.51, large gradient. Data are acceptable. Primary and secondary sensor agreement, 0.006. Okay as is.

109-112 Bottles tripped for deck safety, samples not drawn.

**Station 011.001**

103 SampleLog: "Severe leak coming out of water; no water left for sampling."

104-108 Salinity not drawn.

110-112 Bottle tripped for deck safety, samples not drawn.

**Station 012.001**

101 SampleLog: "Oxygen flask broken on second shake."

103-109 Salinity not drawn.

106 Sample Log: "Leaking when brought on deck, sampled 7 which was scheduled for HPLC only."

107 SampleLog: "Small spigot leak." Data are acceptable.

111-112 Duplicate trips, samples not drawn.

**Station 013.001**

102-106 Salinity not drawn.

107 CTD Log: "Replace bottle prior to cast for small spigot repair." Large difference between CTD and bottle salinity. Gradient at the surface; could be the 1 meter difference between bottle and CTD. Primary and secondary sensor agreement, 0.009. Okay as is.

108-112 Bottles tripped for deck safety, but no samples drawn.

**Station 014.001**

101-103 Oxygen not drawn per sampling schedule.

103 SampleLog: "Leaking from bottom end cap." Data are acceptable.

104 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation, Bio-optics and DOM/POM, POM.

105 Sample Log: "Bottom cap leak, after oxygen drawn." Oxygen and other data are acceptable.

107 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

111 SampleLog: "Oxygen redrawn." Oxygen is acceptable.

112 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

Cast 1 Salinity not drawn, Productivity cast.

**Station 014.002**

201 Nutrients drawn per sampling schedule, POM, and DOM/Lignin.

202 Nutrients drawn per sampling schedule, POM, and DOM/Lignin.

203 Nutrients drawn per sampling schedule, Zooplankton.

205 SampleLog: "Bottom cap leak."

212 Nutrients drawn per sampling schedule, Zooplankton.

Cast 2 Salinity, oxygen and nutrients not drawn, except as noted, Zooplankton cast.

**Station 014.003**

301 Salinity and oxygen not drawn, nutrients drawn per sampling schedule, Radium cast.

303 SampleLog: "Bottom cap leak."

305 SampleLog: "Bottom cap leak."

Cast 3 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 015.001**

103-111 Salinity not drawn.

104 SampleLog: "Small spigot leak." Oxygen as well as other samples are acceptable.

105 Sample Log: "Bottom cap leak after oxygen drawn, reseated then okay." Oxygen as well as other samples are acceptable.

111 SampleLog: "Oxygen redrawn." Oxygen rich, data are acceptable.

**Station 015.002**

201 Salinity and oxygen not drawn, nutrients drawn per sampling schedule, Radium cast.

Cast 2 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 015.003**

301 Salinity and oxygen not drawn, sampled for POM.

302 Salinity, oxygen and nutrients not drawn, sampled for DOM/Lignin and O18.

303 Salinity, oxygen and nutrients not drawn, sampled for Bacteria.

304 Salinity and oxygen not drawn, sampled for Bacteria.

305 Salinity and oxygen not drawn, sampled for Bacteria, DOM/Lignin and O18.

307 Salinity, oxygen and nutrients not drawn, sampled for POM, DOM/Lignin and O18.

311 Sample Log: "Bottle cap leak, reseated, then started leaking on venting." Oxygen as well as other data are acceptable.

Cast 3 Salinity not drawn, Productivity cast.

**Station 016.001**

103 Salinity and oxygen not drawn per sampling schedule.

104 Salinity not drawn

105 SampleLog: "Bottom cap leak, no oxygen."

105-110 Salinity not drawn.

109 SampleLog: "Small spigot leak." Oxygen and well as other data are acceptable.

112 SampleLog: "Oxygen redrawn. Oxygen and well as other data are acceptable.

**Station 017.001**

101 CTDLog: "Could not let bottom bottle soak full 2 minutes due to shoaling bottom."

103-111 Salinity not drawn.

104 SampleLog: "Small spigot leak."

105 SampleLog: "Bad bottom leak." Samples not drawn.

110 Density inversion, probably ship effect. Footnote CTD temperature, conductivity/salinity, and oxygen as questionable.

111 Density inversion, probably ship effect. Footnote CTD temperature, conductivity/salinity questionable.

**Station 018.001**

101 CTDLog: "No yo-yo at bottom, could soak only for 1.5 minutes vs. 2 due to shoaling." Large salinity difference, 0.025, nutrients are acceptable, oxygen is also high compared with CTD. Leave as is.

103-110 Salinity not drawn.

104 SampleLog: "Small spigot leak." Oxygen as well as other data are acceptable.

**Station 019.001**

102-111 Salinity not drawn.

**Station 020.001**

103-111 Salinity not drawn.

**Station 021.001**

101 Salinity and oxygen not drawn, nutrients drawn per sampling schedule, Radium cast.

107 Salinity and oxygen not drawn, nutrients drawn per sampling schedule, Radium cast.

Cast 1 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 021.002**

201-204 Salinity and oxygen not drawn per sampling schedule.

205 Salinity, oxygen and nutrients not drawn.

206 Oxygen not drawn.

207 Urea lost due to AA malfunction.

Cast 2 Salinity not drawn, Productivity cast.

**Station 022.001**

Cast 1 Cast aborted, CTD failure.

**Station 022.002**

201 Sample Log: "Leaked, no samples drawn." Nutrients: "Sample 201 was drawn."

Footnote nutrients bad.

203 SampleLog: "Leaked, no samples drawn."

**Station 022.003**

Cast 3 Cast aborted, file set up problem.

**Station 022.004**

504-510 Salinity not drawn.

**Station 022.005**

504-510 Salinity not drawn.

**Station 022.006**

601 Salinity and oxygen not drawn, nutrients drawn per sampling schedule, Radium cast.

607 Salinity and oxygen not drawn, nutrients drawn per sampling schedule, Radium cast.

611 SampleLog: "Leaking from bottom cap, large flow."

Cast 6 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 022.007**

701 SampleLog: "Bottom cap leak." Nutrients are acceptable.

701-703 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

705 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

712 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 7 Salinity, oxygen and nutrients not drawn, except as noted, combination Radium and Bio-Marker cast.

**Station 022.008**

801-804 Oxygen not drawn per sampling schedule.

803 SampleLog: "Leaking from bottom end cap." Nutrients are acceptable.

804 Nutrients were inadvertently drawn before O2 incubation. Salinity, and oxygen not drawn, sampled for O2 incubation.

805 Nutrients not drawn from bottle 5, draw was from 4, error in Sample Log.

807 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation.

811 SampleLog: "Leaking from bottom end cap." Bacteria was drawn.

812 Sample Log indicates that sample was taken from bottle, but it was not analyzed.  
Footnote nutrients lost.

Cast 8 Salinity not drawn, Productivity cast.

**Station 022.009**

901 Nutrients drawn per sampling schedule.

9all Salinity, oxygen and nutrients not drawn, except as noted, Zooplankton cast.

**Station 023.001**

104 Sample Log: "Leaking from bottom, no oxygen taken." Bottle is leaking and samples are bad.

105-111 Salinity not drawn.

**Station 023.002**

203-212 Salinity not drawn.

**Station 023.003**

301 SampleLog: "Leaking from bottom cap when came on deck."

303 SampleLog: "Slight leak from bottom cap."

304 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

308 Sample Log: "Leaking from bottom cap." Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 3 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 023.004**

409 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 4 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 023.005**

501-503 Oxygen not drawn and nutrients drawn per sampling schedule.

504 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

505 Analyst entered nutrient sample as 4, but Sample Log says 5. Changed to 5.

508 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

512 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

Cast 5 Salinity not drawn, Productivity cast.

**Station 024.001**

101 PO4 a little high, corrected peak with bubble, but corrected still seems a tad high.

Footnote PO4 questionable.

102 Sample Log: "Leaking when brought on deck, did not sample for O2." Salinity low and nutrients bad. Footnote bottle leaking and samples bad.

109-111 Salinity not drawn.

**Station 024.002**

201-203 Nutrients drawn, samples taken for Bacteria.

204 Salinity, oxygen and nutrients not drawn, sampled for Bacteria.

207 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

212 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

Cast 2 Salinity not drawn, Productivity cast.

**Station 024.003**

303-310 Salinity not drawn.

304 NO3 appears low, rechecked data and no problems found.

311 SampleLog: "Leaking from bottom, no O2 drawn." Salinity and nutrients are acceptable.

312 Salinity not drawn.

**Station 025.001**

101-102 Bottle salinity appears low compared with CTD. Temperature gradient, salinity indicates that there could have been biological fouling. However, the sensors agree with one another and similar depth on the next cast. There is no real indication that there is a problem with the bottle salinities, however bottle 1 was run after a very low salinity. Footnote bottle salinity questionable.

101-104 Sample Log: "Jellyfish tentacles across bottles."

102 Oxygen not drawn per sampling schedule.

103-110 Salinity not drawn.

104 Sample Log: "Bottom cap leak when spigot open." Oxygen not drawn per sampling schedule. Nutrients are acceptable.

112 Large CTD-bottle salinity difference, large gradient. Data are acceptable.

**Station 025.002**

202 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

212 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 2 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 025.003**

301-303 Nutrients drawn per sampling schedule.

304 Salinity, oxygen and nutrients not drawn, sampled for O<sub>2</sub> incubation only.

308 Salinity, oxygen and nutrients not drawn, sampled for O<sub>2</sub> incubation only.

312 Salinity, oxygen and nutrients not drawn, sampled for O<sub>2</sub> incubation only.

Cast 3 Salinity not drawn, Productivity cast.

**Station 026.001**

101 Sample Log: "Leaking from bottom cap, no oxygen drawn." Salinity not drawn. Nutrients are acceptable.

102 Oxygen: "Brown precipitate after acidification prevented proper titration-oxygen lost."

103-104 Salinity not drawn.

104 SampleLog: "Leaking from bottom cap, no oxygen drawn." Nutrients are acceptable.

106-111 Salinity not drawn.

**Station 026.002**

202 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

211 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 2 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 027.001**

103-110 Salinity not drawn.

**Station 028.001**

101 Salinity, oxygen and nutrients not drawn, sampled for POM, DOM/Lignin and O<sub>18</sub>.

103-104 Nutrients drawn per sampling schedule, Bacteria.

105 Salinity, oxygen and nutrients not drawn, sampled for POM, DOM/Lignin and O<sub>18</sub>.

109 Salinity, oxygen and nutrients not drawn, sampled for O<sub>2</sub> incubation only.

Cast 1 Salinity not drawn, Productivity cast.

**Station 028.002**

201 Nutrients drawn per sampling schedule.

212 Nutrients drawn per sampling schedule.

Cast 2 Salinity, oxygen and nutrients not drawn, except as noted, Zooplankton cast.

**Station 029.001**

103 Salinity not drawn.

104 SampleLog: "Bad bottom leak, no samples drawn."

105-110 Salinity not drawn.

**Station 029.002**

201 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

207 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 2 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 030.001**

103 SampleLog: "Leaking from bottom cap." No samples drawn.

105 SampleLog: "Leaking from spigot when vented." Data are acceptable.

108 Sample Log: "Leaking from bottom cap." Oxygen and salinity not drawn. Footnote nutrient data bad.

109 Data are questionable. Not certain what is wrong. Footnote data questionable.

110 Sample Log: "Leaking from bottom cap." Oxygen not drawn. Large CTDS-bottle difference, two sensors agree with one another. Footnote bottle leaking and samples bad.

112 SampleLog: "Leaking from bottom cap." No samples drawn, except O18.

**Station 030.002**

204-211 Salinity not drawn.

205 SampleLog: "Leaking from spigot."

**Station 030.003**

301 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

312 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 3 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 030.004**

402 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 4 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 030.005**

501-503 Nutrients drawn per sampling schedule, Bacteria.

504 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

508 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

512 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

Cast 5 Salinity not drawn, Productivity cast.

**Station 030.006**

601 Nutrients drawn per sampling schedule.

612 Nutrients drawn per sampling schedule.

Cast 6 Salinity, oxygen and nutrients not drawn, except as noted, Zooplankton cast.

**Station 030.007**

702 Urea appears high, rechecked data and no problem found.

703 Sample Log: "Top o-ring failure." Probably due to lowering bottles after trip due to winch problem. No samples drawn.

709 Sample Log: "Top cap failure." Probably due to lowering bottles after trip due to winch problem. No samples drawn.

Cast 7 Salinity and oxygen not drawn, Bio-Marker cast.

**Station 030.008**

801 Nutrients drawn per sampling schedule, Radium cast.

812 Nutrients drawn per sampling schedule, Radium cast.

Cast 8 Sample Log: "This started out as a test cast to get rid of crossovers on wire spool and then became a Radium cast." Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 031.001**

105 SampleLog: "Bottom cap leak, o-ring popped out." No water for sampling.

105-111 Salinity not drawn.

**Station 031.002**

201 Oxygen appears high. Gradient, oxygen is acceptable.

202-211 Salinity not drawn.

209 SampleLog: "Small spigot leak when vented, top o-ring not sealed." Data are acceptable.

**Station 031.003**

301-302 Nutrients drawn per sampling schedule, Bacteria.

303 Salinity, oxygen and nutrients not drawn, sampled for O<sub>2</sub> incubation only.

306 Salinity, oxygen and nutrients not drawn, sampled for O<sub>2</sub> incubation only.

307 No samples taken from this bottle.

309 SampleLog: "Bottom cap leak, could not sample from spigot."

312 Sample Log: "Bottom cap leak." Salinity, oxygen and nutrients not drawn, Bacteria sampled from this bottle.

Cast 3 Salinity not drawn, Productivity cast.

**Station 031.004**

401 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

412 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 4 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 031.005**

502 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

511 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 5 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 032.001**

101 SiO<sub>3</sub> appears high, rechecked data and found no problems.

102 SampleLog: "Large spigot leak, reseated top o-ring then okay."

105-111 Salinity not drawn.

**Station 032.002**

201-203 Nutrients drawn per sampling schedule, Bacteria.

205 Salinity, oxygen and nutrients not drawn, sampled for C13/N15 only.

211-212 No samples drawn per sampling strategy.

Cast 2 Salinity not drawn, Productivity cast.

**Station 032.003**

301 Nutrients drawn per sampling schedule.

312 Nutrients drawn per sampling schedule.

Cast 3 Salinity, oxygen and nutrients not drawn, except as noted, Zooplankton cast.

**Station 032.004**

403-411 Salinity not drawn.

409 SampleLog: "Air vent open." Data are acceptable.

**Station 032.005**

503 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.  
510 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.  
Cast 5 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 032.006**

609 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.  
611 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.  
Cast 6 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 032.007**

701 Nutrients drawn per sampling schedule, Bio-Marker cast.  
705 SampleLog: "Top cap did not seal." No samples drawn.  
706 Sample Log: "Possible top cap leak. Nutrients drawn per sampling schedule, Bio-Marker cast. Data are acceptable.  
707 Sample Log: "Top cap leak. Water rushed out with spigot open and air vent closed."  
No samples drawn.  
708-709 Nutrients drawn per sampling schedule, Bio-Marker cast.  
711 Nutrients drawn per sampling schedule, Bio-Marker cast.  
Cast 7 Salinity, oxygen and nutrients not drawn, except as noted, Bio-Marker cast.

**Station 033.001**

106-110 Salinity not drawn. Nutrients: "NH<sub>4</sub> lost due to ship's power outage."  
111 Sample Log: "Bottom leak." Oxygen not drawn. All samples affected by bottle leak.  
Footnote bottle leaking and samples bad.  
112 Salinity not drawn.  
Cast 1 Oxygen temperature reading approximately 2.5 low, switched to alternate temperature sensor on bottle 6. Used 0 for 1-5.

**Station 033.002**

203-210 Salinity not drawn.  
206 SampleLog: "Big leak on small spigot." Data are acceptable.  
211 SampleLog: "Small spigot leak." Data are acceptable.

**Station 033.003**

301 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.  
312 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.  
Cast 3 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 033.004**

401 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.  
Cast 4 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 033.005**

501-503 Oxygen not drawn per sampling strategy, Productivity cast.  
504 Salinity, oxygen and nutrients not drawn, sampled for O<sub>2</sub> incubation only.  
506 SampleLog: "Small spigot leak before venting." Data are acceptable.  
507 Salinity, oxygen and nutrients not drawn, sampled for O<sub>2</sub> incubation only.  
512 Salinity, oxygen and nutrients not drawn, sampled for O<sub>2</sub> incubation only.  
Cast 5 Salinity not drawn, Productivity cast.

**Station 034.001**

102 Sample Log: "Maybe short squirt with NaOH/NaI." Oxygen is acceptable. Salinity not drawn.

104 SampleLog: "Leaking from bottom when spigot pushed in." Data are acceptable.  
104-108 Salinity not drawn.  
106 SampleLog: "Small spigot leak." Data are acceptable.  
110 Salinity not drawn.  
111 SampleLog: "Slight small spigot leak." Data are acceptable.  
112 Salinity not drawn.  
Cast 1 Sample Log: "Sampling depths modified to allow 3 double bottles on shallow cast for Bio-Markers."

**Station 034.002**

201-202 No oxygen drawn.  
204 SampleLog: "Small leak from bottom cap." Data are acceptable.  
204-209 Salinity not drawn.  
206 SampleLog: "Small spigot leak." Data are acceptable.  
208 Nooxygen drawn.  
211 SampleLog: "Small spigot leak, significant." Data are acceptable.

**Station 034.003**

301 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.  
312 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.  
Cast 3 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 034.004**

406 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.  
Cast 4 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 034.005**

501-503 Oxygen not drawn per sampling strategy, Productivity cast.  
504 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.  
507 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.  
512 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.  
Cast 5 Salinity not drawn, Productivity cast.

**Station 034.006**

601 Nutrients drawn per sampling schedule.  
612 Nutrients drawn per sampling schedule.  
Cast 6 Salinity, oxygen and nutrients not drawn, except as noted, Zooplankton cast.

**Station 035.001**

101 Oxygen: "Debris in flask, overtitrated, sample lost." Urea seems high, leave as is.  
103 Salinity not drawn.  
105 Salinity not drawn.  
107 SampleLog: "Bottom cap leaks, large flow." Samples not drawn except O18.  
108 SampleLog: "Bottom cap leaks, large flow." Samples not drawn except O18.  
109-110 Salinity not drawn.

**Station 035.002**

203-211 Salinity not drawn.  
204 Sample Log: "Slow leak on bottom cap, started after O2 draw, reseated then okay."  
Oxygen as well as other data are acceptable.

**Station 035.003**

301 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.  
312 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 3 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 035.004**

401 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 4 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 035.005**

501-502 No samples drawn per sampling strategy.

509-512 No samples drawn per sampling strategy.

Cast 5 Salinity not drawn, Productivity cast.

**Station 035.006**

Cast 6 Salinity and oxygen not drawn, Bio-Marker cast.

**Station 036.001**

103-104 CTD vs. bottle salinity high, suspect bottle salinity. Not analytical problems. Agreement between the two sensors, primary and secondary, is a little off. The primary has a slight offset at about 1120 meters but then it drifts back. Footnote CTD primary salinity questionable.

105 Sample Log: "Leaking from bottom cap, slow leak." Comparison between O2 probe and bottle oxygen looks okay.

105-110 Salinity not drawn.

109 Sample Log: "Leaking from bottom cap, reseated then slight leak, reventing started the leak again." Samples not drawn except O18.

**Station 036.002**

202-211 Salinity not drawn.

**Station 036.003**

301 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

312 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 3 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 036.004**

401 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 4 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 036.005**

501-503 Oxygen not drawn per sampling strategy, Productivity cast.

504 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

507 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

512 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

Cast 5 Salinity not drawn, Productivity cast.

**Station 036.006**

601-602 Nutrients drawn per sampling schedule.

611-612 Nutrients drawn per sampling schedule.

Cast 6 Salinity, oxygen and nutrients not drawn, except as noted, Zooplankton cast.

**Station 037.001**

105-110 Salinity not drawn.

106 SampleLog: "Minor spigot leak." Data are acceptable.

111 SampleLog: "Top cap canted significant small spigot leak." Data are acceptable.

**Station 037.002**

202-205 Salinity not drawn.

207-210 Salinity not drawn.

212 Salinity not drawn.

**Station 037.003**

301 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

312 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 3 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 037.004**

412 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 4 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 037.005**

501-502 Oxygen not drawn per sampling strategy, Bacteria.

503 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

506-507 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

508 Oxygen appears low compared with CTD. No analytical problem noted. Oxygen is acceptable.

512 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

Cast 5 Salinity not drawn, Productivity cast.

**Station 037.006**

605 SampleLog: "Bad bottom cap leak." No samples drawn.

607 SampleLog: "Bad bottom cap leak." No samples drawn.

608 SampleLog: "Good size small spigot leak." Nutrients are acceptable.

Cast 6 Salinity and oxygen not drawn, Bio-Marker cast.

**Station 038.001**

102 Oxygen appears low, strong gradient. Data are acceptable.

103-104 Salinity, oxygen and nutrients not drawn, sampled for C13/N15 only.

109-112 No samples drawn per sampling strategy.

Cast 1 Salinity not drawn, Productivity cast.

**Station 038.002**

201 All values suspect, poor flushing or leaking bottle. Footnote bottle leaking, data questionable.

203 SampleLog: "Bottom cap leak, small." Data are acceptable.

203-211 Salinity not drawn.

205 Duplicate trip, no samples drawn.

208 Duplicate trip, no samples drawn.

210 Duplicate trip, no samples drawn.

**Station 038.003**

301-303 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

303 Rechecked Nitrate could not find any analytical problem. Footnote NO3 questionable.

312 Salinity and oxygen not drawn, nutrients drawn per sampling schedule. Rechecked Nitrate could not find any analytical problem. Footnote NO3 questionable.

Cast 3 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 039.001**

102 Duplicate trip samples not drawn.

104 Duplicate trip samples not drawn.

106 Duplicate trip samples not drawn.

108 Duplicate trip samples not drawn.

110 Duplicate trip samples not drawn.

111 SampleLog: "Spigot leak, sampling moved to 12." Duplicate trip samples not drawn.

111-102 Salinity not drawn.

**Station 040.001**

102 Oxygen not drawn.

102-111 Salinity not drawn.

104 Oxygen not drawn.

106 Oxygen not drawn.

108 Oxygen not drawn.

110 Oxygen not drawn.

111 SampleLog: "Small spigot leak." Data are acceptable.

112 Oxygen not drawn.

**Station 041.001**

101 SampleLog: "Leaked from bottom cap." Duplicate level, samples not drawn.

103-111 Salinity not drawn.

104 Salinity, oxygen and nutrients not drawn, sampled for thorium.

106 Salinity, oxygen and nutrients not drawn, sampled for thorium.

107 SampleLog: "Bottom cap leak with vent open-check o-ring." Data are acceptable.

108 Salinity, oxygen and nutrients not drawn, sampled for thorium.

110 Oxygen not drawn.

111 SampleLog: "Small spigot leak." Data are acceptable.

112 Oxygen not drawn.

**Station 042.001**

103-111 Salinity not drawn.

107 Salinity, oxygen and nutrients not drawn, duplicate bottle trip, sampled for C13/N15 only.

**Station 042.002**

201 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

212 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 2 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 042.003**

301-302 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

303 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

305 Oxygen not drawn.

306 Oxygen low, okay strong gradient, interleaving.

307 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

308 Oxygen high, okay strong gradient, interleaving.

312 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

Cast 3 Salinity not drawn, Productivity cast.

**Station 042.004**

401 Nutrients drawn per sampling schedule.

412 Nutrients drawn per sampling schedule.

Cast 4 Salinity, oxygen and nutrients not drawn, except as noted, Zooplankton cast.

**Station 043.001**

102 Oxygen not drawn.

103-105 Salinity not drawn.

104 Oxygen not drawn.

106 Oxygen not drawn.

108 Oxygen not drawn.  
108-111 Salinity not drawn.  
110 Oxygen not drawn.  
111 SampleLog: "Small spigot leak." Data are acceptable.  
112 Oxygen and salinity not drawn.

**Station 044.001**

101 SampleLog: "Bottom cap leak." Salinity, oxygen and nutrients not drawn.  
102 Salinity not drawn.  
104 Salinity not drawn.  
105 SampleLog: "Top cap leak." Salinity, oxygen and nutrients not drawn.  
106 Salinity not drawn.  
109-111 Salinity not drawn.  
111 Oxygen low, okay large gradient.

**Station 044.002**

201-202 Salinity and oxygen not drawn, nutrients drawn per sampling schedule, Radium cast.  
207-208 Salinity and oxygen not drawn, nutrients drawn per sampling schedule, Radium cast.  
212 Salinity and oxygen not drawn, nutrients drawn per sampling schedule, Radium cast.  
Cast 2 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 044.003**

301-303 Nutrients drawn per sampling schedule.  
304 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.  
307 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.  
312 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.  
Cast 3 Salinity not drawn, Productivity cast.

**Station 045.001**

102 Oxygen not drawn.  
102-111 Salinity not drawn.  
104 Oxygen not drawn.  
106 Oxygen not drawn.  
107 SampleLog: "Small spigot leak, minor." Data are acceptable.  
108 Oxygen not drawn.  
110 Oxygen not drawn.  
111 SampleLog: "Small spigot leak." Data are acceptable.  
112 Oxygen not drawn.

**Station 046.001**

101 SampleLog: "Bottom cap leak." No samples drawn.  
103-111 Salinity not drawn.  
104 Oxygen not drawn.  
106 Oxygen not drawn.  
108 Oxygen not drawn.  
110 Oxygen not drawn.  
112 Oxygen not drawn.

**Station 047.001**

102 Oxygen not drawn.  
102-105 Salinity not drawn.  
108-111 Salinity not drawn.

110 SampleLog: "Small spigot leak, miniscule." Data are acceptable.  
111 Sample Log: "Small spigot leak." Rechecked NO3 and found no problems.  
Rechecked CTDO, appears to be reasonable, gradient area. Data are acceptable.

**Station 047.002**

202-204 Salinity not drawn.

206-211 Salinity not drawn.

210 SampleLog: "Small spigot leak." Data are acceptable.

211 SampleLog: "Small spigot leak." Data are acceptable.

**Station 047.003**

301 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

303 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

305 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

307 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

309 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

311 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 3 Salinity, oxygen and nutrients not drawn, except as noted, Bio-Marker cast.

**Station 047.004**

401 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

412 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 4 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 047.005**

501 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 5 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 047.006**

601-603 Oxygen not drawn per sampling strategy.

604 No samples drawn per sampling strategy.

605 SampleLog: "Small spigot leak." Data are acceptable.

607 No samples drawn per sampling strategy.

609 Sample Log: "Small spigot leak when vented, top cap not seated." Data are acceptable.

612 No samples drawn per sampling strategy.

Cast 6 Salinity not drawn, Productivity cast.

**Station 048.001**

106-111 Salinity not drawn.

108 SampleLog: "Spigot leak." Data are acceptable.

109 SampleLog: "Top cap did not close properly-no samples drawn."

110 SampleLog: "Top cap did not close properly-no samples drawn."

111 SampleLog: "Spigot leak, questionable sample." Data are acceptable.

**Station 048.002**

203 SampleLog: "Slight bottom cap leak." Data are acceptable.

204-208 Salinity not drawn.

208 SampleLog: "Slight spigot leak." Data are acceptable.

210 SampleLog: "Slight spigot leak." Data are acceptable.

211 SampleLog: "Spigot leak." Data are acceptable.

212 Salinity not drawn.

**Station 048.003**

301 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

311 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.  
Cast 3 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 048.004**

401 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.  
412 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.  
Cast 4 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 048.005**

501-503 Oxygen not drawn per sampling strategy.  
504 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.  
507 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.  
510-512 CTD salinity at duplicate trip +/-0.004 different from each other. Salinity at 10 meters could be a little low. Suspect temperature effect. Within accuracy leave as is. Ship's effect could be the cause, but usually ship's effect gives higher temperature.  
511 SampleLog: "Small spigot leak." Data are acceptable.  
512 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.  
Cast 5 Salinity not drawn, Productivity cast.

**Station 048.006**

601 Nutrients drawn per sampling schedule.  
612 Nutrients drawn per sampling schedule.  
Cast 6 Salinity, oxygen and nutrients not drawn, except as noted, Zooplankton cast.

**Station 049.001**

Cast 1 Cast aborted, bottle 11 bottom cap closed when rosette entered the water.

**Station 049.002**

206 SampleLog: "Very small spigot leak." Data are acceptable.  
206-211 Salinity not drawn.  
208 SampleLog: "Spigot leak, bad." Data are acceptable.  
210 SampleLog: "Spigot leak." Data are acceptable.  
211 SampleLog: "Small spigot leak." Data are acceptable.

**Station 049.003**

301-302 Salinity not drawn.  
304-306 Salinity not drawn.  
308 SampleLog: "Bad spigot leak." Data are acceptable.  
310 Sample Log: "Spigot leak." Salinity: "Replaced due to repeated failure to hold thimble." Salinity as well as other data are acceptable.  
312 Salinity not drawn.

**Station 049.004**

401 SampleLog: "Bottom cap leak." Data are acceptable.  
401-403 Oxygen not drawn per sampling strategy.  
405 Oxygen not drawn per sampling strategy.  
406 SampleLog: "Small and big spigot leak, top o-ring popped." Data are acceptable.  
408-409 CTDO questionable, slight offset when bottle tripped.  
410 Sample Log: "Bottom cap leak." No samples drawn per sampling strategy, duplicate trip.  
410-412 There is a large difference in the temperature for the 3 bottles that were tripped at the surface. Leave as is.  
412 No samples drawn per sampling strategy, duplicate trip.

Cast 4 Salinity not drawn, Productivity cast.

**Station 049.005**

501 Salinity and oxygen not drawn, nutrients drawn per sampling schedule. Rechecked urea peaks and data are acceptable.

512 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 5 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 049.006**

601 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 6 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 049.007**

701 Sample Log: "Bottom cap leak." Salinity, oxygen and nutrients not drawn. Coded bottle leaking.

702-707 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

705 Sample Log: "Top cap leak." Nutrient duplicate with bottle 4 agree very well. Data are acceptable.

708 Sample Log: "Bottom cap leak." Salinity, oxygen and nutrients not drawn. Coded bottle leaking.

709-712 Nutrients drawn per sampling schedule.

710 SampleLog: "Spigot leak." Data are acceptable.

Cast 7 Salinity, oxygen and nutrients not drawn, except as noted, Bio-Marker cast.

**Station 050.001**

104-105 Salinity not drawn.

107 Salinity not drawn.

108 SampleLog: "Spigot leak." Data are acceptable.

109 SampleLog: "Spigot leak, slight." Salinity not drawn. Data are acceptable.

110 SampleLog: "Spigot leak." Data are acceptable.

111 Salinity not drawn.

112 Salinity: "Replaced bottle due to repeated failure to hold thimble." Salinity appears high compared with CTD. Footnote salinity bad.

**Station 050.002**

206 SampleLog: "Spigot leak from top cap, skewed." Data are acceptable.

210 Salinity not drawn.

212 Salinity: "Three readings to obtain two good readings." Salinity is acceptable. Bottle oxygen appears a little high, gradient. Data rechecked and no problem found with the analyses.

**Station 050.003**

301 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

312 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 3 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 050.004**

401 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 4 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 050.005**

501-503 Oxygen not drawn per sampling schedule.

504 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

507 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

509 Sample Log: "Bottom cap leak, slight, okay when reseated, noticed after oxygen draw." Data are acceptable.

512 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

Cast 5 Salinity not drawn, Productivity cast.

**Station 051.001**

108 SampleLog: "Significant small spigot leak." Data are acceptable.

110 SampleLog: "Significant small spigot leak." Data are acceptable.

Cast 1 Salinity and oxygen not drawn, nutrients drawn per sampling schedule, Bio-Marker cast.

**Station 051.002**

202-205 Salinity not drawn.

206 Sample Log: "Minor spigot leak." Data are acceptable. CTD salinity if a little low. Primary and secondary comparison indicate that primary is approximately 0.007 low.

Within accuracy, leave as is.

206-212 CTD oxygen bad.

208 SampleLog: "Significant spigot leak." Data are acceptable.

210 SampleLog: "Just a spigot leak." Data are acceptable.

211-212 Salinity not drawn.

**Station 051.003**

302-311 Salinity not drawn.

**Station 051.004**

401-402 Oxygen not drawn per sampling strategy.

403 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

406 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

409 SampleLog: "Small spigot leak." Data are acceptable.

411 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

412 No samples drawn per sampling strategy.

Cast 4 Salinity not drawn, Productivity cast.

**Station 051.005**

501 Nutrients drawn per sampling schedule.

512 Nutrients drawn per sampling schedule.

Cast 5 Salinity, oxygen and nutrients not drawn, except as noted, Zooplankton cast.

**Station 051.006**

601 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

603 SampleLog: "Bottom cap leak."

612 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 6 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 051.007**

702 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

711 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 7 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 052.001**

102-104 Salinity not drawn.

106 Salinity not drawn.

108 Salinity not drawn.

110-111 Salinity not drawn.

**Station 052.002**

203 Sample Log: "Leaking from bottom cap, reseated then okay." No samples drawn.  
Code bottle leaking.

204 Sample Log: "Leaking from bottom cap, reseated then okay." No oxygen drawn.  
Data are not acceptable. Salinities show bad agreement, other data are all wrong.  
Footnote bottle leaking and samples bad.

206 SampleLog: "Small spigot leak." Data are acceptable.

208 SampleLog: "Small spigot leak." Data are acceptable.

208-211 Salinity not drawn.

**Station 052.003**

301 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

312 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 3 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 052.004**

401 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 4 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 053.001**

103-105 Salinity not drawn.

105 Sample Log: "Bottom cap leak, small leak, reseated then okay." Data are acceptable.

106 SampleLog: "Small spigot leak." Data are acceptable.

107-109 Salinity not drawn.

112 Salinity not drawn.

**Station 053.002**

204 Salinity not drawn.

206 SampleLog: "Slow small spigot leak." Data are acceptable.

206-211 Salinity not drawn.

208 SampleLog: "Slow small spigot leak." Data are acceptable.

**Station 054.001**

103-111 Salinity not drawn.

106 SampleLog: "Slow small spigot leak."

**Station 054.002**

201-203 Nutrients drawn per sampling schedule, Bacteria. Oxygen not drawn per sampling strategy.

204 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

206 SampleLog: "Spigot leaks, both." Data are acceptable.

207 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

212 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

Cast 2 Salinity not drawn, Productivity cast.

**Station 054.003**

303-305 Salinity not drawn.

307 Salinity not drawn.

308 Sample Log: "Spigot leak." Salinity: "Salinity bottle filled too full, above neck."  
Data are acceptable.

309 Salinity not drawn.

310 Sample Log: "Spigot leak." Salinity: "Salinity bottle filled too full, above neck."  
Data are acceptable.

312 Salinity not drawn.

**Station 054.004**

406 SampleLog: "Bottom cap leak, when vent open." Data are acceptable.

408 SampleLog: "Minor spigot leak." Data are acceptable.

410 SampleLog: "Bottom cap leak." No samples drawn.

Cast 4 Salinity and oxygen not drawn, Bio-Marker cast.

**Station 054.005**

501 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

512 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 5 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 054.006**

601 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

612 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 6 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 055.001**

102-106 Salinity not drawn.

103 SampleLog: "Bad bottom cap leak." No samples drawn.

108 SampleLog: "Spigot leak." Data are acceptable.

109 Salinity not drawn.

110 SampleLog: "Spigot leak."

111 SampleLog: "Possible top cap leak." Data are acceptable.

112 Salinity not drawn.

**Station 055.002**

201-202 Salinity not drawn.

203 SampleLog: "Small bottom cap leak." Data are acceptable

204-206 Salinity not drawn.

208 SampleLog: "Spigot leak." Data are acceptable

209 Salinity not drawn.

210 Sample Log: "Minor spigot leak." Salinity: "Won't hold thimble, replaced." Data are acceptable

211-212 Salinity not drawn.

**Station 055.003**

308 SampleLog: "Spigot leak." Data are acceptable.

Cast 3 Salinity and oxygen not drawn, Bio-Marker cast.

**Station 055.004**

401 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

412 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 4 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 055.005**

507 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 5 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 055.006**

601 Sample Log: "Leaking from bottom cap." Salinity, oxygen and nutrients not drawn. Bacteria drew from bottom cap.

602-603 Salinity and oxygen not drawn per sampling strategy.

606 Salinity, oxygen and nutrients not drawn, sampled for O2 incubation only.

611-612 No samples drawn per sampling strategy.

Cast 6 Salinity not drawn, Productivity cast.

**Station 055.007**

701 Nutrients drawn per sampling schedule.

712 Nutrients drawn per sampling schedule.

Cast 7 Salinity, oxygen and nutrients not drawn, except as noted, Zooplankton cast.

**Station 056.001**

101-105 Salinity not drawn.

104 SampleLog: "Top cap leak." No samples drawn.

106 SampleLog: "Minor bottom cap leak." Data are acceptable.

108 SampleLog: "Spigot leak." Data are acceptable.

110 SampleLog: "Minor spigot leak." Data are acceptable.

111-112 Salinity not drawn.

**Station 056.002**

201 Sample Log: "Bottom cap leak." Nutrients appear to have been drawn from bottle 2.

Footnote nutrients questionable.

202-204 Salinity not drawn.

205-206 Sample Log: "Slight bottom cap leak." Data are acceptable.

207 Salinity not drawn.

208 SampleLog: "Spigot leak." Data are acceptable.

209 Salinity not drawn.

210 SampleLog: "Spigot leak." Data are acceptable.

211-212 Salinity not drawn.

**Station 056.003**

303 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

305 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

306 Sample Log: "Bottom cap leak after venting." Bio-Markers switched all sampling to bottle 5. Nutrients drawn. Data are acceptable. Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

309 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

312 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 3 Salinity, oxygen and nutrients not drawn, except as noted, Bio-Marker cast.

**Station 056.004**

401 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

412 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 4 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 056.005**

501 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 5 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 057.001**

101 SampleLog: "Leaking from bottom cap, reseated then okay." Data are acceptable.

101-103 Salinity and oxygen not drawn per sampling strategy.

105 Salinity and oxygen not drawn per sampling strategy, duplicate trip, nutrients only.

111-112 No samples drawn per sampling strategy.

Cast 1 Salinity not drawn, Productivity cast.

**Station 058.001**

103 Rechecked urea peak and there was no analytical problem.

103-105 Salinity not drawn.

106 SampleLog: "Slight bottom cap leak after spigot was opened." Data are acceptable.

107 Salinity not drawn.

109 Salinity not drawn.

110 SampleLog: "Slight spigot leak." Data are acceptable.

111 Salinity not drawn.

**Station 058.002**

201 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

212 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 2 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 059.001**

101 SampleLog: "Bottom cap leak on venting, reseated then okay." Data are acceptable.

103-111 Salinity not drawn.

106 Sample Log: "Bottom cap leak after oxygen draw, reseated then okay." Data are acceptable.

109 SampleLog: "Slight spigot leak." Data are acceptable.

**Station 059.002**

201 Salinity and oxygen not drawn per sampling strategy.

202 Nutrients sampled before oxygen. Data are acceptable.

203 Salinity and oxygen not drawn per sampling strategy.

204 No samples drawn per sampling strategy, duplicate trip.

208 No samples drawn per sampling strategy, duplicate trip.

210 No samples drawn per sampling strategy, duplicate trip.

212 No samples drawn per sampling strategy, duplicate trip.

Cast 2 Salinity not drawn, Productivity cast.

**Station 059.003**

301 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

312 Salinity and oxygen not drawn, nutrients drawn per sampling schedule.

Cast 3 Salinity, oxygen and nutrients not drawn, except as noted, Radium cast.

**Station 060.001**

101 SampleLog: "Bottom cap leak." Data are acceptable.

102-107 Salinity not drawn.

106 SampleLog: "Slight bottom cap leak." Data are acceptable.

109 SampleLog: "Slight bottom cap leak." Data are acceptable. Salinity not drawn.

111 Salinity not drawn.

**Station 060.002**

Cast 2 Salinity, oxygen and nutrients not drawn, Radium cast. Bottles were sampled and drained before nutrients were drawn.

## CCHDO Data Processing Notes

Date	Person	Data Type	Action	Summary
2009-05-08	Fields, Justin	Bottle File	Replaced	Replaced bottle file Dr. Bob Key: Final TCO2 and Alk from N. Bates 1/30/09. Values merged and file reprinted. This file supersedes that included in CARINA tarball
2014-01-09	Staff, CCHDO	CrsRpt	Website Update	Available under 'Files as received' The following files are now available online under 'Files as received', unprocessed by the CCHDO. 32H1HLY0403_final.doc
2014-01-09	Barna, Andrew	BTL/CrsRpt	Website Updated	Bottle Data online The bottle and cruise <b>report</b> have been copied over from the CARINA collection
2014-01-23	Lee, Rox	maps	Website Update	Maps created ===== 32H120040718 processing - Maps ===== 2014-01-23 R Lee .. contents:: :depth: 2 Process ===== Changes ----- - Maps created from 32H120040718_hy1.csv Directories ===== :working directory: /data/co2clivar/arctic/HLY0403/original/2014.01.23_maps_RJL :cruise directory: /data/co2clivar/arctic/HLY0403 Updated Files Manifest ===== ===== file          stamp ===== 32H120040718_trk.gif 32H120040718_trk.jpg =====
2014-02-07	Kappa, Jerry	CrsRpt	Website Update	PDF version online I've placed a new PDF version of the cruise report: 32H120040718do.pdf into the directory: <a href="http://cchdo.ucsd.edu/data/co2clivar/arctic/HLY0403/">http://cchdo.ucsd.edu/data/co2clivar/arctic/HLY0403/</a> .  It includes all the reports provided by the cruise PIs, summary pages and CCHDO data processing notes, as well as a linked Table of Contents.