CRUISE REPORT: P06

(Updated APR 2010)
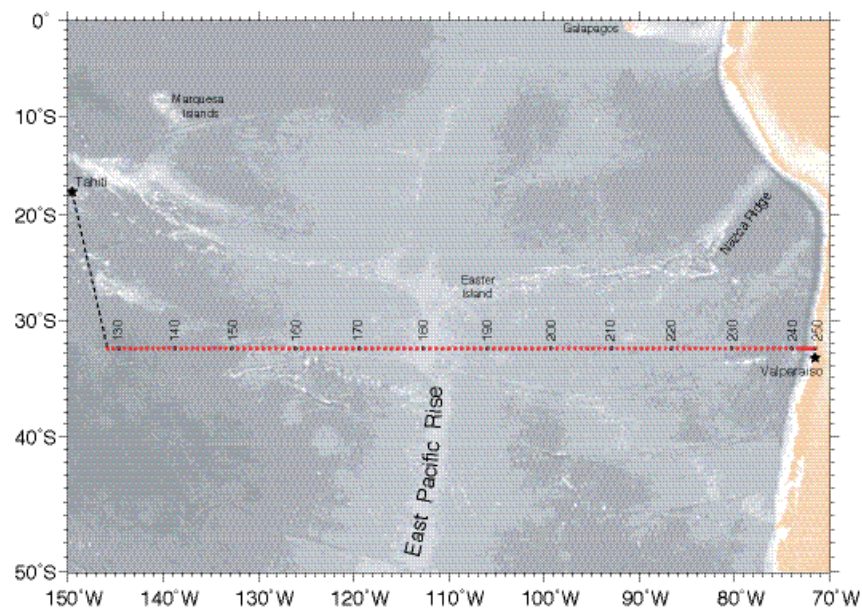
A.   HIGHLIGHTS

Cruise Summary Information

|	
WOCE Section Designation	**P06**
Expedition designation (ExpoCodes)	**318M20100105**
Chief Scientist	**Ruth Curry/WHOI**
Co-Chief Scientist	**Elizabeth Douglass/WHOI**
Dates	5 Jan 2010 - 11 Feb 2010
Ship	R/V Melville
Ports of call	Papeete, Tahiti -Valparaiso, Chile
Geographic Boundaries	32° 29.83' S 145° 50.5' W 71° 42.26' W 32° 30.26' S
Stations	123
Floats and drifters deployed	0
Moorings deployed or recovered	0

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Links To Select Locations
Shaded sections are not relevant to this cruise or were not available when this report was compiled

Cruise Summary Information	Hydrographic Measurements
Description of Scientific Program	**CTD Data:**
Geographic Boundaries	Acquisition
Cruise Track (Figure): PI CCHDO	Processing
Description of Stations	Calibration
Description of Parameters Sampled	Temperature Pressure
Bottle Depth Distributions (Figure)	Salinities Oxygens
Floats and Drifters Deployed	**Bottle Data**
Moorings Deployed or Recovered	Salinity
	Oxygen
Principal Investigators	Nutrients
Cruise Participants	Carbon System Parameters
	CFCs
Problems and Goals Not Achieved	Helium / Tritium
Other Incidents of Note	Radiocarbon

Underway Data Information	References
Navigation Bathymetry	CTD/BTL Data
Acoustic Doppler Current Profiler (ADCP)	CO2
Thermosalinograph	CFCs
XBT and/or XCTD	Radiocarbon
Meteorological Observations	
Atmospheric Chemistry Data	

Data Processing Notes	Acknowledgments

Station Locations • P06E • 2010 • Curry/Douglass • R/V Melville
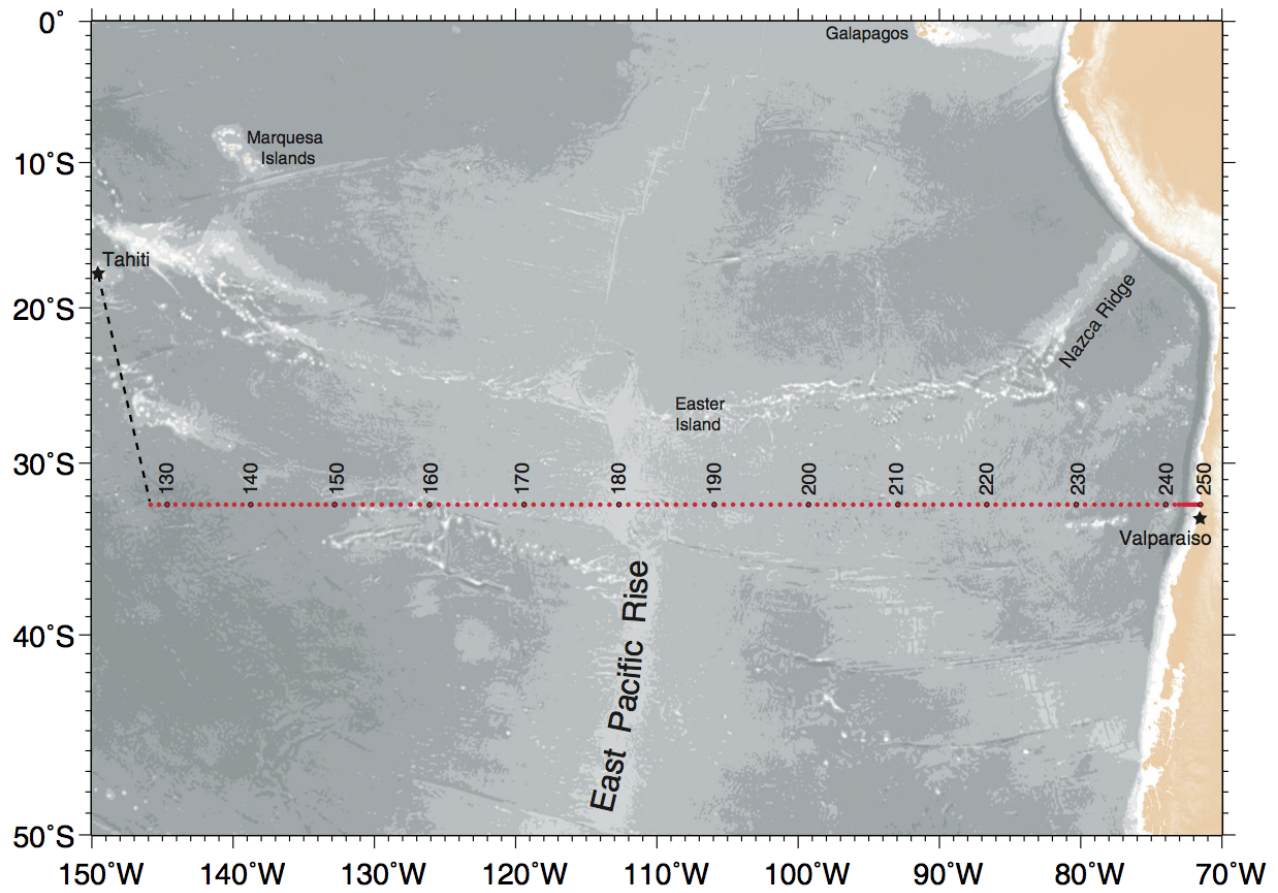
Summary

A hydrographic survey consisting of CTDO (conductivity, temperature, pressure, oxygen), LADCP (lowered acoustic Doppler current profiler), rosette water samples, underway shipboard ADCP and bio-optical casts in the south eastern Pacific Ocean was conducted aboard the UNOLS vessel R/V Melville from January 5 - February 11, 2010. A total of 123 CTD/LADCP/Rosette casts and 31 bio-optical casts were completed. CTD casts were collected to within 10 meters of the seafloor and up to 36 water samples were acquired at different depth levels on the upcast. Salinity, dissolved oxygen and nutrient samples were analyzed and used to calibrate the CTD conductivity and oxygen sensors for each cast. Water samples were also analyzed on board the ship for dissolved inorganic carbon (DIC), pH, total alkalinity, and transient tracers (CFCs and SF6). Additional water samples were collected and stored for analysis onshore: dissolved organic carbon (DOC), helium/tritium , 13C/14C, chromophoric dissolved organic matter (CDOM), chlorophyll-a, bacterial cell count, particulate organic carbon (POC), δ 15N in nitrate, and 14C in DOC. Underway measurements included surface pCO2, temperature, conductivity, dissolved oxygen, fluorescence, various meteorological parameters and bathymetry.

Cruise Narrative

The R/V Melville P6 cruise represented one component of the ongoing US CLIVAR/CO2 Repeat Hydrography program and was conducted as a two-leg zonal transect of the South Pacific along 32.5° S including 250 full depth CTDO/LADCP/hydrographic/carbon/tracer stations, and daily bio-optical casts. The first leg was occupied between November 21, 2009 and Jan 2, 2010 (44 days at sea, 127 stations) from Brisbane, Australia to Papeete, French Polynesia, the second leg left Papeete on January 5, 2010 and arrived in Valparaiso, Chile on February 10, 2010 (37 days at sea, 123 stations). The section had been carried out twice before: in 1992 (R/V Knorr) as part of the US WOCE program and in 2003 (R/V Mirai) as part of the Japanese Blue Earth Global Expedition. Both previous occupations were well-measured near coastal boundaries and over steep topography, but included large interior portions where station spacing exceeded 70 nm. This occupation was carried out with nominal spacing of 30-35 nm across the entire interior with slightly longer spacing (~50 nm) for just 8 stations on the first leg of the cruise.

The Leg 2 science party assembled in Tahiti to meet the ship upon its arrival in Papeete on Jan 2, 2010. Because the equipment and lab supplies were already set up for leg 1, the amount of preparation required in port for the scientific program was limited. Repairs to the helium/tritium van air conditioning unit, disabled by heavy seas on the first leg, were successfully completed dockside. Because of the holidays, taking on fuel and supplies in Tahiti was a slow process, but the Melville was at last ready to depart Papeete on 5 Jan 2010 ~1600 local. The 3.5 day steam to the first station on leg 2 allowed new science crew members time to get their sea legs, adjust to the ship's schedule, take part in safety drills and become familiar with operations in the lab and on deck.

The first cast (station 128), a repeat of the last station of leg 1, went into the water ~ 0300 local on Saturday (9 Jan). Data dropouts ended the cast ~800 m, the package was recovered and the wire was reterminated. The next launch resulted in a full water column profile to the seafloor at just over 5000 m depth and the instruments performed smoothly for the remainder of the cruise.

The primary task for Leg 2 was to complete the transect of CTD/rosette casts beginning near longitude 146° W and ending at the Chilean coast near 71° W. The CTD and other electronics mounted on the rosette frame provided measurements of pressure, temperature, conductivity (salinity) and dissolved oxygen, with additional sensors to measure light transmission and fluorometry. A lowered Acoustic Doppler Current Profiler (ADCP, RDI Workhorse 300) measured velocities relative to the rosette, from which absolute

velocities were subsequently derived. Water samples from the 36 10-liter bottles on the rosette were analyzed onboard for salinity, dissolved oxygen, nutrients (nitrate, nitrite, silicate, phosphate), CFCs (F11, F12, SF6), dissolved inorganic carbon, total alkalinity and pH. Samples for shore analysis were collected for dissolved organic carbon, 14C in inorganic and organic material, isotopes of nitrate, dissolved helium and 3He. A continuously pumped surface seawater system measured temperature, salinity, dissolved oxygen, fluorescence, and pCO2. Other measurements included velocity from the hull-mounted ADCP, a suite of meteorological parameters, multibeam bathymetry and navigation data. A variety of sampling was conducted to quantify distributions and properties of chromophoric dissolved organic matter (CDOM). In addition to spectrophotometer analyses of water samples, a bio-optical profiling cast was conducted each day as close to midday as possible using a package equipped with upwelling and downwelling radiometers (wavelength range from 305 to 665 nm), a chlorophyll fluorometer and backscatter sensor. Station work (deployment/recovery of CTD/rosette package and drawing water samples) was conducted around the clock, at an average rate of ~4 stations per day. The combination of reasonably good weather, well-functioning instruments and a remarkably strong spirit of cooperation amongst the science and ship crews enabled us to operate well within the projected timeline, and to complete the measurement program one day ahead of the total allocated for the cruise.

Leg 2 resumed the P6 section line along 32.5° S near 146° W, in the middle of the Southwest Pacific Basin, where seafloor depths generally ranged 4500 - 5500 m. For the first three weeks, the ship tracked up the western flank of the East Pacific Rise to its crest at ~2700 m depth near 110° W, crossing one of the transverse ridges that radiates northwestward from the main spine of the Rise at 128° W. For the last two weeks, the section tracked eastward through the Roggeveen Basin where more moderate depths (3000 - 4000 m) prevailed, until we reached the Peru-Chile Trench at the eastern margin. The deepest cast of leg 2 (~6000 m) was conducted there, and followed by a set of closely spaced stations tracking up the continental shelf, at 500 meter bathymetric intervals to the shallowest cast performed at ~750 m near 71.5° W.

Weather conditions were generally moderate with only one gale punctuating the otherwise subtropical good to excellent conditions that prevailed throughout the cruise. No time was lost to weather. However, rough seas caused kinks in the CTD wire on a few stations requiring mechanical terminations (see section 1.6 of Hydrographic Data Report for details of CTD acquisition problems). Rough conditions also contributed to problems with one of two titration systems for analyzing total alkalinity, which caused a significant reduction in the number of samples that could be acquired (see section on total alkalinity for further details).

Overall, the scientific equipment performed remarkably well. Full electrical reterminations of the CTD wire were necessary only twice over the 5 weeks of sampling: on the initial cast of the leg, and on station 183 following a deck mishap during the CTD launch. LADCP measurements predictably encountered difficulties in the deep waters of the basin interior characterized by a dearth of particulate matter (i.e., the biological desert). Scatter abundance was sufficiently low to affect profiles primarily below 2000 m from station 100 (~ 166° W, Leg 1) to station 198 (~ 100° W, Leg 2). Otherwise, the LADCP functioned extremely well, providing full water column profiles of horizontal velocity currents with a vertical resolution of approximately eight meters.

Data Quality Assessment (refers to preliminary shipboard data only)

The overall data quality from Level 1 parameters measured shipboard during P6 appears to be very good. There is no parameter whose overall quality of measurement does not appear to meet or exceed requirements and expectations. Details regarding calibration and quality control procedures are reported in section 1.6. Figures showing zonal property sections (for all of P6) and properties versus potential temperature are provided in Appendix B.

One SeaBird CTDO instrument, serial 796, was used throughout the cruise. The instrument was remarkably stable, and its drifts were small and easily corrected. Preliminary CTD conductivity data fit to the water sample data (expressed in salinity) shows overall agreement below ca 1500 db better than 0.001 PSS-78, except for differences slightly greater than 0.001 at a few stations. Except for possibly those few stations, it is thus highly unlikely that any post- cruise adjustments greater than 0.001 will be made to the preliminary shipboard CTD salinities. A preliminary fit of the SBE-43 CTD dissolved oxygen sensor data to the water samples was performed for down-cast CTD oxygen values matched to up-cast water samples, usually on density surfaces. The overall fit for leg 2 is excellent with differences of order 0.5 µM kg-1.

Shipboard analyses of bottle data also appear to be of very high quality. For salinity and oxygen, the consistency of the measurements - i.e. the high degree of overall internal precision achieved during the cruise. It is unlikely that any significant post-cruise changes to the bottle salinity or bottle oxygen data values will be made, though it is likely that some quality code changes will take place during final post-cruise data processing.

Much the same can be said about the nutrient data, which appear to be of very high quality, or at the very least, very high internal consistency. When compared to 2003 occupation of P6, the phosphate-potential temperature curves for the deep ocean exhibit some offsets in specific longitude bands (see Appendix B). Ascertaining the cause of these shifts will require further investigation in the post-cruise data assessment phase. The silicate and nitrate data are clearly ready for scientific work, and few, if any, significant changes are expected at this time, although, as with any of the bottle data, quality code changes associated with some data values may change.

Introduction

A sea-going science team gathered from 10 oceanographic institutions participated on the cruise. The programs and PIs, and the shipboard science team and their responsibilities, are listed below.

Principal Programs Of Clivar P06e

Program	Affiliation	PI	email
CTDO/Rosette, Nutrients, O_2, Salinity, Data Processing	UCSD/SIO	James H. Swift	jswift@ucsd.edu
CO2-Alkalinity, pH	UM/RSMAS	Frank Millero	fmillero@rsmas.miami.edu
CO2-DIC/Underway pCO2	NOAA/AOML	Rik Wanninkhof	Rik.Wanninkhof@noaa.gov
CFCs	U. Washington	Mark Warner	mwarner@ocean.washington.edu
Helium/Tritium	WHOI	William Jenkins	wjenkins@whoi.edu
DOC/TDN	UM/RSMAS	Craig Carlson	carlson@lifesci.ucsb.edu
$^{13}C/^{14}C$	WHOI	Ann McNichol	amcnichol@whoi.edu
	Princeton	Robert Key	key@Princeton.EDU
ADCP/LADCP	UHawaii	Eric Firing	efiring@soest.hawaii.edu
Transmissometer	TAMU	Wilf Gardner	wgardner@tamu.edu
CDOM	UCSB	Norm Nelson	norm@icess.ucsb.edu
	UCSB	Dave Siegel	siegel@lifesci.ucsb.edu
Isotopic Composition of Nitrate	U. Mass.	Mark Altabet	maltabet@umassd.edu
Isotopic Composition of O_2 and Argon	NOAA	Lauren Juranek	Laurie.Juranek@noaa.gov
C14 in DOC	UCI	Ellen Druffel	edruffel@uci.edu

Shipboard Scientific Personnel On Clivar P06e

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B.   DESCRIPTION OF MEASUREMENT TECHNIQUES

1.   CTD/Hydrographic Measurements Program
PI: James H. Swift
On Board Team:
   Oceanographic Data Facility, Computing Resources and Research Technicians
   Shipboard Technical Support, Scripps Institution of Oceanography
   La Jolla, CA 92093-0214

A total of 123 Rosette/CTD/LADCP casts were made at 123 stations. Most casts were lowered to within 10m of the bottom.

Hydrographic measurements consisted of salinity, dissolved oxygen and nutrient water samples taken from each Rosette cast. Pressure, temperature, conductivity/salinity, dissolved oxygen, transmissometer and fluorometer data were recorded from CTD profiles. Current velocities were measured by the downward-facing LADCP. The distribution of samples is shown in figure 1.0.

Figure 1.0:   **P06E Sample distribution, stations 128-250.**
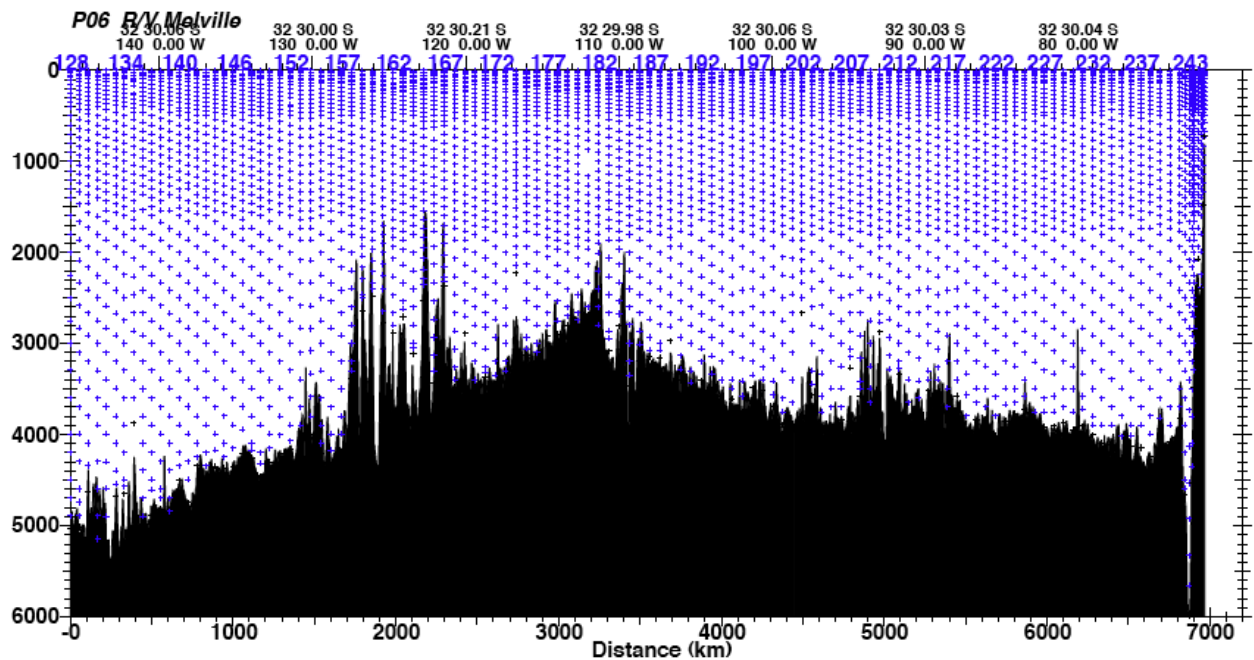
1.1.   Water Sampling Package

Rosette/CTD/LADCP casts were performed with a package consisting of a 36-bottle rosette frame (SIO/STS), a 36-place carousel (SBE32) and 36 10.0L Bullister bottles (SIO/STS) with an absolute volume of 10.4L. Underwater electronic components consisted of a Sea-Bird Electronics SBE9plus CTD with dual pumps (SBE5), dual temperature (SBE3plus), reference temperature (SBE35RT) dual conductivity

(SBE4C), dissolved oxygen (SBE43), transmissometer (Wetlabs), fluorometer (Wetlabs CDOM), altimeter (Simrad) and LADCP (RDI).

The CTD was mounted Vertically in an SBE CTD cage attached to the bottom of the rosette frame and located to one side of the carousel. The SBE4C conductivity, SBE3plus temperature and SBE43 Dissolved oxygen sensors and their respective pumps and tubing were mounted Vertically in the CTD cage, as recommended by SBE. Pump exhausts were attached to the CTD cage on the side opposite from the sensors and directed downward. The transmissometer was mounted horizontally, and the fluorometer was mounted Vertically near the bottom of the rosette frame. The altimeter was mounted on the inside of the bottom frame ring. The 150 KHz downward-looking Broadband LADCP (RDI) was mounted Vertically on one side of the frame between the bottles and the CTD. Its battery pack was located on the opposite side of the frame, mounted on the bottom of the frame. Table 1.1.0 shows height of the sensors referenced to the bottom of the frame.

Table 1.1.0:   Heights referenced to bottom of rosette frame

Instrument	Height in cm
Temperature sensors	11
SBE35	11
Altimeter	4
Transmissometer	8
CDOM Fluorometer	7
Pressure Sensor	28
Inner bottle midline	112
Outer bottle midline	119
BB LADCP XDCR Face midline	11
Zero tape	180

The rosette system was suspended from a UNOLS-standard three-conductor 0.322" electro-mechanical sea cable. The sea cable was terminated at the beginning of P06E. The R/V Melville'sDESH-6 winch was used for all casts.

The deck watch prepared the rosette 10-30 minutes prior to each cast. The bottles were cocked and all valves, vents and lanyards were checked for proper orientation. Once stopped on station, the rosette was moved out from the aft hanger to the deployment location under the A-frame using an air-powered cart and tracks. The CTD was powered-up and the data acquisition system started from the computer lab. The rosette was unstrapped from the air-powered cart. Tag lines were threaded through the rosette frame and syringes were removed from CTD intake ports. The winch operator was directed by the deck watch leader to raise the package. The A-frame and rosette were extended outboard and the package was quickly lowered into the water. Tag lines were removed and the package was lowered to 10 meters, until the console operator determined that the sensor pumps had turned on and the sensors were stable. The winch operator was then directed to bring the package back to the surface, at which time the wireout reading required re-zeroing before descent. Re-zeroing required that the winch operator walk out of his shack, so on most casts the deck watch zero'd the reading, at times it was done by the winch operator, and at times it was not done at all.

Most rosette casts were lowered to within 10 meters of the bottom, using the altimeter, winch wireout, CTD depth and echosounder depth to determine the distance.

For each up cast, the winch operator was directed to stop the winch at up to 36 predetermined sampling depths. These standard depths were staggered every station using 3 sampling schemes. To insure package

shed wake had dissipated, the CTD console operator waited 30 seconds prior to tripping sample bottles. An additional 10 seconds elapsed before moving to the next consecutive trip depth, to allow the SBE35RTtime to take its readings. The deck watch leader directed the package to the surface for the last bottle trip.

Recovering the package at the end of the deployment was essentially the reverse of launching, with the additional use of poles and snap-hooks to attach tag lines. The rosette was secured on the cart and moved into the aft hanger for sampling. The bottles and rosette were examined before samples were taken, and anything unusual was noted on the sample log.

Each bottle on the rosette had a unique serial number, independent of the bottle position on the rosette. Sampling for specific programs was outlined on sample log sheets prior to cast recovery or at the time of collection.

Routine CTD maintenance included soaking the conductivity and oxygen sensors in fresh water between casts to maintain sensor stability, and putting dilute 1% Triton-X solution through the conductivity sensors to eliminate any accumulating bio-films. Rosette maintenance was performed on a regular basis. Valves and o-rings were inspected for leaks. The rosette, CTD and carousel were rinsed with fresh water as part of the routine maintenance.

1.2.   Underwater Electronics

The SBE9plus CTD supplied a standard SBE-format data stream at a data rate of 24 frames/second. The sensors and instruments used during CLIVAR P06E are listed below.

Table 1.2.0:   CLIVAR P06E Rosette Underwater Electronics.

Instrument/Sensor	Mfr./Model	Serial Number	A/D Channel	Stations Used
Carousel Water Sampler	Sea-Bird SBE32 (36-Pl.)	3213290-0113	n/a	128-250
CTD	Sea-Bird SBE9plus	796	n/a	128-250
Pressure	Paroscientific Digiquartz	98627	n/a	128-250
Primary Temperature (T1)	Sea-Bird SBE3plus	03P-4907	n/a	128-250
Primary Conductivity (C1)	Sea-Bird SBE4C	04-3369	n/a	128-250
Dissolved Oxygen	Sea-Bird SBE43	43-1508	Aux4/V6	128-250
Primary Pump	Sea-Bird SBE5T	05-4160	n/a	128-250
Secondary Temperature (T2)	Sea-Bird SBE3plus	03P-5046	n/a	128-250
Secondary Conductivity (C2)	Sea-Bird SBE4C	04-3578	n/a	128-250
Secondary Pump	Sea-Bird SBE5T	05-5124	n/a	128-250
Transmissometer	WETLabs C-STAR	CST-1115DR	Aux2/V2	128-250
Fluorometer	WETLabs CDOM	FLCDRTD-428	Aux1/V0	128-250
Altimeter	Simrad 807	9711091	Aux3/V4	128-250
Reference Temperature	Sea-Bird SBE35	35-0035	n/a	128-250
LADCP	RDI WHM300-I-UG50	13330	n/a	128-250
Deck Unit (in lab)	Sea-Bird SBE11	11P31807-0654	n/a	128-250

An SBE35RTreference temperature sensor was connected to the SBE32 carousel and recorded a temperature for each bottle closure. These temperatures were used as additional CTD calibration checks. The SBE35RT

was utilized per the manufacturer's specifications and instructions, as described on their website, www.seabirdelectronics.com.

The SBE9plus CTD was connected to the SBE32 36-place carousel providing for single-conductor sea cable operation. The sea cable armor was used for ground (return). Power to the SBE9plus CTD (and sensors), SBE32 carousel and Simrad 807 altimeter was provided through the sea cable from the SBE11plus deck unit in the main lab.

1.3. Navigation and Bathymetry Data Acquisition

Navigation data were acquired at 1-second intervals from the ship's Furuno GP150 GPS receiver by a Linux system beginning January 5, 2010.

Bathymetric data were logged from both the Knudsen 12KHz single beam echosounder and the Kongsberg EM122 multibeam echosounder systems.

The reported bottom depths associated with rosette casts were recorded on the Console Logs during deployments. The Kongsberg EM122 center beam depths were typically used.

1.4. CTD Data Acquisition and Rosette Operation

The CTD data acquisition system consisted of an SBE-11plus (V2) deck unit and three networked generic PC workstations running CentOS-5.4 Linux. Each PC workstation was configured with a color graphics display, keyboard, trackball and DVD+RW drive. One system had a Comtrol Rocketport PCI multiple port serial controller providing 8 additional RS-232 ports. The systems were interconnected through the ship's network. These systems were available for real-time operational and CTD data displays, and provided for CTD and hydrographic data management.

One of the workstations was designated the CTD console and was connected to the CTD deck unit via RS-232. The CTD console provided an interface and operational displays for controlling and monitoring a CTD deployment and closing bottles on the rosette. Another of the workstations was designated the website and database server and maintained the hydrographic database for P06E. Redundant backups were managed automatically.

CTD deployments were initiated by the console watch after the ship had stopped on station. The acquisition program was started and the deck unit turned on at least 3 minutes prior to package deployment. The watch maintained a console operations log containing a description of each deployment, record of every attempt to close a bottle and any relevant comments. The deployment and acquisition software presented a short dialog instructing the operator to turn on the deck unit, to examine the on- screen CTD data displays and to notify the deck watch that this was accomplished.

Once the deck watch had deployed the rosette, the winch operator lowered it to 10 meters. The CTD sensor pumps were configured with a 5-second startup delay after detecting seawater conductivities. The console operator checked the CTD data for proper sensor operation and waited for sensors to stabilize, then instructed the winch operator to bring the package to the surface and descend to a specified target depth (wire-out). The profiling rate was no more than 30m/min to 50m, no more than 45m/min to 200m and no more than 60m/min deeper than 200m, depending on sea cable tension and sea state.

The progress of the deployment and CTD data quality were monitored through interactive graphics and operational displays. Bottle trip locations were transcribed onto the console and sample logs. The sample log was used later as an inventor y of samples drawn from the bottles. The altimeter channel, CTD depth, winch wire-out and bathymetric depth were all monitored to determine the distance of the package from the bottom, allowing a safe approach to 8-10 meters.

Bottles were closed on the up cast by operating an on-screen control. The winch operator was given a command to slowto20m/min when 10m from the target desired depth, the console operator gave the command to stop just before the intended depth. Bottles were tripped 30-40 seconds after stopping to allow the rosette wake to dissipate and the bottles to flush. The winch operator was instructed to proceed to the next bottle stop at least 10 seconds after closing bottles to ensure that stable CTD data were associated with the trip and to allow the SBE35RT temperature sensor to make measurement.

When the last bottle was closed, the console operator directed the winch operator to have the deck watch bring the rosette to just below the surface. After the 30 second flushing period and the 10 second time for the SBE35RTtostabilizethe package was brought on deck. Once the rosette was on deck, the console operator terminated the data acquisition, turned off the deck unit and assisted with rosette sampling.

1.5.   CTD Data Processing

Shipboard CTD data processing was performed automatically during each Rosette/CTD/LADCP deployment using SIO/ODF CTD processing software.

Processing was performed during data acquisition for Rosette/CTD/LADCP deployments. The raw CTD data were converted to engineering units, filtered, response-corrected, calibrated and decimated to a more manageable 0.5-second time series. The laboratory calibrations for pressure, temperature and conductivity were applied at this time. The 0.5-second time series data were used for real-time graphics during deployments, and were the source for CTD pressure and temperature associated with each rosette bottle. Both the raw 24Hzdata and the 0.5-second time series were stored for subsequent processing. during the deployment, the data were backed up to another Linux workstation.

At the completion of a deployment a sequence of processing steps were performed automatically. The 0.5-second time series data were checked for consistency, clean sensor response and calibration shifts. A 2-decibar pressure series was then generated from the down cast. Both the 2-decibar pressure series and 0.5-second time series data were made available for downloading, plotting and reporting on the shipboard cruise website.

Rosette/CTD/LADCP data were routinely examined for sensor problems, calibration shifts and deployment or operational problems. The primary and secondary temperature sensors (SBE3plus)were compared to each other and to the SBE35 temperature sensor. CTD conductivity sensors (SBE4C) were compared to each other, then calibrated by examining differences between CTD and check sample conductivity values. The CTD dissolved oxygen sensor data were calibrated to check sample data. Additional salinity and O_2 comparisons were made with respect to isopycnal surfaces between down and up casts as well as with adjacent deployments. Vertical sections were made of the various properties derived from sensor data and checked for consistency.

A total of 123 casts were made using the 36-place CTD/LADCP rosette.

The primary temperature and conductivity sensors were used for reported CTD temperatures and conductivities. The secondary temperature and conductivity sensors were used as calibration checks.

1.6. CTD Acquisition And Data Processing Problems

At the beginning of the expedition, Station 128, the CTD encountered several missed frames on the way down. The system was monitored to ~800m as the data loss was getting progressively worse. The package was brought on board and a new termination was performed. The subsequent cast performed properly. Mechanical terminations were also performed prior to casts 139/2, 140/1, 142/1 and again on 222/1, 223/1, and 226/1, due to bad weather.

Amid preparation for deployment on station 183, the winch operator became distracted by the lab making communication on the squalk box while the winch was taking up slack wire onto the drum. The rosette was pulled off the deck causing the tension of the wire to exceed 9641 pounds at which time the CTD cable parted at exit of the level wind. The package fell approximately 1m to the deck. The rosette was strapped to the cart with two tag lines attached to the cleats on the A-Frame. The lifting broke weld tabs on the aft cart track, and the cart exited tracks. The straps held the rosette firmly to the cart. The tag lines took the full strain and held until wire parted. One crash bar was severely bent, and the top ring and the radial support bent downward. No personnel were injured. The Electronic Technician (ET) spooled out 100m of wire and performed an electrical retermination. The ET also replaced the bent crash bar with one from the spare rosette, and straightened the horizontal ring and radial support arm. These were removed, straightened, and reinstalled with washers and bolts. The axle bolts for cartwheels became bent from jamming on the track lip. One track wheel wound up with a distorted edge, which the ET cleaned and straightened. CTD sensors were checked and seemed undamaged on deck, but a time- variant drift in the secondary temperature and conductivity sensors would be noted and addressed as of Station 189. After recovering cast 183/01, Niskin bottle 3 was found with spigot broken off; it's unclear if this happened during deployment or recovery.

During cast 1 of station 240, a jellyfish was sucked into the primary pump circuit, which caused C1 offset for that cast. T1 and O_2 weren't affected. T2/C2 were used as primary data. As a result, the top 48 db of secondary conductivity was noisy and flagged as such. The primary conductivity sensor was then cleaned with a Kim-Wipe, which caused a C1 offset relative to C2with time.

During the first cast of station 243, console operator and data processor noted a 4 unit difference between primary and secondary conductivity sensors, and a 2 degree Celsius difference between T1/T2. Suspecting another jellyfish, the cast was aborted and recovered. Sensors were clean, but flushed with Triton-X. The second cast revealed much smaller offsets between primary and secondary circuits, which maintained through the leg.

LADCP battery was changed after station 190 as it would not charge for the few preceding stations. Because battery charging issues continued, the LADCP wyecable was changed after station 193, which resolved said problems.

Fluorometer data displayed data offset between legs 1 and 2, possibly due to a change in its physical location on the rosette.

Multiple problems were encountered throughout the leg with the LCI-90 display for the winch. The LCI-90 apparently overheated, causing it to blank out, typically while the winch was stopped for bottle trips. Most casts required multiple resets, which involved manually flipping the breaker to the winch (in the main lab) off and on. Occasionally the wireout reading shifted or rezeroed during these breaker trips, causing negative readings or offsets for a substantial part of the up-casts.

1.7.   CTD Sensor Laboratory Calibrations

Laboratory calibrations of the CTD pressure, temperature, conductivity and dissolved oxygen sensors were performed prior to CLIVAR P06E. The calibration dates are listed in table 1.7.0.

Table 1.7.0:   CLIVAR P06E CTD sensor Laboratory calibrations.

Sensor	S/N	Calibration Date	Calibration Facility
Paroscientific Digiquartz Pressure	98627	10-July-2009	SIO/STS
Sea-Bird SBE3plus T1 Temperature	03P-4907	2July 2009	SIO/STS
Sea-Bird SBE3plus T2 Temperature	03P-5046	6July 2009	SIO/STS
Sea-Bird SBE4C C1a Conductivity	04-3369	16 June 2009	SBE
Sea-Bird SBE4C C1b Conductivity	04-3430	16 June 2009	SBE
Sea-Bird SBE4C C2 Conductivity	04-3578	16 June 2009	SBE
Sea-Bird SBE43 Dissolved Oxygen	43-1508	1 July 2009	SBE
Sea-Bird SBE35 Reference Temperature	35-0035	20 June 2009	SBE

ODF typically calibrates sensors about two months before a CLIVAR expedition. However, the P6 sensors had an additional shelf life due to the 2-month cruise delay for P06: the sensors had been shipped in anticipation of an early September start date.

1.8.   CTD Shipboard Calibration Procedures

CTD #796 was used for all Rosette/CTD/LADCP casts during P06E. The CTD was deployed with all sensors and pumps aligned Vertically, as recommended by SBE. The primary temperature sensor (T1/03P-4907) and conductivity sensors (C1/04-3430) were used for all reported CTD data on all casts (128/01-250/01) excepting 240/01 where the secondary sensors were used.

The SBE35RT Reference Temperature sensor (S/N 3528706-0035) provided an independent calibration check for T1 and T2. In-situ salinity and dissolved O_2 check samples collected during each cast were used to calibrate the conductivity and dissolved O_2 sensors.

1.8.1.   CTD Pressure

The Paroscientific Digiquartz pressure transducer (S/N 98627) was calibrated in July 2009 at the STS/ODF Calibration Facility. The supplied calibration coefficients were used to convert frequencies to pressure. A calibration correction slope and offset was then applied. The residual pressure offsets (the difference between the last and first submerged pressures) varied from -0.4 to +0.0 db. No additional adjustments were made to calculated pressures.

1.8.2.   CTD Temperature

The same primary (T1/03P-4907) and secondary(T2/03P-5046) temperature sensors were used during all Leg 2 casts and were the same sensors used on Leg 1. Calibration coefficients derived from the precruise calibrations, plus shipboard temperature corrections determined during the cruise, were applied to raw primary and secondary sensor data during each cast.

An SBE35RT was used as a tertiary temperature check. It was located equidistant between T1 and T2 with the sensor aligned in the same plane as the T1 and T2 sensors. The SBE35Rt is an internally recording temperature sensor that operates in response to a signal sent by the SBE32 carousel for each bottle closure. According to the manufacturer's specifications, the typical stability is 0.001°C/year. The SBE35RT on P06E was set to internally average over an 8 second period.

Two independent metrics of calibration accuracy were examined. At each bottle closure, the primary and secondary temperatures were compared with each other and with the SBE35RTtemperatures.

P06E Leg 2 temperature corrections were not substantially different from the corrections determined during the first leg. A single correction was used for T1 and another for T2. T2 additionally exhibited a time-dependent sensor drift which was corrected over the course of the cruise. The corrections made to CTD temperatures had the form:

$$T_{ITS90} = T + aP^2 + bP + cT_2 + dT + \text{offset}$$

Residual temperature differences after correction are shown in figures 1.8.2.0 through 1.8.2.5.

The 95% confidence limits are ± 0.00087°C for the mean deep T1 residuals and ± 0.00065 for the mean deep T1 and T2 differences.

Figure 1.8.2.0: T1-T2 by station.
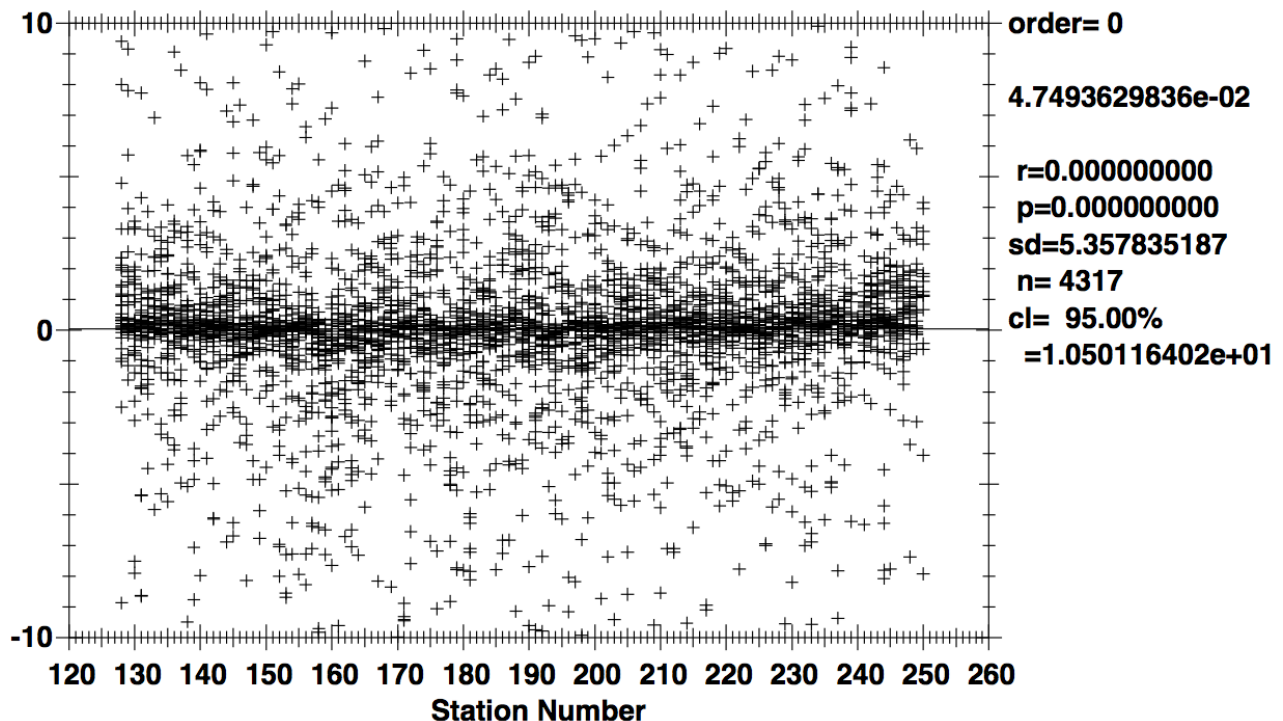
Figure 1.8.2.1: SBE35RT-T1 by station.

order= 0

2.9360375542e-01

r=0.000000000
p=0.000000000
sd=6.709959834
n= 4154
cl= 95.00%
=1.315127963e+01
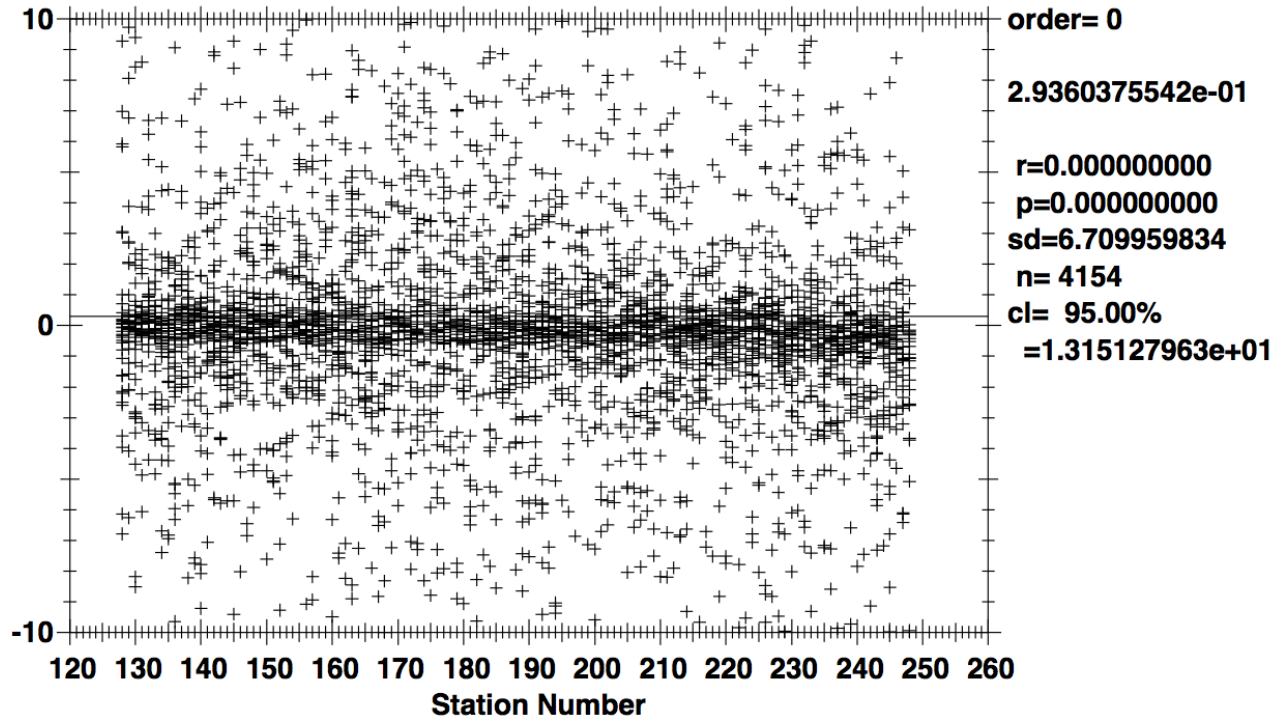
Figure 1.8.2.2: SBE35RT-T2 by station.

order= 0

2.8409626955e-01

r=0.000000000
p=0.000000000
sd=6.831079896
n= 4155
cl= 95.00%
=1.338867059e+01
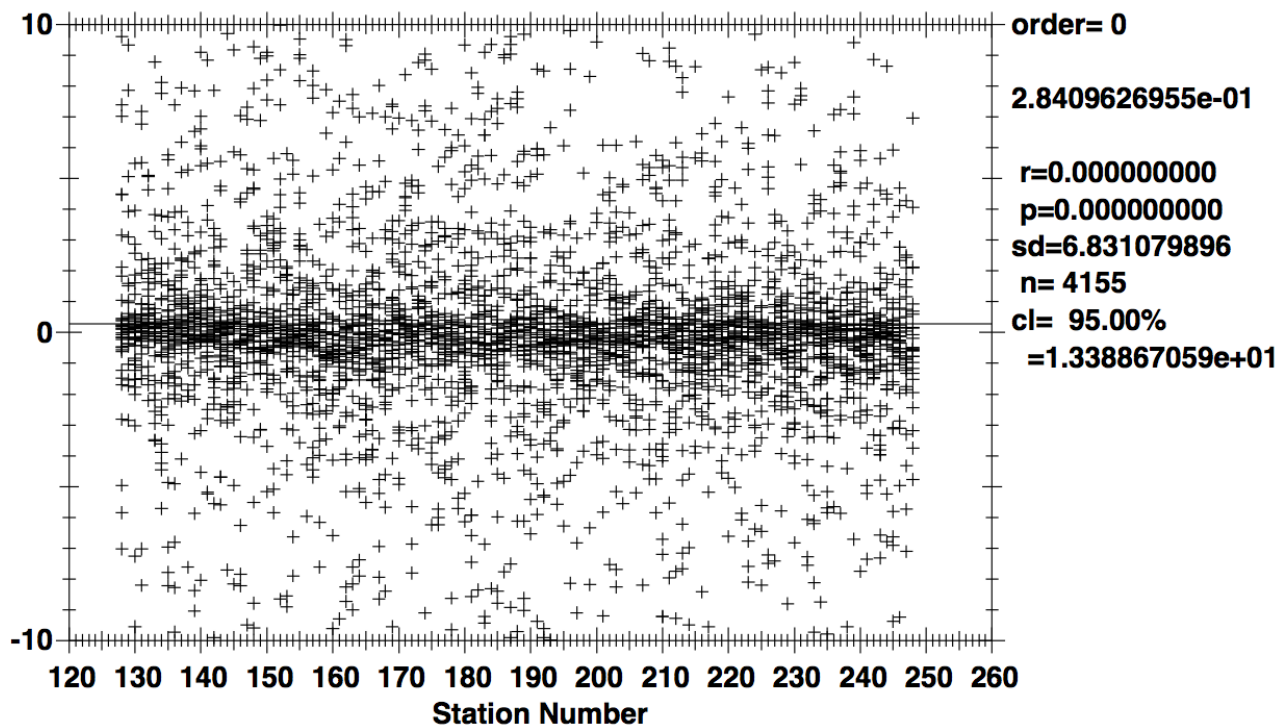
Figure 1.8.2.3: T1-T2 by pressure.

order= 0

4.7493629836e-02

r=0.000000000
p=0.000000000
sd=5.357835187
n= 4317
cl= 95.00%
=1.050116402e+01
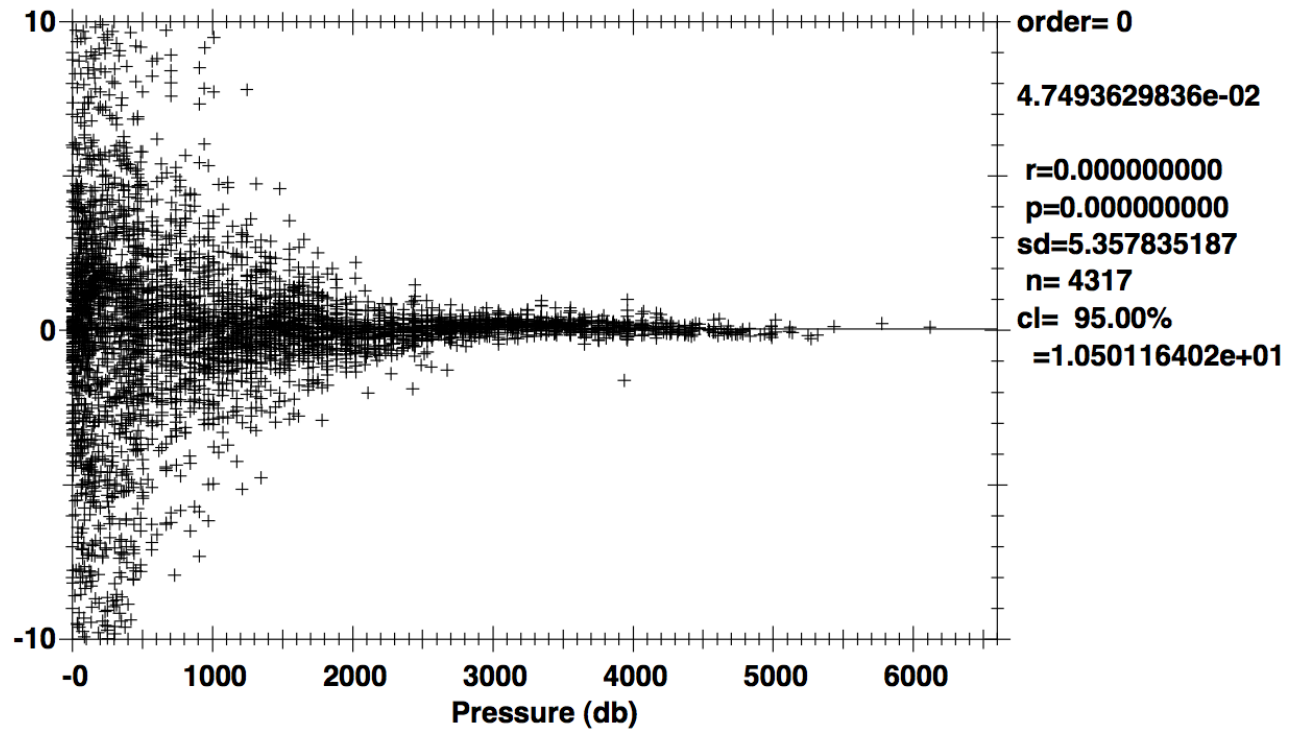
Figure 1.8.2.4: SBE35RT-T1 by station (P ≥ 2000.0db).

order= 0

-8.1132812500e-02

r=0.000000000
p=0.000000000
sd=0.443531423
n= 1024
cl= 95.00%
=8.693056161e-01
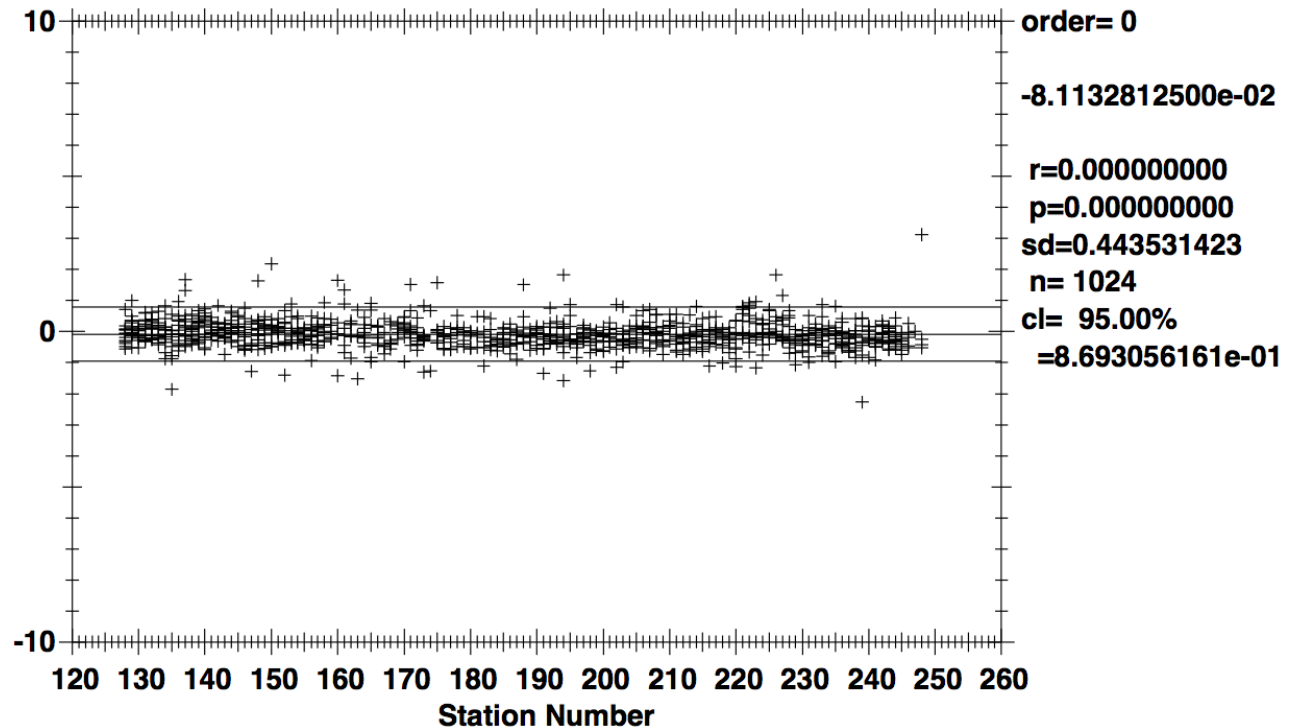
Figure 1.8.2.5: T1-T2 by station (P ≥ 2000.0db).

order= 0

7.7813411079e-02

r=0.000000000
p=0.000000000
sd=0.332913065
n= 1029
cl= 95.00%
=6.524976191e-01
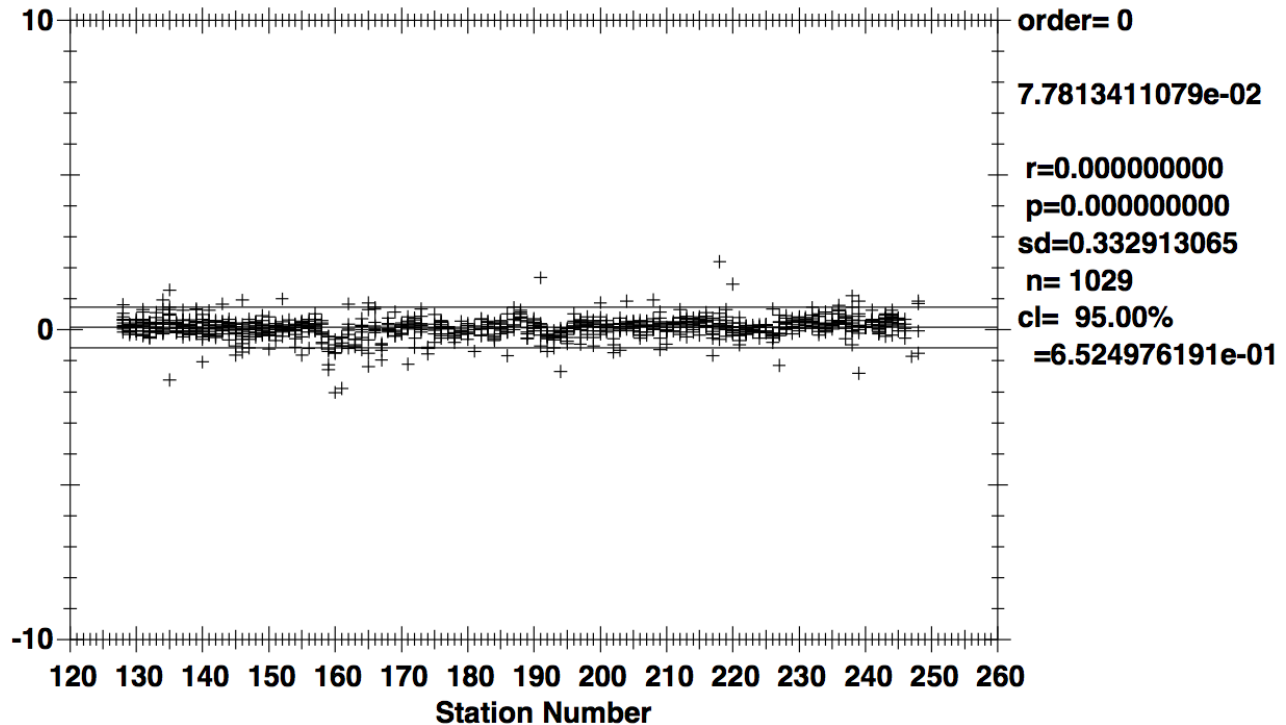
1.8.3. CTD Conductivity

The same primary (C1/04-3430) and secondary (C2/04-3578) conductivity sensors were used throughout Leg 2 and were the same sensors used for Leg 1. Shipboard calibration corrections were derived from salinity check samples and from sensor intercomparisons.

Two independent metrics of calibration accuracy were examined. For each rosette sample, the primary and secondary conductivities were compared with each other and with the bottle conductivity. The bottle conductivity was calculated from bottle salinity using CTD pressure and temperature.

The differences between primary and secondary temperature sensors were used as filtering criteria to reduce the contamination of comparisons by rosette package wake. The coherence of this relationship is shown in figure 1.8.3.0.

Figure 1.8.3.0: Coherence of conductivity differences as a function of temperature differences.

order= 1

1.0224101283e+00
-3.6873542259e-02

r=0.958368342
p=1.000000000
sd=1.625595941
n= 4299

T1-T2 Residual (T90 milliDeg C)
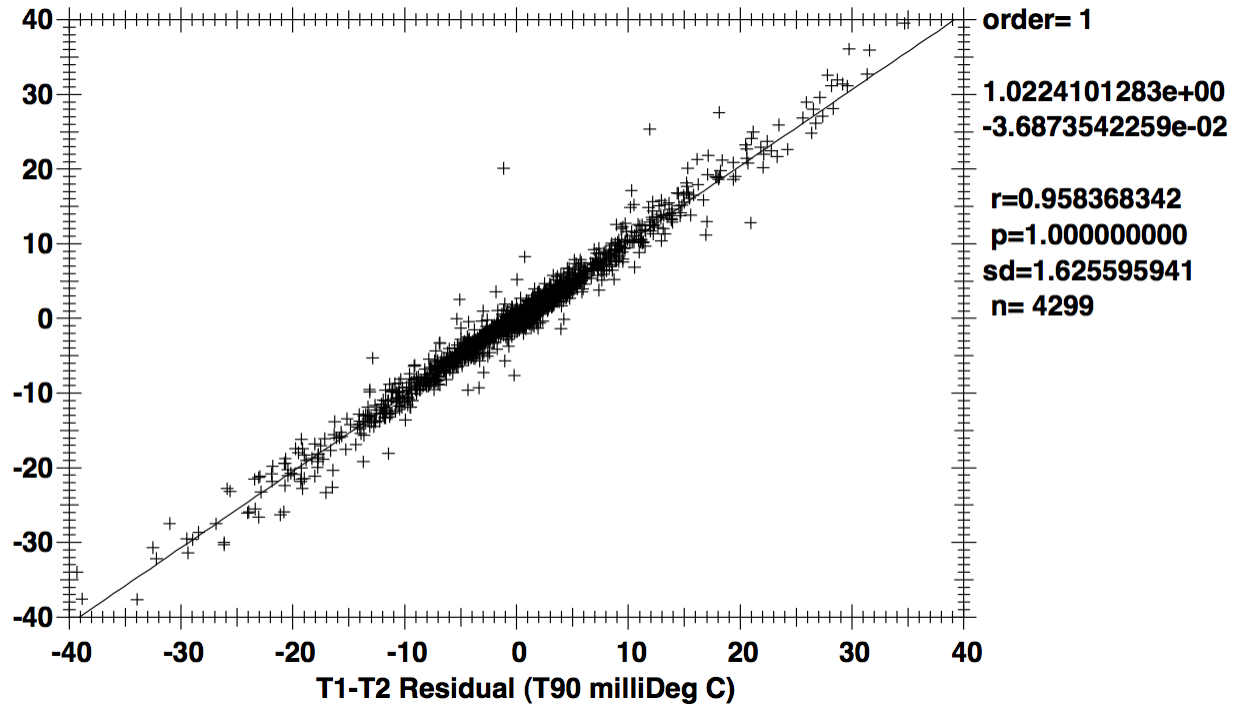
Uncorrected conductivity comparisons are shown in figures 1.8.3.1 through 1.8.3.3.

Figure 1.8.3.1: Uncorrected C1 – C2 by station.

order= 0

9.0257189055e+00

r=0.000000000
p=0.000000000
sd=6.374885990
n= 4020
cl= 68.27%
=6.374885990e+00

Station Number
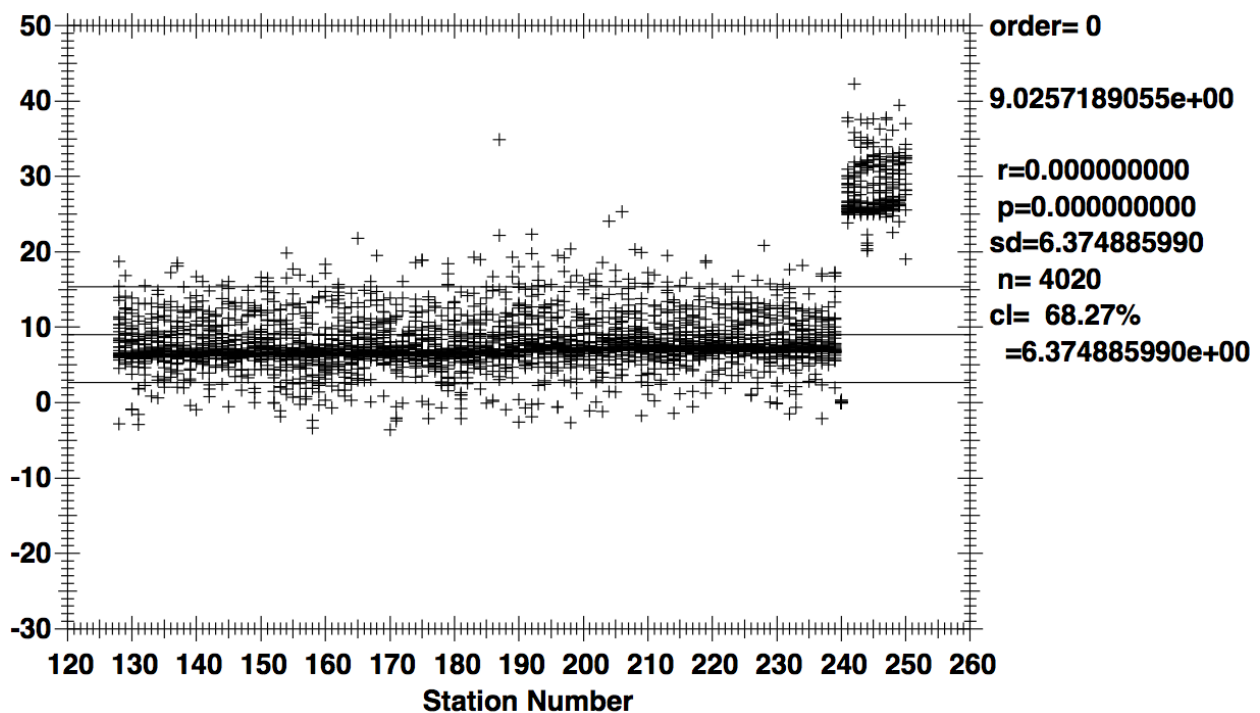
Figure 1.8.3.2: Uncorrected C$_{\text{Bottle}}$ – C1 by station.

order= 0

-5.9242153611e-02

r=0.000000000
p=0.000000000
sd=6.444384691
n= 3919
cl= 68.27%
=6.444384691e+00
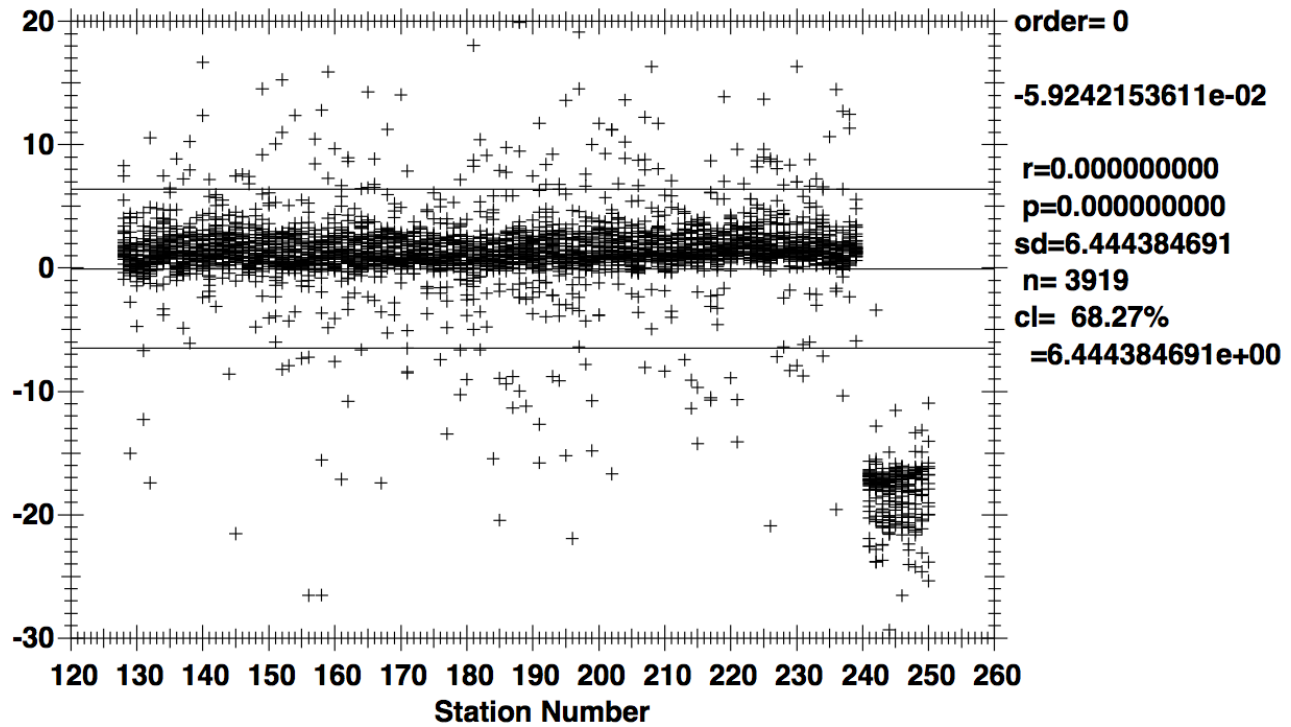
Figure 1.8.3.3: Uncorrected C$_{\text{Bottle}}$ – C2 by station.

order= 0

8.9625959596e+00

r=0.000000000
p=0.000000000
sd=3.865062854
n= 3960
cl= 68.27%
=3.865062854e+00
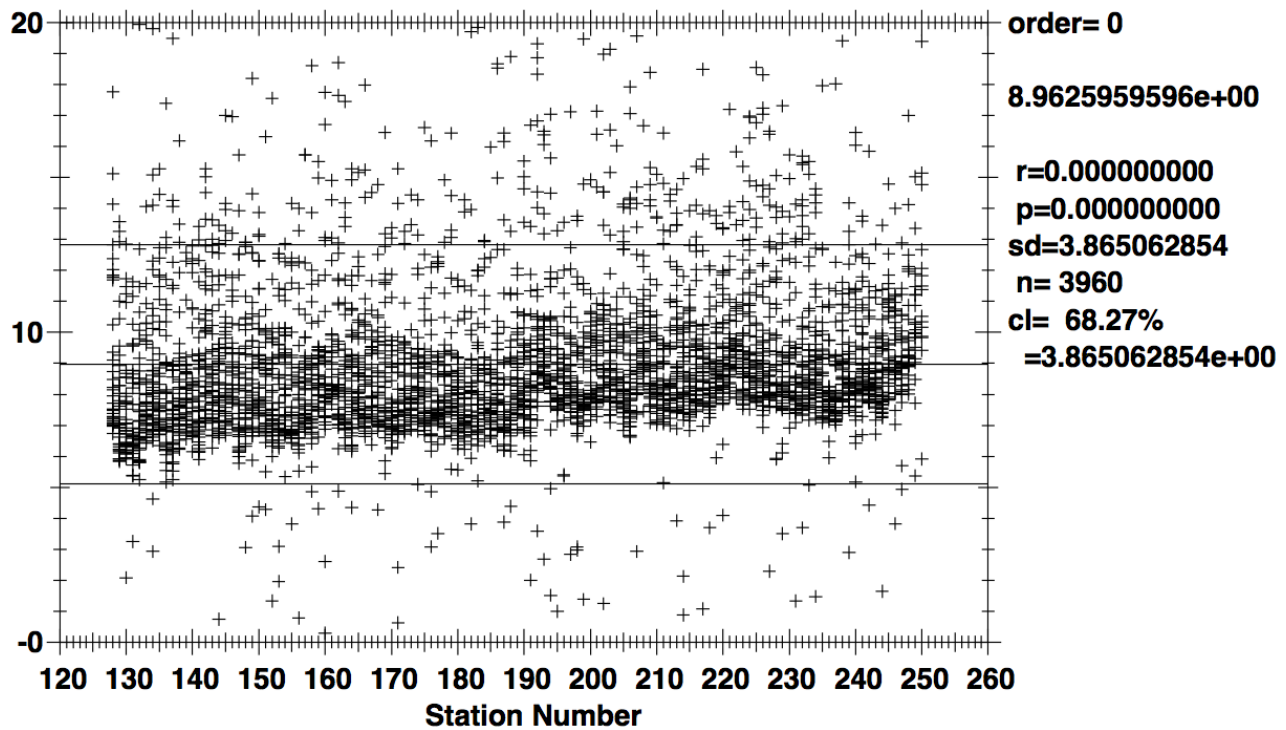
It was determined that both primary and secondary sensors drifted with time. C1 exhibited a small linear drift from cast 128/01 to 239/01, and then appeared to stabilize for the rest of the cruise. C2 exhibited 3 drift groupings: 128/01-188/01, 189/02-191/01 and 192/01-250/01. After correcting for drift, primary and secondary response corrections were derived from sensor and check sample comparisons. Two corrections were used for C1: one for casts 128/01-239/01 and one for casts 241/01-250/01. A single correction was used for C2 throughout the leg.

C2 was used for reported CTD conductivities on cast 240/01 as C1 had become fouled by biofilm. C1 was cleaned with TritonX and a Kim wipe prior to cast 241/01, changing its calibration.

The corrections made to CTD conductivities had the form:

$$C_{cor} = C + aP^2 + bP + cC^2 + dC + offset$$

The residual differences after correction are shown in figures 1.8.3.4 through 1.8.3.7.

Figure 1.8.3.4: Corrected C1 – C2 by station.

22
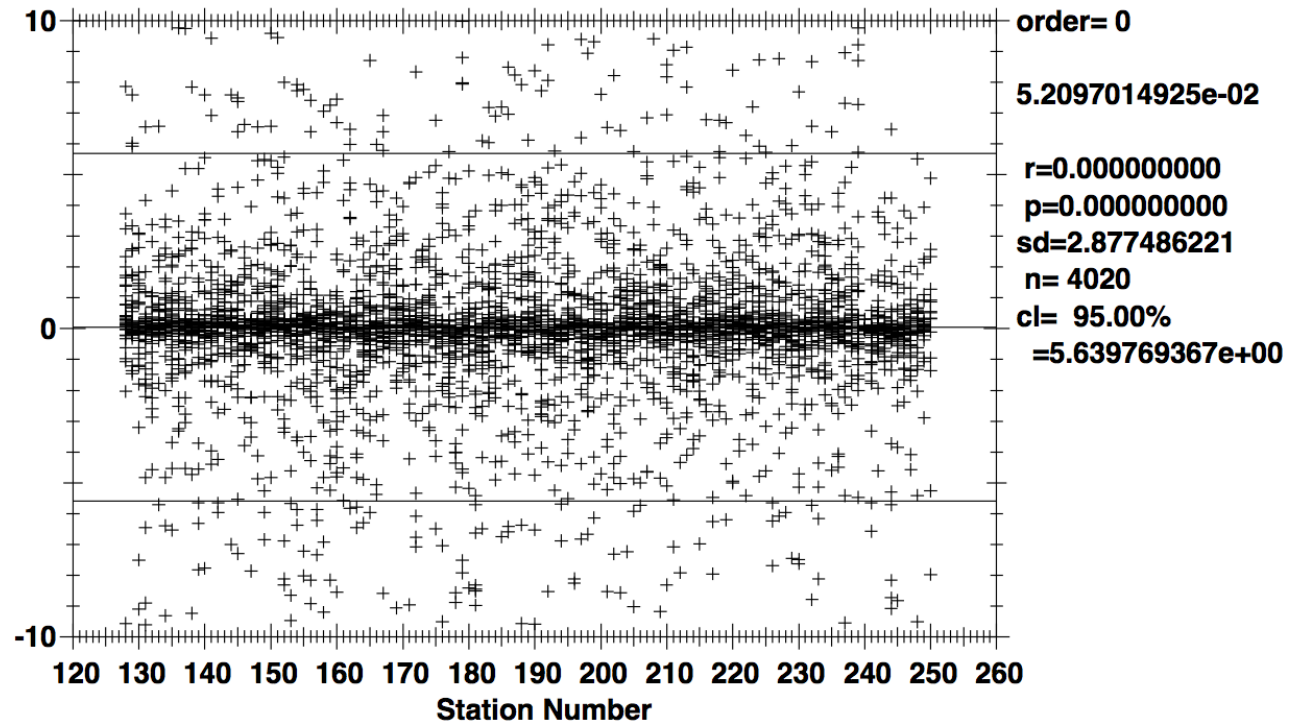
Figure 1.8.3.5: Corrected $C_{Bottle} - C1$ by station.

order= 0

-7.7832026309e-02

r=0.000000000
p=0.000000000
sd=3.771814168
n= 3953
cl= 95.00%
 =7.392619935e+00

Station Number
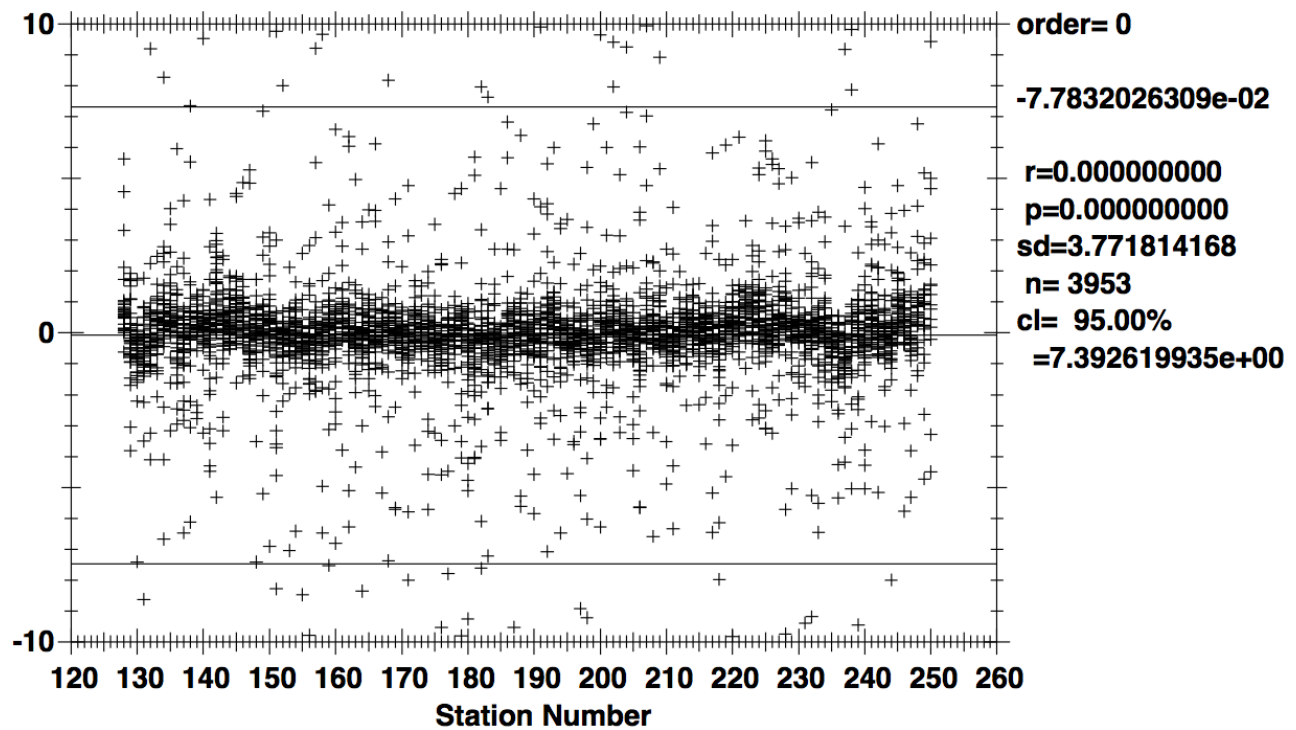
Figure 1.8.3.6: Corrected C1 – C2 by pressure.

order= 0

5.2097014925e-02

r=0.000000000
p=0.000000000
sd=2.877486221
n= 4020
cl= 95.00%
 =5.639769367e+00
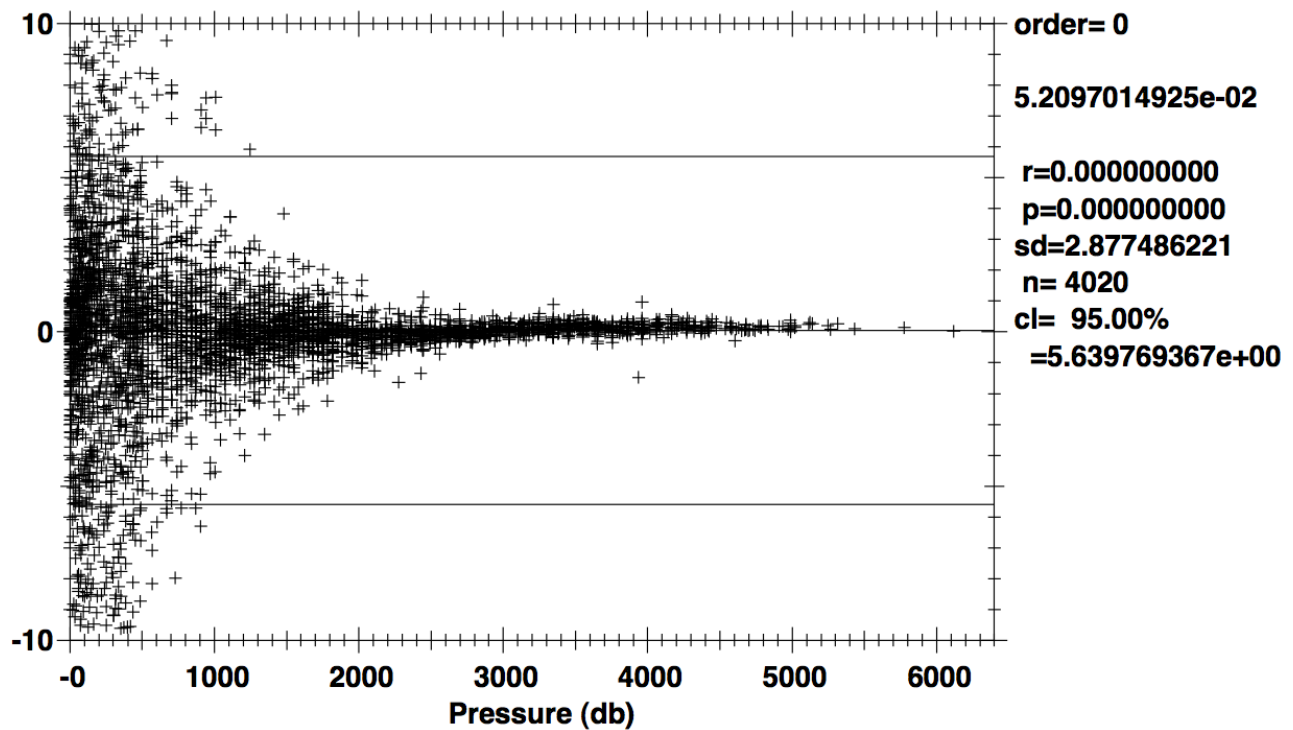
Pressure (db)

Figure 1.8.3.7: Corrected $C_{Bottle} - C1$ by pressure.
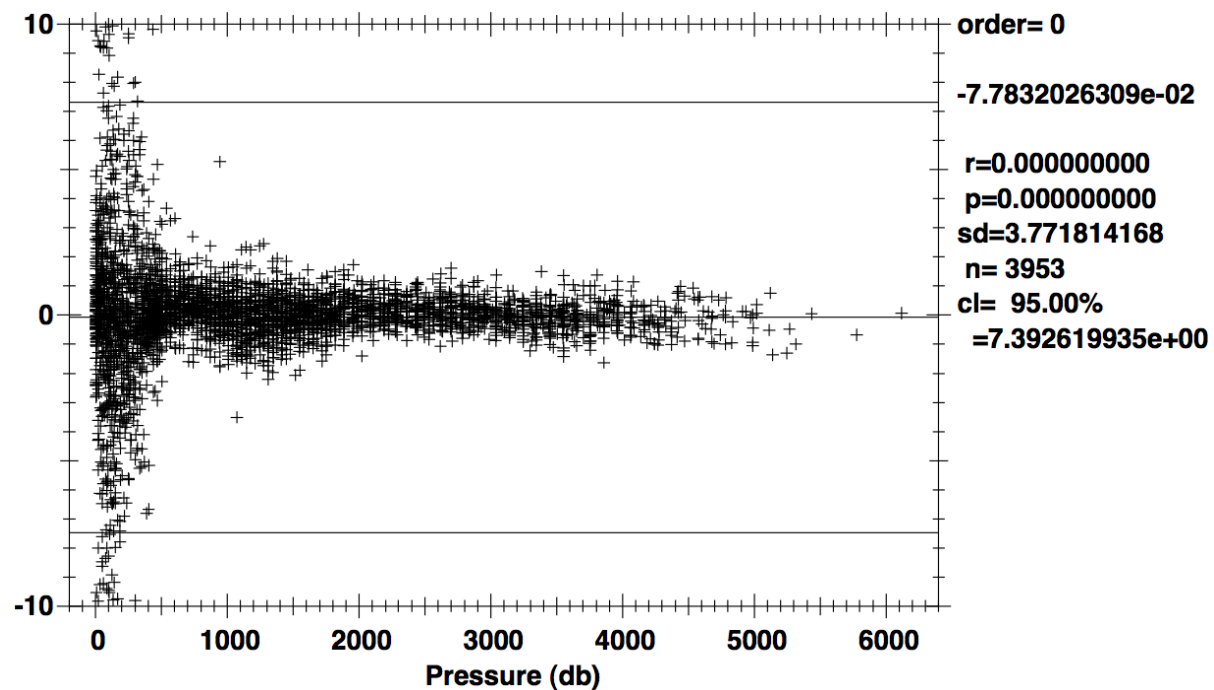
Figures 1.8.3.8 and 1.8.3.9 represent estimates of the CTD salinity accuracy of CLIVAR P06E. The 95% confidence limits are ±0.00102 PSU relative to deep bottle salinities, and ±0.00151 PSU relative to all bottle salinities, excluding samples taken in high thermal gradients.

Figure 1.8.3.8: Deep salinity residuals by station (Pressure>2000db).
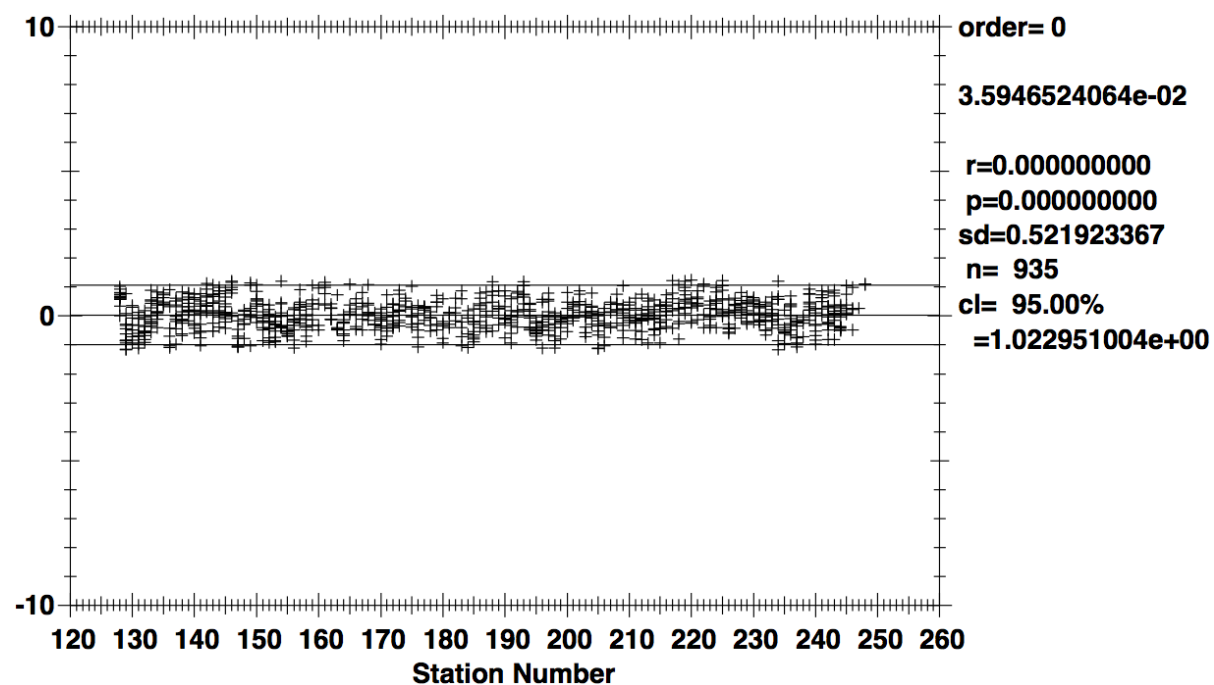
Figure 1.8.3.9: Salinity residuals by station.
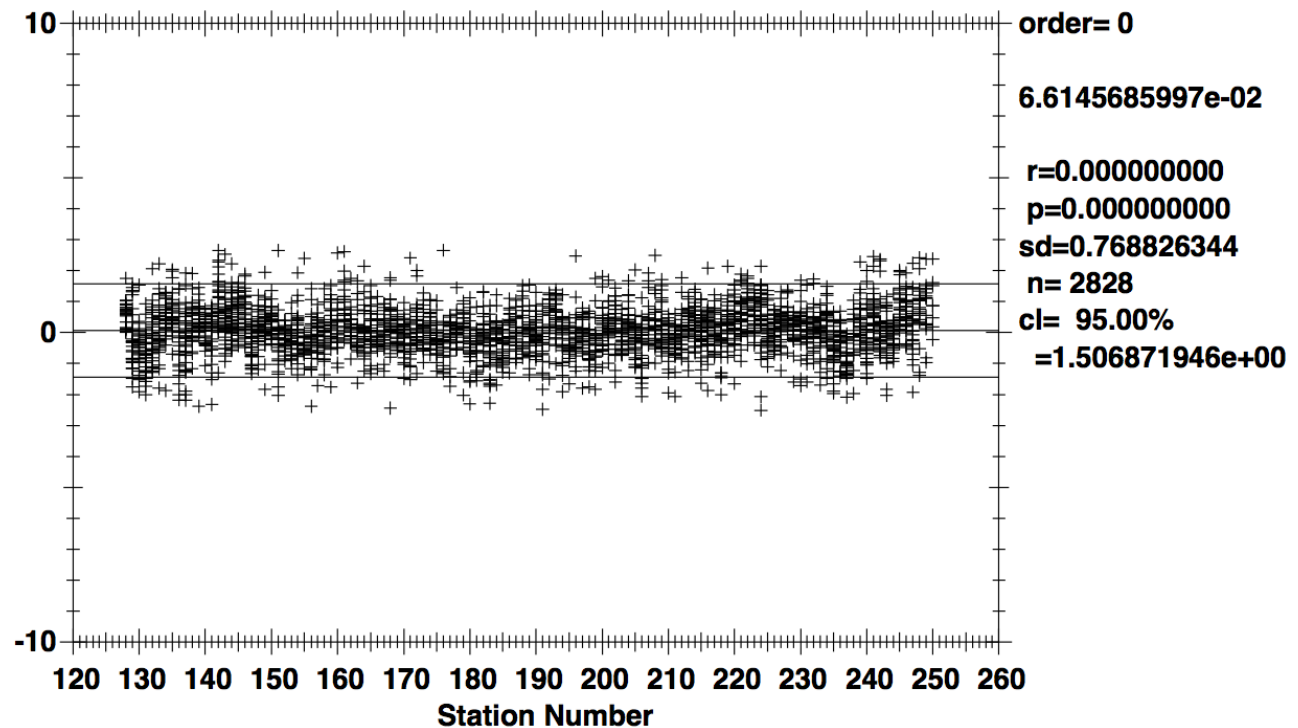
1.8.4. CTD Dissolved Oxygen

A single SBE43 dissolved O_2 sensor (DO/43-1508) was used during this leg. The sensor was plumbed into the primary T1/C1 pump circuit after C1.

The DO sensor was calibrated to dissolved O_2 check samples matching the down cast CTD data to the up cast trip locations on isopycnal surfaces. CTD dissolved O_2 was then calculated using a DO sensor response model and minimizing the residual differences from the check samples. A non-linear least squares fitting procedure was used to minimize the residuals and to determine sensor model coefficients.

The time constants for the lagged terms in the model were determined for the sensor during the first leg. These time constants are sensor-specific but applicable to an entire cruise. Casts were fit individually to check sample data. Consecutive casts were checked on plots of Theta vs. O_2 to check for consistency.

Standard and blank values for check sample oxygen titration data were smoothed, and the oxygen values recalculated, prior to the final fitting of CTD oxygen. After smoothing, changes to the preliminary fits were deemed unnecessary.

CTD dissolved O_2 residuals are shown in figures 1.8.4.0 - 1.8.4.2.

Figure 1.8.4.0: O$_2$ residuals by station (-0.01°C ≤T1-T2≤0.01°C).

order= 0

4.1993431026e-02

r=0.000000000
p=0.000000000
sd=2.142766108
n= 3958
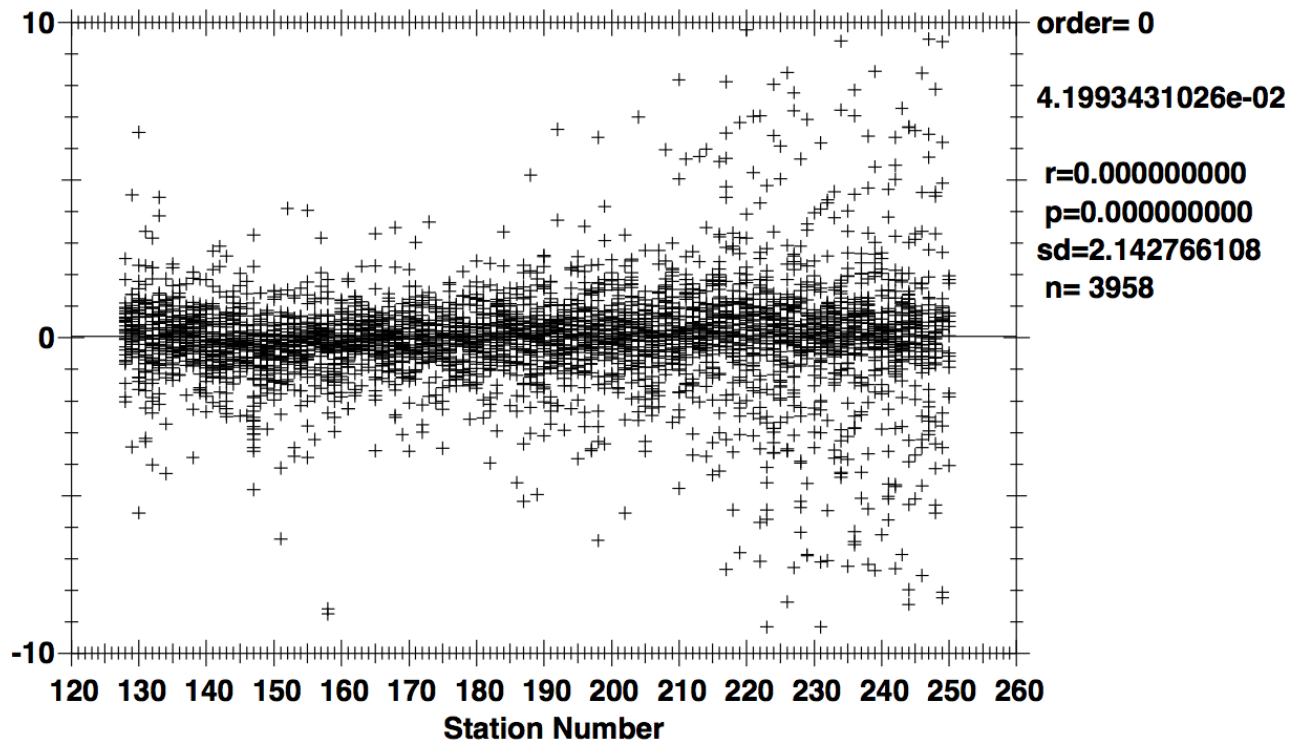
Figure 1.8.4.1: O$_2$ residuals by pressure (-0.01°C ≤T1-T2≤0.01°C).

order= 0

4.1993431026e-02

r=0.000000000
p=0.000000000
sd=2.142766108
n= 3958
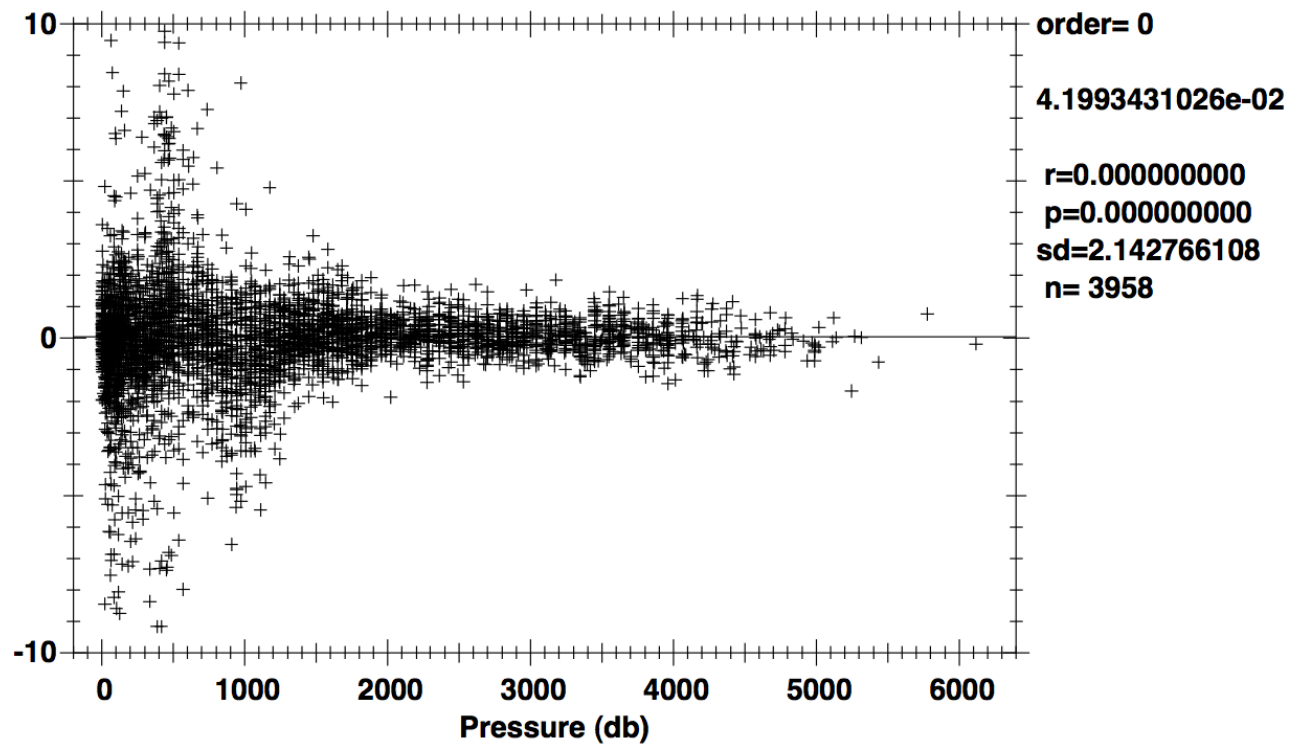
Figure 1.8.4.2: O$_2$ residuals by station (Pressure>2000db).
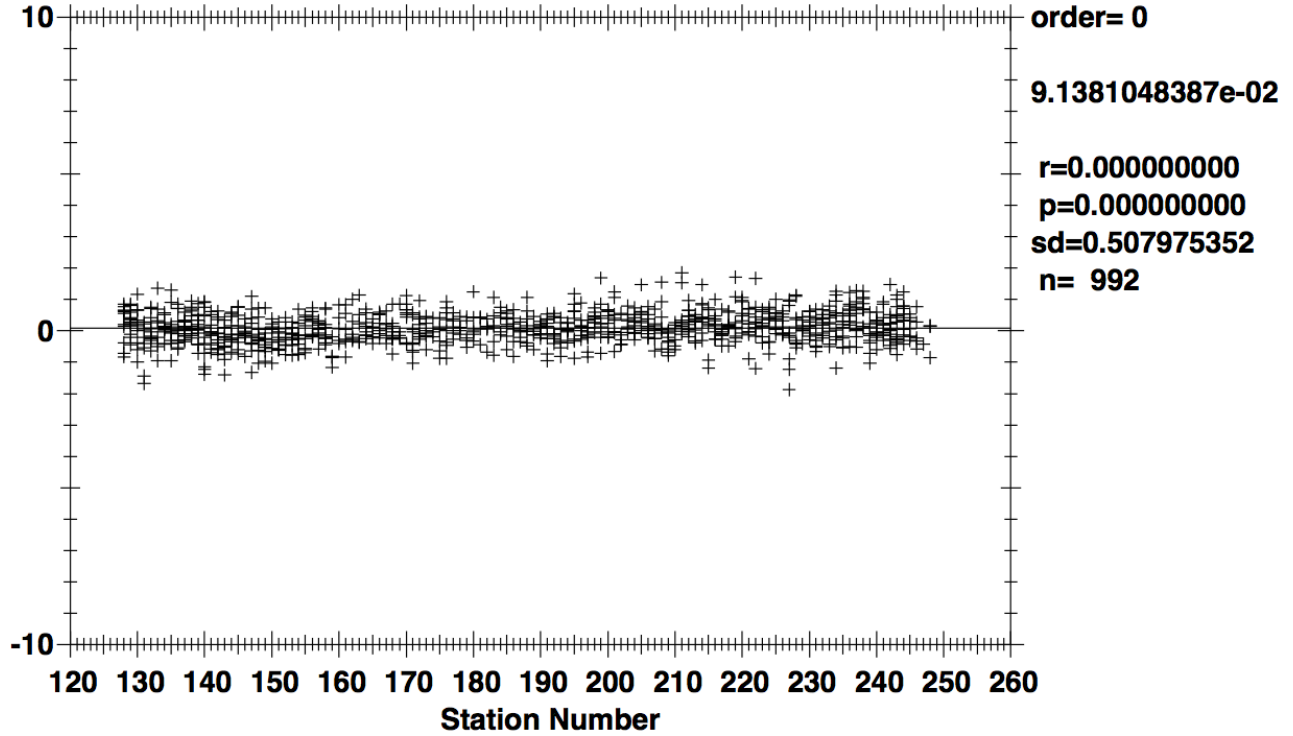
The standard deviations of 2.05 µmol/kg for all oxygens and 0.49 µmol/kg for deep oxygens are only presented as general indicators of goodness of fit. ODF makes no claims regarding the precision or accuracy of CTD dissolved O$_2$ data.

The general form of the ODF DO sensor response model equation for Clark cells follows Brown and Morrison [Brow78], and Millard [Mill82], [Owen85]. ODF models DO sensor secondary responses with lagged CTD data. In-situ pressure and temperature are filtered to match the sensor responses. Time constants for the pressure response τ_p, a slow (τ_{Tf}) and fast (τ_{Ts}) thermal response, package velocity (t_{dP}), thermal diffusion (τ_{dT})and pressure hysteresis (τ_h) are fitting parameters. Once determined for a given sensor, these time constants typically remain constant for a cruise. The thermal diffusion term is derived by low-pass filtering the difference between the fast response (T$_s$) and slow response (T$_l$) temperatures. This term is intended to correct non-linearities in sensor response introduced by inappropriate analog thermal compensation. Package velocity is approximated by low-pass filtering 1st-order pressure differences, and is intended to correct flow-dependent response. Dissolved O$_2$ concentration is then calculated:

$$O_2ml/l = [C_1 V_{DO} e^{(C_2 \frac{P_h}{5000})} + C_3] \cdot f_{sat}(T,P) \cdot e^{(C_4 T_l + C_5 T_s + C_7 P_l + C_6 \frac{dO_c}{dt} + C_8 \frac{dP}{dt} + C_9 dT)} \qquad (1.8.4.0)$$

where:

O$_2$ml/l	Dissolved O$_2$ concentration in ml/l;
V$_{DO}$	Raw sensor output;
C$_1$	Sensor slope
C$_2$	Hysteresis response coefficient

C_3 Sensor offset
$f_{sat}(T,P)$ O_2 saturation at T, P (ml/l);
T   insitu temperature (°C);
P   insitu pressure (decibars);
P_h Low-pass filtered hysteresis pressure (decibars);
T_l Long-response low-pass filtered temperature (°C);
T_s Short-response low-pass filtered temperature (°C);
P_l Low-pass filtered pressure (decibars);

$\dfrac{dO_c}{dt}$ Sensor current gradient (mamps/sec);

$\dfrac{dP}{dt}$ Filtered package velocity (db/sec);

dT   low-pass filtered thermal diffusion estimate (Ts -Tl).
$C_4 - C_8$ Response coefficients.

1.9. Bottle Sampling

At the end of each rosette deployment water samples were drawn from the bottles in the following order:

- CFC-11, CFC-12, SF_6
- ^3He
- O_2
- O^{18} - O_2, Argon
- Dissolved Inorganic Carbon (DIC)
- pH
- Total Alkalinity
- ^{13}C and ^{14}C
- Dissolved Organic Carbon (DOC) and Total Dissolved Nitrogen (TDN)
- Tritium
- Nutrients
- Chromophoric Dissolved Organic Matter (CDOM)
- Chlorophyll a
- Bacterial Cell Count
- Particulate Organic Carbon (POC)
- Del 15N of NO3
- Salinity
- Millero Density

The correspondence between individual sample containers and the rosette bottle position (1-36) from which the sample was drawn was recorded on the sample log for the cast. This log also included any comments or anomalous conditions noted about the rosette and bottles. One member of the sampling team was designated the sample cop, whose sole responsibility was to maintain this log and insure that sampling progressed in the proper drawing order.

Normal sampling practice included opening the drain valve and then the air vent on the bottle, indicating an air leak if water escaped. This observation together with other diagnostic comments (e. g., "lanyard caught in

lid", "valve left open") that might later prove useful in determining sample integrity were routinely noted on the sample log. Drawing oxygen samples also involved taking the sample draw temperature from the bottle. The temperature was noted on the sample log and was sometimes useful in determining leaking or mis-tripped bottles.

Once individual samples had been drawn and properly prepared, they were distributed for analysis. Oxygen, nutrient and salinity analyses were performed on computer-assisted (PC) analytical equipment networked to the data processing computer for centralized data management.

1.10. Bottle Data Processing

Water samples collected and properties analyzed shipboard were centrally managed in a relational database (PostgreSQL 8.1.18) running on a Linux system. A web service (OpenACS 5.3.2 and AOL Server 4.5.1) front-end provided ship-wide access to CTD and water sample data. Web-based facilities included on-demand arbitrary property-property plots and Vertical sections as well as data uploads and downloads.

The sample log (and any diagnostic comments) was entered into the database once sampling was completed. Quality flags associated with sampled properties were set to indicate that the property had been sampled, and sample container identifications were noted where applicable (e. g., oxygen flask number).

Analytical results were provided on a regular basis by the various analytical groups and incorporated into the database. These results included a quality code associated with each measured value and followed the coding scheme developed for the World Ocean Circulation Experiment Hydrographic Programme (WHP) [Joyc94].

Table 1.10.0 shows the number of samples drawn and the number of times each WHP sample quality flag was assigned for each basic hydrographic property:

Table 1.10.0:   Frequency of WHP quality flag assignments.

Rosette Samples Stations 128- 250

	Reported levels	WHP Quality Codes						
		1	2	3	4	5	7	9
Bottle	4368	0	4350	3	12	0	0	3
CTD Salt	4368	0	4346	14	8	0	0	0
CTD Oxy	4350	0	4343	5	2	0	0	18
Salinity	4361	0	4295	22	44	1	0	6
Oxygen	4352	0	4292	30	30	11	0	5
Silicate	4352	0	4337	3	12	11	0	5
Nitrate	4361	0	4302	47	12	2	0	5
Nitrite	4361	0	4348	0	13	2	0	5
Phosphate	4361	0	4342	6	13	2	0	5

Additionally, data investigation comments are presented in Appendix A. Various consistency checks and detailed examination of the data continued throughout the cruise.

1.11. Salinity

Equipment and Techniques

A single Guildline Autosal 8400B salinometer (S/N 69-180) located in Melville's Photolab, was used for all salinity measurements. This salinometer had been modified to include a communication interface for computer-aided measurement, a higher capacity pump and three temperature sensors. Two of these sensors were used to measure air and bath temperatures. The third was used to check sample bottle temperature.

Samples were analyzed after they had equilibrated to Laboratory temperature, usually within 12-29 hours after collection. The salinometer was standardized for each group of analyses (usually 1-2 casts, up to ~36 samples) using at least two fresh vials of standard seawater per group.

Salinometer measurements were aided by a computer using LabVIEW software developed by SIO/STS. The software maintained an Autosal log of each salinometer run which included salinometer settings and air and bath temperatures. The air temperature was displayed and monitored via a 24-hour strip-char t in order to observe cyclical changes. The program also guided the operator through the standardization procedure and making sample measurements. The analyst was prompted to change samples and flush the cells between readings.

Special standardization procedures included flushing the cell at least 4 times with a fresh vial of Standard Seawater (SSW), setting the flow rate as low as possible during the last fill, and monitoring the STD dial setting. If the STD dial changed by 10 units or more since the last salinometer run (or during standardization), another vial of SSW was opened and the standardization procedure repeated to verify the setting.

Samples were run using 3 flushes before the final fill. The computer determined the stability of a measurement and prompted for additional readings if there appeared to be drift. The operator could annotate the salinometer log, and would routinely add comments about cracked sample bottles, loose thimbles, salt crystals or anything unusual in the amount of sample in the bottle.

System of fans and heaters set up to expedite equilibrating salinity samples usually worked, but needed some refinement. during the first part of the cruise, cases of samples were placed in a heated container as soon as possible to help bring them to room temperature. They were then removed and set on a shelf near the Autosal for storage until the current case is finished, and for further equilibration. The next or current case to be run sat to the right of the Autosal, next to the standard seawater. The amount of time each case spent at each location varied depending on sample temperature and rate of analysis by the operator.

After encountering issues with thermal fluctuations and noisy data, the process was refined to the current procedure. After sampling, cases are now placed on the floor for storage until there is space in the heated container. They are stacked in the container three high with the next in line at the bottom until analysis can begin. Cases are run within 30-60 minutes of removal. Standard seawater storage is behind the case being run, underneath a computer shielded from room temperature fluctuations. There is also the addition of a room fan to circulate air and help dissipate the photo lab's temperature gradients.

Sampling and Data Processing

A total of 4268 salinity measurements were made and approximately 250 vials of standard seawater (IAPSO SSW) were used.

Salinity samples were drawn into 200 ml Kimax high-alumina borosilicate bottles, which were rinsed three times with the sample prior to filling. The bottles were sealed with custom-made plastic insert thimbles and kept closed with Nalgene screwcaps. This assembly provides very low container dissolution and sample evaporation. Prior to sample collection, inserts were inspected for proper fit and loose inserts replaced to insure an airtight seal. The draw and equilibration times were logged for all casts. Laboratory temperatures were logged at the beginning and end of each run.

PSS-78 salinity [UNES81] was calculated for each sample from the measured conductivity ratios. The difference between the initial vial of standard water and the next one run as an unknown was applied as a linear function of elapsed run time to the measured ratios. The corrected salinity data were then incorporated into the cruise database.

Data processing included double checking that the station, sample and box number had been correctly assigned, and reviewing the data and log files for operator comments. The salinity data were compared to CTD salinities and were used for shipboard sensor calibration.

Laboratory Temperature

The salinometer water bath temperature was maintained slightly higher than ambient Laboratory air temperature at 27°C. The ambient air temperature varied from 22.6 to 27.4°C during the cruise, and from -0.6 to 1.7°C during any particular run. Stations 129, 161, 188, 201, 208, 217 and 224 had a 1-1.7°C change in lab temperature during the run.

The ambient room temperature also maintained a steady observable 24-hour cycle that was dependent on environmental conditions and user interaction with the Autosal for most of the cruise. There were occasional temperature spikes that brought the room temperature above bath temperature, but this was resolved midway with greater air circulation.

Standards

IAPSO Standard Seawater Batches P-149 was used to standardize station 128-174, Batch P-150 was used on stations 175-XXX, and Batch P-151 was used on stations xxx-250. It was noticed that some of the vials did not have uniform volumes of standard, labels were not put on the vial straight and many of the crimp seals did not release properly, the tab breaking away instead of pulling the sealed section away. These observations raise quality control questions about this batch of Standard Seawater. A recent batch to batch comparison conducted by Dr. Kawano [Kawa09] suggests that P-149 requires a salinity offset of +0.8 *1 0-3 relative to other standard batches tested.

Analytical Problems

A large drift was identified on stations ? and ?? attributed to a tainted starting IAPSO standards. A correction of the difference in starting and ending standard conductivity ratios (0.00048, 0.00015 consecutively) was applied to average conductivity ratios for each bottle value. The inconsistency in the lab temperature resulted in a correction to Stations 132, 212, 230, 232 and 233. It appears that the salinometer was standardized to a lower temperature standard, and therefore the standard dial was set incorrectly relative to adjacent runs.

Results

The estimated accuracy of bottle salinities run at sea is usually better than ±0.002 PSU relative to the particular standard seawater batch used. The 95% confidence limit for residual differences between the

bottle salinities and calibrated CTD salinity relative to SSW batch P-149 was ± 0.0017 PSU for all salinities, and ± 0.0006 PSU for salinities deeper than 2000 db. The difference with the SSW batch P-150 was ± 0.00?? PSU for all salinities, and ± 0.000? PSU for salinities deeper than 2000 db.

1.12. Oxygen Analysis

Equipment and Techniques

Dissolved oxygen analyses were performed with an SIO/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 LabView software. Thiosulfate was dispensed by a Dosimat 665 buret driver fitted with a 1.0 mL buret. ODF used a whole-bottle modified-Winkler titration following the technique of Carpenter [Carp65] with modifications by Culberson et al. [Culb91], but with higher concentrations of potassium iodate standard (~0.012N) and thiosulfate solution (~55 gm/l). Pre-made liquid potassium iodate standards were run daily (approximately every 2-4 stations), unless changes were made to the system or reagents. Reagent/distilled water blanks were also deter mined daily or more often if a change in reagents required it to account for presence of oxidizing or reducing agents.

Sampling and Data Processing

4350 oxygen measurements were made from the main rosette. Samples were collected for dissolved oxygen analyses soon after the rosette was brought on board. Three different cases of 36 flasks each were rotated by station to minimize flask calibration issues, if any. Using a Tygon and silicone drawing tube, nominal 125ml volume-calibrated iodine flasks were rinsed 3 times with minimal agitation, then filled and allowed to overflow for at least 3 flask volumes. The sample drawing temperatures were measured with an electronic resistance temperature detector (RTD) embedded in the drawing tube. These temperatures were used to calculate μmol/kg concentrations, and as a diagnostic check of bottle integrity. Reagents (MnCl2 then NaI/NaOH) were added to fix the oxygen before stoppering. The flasks were shaken twice (10-12 inversions each time) to assure thorough dispersion of the precipitate, once immediately after drawing, and then again after about 20 minutes.

The samples were analyzed within 1-4 hours of collection, and the data incorporated into the cruise database.

Thiosulfate normalities were calculated from each standardization and corrected to 20°C. The thiosulfate normalities and blanks were monitored for possible drifting or possible problems when new reagents were used. An average blank and thiosulfate normality were used to recalculate oxygen concentrations. The difference between the original and "smoothed" data in all cases was less than 0.03%.

Bottle oxygens data was reviewed insuring proper station, cast, bottle number, flask, and draw temperature were entered properly. Any comments made during analysis was also reviewed making certain that any anomalous actions were investigated and resolved. Occasionally, an incorrect end point was encountered. The analyst has the provisions available through the software to check the raw data and have the program recalculate a correct end point. This happened a few times on this data set. The occurrence is usually attributed to debris in the water bath.

After the data is uploaded to the database, oxygen is graphically compared with CTD oxygen and adjoining stations. Any erroneous looking points are reviewed and comments are made regarding the final outcome of the investigation. These investigations and final data coding are reported in Appendix A.

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 volume is 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

Liquid potassium iodate standards were prepared in 6 liter batches and bottled in sterile glass bottles at ODF's chemistry Laboratory prior to the expedition. The normality of the liquid standard was determined by calculation from weight. The standard was supplied by Alfa Aesar (lot B05N35) and has a reported purity of 99.4-100.4%. All other reagents were "reagent grade" and were tested for levels of oxidizing and reducing impurities prior to use.

1.13. Nutrient Analysis

Equipment and Techniques

Nutrient analyses (phosphate, silicate, nitrate plus nitrite, and nitrite) were performed on an SIO/STS/ODF-modified 4 channel Technicon AutoAnalyzer II. Modifications to the system include STS/ODF developed data acquisition and processing software using the LabView utility and an interface from the detectors to the computer. The analytical methods used are described by Gordon et al. [Gord92] Hager et al. [Hage68] and Atlas et al. [Atla71]

Silicate

Silicate was analyzed using the technique of Armstrong et al. [Arms67]. An acidic solution of ammonium molybdate was added to a seawater sample to produce silicomolybdic acid which was then reduced to silicomolybdous acid (a blue compound) following the addition of stannous chloride. Tartaric acid was also added to impede PO_4 color development. The sample was passed through a 15mm flowcell and the absorbance measured at 660nm.

Reagents

Tartaric Acid (ACS Reagent Grade)
  200g tartaric acid dissolved in DW and diluted to 1 liter volume. Stored at room temperature in a polypropylene bottle.

Ammonium Molybdate
  10.8g Ammonium Molybdate Tetrahydrate dissolved in 1000ml dilute H_2SO_4*. *(Dilute H_2SO_4 =2.8ml conc H_2SO_4 to a liter DW). Added 3 drops 15% ultrapure SDS per liter of solution.
Stannous Chloride (ACS Reagent Grade)
  Stock solution:
    40g of stannous chloride dissolved in 100 ml 5N HCl. Refrigerated in a polypropylene bottle.

Working solution:
  5mlofstannous chloride stock diluted to 200 ml final volume with 1.2N HCl. Made up daily and stored at room temperature when not in use in a dark polypropylene bottle.
  NOTE: Oxygen introduction was minimized by swirling rather than shaking the stock solution.

Nitrate + Nitrate

A modification of the Armstrong et al. [Arms67] procedure was used for the analysis of nitrate and nitrite. For the nitrate analysis, the seawater sample was passed through a cadmium reduction column where nitrate was quantitatively reduced to nitrite. Sulfanilamide was introduced to the sample stream followed by N-(1-naphthyl) ethylenediamine dihydrochloride which coupled to form a red azo dye . 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 not present, and a 50mm flowcell was used for measurement.

Reagents

Sulfanilamide (ACS Reagent Grade)
  10g sulfanilamide dissolved in 1.2N HCl and brought to 1 liter volume. Added 5 drops of 40% surfynol 465/485 surfactant. Stored at room temperature in a dark polypropylene bottle.

N-(1-Naphthyl)-ethylenediamine dihydrochloride (N-1-N) (ACS Reagent Grade)
  1g N-1-N in DIW, dissolved in DW and brought to 1 liter volume. Added 2 drops 40% surfynol 465/485 surfactant. Stored at room temperature in a dark polypropylene bottle. Discarded if the solution turned dark reddish brown.
Imidazole Buffer (ACS Reagent Grade)
  13.6g imidazole dissolved in ~3.8 liters DIW. Stirred for at least 30 minutes until completely dissolved. Added 60 ml of $CuSO_4$ + NH_4Cl mix (see below). Added 4drops 40% Surfynol 465/485 surfactant. Using a calibrated pH meter, adjusted to pH of 7.83-7.85 with 10% (1.2N) HCl (about 20-30ml of acid, depending on exact strength). Final solution brought to 4L with DIW. Stored at room temperature.

NH_4Cl + $CuSO_4$ mix:
  2g cupric sulfate dissolved in DIW, brought to 100 ml volume (2%) 250g ammonium chloride dissolved in DIW, brought to 1 liter volume. Added 5ml of 2% $CuSO_4$ solution to the NH_4Cl stock.
  Note: 40% Surfynol 465/485 is 20% 465 plus 20% 485 in DIW.
        Prepared solution at least one day before use to stabilize.

Phosphate

Phosphate was analyzed using a modification of the Bernhardt and Wilhelms [Bern67] technique. An acidic solution of ammonium molybdate was added to the sample to produce phosphomolybdic acid, then reduced to phosphomolybdous acid (a blue compound) following the addition of dihydrazine sulfate. The reaction product was heated to ~55°C to enhance color development, then passed through a 50mm flowcell and the absorbance measured at 820nm.

Reagents

Ammonium Molybdate (ACS Reagent Grade)
  H_2SO_4 solution:
  420 ml of DIW poured into a 2 liter Ehrlenmeyer flask or beaker, this flask or beaker was placed into an ice bath. SLOWLY added 330 ml of conc H_2SO_4. This solution gets VERY HOT!!

27g ammonium molybdate dissolved in 250ml of DIW. Brought to 1 liter volume with the cooled sulfuric acid solution. Added 5 drops of 15% ultrapure SDS surfactant. Stored in a dark polypropylene bottle.
Dihydrazine Sulfate (ACS Reagent Grade)
6.4g dihydazine sulfate dissolved in DIW, brought to 1 liter volume and refrigerated.

Sampling and Data Processing

4361 nutrient samples from 123 CLIVAR stations were analyzed. The cruise started with new pump tubes and then they were changed twice during the cruise, after Stations 160, and 206. The spare pump was put on after Station 194. Four Beer's Law calibration checks were run throughout the cruise. Four sets of primary/secondary standards were made up over the course of the cruise. Primary and secondary standards were compared to the "old" standard before they were used to insure continuity between standards. The cadmium column reduction efficiency was checked periodically and ranged between 97%-100%.

Nutrient samples were drawn into 40 ml polypropylene screw-capped centrifuge tubes. The tubes and caps were cleaned with 10% HCl and rinsed once with de-ionized water and 2-3 times with sample before filling. Samples were analyzed within two hours after sample collection, allowing sufficient time for all samples to reach room temperature. The centrifuge tubes fit directly onto the sampler.

The analog outputs from each of the channels were digitized and logged automatically by computer (PC) at 2-second intervals. After each group of samples was analyzed, the raw data file was processed to produce another file of response factors, baseline values, and absorbances. Computer-produced absorbance readings were checked for accuracy against values taken from a strip chart recording which is produced simultaneously with the computer. Refractive Index blanks were determined periodically by measuring the absorbance of low nutrients seawater with one reagent from each of the chemistries offline. The difference between the distilled water baseline and the seawater absorbance was recorded. Sample concentrations were then calculated, refractive index blanks and anynon-linear corrections applied, and data merged with other hydrographic measurements. Carryover was minimized by running the samples from low to high concentration. Nutrients, 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 lab temperature measured when individual samples were drawn into the AA.

Standards and Glassware

Standardizations were performed at the beginning and end of each group of analyses with an inter mediate concentration mixed nutrient standard prepared prior to each run from a secondary standard in a low-nutrient seawater matrix. A group usually consisted of one station/cast (up to 36 samples). The secondary standards were prepared aboard ship by dilution from the pre-weighed primary standards. A set of 7 different standard concentrations, Table 1.13.0, were analyzed periodically to determine the deviation from linearity, if any, as a function of absorbance for each nutrient. Residuals were determined and fit to a 3rd order polynomial, which was then used to calculate the non-linear corrections applied to the nutrient concentrations. An aliquot from a large volume of stable deep seawater was also run with each set of samples as a substandard and as an additional check.

Table 1.13.0: CLIVAR P06E Standard Concentrations

std	N+N	PO4	SiO3	NO2
1)	0.0	0.0	0.0	0.0
2)	7.75	0.6	30	0.25
3)	15.50	1.2	60	0.50
4)	23.25	1.8	90	0.75
5)	31.00	2.4	120	1.00
6)	38.75	3.0	150	1.25
7)	46.50	3.6	180	1.50

All glass volumetric flasks and pipettes were gravimetrically calibrated prior to the cruise. The primary standards were dried and weighed prior to the cruise. The exact weight was noted for future reference. When primary standards were made, the flask volume at 20°C, the weight of the powder, and the temperature of the solution were used to buoyancy correct the weight, calculate the exact concentration of the solution, and determine how much of the primary was needed for the desired concentrations of secondary standard.

All the reagent solutions, primary and secondary standards were made with fresh distilled deionized water (DIW).

Working standards were made up in low nutrient seawater (LNSW). LNSW was collected from the sea surface via the ship's uncontaminated SW supply. The actual concentration of nutrients in this water was empirically determined during the calculation of the non-linear corrections that were applied to the nutrient concentrations.

The Nitrate (KNO3 lot# 042263) and Phosphate (KH2PO4 lot# 991608) primary standards were obtained from Fisher Scientific with reported purities of 100% and 99.8%, respectively. The Silicate (Na2SiF6 lot# J25E26) and Nitrite (NaNO2 lot# K19D12) standards were obtained from Alfa Aesar with reported purities of >98% and 97%.

Quality Control

As is standard ODF practice, a deep calibration check sample was run with each set of sample. Table 1.13.1 is a summary of those calibration check samples.

Table 1.13.1: Calibration check samples

Parameter	Concentration (uM)
NO3	33.3 ±0.22
PO4	2.33 ±0.02
SIL	121.72 ±0.60

Reference Material for Nutrient Seawater (RMNS)

Lot "BE" RMNS samples (kindly provided by M. Aoyama of Japan Meteorological Research Institute) were run on all stations. In addition, 12 calibration sets of four concentrations (lots AS, AX, AZ, and BE) were run throughout the cruise. Table 1.13.1 is a summary of those calibration check samples.

Table 1.13.1: Calibration check samples

Parameter	Concentration (uM)
NO3	37.62 $\pm$0.26
PO4	2.75 $\pm$0.02
SIL	103.89 $\pm$0.56

For stability testing purposes, each time a BE sample was run it was stored in the refrigerator and run on the next two subsequent stations. These calibrations sets were also run once "fresh" then stored in the refrigerator and re-run on the subsequent station.

Analytical problems

On Station 131, the acquisition computer hung up. The samples were rerun, but one sample could not be salvaged. At the beginning of Station 150 run, the AutoAnalyzer UPS overheated and switched off.

During the troubleshooting purposes, the samples sat out for approximately 1 hour and were then stored in the refrigerator for 1-2 hours before they were re-run. On Station 163, there was a reagent delivery problem which caused the loss of the first nine silicate samples. The AutoAnalyzer pump was replaced after station 194 due to a horrendous grinding gear type noise. Station 196 120-129 had cadmium column issues and these samples could not be recovered. Station 207 also had a cadmium column issue; All nitrate for this station was deemed questionable. Other than these issues, no major analytical problems occurred.

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2.   Lowered Acoustic Doppler Current Profiler
PI: Eric Firing, University of Hawaii at Manoa

An RD Instruments Work Horse 300kHz (WH300), Model WHM300IUG50, LADCP was used throughout the cruise, powered by a DEEPSEA Power & Light 50V SeaBattery. Both were installed on the main rosette by the resident technicians. The instrument provides full water column profiles of horizontal velocity currents with a vertical resolution of approximately eight meters.

LADCP downloading and processing were done on a Lenovo S10e laptop running Ubuntu Linux, and using a python gui developed at the University of Hawaii. Data was processed using LDEO software maintained by Andreas Thurnherr, with vertical profiles as well as longitude section plots being produced for general use. CTD time series data, but not shipboard ADCP data, were used to constrain calculations.

As for the first leg of the CLIVAR P6 cruise, two problems were encountered. Occasionally, the WH300 LADCP would create two or more data files during the deployment. Without a single continuous data file it is not possible to process the data at present. Secondly, past the Tonga Trench and well into the waters of the deep central South Pacific, the waters are characterized by very low scatterer abundance (i.e., the biological desert). The lack of scatterers resulted in suspect LADCP current estimates, particularly at depths greater than ~ 2000 m. Velocity estimates in this region based on the shear method differed greatly from estimates based on inversion resulting in the telltale "increased error because of shear inverse difference" warning from the LDEO processing software. Scatterer abundance was sufficiently low to affect LADCP measurements from station 100 (32° 30.00 S 166° 22.33 W, Leg 1) to station198 (32° 30.00 S 100° 33.56 W, Leg 2). The figure below shows the meridional and zonal velocities from station 198 onwards.

Figure 2.1: Zonal and Meridional velocities from the 300 KHz RD WH300 ADCP. Leg 2 of CLIVAR P6
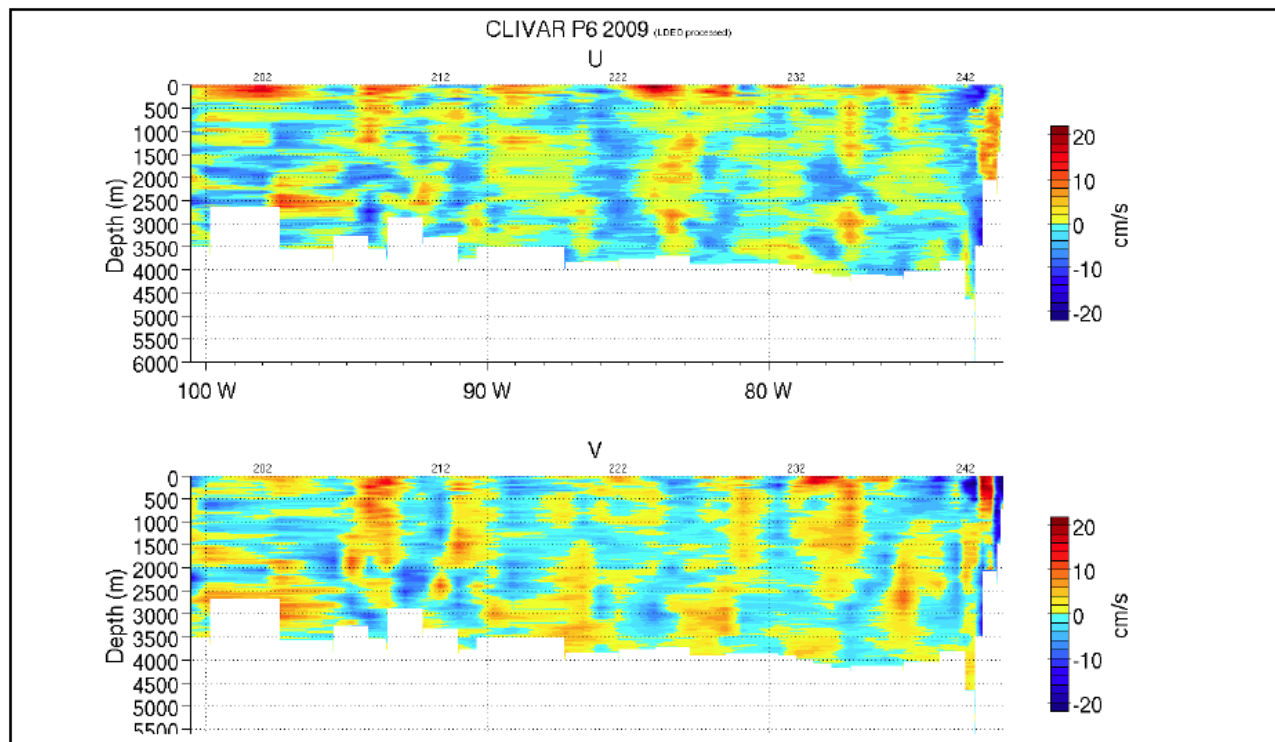
3. Total CO2 Measurements

PI: Rik Wanninkhof (NOAA/AOML)
Cruise Participants: Robert Castle, NOAA/AOML; Lauren Juranek, NOAA/PMEL

Samples for TCO2 measurements were drawn according to procedures outlined in the Handbook of Methods for CO2 Analysis (DOE 1994) from 11.7-L Niskin bottles into cleaned 294-mL glass bottles. Bottles were rinsed and filled from the bottom, leaving 6 mL of headspace; care was taken not to entrain any bubbles. After 0.2 mL of saturated HgCl2 solution was added as a preservative, the sample bottles were sealed with glass stoppers lightly covered with Apiezon-L grease and were stored at room temperature for a maximum of 12 hours prior to analysis.

TCO2 samples were collected from a variety of depths with one to three replicate samples. Typically the replicate seawater samples were taken from the surface, around 1000 m and bottom Niskin bottles and run at different times during the cell. No systematic difference between the replicates was observed.

The TCO2 analytical equipment was set up in a seagoing laboratory van. The analysis was done by coulometry with two analytical systems (AOML3 and AOML4) used simultaneously on the cruise. Each system consisted of a coulometer (UIC, Inc.) coupled with a Dissolved Inorganic Carbon Extractor (DICE) inlet system. DICE was developed by Esa Peltola and Denis Pierrot of NOAA/AOML and Dana Greeley of NOAA/PMEL to modernize a carbon extractor called SOMMA (Johnson et al. 1985, 1987, 1993, and 1999; Johnson 1992). In the coulometric analysis of TCO2, all carbonate species are converted to CO_2 (gas) by addition of excess hydrogen ion (acid) to the seawater sample, and the evolved CO_2 gas is swept into the titration cell of the coulometer with pure air or compressed nitrogen, where it reacts quantitatively with a proprietary reagent based on ethanolamine to generate hydrogen ions. In this process, the solution changes from blue to colorless, which triggers a current through the cell and causes coulometrical generation of OH- ions at the anode. The OH- ions react with the H+, and the solution turns blue again. A beam of light is shone through the solution, and a photometric detector at the opposite side of the cell senses the change in transmission. Once the percent transmission reaches its original value, the coulometric titration is stopped, and the amount of CO_2 that enters the cell is determined by integrating the total charge during the titration.

The coulometers were calibrated by injecting aliquots of pure CO_2 (99.99%) by means of an 8-port valve outfitted with two sample loops with known gas volumes bracketing the amount of CO_2 extracted from the water samples for the two AOML systems. The stability of each coulometer cell solution was confirmed three different ways: two sets of gas loops were measured at the beginning; also the Certified Reference Material (CRM), Batches 86 and 96, supplied by Dr. A. Dickson of SIO, were measured at the beginning; and the duplicate samples at the beginning, middle, and end of each cell solution. The coulometer cell solution was replaced after 25 mg of carbon was titrated, typically after 9-12 hours of continuous use.

The pipette volume was determined by taking aliquots at known temperature of distilled water from the volumes. The weights with the appropriate densities were used to determine the volume of the pipettes. Calculation of the amount of CO_2 injected was according to the CO_2 handbook (DOE 1994). The concentration of CO_2 ([CO_2]) in the samples was determined according to:

[CO_2] = Cal. factor * (Counts Blank * Run Time) * K mmol/count pipette volume * density of sample

where Cal. Factor is the calibration factor, Counts is the instrument reading at the end of the analysis, Blank is the counts/minute determined from blank runs performed at least once for each cell solution, Run Time is the length of coulometric titration (in minutes), and K is the conversion factor from counts to μmol. The instrument has a salinity sensor, but all TCO2 values were recalculated to a molar weight (μmol/kg) using density obtained from the CTD's salinity. The TCO2 values were corrected for dilution by 0.2 mL of saturated $HgCl_2$ used for sample preservation. The total water volume of the sample bottles was 288 mL (calibrated by Esa Peltola, AOML). The correction factor used for dilution was 1.0007. A correction was also applied for the offset from the CRM. This correction was applied for each cell using the CRM value obtained in the beginning of the cell. The average correction was 3.1 mmol/kg. The results underwent initial quality control on the ship using TCO2-pressure/ salinity/ oxygen/ phosphate/ nitrate/ silicate/ alkalinity and pH plots. Also vertical sections were used for the quality control.

The overall performance of the instruments was good during the cruise. There were some problems with the systems. Twice the counts on instrument 4 decreased substantially for no apparent reason in the middle of the cell. The first time this happened (on station 128) it was not noticed until the end of the cell and consequently about half the samples were bad. The second time it happened, on station 218, 3 samples were lost. There were several cases where the pipette failed to fill for unknown reasons resulting in lost samples

and several long titrations that may have been caused by problems with the ship's power. The often occurred when the ship was coming on station or leaving station and the bow thrusters were being turned on or off. AOML 3 had problems with solenoid valve 13 that caused slow and sometimes incomplete filling of the pipette. I first modified the program to wait longer for the pipette to fill and a week later I capped off the output from SV 13. This had the effect of speeding up the filling but leaving the sample bottles pressurized so that care needed to be take when removing the stoppers. After about 2 weeks, the toaster oven we use to dry our glassware failed and could not be repaired. At first we were careful to dry every part of the cell when we cleaned it and placed them in the closet where the AC vent runs through. This area is usually quite warm and dry, but when the weather got cooler, the AC worked less hard and the closet became less dry. This caused a lot of problems getting cells to start because they were so noisy. Finally, on Feb. 3 I borrowed a small space heater from the electrician and put it in the closet where it blew hot air on the glassware. This worked quite well and for the rest of the cruise the cells started reasonably well.

A total of 2660 samples were analyzed for discrete dissolved inorganic carbon. The total dissolved inorganic carbon data reported to the database directly from the ship are to be considered preliminary until a more thorough quality assurance can be completed shore side.

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4.   Discrete pH Analyses

PI: Frank Millero, RSMAS, Univ of Miami
Cruise Participants: Jason Brown, RSMAS/UM; Giuseppe Manfredi, RSMAS/UM
   Stacy Brown, RSMAS/UM

Sampling

From stations 128 to 154, samples were collected in 50ml borosilicate glass syringes rinsing a minimum of 2 times. Starting at station 157, samples were collected in 10cm, special-optical glass spectrophotometer cells. These cells were rinsed a minimum of 2 times and allowed to over fill with twice their volume before being sealed with Teflon stoppers. All samples were brought to 20°C before analysis. Three duplicates were collected from each station. Samples were collected on the same bottles as total alkalinity or dissolved inorganic carbon in order to completely characterize the carbon system. All submitted data is preliminary.

Analysis

pH (μmol/kg H2O) on the seawater scale was measured using a Agilent 8453 spectrophotometer according to the methods outlined by Clayton and Byrne (1993). A RTE17 water bath maintained spectrophotometric cell temperature at 20.0°C. For samples analyzed before station 154, a 10cm flow through cell was filled automatically using a Kloehn 6v syringe pump. The sulfonephthalein indicator m-cresol purple (mCP) was also injected automatically by the kloehn 6v syringe pump into the spectrophotometric cells. Samples after station 157 were blanked in the 10cm glass spectrophotometer cell and the mCP was injected using a Gilmont micropipette. For all stations, the absorbance of light was measured at three different wavelengths (434 nm, 578 nm, 730 nm). The ratios of absorbances at the different wavelengths were input and used to calculate pH on the total and seawater scales, incorporating temperature and salinity into the equations. The equations of Dickson and Millero (1987), Dickson and Riley (1979), and Dickson (1990) were used to convert pH from total to seawater scales. Salinity data were obtained from the conductivity sensor on the CTD. These data were later corroborated by shipboard measurements. Temperature of the samples was measured immediately after spectrophotometric measurements using a Guildline 9540 digital platinum resistance thermometer.

Reagents

The mCP indicator dye was a concentrated solution of 2.0 mM with an R = 1.61350.

Standardization

The precision of the data can be accessed from measurements of duplicate samples, certified reference material (CRM) Batch 96 (Dr. Andrew Dickson, UCSD) and TRIS buffers. CRMs were measured approximately every odd station and TRIS buffers were measured on every even station.

Data Processing

Addition of the indicator affects the pH of the sample, and the degree to which pH is affected is a function of the pH difference between the seawater and indicator. Therefore, a correction is applied for each batch of dye. To obtain this correction factor, all samples throughout the cruise were measured after two consecutive additions of mCP. From these two measurements, a change in absorbance ratio per mL of mCP indicator is calculated. R was calculated using the absorbance ratio (R_m) measured after the initial indicator addition from:

$$R = R_m + (-0.00173 + 0.000382\ R_m)\ V_{ind} \quad (1)$$
$$R = R_m + (-0.00254 + 0.000571\ R_m)\ V_{ind} \quad (2)$$

where V*ind* is the volume of mCP used. Clayton and Byrne (1993) calibrated the mCP indicator using TRIS buffers (Ramette et al. 1977) and the equations of Dickson (1993). These equations are used to calculate pH *t*, the total scale in units of moles per kilogram of solution.

Problems

At station 154, the Kloehn syringe pump ceased to function. All attempts to replace the syringe pump with one of the backup pumps failed. This caused a switch in the analysis methods, from the automated system to the manual system.

Blank absorbencies between 600 and 650nm, were in excess of 0.003. This is a problem extending from station 47 in the first leg. This is thought to be a problem with the spectrophotometer's diode array detector.

Measurement temperature was decreased from 25 to 20°C between legs. This change was made due to the high occurrence of cracked syringes in the water baths during the first leg. It is thought the rapid introduction of the syringes, containing water samples at temperatures well below 25°C, into the warm water bath caused the syringes to become brittle and crack. This problem was no longer encountered once the water bath temperature was decreased.

5. Total Alkalinity Analyses
PI: Frank Millero, RSMAS, Univ of Miami
Cruise Participants: Jason Brown, RSMAS/UM; Giuseppe Manfredi, RSMAS/UM
  Stacy Brown, RSMAS/UM

Sampling

The sampling scheme was roughly an alternation between full (36 Niskins) and partial (18 or fewer Niskins) on stations up to 139. All casts, prior to station 139, had three duplicate samples drawn; one from the near the bottom, oxygen minimum, and surface. These duplicates were analyzed so one was split between the titration systems A & B, the second set was analyzed on system A and the third set analyzed on system B. Due to problems with the titration system A, sampling after station 139 was restricted to partial sampling and only one duplicate was taken per station. Samples were drawn from Niskin bottles into 500 ml borosilicate flasks using silicone tubing fit over the petcock. Bottles were rinsed a minimum of two times and filled from the bottom, overflowing half of a volume while taking care not to entrain any bubbles.

Approximately 15 ml of water was withdrawn from the flask by arresting the sample flow and removing the sampling tube, thus creating a small expansion volume and reproducible headspace. The sample bottles were sealed at a ground glass joint with a glass stopper. The samples were thermostated at 25°C before analysis.

Analyzer Description

The total alkalinity of seawater (TAlk) was evaluated from the proton balance at the alkalinity equivalence point, pHequiv = 4.5 at 25°C and zero ionic strength in one kilogram of sample. The method utilizes a multi-point hydrochloric acid titration of seawater according to the definition of total alkalinity (Dickson 1981). The potentiometric titrations of seawater not only give values of TAlk but also those of DIC and pH, respectively from the volume of acid added at the first end point and the initial emf, E0. Two titration systems, A and B were used for TAlk analysis. Each of them consists of a Metrohm 665 Dosimat titrator, an Orion 720A pH meter and a custom designed plexiglass water-jacketed titration cell (Millero et al, 1993). Both the seawater sample and acid titrant were temperature equilibrated to a constant temperature of 25 $\pm$

0.1°C with a water bath (Neslab, model RTE-17). The water-jacketed cell is similar to the cells used by Bradshaw and Brewer (1988) except a larger volume (200 ml) is employed to increase the precision. Each cell has a fill and drain valve which increases the reproducibility of the volume of sample contained in the cell. A typical titration recorded the EMF after the readings became stable (deviation less than 0.09 mV) and then enough acid was added to change the voltage a pre-assigned increment (13 mV). A full titration (25 points) takes about 15-20 minutes. The electrodes used to measure the EMF of the sample during a titration consisted of a ROSS glass pH electrode (Orion, model 810100) and a double junction Ag, AgCl reference electrode (Orion, model 900200).

Reagents

A single 50-l batch of 0.25 m HCl acid was prepared in 0.45 m NaCl by dilution of concentrated HCl, AR Select, Mallinckrodt, to yield a total ionic strength similar to seawater of salinity 35.0 (I ≈ 0.7 M). The acid was standardized by a coulometric technique (Marinenko and Taylor, 1968; Taylor and Smith, 1959) and verified with alkalinity titrations on seawater of known; alkalinity. The calibrated molarity of the acid used was 0.24178 $\pm$ 0.0001 M HCl. The acid was stored in 500-ml glass bottles sealed with Apiezon(r) L grease for use at sea.

Standardization

The volumes of the cells used were determined to $\pm$0.03 ml during the initial set up by multiple titrations using seawater of known total alkalinity and CRM. The cell for system B was replaced at station 28 and calibrated before analyzing any samples. Calibrations of the burette of the Dosimat with water at 25°C indicate that the systems deliver 3.000 ml (the approximate value for a titration of 200 ml of seawater) to a precision of $\pm$ 0.0004 ml, resulting in an error of $\pm$ 0.3 μmol/kg in TAlk. The reproducibility and precision of measurements are checked using low nutrient surface seawater and Certified Reference Material (Dr. Andrew Dickson, Marine Physical Laboratory, La Jolla, California), Batch 96. CRM's were utilized in order to account for instrument drift and to maintain measurement precision. Duplicate analyses provide additional quality assurance and were taken from the same Niskin bottle.

Data Processing

An integrated program controls the titration, data collection, and the calculation of the carbonate parameters (TAlk, pH, and DIC). The program is patterned after those developed by Dickson (1981), Johansson and Wedborg (1982), and U. S. Department of Energy (DOE) (1994). The program uses a Levenberg-Marquardt nonlinear

6. Chlorofluorocarbon (CFC) and Sulfur Hexafluoride (SF6) Measurements

PI: Mark J. Warner, University of Washington (warner@u.washington.edu)
Cruise Participants: Mark J. Warner, University of Washington
   Wendi Ruef, University of Washington
   Carmen Hill-Lindsay, University of California, Los Angeles

Samples for the analysis of dissolved CFC-11, CFC-12, and SF6 were collected from approximately 3070 of the Niskin water samples collected during the expedition. When taken, water samples for CFC analysis were the first samples drawn from the 10-liter bottles. Care was taken to co-ordinate the sampling of CFCs with other samples to minimize the time between the initial opening of each bottle and the completion of sample drawing. In most cases, dissolved oxygen, alkalinity and dissolved inorganic carbon samples were collected within several minutes of the initial opening of each bottle. To minimize contact with air, the CFC samples were collected from the Niskin bottle petcock using Viton tubing to fill a 300-ml BOD bottle. The Viton tubing was flushed of air bubbles. The BOD bottle was placed into a plastic overflow container and filled from the bottom. The overflow water filled the container to a depth greater than the height of the BOD bottle. The stopper was held in the overflow container to be rinsed. When the overflow container was filled, it (and the BOD bottle) were lowered to remove the Viton tubing and the BOD bottle was stoppered under water. A plastic cap was snapped on to hold the stopper in place. The BOD bottles were stored in a refrigerator in the laboratory at 3.5° - 6°C until 30-45 minutes before analysis to reduce the degassing and bubble formation in the sample. At that time, they were transferred to a water bath at 13°-15°C in order to increase the stripping efficiency.

For atmospheric sampling, a ~200 meter length of 3/8-in OD Dekaron tubing was run from the portable laboratory to the bow of the ship. A flow of air was drawn through this line to the main laboratory using an Air Cadet pump. The air was compressed in the pump, with the downstream pressure held at ~1.5 atm. using a back-pressure regulator. A tee allowed a flow (100 ml min-1) of the compressed air to be directed to the gas sample valves of the CFC/SF6 analytical systems, while the bulk flow of the air (>7 l min-1) was vented through the back pressure regulator. Air samples were generally analyzed when the relative wind direction was within 100 degrees of the bow of the ship to reduce the possibility of shipboard contamination. The pump was run for approximately 30 minutes prior to analysis to insure that the air inlet lines and pump were thoroughly flushed. the average atmospheric concentrations determined during the cruise (from a set of 5 measurements analyzed when possible, n=13) were 241.9 +/- 5.8 parts per trillion (ppt) for CFC-11, 524.7 +/- 5.9 ppt for CFC-12, and 6.7 +/- 0.4 ppt for SF6.

Concentrations of CFC-11 and CFC-12, and SF6 in air samples, seawater and gas standards were measured by shipboard electron capture gas chromatography (EC-GC). This system was provided by J. Happell from the U Of Miami Rosentiel School of Marine and Atmospheric Sciences and had been utilized on CLIVAR P6 Leg 1. Samples were introduced into the GC-EC via a purge and dual trap system. 202 ml water samples were purged with nitrogen and the compounds of interest were trapped on a main Porapack N/Carboxen 1000 trap cooled by a Vortec Tube to ~ -20°C. After the sample had been purged and trapped for 6 minutes at 180 ml min-1 flow, the gas stream was stripped of any water vapor via a magnesium perchlorate trap prior to transfer to the main trap. The main trap was isolated and heated by direct resistance to 150°C. The desorbed contents of the main trap were back-flushed and transferred, with helium gas, over a short period of time, to a small volume focus trap in order to improve chromatographic peak shape. The focus trap (Porapak N) is also cooled to ~ -20°C with a Vortec Tube cooler. The focus trap was then flash heated by direct resistance to 180°C to release the compounds of interest onto the analytical precolumns.

The first precolumn was a 5-cm length of 1/16-in tubing packed with 80/100 mesh molecular sieve 5A. This column was used to hold back N2O and keep it from entering the main column. The second pre-column was the first 5 meters of a 60 m Gaspro capillary column with the main column consisting of the remaining 55 meters. The analytical pre-columns were held in-line with the main analytical column for the first 50

seconds of the chromatographic run. After 50 seconds, all of the compounds of interest were on the main column and the pre-column was switched out of line and back-flushed with a relatively high flow of nitrogen gas. This prevented later eluting compounds from building up on the analytical column, eventually eluting and causing the detector baseline signal to increase.

The analytical system was calibrated frequently using a standard gas of known CFC composition. Gas sample loops of known volume were thoroughly flushed with standard gas and injected into the system. The temperature and pressure was recorded so that the amount of gas injected could be calculated. The procedures used to transfer the standard gas to the trap, precolumns, main chromatographic column and EC detector were similar to those used for analyzing water samples. Three sizes of gas sample loops were used. Multiple injections of these loop volumes could be made to allow the system to be calibrated over a relatively wide range of concentrations. Air samples and system blanks (injections of loops of CFC-free gas) were injected and analyzed in a similar manner. The typical analysis time for samples was 11.0 min. Concentrations of the CFCs in air, seawater samples and gas standards are reported relative to the SIO98 calibration scale (Cunnold, et. al., 2000). Concentrations in air and standard gas are reported in units of mole fraction CFC in dry gas, and are typically in the parts per trillion (ppt) range. Dissolved CFC concentrations are given in units of picomoles per kilogram seawater (pmol kg-1), and SF6 in femtomoles per kilogram seawater (fmol kg-1). CFC concentrations in air and seawater samples were determined by fitting their chromatographic peak areas to multipoint calibration curves, generated by injecting multiple sample loops of gas from a working standard (RSMAS cylinder 32403 for CFC-11: 579 ppt, CFC-12: 429 ppt, and SF6: 0.935 ppt) into the analytical instrument. Full-range calibration curves were run three times during the cruise. These were supplemented with occasional injections of multiple aliquots of the standard gas at more frequent time intervals. Single injections of a fixed volume of standard gas at one atmosphere were run much more frequently (at intervals of 2 hours) to monitor short-term changes in detector sensitivity. The SF6 peak was often on a small bump on the baseline, resulting in a large dependence of the peak area on the choice of endpoints for integration.

Estimated accuracy is +/-2%. Precision for CFC-12, CFC-11, and SF6 was less than 1%. Estimated limit of detection is 1 fmol kg-1 for CFC-11, 3 fmol kg-1 for CFC-12 and 0.05 fmol kg-1 for SF6.

The efficiency of the purging process was evaluated twice daily by re-stripping high concentration surface water samples and comparing the residual concentrations to initial values. These re-strip values were approximately 1% for CFC-12 and 8-12% for CFC-11. A correction has been applied to the shipboard data. No SF6 was detected in the re-stripped sample. The determination of a blank due to sampling and analysis of CFC-free waters was hampered by the apparent lack of CFC-free waters. No sampling blank corrections have been made to this preliminary data set.

On this expedition, based on the analysis of 65 duplicate samples, we estimate precisions (1 standard deviation) of 1.3% or 0.006 pmol kg-1 (whichever is greater) for dissolved CFC-11, 0.70% or 0.005 pmol kg-1 for CFC-12 measurements, and 0.05 fmol kg-1 for SF6.

Analytical Difficulties.

Between the two legs of the expedition, the flow of the purging gas decreased. This resulted in the backflush time of 35 s for water samples (compared to 50 s for gas samples) being too short for all of the CFC-11 to have been transferred to the main column from the pre-column. Due to a combination of lack of familiarity with the system and software and the backflush time for gases being at 50 s, it took ~3.5 days to identify the problem. This resulted in the loss of CFC-11 data from the first 13 stations of this leg (Stations 128-140). A fair number of water samples had anomalously high CFC concentrations relative to adjacent samples in the deep water along this section. These samples occurred sporadically during the cruise and were not clearly associated with other features in the water column (e.g. anomalous dissolved oxygen, salinity or temperature

features). This suggests that these samples were probably contaminated with CFCs during the sampling or analysis processes. Measured concentrations for these anomalous samples are included in the preliminary data, but are given a quality flag value of either 3 (questionable measurement) or 4 (bad measurement).

References:

Prinn, R.G., Weiss, R.F., Fraser, P.J., Simmonds, P.G., Cunnold, D.M., Alyea, F. N., O'Doherty, S., Salameh, P., Miller, B.R., Huang, J., Wang, R.H.J., Hartley, D.E., Harth, C., Steele, L.P., Sturrock, G., Midgley, P.M., McCulloch, A., 2000. A history of chemically and radiatively important gases in air deduced from ALE/GAGE/AGAGE. Journal of Geophysical Research, 105, 17, 751-17, 792

7. Chromophoric DOM -- A Photoactive Tracer of Geochemical Process
PIs: N. Nelson, D. Siegel, C. Carlson, Univ. of California, Santa Barbara
Field Team (P6 Leg 2): Norm Nelson (PI), K. G. Fairbarn (Technician)

Project Goals:

This project is an ongoing study of the distribution and dynamics of chromophoric dissolved organic matter in the open ocean (surface and interior). CDOM is an important player in photochemistry and photobiology in the surface ocean and has a long lifetime in the interior, suggesting its application as a semi conservative tracer of intermediate water renewal and DOM diagenesis. We are collecting a variety of samples and data for analysis, primarily of optical properties. Ancillary measurements include biological (chlorophyll, phytoplankton pigments, cell counts and classification) and geochemical measurements.

Activities on P6 Leg 2:

Daily goals are to collect samples from one main rosette profile (coordinated with DOC and DIC measurements), and conduct one free-fall bio-optics profiler deployment. Occasional large volume samples are collected to archive for further analysis ashore. We also installed an alongtrack surface optical properties system (first use on P6 Leg 1) and a CDOM fluorometer on the main ctd rosette.

Radiometric Profiler

We hand deployed a Satlantic MicroPro II profiling spectroradiometer package off the stern rail, port side, each day within a time window of 1000 to 1400 local. Typical procedure was to carry out one drop to 150 m then two drops to 20 m to better resolve surface water properties. Average time for the cast was ~15 minutes. No cast was performed 13 January due to weather conditions. The package contains upwelling and downwelling radiometers covering a wavelength range from 305 to 665 nm. The package also carried a combined sensor unit with a chlorophyll fluorometer and single-channel backscatter sensor that both proved effective. A CDOM fluorometer in the same unit was not effective, as sensitivity in the combined unit was lower than normal due to electronic interference.

Aerosol Optical Depth Measurements

We carried a Solar Light, Inc. Microtops II sunphotometer for occasional (clear skies permitting) measurements of spectral solar radiance. These data are useful for aerosol modeling and atmospheric

correction of ocean color data. Data are processed ashore by Dr. Alexander Smirnov, NASA, and are available in near real time via the AERONET website: http://aeronet.gsfc.nasa.gov/

CDOM Fluorometer on ctd package

On the ctd package we installed a WETLabs, inc. ECO CDOM fluorometer (EX 370 nm, EM 420 nm) sn#428 rated for 6000m. This is designated as "Fluorometer" in the ctd data set descriptions. Data are reported as voltage. The last calibration at WETLabs against quinine sulfate standards yielded a calibration equation of quinine sulfate equivalent (ppb) = 28.65*(V0.067).

This instrument performed well but at oceanic CDOM concentrations the signal to noise ratio is less than 3. CDOM fluorescence profiles reproduced absorption coefficient profiles from bottle samples well except in the upper water column where the bulk of the absorbing CDOM does not fluoresce efficiently in the fluorometer waveband.

This instrument was also deployed on the I5 section and on Leg 1. Something happened to it on the last cast before the port call which resulted in an approximately 0.02 V offset in the data for Leg 2. We cannot account for this, and the only clue we have is the fact that the sensor was moved without the knowledge of the marine techs on or about the last station of Leg 1. Perhaps it was damaged at this point. Any damage is minor and has only resulted in the aforementioned offset. CTD crew has been good about keeping the optics clean throughout the section.

CDOM analysis

60 ml samples were taken from all rosette bottles on one cast daily -- approximately every fourth ctd cast, approximately 1110 samples in total. Duplicates were collected on two randomly selected samples per cast. The samples were filtered through 0.2 um Nuclepore filters, then absorption spectra were acquired using an WPI UltraPath liquid waveguide spectrophotometer system. The spectrophotometer system used on Leg 1 failed on the first station, so a subset of samples were collected and returned to UCSB for shore analysis. A new system was installed for Leg 2 but the cell has not been calibrated to account for refractive index differences between the samples (seawater) and blanks (freshwater) so data submission to the CCHDO will be delayed.

On average two of every 38 samples were contaminated, resulting in excessively high background absorption. Repeated measurements of the contaminated samples yielded similar results, indicating that this was not due to an electronic transient (always a possibility in a single- beam spectrophotometer). In some cases where contaminated samples were detected replicates were taken and the replicates agreed with the primaries; in other cases the replicate was acceptable and the primary was bad or vice versa. No consistent pattern was detected in general and cleaning my filtration apparatus and sample gear had no obvious effect. Data from these samples were replaced with -999 and were given WOCE flag 5. A possible repetitive contamination problem with bottle 36 was noted starting at station 208. The contamination was not evident at station 228. The contamination appeared to be independent of DO14C group's cleaning of the Niskin spigots. Duplicate bottles were tripped at ~5m on station 232 as an additional test, and again the contamination was not evident. Samples and duplicates from both Niskin bottles on this cast were identical within average errors.

Replication of data from randomly selected duplicate samples was excellent. Absorption at 325 nm of duplicate samples was within 2.5% (rms) of the average value from the primary samples.

CHLOR_A measurements

We measured chlorophyll a using the fluorometric method on the CDOM cast each day (bottles 29-36, ~250 m to surface). Samples are filtered onto 0.45 Millipore HA filters and extracted 48 hrs in 90% acetone. The extracts were analyzed at sea using a Turner Designs 10-AU fluorometer (last calibration date 04/09). Incorrectly diluted acetone was responsible for loss of several stations worth of data (PI error). Submission of the data to CCHDO is delayed pending examination of the calibration history.

Returned samples

We stored approximately 300 20 ml seawater samples from rosette casts for ashore CDOM characterization. These samples were left over from onboard CDOM analysis so no additional water was demanded. Samples were stored in the only available refrigerator on the Melville. This fridge is designated for flammable material storage and was on average warmer than requested, so we are unsure whether the samples will survive uncontaminated. We also collected approximately 16 1-liter (large volume) samples from selected stations where water budget was not critical. These samples may be subjected to further analysis ashore.

We also collected approximately 800 samples for flow cytometric analysis of bacterial number and characterization. Samples were preserved in dilute formaldehyde and frozen at -80°C, and will be analyzed at UCSB.

We also collected ~80 2-liter samples from the uncontaminated surface seawater system for particle analysis. Filters were stored under liquid nitrogen and will be returned for particulate light absorption and HPLC phytoplankton pigment analysis. An equal number of samples for ashore POC analysis were collected from rosette casts where water budget was not critical .

Particulate light absorption and HPLC data will be made available after analysis via the NASA SeaBASS website and database: http://seabass.gsfc.nasa.gov/

POC samples will be analyzed at the MSI Analytical Laboratory, UCSB (www.msi.ucsb.edu). The data will be turned over to Dr. Wilford Gardner, TAMU, for calibration of the SIO beam transmissometer deployed on the ctd package.

Alongtrack system

We used a prototype alongtrack system for measuring inherent optical properties of the water column on the uncontaminated seawater supply in the main lab. The primary instruments on the package are a WETLabs ECO BB3 three-wavelength optical backscatter sensor (470, 532, 595 nm) and a WETLabs AC-s hyperspectral absorption and beam attenuation meter (400-700 nm). Baseline drift and CDOM effects on the signal are assessed by switching in or out an 0.2 micron nylon filter cartridge with a computer controlled valve. Filters were changed every five days and no discoloration of the filters was noted, indicating the system was staying clean. In the coastal transition zone the filters clogged quickly and needed daily replacement. This was not observed in onshore testing with high biomass seawater, so we concluded that there was insufficient head pressure in the Melville's uncontaminated seawater system to maintain flow through a partially loaded filter cartridge. The system was flushed daily with fresh water to reduce the biofouling rate and the system was cleaned every five days by wiping surfaces with ethanol. On this leg we collected data during the fresh water flush to assess the flushing rate and to assess instrument calibration drift.

The instruments performed well and we should get some good data after reduction. Our biggest problem was leaks, resulting in air intake by the system downstream of the debubbler. The head pressure on the

uncontaminated seawater system was insufficient to maintain good flow through the system at all times so in the future we may need to develop an alternate means of collecting seawater for the system.

Processed and QCd data will be made available through the NASA SeaBASS database: http://seabass.gsfc.nasa.gov/

8.   Helium and Tritium
PI: William Jenkins, WHOI
Cruise Participant: Pete Landry, WHOI

Helium Sampling

664 Helium samples were taken with one lost due to a leaky cylinder.

Samples were taken roughly every 2.5-3.5 degrees, with 28 stations sampled.

One duplicate was taken on each station except for the stations 249 and 250 where only 8 and 4 samples were taken.

Helium samples were taken in stainless steel sample cylinders. The sample cylinders were leak-checked and Back filled with N2 prior to the cruise. Samples were drawn using tygon tubing connected to the Niskin bottle at one end and the cylinder at the other. Silicon tubing was used as an adapter to prevent the tygon from touching the Niskin per the request of the CDOM group. Cylinders are thumped vigorously with a bat while being flushed with water from the Niskin to help remove bubbles. After flushing roughly 1 liter of water through them, the plug valves are closed. As the cylinders are sealed by O-ringed plug valves, the samples must be extracted within 24 hours to limit out-gassing.

Eight samples at a time were extracted using our At Sea Extraction line set up in the Helium Van. The stainless steel sample cylinders are attached to the vacuum manifold and pumped down to ~2e-7 Torr using a diffusion pump for a minimum of 1 hour to check for leaks. The sections are then isolated from the vacuum manifold and introduced to the reservoir cans which are heated to >90°C for roughly 10 minutes. Glass bulbs are attached to the sections and immersed in an individual ice water bath during the extraction process. After 10 minutes each bulb is flame sealed and packed for shipment back to WHOI. The extraction cans and sections are cleaned with distilled water and isopropanol, and then dried between each extraction.

Helium samples will be analyzed using a mass spectrometer at WHOI.

Due to the AC failure on Leg 1 only 264 Helium samples were taken instead of the intended 472. Those not taken were added to the Leg 2 schedule.

Tritium Sampling

456 Tritium samples were taken on the same stations as the Helium samples. Each Tritium sample taken corresponded to a Helium sample taken on that station.

A duplicate was taken on every other station.

Tritium samples were taken using a silicon adapter and tygon tubing to fill 1-qt glass jugs. The jugs were baked in an oven, backfilled with argon, and the caps were taped shut with electrical tape prior to the cruise. While filling, the jugs are place on the deck and filled to about 2 inches from the top of the bottle, being

careful not to spill the argon. Caps were replaced and taped shut with electrical tape before being packed for shipment back to WHOI.

Tritium samples will be degassed in the lab at WHOI and stored for a minimum of 6 months before mass spectrometer analysis.

9. Dissolved Organic Matter and Bacterial Samples

PI: C. Carlson, University of California, Santa Barbara
Support: NSF
Cruise Participants: Anna James and Sheila Griffin, University of California, Santa Barbara

Project Goals.

The goal of the DOM project is to evaluate dissolved organic carbon (DOC) and total dissolved nitrogen (TDN) concentrations over along the P6 south Pacific line. During the P6 cruise, casts were specifically targeted in order to overlap with the chromophoric dissolved organic matter (CDOM) sampling.

Dissolved Organic Carbon and Total Dissolved Nitrogen (DOC/TDN)

DOC profiles were taken at approximately every other station (~1600 samples). Depending on the station depth, 12 - 36 Niskin bottles were sampled. DOC samples were passed through an inline filter holding a combusted GF/F filter attached directly to the Niskin for samples in the top 500 m of each cast. This was done to eliminated particles > than 0.7 μm from the sample. Samples from deeper depths were not filtered. Previous work has demonstrated that there is no resolvable difference between filtered and unfiltered sample in waters below the upper 200 m at the μmol/kg resolution. High density polyethylene 60 ml sample bottles were 10% HCl cleaned and Mili-Q water rinsed. Filters were combusted at 450°C for overnight. Filter holders were 10% HCl cleaned and Mili-Q water rinsed. Bottles were rinsed by sample 3 times before filling. 40-50 ml of water were taken for each sample. Samples were kept frozen at -20C in the ship's freezer. Frozen samples will be shipped back by express shipping to UC Santa Barbara for analysis. All samples will be analyzed via the high temperature combustion technique on a Shimadzu TOC-V analyzer. DOC analyses are expected to be complete within approximately 12 months of their return to the laboratory. TDN samples will be analyzed for the surface 200 m from the same DOC sample bottle.

Bacterial Abundance via Flow Cytometry

Concurrently we collected samples for bacterial abundance to compare the distribution to that of CDOM and DOC. We collected 1 profile per day, up to 22 samples, 15 ml per sample. They are prepped under fume hood, and stored in the ship's -80C freezer. Frozen samples will be shipped back by express shipping to UC Santa Barbara for analysis. Samples will be analyzed using a BD LSR.

[14]C-DIC Sampling was conducted for Ann McNichol's group from WHOI. [14]C samples were taken at ~ every 4 - 8 stations; deep and shallow profiles were interspersed along the transect. 16 stations were sampled in total. Bottles were cleaned at WHOI before the cruise. Samples were taken and sealed for storage according to the instructions provided by WHOI[1]. Samples will be shipped back to WHOI for [14]C

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(1) Measuring ^{14}C in seawater total CO2 will be performed by accelerator mass spectrometry, according to WHP Operation and Methods.

analyses. Samples were taken immediately following alkalinity samples. Some samples on casts # 146, 170, 176 did not overlap because I was not aware that alkalinity had ceased to sample full casts on even stations (every other sample overlaps at these stations.) Stations # 155 and 163 there were some processing issues and so not as many alkalinity samples were able to be taken as ^{14}C.

10. Radiocarbon in Dissolved Organic Matter
PI: Ellen R M. Druffel, University of California, Irvine
Support: NSF Chemical Oceanography
Cruise Participant P-6: Sheila Griffin, University of California, Irvine

Project Goal:

DOC Δ14C profile for the South Pacific. DOC Δ14C values will be measured to establish a better understanding of the timescale of DOC cycling in the ocean.

Activities on P-6:

Detailed profiles were collected at five stations along the cruise transit line. using 1-L amber boston round jars with Teflon lined caps. The jars have been cleaned with soap and water, soaked in 10% HCl and baked at 550°C for two hours. The caps were washed in soap and water and then flushed with 10% HCl, rinsed with DI water and air dried.

This work will increase the number of locations for which profiles of DOC Δ14C are available in the Pacific from 3 to 8 sites.

No processing of samples was done aboard ship. The samples are sent back to UCI frozen.

DOC Δ14C:

At UCI, bulk DOC will be oxidized using a high-energy (1200-W) ultra-violet Hg-arc light source (Williams and Druffel, 1987) modified for a 900ml volume and lower blank techniques (Beaupre et al., 2007).

Following production of CO_2, aliquots are taken for Δ14C and Δ13C analysis. CO_2 is converted to graphite using standard techniques (Southon et al., 2004). Δ14C measurements for all samples are reported as 14C in per mil (Stuiver and Polach, 1977) and are corrected for extraneous carbon introduced during processing (Griffin et al., 2009). The 14C analyses of all samples recovered from these procedures will be performed at the Keck Carbon Cycle AMS Laboratory at UCI.

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11. Isotopic Composition of Nitrate
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Tel.: (508) 999-8622
Samplers: Leg 1: Shenfu Dong
Leg 2: Liz Douglass

Summary:

A total of 1897 samples were taken at 80 stations between Brisbane and Valparaiso, in accordance with sampling strategy as described below. These samples are being shipped to WHOI for further analysis.

Purpose:

To measure the ∂15N and ∂18O of dissolved NO3-and possibly the ∂15N of DON

What was shipped:

15 grey plastic boxes with hinged lids, consecutively numbered. In each box, are ~130 x 125 ml bottles for a total of 1950 bottles. Each bottle has been pre-labeled with consecutive numbers and preloaded with dilute HCL as a preservative.

Sampling directions:

DO NOT RINSE BOTTLES. Simply fill to neck directly with water from Niskin and cap tightly, noting the bottle number and associate info in the log book. If possible, write station and cast number on the bottle. Samples are stored at room temperature, but better not to be left out on deck.

Sampling Strategy:

1) Generally the 24 shallowest depths should be sampled (down to 1500 to 2000m). However, 1/5 of the stations sampled for me should spread out the vertical spacing down to the bottom.

2) On the first leg (Brisbane to Tahiti), collect a total of 20 stations spread out along the transect or about 1 in 7 station occupations

3) On the second leg (Tahiti to Valparaiso), collect a total of 60 or more stations spread out along the transect or about 1 in 2 stations occupations. However try to reserve enough bottles to collect the last 5 stations before Valparaiso, Chile.

12. Graduate Student Experience at Sea

The National Science Foundation grant which supports the chief scientist's and co-chief scientist's participation also includes support for graduate students to participate at sea. At least two students work on the physical oceanography team on each cruise, and any savings from other program expenses are used to support up to two additional students, berths and other considerations allowing. Plus one graduate student is supported to work with the CFC group at sea. Five students participated on the P6 leg 2 cruise. Below are short statements from each describing their respective experiences and what they gained from them.

Andrew Bird, University of Rhode Island

I am currently doing a masters in ocean engineering and wanted a hands-on experience in the field, and it does not get much more hands on than a cruise like this. In my position as a CTD watch stander I was responsible for deployment and recovery of the CTD, sampling the Niskin bottles, and ensuring the continuity of the data by acting as a sample cop.

I believe this cruise has been extremely beneficial to my graduate career. It has not only helped me understand the science that goes on, but has allowed me to meet experts in the associated fields. Though the length of time at sea and the sometimes repetitive nature of the work can be tough at times, it pales in comparison to the fun and life experience that I gained. We had a fantastic group on board, everyone pulling together as a team and as a result everything went smoothly. This experience is something I would definitely recommend to others, as it allows you to see oceanography in action and allows you to be part of it.

Angie Pendergrass, University of Washington

The P6 cruise is my first sea-going experience. I spent the 34 days at sea talking to the winch operator, directing the CTD/rosette down to the depths of the ocean, bringing it back up, and yelling with a clipboard, while sneaking peaks of the beautiful blue ocean and the stratocumulus clouds on the console camera and taking breaks to sit outside as often as possible. I am a graduate student in an atmospheric sciences department, but I am an aspiring climate scientist, and the ocean is a non-negligible part of the climate system. This cruise has given me invaluable experiential knowledge and appreciation of the ocean. I've spent the last few years writing a lot of code in isolation, so going to sea has been my first opportunity to participate in observational science. I have seen how much hard work goes into measuring the climate system, and how much fun it is to work as part of a team (a great team, at that). I will take away from this cruise nearly a thousand pictures of water, clouds, and sun, and horizons broadened to include the indigo of the open ocean, 32 degrees 30 minutes south, new friends, and new ocean observing skills.

Hannah Traggis, University of New Hampshire

As a graduate student, I have been studying the effects of iron deficiency on the photosynthetic apparatus of oceanic phytoplankton. For a plant physiologist, opportunities to participate in ocean-going research expeditions are not that frequent. Participating in leg 2 of the P6 CLIVAR cruise has been pivotal in reaffirming my lifelong, if not circuitous, pursuit of oceanography. When the initial call for watch-stander participants was made known to me, I did not hesitate. This was a dream come true. Nearly five weeks at sea sounded like heaven and thoughts of Cousteau's adventurous worldwide explorations filled my head, Oceanography - pure and realized! The email came, "a berth awaits". The only possible answer was "yes!" A long and weary flight brought me from Boston to Tahiti for the start of a new year - symbolic irony at its best. Chomping at the bit, we boarded the R/V Melville January 4th and were soon underway. At sea, at last!

From the very beginning and initial meetings, there was an exciting synergy amongst all present and boded well for the big push we had ahead; 34 days for sampling, 123 stations, ~32nm apart and nearly 4000nm of open South Pacific Ocean. The 4-day transit from Papeete to our first station on the 32.3 S latitude line was spent in preparation for the duties ahead and we were all excited and ready. My shift as a student CTD watch-stander, shared with Sam Wilson, was midnight to noon and as a "night-person", this suited me fine. We soon developed a comfortable routine, supporting each other, keeping spirits high and samples flying. We learned that life at sea, in general, and all aspects of data collection, specifically, necessitates close attention to detail and a willingness to take initiative, jumping in to help whoever is in need of an extra hand. I found the entire experience exhilarating, my past dream of pursuing a PhD in Biological oceanography now a concrete goal.

Sam Wilson, UCLA

I am a recent graduate from UCLA with a degree in Math/Atmospheric and Oceanic Sciences. In order to postpone any real world obligations while gaining real world experience in my desired field of Oceanography, I jumped at the opportunity to be a CTD Watchstander onboard the R/V

Melville during CLIVAR P6, Leg 2. I arrived in Tahiti on New Year's, 2010, wide-eyed and excited for the adventure that was before me.

After the first few awkward days of adjusting to life at sea and becoming acquainted with the console, I realized both the simplicity and importance of my job. As console operators, we control when the CTD goes into the water, converse with the winch operators regarding package speeds and depths , remotely trip Niskin Bottles on the up-cast of the package, and command samplers during the Rosette Dance. It was soon understood that not only was it important to complete these tasks, we needed to complete these tasks quickly; a five or ten minute loss on each cast could mean entire days when compounded. As a team, the console operators performed admirably and had cast times comparable and even quicker than CLIVAR averages; we destroyed Leg 1 cast times.

I have gained an immense amount of experience and learned many things about myself and the field of observational oceanography. One of the greatest accomplishments I will take away from this cruise is the fact that I spent a full 36 days on a boat. I was able to eat, work, read, write, and play on a boat enough to keep myself entertained, all without getting seasick or going insane. I learned how to sample from Niskin Bottles, interpret water column profiles, and run taglines while deploying and recovering. I learned to use lifejackets to tilt my bunk to prevent rolling with the ship. I learned that research vessels are fully stocked with provisions enough to satiate even my hunger. I was able to make some great friends in the field of Marine Sciences who I will travel around Chile with and keep in contact with later. Most of all, however, I reaffirmed that I love the ocean and have picked the correct field for me.

13. Acknowledgements of Interagency cooperation and support

The U. S. Global Ocean Carbon and Repeat Hydrography Program (also known as the U. S. CLIVAR/CO2 Repeat Hydrography Program) has benefited from interagency, multi- institutional, and cross-disciplinary collaboration from its inception. A tradition of close cooperation between NSF and NOAA funded partners was particularly strong for the long 2-leg occupation of the P6 section. Overall, the principal investigators and scientific party included representatives from 10 different U. S. institutions We are grateful to NSF and NOAA and program managers for the support, advice and encouragement which continues to make this program a success. We acknowledge the support of Servicio Hidrografico y Oceanografico de la Armada in granting clearance to work in Chilean waters on the eastern end of this section. We greatly appreciate the efforts and professionalism of Captain Wesley Hill and the officers and crew of R/V Melville in facilitating the science objectives of this cruise.

Officers and Crew of R/V Melville

Name	Position
Wesley Hill	Captain
Dave Seltzer	Chief Engineer
Ian Lawrence	1st Mate
Michelle Jackson	2nd Mate
Chris Sheridan	3rd Mate
Eliza Mack	1st A/E
Sabrina Tarraboletti	2nd A/E
Laura Anderson	3rd A/E
Bob Seeley	1st Cook
Richard Buck	2nd Cook
Dave Grimes	Boatswain
John Boing	Electrician
Cletus Finell	A/B
Sandor Vinkovits	A/B
Edmund Warren	A/B
Will Brown	Oiler
Phil Hogan	Oiler
Joe Ramos	Oiler
Pam St. Amand	Oiler
Rolando Yco	Wiper
Jeanne Fleming	OS

Appendix A

CLIVAR P06E: Bottle Quality Comments

Comments from the Sample Logs and the results of STS/ODF's data investigations are included in this report. Units stated in these comments are degrees Celsius for temperature, Unless otherwise noted, milliliters per liter for oxygen and micromoles per liter for Silicate, Nitrate, Nitrite, and Phosphate. The sample number is the cast number times 100 plus the bottle number. 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 re-reading of charts (i.e. nutrients).

Station /Cast	Sample No.	Quality Property	Code	Comment
128/1	105	o2	4	Oxygen appears high. No analytical problems noted, suspect drawing error. Other data are acceptable. Code oxygen bad.
128/1	106	salt	2	Salinity slightly high compared with CTD and adjoining stations, within accuracy of the measurement. Salinity, oxygen and nutrients are acceptable.
128/1	111	o2	4	Oxygen appears high. No analytical problems noted, suspect drawing error. Other data are acceptable. Code oxygen bad.
128/1	116	o2	3	O2 low, 0.02. Analyst: "Rechecked endpoints, okay." Suspect drawing error, code oxygen questionable, salinity and nutrients are acceptable.
128/1	124	salt	2	Salinity thimble came out with cap. Salinity as well as other data agree with adjoining stations and CTD. Salinity as well as other data are acceptable.
128/1	126	salt	4	Bottle salinity is low compared with CTD and adjoining stations. No analytical problem noted, could have been drawn from bottle 24. Other data are acceptable. Code salinity bad.
128/1	135	o2	2	Oxygen stopper broke, sample still good but had glass in sample. Oxygen as well as salinity and nutrients are acceptable.
129/1	104	salt	2	Salinity slightly high compared with adjoining stations and CTD. No analytical problems noted. Salinity as well as oxygen and nutrients are acceptable.
129/1	109	salt	2	3 attempts for a good salinity reading. Thimble came out with cap. Operator error, only 2 readings taken. Classic contamination signs. Salinity as well as oxygen and nutrients are acceptable.
129/1	111	salt	2	Salinity thimble came out with cap. Salinity as well as oxygen and nutrients are acceptable.
129/1	119	o2	2	Oxygen was drawn from bottle 18 instead of 19, 20 was drawn from 19 and appears acceptable.
129/1	120	o2	5	Oxygen was drawn from bottle 19 instead of 20. Oxygen sample lost. Speck of dirt or something swirling in sample, causing erratic graph. Oxygen as well as salinity and nutrients are acceptable. CTDO not reported since there is no bottle oxygen.
129/1	121	salt	2	Salinity thimble came out with cap. Salinity as well as oxygen and nutrients are acceptable.
129/1	123	salt	2	Salinity thimble came out with cap. Salinity as well as oxygen and nutrients are acceptable.
129/1	127	bottle	2	Top vent not closed. Oxygen as well as salinity and nutrients are acceptable.
129/1	128	CTDT1	3	CTDT1 unstable primary temperature reading vs. CTDT2/SBE35T, code questionable.

Station /Cast	Sample No.	Quality Property	Code	Comment
129/1	128	salt	2	3 attempts for a good salinity reading. Salinity as well as oxygen and nutrients are acceptable.
129/1	130	salt	2	3 attempts for a good salinity reading. Salinity as well as oxygen and nutrients are acceptable.
129/1	133	o2	2	Oxygen redrawn. Oxygen as well as salinity and nutrients are acceptable.
129/1	134	o2	2	Oxygen redrawn. Oxygen as well as salinity and nutrients are acceptable.
129/1	135	o2	2	Oxygen redrawn. Oxygen as well as salinity and nutrients are acceptable.
129/1	136	salt	2	3 attempts for a good salinity reading. Salinity as well as oxygen and nutrients are acceptable.
130/1	101	bottle	2	Ran out of water before salinity could be drawn. Oxygen appears a little high, nutrients are acceptable. Could have been that samplers were not conservative, should have had ~3 liters of water remaining.
130/1	105	o2	4	Oxygen appears high compared with CTD and adjoining stations. Code oxygen questionable. Analyst: "Noisy end point, code sample bad."
130/1	105	salt	2	Had to flush salinometer cell multiple times on second reading due to trapped air bubbles. Salinity as well as nutrients are acceptable.
130/1	106	no3	3	Nitrate high compared to profile and adjoining stations. Phosphate is low. No corresponding feature in other nutrient or oxygen. No analytical errors noted. SiO3 agrees with Station 129. Code NO3 questionable, salinity, oxygen and SiO3 acceptable.
130/1	106	po4	3	Phosphate low compared to profile and adjoining stations. No corresponding feature in other nutrient or oxygen. No analytical errors noted. Code PO4 questionable, salinity, oxygen and SiO3 acceptable.
130/1	112	salt	2	Multiple flush attempts due to trapped air bubbles in salinometer cell. Salinity as well as oxygen and nutrients are acceptable.
130/1	113	o2	4	Oxygen appears high compared with CTD and adjoining stations. Code oxygen bad. Analyst: "Noisy end point curve, code bad."
130/1	116	o2	2	Oxygen had an operator error and recovery. Oxygen as well as salinity and nutrients are acceptable.
131/1	105	salt	2	Salinity bottle rim chip - bad sampling technique. Seal compromised; bottle discarded. Salinity as well as oxygen and nutrients are acceptable.
131/1	107	o2	3	Oxygen is high compared with CTD and adjoining stations. No analytical problems noted, suspect sampling error. Code oxygen questionable, salinity and nutrients are acceptable. Analyst: "Good endpoint. No analytical errors found, suspect sampling error. Code oxygen questionable." PN: after new CTDO fit, this sample agrees with the CTD.
131/1	109	o2	3	Oxygen is high compared with CTD and adjoining stations. No analytical problems noted, suspect sampling error. Code oxygen questionable, salinity and nutrients are acceptable.
131/1	110	o2	3	Oxygen is high compared with CTD and adjoining stations. No analytical problems noted, suspect sampling error. Code oxygen questionable, salinity and nutrients are acceptable.
131/1	111	o2	3	Oxygen is high compared with CTD and adjoining stations. No analytical problems noted, suspect sampling error. Code oxygen questionable, salinity and nutrients are acceptable.
131/1	112	o2	3	Oxygen is slightly low compared with CTD and adjoining stations. No analytical problems noted, suspect pickling error. Code oxygen questionable, salinity and nutrients are acceptable.
131/1	127	no2	5	
131/1	127	no3	5	Nutrient computer hung-up, sample was subsequently lost.
131/1	127	po4	5	

Station /Cast	Sample No.	Quality Property	Code	Comment
131/1	127	sio3	5	
131/1	129	salt	2	Bottle salinity is low compared with CTD and slightly low compared with adjoining stations. Bottle flushing problem, water entrained from lower in water column. Salinity as well as oxygen and nutrients are acceptable.
131/1	130	no2	5	
131/1	130	no3	5	Nutrient sample was spilled, therefore, there was not enough water for rerun.
131/1	130	po4	5	
131/1	130	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
131/1	130	sio3	5	
131/1	131	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
131/1	135	CTDT2	3	CTDT2 unstable secondary temperature reading vs. CTDT1/SBE35T, code questionable.
132/1	101	salt	2	(1-36) Salinometer standardized to low temp std, std dial set inconsistently with adjacent runs. Correction made for std dial. DP: "Salinity high compared with CTD and adjoining station profiles. Within the accuracy of the measurement, but obviously offset. Suspect that standard seawater was not equilibrated to salinometer bath temperature. Adjusted bottle salinity data."
132/1	104	o2	2	Sample was overtitrated and backtitrated. Oxygen as well as salinity and nutrients are acceptable.
132/1	112	o2	4	Oxygen low compared with CTD. Code oxygen questionable. Analyst: "Fixed endpoint. Data still looks questionable. Suspect sampling error. Code oxygen bad."
132/1	114	o2	2	Oxygen flask broken during sampling, replaced 1451 with 1753.
132/1	121	salt	2	Salinity thimble came out with cap. Salinity as well as oxygen and nutrients are acceptable.
132/1	129	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
132/1	131	salt	2	Bottle salinity is low compared with CTD and adjoining stations. Suspect entrained water and bottle was not flushed properly. Salinity as well as oxygen and nutrients are acceptable.
132/1	136	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
133/1	101	o2	3	Oxygen ˜0.03ml/l high compared with adjoining stations. No analytical problems noted, suspect sampling error. Code oxygen questionable, salinity and nutrients are acceptable.
133/1	105	o2	3	Oxygen high compared with CTD and adjoining stations. Code oxygen questionable, salinity and nutrients acceptable.
133/1	110	o2	3	Oxygen low compared with CTD and adjoining stations. Draw temperature also appears slightly low. Code oxygen questionable, salinity and nutrients acceptable.
133/1	111	o2	2	Oxygen high compared with CTD. Analyst: "Good endpoint. No analytical errors found." Suspect data reviewed before CTDO was fit, agrees with adjoining stations.
133/1	112	o2	2	Oxygen high compared with CTD. Analyst: "Good endpoint. No analytical errors found." Suspect data reviewed before CTDO was fit, agrees with adjoining stations.
133/1	120	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
133/1	124	salt	2	Salinity cap came off with lid. Salinity, oxygen and nutrients are acceptable.
133/1	126	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
133/1	129	salt	2	Salinity cap came off with lid before wiping. Salinity, oxygen and nutrients are acceptable.
133/1	135	CTDT2	3	CTDT2 gives an unstable reading vs. CTDT1. Appears all three temperature readings had a problem. Code CTDT2 questionable.

Station /Cast	Sample No.	Quality Property	Code	Comment
133/1	135	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
134/1	101	o2	2	Oxygen appears low compared with station profile, agrees with CTD. Oxygen as well as salinity and nutrients are acceptable.
134/1	101	salt	2	Salinity slightly high compared with CTD. Within the accuracy of the measurement. Salinity as well as oxygen and nutrients are acceptable.
134/1	111	o2	3	Oxygen appears high, ˜0.02, compared with CTD and silicate profile. Code oxygen questionable, salinity and nutrients are acceptable.
134/1	113	o2	3	Oxygen appears high, ˜0.02, compared with CTD and silicate profile. Code oxygen questionable, salinity and nutrients are acceptable.
134/1	119	salt	2	4 attempts for a good salinity reading. Thimble came off with cap - classic contamination reading pattern. Salinity as well as oxygen and nutrients are acceptable.
134/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
134/1	135	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
135/1	101	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
135/1	124	CTDT1	3	CTDT1 unstable primary temperature reading vs. CTDT2/SBE35T, code questionable.
135/1	129	bottle	2	Bottle was mistakenly tripped as the package was moving. NO3 and PO4 slightly low, salinity and oxygen are acceptable
135/1	129	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
135/1	135	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
136/1	101	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 5 attempts for a good salinity reading. Used the first reading, but that did not completely resolve the salinity issue. Suspect the salinometer was have problems, within the accuracy of the measurement. Salinity as well as oxygen and nutrients are acceptable.
136/1	102	salt	3	Bottle salinity is low compared with CTD and adjoining stations. No analytical problems noted, had problems with the first sample stabilizing. Code salinity questionable, oxygen and nutrients are acceptable.
136/1	105	salt	4	4 attempts for a good salinity reading. The first reading did not resolve the disagreement with adjoining station and CTD comparison. Code salinity bad, oxygen and nutrients are acceptable.
136/1	109	salt	2	3 attempts for a good salinity reading. Salinity as well as oxygen and nutrients are acceptable.
136/1	112	salt	2	3 attempts for a good salinity reading. Salinity as well as oxygen and nutrients are acceptable.
136/1	117	o2	2	Changed O2 thermometer.
136/1	122	salt	2	3 attempts for a good salinity reading. Salinity as well as oxygen and nutrients are acceptable.
136/1	126	CTDT1	3	CTDT1 unstable primary temperature reading vs. CTDT2/SBE35T, code questionable.
136/1	129	no3	2	Nutrients all low compared to profile and adjoining stations. Corresponding feature in o2 profile. Salinity agrees with CTD. Nutrients as well as salinity and oxygen are acceptable.
136/1	134	CTDT2	3	CTDT2 unstable primary temperature reading vs. CTDT1/SBE35T, code questionable.
136/1	135	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
137/1	105	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. Cap came off with lid before wiping; visible salt crystals. Used first reading resulting in good agreement with adjoining stations and CTD. Salinity as well as oxygen and nutrients are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
137/1	108	salt	2	Salinity cap came off with lid before wiping. Salinity as well as oxygen and nutrients are acceptable.
137/1	118	salt	2	Multiple salinity flush attempts due to 'sticky' air bubbles. Salinity as well as oxygen and nutrients are acceptable.
137/1	126	salt	2	3 attempts for a good salinity reading. Significant oscillations in second to last decimal place; unknown cause. Additional readings do not resolve CTD difference. Gradient area, bottle may not have been flushed well enough. Salinity as well as oxygen and nutrients are acceptable.
137/1	128	salt	2	3 attempts for a good salinity reading. Salinity as well as oxygen and nutrients are acceptable.
137/1	135	salt	2	3 attempts for a good salinity reading. Significant oscillations; unknown cause. Salinity as well as oxygen and nutrients are acceptable.
138/1	104	o2	2	Oxygen flask broken, 1183, replaced with next flask in box and 1710 retrieved from the lab for bottle 7. Oxygen as well as salinity and nutrients are acceptable.
138/1	108	salt	4	Bottle salinity is low compared with CTD and adjoining stations. Suspect the sample was run too quickly. Code bottle salinity bad, oxygen and nutrients are acceptable.
138/1	128	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
138/1	129	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
138/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
138/1	135	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
138/1	136	bottle	2	Bottle out of water for POC, salinity and D14_no3 sampling, should have been 3 liters of water left even with duplicate surface sampling. O2 does appear slightly high, but acceptable. Suspect samplers were not frugal with the water.
139/2	204	o2	5	Forgot stirrer bar in oxygen flask; sample lost. CTDO not reported since there is no bottle oxygen.
139/2	211	salt	2	Salinity bottles out of order in box, 11, 12, 10. Analyst assigned the numbers that were on the bottle and per the Sample Log sheet, appears to be the correct order as analyzed. Salinity as well as oxygen and nutrients are acceptable.
139/2	212	salt	2	Bottle salinity is high compared with CTD and adjoining stations. No analytical problems noted, other than bottles switched in box. Salinity difference is just outside of the accuracy of the measurement. Code salinity questionable, oxygen and nutrients are acceptable.
139/2	220	salt	4	Bottle salinity is high compared with CTD and adjoining stations. Salinity could have been mis-drawn from bottle 19. Code salinity bad, oxygen and nutrients are acceptable.
139/2	221	salt	2	Salinity cap came off with lid before wiping. Salinity as well as oxygen and nutrients are acceptable.
139/2	224	salt	2	Salinity cap came off with lid before wiping. Salinity as well as oxygen and nutrients are acceptable.
139/2	227	CTDT1	3	CTDT1 unstable reading vs. SBE35RT/CTDT2, code questionable.
139/2	229	salt	2	3 attempts for a good salinity reading. Salinity as well as oxygen and nutrients are acceptable.
139/2	232	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
139/2	232	salt	2	Bottle salinity is high compared with CTD. CTD measuring water from deeper in the water column, could be bottle not flushed properly. Salinity as well as oxygen and nutrients are acceptable.
139/2	234	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.

Station /Cast	Sample No.	Quality Property	Code	Comment
139/2	236	bottle	2	Bottle out of water for BACT, salinity and D14_no3 sampling, duplicate surface sampling. Suspect samplers were not frugal with the water.
140/1	105	salt	2	Salinity bottle cap came off with lid before wiping. Salinity as well as oxygen and nutrients are acceptable.
140/1	106	salt	4	Bottle salinity is high compared with CTD and adjoining stations. Salinity appears to have been drawn from bottle 5. Code salinity bad, oxygen and nutrients are acceptable.
140/1	107	po4	2	PO4 low, ˜0.02. Feature not seen in other nutrients, salinity or oxygen. Analyst: "No analytical errors." Within accuracy of the measurement, nutrients, salinity and oxygen are acceptable.
140/1	107	salt	2	3 attempts for a good salinity reading. Excessive flushes on salinometer to clear air bubbles. Salinity as well as oxygen and nutrients are acceptable.
140/1	124	salt	2	Salinity bottle very dirty cap; replaced for next use. Salinity as well as oxygen and nutrients are acceptable.
140/1	126	salt	2	4 attempts for a good salinity reading. Salinity cap came off with lid before wiping. Salinity as well as oxygen and nutrients are acceptable.
140/1	128	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
140/1	128	salt	2	Bottle salinity is high compared with CTD. Gradient, salinity as well as oxygen and nutrients are acceptable.
140/1	129	salt	2	3 attempts for a good salinity reading. Gradient, salinity as well as oxygen and nutrients are acceptable.
140/1	130	salt	2	4 attempts for a good salinity reading. Gradient, salinity as well as oxygen and nutrients are acceptable.
141/1	111	o2	2	Oxygen appears high compared with CTD and adjoining stations. No analytical problems noted. Salinity and nutrients are acceptable. RC: "Oxygen is acceptable."
141/1	119	o2	2	Sample cop did not hear O2 draw temp, "guesstimated." Oxygen temperature looks reasonable. Oxygen as well as salinity and nutrients are acceptable.
141/1	124	salt	2	3 attempts for a good salinity reading. Thimble popped out same time as cap. First reading used for calculation of salinity. Salinity as well as oxygen and nutrients are acceptable.
141/1	128	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
141/1	132	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
141/1	135	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
142/1	109	salt	2	Bottle salinity is high compared with CTD. No analytical problems noted, although this run is a little noisy, within accuracy of the measurement. Salinity as well as oxygen and nutrients are acceptable.
142/1	116	salt	2	Bottle salinity is high compared with CTD and adjoining stations. Used first salinity reading to resolve salinity difference with CTD and adjoining stations. Salinity as well as oxygen and nutrients are acceptable.
142/1	119	salt	2	Salinity bottle thimble came out with cap. Salinity as well as oxygen and nutrients are acceptable.
142/1	130	o2	5	Oxygen flask, 1630, broken during double shake, sample lost.
143/1	120	bottle	4	Bottle mis-tripped, code bottle leaking and samples bad.
143/1	120	no2	4	Nutrients all high compared to profile and adjoining stations. Corresponding feature in o2 profile. Possible mis-trip?
143/1	120	no3	4	
143/1	120	o2	4	
143/1	120	po4	4	

Station /Cast	Sample No.	Quality Property	Code	Comment
143/1	120	salt	4	Bottle salinity is high compared with CTD and adjoining stations. Bottle mis-tripped. Code salinity bad, bottle did not trip as scheduled and samples bad.
143/1	120	sio3	4	
143/1	121	salt	2	3 attempts for a good salinity reading. Cap came off with lid before wiping. First reading gave better agreement with CTD and adjoining bottles. Salinity as well as oxygen and nutrients are acceptable.
143/1	123	salt	2	Salinity cap came off with lid before wiping. Salinity as well as oxygen and nutrients are acceptable.
143/1	124	salt	2	Salinity cap came off with lid before wiping. Salinity as well as oxygen and nutrients are acceptable.
143/1	126	salt	2	Salinity cap came off with lid before wiping. Salinity as well as oxygen and nutrients are acceptable.
144/1	104	salt	2	Bottle salinity is high compared with CTD and adjoining stations. No analytical problems noted, within the accuracy of the measurement, 0.001. Salinity as well as oxygen and nutrients are acceptable.
144/1	107	salt	2	Bottle salinity is high compared with CTD and adjoining stations. No analytical problems noted, within the accuracy of the measurement. Salinity as well as oxygen and nutrients are acceptable.
144/1	109	no3	2	NO3 low, ~0.2. Analyst: "Peak reread, fixed and uploaded new file.
144/1	112	o2	2	Oxygen low compared with adjoining stations, gradient, could be bottle flushing issue. Oxygen as well as salinity and nutrients are acceptable.
144/1	113	bottle	3	Leaking from spigot, vent is too loose. Oxygen and nutrients were not drawn. Salinity and D15N_NO3 were drawn. Salinity is acceptable.
144/1	119	salt	2	Salinity cap came off with lid before wiping. Salinity as well as oxygen and nutrients are acceptable.
144/1	130	o2	5	Oxygen flask, 1630, broken during double shake, sample lost. CTDO not reported since there is no bottle oxygen.
144/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
145/1	104	o2	3	Oxygen high compared with CTD. Analyst: "Good endpoint. No analytical errors found. Suspect sampling error, code oxygen questionable."
145/1	107	salt	2	Salinity thimble popped out with cap. Salinity as well as oxygen and nutrients are acceptable.
145/1	114	salt	2	Salinity thimble popped out before bottle neck was cleaned. Salinity as well as oxygen and nutrients are acceptable.
145/1	116	salt	2	4 attempts for a good salinity reading. Salinity thimble came out with cap-classic contamination readings. Salinity as well as oxygen and nutrients are acceptable.
145/1	123	salt	2	Salinity thimble came out with cap. Salinity as well as oxygen and nutrients are acceptable.
145/1	124	salt	2	4 attempts for a good salinity reading. Salinity thimble came out with cap-classic contamination readings. Salinity as well as oxygen and nutrients are acceptable.
145/1	128	salt	2	3 attempts for a good salinity reading. Gradient area, salinity as well as oxygen and nutrients are acceptable.
145/1	132	salt	2	Bottle salinity is low compared with CTD. Probably difference between bottle sampling and CTD, 1 meter, low salinity feature seen. Salinity as well as oxygen and nutrients are acceptable.
145/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
146/2	201	no3	2	NO3 high, ~0.3. Analyst: "No analytical errors noted."

Station /Cast	Sample No.	Quality Property	Code	Comment
146/2	201	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. First reading gives better agreement with CTD. Entire cast is high, most are within accuracy of the measurement. Salinity as well as oxygen and nutrients are acceptable.
146/2	202	salt	2	3 attempts for a good salinity reading. Salinity as well as oxygen and nutrients are acceptable.
146/2	203	salt	2	Bottle salinity is high compared with CTD and adjoining stations. Salinity is within accuracy of the measurement, oxygen and nutrients are acceptable.
146/2	204	salt	4	Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. Additional readings did not resolve salinity difference. Code salinity bad, oxygen and nutrients are acceptable.
146/2	209	salt	4	Bottle salinity is high compared with CTD and adjoining stations. Entire cast is high. Code salinity bad, oxygen and nutrients acceptable.
146/2	221	salt	2	4 attempts for a good salinity reading. Additional readings did not resolve salinity difference with CTD, within accuracy of measurement. Salinity, oxygen and nutrients are acceptable.
146/2	224	salt	2	4 attempts for a good salinity reading. First reading give better agreement with CTD and adjoining stations. Entire cast is high, most are within accuracy of the measurement. Salinity, oxygen and nutrients are acceptable.
146/2	226	CTDT2	3	CTDT2 unstable reading vs. CTDT1/SBE35RT, code questionable.
146/2	230	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
146/2	234	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
147/1	103	salt	2	3 attempts for a good salinity reading. First reading gave better agreement with CTD and adjoining stations. Salinity as well as oxygen and nutrients are acceptable.
147/1	105	salt	2	Salinity cap came off with lid before wiping. Salinity as well as oxygen and nutrients are acceptable.
147/1	112	salt	2	3 attempts for a good salinity reading. Salinity as well as oxygen and nutrients are acceptable.
147/1	113	salt	2	3 attempts for a good salinity reading. Salinity as well as oxygen and nutrients are acceptable.
147/1	114	salt	2	3 attempts for a good salinity reading. Salinity as well as oxygen and nutrients are acceptable.
147/1	115	salt	2	Salinity cap came off with lid before wiping. Significant oscillations in second to last decimal place for majority of bottles. Unknown cause. Salinity as well as oxygen and nutrients are acceptable.
147/1	118	salt	2	Salinity bottle improperly sealed by sampler. Salinity is a little high, within the accuracy of the measurement. Salinity as well as oxygen and nutrients are acceptable.
147/1	119	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 6 attempts for a good salinity reading. Lid came off with cap before wiping. First reading resolved salinity discrepancy. Salinity as well as oxygen and nutrients are acceptable.
147/1	121	salt	2	3 attempts for a good salinity reading. First reading gave better agreement with CTD and adjoining stations. Salinity as well as oxygen and nutrients are acceptable.
147/1	122	salt	2	4 attempts for a good salinity reading. First reading gave better agreement with CTD and adjoining stations. Salinity as well as oxygen and nutrients are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
147/1	124	salt	2	3 attempts for a good salinity reading. First reading gave better agreement with CTD and adjoining stations. Salinity as well as oxygen and nutrients are acceptable.
147/1	132	CTDT2	3	CTDT2 unstable secondary temperature reading vs. CTDT1/SBE35T, code questionable.
147/1	135	CTDT2	3	CTDT2 unstable secondary temperature reading vs. CTDT1/SBE35T, code questionable.
148/1	105	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 5 attempts for a good salinity reading. First reading resolved salinity difference. Salinity as well as oxygen and nutrients are acceptable.
148/1	107	salt	4	Bottle salinity is high compared with CTD and adjoining stations. Cap came off with lid before wiping. 3 attempts for a good salinity reading. Code salinity bad; oxygen and nutrients are acceptable.
148/1	110	salt	2	Bottle salinity is high compared with CTD and adjoining stations. Excessive flushes needed to clear air bubbles throughout sample analysis. 4 attempts for a good salinity reading. First reading resolved salinity difference. Salinity as well as oxygen and nutrients are acceptable.
148/1	113	o2	2	Check oxygen data. Oxygen as well as salinity and nutrients are acceptable.
148/1	127	CTDT1	3	CTDT1 unstable reading vs. CTDT2/SBE35RT, code questionable.
148/1	128	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
148/1	128	salt	2	Salinity cap came off with lid before wiping. Salinity as well as oxygen and nutrients are acceptable.
148/1	130	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
148/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
149/1	101	salt	2	Bottle salinity is high compared with CTD and adjoining stations. Within accuracy of measurement, 0.001. Salinity, oxygen and nutrients are acceptable.
149/1	103	bottle	9	At the end of the cast, found that the spigot was no longer on the bottle. No samples drawn.
149/1	104	po4	2	PO4 low 0.02 compared with adjoining stations, looks okay on Redfield ratio plot. Corresponding feature in oxygen and salinity. Analyst: "No analytical errors noted." Within accuracy of the measurement, nutrients as well as salinity and oxygen are acceptable.
149/1	104	salt	2	Bottle salinity is high compared with CTD and adjoining stations. Within accuracy of measurement, 0.001. Salinity, oxygen and nutrients are acceptable.
149/1	107	salt	4	Bottle salinity is low compared with CTD and adjoining stations. Appears that salinity was run too fast, not enough flushing time between previous sample and this sample. Code salinity bad.
149/1	109	salt	2	Salinity thimble came out with cap. Salinity as well as oxygen and nutrients are acceptable.
149/1	111	salt	4	Salinity thimble popped out as cap was removed. Salinity is high compared with the CTD and adjoining stations, appears there was some contamination. Within the accuracy of the measurement, and ˜0.001 high. Code salinity bad, oxygen and nutrients are acceptable.
149/1	121	salt	2	Salinity thimble popped out before bottle neck was wiped. Salinity is a little high, but within the accuracy of the measurement.
149/1	124	salt	2	3 attempts for a good salinity reading. Salinity thimble popped out with cap.First reading resolved salinity difference. Salinity as well as oxygen and nutrients are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
149/1	126	CTDT1	3	CTDT1 unstable primary temperature reading vs. CTDT2/SBE35T, code questionable.
149/1	129	bottle	3	Lanyard hooked the bottle on recovery, bottle opened. Salinity, oxygen and nutrients were drawn. Gas samples other than oxygen were not drawn.
149/1	129	o2	4	Oxygen high compared with CTD, sample compromised when bottle opened. Code oxygen questionable, salinity and nutrients are acceptable.
149/1	130	o2	3	Oxygen low compared with CTD. Analyst: "Good endpoint. No analytical errors found. Suspect sampling error, code oxygen questionable."
149/1	133	o2	2	O2 high, 0.01. Analyst: "Rechecked endpoints, okay." Suspect drawing error, within accuracy of measurement, salinity and nutrients are acceptable.
149/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
150/1	101	salt	3	Bottle salinity is high compared with CTD and adjoining stations. Salinity sample may have been too low for water bath. Just outside of the accuracy of the measurement. Code salinity questionable, oxygen and nutrients are acceptable.
150/1	105	o2	5	Forgot to dispense acid into oxygen sample, sample lost. CTDO not reported since there is no bottle oxygen.
150/1	105	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. First reading resolved salinity difference. Salinity as well as nutrients are acceptable.
150/1	109	no2	4	Nutrient sample sat out for an extended period, computer hung-up. Code NO2 bad; salinity, oxygen and the rest of the nutrients are acceptable.
150/1	110	o2	4	Oxygen high compared with CTD. Analyst: "Good endpoint. Analyzed last due to stuck cap, should not have caused the problem, could be sample was spilled. Code oxygen bad."
150/1	113	salt	2	3 attempts for a good salinity reading. First reading resolved salinity difference. Salinity as well as oxygen and nutrients are acceptable.
150/1	130	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
150/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
150/1	135	CTDT1	3	CTDT1 unstable reading vs. CTDT2/SBE35RT, code questionable.
151/1	104	salt	2	Salinity slightly low compared with CTD and stations profile. Within accuracy of measurement. Salinity as well as oxygen and nutrients are acceptable.
151/1	107	salt	2	3 attempts for a good salinity reading. First reading resolved salinity difference. Salinity as well as oxygen and nutrients are acceptable.
151/1	129	salt	2	4 attempts for a good salinity reading. Salinity thimble came off with lid before wiping. First reading resolved salinity difference. Salinity as well as oxygen and nutrients are acceptable.
151/1	131	bottle	2	Missed target depth by 15m.
151/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
151/1	136	CTDOXY	3	CTD data noisy due to rough weather during deployment.
152/1	109	o2	3	Oxygen high compared with CTD. Analyst: "Good endpoint. No analytical errors found. Suspect sampling error, code oxygen questionable."
152/1	110	o2	4	Oxygen appears high compared with CTD and adjoining stations. Sample log tabulates 696 as the flask, oxygen file reports 1093. Tried switching the flask numbers in the data file which did not resolve the problem. Suspect flask 1093 was damaged on Station 150. Code oxygen bad, salinity and nutrients are acceptable.
152/1	118	salt	2	Bottle salinity is high compared with CTD and adjoining stations. New technique per advice in order to compensate for the temperature difference. 5 attempts for a good salinity reading. Second reading resolved salinity difference. Salinity as well as oxygen and nutrients are acceptable

Station /Cast	Sample No.	Quality Property	Code	Comment
152/1	126	bottle	2	Bottle was mistakenly tripped as the package was moving, on-the-fly. Salinity and nutrient are acceptable, oxygen is slightly high and acceptable.
152/1	126	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
152/1	128	o2	2	Oxygen appears high with adjoining stations and SiO3 station profile, agrees with CTDO. Analyst: "Checked oxygen endpoint, okay." Oxygen as well as nutrients are acceptable.
152/1	128	salt	4	3 attempts for a good salinity reading. First reading did not resolve salinity difference. Code salinity bad; oxygen and nutrients are acceptable
152/1	129	salt	2	3 attempts for a good salinity reading. Salinity thimble came out with cap before wiping. Salinity as well as oxygen and nutrients are acceptable.
152/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
153/2	212	o2	2	Oxygen flask broken, 1276, replaced with 1723.
153/2	219	salt	2	Salinity thimble popped out with cap. Salinity thimble popped out with cap. Salinity as well as oxygen and nutrients are acceptable.
153/2	234	salt	2	3 attempts for a good salinity reading. Salinity as well as oxygen and nutrients are acceptable.
154/1	105	salt	2	3 attempts for a good salinity reading. Salinity as well as oxygen and nutrients are acceptable.
154/1	107	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. Thimble came off with lid before wiping. First reading resolved salinity difference. Salinity as well as oxygen and nutrients are acceptable.
154/1	124	salt	2	3 attempts for a good salinity reading. Thimble came off with lid before wiping. First reading resolved salinity difference. Salinity as well as oxygen and nutrients are acceptable.
154/1	129	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
154/1	129	salt	2	Salinity thimble came off with cap before wiping. Salinity is a little high compared with CTD, within the accuracy of the measurement.
154/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
155/1	101	o2	4	Oxygen appears low compared with CTD and adjoining stations and high compared with SiO3. Code oxygen bad, salinity and nutrients are acceptable.
155/1	102	po4	4	PO4 high, ˜0.04, compared with adjoining stations. Analyst: " Unreadable peak, code bad." Code PO4 bad, salinity, oxygen and other nutrients are acceptable. Code PO4 bad, salinity, oxygen and nutrients are acceptable.
155/1	110	o2	4	Oxygen appears high compared with CTD and adjoining stations. Sample log reports 1093 as the flask as does the oxygen file. Removed this flask from service, suspect it was damaged on Station 150 as it has given high points last 3 times it was used. Code oxygen bad, salinity and nutrients are acceptable.
155/1	113	o2	3	Oxygen appears high compared with CTD and adjoining stations and compared with SiO3. Analyst: "Re-checked end point and looks good." There is a low feature in PO4 and NO3 not seen in SiO3. Code oxygen questionable, salinity and nutrients are acceptable.
155/1	121	salt	2	Salinity thimble came off with lid before wiping. Salinity, oxygen and nutrients are acceptable.
155/1	123	salt	4	Bottle salinity is low compared with CTD and adjoining stations. Appears to have been drawn from bottle 21. Code salinity bad; oxygen and nutrients are acceptable.
155/1	125	no2	4	Nutrient samples were mis-drawn from bottle 26. Oxygen does not show a "feature". Code nutrients bad, oxygen acceptable.
155/1	125	no3	4	

Station /Cast	Sample No.	Quality Property	Code	Comment
155/1	125	po4	4	
155/1	125	sio3	4	
155/1	126	salt	4	4 attempts for a good salinity reading. First two reading did not resolve salinity difference. Salinity improperly sealed by thimble; probable contamination. Salinity, oxygen and nutrients are acceptable. Code salinity questionable; oxygen and nutrients are acceptable.
155/1	128	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
155/1	129	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
155/1	133	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
155/1	133	salt	3	Bottle salinity is high compared with CTD and adjoining stations. No analytical problems noted. Code salinity questionable, oxygen and nutrients are acceptable.
155/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
156/1	105	salt	2	Salinity thimble popped out with cap. Salinity as well as oxygen and nutrients are acceptable.
156/1	112	po4	2	PO4 high, ~0.03. Analyst: "No analytical errors noted."
156/1	119	salt	2	4 attempts for a good salinity reading. Thimble came out with cap - classic contamination readings. First reading resolved salinity difference. First reading resolved salinity difference. Salinity as well as oxygen and nutrients are acceptable.
156/1	121	o2	2	Oxygen sample ran out of order, swapped with 26. Samples correctly annotated in the file. Oxygen as well as salinity and nutrients are acceptable.
156/1	126	o2	2	Oxygen sample ran out of order, swapped with 21. Samples correctly annotated in the file. Oxygen as well as salinity and nutrients are acceptable.
156/1	135	salt	2	Bottle salinity is low compared with CTD and adjoining stations. Waited the 30 seconds for bottle flushing. High salinity feature seen in CTD. Salinity as well as oxygen and nutrients are acceptable.
157/1	101	salt	4	Bottle salinity is high compared with CTD and adjoining stations. No analytical problem noted. Code salinity bad, oxygen and nutrients are acceptable.
157/1	108	salt	2	Salinity thimble came off with cap before wiping. Salinity as well as oxygen and nutrients are acceptable.
157/1	126	salt	2	Salinity thimble came off with cap before wiping. Salinity as well as oxygen and nutrients are acceptable.
157/1	129	bottle	4	Bottle did not trip as scheduled, mis-tripped. Suspect bottom lanyard was caught upon deployment. Code bottle did not trip as scheduled, all samples bad.
157/1	129	no2	4	
157/1	129	no3	4	
157/1	129	o2	4	Oxygen draw temperature probe replaced, temperature not taken on this bottle. Draw temp estimated from CTD temperature. Bottle mis-tripped and the analyst thought there was something wrong with the temperature probe. Code oxygen bad.
157/1	129	po4	4	
157/1	129	salt	4	Bottle salinity is low compared with CTD. Bottle did not trip as scheduled.
157/1	129	sio3	4	
158/1	101	salt	2	03 attempts for a good salinity reading. Salinity thimble came off with cap before wiping. First reading resolved the small salinity difference. Salinity as well as oxygen and nutrients are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
158/1	106	o2	2	Check oxygen endpoint. Checked & Fixed. Oxygen as well as salinity and nutrients are acceptable.
158/1	109	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
158/1	111	sio3	2	SiO3 low, ˜4, compared with adjoining stations. Looks okay when plotted vs. potential temperature. Analyst: "No analytical problems, data is acceptable."
158/1	116	salt	4	Salinity thimble came off with cap before wiping. Salinity is low compared with the CTD. Code salinity bad, oxygen and nutrients are acceptable.
158/1	118	o2	2	Noisy oxygen curve. Oxygen as well as salinity and nutrients are acceptable.
158/1	124	salt	2	Salinity thimble came off with cap before wiping. Salinity as well as oxygen and nutrients are acceptable.
158/1	128	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
158/1	129	CTDT1	3	CTDT1 unstable reading vs. CTDT2/SBE35RT, code questionable.
158/1	129	salt	4	Salinity thimble came off with cap before wiping. Salinity high compared with CTD. Code salinity bad, oxygen and nutrients are acceptable.
158/1	132	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
158/1	132	salt	2	Bottle salinity is low compared with CTD. No analytical problems noted. Lots of structure seen in the CTD trace, could be the bottle vs. CTD physical difference or bottles not flushed. Salinity as well as oxygen and nutrients are acceptable.
158/1	133	salt	2	Bottle salinity is low compared with CTD. No analytical problems noted. Lots of structure seen in the CTD trace, could be the bottle vs. CTD physical difference or bottles not flushed. Salinity as well as oxygen and nutrients are acceptable.
158/1	136	salt	2	Bottle salinity is high compared with CTD. Salinity as well as oxygen and nutrients are acceptable.
159/1	101	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
159/1	104	o2	3	O2 high, 0.02. Analyst: "Rechecked endpoints, okay." Suspect drawing error, code oxygen questionable, salinity and nutrients are acceptable.
159/1	107	o2	2	Check oxygen Endpoint. Checked & Fixed. Oxygen as well as salinity and nutrients are acceptable.
159/1	112	salt	2	3 attempts for a good salinity reading. First reading resolved the salinity difference. Salinity as well as oxygen and nutrients are acceptable.
159/1	121	o2	2	Noisy oxygen curve. Oxygen as well as salinity and nutrients are acceptable.
159/1	129	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
159/1	130	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
159/1	131	CTDT2	3	CTDT2 unstable reading vs. CTDT1/SBE35RT, code questionable.
159/1	131	salt	2	3 attempts for a good salinity reading. First reading resolved the salinity difference. Salinity as well as oxygen and nutrients are acceptable.
159/1	132	reft	3	
159/1	134	CTDT2	3	CTDT2 unstable reading vs. CTDT1/SBE35RT, code questionable.
159/1	135	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
160/1	112	o2	2	Oxygen low compared with adjoining stations and with SiO3 agrees with CTD. Stations 162, 163 also show this feature. Oxygen as well as salinity and nutrients are acceptable.
160/1	113	o2	2	Oxygen low compared with adjoining stations and with SiO3 agrees with CTD. Stations 162, 163 also show this feature. Oxygen as well as salinity and nutrients are acceptable.
160/1	114	bottle	2	Missed target depth by 15m.
160/1	115	salt	2	Salinity thimble popped out with cap. Salinity is slightly low, suspect salinity sample contamination. Code salinity bad, oxygen and nutrients are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
160/1	119	salt	4	Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. Salinity thimble came out with cap - large jump from first reading. First reading resolved some of the salinity difference, suspect salinity sample contamination. Code salinity bad, oxygen and nutrients are acceptable.
160/1	124	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
160/1	125	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
160/1	128	CTDT2	3	CTDT2 unstable secondary temperature reading vs. CTDT1/SBE35T, code questionable.
160/1	131	salt	2	Salinity bottle rim chip found seal compromised - poor sampling technique. Salinity is within accuracy of the measurement. Salinity as well as oxygen and nutrients are acceptable.
160/1	133	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
160/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
160/1	134	salt	2	Bottle salinity is high compared with CTD. 3 attempts for a good salinity reading. First reading resolved some of the salinity difference, gradient area. Salinity as well as oxygen and nutrients are acceptable.
161/1	118	salt	2	3 attempts for a good salinity reading.First reading resolved salinity discrepancy. Salinity as well as oxygen and nutrients are acceptable.
161/1	124	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
161/1	125	CTDT2	3	CTDT2 unstable secondary temperature reading vs. CTDT1/SBE35T, code questionable.
161/1	125	salt	2	6 attempts for a good salinity reading. Thimble came off before wiping. First reading resolved salinity discrepancy. Salinity as well as oxygen and nutrients are acceptable.
161/1	129	salt	2	Salinity thimble came off with cap before wiping. Salinity as well as oxygen and nutrients are acceptable.
161/1	133	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
161/1	133	salt	2	Bottle salinity is low compared with CTD and adjoining stations. CTD is a spiky to ˜100m. Salinity as well as oxygen and nutrients are acceptable.
161/1	134	salt	2	Bottle salinity is low compared with CTD and adjoining stations. CTD is a spiky to ˜100m. Salinity as well as oxygen and nutrients are acceptable.
161/1	135	salt	2	Bottle salinity is low compared with CTD. No analytical problems noted. CTD is a spiky to ˜100m. Salinity as well as oxygen and nutrients are acceptable.
161/1	136	bottle	4	Bottle tripped out of the water. Gas samples were not sampled. Code bottle did not trip as scheduled, salinity and nutrients acceptable.
162/1	105	salt	2	Salinity thimble came off with cap before wiping. Salinity as well as oxygen and nutrients are acceptable.
162/1	111	salt	2	3 attempts for a good salinity reading. Salinity as well as oxygen and nutrients are acceptable.
162/1	112	o2	2	Check oxygen endpoint. Checked & fixed. Oxygen as well as salinity and nutrients are acceptable.
162/1	121	salt	2	3 attempts for a good salinity reading. First reading resolved salinity difference. Salinity as well as oxygen and nutrients are acceptable.
162/1	126	salt	2	Salinity thimble came off with cap before wiping. Salinity as well as oxygen and nutrients are acceptable.
162/1	127	CTDT2	3	CTDT2 gives an unstable reading vs. CTDT1. Appears all three temperature readings had a problem. Code CTDT2 questionable.
162/1	127	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
162/1	132	bottle	2	Bottle 32 was mistakenly tripped with 31, operator error.

Station /Cast	Sample No.	Quality Property	Code	Comment
162/1	134	bottle	2	Bottle was mistakenly tripped at desired depth of 35 instead of 60, operator error.
162/1	135	bottle	2	Bottle was mistakenly tripped at the surface with bottle 36.
163/1	110	bottle	2	Vent left open. Oxygen, salinity and nutrients are acceptable.
163/1	116	salt	2	Salinity thimble came out with cap. Salinity, oxygen and nutrients are acceptable.
163/1	122	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
163/1	124	CTDT1	3	
163/1	124	CTDT2	3	CTDT2 unstable reading vs. CTDT1/SBE35RT, code questionable.
163/1	124	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
163/1	124	salt	2	Salinity thimble came out with cap. Salinity, oxygen and nutrients are acceptable.
163/1	128	sio3	5	Autoanalyzer error, SiO3 lost.
163/1	129	salt	2	4 attempts for a good salinity reading. Thimble popped out with cap -classic contamination readings. Salinity, oxygen and nutrients are acceptable.
163/1	129	sio3	5	Autoanalyzer error, SiO3 lost.
163/1	130	sio3	5	Autoanalyzer error, SiO3 lost.
163/1	131	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
163/1	131	sio3	5	Autoanalyzer error, SiO3 lost.
163/1	132	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
163/1	132	sio3	5	Autoanalyzer error, SiO3 lost.
163/1	133	sio3	5	Autoanalyzer error, SiO3 lost.
163/1	134	sio3	5	Autoanalyzer error, SiO3 lost.
163/1	135	sio3	5	Autoanalyzer error, SiO3 lost.
163/1	136	sio3	5	Autoanalyzer error, SiO3 lost.
164/1	101	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. First reading resolves salinity difference. Salinity, oxygen and nutrients are acceptable.
164/1	111	salt	2	3 attempts for a good salinity reading. First reading resolves salinity difference. Salinity, oxygen and nutrients are acceptable.
164/1	124	salt	2	3 attempts for a good salinity reading. Salinity, oxygen and nutrients are acceptable.
164/1	135	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
164/1	135	salt	2	Bottle salinity is low compared with CTD. No analytical problems noted, gradient. Salinity, oxygen and nutrients are acceptable.
165/2	201	salt	2	Bottle salinity is high compared with CTD and adjoining stations. Salinity was run a little fast between flushes, within accuracy of measurement. Salinity, oxygen and nutrients are acceptable.
165/2	202	salt	2	3 attempts for a good salinity reading. First reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.
165/2	205	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. First reading gave a better agreement with the CTD and adjoining stations, still a little high, within accuracy of the measurement. Salinity, oxygen and nutrients are acceptable.
165/2	227	CTDT2	3	CTDT2 unstable reading vs. CTDT1/SBE35RT, code questionable.
165/2	230	CTDT2	3	CTDT2 unstable reading vs. CTDT1/SBE35RT, code questionable.
165/2	236	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
166/1	101	o2	2	Strange oxygen endpoint. Oxygen, salinity and nutrients are acceptable.
166/1	103	salt	2	3 attempts for a good salinity reading. Salinity thimble came off with cap before wiping. Readings were averaged appropriately. Salinity, oxygen and nutrients are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
166/1	104	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
166/1	105	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
166/1	106	salt	2	3 attempts for a good salinity reading. Readings were averaged appropriately. Salinity, oxygen and nutrients are acceptable.
166/1	110	salt	2	3 attempts for a good salinity reading. Readings were averaged appropriately. Salinity, oxygen and nutrients are acceptable.
166/1	114	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
166/1	117	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
166/1	125	salt	2	3 attempts for a good salinity reading. Salinity thimble came off with cap before wiping. First reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.
166/1	132	salt	2	5 attempts for a good salinity reading. Thimble came off with cap before wiping. First reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.
166/1	134	salt	2	3 attempts for a good salinity reading. Thimble came off with cap before wiping. Readings were averaged appropriately. Salinity, oxygen and nutrients are acceptable.
167/1	104	o2	2	Oxygen appears high compared with adjoining station profiles. SiO3 relationship is acceptable. Oxygen, salinity and nutrients are acceptable.
167/1	105	o2	2	Oxygen appears high compared with adjoining station profiles. SiO3 relationship is acceptable. Oxygen, salinity and nutrients are acceptable.
167/1	106	o2	2	Oxygen appears high compared with adjoining station profiles. SiO3 relationship is acceptable. Oxygen, salinity and nutrients are acceptable.
167/1	108	salt	4	Bottle salinity is high compared with CTD and adjoining stations. Salinity thimble came out with cap. Readings very erratic. 4 attempts for a good salinity reading. First reading resulted in better agreement. Code salinity bad, oxygen and nutrients are acceptable.
167/1	118	bottle	4	Bottle did not trip as scheduled, mis-tripped. Suspect bottom lanyard was caught upon deployment. Code bottle did not trip as scheduled, all samples bad.
167/1	118	no2	4	
167/1	118	no3	4	
167/1	118	o2	4	Oxygen draw temperature appears reasonable, 0.2 higher than bottle below and above. Code oxygen bad, bottle did not trip as scheduled and all samples bad.
167/1	118	po4	4	
167/1	118	salt	4	Bottle salinity is low compared with CTD. Bottle did not trip as scheduled.
167/1	118	sio3	4	
167/1	126	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
167/1	126	salt	4	4 attempts for a good salinity reading. Salinity thimble came out with cap - classic contamination readings. First reading was used and other 3 readings would result in a higher salinity. Code salinity bad, oxygen and nutrients are acceptable.
167/1	133	salt	2	Bottle salinity is low compared with CTD. No analytical problems noted. Gradient, salinity, oxygen and nutrients are acceptable.
168/1	108	salt	2	Salinity thimble came out with cap. Salinity, oxygen and nutrients are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
168/1	109	o2	2	Check oxygen endpoint. Checked & fixed. Oxygen, salinity and nutrients are acceptable.
168/1	135	salt	2	Bottle salinity is low compared with CTD. Structure seen in CTD. Salinity, oxygen and nutrients are acceptable.
169/2	203	o2	2	Oxygen high compared with adjoining stations and CTD. Deep SiO3 also higher than adjoining stations. Oxygen, salinity and nutrients are acceptable.
169/2	205	salt	4	Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. Additional readings did not resolve salinity difference. Thimble came out with cap - large jump DOWN after first reading- very strange. Code salinity bad, oxygen and nutrients are acceptable.
169/2	215	salt	2	3 attempts for a good salinity reading. The appropriate average was used. Salinity, oxygen and nutrients are acceptable.
170/1	110	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. First reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.
170/1	111	o2	2	Maybe a bad endpoint? Checked end point, OK. Oxygen agreed well on SiO3 relationship plot. Oxygen, salinity and nutrients are acceptable.
170/1	125	salt	2	3 attempts for a good salinity reading. First reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.
170/1	126	CTDT1	3	CTDT1 unstable primary temperature reading vs. CTDT2/SBE35T, code questionable.
170/1	127	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
170/1	130	o2	5	Sample lost. No stir bar.
170/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
170/1	134	salt	2	Bottle salinity is high compared with CTD. 5 attempts for a good salinity reading. First reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.
171/1	101	o2	2	Oxygen appears low compared with adjoining stations, the feature is also seen in SiO3 and salinity. Oxygen, salinity and nutrients are acceptable.
171/1	102	o2	2	Oxygen appears low compared with adjoining stations, the feature is also seen in SiO3 and salinity. Oxygen, salinity and nutrients are acceptable.
171/1	105	salt	3	Salinity low compared with adjoining stations and CTD. No analytical problems noted. Code salinity questionable, oxygen and nutrients are acceptable.
171/1	107	salt	3	Salinity low compared with adjoining stations and CTD. No analytical problems noted. Code salinity questionable, oxygen and nutrients are acceptable.
171/1	110	o2	3	Oxygen is high compared with CTD and adjoining stations. No analytical problems noted. Analyst: "Endpoint okay." Code oxygen questionable, salinity and nutrients are acceptable.
171/1	127	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
171/1	129	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
171/1	131	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
171/1	131	salt	2	Bottle salinity is high compared with CTD. No analytical problems noted, gradient. Salinity, oxygen and nutrients are acceptable.
171/1	132	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
171/1	135	CTDT1	3	CTDT1 unstable primary temperature reading vs. CTDT2/SBE35T, code questionable.

Station /Cast	Sample No.	Quality Property	Code	Comment
172/1	101	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 4 attempts for a good salinity reading. Large jumps each of first three readings cause not clear. First reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.
172/1	108	o2	2	Oxygen high compared with CTD and adjoining stations. SiO3 relationship looks reasonable. Analyst: "Endpoint okay." Oxygen, salinity and nutrients are acceptable.
172/1	108	salt	2	3 attempts for a good salinity reading. Salinity slightly low, within accuracy of measurement. Salinity, oxygen and nutrients are acceptable.
172/1	119	salt	2	4 attempts for a good salinity reading. First reading resolved salinity discrepancy. Thimble popped out before neck was cleaned - large jump between readings. First reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.
172/1	129	salt	2	3 attempts for a good salinity reading. Readings were within accuracy of the measurement. Salinity, oxygen and nutrients are acceptable.
172/1	132	salt	2	Bottle salinity is low compared with CTD. No analytical problems noted. Salinity, oxygen and nutrients are acceptable.
172/1	134	o2	2	Oxygen endpoint questionable. Analyst: "Endpoint noisy but okay." Oxygen, salinity and nutrients are acceptable.
172/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
172/1	134	salt	2	Bottle salinity is high compared with CTD. No analytical problems noted. Salinity, oxygen and nutrients are acceptable.
172/1	135	salt	2	Bottle salinity is low compared with CTD. No analytical problems noted, structure in CTD profile. Salinity, oxygen and nutrients are acceptable.
173/2	205	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. Thimble came off with cap before wiping. First reading did not completely resolve salinity difference, within accuracy of measurement, since there were so many problems, code salinity bad, oxygen and nutrients acceptable.
173/2	206	o2	2	Pulled oxygen sample early, no endpoint. Oxygen, salinity and nutrients are acceptable.
173/2	214	o2	2	Oxygen redraw sample. Oxygen, salinity and nutrients are acceptable.
173/2	215	o2	2	Oxygen high on SiO3 plot, no analytical problems noted, SiO3 agrees with adjoining stations and O2 agrees with CTD and adjoining stations. Oxygen, salinity and nutrients are acceptable.
173/2	225	salt	2	Salinity thimble came off with cap before wiping. Salinity abnormally salty under thimble rim, possibly contaminated. Salinity is a little high, but within accuracy of measurement. Salinity as well as oxygen and nutrients are acceptable.
173/2	230	salt	4	Low water level in salinity bottle, 2 inches below shoulder of bottle. Suspect that this was not sampled for this cast rather was the water from last usage. Code salinity bad, oxygen and nutrients are acceptable.
173/2	231	CTDT2	3	
173/2	233	CTDT1	3	CTDT1 unstable reading vs. CTDT2/SBE35RT, code questionable.
173/2	234	salt	2	4 attempts for a good salinity reading. First reading resolved salinity difference, gradient. Salinity, oxygen and nutrients are acceptable.
173/2	235	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
173/2	235	salt	2	Bottle salinity is high compared with CTD. No analytical problems noted, gradient. Salinity, oxygen and nutrients are acceptable.
174/1	102	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.

Station /Cast	Sample No.	Quality Property	Code	Comment
174/1	102	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
174/1	104	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
174/1	117	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
174/1	118	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
174/1	124	o2	5	Forgot stirrer bar, oxygen lost. Salinity and nutrients are acceptable.
174/1	132	salt	2	Bottle salinity is low compared with CTD and adjoining stations. Sampling error, salinity 34 was drawn from 33, 33 from 32 and 32 from 31, data corrected. 3 attempts for a good salinity reading. Salinity, oxygen and nutrients are acceptable.
174/1	133	salt	2	Bottle salinity is low compared with CTD and adjoining stations. Sampling error, salinity 34 was drawn from 33, 33 from 32 and 32 from 31, data corrected. Salinity, oxygen and nutrients are acceptable.
174/1	134	salt	5	Bottle salinity is low compared with CTD and adjoining stations. Salinity thimble came off with cap before wiping. Sampling error, salinity 34 was drawn from 33, 33 from 32 and 32 from 31, data corrected. Salinity lost. Oxygen and nutrients are acceptable.
174/1	136	CTDOXY	3	CTD oxy data noisy.
175/1	101	salt	2	Bottle salinity is high compared with CTD and adjoining stations. Within accuracy of measurement. Salinity, oxygen and nutrients are acceptable.
175/1	106	o2	3	Oxygen appears high, 0.04, versus adjoining stations and SiO3 plot. Analyst: "Rechecked endpoints, okay." Suspect drawing error, code oxygen questionable, salinity and nutrients are acceptable.
175/1	132	CTDT2	3	CTDT2 unstable secondary temperature reading vs. CTDT1/SBE35T, code questionable.
175/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
175/1	136	salt	3	Bottle salinity is high compared with CTD. Bottle tripped before shed wake subsided. Code salinity questionable, oxygen shows similar high disagreement but acceptable, oxygen and nutrients are acceptable.
176/1	102	salt	2	3 attempts for a good salinity reading. Averaged readings resulted in acceptable salinity. Salinity, oxygen and nutrients are acceptable.
176/1	112	o2	2	Oxygen flasks were switched in the box, analyst ran them in the correct order and used the values as written on the Sample Log sheet. Oxygen, salinity and nutrients are acceptable.
176/1	113	o2	2	Oxygen flasks were switched in the box, analyst ran them in the correct order and used the values as written on the Sample Log sheet. Oxygen, salinity and nutrients are acceptable.
176/1	114	salt	2	3 attempts for a good salinity reading. First reading resolved salinity difference. Increasing readings are suspicious. Salinity, oxygen and nutrients are acceptable.
176/1	116	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 4 attempts for a good salinity reading. First reading resulted in a acceptable salinity difference. Thimble came out with cap readings very erratic first and fourth matched. Salinity, oxygen and nutrients are acceptable.
176/1	122	o2	2	Oxygen flasks were switched in the box, analyst ran them in the correct order and used the values as written on the Sample Log sheet. Oxygen, salinity and nutrients are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
176/1	123	no2	9	Sampler error, no water taken from bottle for nutrients.
176/1	123	no3	9	Sampler error, no water taken from bottle for nutrients.
176/1	123	o2	2	Oxygen flasks were switched in the box, analyst ran them in the correct order and used the values as written on the Sample Log sheet. Oxygen, salinity and nutrients are acceptable.
176/1	123	po4	9	Sampler error, no water taken from bottle for nutrients.
176/1	123	sio3	9	Sampler error, no water taken from bottle for nutrients.
176/1	126	CTDT1	3	CTDT1 unstable primary temperature reading vs. CTDT2/SBE35T, code questionable.
176/1	130	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
176/1	131	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
176/1	135	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
176/1	136	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
177/2	201	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 5 attempts for a good salinity reading. First reading resolves salinity difference. Salinity, oxygen and nutrients are acceptable.
177/2	205	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
177/2	206	bottle	2	Missed target depth by 20m, 2065 versus 2045.
177/2	231	CTDT1	3	CTDT1 unstable primary temperature reading vs. CTDT2/SBE35T, code questionable.
177/2	235	salt	2	Salinity appears much higher than adjoining stations, agrees with CTD. Feature is not seen in oxygen or nutrients. Salinity, oxygen and nutrients are acceptable.
178/1	101	o2	2	Bottle oxygen seems low. kms: "Oxygen agrees with adjoining stations and has a good relationship with SiO3. No analytical problems noted. Oxygen, salinity and nutrients are acceptable."
178/1	108	o2	3	O2 high, 0.02. Analyst: "Rechecked endpoints, okay." Suspect drawing error, code oxygen questionable, salinity and nutrients are acceptable.
178/1	108	salt	2	3 attempts for a good salinity reading. Averaged values are acceptable. Salinity and nutrients are acceptable.
178/1	111	o2	2	Oxygen end point looks way off; endpoint corrected. Oxygen, salinity and nutrients are acceptable.
178/1	112	salt	2	3 attempts for a good salinity reading. Averaged values are acceptable. Salinity, oxygen and nutrients are acceptable.
178/1	130	salt	4	Bottle salinity is high compared with CTD and adjoining stations. Salinity mis-drawn from bottle 31. Code salinity bad, oxygen and nutrients are acceptable.
178/1	131	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
178/1	136	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
179/1	104	o2	3	O2 high, 0.03. Analyst: "Rechecked endpoints, okay." Suspect drawing error, code oxygen questionable, salinity and nutrients are acceptable.
179/1	104	salt	2	Salinity thimble came out with cap. Salinity and nutrients are acceptable.
179/1	105	salt	2	3 attempts for a good salinity reading. Thimble popped out before neck wiped. Averaged readings were acceptable. Salinity, oxygen and nutrients are acceptable.
179/1	109	ctdc1	3	
179/1	109	ctdc2	3	
179/1	109	CTDS1	3	
179/1	109	ctds2	3	

Station /Cast	Sample No.	Quality Property	Code	Comment
179/1	109	salt	2	Salinity slightly high compared with CTD, agrees with adjoining stations, gradient. Data shows that CTD was measuring the saltier deeper water when the bottle tripped. Salinity, oxygen and nutrients are acceptable, code CTD salinity questionable.
179/1	114	salt	2	Salinity thimble popped out before neck wiped. Salinity, oxygen and nutrients are acceptable.
179/1	127	salt	2	Salinity low compared with adjoining stations vs. theta. Feature also seen in oxygen and CTD, not in nutrients. Salinity, oxygen and nutrients are acceptable.
179/1	128	salt	2	Salinity low compared with adjoining stations vs. theta. Feature also seen in oxygen and CTD, not in nutrients. Salinity, oxygen and nutrients are acceptable.
179/1	130	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
179/1	134	salt	2	Salinity thimble popped out with cap. Salinity, oxygen and nutrients are acceptable.
179/1	135	CTDT2	3	CTDT2 unstable secondary temperature reading vs. CTDT1/SBE35T, code questionable.
180/1	101	o2	2	Checked and corrected oxygen endpoint. Oxygen, salinity and nutrients are acceptable.
180/1	104	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 4 attempts for a good salinity reading. First reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.
180/1	106	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 4 attempts for a good salinity reading. First reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.
180/1	107	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 4 attempts for a good salinity reading. Second reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.
180/1	113	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 4 attempts for a good salinity reading. First reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.
180/1	117	o2	2	Checked and corrected oxygen endpoint. Oxygen, salinity and nutrients are acceptable.
180/1	125	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
180/1	126	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
180/1	127	o2	2	Checked and corrected oxygen endpoint. Oxygen, salinity and nutrients are acceptable.
180/1	129	o2	2	Checked and corrected oxygen endpoint. Oxygen, salinity and nutrients are acceptable.
181/1	103	bottle	2	Some intended depths missed, 2533, duplicate trips at 1165, bottles 14 & 15, 965 intended depth missed, 9 & 10 are duplicates, duplicate trips at the surface.
181/1	109	salt	2	3 attempts for a good salinity reading. Additional readings did not resolve the small salinity difference. Salinity, oxygen and nutrients are acceptable.
181/1	116	salt	2	3 attempts for a good salinity reading. Thimble came off with cap before wiping. First reading produced good agreement.Salinity, oxygen and nutrients are acceptable.
181/1	121	bottle	2	Bottle is leaking from bottom, bad bottom seal. Oxygen, salinity and nutrients are acceptable.
181/1	127	CTDT2	3	CTDT2 unstable secondary temperature reading vs. CTDT1/SBE35T, code questionable.

Station /Cast	Sample No.	Quality Property	Code	Comment
181/1	131	CTDT1	3	CTDT1 unstable primary temperature reading vs. CTDT2/SBE35T, code questionable.
182/1	110	o2	2	Stepped oxygen endpoint, checked OK. Oxygen, salinity and nutrients are acceptable.
182/1	135	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
183/1	103	bottle	9	Faulty nipple on bottle broke off. No samples were drawn.
183/1	104	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
183/1	124	salt	2	4 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
183/1	125	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
183/1	126	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
183/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
184/1	102	salt	2	3 attempts for a good salinity reading. First reading resolved small salinity difference. Thimble popped out after cap - erratic readings. Salinity, oxygen and nutrients are acceptable.
184/1	118	salt	2	Salinity thimble popped out with cap. Salinity, oxygen and nutrients are acceptable.
184/1	128	salt	2	Feature in salinity not seen in oxygen or nutrients, agrees with CTD. Salinity, oxygen and nutrients are acceptable.
184/1	129	salt	2	Feature in salinity not seen in oxygen or nutrients, agrees with CTD. Salinity, oxygen and nutrients are acceptable.
184/1	130	o2	2	Oxygen endpoint plot noisy. Analyst: "Endpoint okay." Oxygen, salinity and nutrients are acceptable.
184/1	130	salt	2	Feature in salinity not seen in oxygen or nutrients, agrees with CTD. Salinity, oxygen and nutrients are acceptable.
184/1	131	salt	2	Bottle salinity is low compared with CTD. CTD package shed wake in gradient area causing difference. Salinity, oxygen and nutrients are acceptable.
184/1	135	salt	2	Bottle salinity is high compared with CTD. CTD package shed wake in gradient area causing difference. Salinity, oxygen and nutrients are acceptable.
184/1	136	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
185/2	212	o2	2	Oxygen looks high. Flasks for 12 and 13 were switched in the box, followed sample log. Oxygen, salinity and nutrients are acceptable.
185/2	213	o2	2	Oxygen looks low. Flasks for 12 and 13 were switched in the box, followed sample log. Oxygen, salinity and nutrients are acceptable.
185/2	222	o2	2	Oxygen flasks 22 & 23 switched, must have occurred during analysis of last station, just put in the box incorrectly. Oxygen, salinity and nutrients are acceptable.
185/2	223	o2	2	Oxygen flasks 22 & 23 switched, must have occurred during analysis of last station, just put in the box incorrectly. Oxygen, salinity and nutrients are acceptable.
185/2	228	o2	2	Bad oxygen endpoint?. Analyst: "Endpoint fixed and resubmitted." PN: Oxygen looks reasonable. Oxygen, salinity and nutrients are acceptable.
185/2	233	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
185/2	235	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
185/2	235	salt	2	Bottle salinity is low compared with CTD. Salinity feature seen in CTD. Salinity, oxygen and nutrients are acceptable.
186/1	108	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
186/1	112	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
186/1	119	salt	2	Salinity thimble came off with cap before wiping. Salinity is slightly high, within accuracy of measurement. Salinity, oxygen and nutrients are acceptable.
186/1	125	o2	2	Corrected oxygen endpoint. Oxygen, salinity and nutrients are acceptable.
186/1	125	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
186/1	125	salt	2	4 attempts for a good salinity reading. Additional readings did not resolve salinity difference. Code salinity bad, oxygen and nutrients are acceptable.
186/1	127	salt	2	Bottle salinity is high compared with CTD. No analytical problems noted, gradient. Salinity, oxygen and nutrients are acceptable.
186/1	128	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
186/1	134	CTDT2	3	CTDT2 unstable secondary temperature reading vs. CTDT1/SBE35T, code questionable.
186/1	134	salt	2	Bottle salinity is low compared with CTD. No analytical problems noted, gradient. Salinity, oxygen and nutrients are acceptable.
186/1	135	salt	2	3 attempts for a good salinity reading. Additional readings did not resolve small salinity difference. Salinity, oxygen and nutrients are acceptable.
187/1	103	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. First reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.
187/1	104	o2	3	Oxygen high, 0.04ml/l, compared with CTD and adjoining stations. Analyst: "Endpoint Okay." Code oxygen questionable, salinity and nutrients acceptable.
187/1	104	salt	2	5 attempts for a good salinity reading. Averaged readings are acceptable. Salinity and nutrients are acceptable, oxygen is questionable.
187/1	126	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
187/1	130	CTDT2	3	CTDT2 unstable secondary temperature reading vs. CTDT1/SBE35T, code questionable.
188/1	103	salt	3	Bottle salinity is high compared with CTD and adjoining stations. No analytical problems noted, suspect sampling problems. Code salinity questionable, oxygen and nutrients acceptable.
188/1	105	salt	2	Bottle salinity is high compared with CTD and adjoining stations. Salinity thimble popped out with cap - large jump first to second readings. 3 attempts for a good salinity reading. First reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.
188/1	108	salt	3	Bottle salinity is high compared with CTD and adjoining stations. No analytical problems noted. Code salinity questionable, oxygen and nutrients acceptable.
188/1	112	o2	2	Oxygen flasks were switched in box, followed order on Sample Log. Oxygen, salinity and nutrients are acceptable.
188/1	113	o2	2	Oxygen flasks were switched in box, followed order on Sample Log. Oxygen, salinity and nutrients are acceptable.
188/1	113	salt	2	Salinity thimble came out with cap. Salinity, oxygen and nutrients are acceptable.
188/1	114	salt	2	Salinity thimble came out with cap. Salinity, oxygen and nutrients are acceptable.
188/1	118	o2	2	Oxygen end point was strange; corrected. Oxygen, salinity and nutrients are acceptable.
188/1	126	o2	2	Oxygen end point was strange; corrected. Oxygen, salinity and nutrients are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
188/1	131	ctds	3	
188/1	131	salt	2	Bottle salinity is low compared with CTD. Appears that bottle was tripped before the water from below dissipated. Code CTD salinity questionable, salinity, oxygen and nutrients are acceptable.
188/1	132	ctds	3	
188/1	132	salt	2	Bottle salinity is high compared with CTD. Appears that bottle was tripped before the water from below dissipated. Code CTD salinity questionable, salinity, oxygen and nutrients are acceptable.
188/1	133	ctds	3	
188/1	133	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
188/1	133	salt	2	Bottle salinity is low compared with CTD. Appears that bottle was tripped before the water from below did not dissipate. Code CTD salinity questionable, salinity, oxygen and nutrients are acceptable.
189/2	202	salt	2	3 attempts for a good salinity reading. First reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.
189/2	204	salt	2	3 attempts for a good salinity reading. Thimble came off with cap before wiping. First reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.
189/2	205	salt	2	Thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
189/2	208	salt	2	3 attempts for a good salinity reading. First reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.
189/2	228	o2	2	Curvy endpoint chart, but ok endpoint. Oxygen, salinity and nutrients are acceptable.
189/2	229	salt	4	Bottle salinity is low compared with CTD and adjoining stations. Operator error, inaccurate reading, analyzed 28 twice, paint fumes dulled operations. Code salinity bad, oxygen and nutrients are acceptable.
189/2	234	salt	4	3 attempts for a good salinity reading. Thimble came off with cap before wiping. Additional readings did not resolve salinity difference. Code salinity bad, oxygen and nutrients are acceptable.
189/2	235	CTDT1	3	CTDT1 unstable primary temperature reading vs. CTDT2/SBE35T, code questionable.
190/1	115	salt	2	3 attempts for a good salinity reading. First reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.
190/1	119	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
190/1	128	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
190/1	133	salt	2	Bottle salinity is low compared with CTD. Gradient area. Salinity, oxygen and nutrients are acceptable.
191/1	101	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 4 attempts for a good salinity reading. First reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.
191/1	110	sio3	3	SiO3 low, 2um/l, with adjoining stations. Analyst: "No analytical errors noted." Within accuracy of measurement. Nutrients. oxygen and salinity are acceptable.
191/1	111	sio3	3	SiO3 low, 2um/l, with adjoining stations. Analyst: "No analytical errors noted." Within accuracy of measurement. Nutrients. oxygen and salinity are acceptable.
191/1	118	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. First reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
191/1	123	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
191/1	124	salt	2	4 attempts for a good salinity reading. First reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.
191/1	128	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
191/1	131	salt	2	Bottle salinity is low compared with CTD. 3 attempts for a good salinity reading. Additional reading does not resolve salinity difference. Gradient, salinity, oxygen and nutrients are acceptable.
191/1	132	o2	2	Fixed oxygen endpoint. Oxygen, salinity and nutrients are acceptable.
191/1	133	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
191/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
191/1	134	salt	2	Bottle salinity is high compared with CTD. Gradient, salinity, oxygen and nutrients are acceptable.
192/1	107	salt	4	Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. Additional readings did not resolve the salinity difference. Code salinity bad, oxygen and nutrients are acceptable.
192/1	109	bottle	2	Double trip with bottle 10, operator error. Salinity, oxygen and nutrients are acceptable.
192/1	113	salt	2	3 attempts for a good salinity reading. Additional readings would make salinity lower. Within accuracy of measurement. Salinity, oxygen and nutrients are acceptable.
192/1	127	CTDT1	3	CTDT1 unstable primary temperature reading vs. CTDT2/SBE35T, code questionable.
193/1	101	po4	2	PO4 appears high deep with adjoining stations. Analyst: "N:P rations look okay, run looks good-no analytical errors noted. RMNS and deep check standard 0.02-0.03 high for 193. Nutrients, oxygen and salinity are acceptable.
193/1	101	salt	2	Bottle salinity is high compared with CTD and adjoining stations. No analytical problems noted, just outside of accuracy of measurement. Salinity, oxygen and nutrients are acceptable.
193/1	102	po4	2	PO4 appears high deep with adjoining stations. Analyst: "N:P rations look okay, run looks good-no analytical errors noted. RMNS and deep check standard 0.02-0.03 high for 193. Nutrients, oxygen and salinity are acceptable.
193/1	103	o2	3	Oxygen high, 0.02ml/l, compared with CTD, SiO3 and adjoining stations. Analyst: "Endpoint good." Code oxygen questionable, salinity and nutrients acceptable.
193/1	103	po4	2	PO4 appears high deep with adjoining stations. Analyst: "N:P rations look okay, run looks good-no analytical errors noted. RMNS and deep check standard 0.02-0.03 high for 193. Nutrients, oxygen and salinity are acceptable.
193/1	104	po4	2	PO4 appears high deep with adjoining stations. Analyst: "N:P rations look okay, run looks good-no analytical errors noted. RMNS and deep check standard 0.02-0.03 high for 193. Nutrients, oxygen and salinity are acceptable.
193/1	105	po4	2	PO4 appears high deep with adjoining stations. Analyst: "N:P rations look okay, run looks good-no analytical errors noted. RMNS and deep check standard 0.02-0.03 high for 193. Nutrients, oxygen and salinity are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
193/1	106	po4	2	PO4 appears high deep with adjoining stations. Analyst: "N:P rations look okay, run looks good-no analytical errors noted. RMNS and deep check standard 0.02-0.03 high for 193. Nutrients, oxygen and salinity are acceptable.
193/1	107	po4	2	PO4 appears high deep with adjoining stations. Analyst: "N:P rations look okay, run looks good-no analytical errors noted. RMNS and deep check standard 0.02-0.03 high for 193. Nutrients, oxygen and salinity are acceptable.
193/1	108	po4	2	PO4 appears high deep with adjoining stations. Analyst: "N:P rations look okay, run looks good-no analytical errors noted. RMNS and deep check standard 0.02-0.03 high for 193. Nutrients, oxygen and salinity are acceptable.
193/1	109	po4	2	PO4 appears high deep with adjoining stations. Analyst: "N:P rations look okay, run looks good-no analytical errors noted. RMNS and deep check standard 0.02-0.03 high for 193. Nutrients, oxygen and salinity are acceptable.
193/1	110	po4	2	PO4 appears high deep with adjoining stations. Analyst: "N:P rations look okay, run looks good-no analytical errors noted. RMNS and deep check standard 0.02-0.03 high for 193. Nutrients, oxygen and salinity are acceptable.
193/1	111	po4	2	PO4 appears high deep with adjoining stations. Analyst: "N:P rations look okay, run looks good-no analytical errors noted. RMNS and deep check standard 0.02-0.03 high for 193. Nutrients, oxygen and salinity are acceptable.
193/1	112	po4	2	PO4 appears high deep with adjoining stations. Analyst: "N:P rations look okay, run looks good-no analytical errors noted. RMNS and deep check standard 0.02-0.03 high for 193. Nutrients, oxygen and salinity are acceptable.
193/1	113	po4	2	PO4 appears high deep with adjoining stations. Analyst: "N:P rations look okay, run looks good-no analytical errors noted. RMNS and deep check standard 0.02-0.03 high for 193. Nutrients, oxygen and salinity are acceptable.
193/1	114	po4	2	PO4 appears high deep with adjoining stations. Analyst: "N:P rations look okay, run looks good-no analytical errors noted. RMNS and deep check standard 0.02-0.03 high for 193. Nutrients, oxygen and salinity are acceptable.
193/1	115	po4	2	PO4 appears high deep with adjoining stations. Analyst: "N:P rations look okay, run looks good-no analytical errors noted. RMNS and deep check standard 0.02-0.03 high for 193. Nutrients, oxygen and salinity are acceptable.
193/1	121	o2	2	Oxygen endpoint off; corrected manually. Oxygen, salinity and nutrients are acceptable.
193/1	129	salt	2	Bottle salinity is high compared with CTD. Gradient, suspect deeper waters did not dissipate before bottle was tripped. Salinity, oxygen and nutrients are acceptable.
193/1	134	salt	2	Bottle salinity is low compared with CTD. Feature seen in CTD trace, suspect deeper waters did not dissipate before bottle was tripped. Salinity, oxygen and nutrients are acceptable.
194/1	110	o2	2	Fixed oxygen endpoint. Oxygen, salinity and oxygen are acceptable.
194/1	119	bottle	4	Bottle mis-tripped. Code bottle did not trip as scheduled, all samples bad.
194/1	119	no2	4	

Station /Cast	Sample No.	Quality Property	Code	Comment
194/1	119	no3	4	
194/1	119	po4	4	
194/1	119	salt	4	Bottle salinity is high compared with CTD and adjoining stations. Bottle mis-tripped, code bottle did not trip as scheduled, all samples bad.
194/1	119	sio3	4	
194/1	120	bottle	4	Bottle mis-tripped. Code bottle did not trip as scheduled, all samples bad.
194/1	120	no2	4	
194/1	120	no3	4	
194/1	120	po4	4	
194/1	120	salt	4	Bottle salinity is high compared with CTD and adjoining stations. Bottle mis-tripped, code bottle did not trip as scheduled, all samples bad.
194/1	120	sio3	4	
194/1	133	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
195/1	103	o2	2	Checked and corrected oxygen endpoint. Within the accuracy of the measurement. Oxygen, salinity and nutrients are acceptable.
195/1	104	o2	2	Checked and corrected oxygen endpoint. Within the accuracy of the measurement. Oxygen, salinity and nutrients are acceptable.
195/1	108	o2	3	Oxygen high, 0.04ml/l, compared with adjoining stations and CTD. Salinity and nutrients do not show this feature. Analyst: "Endpoint Okay." Code oxygen questionable, salinity and nutrients are acceptable.
195/1	117	o2	4	Checked and corrected oxygen endpoint. Oxygen is high compared with CTD and adjoining stations. Code oxygen bad, salinity and nutrients are acceptable.
195/1	121	salt	2	Salinity thimble popped out with cap. Salinity, oxygen and nutrients are acceptable.
195/1	124	salt	2	Salinity thimble popped out with cap. Salinity, oxygen and nutrients are acceptable.
195/1	133	o2	2	Oxygen sample was overtitrated and backtitrated. Oxygen, salinity and nutrients are acceptable.
195/1	133	po4	2	PO4 high compared to adjoining stations. Analyst: "Real feature, no analytical errors noted." Nutrients, salinity and oxygen are acceptable.
195/1	134	po4	2	PO4 high compared to adjoining stations. Analyst: "Real feature, no analytical errors noted." Nutrients, salinity and oxygen are acceptable.
195/1	135	po4	2	PO4 high compared to adjoining stations. Analyst: "Real feature, no analytical errors noted." Nutrients, salinity and oxygen are acceptable.
195/1	136	po4	2	PO4 high compared to adjoining stations. Analyst: "Real feature, no analytical errors noted." Nutrients, salinity and oxygen are acceptable.
196/1	101	po4	2	High N:P ratio plot. Analyst: "Corrected and uploaded file." Nutrients, oxygen and salinity are acceptable.
196/1	102	po4	2	High N:P ratio plot. Analyst: "Corrected and uploaded file." Nutrients, oxygen and salinity are acceptable.
196/1	103	po4	2	High N:P ratio plot. Analyst: "Corrected and uploaded file." Nutrients, oxygen and salinity are acceptable.
196/1	104	po4	2	High N:P ratio plot. Analyst: "Corrected and uploaded file." Nutrients, oxygen and salinity are acceptable.
196/1	105	po4	2	High N:P ratio plot. Analyst: "Corrected and uploaded file." Nutrients, oxygen and salinity are acceptable.
196/1	106	po4	2	High N:P ratio plot. Analyst: "Corrected and uploaded file." Nutrients, oxygen and salinity are acceptable.
196/1	107	po4	2	High N:P ratio plot. Analyst: "Corrected and uploaded file." Nutrients, oxygen and salinity are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
196/1	108	po4	2	High N:P ratio plot. Analyst: "Corrected and uploaded file." Nutrients, oxygen and salinity are acceptable.
196/1	109	po4	2	High N:P ratio plot. Analyst: "Corrected and uploaded file." Nutrients, oxygen and salinity are acceptable.
196/1	110	po4	2	High N:P ratio plot. Analyst: "Corrected and uploaded file." Nutrients, oxygen and salinity are acceptable.
196/1	111	po4	2	High N:P ratio plot. Analyst: "Corrected and uploaded file." Nutrients, oxygen and salinity are acceptable.
196/1	112	po4	2	High N:P ratio plot. Analyst: "Corrected and uploaded file." Nutrients, oxygen and salinity are acceptable.
196/1	113	po4	2	High N:P ratio plot. Analyst: "Corrected and uploaded file." Nutrients, oxygen and salinity are acceptable.
196/1	114	po4	2	High N:P ratio plot. Analyst: "Corrected and uploaded file." Nutrients, oxygen and salinity are acceptable.
196/1	115	o2	2	Checked and corrected oxygen endpoint. Oxygen, salinity and nutrients are acceptable.
196/1	116	o2	2	Bad oxygen graph, but decent endpoint. Oxygen, salinity and nutrients are acceptable.
196/1	117	salt	2	Bottle salinity is low compared with CTD. Gradient, salinity, oxygen and nutrients are acceptable.
196/1	120	no3	3	N:P ratio low. Analyst: "Cadmium column issues." Code NO3 questionable, other nutrients, salinity and oxygen and acceptable.
196/1	120	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
196/1	121	no3	3	N:P ratio low. Analyst: "Cadmium column issues." Code NO3 questionable, other nutrients, salinity and oxygen and acceptable.
196/1	122	no3	3	N:P ratio low. Analyst: "Cadmium column issues." Code NO3 questionable, other nutrients, salinity and oxygen and acceptable.
196/1	123	no3	3	N:P ratio low. Analyst: "Cadmium column issues." Code NO3 questionable, other nutrients, salinity and oxygen and acceptable.
196/1	123	salt	2	3 attempts for a good salinity reading. Second reading would make salinity slightly higher. Within accuracy of the measurement. Salinity, oxygen and nutrients are acceptable.
196/1	124	no3	3	N:P ratio low. Analyst: "Cadmium column issues." Code NO3 questionable, other nutrients, salinity and oxygen and acceptable.
196/1	125	no3	3	N:P ratio low. Analyst: "Cadmium column issues." Code NO3 questionable, other nutrients, salinity and oxygen and acceptable.
196/1	126	no3	3	N:P ratio low. Analyst: "Cadmium column issues." Code NO3 questionable, other nutrients, salinity and oxygen and acceptable.
196/1	127	no3	3	N:P ratio low. Analyst: "Cadmium column issues." Code NO3 questionable, other nutrients, salinity and oxygen and acceptable.
196/1	128	no3	3	N:P ratio low. Analyst: "Cadmium column issues." Code NO3 questionable, other nutrients, salinity and oxygen and acceptable.
196/1	128	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
196/1	129	no3	3	N:P ratio low. Analyst: "Cadmium column issues." Code NO3 questionable, other nutrients, salinity and oxygen and acceptable.
196/1	129	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
196/1	130	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
196/1	133	salt	2	3 attempts for a good salinity reading. Second reading would make salinity slightly higher. Within accuracy of the measurement. Salinity, oxygen and nutrients are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
196/1	134	salt	2	Bottle salinity is low compared with CTD. Gradient, salinity, oxygen and nutrients are acceptable.
197/1	103	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
197/1	108	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
197/1	113	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
197/1	119	o2	2	Checked and corrected oxygen stepped endpoint. Oxygen, salinity and nutrients are acceptable.
197/1	119	salt	2	4 attempts for a good salinity reading. First reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.
197/1	120	bottle	2	Slight leak when first opened. Oxygen, salinity and nutrients are acceptable.
197/1	127	o2	2	Checked and corrected oxygen endpoint. Oxygen, salinity and nutrients are acceptable.
197/1	130	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable, other readings do not resolve the small salinity difference. Salinity, oxygen and nutrients are acceptable.
197/1	135	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
197/1	136	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
198/1	102	o2	3	Oxygen bottle high relative to trace and adjoining stations. Analyst: "Checked end point, looks okay." Code oxygen questionable, salinity and nutrients acceptable.
198/1	103	o2	2	Oxygen high compared with CTD, SiO3 and adjoining stations. Analyst: "Endpoint good." Code oxygen questionable, salinity and nutrients acceptable.
198/1	104	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
198/1	109	CTDT1	3	CTDT1 unstable primary temperature reading vs. CTDT2/SBE35T, code questionable.
198/1	113	salt	2	3 attempts for a good salinity reading. First reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
198/1	114	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
198/1	116	salt	2	4 attempts for a good salinity reading. 16 Thimble came off with cap before wiping. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
198/1	119	salt	2	3 attempts for a good salinity reading. Thimble came off with cap before wiping.
198/1	125	o2	2	Fixed oxygen endpoint. Oxygen, salinity and nutrients are acceptable.
198/1	126	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
198/1	128	CTDT2	3	CTDT2 unstable secondary temperature reading vs. CTDT1/SBE35T, code questionable.
198/1	128	salt	2	3 attempts for a good salinity reading.First reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
198/1	129	CTDT2	3	CTDT2 unstable secondary temperature reading vs. CTDT1/SBE35T, code questionable.
198/1	131	salt	2	3 attempts for a good salinity reading.First reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
198/1	132	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
198/1	135	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.

Station /Cast	Sample No.	Quality Property	Code	Comment
198/1	135	salt	2	Bottle salinity is high compared with CTD. Appears that the deeper water was entrained in the bottle, within accuracy of the measurement. Salinity, oxygen and nutrients are acceptable.
199/1	103	o2	2	Fix endpoint. Oxygen, salinity and nutrients are acceptable.
199/1	105	salt	2	Salinity thimble popped out with cap. Salinity, oxygen and nutrients are acceptable.
199/1	108	o2	2	Oxygen is high compared with CTD, but agrees with bottle data on adjoining stations. Oxygen, salinity and nutrients are acceptable.
199/1	128	salt	2	Bottle salinity is low compared with CTD, gradient. Salinity, oxygen and nutrients are acceptable.
199/1	134	salt	2	4 attempts for a good salinity reading. Salinity thimble popped loose while removing cap - erratic readings with large jumps. First reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
199/1	136	CTDT2	3	CTDT2 gives an unstable reading vs. CTDT1. Appears all three temperature readings had a problem. Code CTDT2 questionable.
199/1	136	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
199/1	136	salt	3	Bottle salinity is low compared with CTD and adjoining stations, although it does agree with 201. Appears that the deeper water had not dissipated when the bottle was tripped. Code salinity questionable, oxygen and nutrients are acceptable.
200/1	101	o2	2	Bad oxygen end point, severely stepped; corrected. Oxygen and nutrients are acceptable.
200/1	101	salt	3	Bottle salinity is high compared with CTD and adjoining stations, 0.002. No analytical problems noted. Code salinity questionable, oxygen and nutrients are acceptable.
200/1	101	sio3	2	SiO3 does not agree with adjoining stations. Analyst: "No analytical errors noted. Deep check standard and RMNS values okay." Nutrients, oxygen and salinity are acceptable.
200/1	102	sio3	2	SiO3 does not agree with adjoining stations. Analyst: "No analytical errors noted. Deep check standard and RMNS values okay." Nutrients, oxygen and salinity are acceptable.
200/1	103	sio3	2	SiO3 does not agree with adjoining stations. Analyst: "No analytical errors noted. Deep check standard and RMNS values okay." Nutrients, oxygen and salinity are acceptable.
200/1	104	sio3	2	SiO3 does not agree with adjoining stations. Analyst: "No analytical errors noted. Deep check standard and RMNS values okay." Nutrients, oxygen and salinity are acceptable.
200/1	105	salt	3	Bottle salinity is high compared with CTD and adjoining stations. No analytical problems noted. Could be analyst did not properly switch the bottom or a drawing error. Code salinity questionable, oxygen and nutrients are acceptable.
200/1	105	sio3	2	SiO3 does not agree with adjoining stations. Analyst: "No analytical errors noted. Deep check standard and RMNS values okay." Nutrients, oxygen and salinity are acceptable.
200/1	109	bottle	2	Bottle tripped @2050 instead of intended depth of 2000.
200/1	109	salt	3	Bottle salinity is high compared with CTD and adjoining stations. No analytical problem noted. Although the intended depth was missed, operator does not claim that the bottle was not properly flushed. Code salinity questionable, oxygen and nutrients are acceptable.
200/1	121	bottle	2	Bottle 21 or 23 was hit at bottom with hook on recovery, some water came out. Oxygen, salinity and nutrients are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
200/1	123	bottle	2	Bottle 21 or 23 was hit at bottom with hook on recovery, some water came out. Oxygen, salinity and nutrients are acceptable.
200/1	128	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
200/1	134	salt	2	Bottle salinity is high compared with CTD. No analytical problems noted. Salinity, oxygen and nutrients are acceptable.
200/1	135	CTDT1	3	CTDT1 unstable primary temperature reading vs. CTDT2/SBE35T, code questionable.
201/1	105	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
201/1	108	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
201/1	128	o2	2	Oxygen endpoint; corrected and corrected. Oxygen, salinity and nutrients are acceptable.
201/1	129	o2	2	Oxygen endpoint; reviewed and corrected. Oxygen, salinity and nutrients are acceptable.
201/1	135	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
201/1	136	ctdc1	4	
201/1	136	ctdc2	4	
201/1	136	ctds	4	
201/1	136	salt	2	Bottle salinity is high compared with CTD. Appears that the CTD values were out of water. Salinity looks reasonable for surface value. Code CTD salinity bad, salinity, oxygen and nutrients acceptable.
202/1	101	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
202/1	105	po4	3	PO4 low, 0.02uM, vs. potemp. Analyst: "No analytical error noted." Code PO4 questionable, other nutrients, oxygen and salinity are acceptable.
202/1	109	o2	2	Fix oxygen endpoint. Oxygen, salinity and nutrients are acceptable.
202/1	116	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
202/1	118	salt	2	4 attempts for a good salinity reading. First reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
202/1	119	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
202/1	131	salt	2	Salinity appears low compared with adjoining stations, agrees with CTD. Salinity, oxygen and nutrients are acceptable.
202/1	132	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
203/1	104	salt	2	Salinity thimble came out with cap. Salinity, oxygen and nutrients are acceptable.
203/1	105	salt	2	3 attempts for a good salinity reading. Thimble popped out with cap - second reading was bogus-arm two not entirely filled. Salinity, oxygen and nutrients are acceptable.
203/1	109	o2	3	Oxygen appears 0.04ml/l high. No analytical errors. Code oxygen questionable, salinity and nutrients are acceptable.
203/1	113	sio3	2	SiO3 high, 4uM. Analyst: "Fits profile of 204. No analytical errors noted." Nutrients, oxygen and salinity are acceptable.
203/1	118	o2	2	Fix oxygen endpoint. Noisy but ok. Oxygen, salinity and nutrients are acceptable.
203/1	131	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
203/1	132	CTDT1	3	CTDT1 unstable primary temperature reading vs. CTDT2/SBE35T, code questionable.

Station /Cast	Sample No.	Quality Property	Code	Comment
203/1	132	salt	2	Bottle salinity is low compared with CTD. Salinity, oxygen and nutrients are acceptable.
203/1	134	salt	2	Salinity thimble came out with cap. Salinity, oxygen and nutrients are acceptable.
203/1	136	salt	2	3 attempts for a good salinity reading. Averaged reading acceptable. Salinity, oxygen and nutrients are acceptable.
204/1	101	salt	4	Bottle salinity is high compared with CTD and adjoining stations. Thimble popped out with cap. No analytical problems noted. Code salinity bad, oxygen and nutrients are acceptable.
204/1	103	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
204/1	108	bottle	2	Bottle tripped at 2315m instead of 2335m intended depth.
204/1	108	o2	2	Corrected oxygen end point. Oxygen, salinity and nutrients are acceptable.
204/1	116	o2	2	Corrected oxygen end point. Oxygen, salinity and nutrients are acceptable.
204/1	124	salt	2	4 attempts for a good salinity reading. Thimble came out with cap - large jump between first and second readings. First reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
204/1	127	bottle	2	Spigot is sticky. Oxygen, salinity and nutrients are acceptable.
204/1	127	salt	2	Salinity thimble came out with cap. Salinity, oxygen and nutrients are acceptable.
204/1	129	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
204/1	135	o2	2	Corrected oxygen end point. Oxygen, salinity and nutrients are acceptable.
204/1	135	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
205/1	104	sio3	2	SiO3 does not agree with adjoining stations. Analyst: "No analytical errors noted. Deep check standard and RMNS values okay." Nutrients, oxygen and salinity are acceptable.
205/1	105	o2	2	Oxygen slightly high compared with adjoining stations. Analyst: "Endpoint Okay." Oxygen, salinity and nutrients are acceptable.
205/1	105	sio3	2	SiO3 does not agree with adjoining stations. Analyst: "No analytical errors noted. Deep check standard and RMNS values okay." Nutrients, oxygen and salinity are acceptable.
205/1	107	salt	2	5 attempts for a good salinity reading. Averaged readings are acceptable. Definite signs of salt contamination. Salinity, oxygen and nutrients are acceptable.
205/1	113	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
206/1	108	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
206/1	111	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
206/1	116	o2	2	Fixed oxygen endpoint. Oxygen, salinity and nutrients are acceptable.
206/1	119	salt	2	4 attempts for a good salinity reading. Averaged readings are acceptable. Thimble came off with cap before wiping. Sig. Salinity, oxygen and nutrients are acceptable.
206/1	125	salt	2	3 attempts for a good salinity reading. First reading resolved some of the salinity discrepancy.
206/1	126	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
206/1	133	o2	2	Redrew oxygen. Oxygen, salinity and nutrients are acceptable.
206/1	135	salt	2	4 attempts for a good salinity reading. First reading resolved some of the salinity discrepancy. Salinity, oxygen and nutrients are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
207/1	101	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	101	salt	2	5 attempts for a good salinity reading. Classic contamination readings - cause unknown. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
207/1	102	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	103	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	104	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	104	salt	2	Bottle salinity is high compared with CTD and adjoining stations. No analytical problems noted, salinity not within accuracy of measurement. Code salinity questionable, oxygen and nutrients acceptable.
207/1	105	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	105	salt	2	4 attempts for a good salinity reading. Averaged readings are acceptable. Salinity thimble popped out with cap - classic contamination readings. Salinity, oxygen and nutrients are acceptable.
207/1	106	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	106	salt	3	Bottle salinity is high compared with CTD and adjoining stations. No analytical problems noted. Code salinity questionable, oxygen and nutrients acceptable.
207/1	107	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	107	po4	2	PO4 low, 0.08uM, vs. potemp. Analyst: "No analytical errors noted. Similar trend in NO3 (although entire profile is coded 3, trend is still valid)." Nutrients, oxygen and salinity are acceptable.
207/1	108	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	109	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	110	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	111	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	112	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
207/1	113	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	113	salt	2	Salinity thimble popped out with cap. Salinity, oxygen and nutrients are acceptable.
207/1	114	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	115	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	116	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	116	salt	2	3 attempts for a good salinity reading. Additional reading would result in a higher salinity. Salinity, oxygen and nutrients are acceptable.
207/1	117	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	118	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	119	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	120	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	121	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	122	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	123	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	124	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	125	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	126	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	127	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	127	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.

Station /Cast	Sample No.	Quality Property	Code	Comment
207/1	128	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	129	bottle	2	Bottle tripped w/30 instead of intended depth 185. Suspect that bottle 29 was not properly flushed before bottle was tripped. Salinity low, oxygen agrees well with CTD, nutrients are acceptable.
207/1	129	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	129	o2	2	Ugly oxygen curve. Oxygen, salinity and nutrients are acceptable.
207/1	129	salt	2	Bottle salinity is low compared with CTD, gradient. No analytical problems noted. Salinity, oxygen and nutrients are acceptable.
207/1	130	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	130	o2	2	Fixed oxygen endpoint, high, 0.03ml/l. Oxygen, salinity and nutrients are acceptable.
207/1	131	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	132	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	133	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	134	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	135	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
207/1	136	no3	3	NO3 high compared to adjoining stations. Analyst: "Column issues. Code entire run 3, questionable." Other nutrients, salinity and oxygen are acceptable.
208/1	101	o2	3	Oxygen high compared with CTD and adjoining stations. Analyst: "Good end point." Suspect sampling error. Code oxygen questionable, salinity and nutrients are acceptable.
208/1	101	salt	2	Bottle salinity is high compared with CTD and adjoining stations. No analytical problems noted. Code salinity questionable, just within accuracy of the measurement, oxygen and nutrients are acceptable.
208/1	104	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 4 attempts for a good salinity reading. Excessive flushes required between readings 1 and 2 to clear sticky bubbles. First reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
208/1	108	o2	2	Corrected oxygen end point. Oxygen, salinity and nutrients are acceptable.
208/1	114	bottle	2	Bottle tripped @1353; intended depth 1365."
208/1	124	salt	2	4 attempts for a good salinity reading. First reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
208/1	125	po4	2	N:P ratio low. Analyst: "Nutricline region. No analytical errors noted." Nutrients, oxygen and salinity are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
208/1	126	po4	2	N:P ratio low. Analyst: "Nutricline region. No analytical errors noted." Nutrients, oxygen and salinity are acceptable.
208/1	127	po4	2	N:P ratio low. Analyst: "Nutricline region. No analytical errors noted." Nutrients, oxygen and salinity are acceptable.
208/1	127	salt	2	3 attempts for a good salinity reading. First reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
208/1	129	o2	5	ABORT; could not find oxygen endpoint, likely a poorly pickled sample.
208/1	129	salt	2	3 attempts for a good salinity reading. First reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
208/1	130	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
208/1	135	CTDT2	3	CTDT2 unstable secondary temperature reading vs. CTDT1/SBE35T, code questionable.
209/1	101	salt	2	Bottle salinity is high compared with CTD and adjoining stations. No analytical problems noted. Salinity, oxygen and nutrients are acceptable.
209/1	102	salt	2	3 attempts for a good salinity reading. First reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
209/1	107	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 4 attempts for a good salinity reading. First reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
209/1	114	o2	2	Oxygen end point corrected.
209/1	116	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 4 attempts for a good salinity reading. First reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
209/1	132	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
209/1	133	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
210/1	101	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 4 attempts for a good salinity reading. First reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
210/1	104	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. First reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
210/1	113	bottle	2	Vent open.
210/1	114	salt	2	3 attempts for a good salinity reading. First reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
210/1	117	salt	2	4 attempts for a good salinity reading. Thimble came out with cap - classic contamination readings. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
210/1	123	no3	2	NO3 high, 2ml/l, compared with adjoining stations. Although there appears to be a maximum here. PO4 also a little high compared with adjoining stations, low oxygen which agrees with CTD and high SiO3 confirming this feature. Analyst: "No analytical errors noted." Nutrients, oxygen and salinity are acceptable.
210/1	126	CTDT1	3	CTDT1 unstable primary temperature reading vs. CTDT2/SBE35T, code questionable.
210/1	127	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
210/1	134	salt	2	Salinity thimble popped out with cap. Salinity, oxygen and nutrients are acceptable.
210/1	135	CTDOXY	3	CTD oxygen sensor experience low readings from the surface to ˜35meters, although it appears the sensor returned to state, it is a little low compared to this bottle. Code CTD Oxygen questionable.

Station /Cast	Sample No.	Quality Property	Code	Comment
210/1	135	CTDT2	3	CTDT2 unstable secondary temperature reading vs. CTDT1/SBE35T, code questionable.
210/1	135	salt	2	Bottle salinity is low compared with CTD. Structure seen in CTD trace, may be the physical difference between the bottle and CTD. Salinity, oxygen and nutrients are acceptable.
210/1	136	CTDOXY	4	CTD oxygen sensor experience low readings from the surface to ˜35meters. Code CTD Oxygen bad.
211/1	101	o2	2	Oxygen low, error made in entry of flask number. Oxygen, salinity and nutrients are acceptable.
211/1	101	salt	2	4 attempts for a good salinity reading. First reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
211/1	116	salt	2	4 attempts for a good salinity reading. Additional reading resulted in higher salinity. Salinity, oxygen and nutrients are acceptable.
211/1	119	salt	2	3 attempts for a good salinity reading. First reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
211/1	134	salt	2	Bottle salinity is high compared with CTD, gradient. Salinity, oxygen and nutrients are acceptable.
212/1	101	salt	2	Salinity was a little high compared with CTD and adjoining stations. Appears to have been a poor beginning SSW. Adjusted the data based on the Standard dial, it was 6 units high, so 6 conductivity units were subtracted from the data.
212/1	103	o2	2	Fixed oxygen endpoint. Oxygen, salinity and nutrients are acceptable.
212/1	104	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
212/1	105	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
212/1	108	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
212/1	126	salt	2	04 attempts for a good salinity reading. Salinity thimble came off with cap before wiping. Definite signs of contamination. First reading manually entered, results are acceptable. Salinity, oxygen and nutrients are acceptable.
212/1	133	salt	2	4 attempts for a good salinity reading. Salinity, oxygen and nutrients are acceptable.
213/1	107	salt	3	Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. Additional readings did not resolve salinity difference. Code salinity questionable, oxygen and nutrients are acceptable.
213/1	109	o2	2	Corrected oxygen end point. Oxygen, salinity and nutrients are acceptable.
213/1	113	o2	2	Stepped end point; corrected end point. Oxygen, salinity and nutrients are acceptable.
213/1	121	o2	2	Stepped end point; corrected end point. Oxygen, salinity and nutrients are acceptable.
213/1	124	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
213/1	128	o2	2	Stepped end point; not able to correct. Oxygen, salinity and nutrients are acceptable.
213/1	129	o2	2	Replaced water in oxygen water bath. Oxygen, salinity and nutrients are acceptable.
213/1	129	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
213/1	135	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.

Station /Cast	Sample No.	Quality Property	Code	Comment
213/1	136	CTDOXY	4	CTDO too low, code bad.
214/1	101	salt	2	Salinity bottles for entire box were empty to begin with. Salinity is acceptable.
214/1	105	o2	2	Oxygen flask broken, redrew with 1384. Oxygen, salinity and nutrients are acceptable.
214/1	118	o2	5	Appears that 18 was drawn from 19, 19 from 20. Oxygen lost, salinity and nutrients are acceptable.
214/1	122	salt	2	Salinity thimble came out with cap. salinity, oxygen and nutrients are acceptable.
214/1	126	bottle	4	Bottle mis-tripped, code bottle did not trip as scheduled and all samples bad.
214/1	126	no2	4	
214/1	126	no3	4	
214/1	126	o2	4	
214/1	126	po4	4	
214/1	126	salt	4	Bottle salinity is high compared with CTD and adjoining stations. Code bottle did not trip as scheduled, all samples bad.
214/1	126	sio3	4	
214/1	127	bottle	4	Bottle mis-tripped, code bottle did not trip as scheduled and all samples bad.
214/1	127	no2	4	
214/1	127	no3	4	
214/1	127	o2	4	
214/1	127	po4	4	
214/1	127	salt	4	Bottle salinity is high compared with CTD and adjoining stations. Salinity thimble came out with cap. Code bottle did not trip as scheduled, all samples bad.
214/1	127	sio3	4	
214/1	128	bottle	4	Bottle mis-tripped, code bottle did not trip as scheduled and all samples bad.
214/1	128	no2	4	
214/1	128	no3	4	
214/1	128	o2	4	
214/1	128	po4	4	
214/1	128	salt	4	Bottle salinity is high compared with CTD and adjoining stations. Bottle did not trip as scheduled. Code bottle did not trip as scheduled, all samples bad.
214/1	128	sio3	4	
214/1	129	bottle	4	Bottle mis-tripped, code bottle did not trip as scheduled and all samples bad.
214/1	129	no2	4	
214/1	129	no3	4	
214/1	129	o2	4	
214/1	129	po4	4	
214/1	129	salt	4	Bottle salinity is low compared with CTD and adjoining stations. Bottle did not trip as scheduled. Code bottle did not trip as scheduled, all samples bad.
214/1	129	sio3	4	
214/1	130	bottle	4	Bottle mis-tripped, code bottle did not trip as scheduled and all samples bad.
214/1	130	no2	4	
214/1	130	no3	4	
214/1	130	o2	4	
214/1	130	po4	4	
214/1	130	salt	4	
214/1	130	sio3	4	
214/1	131	bottle	4	Bottle mis-tripped, code bottle did not trip as scheduled and all samples bad.
214/1	131	no2	4	
214/1	131	no3	4	

Station /Cast	Sample No.	Quality Property	Code	Comment
214/1	131	o2	4	
214/1	131	po4	4	
214/1	131	salt	4	Bottle salinity is low compared with CTD and adjoining stations. Bottle did not trip as scheduled. Code bottle did not trip as scheduled, all samples bad.
214/1	131	sio3	4	
214/1	132	ctdc1	3	
214/1	132	ctdc2	3	
214/1	132	salt	2	Bottle salinity is high compared with CTD. 3 attempts for a good salinity reading. First reading gave a better agreement with the CTD, gradient, CTD sampling less saline water from below. Code CTD salinity questionable. Salinity, oxygen and nutrients are acceptable.
214/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
215/1	103	o2	2	Oxygen is low compared with CTD, but agrees with adjoining stations. The rest of the profile appears high. Analyst: "Endpoint Okay." Oxygen, salinity and nutrients are acceptable.
215/1	105	salt	2	4 attempts for a good salinity reading. Thimble came out with cap - classic contamination readings. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
215/1	107	o2	2	Oxygen is low compared with CTD, but agrees with adjoining stations. The rest of the profile appears high. Analyst: "Endpoint Okay." Oxygen, salinity and nutrients are acceptable.
215/1	109	o2	3	Oxygen is high, 0.03ml/l. Code oxygen questionable, salinity and nutrients are acceptable.
215/1	121	o2	2	Fixed oxygen endpoint. Oxygen, salinity and nutrients are acceptable.
215/1	130	salt	2	Bottle salinity is low compared with CTD. The CTD sampled while the deeper water had not dissipated from the package. Code CTD salinity questionable, salinity, oxygen and nutrients are acceptable.
215/1	131	salt	2	Bottle salinity is low compared with CTD. The CTD sampled while the deeper water had not dissipated from the package. Code CTD salinity questionable, salinity, oxygen and nutrients are acceptable.
215/1	132	salt	2	Bottle salinity is low compared with CTD. The CTD sampled while the deeper water had not dissipated from the package. Code CTD salinity questionable, salinity, oxygen and nutrients are acceptable.
215/1	134	salt	2	Salinity thimble popped out before neck wiped. Salinity, oxygen and nutrients are acceptable.
216/1	108	salt	2	Salinity thimble popped off with cap before wiping. Salinity, oxygen and nutrients are acceptable
216/1	116	salt	2	Salinity thimble popped off with cap before wiping. Salinity, oxygen and nutrients are acceptable
216/1	119	salt	2	Salinity thimble popped off with cap before wiping. Salinity, oxygen and nutrients are acceptable
216/1	127	po4	2	N:P ratio low. Analyst: "Nutricline region. NO3 and PO4 trends consistent with SIL and oxygen." Nutrients, salinity and oxygen are acceptable.
216/1	131	bottle	2	Bottle 31 tripped @125m instead of intended 135m.
216/1	132	salt	2	4 attempts for a good salinity reading. Thimble came off with cap before wiping. First reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable
217/1	101	salt	2	Bottle salinity was high compared with CTD and adjoining stations. Large standard dial change without a change in the air temperature between this and the next salinity run. Adjustment based on the standard dial reading gave poor results. The lab air temperature was also low for the bath setting.

Station /Cast	Sample No.	Quality Property	Code	Comment
217/1	103	salt	3	Bottle salinity is high compared with CTD and adjoining stations. No analytical problems noted. Code salinity questionable, oxygen and nutrients acceptable.
217/1	105	salt	4	Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. Additional readings did not resolve salinity difference. Code salinity bad, oxygen and nutrients are acceptable.
217/1	106	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 4 attempts for a good salinity reading. Additional reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.
217/1	107	po4	2	N:P ratio low. Analyst: "Looks okay vs. ptemp. No analytical errors noted 217 or 218, NO3 or PO4." Nutrients, oxygen and salinity are acceptable.
217/1	108	salt	4	Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. Thimble came off with cap before wiping. Additional readings did not resolve salinity discrepancy. Code salinity questionable, Si03 is slightly low, but acceptable, oxygen and nutrients are acceptable.
217/1	113	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
217/1	133	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
218/1	104	salt	3	Bottle salinity is low compared with CTD and adjoining stations. No analytical problems noted, this run was very noisy. Code salinity questionable, oxygen and nutrients acceptable.
218/1	107	salt	2	Salinity thimble came out with cap. Salinity, oxygen and nutrients are acceptable.
218/1	117	salt	2	Salinity thimble popped out before neck wiped. Salinity, oxygen and nutrients are acceptable.
218/1	125	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
218/1	129	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
218/1	131	CTDT1	3	CTDT1 unstable primary temperature reading vs. CTDT2/SBE35T, code questionable.
218/1	135	bottle	2	Bottle tripped at 20m instead of 25 for the mixed layer.
218/1	135	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
219/1	101	salt	2	4 attempts for a good salinity reading. Third reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
219/1	105	sio3	2	SiO3 high. Analyst: "No analytical errors noted. Deep cal and RMNS spot-on." Nutrients, salinity and oxygen are acceptable.
219/1	106	o2	4	Correct oxygen endpoint. Oxygen high compared with adjoining stations. Code oxygen bad, salinity and nutrients are acceptable.
219/1	106	sio3	2	SiO3 high. Analyst: "No analytical errors noted. Deep cal and RMNS spot-on." Nutrients, salinity and oxygen are acceptable.
219/1	107	sio3	2	SiO3 high. Analyst: "No analytical errors noted. Deep cal and RMNS spot-on." Nutrients, salinity and oxygen are acceptable.
219/1	108	sio3	2	SiO3 high. Analyst: "No analytical errors noted. Deep cal and RMNS spot-on." Nutrients, salinity and oxygen are acceptable.
219/1	109	sio3	2	SiO3 high. Analyst: "No analytical errors noted. Deep cal and RMNS spot-on." Nutrients, salinity and oxygen are acceptable.
219/1	110	sio3	2	SiO3 high. Analyst: "No analytical errors noted. Deep cal and RMNS spot-on." Nutrients, salinity and oxygen are acceptable.
219/1	111	sio3	2	SiO3 high. Analyst: "No analytical errors noted. Deep cal and RMNS spot-on." Nutrients, salinity and oxygen are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
219/1	113	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
219/1	114	salt	2	Salinity thimble popped out with cap. Salinity, oxygen and nutrients are acceptable.
219/1	122	salt	2	Salinity thimble popped out before neck wiped. Salinity is slightly high, within accuracy of the measurement. Salinity, oxygen and nutrients are acceptable.
219/1	126	salt	2	5 attempts for a good salinity reading. Third reading resolved salinity discrepancy. Readings erratic cause unknown. Salinity, oxygen and nutrients are acceptable.
219/1	130	salt	2	Salinity thimble came out with cap. Salinity, oxygen and nutrients are acceptable.
220/1	105	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
220/1	106	o2	3	Oxygen high compared with adjoining stations and CTD. Code oxygen questionable, salinity and nutrients acceptable.
220/1	111	o2	2	Oxygen appear exactly the same. Same signature is seen in NO3 and PO4, but not SiO3. Oxygen, salinity and nutrients are acceptable.
220/1	112	o2	2	Oxygen appear exactly the same. Same signature is seen in NO3 and PO4, but not SiO3. Oxygen, salinity and nutrients are acceptable.
220/1	116	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
220/1	120	o2	2	Oxygen stepped end point; corrected. Oxygen, salinity and nutrients are acceptable.
220/1	126	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
220/1	132	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
220/1	133	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
220/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
220/1	134	salt	2	Bottle salinity is low compared with CTD. Bottle was tripped before water dissipated. Code CTD salinity questionable, salinity, oxygen and nutrients acceptable.
221/1	101	salt	2	3 attempts for a good salinity reading. First reading resolves salinity difference. Salinity, oxygen and nutrients are acceptable.
221/1	105	o2	2	Oxygen end point corrected. Oxygen, salinity and nutrients are acceptable.
221/1	107	sio3	2	SiO3 low compared with station profile and adjoining stations. Analyst: "Checked these points, and there were no analytical errors." Nutrients, oxygen and salinity are acceptable.
221/1	108	sio3	2	SiO3 low compared with station profile and adjoining stations. Analyst: "Checked these points, and there were no analytical errors." Nutrients, oxygen and salinity are acceptable.
221/1	120	salt	2	3 attempts for a good salinity reading. First reading resolves salinity difference. Salinity, oxygen and nutrients are acceptable.
221/1	129	salt	2	3 attempts for a good salinity reading. Additional readings do not resolve discrepancy, within accuracy of measurement. Salinity, oxygen and nutrients are acceptable.
221/1	130	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
221/1	130	salt	2	Bottle salinity is low compared with CTD. Salinity, oxygen and nutrients are acceptable.
221/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
222/1	101	bottle	2	This was a styrofoam cup cast.

Station /Cast	Sample No.	Quality Property	Code	Comment
222/1	101	o2	5	Bad titration due to rig leak, oxygen sample lost.
222/1	105	salt	2	4 attempts for a good salinity reading. Thimble popped out with cap. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
222/1	106	salt	4	Bottle salinity is high compared with CTD and adjoining stations. No analytical problems noted, although this run is very noisy and the lab temperature was between 24.3 and 25.5. Code salinity bad, oxygen and nutrients acceptable.
222/1	108	salt	4	Bottle salinity is high compared with CTD and adjoining station. 4 attempts for a good salinity reading.Thimble came out with cap - readings very erratic. Sample either drawn from bottle 7 or analyst took bottle 8 out and reanalyzed 7. Code salinity bad, oxygen and nutrients are acceptable.
222/1	110	o2	3	Oxygen high compared with adjoining stations and CTD. No analytical notes. Oxygen, salinity and nutrients are acceptable.
222/1	110	salt	3	Bottle salinity is high compared with CTD and adjoining stations. No analytical problems noted, although this run is very noisy and the lab temperature was between 24.3 and 25.5. Code salinity bad, oxygen and nutrients acceptable.
222/1	126	salt	2	Salinity thimble came out with cap. Salinity, oxygen and nutrients are acceptable.
222/1	128	ctdc1	3	
222/1	128	ctdc2	3	
222/1	128	salt	2	Bottle salinity is low compared with CTD. Wake from rosette did not dissipate when bottle was tripped. Code CTD salinity questionable, salinity, oxygen and nutrients acceptable.
222/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
222/1	135	ctdc1	3	
222/1	135	ctdc2	3	
222/1	135	CTDOXY	3	
222/1	135	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
222/1	135	salt	2	Bottle salinity is high compared with CTD. CTD trace too low, some debris must have gotten stuck at about 25m. Code CTD salinity and oxygen bad, salinity, oxygen and nutrients are acceptable.
222/1	136	ctdc1	3	
222/1	136	ctdc2	3	
222/1	136	CTDOXY	3	
222/1	136	po4	2	N:P ratio high. Analyst: "Both NO3 and PO4 high at surface this station. Localized upwelling? No analytical errors noted." Nutrients, oxygen and nutrients are acceptable.
222/1	136	salt	2	Bottle salinity is high compared with CTD. CTD trace too low, some debris must have gotten stuck at about 25m. Code CTD salinity and oxygen bad, salinity, oxygen and nutrients are acceptable.
223/1	102	salt	2	Salinity thimble came out with cap. Salinity, oxygen and nutrients are acceptable.
223/1	104	salt	2	Salinity thimble came out with cap. Salinity, oxygen and nutrients are acceptable.
223/1	105	salt	2	Salinity thimble came out with cap. Salinity, oxygen and nutrients are acceptable.
223/1	105	sio3	2	SiO3 high compared with adjoining stations. Analyst: "Okay vs. pot temp. No analytical errors noted." Nutrients, oxygen and salinity are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
223/1	130	CTDT2	3	CTDT2 unstable secondary temperature reading vs. CTDT1/SBE35T, code questionable.
223/1	130	salt	2	Bottle salinity is high compared with CTD. Lots of structure in the CTD trace. Suspect that deeper water did not dissipate when CTD sampled. Code CTD salinity questionable, salinity, oxygen and nutrients are acceptable.
223/1	131	no3	2	NO3 low compared with adjoining stations. Analyst: "Looks okay vs. pot temp. No analytical errors noted." Nutrients, oxygen and salinity are acceptable.
223/1	133	salt	2	Bottle salinity is low compared with CTD. Lots of structure in the CTD trace. Suspect that deeper water did not dissipate when CTD sampled. Code CTD salinity questionable, salinity, oxygen and nutrients are acceptable.
223/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
224/1	110	salt	2	Bottle salinity is high compared with CTD and adjoining stations. No analytical problems noted. Bottle not flushed properly, deeper water entrained in the bottle. Salinity, oxygen and nutrients are acceptable.
224/1	111	salt	2	Bottle salinity is high compared with CTD and adjoining stations. No analytical problems noted. Bottle not flushed properly, deeper water entrained in the bottle. Salinity, oxygen and nutrients are acceptable.
224/1	118	salt	2	3 attempts for a good salinity reading. Second reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
224/1	128	o2	4	Oxygen appears to have been drawn from bottle 27. Code oxygen bad, salinity and nutrients are acceptable.
224/1	130	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
224/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
225/1	101	salt	2	3 attempts for a good salinity reading. Additional readings would result in a larger difference, averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
225/1	105	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
225/1	108	o2	4	Stir bar not moving fast enough; Oxygen endpoint reached before plotting - sample lost. Code oxygen bad, salinity and nutrients are acceptable.
225/1	116	salt	2	3 attempts for a good salinity reading. Salinity thimble came off with cap before wiping. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
225/1	129	salt	2	3 attempts for a good salinity reading. Additional readings would result in a larger difference, averaged readings are acceptable for shallow value. Salinity, oxygen and nutrients are acceptable.
225/1	131	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
226/1	101	bottle	2	Nipple loose prior to sampling. Oxygen, salinity and nutrients are acceptable.
226/1	101	o2	2	Nipple loose prior to sampling.
226/1	108	salt	2	Salinity thimble came out with cap. Salinity, oxygen and nutrients are acceptable.
226/1	116	salt	3	Bottle salinity is high compared with CTD and adjoining stations. No analytical problem noted. Code salinity questionable, oxygen and nutrients are acceptable.
226/1	119	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. Thimble popped out with cap. Salinity, oxygen and nutrients are acceptable.
226/1	122	salt	2	Salinity thimble popped loose while neck being wiped. Salinity, oxygen and nutrients are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
226/1	133	salt	2	Bottle salinity is low compared with CTD. Salinity, oxygen and nutrients are acceptable.
227/1	118	o2	2	Corrected oxygen endpoint. Oxygen, salinity and nutrients are acceptable.
227/1	129	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
228/1	101	salt	3	Bottle salinity is high compared with CTD and adjoining stations. No analytical problems noted. Code salinity questionable, oxygen and nutrients are acceptable.
228/1	109	salt	3	Bottle salinity is high compared with CTD and adjoining stations. No analytical problems noted. Code salinity questionable, oxygen and nutrients are acceptable.
228/1	110	salt	3	Bottle salinity is high compared with CTD and adjoining stations. No analytical problems noted. Code salinity questionable, oxygen and nutrients are acceptable.
228/1	124	o2	2	Corrected oxygen endpoint. Oxygen, salinity and nutrients are acceptable.
228/1	133	ctdc1	3	
228/1	133	ctdc2	3	
228/1	133	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
228/1	133	salt	2	Bottle salinity is low compared with CTD {and adjoining stations}. Gradient, bottle was tripped before deeper water dissipated. Code CTD salinity questionable, salinity, oxygen and nutrients are acceptable.
228/1	134	ctdc1	3	
228/1	134	ctdc2	3	
228/1	134	salt	2	Bottle salinity is high compared with CTD. Gradient, bottle was tripped before deeper water dissipated. Code CTD salinity questionable, salinity, oxygen and nutrients are acceptable.
229/1	126	CTDT1	3	CTDT1 unstable primary temperature reading vs. CTDT2/SBE35T, code questionable.
229/1	126	salt	2	Bottle salinity is low compared with CTD {and adjoining stations}.
229/1	129	ctdc1	3	
229/1	129	ctdc2	3	
229/1	129	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
229/1	129	salt	2	4 attempts for a good salinity reading. First reading resolved salinity discrepancy. Salinity feature that the sensor was measuring the deeper water when the bottle was tripped. Code CTD salinity questionable, salinity, oxygen and nutrients are acceptable.
229/1	132	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
229/1	134	salt	2	4 attempts for a good salinity reading. First reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
230/1	101	salt	2	(1-36) Salinometer standardized to low temp std, std dial set inconsistently with adjacent runs. Correction made for std dial.
230/1	105	salt	2	Salinity thimble came out with cap. Salinity, oxygen and nutrients are acceptable.
230/1	116	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. Thimble came out with cap - large jump first to second readings. First reading resolved salinity discrepancy within accuracy of the measurement. Salinity, oxygen and nutrients are acceptable.
230/1	124	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
230/1	126	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
231/1	110	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
231/1	119	salt	2	4 attempts for a good salinity reading. First reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
231/1	128	sio3	2	SiO3 low, ˜5uM, other nutrients do not show this low feature nor does oxygen. Analyst: "Nutricline region, seen in all nutrients and dissolved oxygen."
231/1	129	sio3	2	SiO3 low, ˜5uM, other nutrients do not show this low feature nor does oxygen. Analyst: "Nutricline region, seen in all nutrients and dissolved oxygen."
232/1	101	salt	2	Salinity run, (1-36), too high. Lab temperature 3 degrees lower than bath temperature, suspect samples had not yet come to lab temperature, corrected run. fmd: (1-36) Salinometer standardized to low temp std, std dial set inconsistently with adjacent runs. Correction made for std dial.
232/1	127	CTDS1	3	
232/1	127	salt	2	Bottle salinity is high compared with CTD. CTD is sampling deeper water at the time the bottle is tripped. Code CTD salinity questionable. Salinity, oxygen and nutrients are acceptable.
232/1	132	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
233/1	101	salt	2	(1-36) Salinometer standardized to low temp std, std dial set inconsistently with adjacent runs. Correction made for std dial.
233/1	125	o2	2	Checked Oxygen endpoint, okay. Oxygen, salinity and nutrients are acceptable.
233/1	129	salt	2	3 attempts for a good salinity reading. First reading gave better results although still low, within the accuracy of the measurement. Salinity, oxygen and nutrients are acceptable.
234/1	101	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 4 attempts for a good salinity reading. Large jumps between first three readings. Within the accuracy of the measurement. Salinity, oxygen and nutrients are acceptable.
234/1	104	o2	2	Oxygen redrawn on 4. Oxygen, salinity and nutrients are acceptable.
234/1	114	o2	4	CHECK: Bottle o2 not in WOCE specs. Code bad.
234/1	124	bottle	2	Console operator missed intended depth of 415m, two bottles were tripped at the surface.
234/1	126	o2	4	CHECK: Bottle o2 not in WOCE specs. Code bad.
234/1	128	o2	4	CHECK: Bottle o2 not in WOCE specs. Code bad.
234/1	133	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
234/1	135	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
235/1	119	o2	2	Oxygen is high compared with SiO3, feature is seen in NO3 and PO4, but is not as strong in SiO3.
235/1	130	salt	2	Bottle salinity is high compared with CTD. Suspect the bottle did not completely flush before tripping. Code CTD salinity questionable, salinity, oxygen and nutrients are acceptable.
235/1	132	ctdc1	3	
235/1	132	CTDT1	3	CTDT1 unstable primary temperature reading vs. CTDT2/SBE35T, code questionable.
235/1	132	salt	2	Bottle salinity is low compared with CTD. Suspect the difference is the physical location of the bottle vs. the CTD. Code CTD salinity questionable, salinity, oxygen and nutrients are acceptable.
235/1	133	ctdc1	3	
235/1	133	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.

Station /Cast	Sample No.	Quality Property	Code	Comment
235/1	133	salt	2	Bottle salinity is low compared with CTD. CTD measuring deeper, saltier water when bottle closed. Code CTD salinity questionable, salinity, oxygen and nutrients are acceptable.
236/1	105	salt	2	Bottle salinity is high compared with CTD and adjoining stations. salt
236/1	107	po4	2	PO4 vs. NO3, high. Analyst: "No analytical error noted. N:P ratio 14.0 for 106-108."
236/1	108	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
236/1	112	po4	3	High compared to profile and adjacent profiles. No analytical errors noted. Code PO4 questionable, other nutrient parameters okay.
236/1	115	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
236/1	126	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
236/1	133	salt	2	Bottle salinity is low compared with CTD. Deeper saltier water still entrained in the bottle when the sample was taken. Salinity, oxygen and nutrients are acceptable.
237/1	104	o2	2	Sample was overtitrated and backtitrated. Hit over-titrate option instead of finish, corrected value using the first. Oxygen is acceptable.
237/1	104	salt	4	Bottle salinity is high compared with CTD and adjoining stations. Salinity thimble came off with cap before wiping. Code salinity bad, oxygen and nutrients are acceptable.
237/1	105	salt	2	Salinity thimble came off with cap before wiping. Salinity is a little high, but within the accuracy of the measurement. Salinity, oxygen and nutrients are acceptable.
237/1	105	sio3	2	SiO3 ~1uM with adjoining stations vs. potemp. Analyst: "No analytical errors noted. Concomitant trend in oxygen." Nutrients, oxygen and salinity are acceptable.
237/1	114	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
237/1	117	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
237/1	120	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
237/1	135	po4	2	PO4 high, similar high value seen in 240. Analyst: "Upwelling region. No analytical error noted."
238/1	105	ctdc1	4	Offset in primary conductivity sensor, code CTD primary conductivity bad.
238/1	106	ctdc1	4	Offset in primary conductivity sensor, code CTD primary conductivity bad.
238/1	107	ctdc1	4	Offset in primary conductivity sensor, code CTD primary conductivity bad.
238/1	108	ctdc1	4	Offset in primary conductivity sensor, code CTD primary conductivity bad.
238/1	109	ctdc1	4	Offset in primary conductivity sensor, code CTD primary conductivity bad.
238/1	110	ctdc1	4	Offset in primary conductivity sensor, code CTD primary conductivity bad.
238/1	111	ctdc1	4	Offset in primary conductivity sensor, code CTD primary conductivity bad.
238/1	131	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
238/1	133	po4	2	N:P ratio low. Analyst: "Dynamic region in both vertical and horizontal dimensions; no analytical errors noted." Nutrients, oxygen and salinity are acceptable.
239/1	108	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
239/1	119	salt	2	3 attempts for a good salinity reading. Thimble came out with cap - large jump between first and second readings. First reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
239/1	124	salt	2	4 attempts for a good salinity reading. Large jumps between first three readings - cause unknown. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
239/1	126	CTDT1	3	CTDT1 unstable primary temperature reading vs. CTDT1 and SBE35RT.
239/1	132	o2	3	Oxygen low compared up, down trace, and with adjoining stations. Possible mistrip. Salinity agrees with with the CTD. Code oxygen, silicate and phosphate questionable, nitrate is reasonable.
239/1	136	CTDT2	3	CTDT2 unstable secondary temperature reading vs. CTDT1/SBE35T, code questionable.
240/1	101	bottle	2	CTDC1 exhibited an offset on the way up. CTDC2 and CTDT2 will be reported for this cast.
240/1	105	salt	2	Bottle salinity is high compared with CTD and adjoining stations. 3 attempts for a good salinity reading. First reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
240/1	110	salt	4	Salinity thimble came off with cap before wiping. Contamination of the sample. Code salinity bad, oxygen and nutrients are acceptable.
240/1	125	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
240/1	130	o2	4	Bottle o2 not within WOCE specs. Code bad.
240/1	130	salt	3	Bottle salinity is high compared with CTD, while oxygen is high. Agrees with up trace although CTD, appears deeper water is entrained. Code salinity questionable, nutrients are acceptable.
240/1	131	salt	2	Bottle salinity is low compared with CTD. CTD sampled the deeper saltier water. Code CTD salinity questionable, salinity, oxygen and nutrients are acceptable.
240/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
240/1	135	po4	2	PO4 vs. NO3, high. Analyst: "Upwelling region. No analytical error noted."
241/1	116	salt	2	3 attempts for a good salinity reading. Could not clear bubbles in reasonable amount of flushes after first reading. Keyboard entry with first reading value. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
241/1	126	salt	2	3 attempts for a good salinity reading. Thimble came off with cap before wiping. First reading resolved salinity discrepancy. Salinity, oxygen and nutrients are acceptable.
241/1	127	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
241/1	128	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
241/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
242/1	102	salt	2	4 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
242/1	113	salt	2	3 attempts for a good salinity reading. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.
242/1	132	salt	2	Bottle salinity is low compared with CTD. CTD sampling deeper less saline water. Salinity, oxygen and nutrients are acceptable.
242/1	133	o2	2	Bottle oxygen not within WOCE specs compared to CTDO. KMS: agrees with adjoining stations, code acceptable.
242/1	133	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
242/1	133	salt	2	Bottle salinity is high compared with CTD. Suspect difference between physical location of the bottle and CTD. Salinity, oxygen and nutrients are acceptable.

Station /Cast	Sample No.	Quality Property	Code	Comment
242/1	134	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
243/2	201	salt	2	(1-36) Salinometer standardized to low temp std, std dial set inconsistently with adjacent runs. Correction made for std dial.
243/2	222	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
243/2	236	bottle	2	Vent open. Oxygen, salinity and nutrients are acceptable.
243/2	236	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
244/2	201	salt	2	(1-36) Salinometer standardized to low temp std, std dial set inconsistently with adjacent runs. Correction made for std dial.
244/2	202	sio3	2	SiO3 high, 1uM. Analyst: "No analytical error noted."
244/2	203	o2	2	Broke oxygen flask 1003, replace with 1743.
244/2	207	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
244/2	216	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
244/2	223	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
244/2	229	bottle	2	Missed intended depth, 235, by 10m.
244/2	235	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
245/1	101	salt	2	(1-36) Salinometer standardized to low temp std, std dial set inconsistently with adjacent runs. Correction made for std dial.
245/1	128	o2	2	Fixed oxygen end point.
245/1	131	reft	3	SBE35RT unstable reading vs. CTDT1/CTDT2, code questionable.
246/1	101	salt	2	(1-36) Salinometer standardized to low temp std, std dial set inconsistently with adjacent runs. Correction made for std dial.
246/1	108	bottle	3	O-ring valve compromised. Oxygen bad, salinity and nutrients are acceptable.
246/1	108	no2	2	CHECK O-ring valve compromised.
246/1	108	no3	2	CHECK O-ring valve compromised.
246/1	108	o2	4	O-ring valve compromised. Code bottle leading, oxygen bad.
246/1	108	salt	2	CHECK O-ring valve compromised.
246/1	108	sio3	2	CHECK O-ring valve compromised.
246/1	130	o2	5	Flask broken, sample lost.
247/1	101	salt	2	(1-36) Salinometer standardized to low temp std, std dial set inconsistently with adjacent runs, it also appears that there was a bad beginning worm. Correction made for std dial and bad worm.
247/1	114	o2	2	Oxygen bottle value high, but matches upcast. Code acceptable.
248/1	102	bottle	9	Bottle 2 was mistakenly tripped with bottle 1, operator error. No samples were taken from bottle 2.
248/1	103	salt	2	Bottle salinity is high compared with CTD and adjoining stations. Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
248/1	106	salt	2	4 attempts for a good salinity reading. First reading resolved salinity difference. Salinity, oxygen and nutrients are acceptable.
248/1	110	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
248/1	114	salt	2	Salinity thimble came off with cap before wiping. Salinity, oxygen and nutrients are acceptable.
248/1	126	salt	2	5 attempts for a good salinity reading. Chosen averaged readings are acceptable. Salinity thimble came off with cap before wiping. Averaged readings are acceptable. Salinity, oxygen and nutrients are acceptable.

| Station /Cast	Sample No.	Quality Property	Code	Comment
249/1	121	salt	2	Bottle salinity is low compared with CTD. Deeper less saline water still entrained in the bottle. Salinity, oxygen and nutrients are acceptable for shallow sampling.
250/1	115	o2	2	Took sample off early, did not reach endpoint. Oxygen agrees with CTD and adjoining stations.
250/1	116	salt	2	Bottle salinity is low compared with CTD. Deeper, less salinity water likely still entrained in bottle. Salinity, oxygen and nutrients are acceptable for surface sampling.

Property Plots

Figures showing property distributions along the 32.5°S section.

1. Potential Temperature
2. Salinity
3. Potential Density (relative to 0 db)
4. Potential Density (relative to 4000 db)
5. Dissolved Oxygen
6. Silicate
7. Phosphate
8. Nitrate

Property versus Potential Temperature

1. Salinity
2. Oxygen
3. Silicate
4. Phosphate
5. Nitrate

Potential Density (sigma-4000)

Oxygen (umole/kg)

Silicate (umole/kg)

Phosphate(umole/kg)
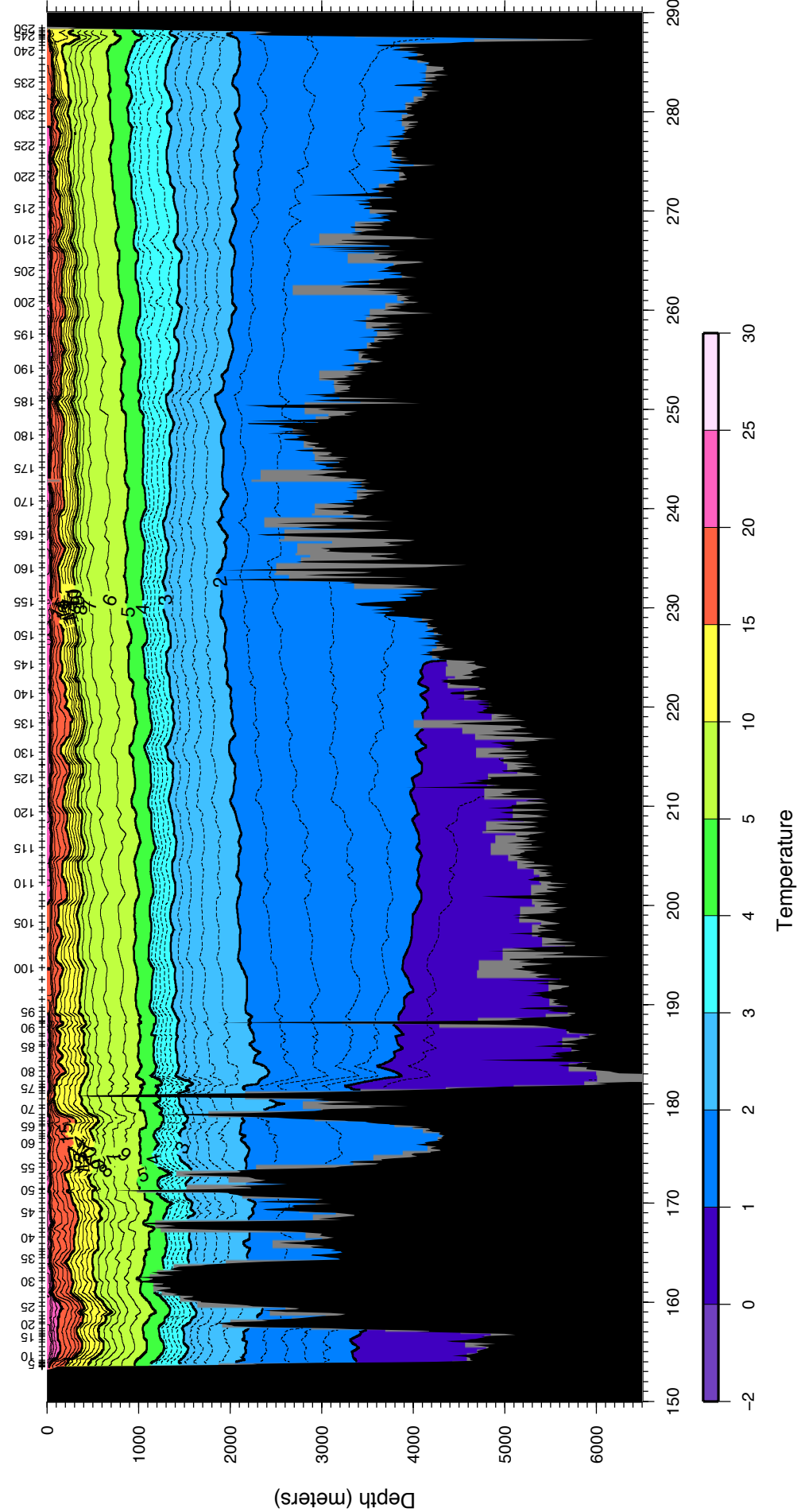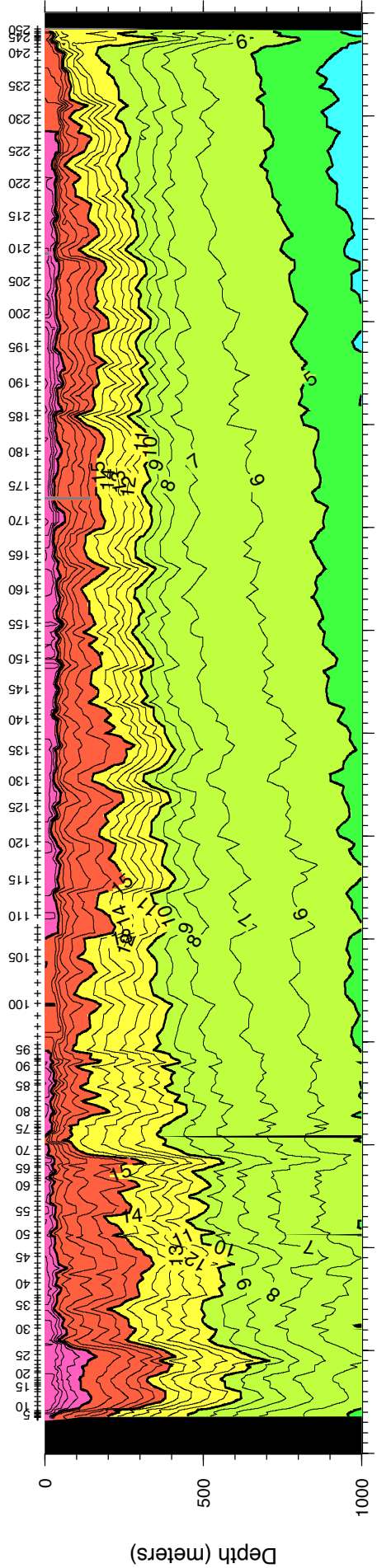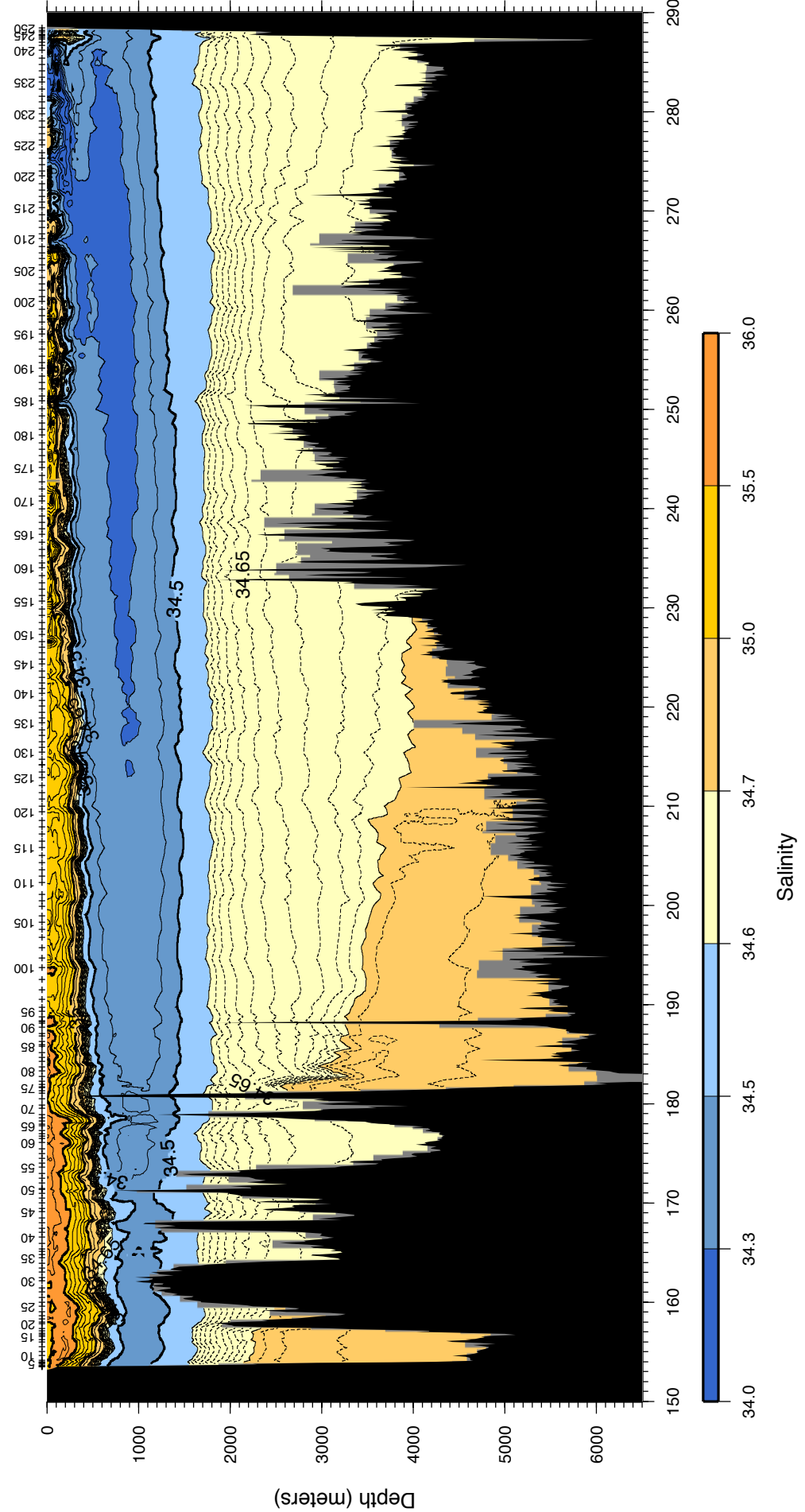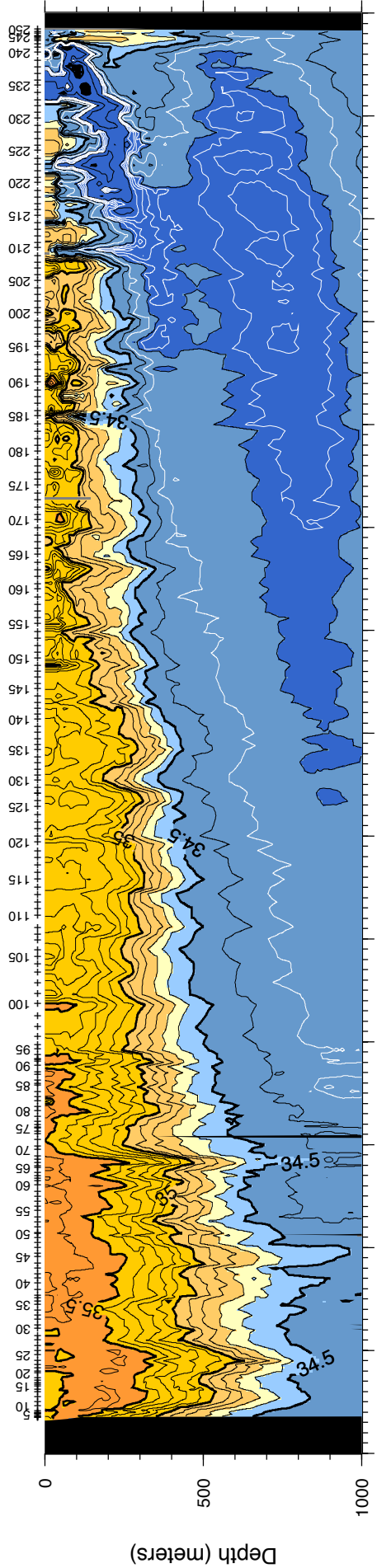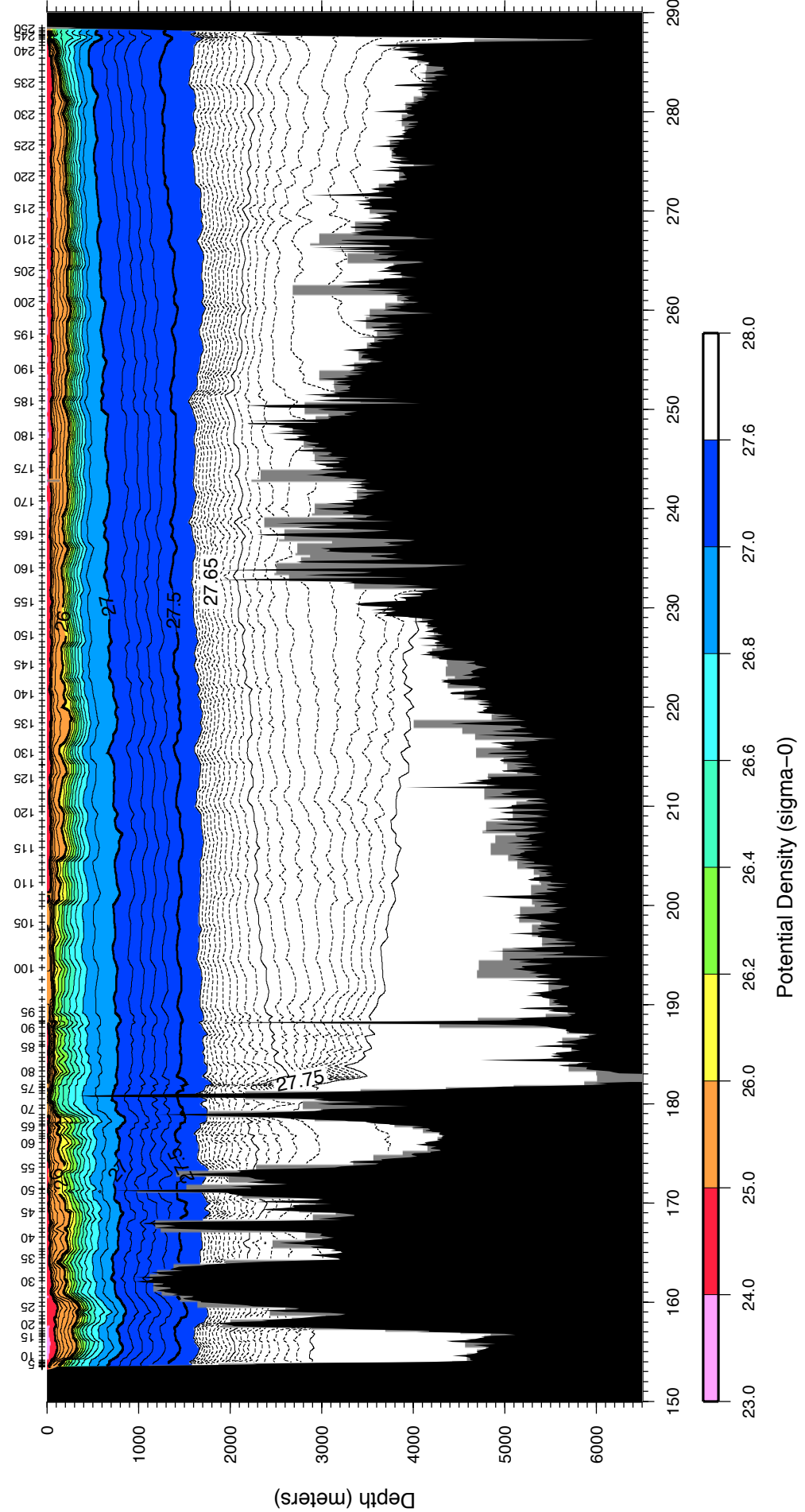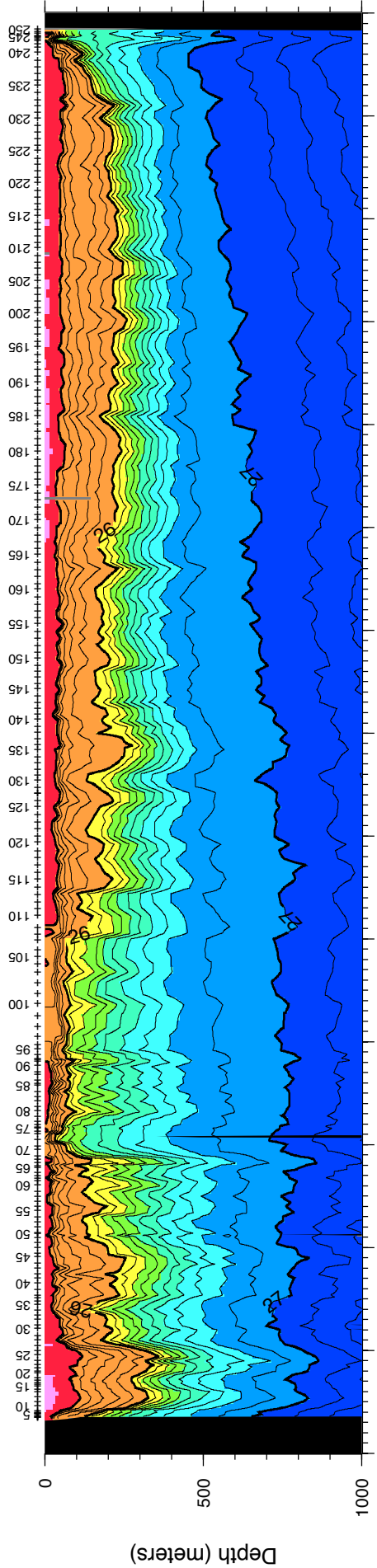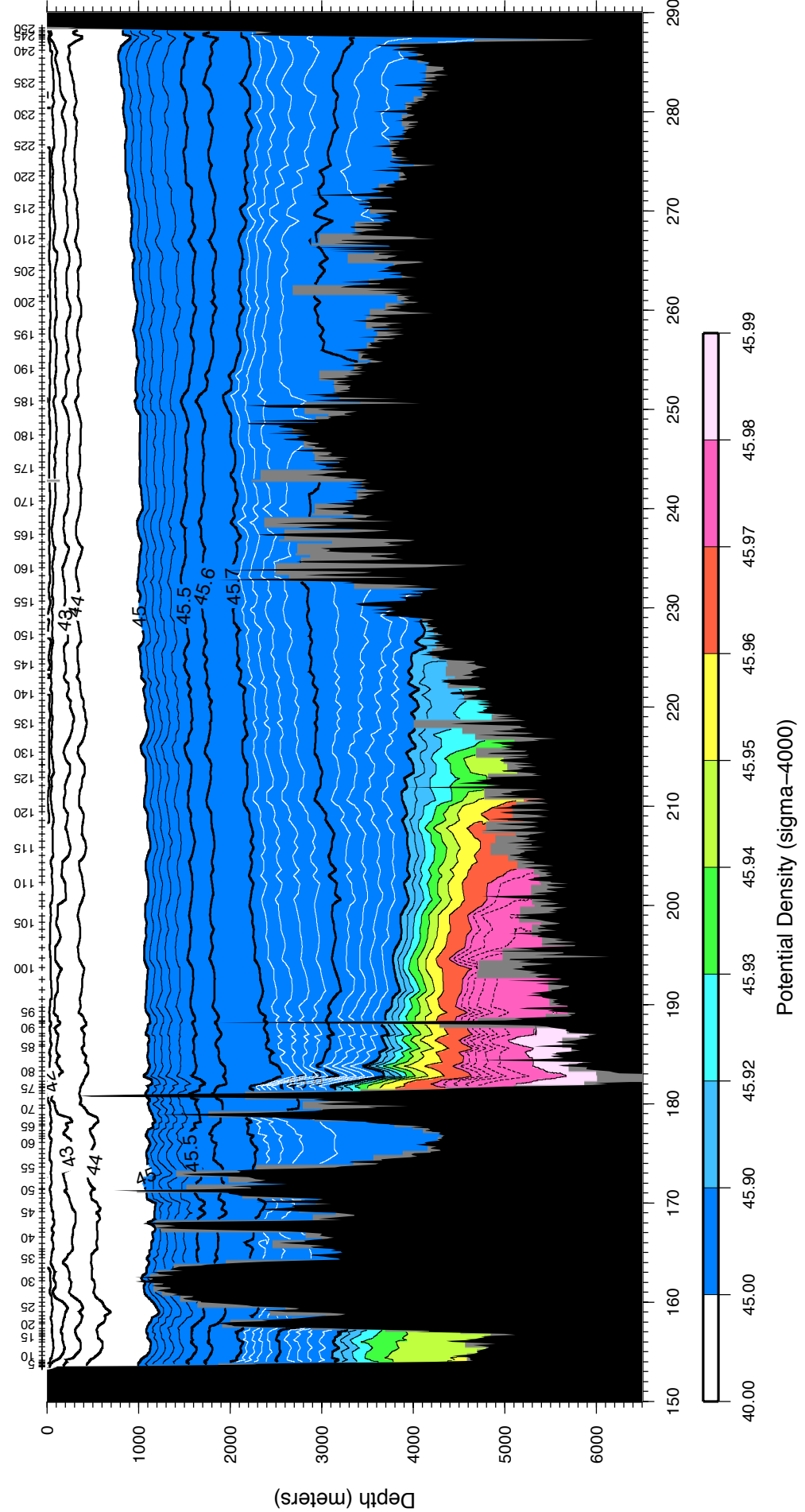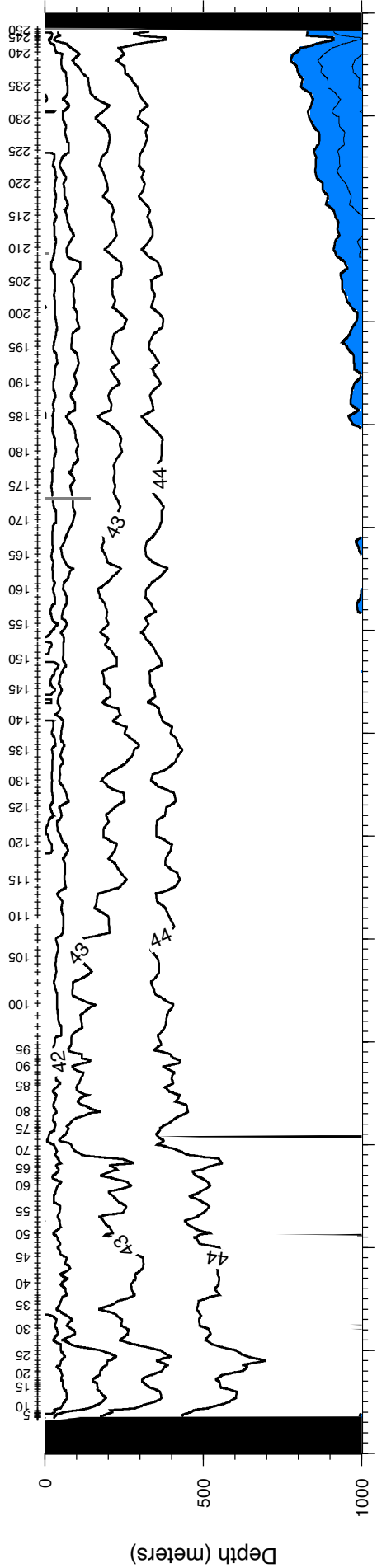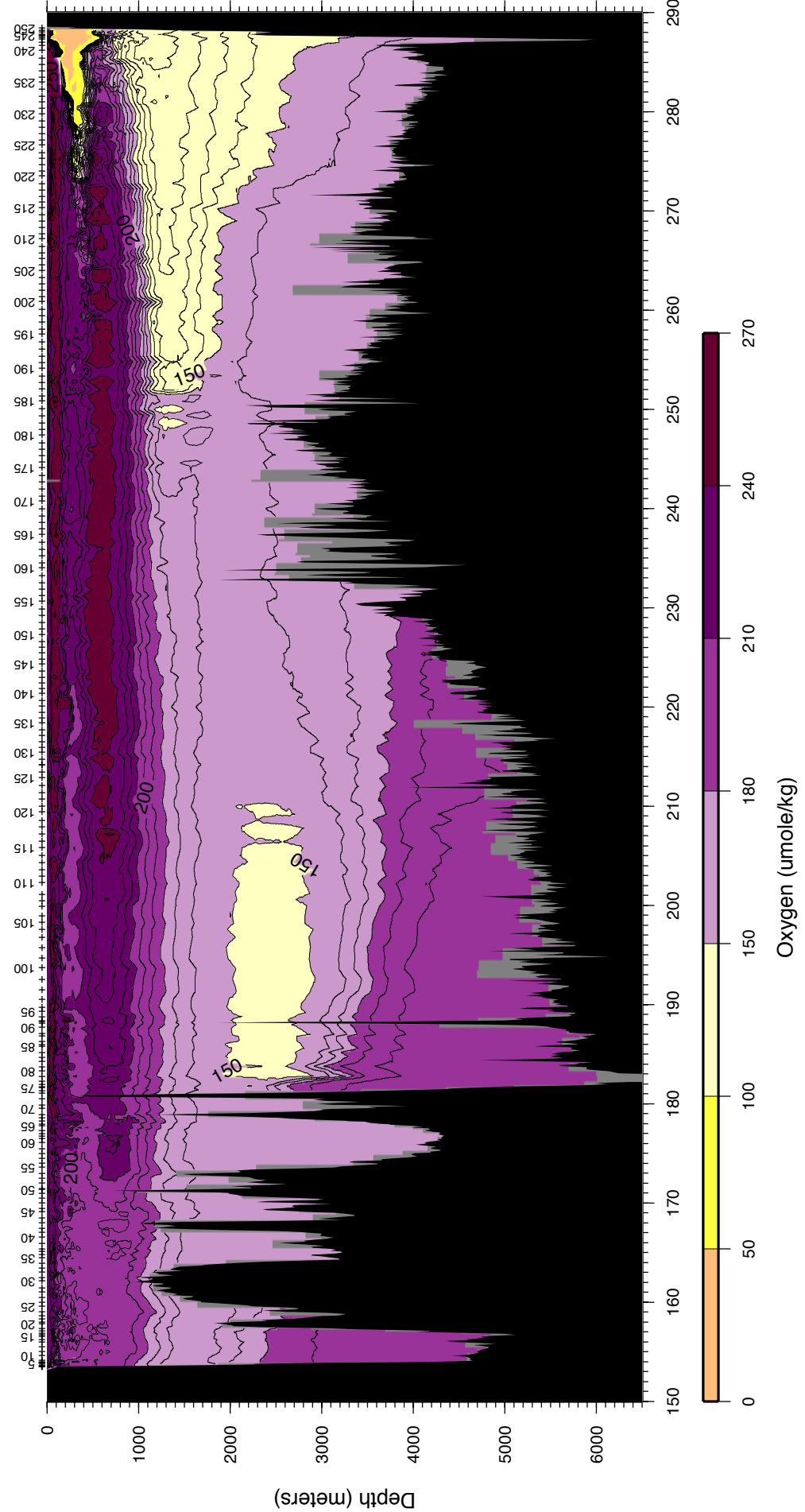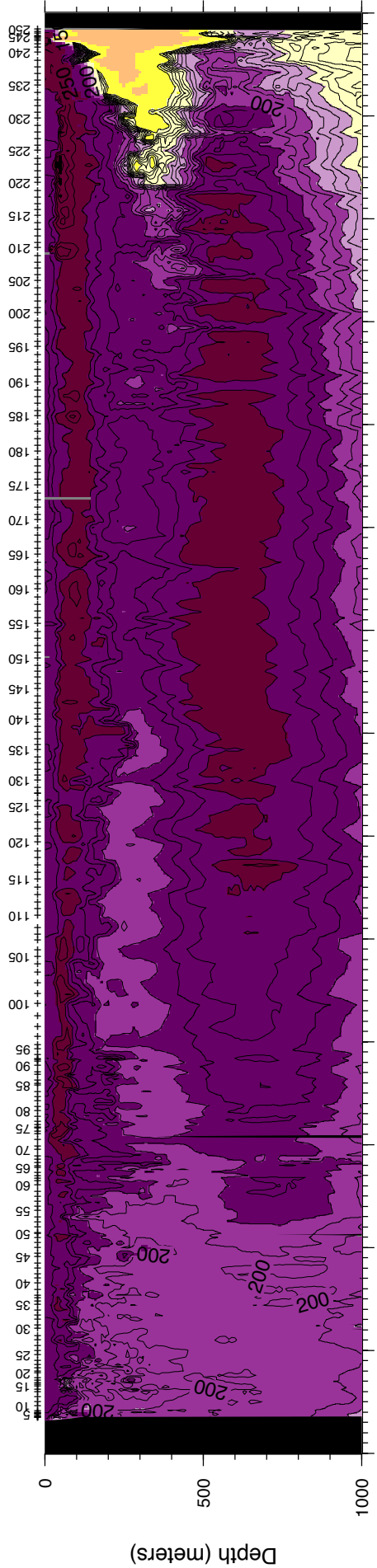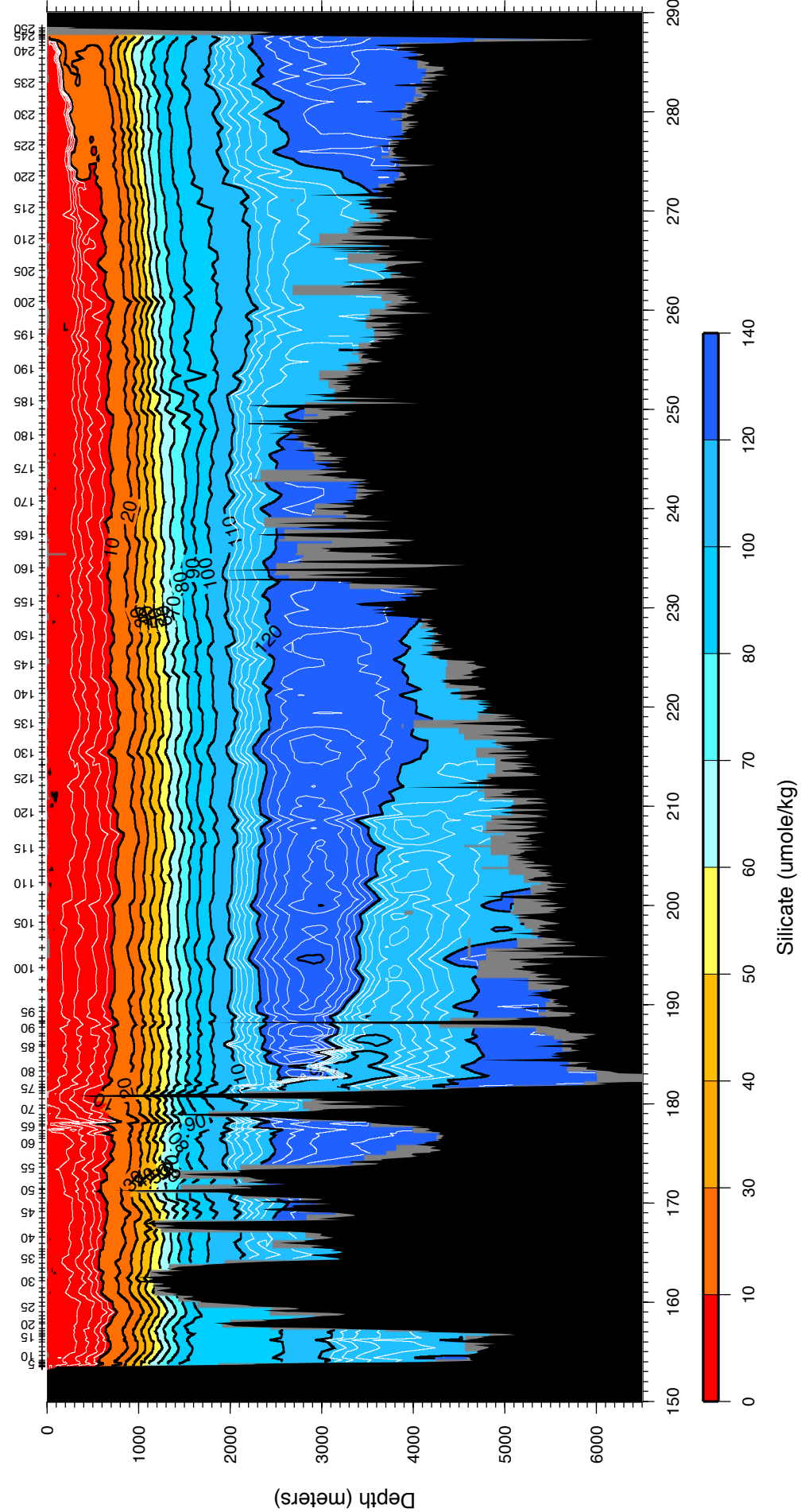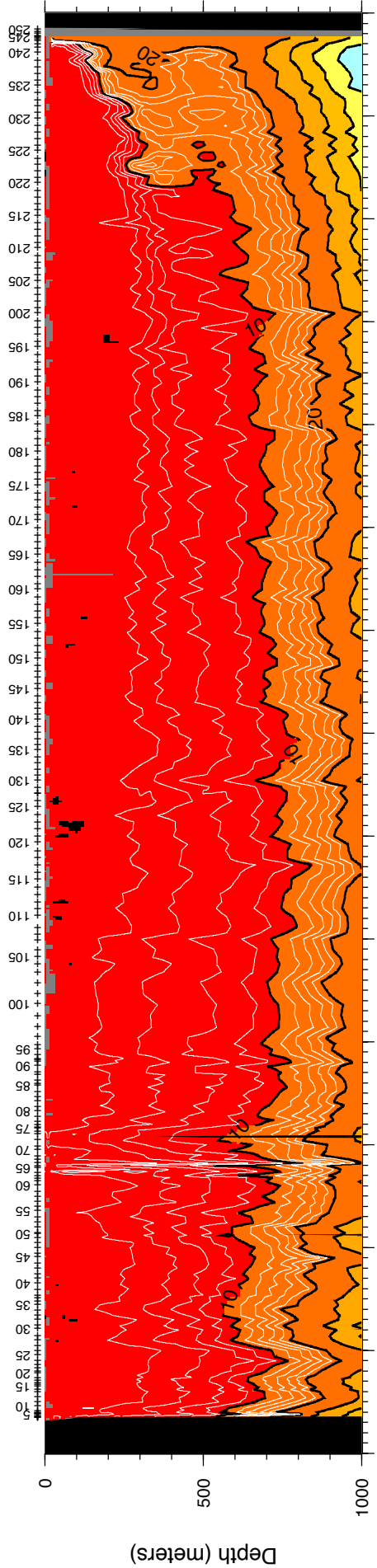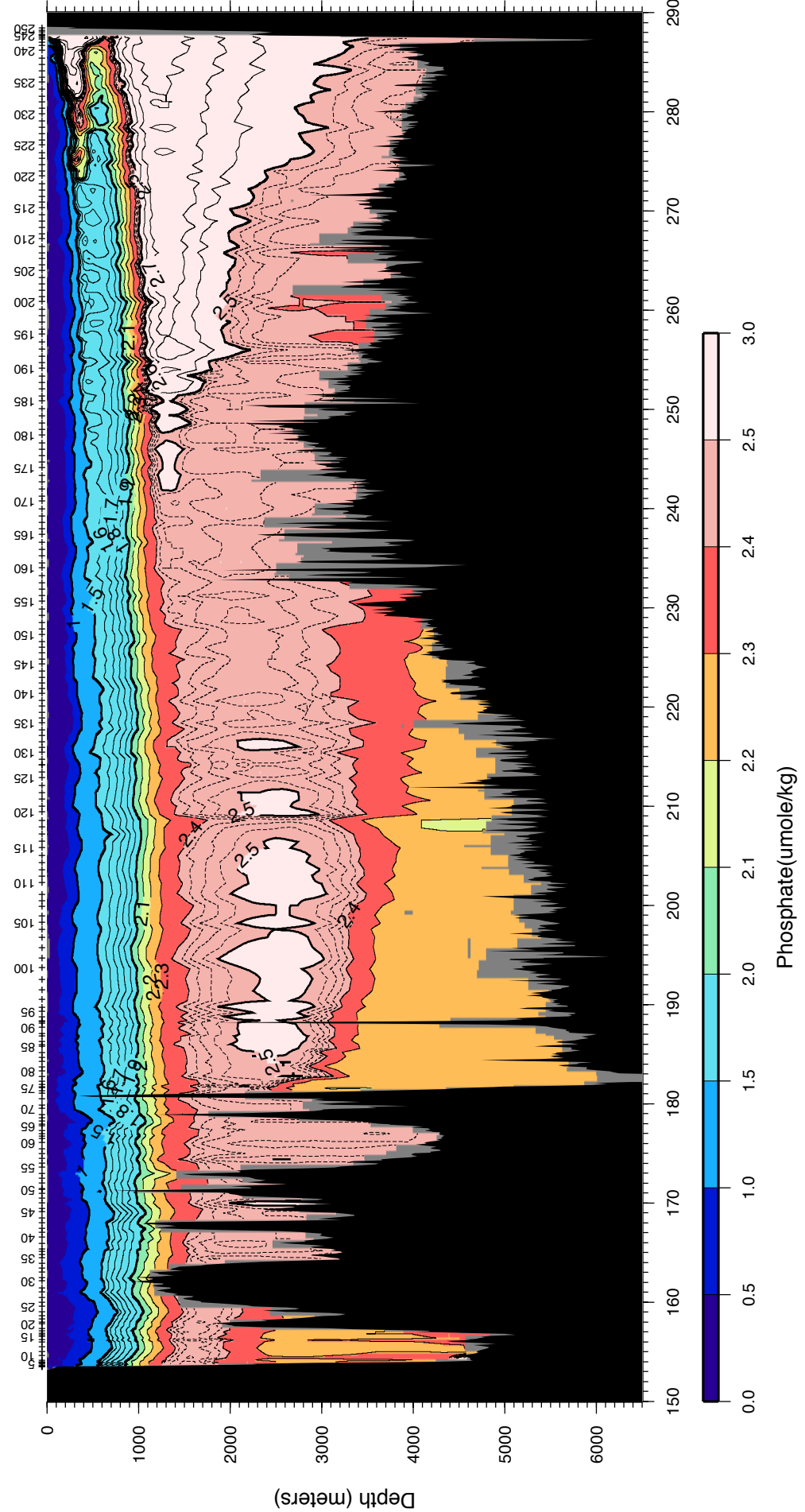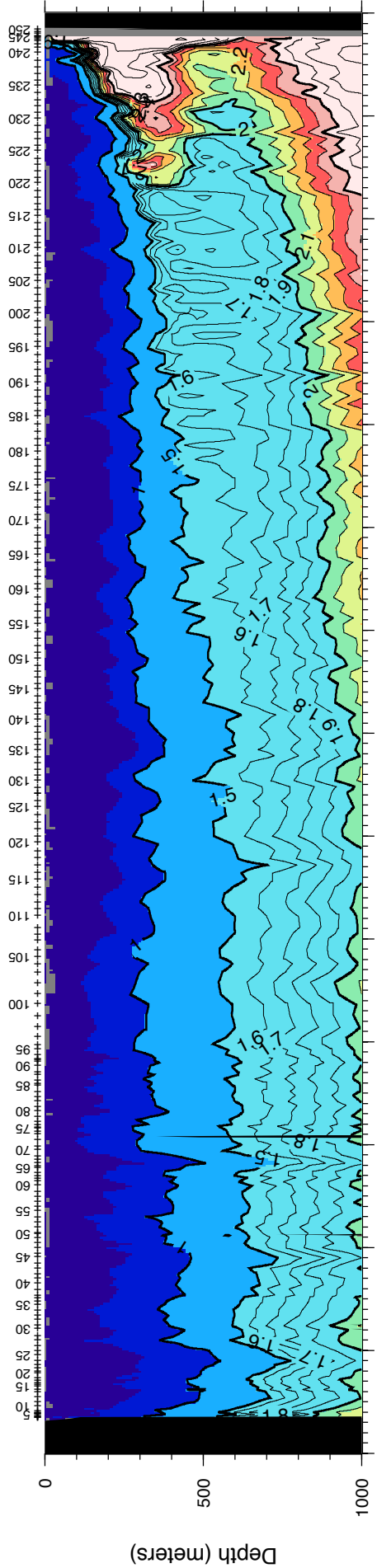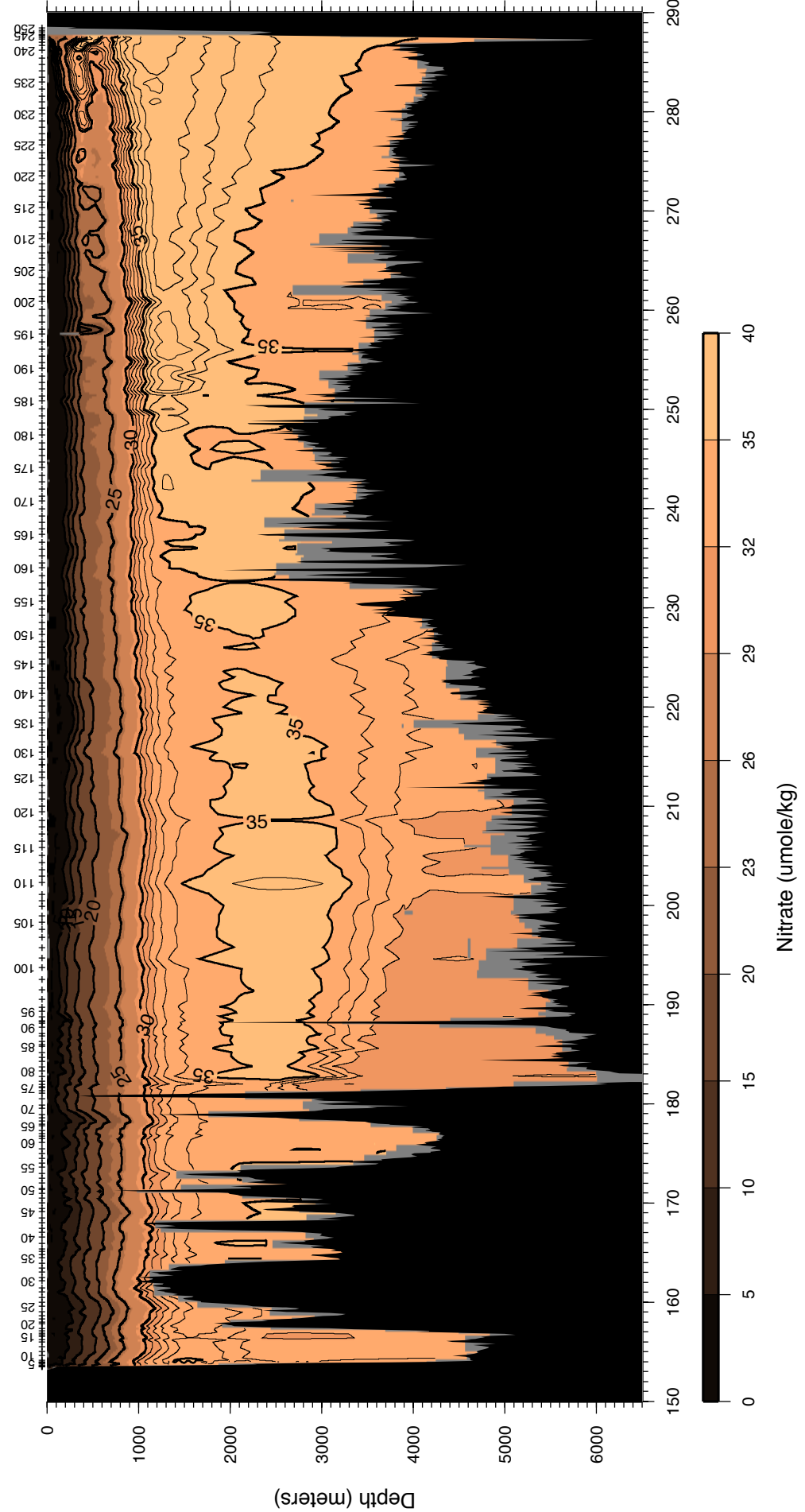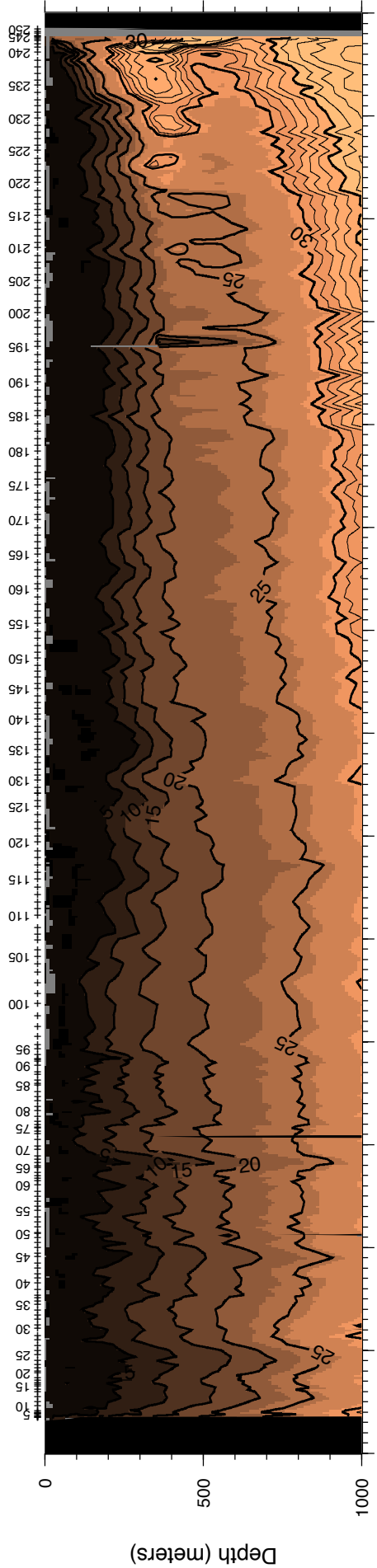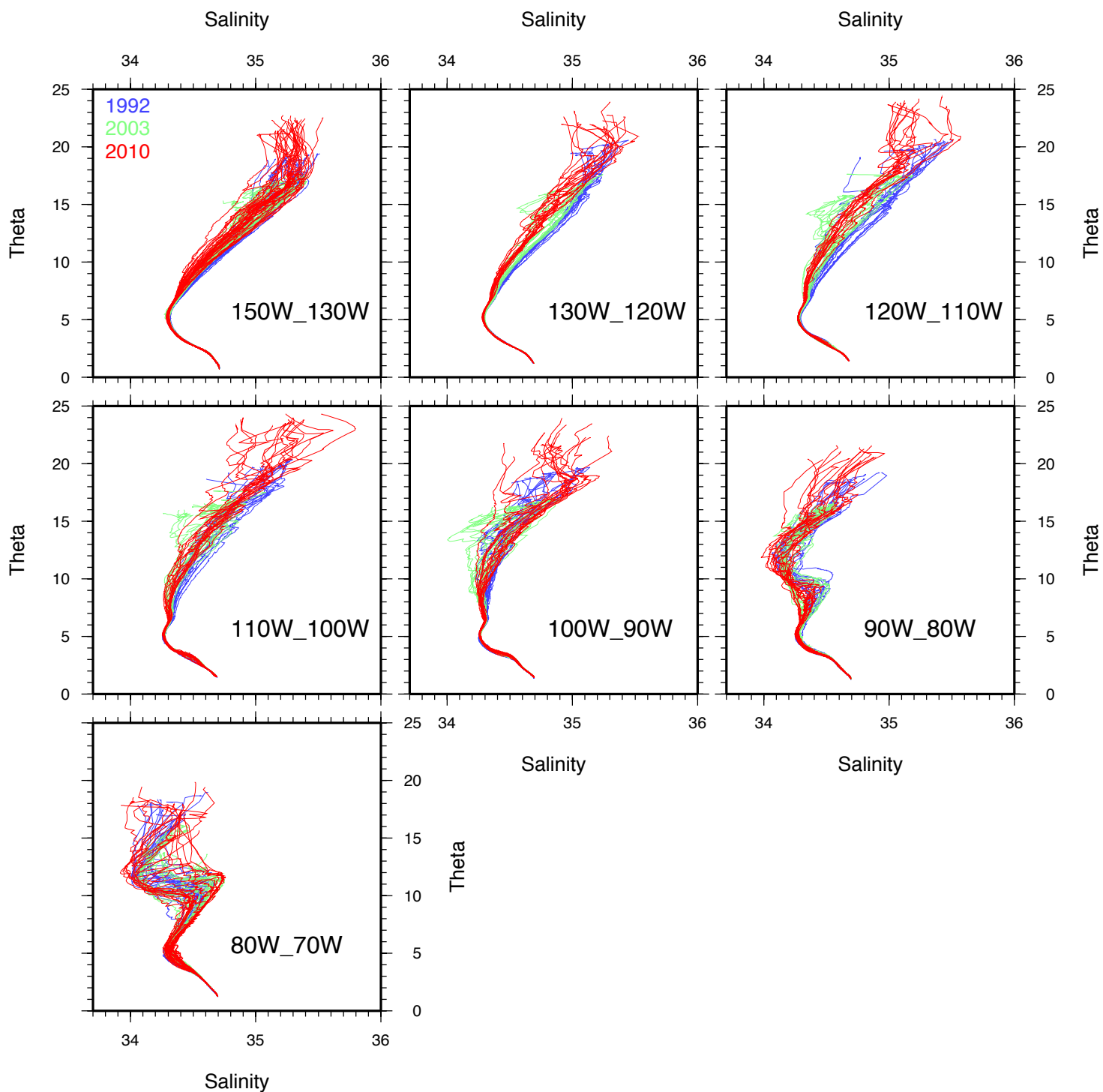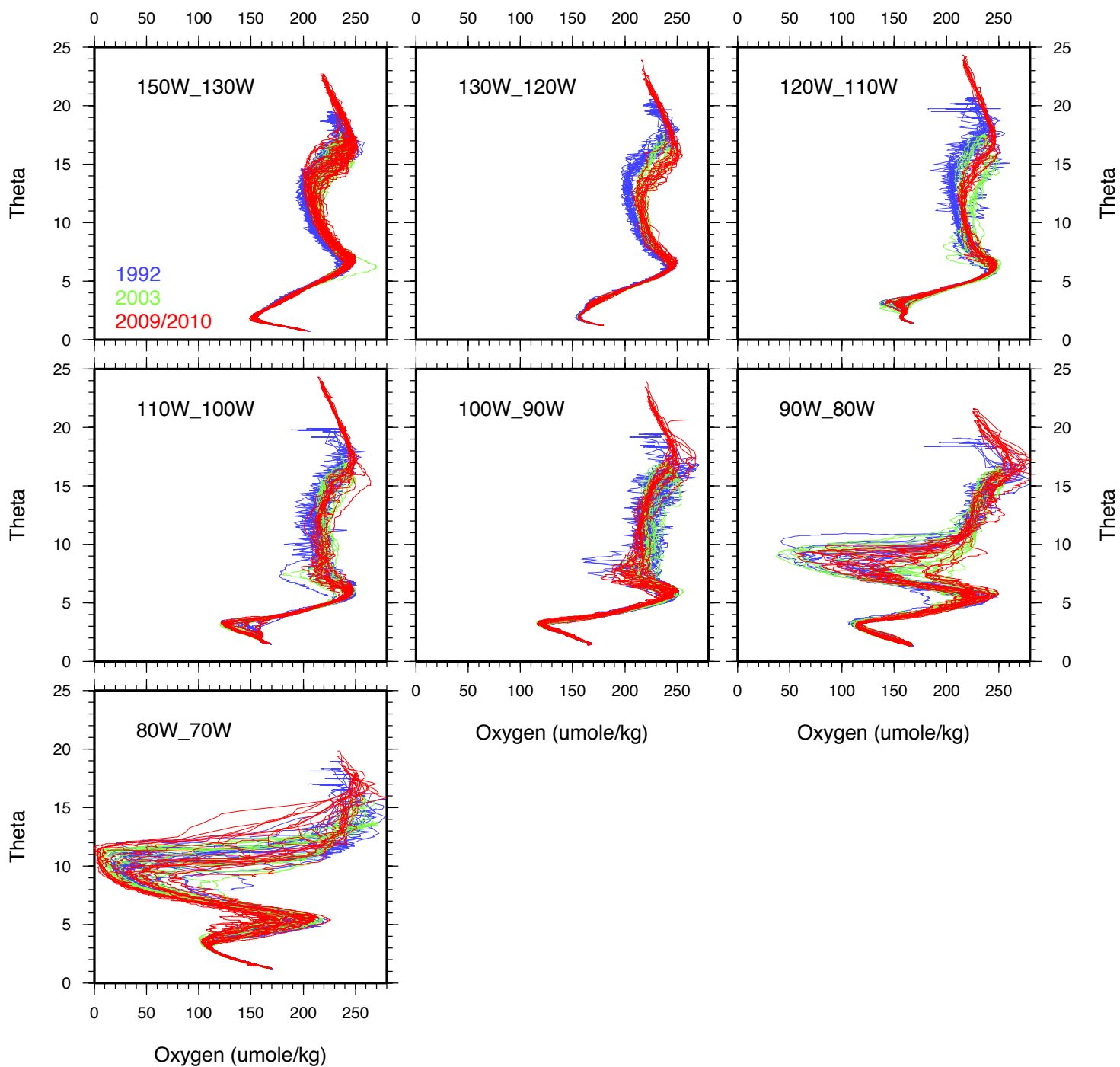
Nitrate (umole/kg)

P06 Theta–S
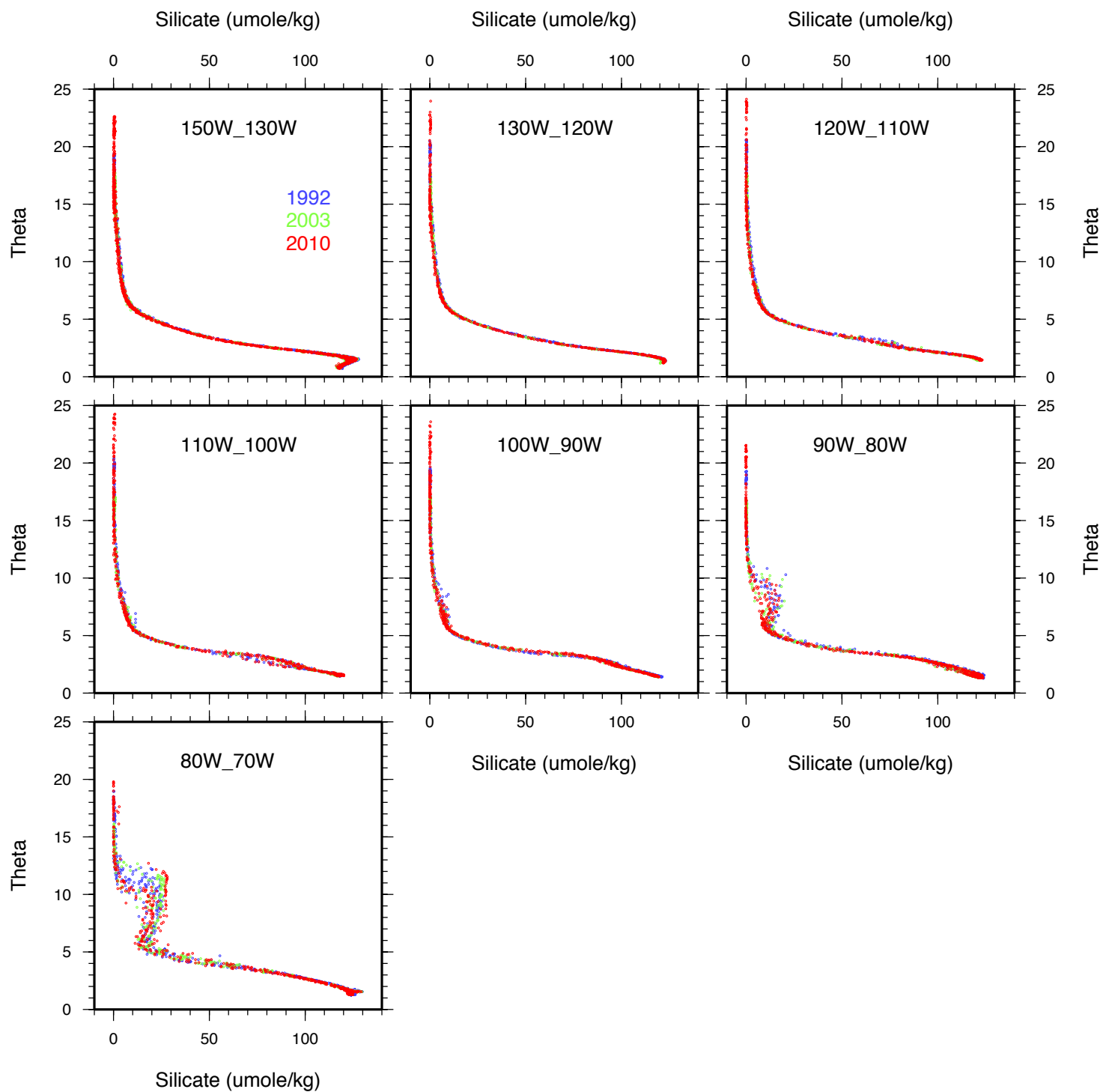
P06 Theta–O2

P06 Theta–Si

P06 Theta–P4

P06 Theta-n3
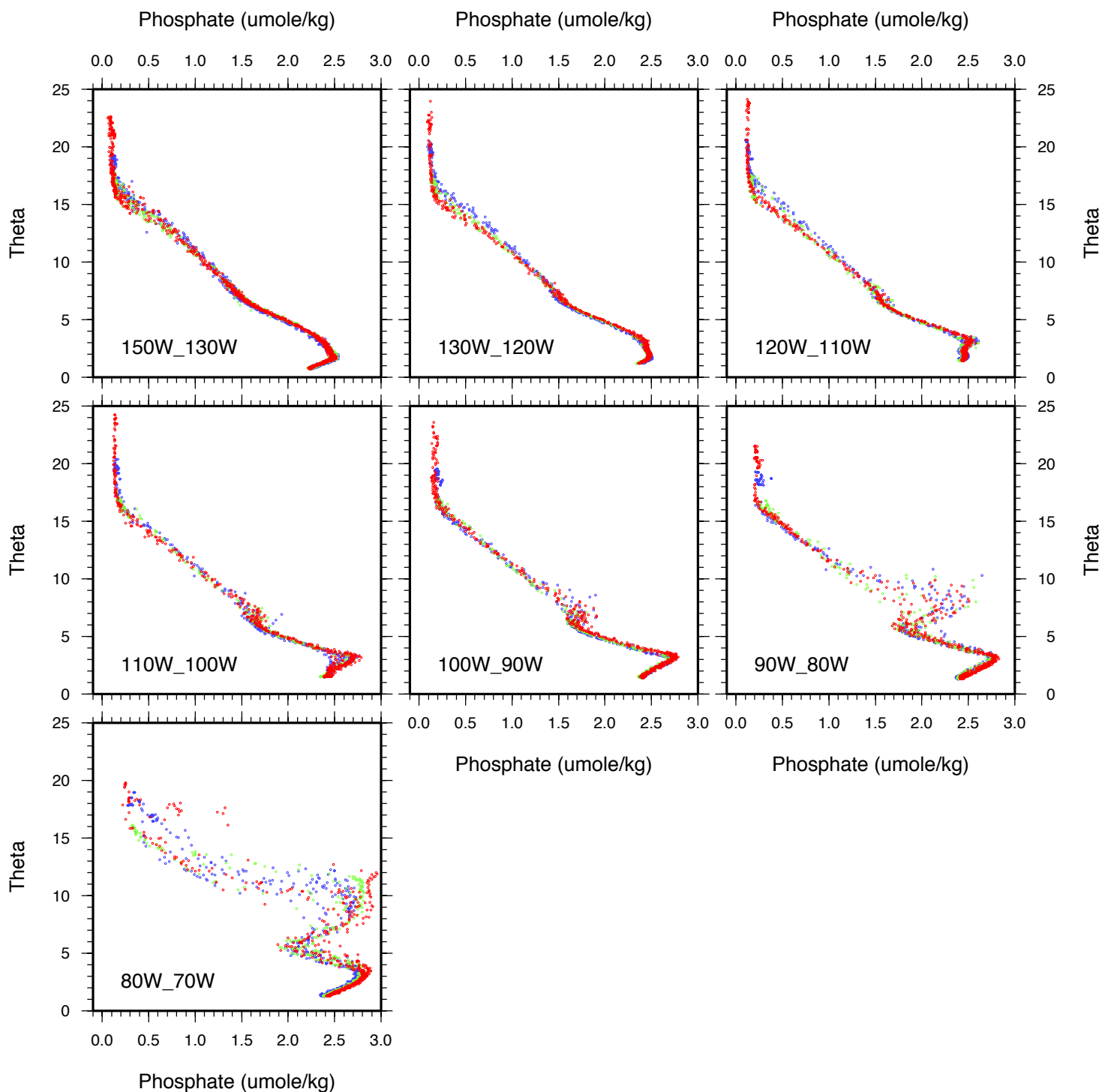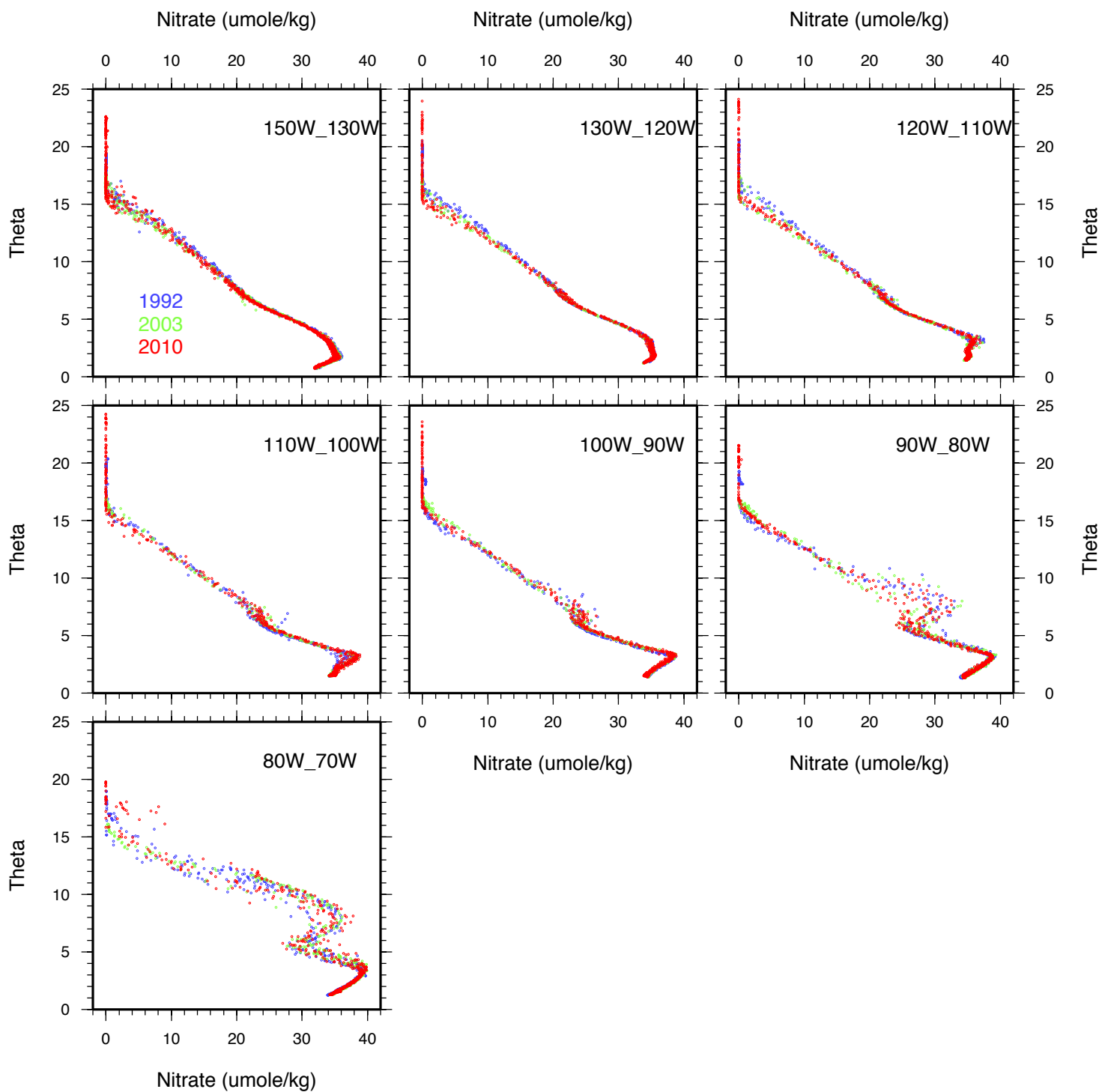
CCHDO DATA PROCESSING NOTES

Date	Contact	Data Type	Event summary
2010-02-16	Sanborn	BTL/SUM	Submitted; Preliminary, to go online
	Action: Place Online		
	Notes: Preliminary Bottle Data - sea and sum		
2010-02-16	Sanborn	CTD	Submitted; To go online
	Action: Place Online		
2010-02-17	Sanborn	Cruise Report	Merge 2 reports, place online
	The ODF write-up is P06E_1a_CTD_Hydrographic.pdf. If you could insert it after the Chief Scientist's Data quality assessment (refers to preliminary shipboard data only) and just before the LADCP section, that would be great.		
2010-02-17	Kappa	Cruise Report	2 reports Merged, placed online
	Done. I'll be adding some bookmarks and links and data processing notes, as well as making a text version, but this is a start.		
2010-03-03	Diggs	SUM/CTD/BOT	See notes for processing details, Data online
	Files (sum/cd/bot) needed EXPOCODE updates to 318M20100105. CTD Exchange and NetCDF online, NetCDF CTD do not contain TRANSM,FLUORM, or CTDETIME as they are "products". Bottle Exchange is online, however, new parameters will either need to be handled properly or excluded in NetCDF files for these discreet data.		
2010-03-05	Diggs	BOT-WOCE	WOCE Bot online
	WOCE bottle file now online. Expocode changed to 318M20100105, submitted by ODF (K. Sanborn) on 2010.03.04.		
2010-03-31	Bartolocci	BTL	updated file online
	2010.03.8 DBK Reformatting the P06_318M20100105 bottle file: Original file was p06_318M20100105_orig_hy1.csv Exchange file: • edited PH_TEMP to PH_TMP • edited REF_TEMP to REF_TMP • edited CHLOR to CHLORA • edited CDOMSLOG to CDOMSL • removed PHOTOLYSIS as per Norm Nelson. These values may come in at a later date, but it is unclear at present. NOTE: It should be noted that the parameter mnemonic BACT currently denotes heterotrophic bacterioplankton at CCHDO, however the data expected for that column is of cyanobacteria and may therefore be changed once data are submitted. • Ran copy_bottle_data.rb to re-order parameters in the exchange file and as a bit of a first pass format check. Edited file named: p06_318M20100105_orig_edt_hy1.csv • NOTE: Because the exchange to netcdf code was crashing based upon placement of the BOT_LAT, BOT_LON parameters, these two parameters were moved in the file to follow other bottle parameters in order. This file was then copied to p06_318M20100105_hy1.csv • Ran exbot_to_netcdf.pl to convert exchange bottle file to netcdf files. Zipped the resultant files into file: p06_318M20100105_nc_hyd.zip ncdump of random stations indicates the conversion ran with no errors. Files were examined in JOA with no errors found.		

	• Ran exchange_to_wocebot.rb to create a woce formatted bottle file, however, attempts to format check file are not possible due to the large number of non-woce parameters within it. File was visually checked and put online. output file named: p06_318M20100105_copy_hy.txt was copied to p06_318M20100105hy.txt and first header was edited to comply with WOCE format.		
2010-04-07	Kappa	Cruise Report	Updated PDF file online
	• Re-arranged sections to WOCE documentation standard		

• Re-arranged sections to WOCE documentation standard
• Added Appendix B (Property Figs)
• Deleted duplicate sections
• Added table of contents and PDF hyperlinks