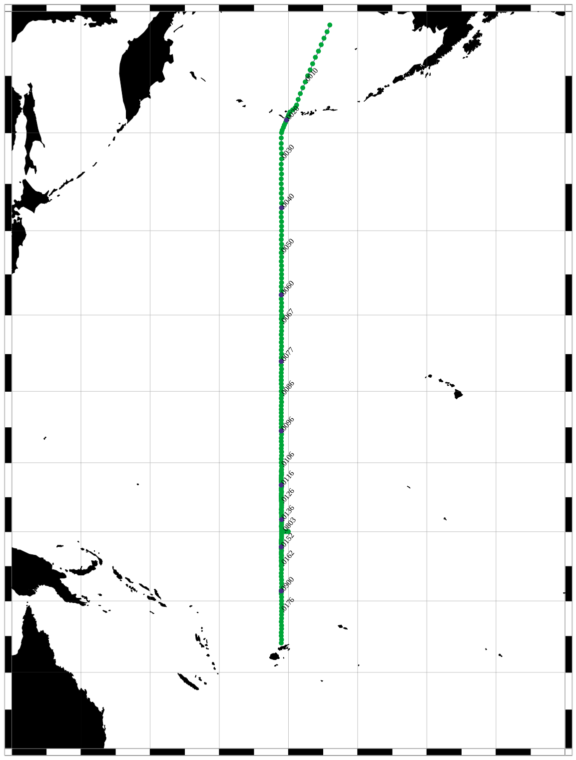
A. Cruise Narrative: P14N



A.1 Highlights

WHP Cruise Summary Information

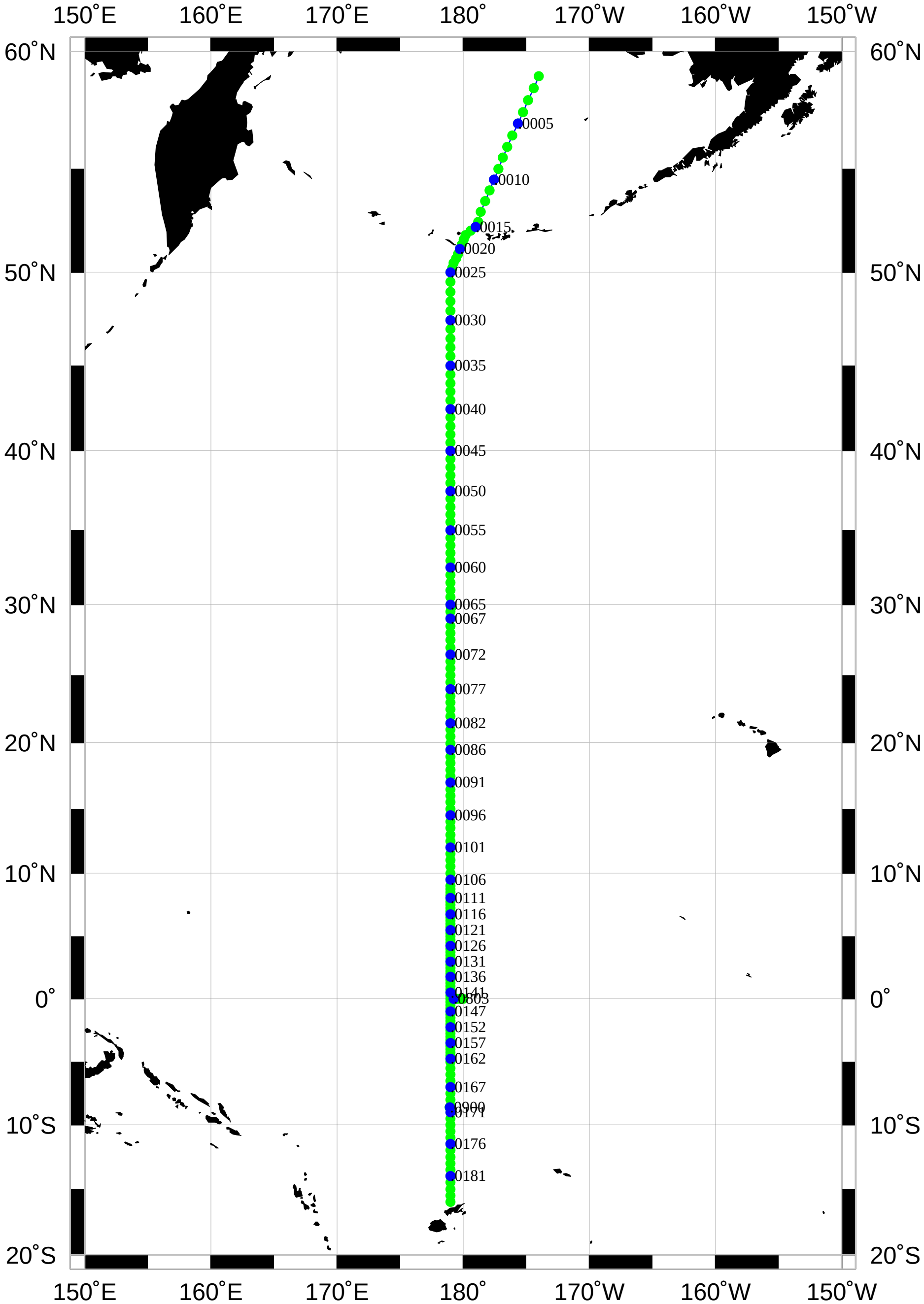
WOCE section designation	**P14N**
Expedition designation (EXPOCODE)	**325023_1**
	325024_1
Chief Scientist(s) and their affiliation	**Gunnar I. Roden/**University of Washington
Dates	1993.JUL.05 - 1993.AUG.11 Leg 1
	1993.AUG.14 - 1993.SEP.01 Leg 2
Ship	R/V Thomas G. Thompson
Ports of call	Leg 1: Dutch Harbor, Alaska to Tarawa
	Leg 2: Tarawa to Suva, Fiji
Number of stations	185
Geographic boundaries of the stations	59°0.1’ N 178°58.15’E 173°59.37’W 15°58.87’ S
Floats and drifters deployed	12 Rafos and 12 Alace floats
Moorings deployed or recovered	none
Contributing Authors	Gunnar I. Roden, Mark J. Warner, Steven Covey, Wilf Gardner, Mary Jo Richardson

WHP Cruise and Data Information

Instructions: Click on any item to locate primary reference(s) or use navigation tools above.

Cruise Summary Information	Hydrographic Measurements
Description of scientific program	CTD - general
	CTD - pressure
Geographic boundaries of the survey	CTD - temperature
Cruise track (figure)	CTD - conductivity/salinity
Description of stations	CTD - dissolved oxygen
Description of parameters sampled	
Bottle depth distributions (figure)	Salinity
Floats and drifters deployed	Oxygen
	Nutrients
	CFCs
Principal Investigators for all measurements	
Cruise Participants	
Problems and goals not achieved	
Underway Data Information	**Acknowledgments**
Navigation	**References**
Bathymetry	
Acoustic Doppler Current Profiler (ADCP)	**DQE Reports**
Meteorological observations	
Atmospheric chemistry data	CFCs
	WHP Data Processing Notes

Station locations for P14N



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A.2 CRUISE SUMMARY INFORMATION

A.2.a GEOGRAPHIC BOUNDARIES

A.2.b STATIONS OCCUPIED

The WOCE crusie P14n, from the Bering Sea to Fiji, included top to bottom hydrography, subsurface float deployments, Acoustic Doppler Current Profiling (ADCP), tracer measurements and meteorological observations.

P14N starts in the Bering Sea at the shelf break and transects the deep Aleutian Basin, Amchitka Pass, and the Aleutian Trench. From 50°N to 16°S the line follows 179°E, which passes through the wide Northeast pacific and Central Pacific Basins. It also crosses the Hess Rise, the Hawaiian Ridge, the Mid-Pacific Seamounts and the Kirbati-Tuvalu ridge. Station spacing was 30 nm (55 km); the only exception ws near the Aleutians and between 9°N and 5°S, where 15 nm (27 km) spacing was used to resolve better the jet-like current structures.

A.2.c FLOATS AND DRIFTERS DEPLOYED

deployed 12 Rafos and 12 Alace floats

A.2.d MOORINGS DEPLOYED OR RECOVERED

A.3 LIST OF PRINCIPAL INVESTIGATORS

Principal Investigators	Affiliation	Responsibility
Russ Davis	SIO	ALACE Floats
Eric Firing	U. Hawaii	ADCP
Richard Gammon	U. Hawaii	Freons
Peter Hacker	U. Hawaii	ADCP
Frank Millero	U. Miami	Carbon Dioxide
Stephen Riser	U. Washington	RAFOS Floats
Gunnar Roden	U. Washington	Hydrography and meteorology
James Swift	SIO	Seagoing CTD Support Group
Zafer Top	U. Miami	Tritum, Helium
Mark Warner	U. Washington	Freons
Christopher Winn	U. Hawaii	Carbon Dioxide

SIO	Scripps Institution of Oceanography
U. Hawaii	University of Hawaii
U. Washington	University of Washington

A.4 SCIENTIFIC PROGRAMME AND METHODS

A.4.a SCIENTIFIC RATIONALE

(Gunnar I. Roden, University of Washington)

Researchers aboard the RV Thomas G. Thompson set sail on a WOCE cruise (P14N) in July 1993 to study the region around the Date Line. This region provides a critical link between the energetic western and more sluggish eastern Pacific flow regimes. Three major midlatitude currents decelerate in this region. The Alaska Stream separates from the Aleutian Island arc, weakening in the process. The Subarctic Current and its associated fronts become broader and weaker, and the Kuroshio extension reaches its eastern limit of penetration as a well defined current. In the subtropics, there are multiple branches of eastward flow. In equatorial latitudes, the structure of the linked system of jetlike currents, countercurrents and undercurrents changes significantly near the Date Line. In addition to the flow changes, the currents and water property structures in the abyssal basins of the Bering Sea and Central Pacific, which are crucial to understanding the deep circulation, have not been sampled adequately on previous occasions.

A.4.b SCIENTIFIC MEASUREMENTS

The WOCE cruise (conducted from July 5 - September 1, 1993) from the Bering Sea to Fiji included top-to-bottom hydrography, subsurface float deployments, Acoustic Doppler Current Profiling (ADCP), tracer measurements and meteorological observations. The principal investigators and their responsibilities are listed in Table 1.

Figure A.4.1 shows the stations occupied during the cruise. P14N starts in the Bering Sea at the shelf break and transects the deep Aleutian Basin, Amchitka Pass, and the Aleutian Trench. From 50°N to 16°S the line follows 179°E, which passes through the wide Northeast Pacific and Central Pacific Basins. It also crosses the Hess Rise, the Hawaiian Ridge, the Mid-Pacific Seamounts and the Kiribati-Tuvalu ridge. Station spacing was 30 nm (55 km); the only exception was near the Aleutians and between 9°N and 5°S, where 15 rim. (27 km) spacing was used to resolve better the jet-like current structures.

A.4.c BERING SEA AND SUBARCTIC NORTH PACIFIC (59°-42°N)

The baroclinic flow relative to the bottom suggests a cyclonic circulation in the Aleutian Basin, westward (10 cm/s) along the northern shelf and eastward (30 cm/s) along the southern rim. The latter resembles a boundary current with speeds of 20 cm/s at 1400 in and a volume transport of 10 Sv. In July 1993 the deep westward Alaska Stream was 100 kin wide and had a double core with speeds up to 54 cm/s (Figure A.4.2). The volume transport relative to 6000 dbar was 38 Sv, of which 14 Sv were below 1000 in. South of 50°N, the flow was dominated by mesoscale eddies, which were superimposed on weak background eastward flow.

The upper thermohaline structure throughout the subarctic domain has a thin, warm, low salinity top layer. It also contains a shallow temperature minimum layer, representing mostly remnant winter cooling, and a 100-200 in thick inversion layer in the halocline. This basic structure is interrupted in Amchitka Pass (where strong tidal mixing eliminates the temperature minimum), and it terminates at the subarctic front near 42°N. Between the subarctic fronts and the Aleutians, the Alaska Dome dominates all property distributions. The Dome is centered near 50°N (Figures A.4.3 and A.4.4), and its top lies near 125 m, which is just beneath the winter mixed layer. The density at the top of the Dome is 26.8 kg/m3. This indicates that North Pacific intermediate water might occasionally form there during prolonged polar air outbreaks.

One of the most surprising discoveries in the Bering Sea was made by Mark Warner from the University of Washington. At the bottom of the Aleutian Basin of the Bering Sea, Warner discovered elevated chlorofluorocarbon levels that indicate, in corroboration with other supporting evidence, recent ventilation of the abyssal waters. The results from the Bering Sea investigation have been published by Warner and Roden (1995) and Roden (1995).

A.4.d SUBARCTIC-SUBTROPICAL TRANSITION ZONE (42°-31°N)

The subarctic-subtropical transition zone occupies the region between the subarctic and subtropical gyres. The northern and southern boundaries of this zone are formed by the subarctic and subtropical fronts, which contain enhanced eastward jets. Near the Date Line, the circulation and property structures are affected also by the Kuroshio extension, which at times crosses the Line as a well defined current and at other times appears to disperse farther west.

The observed property structures in the summer of 1993 reflected this basic zonation. The subarctic front (42°N) was marked by the surfacing of the subarctic halocline, the disappearance of the subsurface temperature minimum, the deepening of the thermocline, and the weakening of the nutricline. The baroclinic jet along the front was about 150 kin wide, reached speeds of 30 cm/ s near the surface, and had an eastward transport of 32 Sv relative to the bottom. The Kuroshio extension was crossed near 35°30°N and had well defined property fronts on its sides. It had a width of 125 kin, a core speed of 44 cm/s, and a volume transport of 34 Sv (about 20 percent of which occurred below 1000 m). The subtropical front was between 3l°-32°N. The associated baroclinic jet was about 100 kin wide, had a maximum speed of 39 cm/s, and had a volume transport of 39 Sv toward the east.

The abyssal property distributions between the Aleutians and the Hess Rise indicate uniform conditions with weak vertical gradients. The most notable feature was the abyssal temperature minimum near 4000 in, the axis and temperature of which are about 500 in deeper and O.1°C cooler than in the Bering Sea.

A.4.e NORTH PACIFIC TRADEWIND REGION (31°-9°N)

The North Pacific tradewind region encompasses the southern branch of the subtropical gyre, roughly between the subtropical and doldrums fronts. It is dominated by easterly tradewinds, strong insolation, excess evaporation over precipitation, and background downward motion induced by the negative curl of the wind stress. The nutricline is deep (150 in), and the surface nutrient concentrations are low.

Despite these general characteristics, the thermohaline and current structures in the tradewind region are complex. This is due to the spatial inhomogeneity of atmospheric forcing, baroclinic instabilities of flow, and eddies migrating into the region.

The geopotential height distributions in the summer of 1993 (Figure A.4.5) revealed several prominent ridges and troughs in the tradewind region, with a clear indication of the poleward shift of the center of the "corrugated" subtropical gyre. At the surface, the maximum occurred at 16°N; however, the highest peak at 400 dbar was located near 36°N.

Banded baroclinic flow structures were associated with the ridge and trough structure of geopotential height. The westward flow from 12°-15°N represents the core of the north equatorial current. This current reached speeds of 44 cm/s near the surface and had a transport of 76 Sv relative to the bottom (about 20 percent of which is below 1000 dbar). The eastward flows were concentrated mainly in the 17°-21°N and 24°-28°N latitude bands with speeds up to 25 cm/s. It is not yet clear if these eastward flows were associated with a meandering subtropical countercurrent, a pair of mesoscale eddies, or a combination of both.

A.4.f EQUATORIAL REGION (90°N-90°S)

The climatology of the equatorial region shows fast zonal, jet-like currents, countercurrents and undercurrents, as well as tradewind and water mass confluence. Influences from both the western and eastern Pacific are evident near the Date Line. In the summer of 1993 western Pacific influences were dominant, and both the oceanic and atmospheric conditions were highly unusual compared to the climatological norm depicted in most atlases.

The first sign of abnormal conditions was the displacement, by about 400 km, of the North Equatorial Countercurrent (NEC) from its expected 5°-8°N latitude range. Instead, it appeared between 2°4°N and merged with the eastward flow along the equator. The northern doldrums salinity minimum was encountered between 2°-4°N, also south of its normal position. There was also the general absence of easterly tradewinds in the equatorial zone between 1°S and 4°N; this resulted in frequent rainy squalls from the north and west. Consequently, surface flow was eastward rather than westward, and mixed layer temperatures around the equator were unusually warm. Advection of low salinity water by the NEC and local rainfall caused low surface salinities at the equator. Between 1°- 4°S, salinities increased again as the surface flow carried salty water from the central Pacific westward, which counteracted to some extent the freshening effect of local rainfall. In the southern doldrums region (between 5°-8°S) the surface flow was eastward, carrying low salinity water from the rainy western to the drier central South Pacific. The boundaries of the opposing flows were marked by well defined upper layer salinity fronts. Beneath the upper layer, the property distributions revealed a dome-like structure that was most pronounced from 100-500 in. The dome was flanked by thermohaline fronts at 10°-4°N; both the North and South Pacific subsurface salinity maxima terminated at these fronts. North Pacific waters penetrated into the South Pacific at mid-depths. At abyssal depths, however, there was clear evidence that cold, saline, high oxygen and low nutrient waters penetrated from the South into the North Pacific (at least as far north as the Hess Rise).

The geopotential heights between 4°N and 4°S show a very complex structure with several ridges and troughs. Because the geostrophic control within this latitude belt is weak, a better picture of the flow is obtained by hull mounted and lowered ADCP measurements. According to Firing and Hacker (personal communication), in August 1993 the flow in the top 100 m was asymmetric with respect to the equator, northeastward between 4°N and 1°S, and westward between 1°-4°S. Between 100-300 m, the flow in this latitude belt was eastward and symmetric around the equator; the core of the undercurrent (50 cm/s) was centered near 175 m. Between 300-2000 m, the equatorial flow was westward with speeds up to 20 cm/s, and weak eastward flow was observed from 2000-3500 m. Beneath 3500 m, the flow was again westward, occasionally reaching 5 cm/s.

The South Equatorial Countercurrent (determined by ADCP) was encountered between 4°-8°S. The eastward flow reached 20 cm/s at the surface, but it was quite shallow, effectively vanishing below 200 in.

A.4.g SOUTH PACIFIC TRADEWIND REGION (9°S-16°S)

Southeasterly tradewinds normally encountered throughout the region were replaced in the north in August 1993 by weak westerly and northwesterly winds. Only south of 13°S did the tradewinds reach their normal speeds of 8-10 m/s. At this latitude a well defined front (i.e., the southern doldrums front) was observed. Like its northern counterpart, the southern doldrums front separated the subtropical and equatorial waters. It was marked by a surface salinity front, a sharp poleward deepening and spreading of the thermocline and halocline, and by the equatorward limit of the subpolar intermediate salinity minimum.

The currents north of the southern doldrums front consisted of bands of alternating eastward and westward flow, possibly related to mesoscale eddies. The bands were about 100 km wide with surface speeds from 10-30 cm/s. South of this front the flow was dominated by the westward South Equatorial Current, the core of which was located between 13°- 1 5°30°S. The current had speeds of 30- 40 cm/s near the surface and a volume transport of 32 Sv relative to the bottom. Just north of Vanua Levu, Fiji, strong eastward flow was observed along the island slope.

Part way through the cruise, the RV Thomas G. Thompson docked at Betio, Tarawa in the Republic of Kiribati to change members of the scientific crew. On learning that the Kiribateses are very interested in the effects of global climate change (as it impacts their low atolls that rise only 4 m above the sea surface), the Chief Scientist invited 10 Kiribatese government ministers to a "state lunch" aboard the vessel, a lecture and a tour of the ship. The purpose of this reception was to familiarize the ministers with the goals of

WOCE, to share scientific information with a developing Third World nation, and to promote international goodwill. The Kiribati officials greatly appreciated this gesture and reciprocated by inviting the scientists to a performance of native dances.

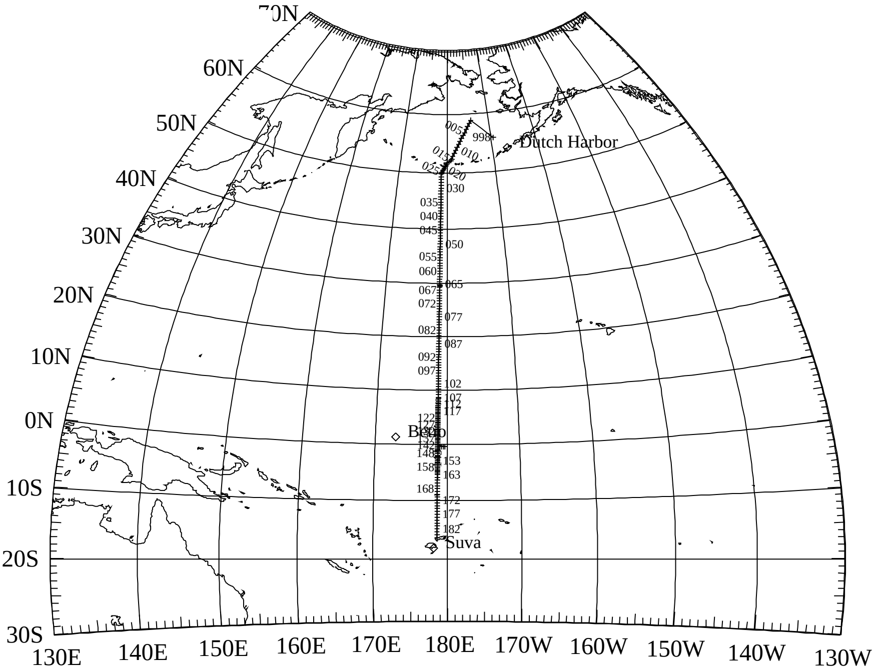
ACKNOWLEDGMENTS

The success of this complex cruise is due to the high competence and team spirit of the diverse scientific groups aboard. It is also due to the generous help of Captain Glenn Gomes and the crew of the RV Thomas G. Thompson. Heartfelt thanks go to each person who helped make P14N such a success.

REFERENCES

Roden, G. 1. 1995. Aleutian Basin of the Bering Sea: thermohaline oxygen, nutrient and current structure in July 1993. J. Geophys. Res., Oceans, in press.

Warner, M. J. and G. I. Roden. 1995. Chlorofluorocarbon evidence for recent ventilation of the deep Bering Sea, Nature, 373: 409-412.



WOCE-93 P14N Cruise Track

Figure A.4.1: WOCE P14N station line. Station spacing was at 30 nm intervals; the only exception was near the Aleutians and between 9°N and 5°S where the intervals were 15 nm.

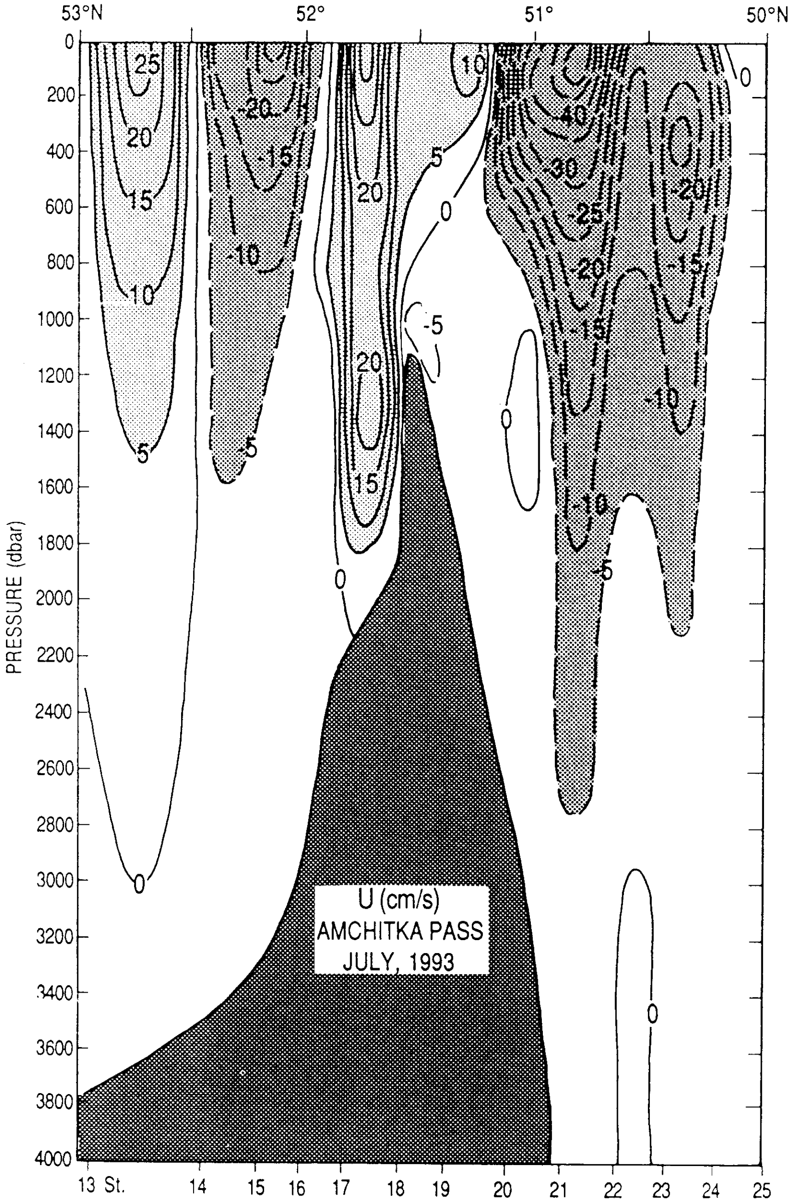


Figure A.4.2 Baroclinic flow relative to the bottom in the vicinity of the Aleutians. Eastward flow is lightly shaded,- westward flow is darkly shaded. Note the strong deep eastward flow north and the westward Alaska Stream south of Amchitka Pass.

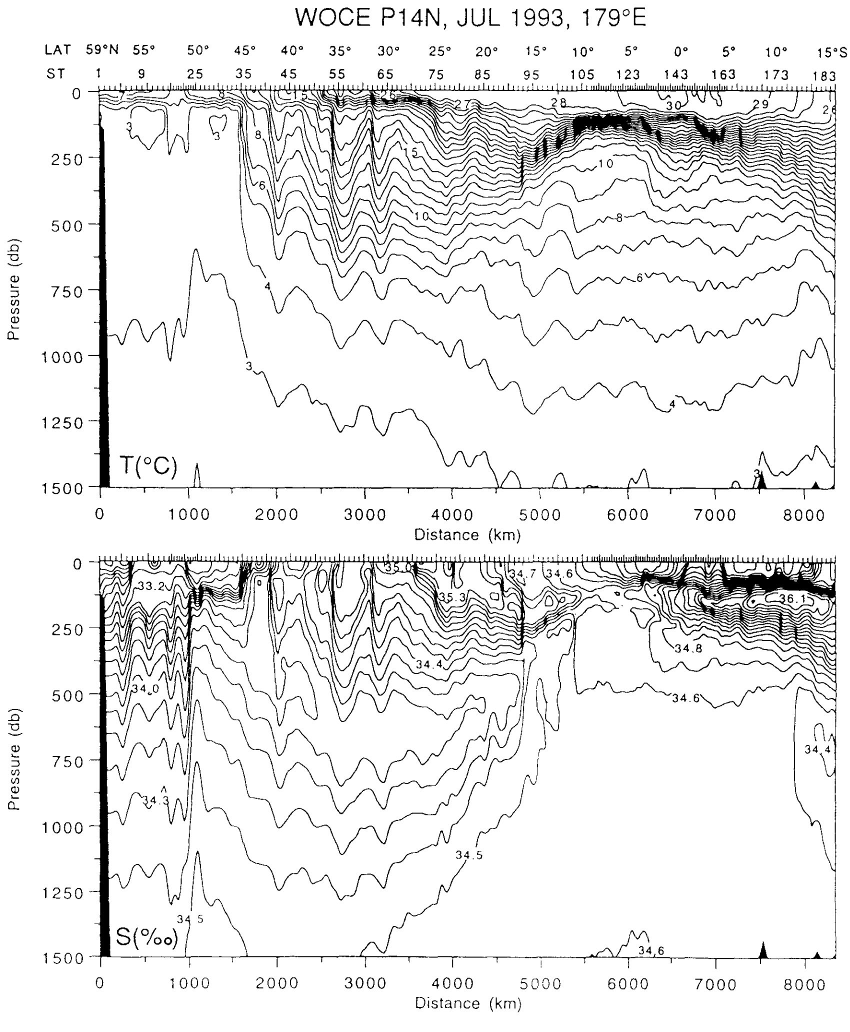


Figure A.4.3 Temperature and salinity in the upper 1500 m along P14N.

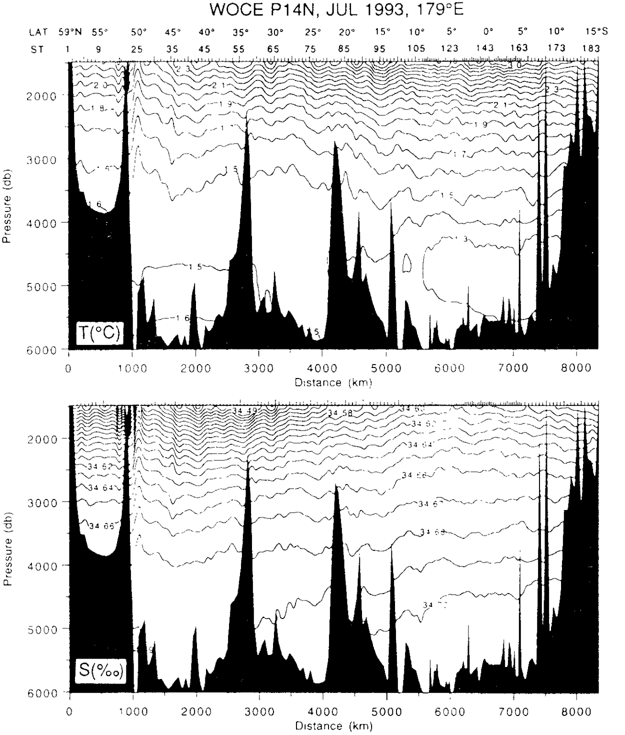


Figure A.4.4 Temperature and salinity from 1500-6000 m along P14N.

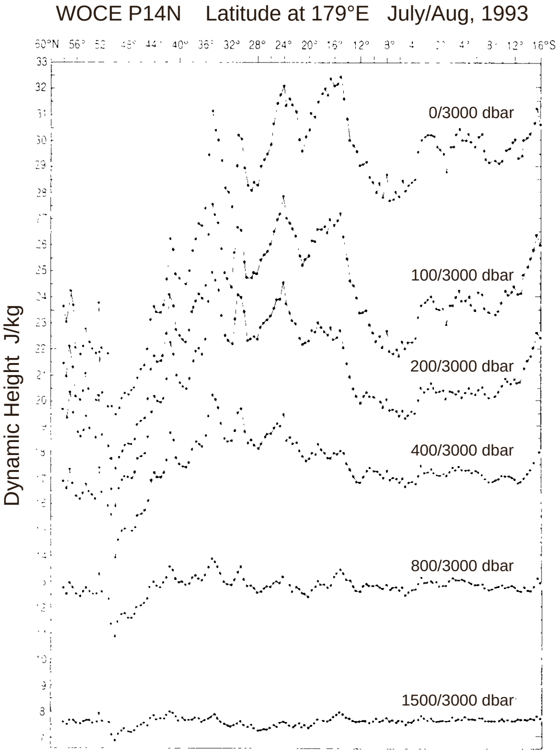


Figure A.4.5 Geopotential height relative to 3000 dbar.

A.5 MAJOR PROBLEMS AND GOALS NOT ACHIEVED

A.6 OTHER INCIDENTS OF NOTE

A.7 LIST OF CRUISE PARTICIPANTS

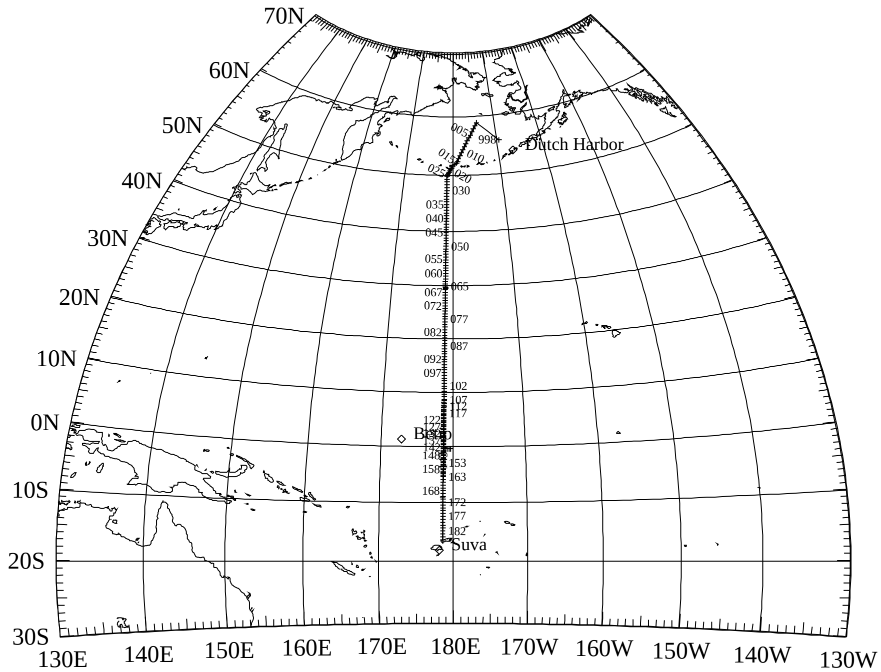
Name	Function	Affiliation
Glenn Gomes	Ship's Captain	UW
Gunnar 1. Roden	Chief Scientist	UW
Steven Riser *	RAFOS floats	UW
William Fredericks	Scientific Programmer	UW
Mark Warner	Chlorofluorocarbons	UW
Steven Covey	Chlorofluorocarbons	UW
James Postel	CTD watch	UW
Kathleen Newell	CTD watch	UW
Stanley Moore	CTD watch	OSU
Carlos Lopez	CTD watch	OSU
Frank Delahoyde	ODF CTD chief	SIO
Scott Hiller	ODF Electronics	SIO
James Schmitt	ODF Electronics	SIO
David Bos	ODF nutrients	SIO
Leonard Lopez	ODF salinity	SIO
Barry Nisly	ODF oxygen	SIO
Ronald Patrick	ODF oxygen	SIO
Rebecca Streib	ODF nutrients	SIO
Engin Yergin	Tritium/Helium	U Miami
James Girton	ADCP	U Hawaii
Eric Firing **	ADCP	U Hawaii
Elodie Kestenare	ADCP	U Hawaii
Daniel Sadler *	Carbon dioxide	U Hawaii
Christopher Carrillo	Carbon dioxide	U Hawaii
Amy Snover	Carbon dioxide	UW
Linda Bingler	Carbon dioxide	Battelle
Douglas Campbell	Carbon dioxide	U Miami
Sonia Olivella **	Carbon dioxide	U Miami
David Purkerson	Carbon dioxide	U Miami
Sant Ram **	Fiji Gov't Observer	Fiji

* Alaska to Tarawa leg
** Tarawa to Fiji leg

B. Hydrography

Data Submitted by:

Oceanographic Data Facility
Scripps Institution of Oceanography
La Jolla, CA 92093-0214



WOCE-93 P14N Cruise Track

B.1. DESCRIPTION OF MEASUREMENT TECHNIQUES AND CALIBRATIONS

Basic Hydrography Program

The basic hydrography program consisted of salinity, dissolved oxygen and nutrient (nitrite, nitrate, phosphate and silicate) measurements made from bottles taken on CTD/rosette casts plus pressure, temperature, salinity and dissolved oxygen from CTD profiles. 204 CTD/rosette casts were made, usually to within 10 meters of the bottom. There were a total of 191 WOCE casts: stations 1-185 and station 900, which was a series of six 18-bottle casts every 4 hours at the same position. Extra casts at stations 651-653 (near a seamount) and 800-803 (1 degree east of the WOCE line and back, along the equator) were also processed. Two test casts and four aborted casts were not included with these final data. 6914 bottles were tripped resulting in 6875 usable bottles. The resulting data set met and in many cases exceeded WHP specifications. The distribution of samples is illustrated in figures 1.0.0 and 1.0.1.

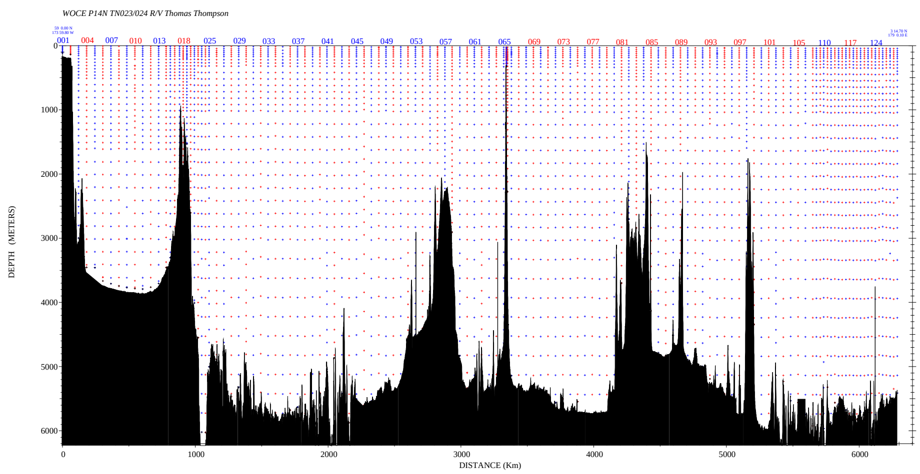


Figure 1.0.0 TN023 sample distribution, stas 001-065, 651-653, 066-130

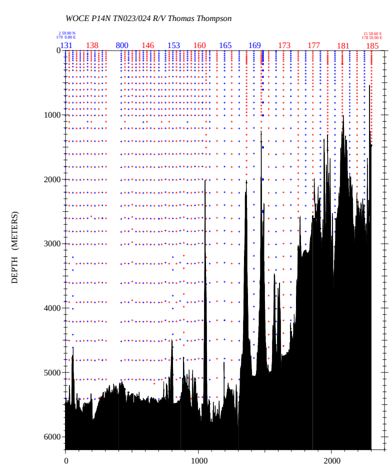


Figure 1.0.1 TN024 sample distribution, stas 131-142, 800-803, 143-170, 900, 171-185

1.1. Water Sampling Package

Hydrographic (rosette) casts were performed with a new design of the rosette system consisting of a 36-bottle ODF-designed rosette frame, a General Oceanics (GO) Model 1016 36-place pylon and 36 10-liter Bullister-style PVC bottles. The frame worked well and held the Lowered Acoustic Doppler Current Profiler (LADCP) without sacrificing any of the 36 samplers. The GO pylon had operating problems which could usually be overcome by the operator through the diagnostics routine. The Bullister-style samplers worked well, but had fragile end-cap edges and tight valves. Recommendations for modifications were made and have since been implemented. Underwater electronic components consisted of an ODF-modified NBIS Mark III CTD (ODF #1) and associated sensors, SeaTech transmissometer provided by Texas A&M University (TAMU), RDI LADCP, Benthos altimeter and Benthos pinger. The CTD was mounted horizontally along the bottom of the rosette frame, with the transmissometer, dissolved oxygen and secondary PRT sensors deployed alongside. The LADCP was mounted vertically in the frame inside the bottle rings. The Benthos altimeter provided distance-above-bottom in the CTD data stream. The Benthos pinger was monitored during a cast with a precision depth recorder (PDR) in the ship's laboratory. The rosette system was suspended from a three-conductor electro-mechanical (EM) cable. Power to the CTD and pylon was provided through the cable from the ship. Separate conductors were used for the CTD and pylon signals. Electronic Deep Sea Reversing Thermometers (DSRTs) were used on this leg to monitor for CTD pressure or temperature drift.

Each rosette cast was performed to within 10 meters of the bottom, unless the bottom returns from both the pinger and altimeter were extremely poor, or the bottom depth exceeded the range of the instrumentation. Bottles on the rosette were each identified with a unique serial number. Usually these numbers corresponded to the pylon tripping sequence, 1-36, where the first (deepest) Bottle tripped was bottle #1. Averages of CTD data corresponding to the time of bottle closure were associated with the bottle data during a cast. Pressure, depth, temperature, salinity, density and nominally-corrected oxygen were immediately available to facilitate examination and quality control of the bottle data as the sampling and laboratory analyses progressed.

The deck watch prepared the rosette approximately 45 minutes prior to a cast. All valves, vents and lanyards were checked for proper orientation. The bottles were cocked and all hardware and connections rechecked. Upon arrival on station, time, position and bottom depth were logged and the deployment begun. The rosette was moved into position under a projecting boom from the rosette room using an air-powered cart on tracks. Two stabilizing tag lines were threaded through rings on the frame. CTD sensor covers were removed, the pinger was turned on and the transmissometer windows were cleaned. Once the CTD acquisition and control system in the ship's laboratory had been initiated by the console operator and the CTD and pylon had passed their diagnostics, the winch operator raised the package and extended the boom over the side of the ship. The package was then quickly lowered into the water, the tag lines removed and the console operator notified by radio that the rosette was at the surface.

Recovering the package at the end of deployment was essentially the reverse of the launching. Two tag lines connected to air tuggers and terminating in large snap hooks were manipulated on long poles by the deck watch to snag recovery rings on the rosette frame. The package was then lifted out of the water under tension from the tag lines, the boom retracted, and the rosette lowered onto the cart. Sensor covers were replaced, the pinger turned off and the cart with the rosette moved into the rosette room for sampling. A detailed examination of the bottles and rosette would occur before samples were taken, and any extraordinary situations or circumstances were noted on the sample log for the cast.

Routine CTD maintenance included soaking the conductivity and CTD O_2 sensors in distilled water between casts to maintain sensor stability. The rosette was stored in the rosette room between casts to insure the CTD was not exposed to direct sunlight or wind, in order to maintain the internal CTD temperature near ambient air temperature. Exceptions to this procedure are noted in Appendix C.

Rosette maintenance was performed on a regular basis. O-rings were changed as necessary and bottle maintenance performed each day to insure proper closure and sealing. Valves were inspected for leaks and repaired or replaced.

1.2. Underwater Electronics Packages

CTD data were collected with a modified NBIS Mark III CTD (ODF CTD #1). This instrument provided pressure, temperature, conductivity and dissolved O_2 channels, and additionally measured a second temperature (FSI temperature sensor) as a calibration check. Other data channels included elapsed-time, an altimeter, several power supply voltages and a transmissometer. The instrument supplied a standard 15-byte NBIS-format data stream at a data rate of 25 fps. Modifications to the instrument included a revised dissolved O_2 sensor mounting; ODF-designed sensor interfaces for the FSI PRT and the SeaTech transmissometer; implementation of 8-bit and 16-bit multiplexer channels; an elapsed-time channel; instrument ID in the polarity byte and power supply voltages channels.

Figure 1.2.0 summarizes the serial numbers of instruments and sensors used during P14N.

<table>
<tr><th>Station(s)</th><th>CTD@
ID#</th><th>TAMU</th><th>Oxygen
Sensor</th><th>Winch</th><th>UofH
LADCP</th></tr>
<tr><td>1-19</td><td rowspan="11">1</td><td rowspan="5">100D</td><td rowspan="3">A</td><td rowspan="10">Primary</td><td>Yes</td></tr>
<tr><td>20-51</td><td>No</td></tr>
<tr><td>52-61,651-653</td><td rowspan="2">Yes</td></tr>
<tr><td>62-68</td><td rowspan="8">B</td></tr>
<tr><td>69-70,72-80</td><td rowspan="2">No</td></tr>
<tr><td>71</td><td>none</td></tr>
<tr><td>81,82/2-87</td><td>151D</td><td rowspan="2">Yes</td></tr>
<tr><td>82/1,88-95</td><td rowspan="4">100D</td></tr>
<tr><td>96-130</td><td>No</td></tr>
<tr><td>131-150,800-803</td><td rowspan="2">Yes</td></tr>
<tr><td>151-185,900</td><td>Backup</td></tr>
</table>

<table>
<tr><th colspan="5">@ ODF CTD #1 sensor serial numbers:</th></tr>
<tr><th rowspan="2">CTD
ID#</th><th rowspan="2">Pressure</th><th colspan="2">Temperature</th><th rowspan="2">Conductivity</th></tr>
<tr><th>PRT-1</th><th>PRT-2</th></tr>
<tr><td>1</td><td>131910</td><td>14304</td><td>FSI-T1320</td><td>5902-F117</td></tr>
</table>

Table 1.2.0 P14N Instrument/Sensor Serial Numbers

The O_2 sensor was deployed in an ODF-designed pressure-compensated holder assembly mounted separately on the rosette frame and connected to the CTD by an underwater cable. The transmissometer interface was designed and built by ODF using an off-the-shelf 12-bit A/D converter.

Although the secondary temperature sensor was located within 6-8 inches of the CTD conductivity sensor, it was not sufficiently close to calculate coherent salinities. It was used as a secondary temperature calibration reference rather than as a redundant sensor, with the intent of eliminating the need for mercury or electronic DSRTs as calibration checks.

Standard CTD maintenance procedures included soaking the conductivity sensor in deionized water and placing a cap on the O_2 sensor between casts to maintain sensor stability, and protecting the CTD from exposure to direct sunlight or wind to maintain an equilibrated internal temperature.

The General Oceanics (GO) 1016 36-place pylon was used in conjunction with the GO pylon deck unit. There were numerous tripping problems caused by the GO pylon/deck unit combination; 80% of these occurred during the first 12 casts. Usually these could be resolved by the console operator via the pylon diagnostics routine. The pylon emitted a confirmation message containing its current notion of bottle trip position, which was an aid in sorting out mis-trips. Using the GO pylon and deck unit also contributed to the magnitude of the variance of salinity differences. The pylon would take a variable amount of time to trip a bottle after the trip had been initiated. The time varied from 8 seconds to over 30 seconds. The acquisition software began averaging data corresponding to the rosette trip as soon as the trip was initiated, ending when the trip confirmed. Consequently, CTD rosette trip data used for the differences contained variable-length averages.

1.3. Navigation and Bathymetry Data Acquisition

Navigation data and underway bathymetry were acquired from the ship's Bathy 2000 or HydroSweep systems via RS-232. Data were logged automatically at one-minute intervals by one of the Sun SPARCstations to provide a time-series of underway position, course, speed and bathymetry data. These data were used for all station positions, PDR depths and bathymetry on vertical sections [Cart80].

1.4. CTD Data Acquisition, Processing and Control System

The CTD data acquisition, processing and control system consisted of a Sun SPARCstation 2 computer workstation, ODF-built CTD deck unit, General Oceanics 1016 pylon deck unit, CTD and pylon power supplies, and a VCR recorder for real-time analog backup recording of the sea-cable signal. The Sun system consisted of a color display with trackball and keyboard (the CTD console), 18 RS-232 ports, 2.5 GB disk and 8mm cartridge tape. One other Sun SPARCstation 2 system was networked to the data acquisition system, as well as to the rest of the networked computers aboard the Thompson. These systems were available for real-time CTD data display as well as for providing hydrographic data management and backup. Each Sun SPARCstation was equipped with a printer and an 8-color drum plotter.

The CTD FSK signal was demodulated and converted to a 9600 baud RS-232C binary data stream by the CTD deck unit. This data stream was fed to the Sun SPARCstation. The pylon deck unit was connected to the data acquisition system through a serial port, allowing the data acquisition system to initiate and confirm bottle trips. A bitmapped color display provided interactive graphical display and control of the CTD rosette sampling system, including real-time raw and processed data, navigation, winch and rosette trip displays.

The CTD data acquisition, processing and control system was prepared by the console watch a few minutes before each deployment. A console operations log was maintained for each deployment, containing a record of every attempt to trip a bottle as well as any pertinent comments. Most CTD console control functions, including starting the data acquisition, were initiated by pointing and clicking a trackball cursor on the display at icons representing functions to perform. The system then presented the operator with short dialog prompts with automatically-generated choices that could either be accepted as default or overridden. The operator was instructed to turn on the CTD and pylon power supplies, then to examine a real-time CTD data display on the screen for stable voltages from the underwater unit. Once this was accomplished, the data acquisition and processing was begun and a time and position automatically associated with the beginning of the cast. A backup analog recording of the CTD signal was made on a VCR tape, which was started at the same time as the data acquisition. A rosette trip display and pylon control window then popped up, giving visual confirmation that the pylon was initializing properly. Various plots and displays were initiated. When all was ready, the console operator informed the deck watch by radio.

Once the deck watch had deployed the rosette and informed the console operator that the rosette was at the surface (also confirmed by the computer displays), the console operator or watch leader provided the winch operator with a target depth (wire-out) and maximum lowering rate, normally 60 meters/minute for this package. The package then began its descent.

The console operator examined the processed CTD data during descent via interactive plot windows on the display, which could also be run at other workstations on the network. Additionally, the operator decided where to trip bottles on the up-cast, noting this on the console log. The PDR was monitored to insure the bottom depth was known at all times.

The watch leader assisted the console operator when the package was ~400 meters above the bottom by monitoring the range to the bottom using the distance between the rosette's pinger signal and its bottom reflection displayed on the PDR. Between 100 and 60 meters above the bottom, depending on bottom conditions, the altimeter typically began signaling a bottom return on the console. The winch and altimeter displays allowed the watch leader to refine the target depth relayed to the winch operator and safely approach to within 10 meters of the bottom.

Bottles were tripped by pointing the console trackball cursor at a graphic firing control and clicking a button. The data acquisition system responded with the CTD rosette trip data and a pylon confirmation message in a window. All tripping attempts were noted on the console log. The console operator then directed the winch operator to the next bottle stop. The console operator was also responsible for generating the sample log for the cast.

After the last bottle was tripped, the console operator directed the deck watch to bring the rosette on deck. Once on deck, the console operator terminated the data acquisition and turned off the CTD, pylon and VCR recording. The VCR tape was filed. Usually the console operator also brought the sample log to the rosette room and served as the *sample cop*.

1.5. CTD Laboratory Calibration Procedures

Pre-cruise laboratory calibrations of the CTD pressure and temperature sensors were used to generate tables of corrections applied by the CTD data acquisition and processing software at sea. These laboratory calibrations were also performed post-cruise.

Pressure and temperature calibrations were performed on CTD #1 at the ODF Calibration Facility in La Jolla. The pre-cruise calibration was done in May 1993 before the start of the P17N expedition, and the post-cruise calibration was done in October 1993.

The CTD pressure transducer was calibrated in a temperature-controlled water bath to a Ruska Model 2400 Piston Gage pressure reference. Calibration curves were measured at 0.01, 11.74 and 31.22°C to 2 maximum loading pressures (2775 and 6080 db) pre-cruise, and at 1.62 and 32.13°C to 2 maximum loading pressures (1400 and 6080 db) post-cruise. Figure 1.5.0 summarizes the laboratory pressure calibration performed in May 1993 and Figure 1.5.1 summarizes the pressure calibrations done in October 1993.

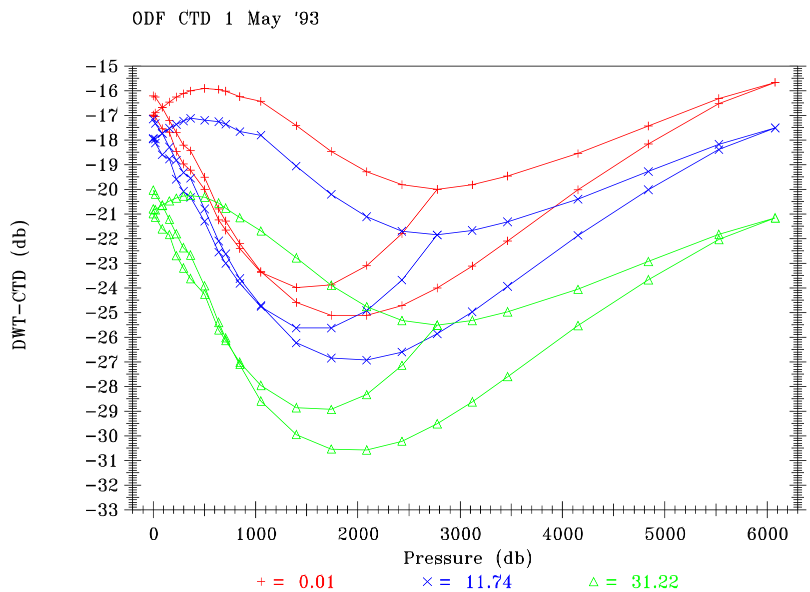


Figure 1.5.0 Pressure calibration for ODF CTD #1, May 1993.

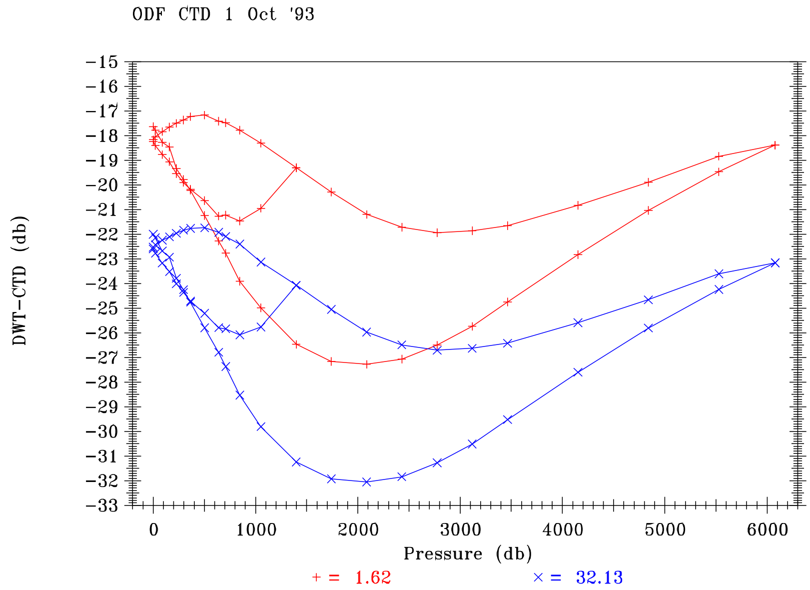


Figure 1.5.1 Pressure calibration for ODF CTD #1, October 1993.

Additionally, dynamic thermal-response step tests were conducted on the pressure transducer to calibrate dynamic thermal effects.

CTD PRT temperatures were calibrated to an NBIS ATB-1250 resistance bridge and Rosemount standard PRT in a temperature-controlled bath. The primary CTD temperature was offset by ~1.5°C to avoid the 0-point discontinuity inherent in the internal digitizing circuitry. Figures 1.5.2 and 1.5.3 summarize the laboratory calibrations performed on the primary PRT during May and October 1993.

These laboratory temperature calibrations were referenced to an ITS-90 standard. Temperatures were converted to the IPTS-68 standard during processing in order to calculate other parameters, including salinity and density, which are currently defined in terms of that standard only.

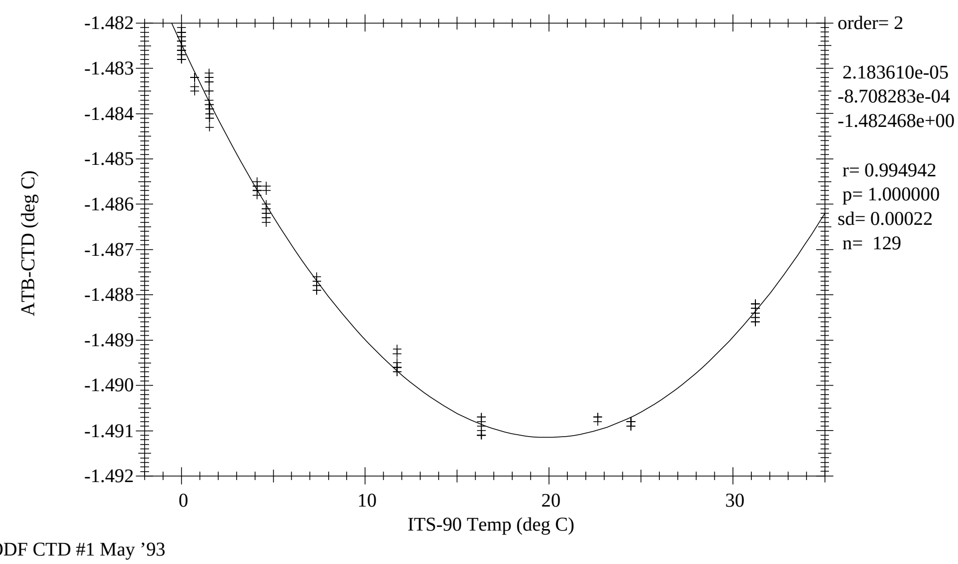


Figure 1.5.2 Temperature calibration for ODF CTD #1, May 1993.

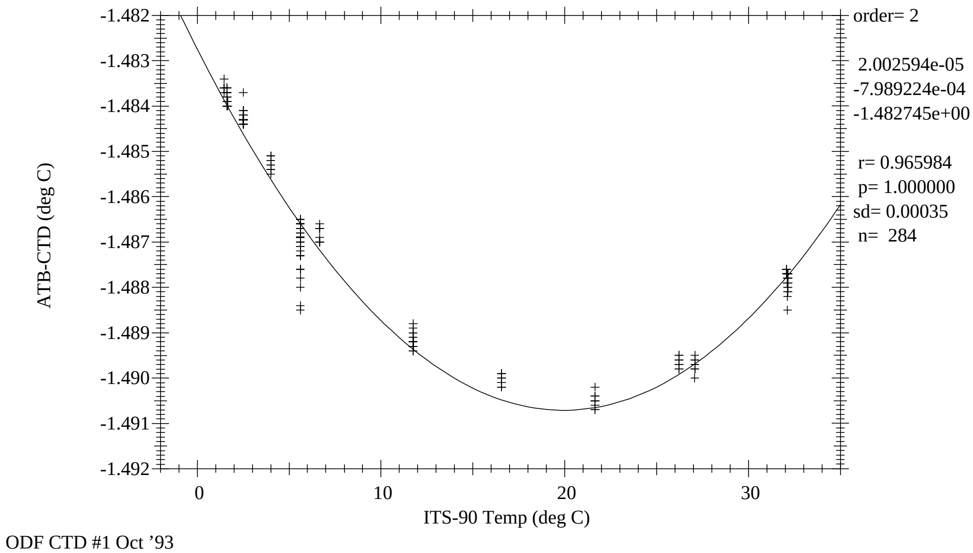


Figure 1.5.3 Temperature calibration for ODF CTD #1, October 1993.

1.6. CTD Calibration Procedures

This cruise was the second of 2 consecutive Pacific Ocean WOCE cruises using this CTD. A redundant sensor was used as a temperature calibration check while at sea; the FSI PRT sensor was deployed as a second temperature channel and compared with the primary PRT channel on most casts.

Comparison of the two PRT sensors did not show any appreciable drift during these expeditions. The response times of the sensors were first matched, then the temperatures compared for a series of standard depths from each CTD down-cast. There was a constant offset maintained between the 2 PRTs throughout both legs. Figure 1.6.0 summarizes the comparison between the primary and secondary PRT channels.

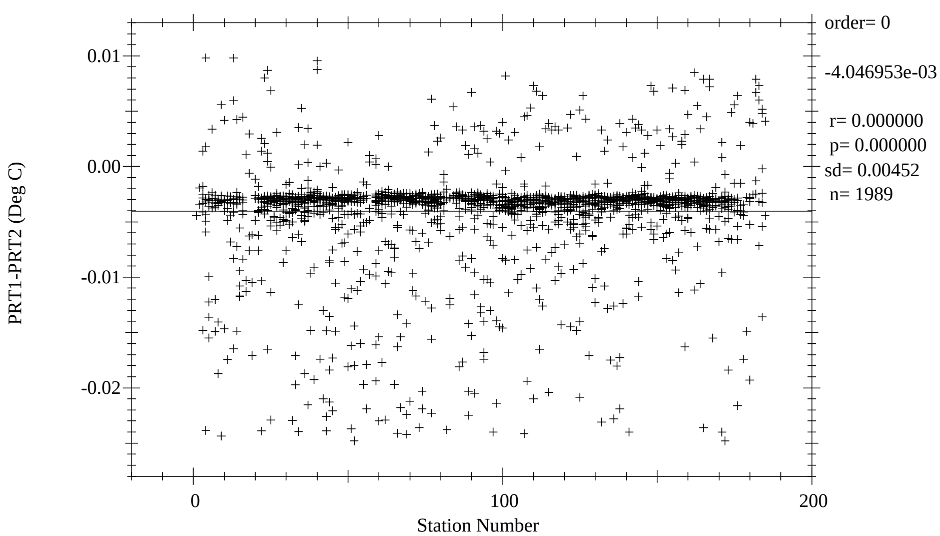


Figure 1.6.0 Comparison between the primary and secondary PRT channels.

CTD conductivity and dissolved O_2 were calibrated to *in-situ* check samples collected during each rosette cast. The stability of the conductivity calibration also verified that there were no significant shifts in the CTD pressure or temperature.

CTD Pressure and Temperature

The final pressure and temperature calibrations were verified during post-cruise processing. There was a 1.5 db slope change from 0-6000 db between the pre- and post-cruise cold "deep" pressure laboratory calibrations, as well as an ~1.5 db offset between the 2 calibrations. In order to determine when the shift occurred, start-of-cast out-of-water pressure and temperature data from the cruise were compared with similar data from the pre- and post-cruise laboratory calibrations for temperature. The pressure data from the cruise were within 0.5 db of the pre-cruise laboratory data at all temperatures, so it was decided to leave the pre-cruise pressure calibrations, applied during the cruise, unchanged.

The primary temperature sensor (Rosemount Model 171BJ Serial No. 14304) laboratory calibration shows essentially the same curve pre- and post-cruise, with at most a .0004°C shift in the range of 10-27°C; colder and warmer than that range, the curves are essentially identical. It was therefore decided to leave the pre-cruise PRT #1 correction in place for this data set.

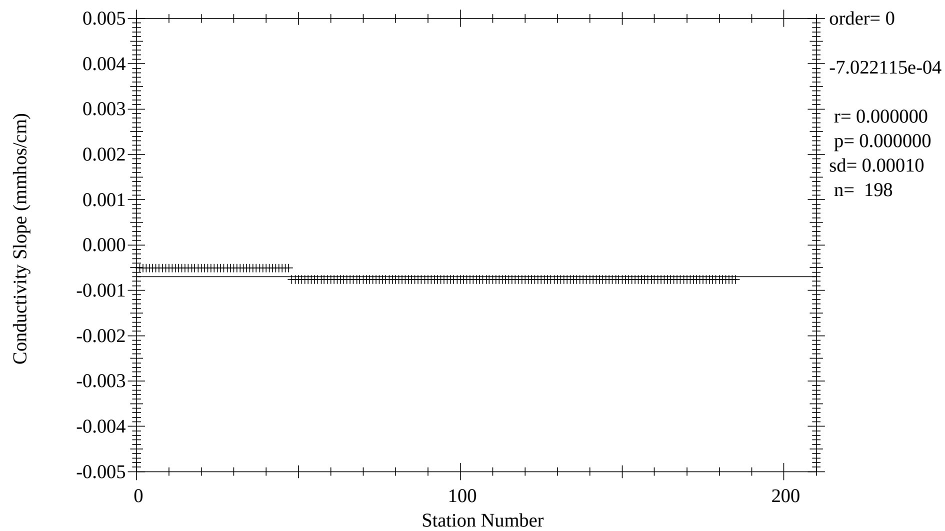
The secondary temperature sensor (FSI Model OTM-D212 Serial No. 1320) laboratory calibrations pre- and post-cruise showed some differences, but the same temperature ranges were not measured and FSI sensors show greater variability than Rosemount sensors. There did not appear to be any major shift, perhaps an ~1 millidegree shift in the range of 1-20°C.

A single rack of electronic DSRT pressure and temperature sensors was also deployed on ~75% of the P14N casts as a further check for pressure and temperature drift. Although factory calibrations only were applied to these electronic data, the comparisons for temperature were quite stable for any specific DSRT. This further verified the absence of any drift in CTD temperature during the cruise. The DSRT-CTD pressure differences were scattered to several times the magnitude of the pre- to post-cruise laboratory calibration shift; they were not useful for monitoring CTD pressure drift.

Conductivity

The CTD rosette trip pressure and temperature were used with the bottle salinity to calculate a bottle conductivity. Differences between the bottle and CTD conductivities were then used to derive a conductivity correction as a linear function of conductivity.

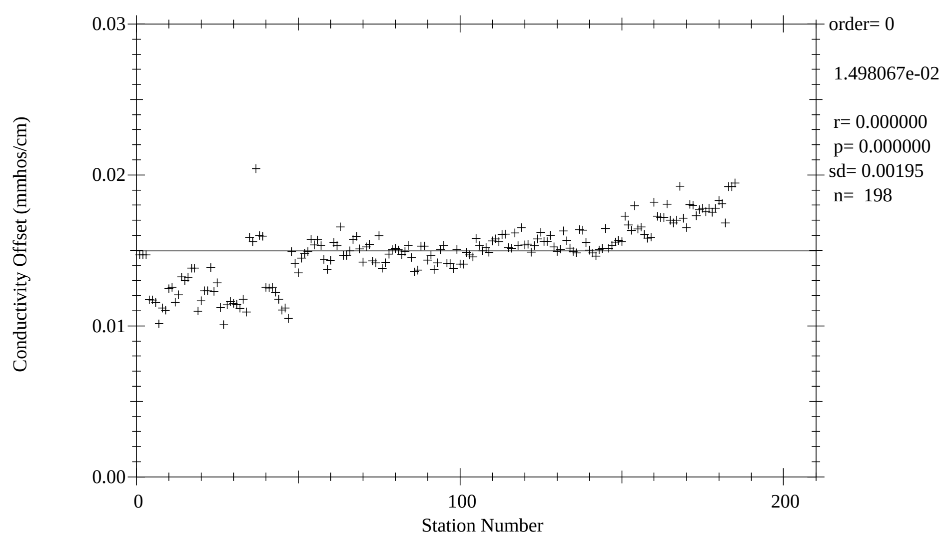
Cast-by-cast comparisons showed only minor shifts in the conductivity sensor offset and no slope changes, aside from the expected shift caused by cleaning the sea-slime contaminated sensor with alcohol between stations 47 and 48. Conductivity differences were fit to CTD conductivity for all casts in two groups, 1-47 and 48 to the end of the cruise, to determine the mean conductivity slope. The mean conductivity slope corrections are summarized in figure 1.6.1.



CTD #1 conductivity slopes

Figure 1.6.1 Mean conductivity slope corrections.

After applying the conductivity slopes, residual CTD #1 conductivity offset values were calculated and applied for each cast using the deepest bottle conductivities. Some offsets were then manually re-adjusted to account for discontinuous shifts in the conductivity transducer response or bottle salinities, or to maintain deep theta-salinity consistency from cast to cast. Figure 1.6.2 summarizes the final applied conductivity offsets by station number.

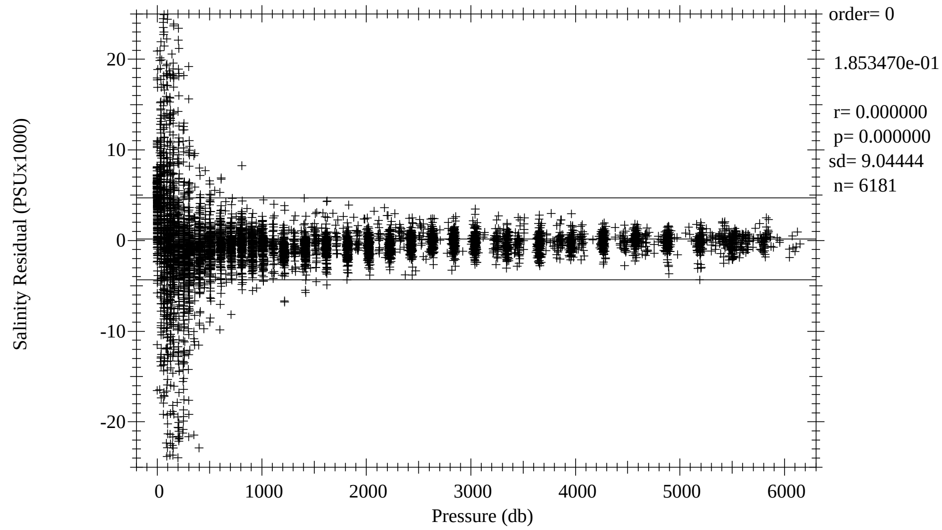


CTD #1 conductivity offsets

Figure 1.6.2 CTD conductivity offsets by station number.

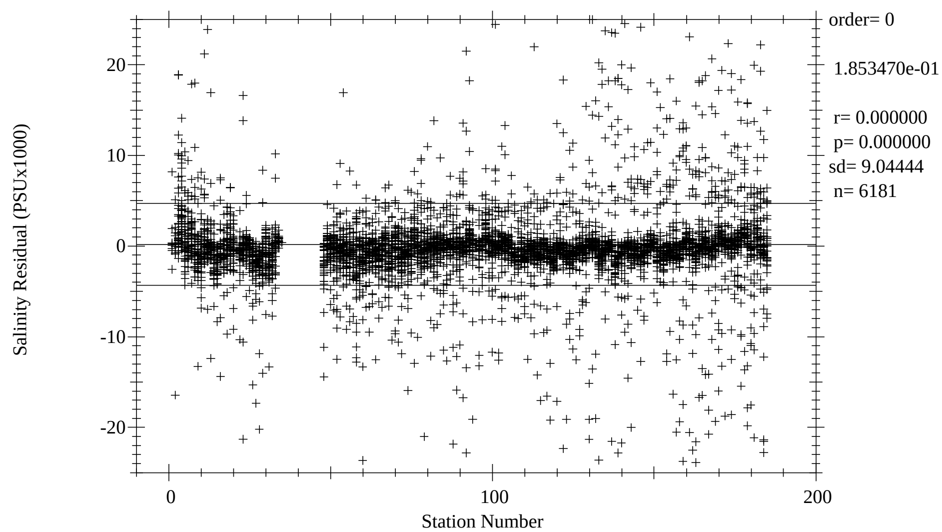
P14N temperature and conductivity correction coefficients are also tabulated in Appendix A.

Figures 1.6.3, 1.6.4 and 1.6.5 summarize the residual differences between bottle and CTD salinities after applying the conductivity corrections. Stations 35-47 are missing from the final differences plots because of problems with CTD conductivity offsets during the up-cast caused by sensor contamination. The conductivity corrections for those casts insure consistency of the down-cast CTD data with bottle data and nearby CTD casts.



CTD #1 all residual salt diffs, after correction

Figure 1.6.3 Salinity residual differences vs pressure (after correction).



CTD #1 all residual salt diffs, after correction

Figure 1.6.4 Salinity residual differences vs station # (after correction).

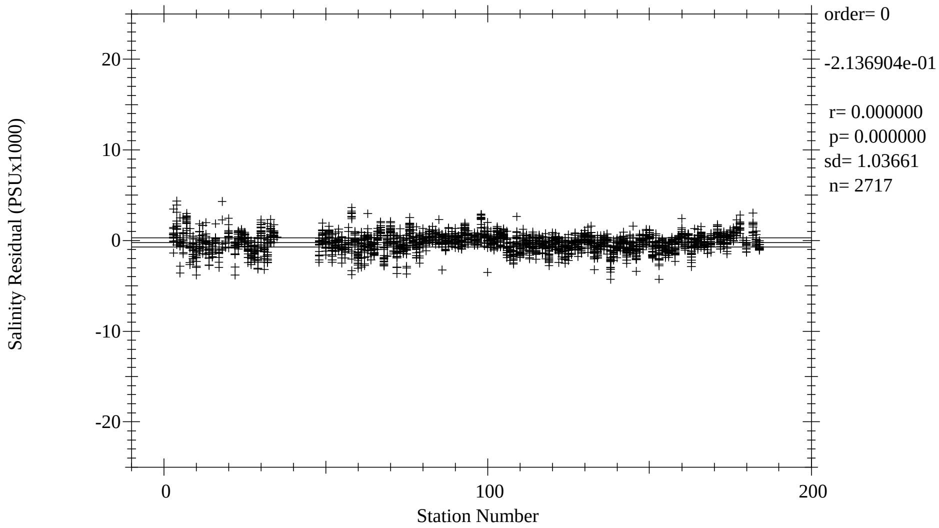


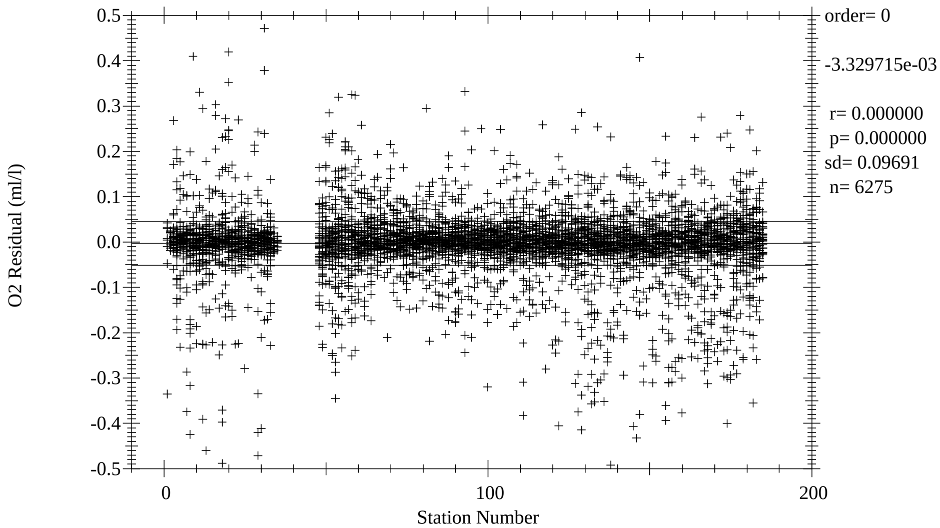
Figure 1.6.5 Deep salinity residual differences vs station # (after correction).

The CTD conductivity calibration represents a best estimate of the conductivity field throughout the water column. 3σ from the mean residual in Figures 1.6.4 and 1.6.5, or ±0.009 PSU for all salinities and ±0.001 PSU for deep salinities, represents the limit of repeatability of the bottle salinities (Autosal, rosette, operators and samplers). This limit agrees with station overlays of deep T-S. Within a cast (a single salinometer run), the precision of bottle salinities appears to exceed 0.001 PSU. The precision of the CTD salinities appears to exceed 0.0005 PSU.

CTD Dissolved Oxygen

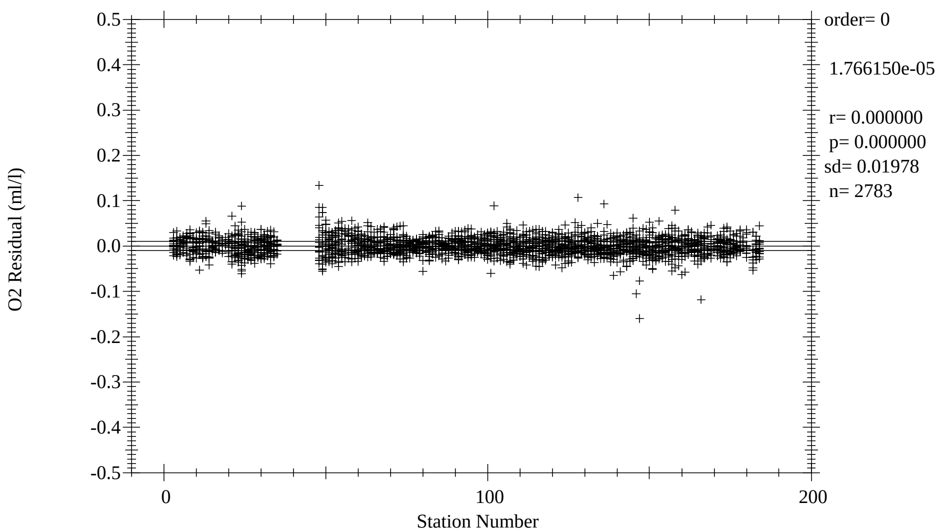
There are a number of problems with the response characteristics of the Sensormedics O_2 sensor used in the NBIS Mark III CTD, the major ones being a secondary thermal response and a sensitivity to profiling velocity. Because of these problems, up-cast CTD rosette trip data cannot be optimally calibrated to O_2 check samples. Instead, down-cast CTD O_2 data are derived by matching the up-cast rosette trips along isopycnal surfaces. When down-casts were deemed to be unusable (see Appendix C), up-cast CTD O_2 data were processed despite the signal drop-offs typically seen at bottle stops. The differences between CTD O_2 data modeled from these derived values and check samples are then minimized using a non-linear least-squares fitting procedure.

Figures 1.6.6 and 1.6.7 show the residual differences between the corrected CTD O_2 and the bottle O_2 (ml/l) for each station. The data from stations 35-47 are missing because of the previously noted problems with CTD conductivity offsetting during up-casts: density surfaces would be difficult to match when one cast direction is unstable.



CTD #1 all residual o2 diffs, after correction

Figure 1.6.6 O_2 residual differences vs station # (after correction).



CTD #1 residual o2 diffs > 1500db, after correction

Figure 1.6.7 Deep O_2 residual differences vs station # (after correction).

Note that the mean of the differences is not zero, because the O_2 values are weighted by pressure before fitting. The standard deviations of 0.10 ml/l for all oxygens and 0.02 ml/l for deep oxygens are only intended as metrics of the goodness of the fits. ODF makes no claims regarding the precision or accuracy of CTD dissolved O_2 data.

The general form of the ODF O_2 conversion equation follows Brown and Morrison [Brow78] and Millard [Mill82], [Owen85]. ODF does not use a digitized O_2 sensor temperature to model the secondary thermal response but instead models membrane and sensor temperatures by low-pass filtering the PRT temperature. *In-situ* pressure and temperature are filtered to match the sensor response. Time-constants for the pressure response τ_p, and two temperature responses τ_{Ts} and τ_{Tf} are fitting parameters. The sensor current, or O_c, gradient is approximated by low-pass filtering 1st-order O_c differences. This term attempts to correct for reduction of species other than O_2 at the cathode. The time-constant for this filter, τ_{og}, is a fitting parameter. Oxygen partial-pressure is then calculated:

$$O_{pp} = [c_1 O_c + c_2] \cdot f_{sat}(S,T,P) \cdot e^{(c_3 P_l + c_4 T_f + c_5 T_s + c_6 \frac{dO_c}{dt})} \tag{1.6.0}$$

where:

O_{pp}	= Dissolved O_2 partial-pressure in atmospheres (atm);
O_c	= Sensor current (μamps);
$f_{sat}(S,T,P)$	= O_2 saturation partial-pressure at S,T,P (atm);
S	= Salinity at O_2 response-time (PSUs);
T	= Temperature at O_2 response-time (°C);
P	= Pressure at O_2 response-time (decibars);
P_l	= Low-pass filtered pressure (decibars);
T_f	= Fast low-pass filtered temperature (°C);
T_s	= Slow low-pass filtered temperature (°C);
$\frac{dO_c}{dt}$	= Sensor current gradient (μamps/secs).

P14N CTD O_2 correction coefficients (c_1 through c_6) are tabulated in Appendix B.

1.7. CTD Data Processing

ODF CTD processing software consists of over 30 programs running under the Unix operating system. The initial CTD processing program (ctdba) is used either in real-time or with existing raw data sets to:

- Convert raw CTD scans into scaled engineering units, and assign the data to logical channels;
- Filter specific channels according to specified filtering criteria;
- Apply sensor or instrument-specific response-correction models;
- Provide periodic averages of the channels corresponding to the output time-series interval; and
- Store the output time-series in a CTD-independent format.

Once the CTD data are reduced to a standard-format time-series, they can be manipulated in a number of various ways. Channels can be additionally filtered. The time-series can be split up into shorter time-series or pasted together to form longer time-series. A time-series can be transformed into a pressure-series, or a larger-interval time-series. The pressure calibration corrections are applied during reduction of the data to time-series. Temperature, conductivity and oxygen corrections to the series are maintained in separate files and are applied whenever the data are accessed.

ODF data acquisition software acquired and processed the CTD data in real-time, providing calibrated, processed data for interactive plotting and reporting during a cast. The 25 hz data from the CTD were filtered, response-corrected and averaged to a 2 hz (0.5 seconds) time-series. Sensor correction and calibration models were applied to pressure, temperature, conductivity and O_2. Rosette trip data were extracted from this time-series in response to trip initiation and confirmation signals. The calibrated 2 hz time-series data were stored on disk (as were the 25 hz raw data) and were available in real-time for reporting and graphical display. At the end of the cast, various consistency and calibration checks were performed, and a 2.0 db pressure-series of the down-cast was generated and subsequently used for reports and plots.

CTD plots generated automatically at the completion of deployment were checked daily for potential problems. The two PRT temperature sensors were inter-calibrated and checked for sensor drift. The CTD conductivity sensor was monitored by comparing CTD values to check-sample conductivities and by deep T-S comparisons with adjacent stations. The CTD O_2 sensor was calibrated to check-sample data.

A few casts exhibited conductivity offsets due to biological or particulate artifacts. Some casts were subject to noise in 1 or more channels caused by sea cable or slip-ring problems. For extremely noisy casts, the 2 hz time series were regenerated from the 25 hz data using tighter filtering criteria on the noisy channel(s). This was done for stations 8-40, especially for the CTD O_2 channel, which is not typically filtered during the 25 hz to 2 hz averaging process. Otherwise, intermittent noisy data were filtered from the 2 hz data using a spike-removal filter that replaced points exceeding a specified multiple of the standard deviation least-squares polynomial fit of specified order of segments of the data. The filtered points were replaced by the filtering polynomial value.

Density inversions can appear in high-gradient regions. Detailed examination of the raw data shows significant mixing occurring in these areas because of ship roll. Although the weather was excellent for most of the cruise, there was rough weather and excessive ship-roll during stations 32-48. In order to minimize density inversions, a ship-roll filter was applied to all casts during pressure-sequencing to disallow pressure reversals.

Pressure intervals with no time-series data can optionally be filled by double-parabolic interpolation.

When the down-cast CTD data have excessive noise, gaps or offsets, the up-cast data are used instead. CTD data from down- and up-casts are not mixed together in the pressure-series data because they do not represent identical water columns (due to ship movement, wire angles, etc.). The six up-casts used for final P14N data are indicated in Appendix C.

Both transmissometers displayed a thermally-induced minimum, centered around 500db, for most of the cruise. Tests or attempted repairs are noted in Appendix C. Transmissometer data have not been processed beyond shipboard conversion from 25 hz to 2 hz time series, and are not included with final ODF CTD data. Wilf Gardner at TAMU should be contacted with any questions regarding transmissometer data.

Appendix C contains a table of CTD casts requiring special attention; P14N CTD-related comments, problems and solutions are documented in detail.

1.8. Bottle Sampling

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

- CFCs;
- Helium;
- Oxygen;
- Partial Pressure of CO2;
- Total CO2;
- pH;
- Tritium;
- Nutrients;
- Salinity.

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

Normal sampling practice included opening the drain valve before opening 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 to their respective laboratories for analysis. Oxygen, nutrients and salinity analyses were performed on computer-assisted (PC) analytical equipment networked to Sun SPARCstations for centralized data analysis. The analyst for a specific property was responsible for insuring that their results were updated into the cruise database.

There were many tripping problems on this leg. The General Oceanics pylon had firmware/electronics problems throughout the cruise. However, there were no apparent major mechanical flaws. About 39 of the 6914 tripped bottles were coded as leaking because of lanyards hung in the top lids, rather than coded as leaking or did not trip correctly because of pylon problems. The bottles that did not trip as planned were re-associated with the correct CTD level. See Underwater Electronics Packages for further details.

ODF suspects bottle 1 leaked slightly, but frequently. The PI disagrees and at his requests, the data coding does not reflect a leaking bottle. See Oxygen Analysis for details.

1.9. Bottle Data Processing

The first stage of bottle data processing consisted of verifying and validating individual samples, and checking the sample log (the sample inventory) for consistency. At this stage, bottle tripping problems were usually resolved, sometimes resulting in changes to the pressure, temperature and other CTD properties associated with the bottle. Note that the rosette bottle number was the primary identification for all samples taken from the bottle, as well as for the CTD data associated with the bottle. All CTD trips were retained (whether confirmed or not), so resolving bottle tripping problems simply consisted of assigning the right rosette bottle number to the right CTD trip level.

Diagnostic comments from the sample log were entered into the computer as part of the quality control procedure. Every potential problem indicated in these computer files were investigated. The data were coded with the results of the investigation.

The second stage of processing began once all the samples for a cast had been accounted for. All samples for bottles suspected of leaking were checked to see if the property was consistent with the profile for the cast, with adjacent stations, and, where applicable, with the CTD data. All comments from the analysts were examined and turned into appropriate WHP water sample codes. Oxygen flask numbers were verified, as each flask is individually calibrated and significantly affects the calculated O_2 concentration.

The third stage of processing continued throughout the cruise and until the data set is considered "final". Various property-property plots and vertical sections were examined for both consistency within a cast and consistency with adjacent stations. In conjunction with this process the analysts would review and sometimes revise their data as additional calibration or diagnostic results became available. Assignment of a WHP water sample code to an anomalous sample value was typically achieved through consensus, usually also involving one of the chief scientists.

WHP water bottle quality flags were assigned with the following additional interpretations:

3	An air leak large enough to produce an observable effect on a sample is identified by a code of 3 on the bottle and a code of 4 on the oxygen. (Small air leaks may have no observable effect, or may only affect gas samples.)
4	Bottles tripped at other than the intended depth were assigned a code of 4. There may be no problems with the associated water sample data.

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

1	The sample for this measurement was drawn from a bottle, but the results of the analysis were not (yet) received.
2	Acceptable measurement.
3	Questionable measurement. The data did not fit the station profile or adjacent station comparisons (or possibly CTD data comparisons). No notes from the analyst indicated a problem. The data could be correct, but are open to interpretation.
4	Bad measurement. Does not fit the station profile, adjacent stations or CTD data. There were analytical notes indicating a problem, but data values were reported. Sampling and analytical errors were also coded as 4.
5	Not reported. There should always be a reason associated with a code of 5, usually that the sample was lost, contaminated or rendered unusable.
9	The sample for this measurement was not drawn.

WHP water sample quality flags were assigned to the CTDSAL (CTD salinity) parameter as follows:

2	Acceptable measurement.
3	Questionable measurement. The data did not fit the bottle data, or there was a CTD conductivity calibration shift during the up-cast.
4	Bad measurement. The CTD up-cast data were determined to be unusable for calculating a salinity.
8	The CTD salinity was derived from the CTD down cast, matched on an isopycnal surface.

WHP water sample quality flags were assigned to the CTDOXY (CTD O_2) parameter as follows:

2	Acceptable measurement.
4	Bad measurement. The CTD data were determined to be unusable for calculating a dissolved oxygen concentration.
5	Not reported. The CTD data could not be reported.
9	Not sampled. No operational CTD O_2 sensor was present on this cast.

Note that all CTDOXY values were derived from the pressure-series CTD data, typically down-casts. CTD data were matched to the up-cast bottle data along isopycnal surfaces. If the CTD salinity was footnoted as bad or questionable, the CTD O_2 is blank.

Table 1.9.0 shows the number of samples drawn and the number of times each WHP sample quality flag was assigned for each basic hydrographic property:

Rosette Samples Stations 1-185,651-653,800-803,900							
	Reported levels	WHP Quality Codes 1	2	3	4	5	9
Bottle	6914	0	6638	39	217	0	20
CTD Salt	6914	0	6416	0	498	0	0
CTD Oxy	6416	0	6364	46	6	0	498
Salinity	6887	0	6670	81	136	3	24
Oxygen	6884	0	6813	33	38	5	25
Silicate	6893	0	6687	127	79	0	21
Nitrate	6893	0	6570	176	147	0	21
Nitrite	6893	0	6417	364	112	0	21
Phosphate	6893	0	6585	265	43	0	21

Table 1.9.0 Frequency of WHP quality flag assignments.

Additionally, all WHP water bottle/sample quality code comments are presented in Appendix D.

1.10. Pressure and Temperatures

All pressures and temperatures for the bottle data tabulations on the rosette casts were obtained by averaging CTD data for a brief interval at the time the bottle was closed on the rosette, then correcting the data based on CTD laboratory calibrations.

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

1.11. Salinity Analysis

Salinity samples were drawn into 200 ml Kimax high alumina borosilicate bottles after 3 rinses, and were sealed with custom-made plastic insert thimbles and Nalgene screw caps. This assembly provides very low container dissolution and sample evaporation. As loose inserts were found, they were replaced to insure a continued airtight seal. Salinity was determined after a box of samples had equilibrated to laboratory temperature, usually within 8-12 hours of collection. The draw time and equilibration time, as well as per-sample analysis time and temperature were logged.

Two Guildline Autosal Model 8400A salinometers (55-654 and 57-396) were used to measure salinities. These were located in a temperature-controlled laboratory. The salinometers were modified by ODF and contained interfaces for computer-aided measurement. A computer (PC) prompted the analyst for control functions (changing sample, flushing) while it made continuous measurements and logged results. The salinometer cell was flushed until successive readings met software criteria for consistency, then two successive measurements were made and averaged for a final result.

The salinometer was standardized for each cast with IAPSO Standard Seawater (SSW) Batch P-122, using at least one fresh vial per cast. The estimated accuracy of bottle salinities run at sea is usually better than 0.002 PSU relative to the particular Standard Seawater batch used. PSS-78 salinity [UNES81] was then calculated for each sample from the measured conductivity ratios, and the results merged with the cruise database.

Salinometer 57-396 was used on stations 022-025. Salinometer 55-654 was used on all other stations. A thermistor failed in 55-654 prior to 021/01 and was replaced.

6887 salinity measurements were made from the rosette stations. 380 vials of standard water were used. The temperature stability of the laboratory used to make the measurements was acceptable (usually within 4°C of the salinometer bath temperature). There were no substantial problems noted with the analyses. The salinities were used to calibrate the CTD conductivity sensor.

1.12. Oxygen Analysis

Samples were collected for dissolved oxygen analyses soon after the rosette sampler was brought on board and after CFC and helium were drawn. Nominal 125 ml volume-calibrated iodine flasks were rinsed twice with minimal agitation, then filled via a drawing tube, and allowed to overflow for at least 3 flask volumes. The sample temperature was measured with a small platinum resistance thermometer embedded in the drawing tube. Draw temperatures were very useful in detecting possible bad trips even as samples were being drawn. Reagents were added to fix the oxygen before stoppering. The flasks were shaken twice to assure thorough dispersion of the $MnO(OH)_2$ precipitate. They were shaken once immediately after drawing, and then again after 20 minutes. The samples were analyzed within 4-36 hours of collection.

Dissolved oxygen analyses were performed with an SIO-designed automated oxygen titrator using photometric end-point detection based on the absorption of 365 nm wavelength ultra-violet light. Thiosulfate was dispensed by a Dosimat 665 buret driver fitted with a 1.0 ml buret. ODF uses 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 (approximately 0.012N) and thiosulfate solution (50 gm/l). Standard solutions prepared from pre-weighed potassium iodate crystals were run at the beginning of each session of analyses, which typically included from 1 to 3 stations. Several standards were made up during the cruise and compared to assure that the results were reproducible, and to preclude the possibility of a weighing error. Reagent/distilled water blanks were determined to account for oxidizing or reducing materials in the reagents. The auto-titrator generally performed very well.

The samples were titrated and the data logged by the PC control software. The data were then used to update the cruise database on the Sun SPARCstations.

Thiosulfate normalities and blanks, calculated from each standardization and corrected to 20°C, were plotted versus time and were reviewed for possible problems. New thiosulfate normalities were recalculated after the blanks had been smoothed. These normalities were then smoothed, and the oxygen data were recalculated.

Oxygens were converted from milliliters per liter to micromoles per kilogram using the *in-situ* temperature. Ideally, for whole-bottle titrations, the conversion temperature should be the temperature of the water issuing from the bottle spigot. The sample temperatures were measured at the time the samples were drawn from the bottle, but were not used in the conversion from milliliters per liter to micromoles per kilogram because the software was not available.

Aberrant drawing temperatures provided an additional flag indicating that a bottle may not have tripped properly.

Oxygen flasks were calibrated gravimetrically with degassed deionized water (DIW) to determine flask volumes at ODF's chemistry laboratory. This is done once before using flasks for the first time and periodically thereafter when a suspect bottle volume is detected. All volumetric glassware used in preparing standards is calibrated as well as the 10 ml Dosimat buret used to dispense standard iodate solution.

Iodate standards are pre-weighed in ODF's chemistry laboratory to a nominal weight of 0.44xx grams and exact normality calculated at sea. Potassium iodate (KIO_3) is obtained from Johnson Matthey Chemical Co. and is reported by the supplier to be > 99.4% pure. All other reagents are "reagent grade" and are tested for levels of oxidizing and reducing impurities prior to use.

6884 oxygen measurements from the rosette stations were made. There is a difference of 0.4 to 3.2 umol/kg in dissolved O_2 at the maximum bottle depth for some of the stations. These stations had 2 bottles (bottle 1 and 2) tripped at the maximum bottle depth as scheduled by the PI to assess variability. It appears that the dissolved O_2 from bottle 1 was lower if there was a difference between these two bottles; there are some exceptions. No analytical error could explain a lower oxygen. The PI requested that these oxygens be deemed acceptable.

ODF suspects bottle 1 leaked slightly, but frequently. In the 1000 meters above bottle 1, there is typically very little change in salinity, and about 10% change in nutrients, but a 25% change in oxygen, making it the most sensitive to leaks in the first few minutes after tripping the bottle. The PI does not agree that the bottle was leaking and at his request, the coding does not reflect a leaking bottle or questionable data.

At the following stations, the oxygens of bottle 1 were significantly lower than at bottle 2:

> 011, 051, 053, 059, 066, 088, 094, 095, 096, 097, 098, 099, 103, 104, 105, 106, 110, 111, 113, 114, 116, 120, 122, 125, 126, 127, 130, 131, 133, 134, 136, 139, 140, 141, 142, 801, 802, 143, 803, 144, 145, 146, 148, 152, 154, 155, 157, 158, 159, 162, 164, 165, 166, 167, 172, 174

At the following stations, the oxygens of bottle 1 were significantly higher than at bottle 2 and adjoining stations:

> 065, 069, 091, 128, 183

The oxygen data were used to calibrate the CTD O_2 sensor.

1.13. Nutrient Analysis

Nutrient samples were drawn into 45 ml high density polypropylene, narrow mouth, screw-capped centrifuge tubes which were rinsed three times before filling. Standardizations were performed at the beginning and end of each group of analyses (one cast, usually 36 samples) with a set of an intermediate concentration standard prepared for each run from secondary standards. These secondary standards were in turn prepared aboard ship by dilution from dry, pre-weighed primary standards. Sets of 5-6 different concentrations of shipboard standards were analyzed periodically to determine the deviation from linearity as a function of concentration for each nutrient.

Nutrient analyses (phosphate, silicate, nitrate and nitrite) were performed on an ODF-modified 4-channel Technicon AutoAnalyzer II, generally within one hour of the cast. Occasionally some samples were refrigerated at 2 to 6°C for a maximum of 4 hours. The methods used are described by Gordon *et al.* [Atla71] [Hage72], [Gord92]., The colorimeter output from each of the four channels were digitized and logged automatically by computer (PC), then split into absorbence peaks. All the runs were manually verified.

Silicate is analyzed using the technique of Armstrong *et al.* [Arms67]. Ammonium molybdate is added to a seawater sample to produce silicomolybdic acid which is then reduced to silicomolybdous acid (a blue compound) following the addition of stannous chloride. Tartaric acid is also added to impede PO4 contamination. The sample is passed through a 15 mm flowcell and the absorbence measured at 820nm. ODF's methodology is known to be non-linear at high silicate concentrations (>120 μM); a correction for this non-linearity is applied in ODF's software.

Modifications of the Armstrong *et al.* [Arms67] techniques for nitrate and nitrite analysis are also used. The seawater sample for nitrate analysis is passed through a cadmium column where the nitrate is reduced to nitrite. Sulfanilamide is introduced, reacting with the nitrite, then N-(1-naphthyl)ethylenediamine dihydrochloride which couples to form a red azo dye. The reaction product is then passed through a 15 mm flowcell and the absorbence measured at 540 nm. The same technique is employed for nitrite analysis, except the cadmium column is not present, and a 50 mm flowcell is used.

Phosphate is analyzed using a modification of the Bernhardt and Wilhelms [Bern67] technique. Ammonium molybdate is 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 is heated to ~55°C to enhance color development, then passed through a 50 mm flowcell and the absorbence measured at 820 nm.

Nutrients reported in micromoles per kilogram were converted from micromoles per liter by dividing by sample density calculated at 1 atm pressure, *in-situ* salinity, and an assumed laboratory temperature of 25°C.

Na_2SiF_6, the silicate primary standard, is obtained from Fluka Chemical Company and Fisher Scientific and is reported by the suppliers to be >98% pure. Primary standards for nitrate (KNO_3), nitrite ($NaNO_2$), and phosphate (KH_2PO_4) are obtained from Johnson Matthey Chemical Co. and the supplier reports purities of 99.999%, 97%, and 99.999%, respectively.

6893 nutrient analyses were performed. The AA generally performed well, with minor pump and sampler problems.

B.1.14. CFC-11 and CFC-12 MEASUREMENTS

(Dr. Mark J. Warner, Mr. Steven Covey, University of Washington

SAMPLE COLLECTION AND ANALYSIS

Samples for CFC analysis were drawn from the 10-liter Niskins into 100-cc ground glass syringes fitted with plastic stopcocks. These samples were the first aliquots drawn from the particular Niskins. There is no evidence of high contamination levels of the CFC samples resulting from the Niskin bottles.

The samples were analyzed using a CFC extraction and analysis system of Dr. Richard Gammon of the University of Washington. The analytical procedure and data analysis are described by Bullister and Weiss (1988). Dr. Warner and his technician set up the analytic system in Sitka, Alaska and transited aboard the R.V. Thompson to Dutch Harbor, Alaska to ensure that the instrument was working properly. The CFC concentrations in air were measured approximately twice per day during this expedition. Air was pumped to the main laboratory from the bow through Dekabon tubing.

CALIBRATION

A working standard, calibrated on the SIO1993 scale, was used to calibrate the response of the electron capture detector of the Shimadzu Mini-2 GC to the CFCs. This standard, Airco cylinder CC88098, contained gas with CFC-11 and CFC-12 concentrations of 267.20 parts per trillion (ppt) and 502.32 ppt, respectively.

SAMPLING BLANKS

There is always a small amount of contamination of the CFCs in the sampling and analysis of water samples. We have attempted to estimate this level of contamination by taking the mode of measured CFC concentration in samples which should be CFC-free. In this region, measurements of other transient tracers such as carbon-14 indicate that the deep waters are much older than the CFC transient. We have used all samples deeper than than 2000 meters to determine the blanks of 0.0045 picomoles per kilogram (pmol/kg) for CFC-11 and 0.0005 pmol/kg for CFC-12. These concentrations have been subtracted from all the reported dissolved CFC concentrations.

DATA

In addition to the CFC concentrations which have merged with the .SEA file, the following three tables have been included to complete the data set. The first two are tables of the duplicate samples. The third is a table of the atmospheric CFC concentrations interpolated to each station.

Table 1: CFC-11 Concentrations in Replicate Samples

STATION	SAMPLE	CFC-11
1	101	5.412
1	101	5.417
1	105	5.524
1	105	5.495
4	101	0.007
4	101	0.012
4	102	0.010
4	102	0.012
4	103	0.012
4	103	0.013
7	102	0.017
7	102	0.018
9	103	0.009
9	103	0.007
11	103	0.014
11	103	0.015
21	103	0.000
21	103	0.002
23	102	0.004
23	102	-0.002
25	103	-0.001
25	103	0.002
27	125	0.142
27	125	0.145
28	126	0.266
28	126	0.273
29	125	0.335
29	125	0.347
31	127	1.289
31	127	1.285
33	126	0.636
33	126	0.616
43	126	2.045
43	126	2.027
45	132	3.470
45	132	3.536
47	130	3.729
47	130	3.707
49	130	3.201
49	130	3.132
51	130	2.781
51	130	2.710
53	125	2.082
53	125	2.049
55	128	2.431
55	128	2.426
57	128	2.593
57	128	2.514
59	129	2.986
59	129	3.000
61	127	2.989
61	127	3.113
63	126	2.642
63	126	2.672
69	127	2.774
69	127	2.806
71	136	1.779
71	136	1.776
73	132	2.512
73	132	2.465
75	125	1.147
75	125	1.144
77	126	1.815
77	126	1.804
83	129	2.605
83	129	2.566
85	130	2.437
85	130	2.401
89	130	2.342
89	130	2.296
91	124	0.015
91	124	0.015
93	130	2.000
93	130	1.999
95	122	-0.002
95	122	0.007
99	130	2.016
99	130	2.025
101	127	0.051
101	127	0.054
105	127	0.024
105	127	0.019
107	132	1.707
107	132	1.701
111	130	0.885
111	130	0.892
113	132	1.642
113	132	1.655
115	133	1.622
115	133	1.625
117	131	1.263
117	131	1.253
119	129	0.175
119	129	0.168
121	132	1.686
121	132	1.688
123	127	0.071
123	127	0.071
125	126	0.020
125	126	0.022
127	134	1.557
127	134	1.564
129	128	0.314
129	128	0.306
131	130	0.849
131	130	0.868
135	130	1.236
135	130	1.217
137	133	1.566
137	133	1.583
139	126	0.093
139	126	0.090
141	130	1.182
141	130	1.186
143	126	0.193
143	126	0.186
145	130	1.202
145	130	1.195
147	123	0.009
147	123	0.009
149	130	1.140
149	130	1.109
151	130	1.388
151	130	1.393
153	126	0.081
153	126	0.082
155	123	0.006
155	123	0.004
157	132	1.636
157	132	1.596
159	130	1.747
159	130	1.734
163	130	1.335
163	130	1.321
165	126	0.105
165	126	0.107
167	124	0.017
167	124	0.010
169	124	0.006
169	124	0.005
171	129	0.973
171	129	0.973
173	126	0.120
173	126	0.114
175	131	1.697
175	131	1.741
177	121	0.043
177	121	0.045
181	130	1.705
181	130	1.746
800	130	1.574
800	130	1.589

Table 2: CFC-12 CONCENTRATIONS IN REPLICATE SAMPLES

Station	Sample	CFC-12
1	101	2.586
1	101	2.525
4	101	0.005
4	101	0.003
4	102	0.005
4	102	0.004
4	103	0.010
4	103	0.008
7	102	0.010
7	102	0.012
9	103	0.002
9	103	0.002
11	103	0.003
11	103	0.006
21	103	0.003
21	103	-0.003
23	102	0.004
23	102	0.017
29	125	0.152
29	125	0.150
31	127	0.563
31	127	0.564
33	126	0.270
33	126	0.270
41	330	1.682
41	330	1.690
43	126	0.993
43	126	0.976
45	132	1.772
45	132	1.750
47	130	1.859
47	130	1.766
49	130	1.631
49	130	1.560
51	130	1.405
51	130	1.367
53	125	0.972
53	125	0.941
55	128	1.225
55	128	1.251
57	128	1.357
57	128	1.313
59	129	1.524
59	129	1.542
61	127	1.527
61	127	1.590
63	126	1.291
63	126	1.343
69	120	0.008
69	120	0.015
69	127	1.395
69	127	1.417
71	136	0.963
71	136	0.973
73	120	0.004
73	120	0.001
73	132	1.278
73	132	1.273
75	125	0.537
75	125	0.528
77	126	0.856
77	126	0.853
83	129	1.313
83	129	1.295
85	130	1.257
85	130	1.234
89	130	1.182
89	130	1.172
91	124	0.010
91	124	0.004
93	130	1.055
93	130	1.061
95	122	-0.001
95	122	0.001
99	130	1.064
99	130	1.070
101	127	0.021
101	127	0.022
105	127	0.010
105	127	0.010
107	132	0.866
107	132	0.856
111	130	0.422
111	130	0.431
113	132	0.840
113	132	0.851
115	133	0.916
115	133	0.917
117	131	0.636
117	131	0.627
119	129	0.083
119	129	0.079
121	132	0.880
121	132	0.884
123	127	0.037
123	127	0.028
125	126	0.014
125	126	0.016
127	134	0.853
127	134	0.871
129	128	0.164
129	128	0.139
131	130	0.424
131	130	0.417
135	130	0.623
135	130	0.601
137	133	0.859
137	133	0.869
139	126	0.042
139	126	0.048
141	130	0.596
141	130	0.585
143	126	0.102
143	126	0.099
145	130	0.619
145	130	0.603
147	123	0.002
147	123	0.004
149	130	0.590
149	130	0.574
151	130	0.721
151	130	0.724
153	126	0.039
153	126	0.041
155	123	0.002
155	123	0.002
157	132	0.882
157	132	0.863
159	130	0.908
159	130	0.933
163	130	0.675
163	130	0.698
165	126	0.052
165	126	0.061
167	124	0.010
167	124	0.006
169	124	0.002
169	124	0.003
171	129	0.498
171	129	0.502
173	126	0.048
173	126	0.056
175	131	0.905
175	131	0.927
181	130	0.895
181	130	0.917
800	130	0.819
800	130	0.826

Table 3: ATMOSPHERIC CFC CONCENTRATIONSINTERPOLATED TO STATIONS

STN #	F11 PPT	F12 PPT	STN #	F11 PPT	F12 PPT	STN #	F11 PPT	F12 PPT	STN #	F11 PPT	F12 PPT
1	275.5	519.6	50	274.1	512.5	99	272.3	513.5	148	271.1	509.5
2	275.4	520.0	51	274.3	513.3	100	272.3	513.5	149	271.1	509.5
3	275.5	519.6	52	274.5	514.2	101	271.7	513.2	150	270.9	510.7
4	275.4	520.0	53	274.3	513.3	102	271.7	513.2	151	270.9	510.7
5	275.4	520.0	54	274.3	514.4	103	271.7	513.2	152	271.0	511.5
6	275.4	520.0	55	274.4	515.6	104	271.7	513.2	153	270.2	511.3
7	275.1	520.2	56	274.3	515.3	105	272.2	513.4	154	270.2	511.3
8	275.1	520.2	57	274.3	515.3	106	272.3	513.4	155	270.6	513.3
9	275.1	520.2	58	274.4	515.1	107	272.7	515.4	156	270.6	513.3
10	275.1	520.2	59	274.4	514.9	108	272.3	515.0	157	270.5	510.7
11	275.1	520.2	60	274.4	514.9	109	272.3	515.0	158	270.5	510.7
12	275.1	520.2	61	274.4	514.9	110	272.7	515.4	159	270.6	511.4
13	275.1	520.8	62	274.0	514.6	111	272.3	515.0	160	270.8	510.1
14	275.1	520.8	63	273.9	514.1	112	272.3	515.0	161	270.8	510.1
15	275.1	520.8	64	273.8	513.7	113	272.3	515.0	162	270.8	510.1
16	275.1	520.8	65	273.3	513.2	114	272.3	515.0	163	270.9	509.9
17	274.6	524.3	66	273.3	513.2	115	272.1	513.0	164	270.9	508.6
18	274.6	524.3	67	273.3	513.2	116	272.1	513.0	165	270.9	508.6
19	274.6	524.3	68	273.3	511.6	117	272.1	513.0	166	270.5	508.1
20	274.6	524.3	69	273.0	513.2	118	271.7	512.8	167	270.4	508.1
21	274.6	524.3	70	273.0	513.2	119	271.7	512.0	168	270.1	508.5
22	274.6	524.3	71	273.0	513.2	120	272.6	513.5	169	269.9	507.5
23	274.6	524.3	72	272.6	514.9	121	272.6	513.5	170	269.7	508.1
24	274.6	524.3	73	272.8	513.4	122	272.6	513.5	171	269.7	508.1
25	274.9	522.9	74	272.8	515.2	123	272.8	514.5	172	269.7	508.6
26	274.8	523.3	75	272.8	514.8	124	272.8	514.5	173	269.7	508.1
27	274.7	522.1	76	272.8	514.8	125	272.8	514.5	174	269.8	507.1
28	274.6	522.2	77	273.2	514.4	126	272.9	514.0	175	269.7	508.2
29	274.9	519.9	78	273.6	514.7	127	272.3	511.6	176	269.7	508.5
30	275.2	519.7	79	273.6	514.7	128	271.1	509.4	177	269.6	508.4
31	275.8	520.1	80	273.6	514.7	129	271.1	509.4	178	269.6	508.4
32	275.0	519.6	81	273.6	514.7	130	270.9	509.7	179	269.6	508.4
33	276.7	520.3	82	273.4	513.2	131	270.7	510.0	180	269.0	508.6
34	276.7	520.3	83	273.4	513.2	132	270.7	510.0	181	268.5	510.8
35	276.7	520.3	84	273.4	513.2	133	270.7	510.0	182	268.5	510.8
36	275.9	519.3	85	272.5	513.0	134	270.6	509.5	183	268.5	510.8
37	275.3	517.8	86	271.8	512.6	135	270.3	510.2	184	268.4	508.4
38	273.9	515.3	87	271.8	512.6	136	270.4	509.8	185	268.4	508.4
39	274.9	513.4	88	272.2	513.9	137	270.4	509.8	651	273.3	513.2
40	274.9	513.4	89	272.2	513.9	138	270.4	509.8	652	273.3	513.2
41	274.9	513.4	90	271.9	514.4	139	269.8	510.8	653	273.3	513.2
42	274.7	513.0	91	271.9	514.4	140	270.0	510.0	800	270.6	510.0
43	274.7	513.0	92	271.9	514.4	141	270.0	510.0	801	269.7	510.6
44	274.6	512.2	93	273.6	515.2	142	270.0	510.0	802	269.7	510.6
45	274.5	511.8	94	273.6	515.2	143	269.7	510.6	803	269.7	510.6
46	273.9	511.5	95	273.6	515.2	144	269.9	509.9	900	269.7	508.1
47	273.8	510.5	96	272.8	515.5	145	270.6	510.3			
48	273.8	510.5	97	272.6	515.2	146	270.6	510.3			
49	273.8	510.5	98	272.6	515.2	147	271.1	509.5			

Table 4: ATMOSPHERIC CFC MEASUREMENTS

Date	Time (hhmm)	Latitude	Longitude	FREON RUN NUMBER	FREON FLAG	F12 PPT	F11 PPT
29 Jun 93	2333	56 36.4 N	138 53.6 W	2	0	535.2	270.3
29 Jun 93	2343	56 36.4 N	138 53.6 W	3	0	533.3	269.3
29 Jun 93	2354	56 36.4 N	138 53.6 W	4	0	527.4	269.9
30 Jun 93	0017	56 36.4 N	138 53.6 W	6	0	519.7	269.3
3 Jul 93	0303	54 11.0 N	160 59.7 W	114	0	517.1	274.3
6 Jul 93	0949	55 39.4 N	168 55.4 W	181	0	522.6	268.1
6 Jul 93	0959	55 39.4 N	168 55.4 W	182	0	530.2	270.1
6 Jul 93	1009	55 39.4 N	168 55.4 W	183	0	520.5	268.3
7 Jul 93	0723	59 00.1 N	173 59.8 W	245	0	526.7	269.0
7 Jul 93	0734	59 00.1 N	173 59.8 W	246	0	523.0	268.6
7 Jul 93	0830	59 00.1 N	173 59.8 W	247	0	525.7	269.2
8 Jul 93	2253	55 00.1 N	177 11.7 W	409	0	525.8	268.2
8 Jul 93	2304	55 00.1 N	177 11.7 W	410	0	525.8	268.2
8 Jul 93	2316	55 00.1 N	177 11.7 W	411	0	527.9	268.3
9 Jul 93	1149	53 42.1 N	178 07.6 W	462	0	525.7	268.0
9 Jul 93	1214	53 42.1 N	178 07.6 W	464	0	525.1	268.6
9 Jul 93	1225	53 42.1 N	178 07.6 W	465	0	525.4	268.2
11 Jul 93	0951	50 56.1 N	179 34.3 E	655	0	522.1	269.2
11 Jul 93	1003	50 56.1 N	179 34.3 E	656	0	531.8	267.7
11 Jul 93	1015	50 56.1 N	179 34.3 E	657	0	529.7	268.0
12 Jul 93	0106	50 14.1 N	179 07.9 E	714	0	528.8	267.5
12 Jul 93	0118	50 14.1 N	179 07.9 E	715	0	530.0	267.0
12 Jul 93	0200	50 14.1 N	179 07.9 E	717	0	538.7	267.1
12 Jul 93	2032	48 59.8 N	178 59.8 E	803	0	527.8	268.1
12 Jul 93	2043	48 59.8 N	178 59.8 E	804	0	528.3	269.4
12 Jul 93	2057	48 59.8 N	178 59.8 E	805	0	521.2	268.7
13 Jul 93	2023	47 00.1 N	179 00.0 E	906	0	524.7	267.6
13 Jul 93	2034	47 00.1 N	179 00.0 E	907	0	527.8	267.4
13 Jul 93	2046	47 00.1 N	179 00.0 E	908	0	524.5	267.3
14 Jul 93	0841	45 59.8 N	179 00.2 E	955	0	519.0	268.3
14 Jul 93	0852	45 59.8 N	179 00.2 E	956	0	530.8	268.9
14 Jul 93	0904	45 59.8 N	179 00.2 E	957	0	525.5	269.4
14 Jul 93	2103	45 00.2 N	179 00.2 E	1004	0	529.4	269.8
14 Jul 93	2114	45 00.2 N	179 00.2 E	1005	0	528.0	269.7
14 Jul 93	2126	45 00.2 N	179 00.2 E	1006	0	523.5	273.1
15 Jul 93	1149	43 59.8 N	178 59.7 E	1057	0	522.7	267.0
15 Jul 93	1201	43 59.8 N	178 59.7 E	1058	0	522.7	267.3
15 Jul 93	1213	43 59.8 N	178 59.7 E	1059	0	524.0	267.3
16 Jul 93	1420	42 32.8 N	179 10.6 E	1120	0	519.9	267.5
16 Jul 93	1432	42 32.8 N	179 10.6 E	1121	0	518.4	267.0
16 Jul 93	1443	42 32.8 N	179 10.6 E	1122	0	518.3	266.7
17 Jul 93	1246	41 59.8 N	178 59.8 E	1188	0	516.8	270.5
17 Jul 93	1258	41 59.8 N	178 59.8 E	1189	0	519.8	268.2
17 Jul 93	1310	41 59.8 N	178 59.8 E	1190	0	521.3	268.4
18 Jul 93	1801	39 59.9 N	179 00.2 E	1283	0	516.5	267.5
18 Jul 93	1812	39 59.9 N	179 00.2 E	1284	0	519.3	267.6
18 Jul 93	1823	39 59.9 N	179 00.2 E	1285	0	518.3	267.3
19 Jul 93	0828	38 59.6 N	179 00.2 E	1346	0	517.4	266.2
19 Jul 93	0839	38 59.6 N	179 00.2 E	1347	0	516.7	266.7
19 Jul 93	0850	38 59.6 N	179 00.2 E	1348	0	514.7	267.5
19 Jul 93	2036	38 00.2 N	179 00.0 E	1397	0	514.7	268.0
19 Jul 93	2047	38 00.2 N	179 00.0 E	1398	0	513.9	266.9

Table 4: ATMOSPHERIC CFC MEASUREMENTS

Date	Time (hhmm)	Latitude	Longitude	FREON RUN NUMBER	FREON FLAG	F12 PPT	F11 PPT
19 Jul 93	2058	38 00.2 N	179 00.0 E	1399	0	519.9	266.9
20 Jul 93	1215	36 59.3 N	178 59.6 E	1454	0	516.9	267.6
20 Jul 93	1153	36 59.3 N	178 59.6 E	1452	0	519.9	268.7
20 Jul 93	1204	36 59.3 N	178 59.6 E	1453	10000	529.9	273.1F
21 Jul 93	1113	35 00.3 N	179 00.2 E	1550	0	523.8	268.7
21 Jul 93	1124	35 00.3 N	179 00.2 E	1551	0	520.8	267.8
21 Jul 93	1135	35 00.3 N	179 00.2 E	1552	0	519.7	267.0
22 Jul 93	0620	32 59.3 N	178 59.8 E	1638	0	521.0	267.3
22 Jul 93	0631	32 59.3 N	178 59.8 E	1639	0	520.8	267.6
22 Jul 93	0642	32 59.3 N	178 59.8 E	1640	0	517.1	266.6
22 Jul 93	0654	32 59.3 N	178 59.8 E	1641	0	523.8	267.2
22 Jul 93	1819	31 59.6 N	178 59.7 E	1684	0	519.7	268.8
22 Jul 93	1830	31 59.6 N	178 59.7 E	1685	0	521.6	267.7
22 Jul 93	1841	31 59.6 N	178 59.7 E	1686	0	520.3	267.6
23 Jul 93	1842	29 59.8 N	178 59.7 E	1789	0	519.1	266.0
23 Jul 93	1853	29 59.8 N	178 59.7 E	1790	0	520.2	266.3
23 Jul 93	1904	29 59.8 N	178 59.7 E	1791	0	519.4	266.6
24 Jul 93	1013	29 29.8 N	178 58.5 E	1863	0	517.0	267.4
24 Jul 93	1025	29 29.8 N	178 58.5 E	1864	0	518.2	266.6
24 Jul 93	1036	29 29.8 N	178 58.5 E	1865	0	519.4	266.1
25 Jul 93	0203	27 59.9 N	179 00.0 E	1922	0	517.5	265.8
25 Jul 93	0225	27 59.9 N	179 00.0 E	1924	0	516.5	266.9
25 Jul 93	0237	27 59.9 N	179 00.0 E	1925	0	513.8	265.7
25 Jul 93	0248	27 59.9 N	179 00.0 E	1926	0	518.7	267.0
25 Jul 93	1840	27 02.1 N	178 57.5 E	1983	0	522.2	265.8
25 Jul 93	1851	27 02.1 N	178 57.5 E	1984	0	523.8	266.4
25 Jul 93	1902	27 02.1 N	178 57.5 E	1985	0	519.6	265.7
26 Jul 93	0932	25 59.7 N	179 00.3 E	2032	0	520.1	265.6
26 Jul 93	0943	25 59.7 N	179 00.3 E	2033	0	520.4	265.9
26 Jul 93	0955	25 59.7 N	179 00.3 E	2034	0	517.9	265.8
27 Jul 93	1006	24 00.0 N	178 59.6 E	2123	0	520.5	266.8
27 Jul 93	1017	24 00.0 N	178 59.6 E	2124	0	523.1	266.7
27 Jul 93	1028	24 00.0 N	178 59.6 E	2125	0	520.9	265.7
29 Jul 93	0744	20 00.0 N	179 00.0 E	2305	0	520.3	266.0
29 Jul 93	0755	20 00.0 N	179 00.0 E	2306	0	519.3	266.5
29 Jul 93	0806	20 00.0 N	179 00.0 E	2307	0	515.7	265.7
30 Jul 93	0636	18 00.1 N	178 59.7 E	2397	0	517.8	262.5
30 Jul 93	0648	18 00.1 N	178 59.7 E	2398	0	518.1	264.3
30 Jul 93	0659	18 00.1 N	178 59.7 E	2399	0	518.8	265.2
30 Jul 93	1752	16 59.7 N	179 00.0 E	2446	0	522.5	266.8
30 Jul 93	1803	16 59.7 N	179 00.0 E	2447	0	522.2	265.8
30 Jul 93	1814	16 59.7 N	179 00.0 E	2448	0	521.5	266.3
1 Aug 93	1023	14 00.4 N	178 59.8 E	2610	0	520.1	268.5
1 Aug 93	1045	14 00.4 N	178 59.8 E	2612	0	519.2	266.6
1 Aug 93	1108	14 00.4 N	178 59.8 E	2614	0	520.0	266.6
2 Aug 93	1458	12 22.0 N	179 00.3 E	2700	0	519.3	264.8
2 Aug 93	1509	12 22.0 N	179 00.3 E	2701	0	525.7	265.6
2 Aug 93	1520	12 22.0 N	179 00.3 E	2702	0	520.4	264.7
2 Aug 93	1531	12 22.0 N	179 00.3 E	2703	0	521.7	264.3
3 Aug 93	0547	11 00.2 N	179 00.1 E	2769	0	523.2	265.4
3 Aug 93	0558	11 00.2 N	179 00.1 E	2770	0	511.5	266.2
3 Aug 93	0611	11 00.2 N	179 00.1 E	2771	0	516.8	264.3

Table 4: ATMOSPHERIC CFC MEASUREMENTS

Date	Time (hhmm)	Latitude	Longitude	FREON RUN NUMBER	FREON FLAG	F12 PPT	F11 PPT
3 Aug 93	0626	11 00.2 N	179 00.1 E	2772	0	513.0	264.5
5 Aug 93	0327	08 00.1 N	178 59.5 E	2940	0	522.4	265.2
20 Jul 93	1215	36 59.3 N	178 59.6 E	1454	0	516.9	267.6
5 Aug 93	0338	08 00.1 N	178 59.5 E	2941	0	525.2	266.2
5 Aug 93	0349	08 00.1 N	178 59.5 E	2942	0	521.6	266.4
5 Aug 93	1337	07 30.0 N	178 59.6 E	2982	0	519.9	265.9
5 Aug 93	1348	07 30.0 N	178 59.6 E	2983	0	518.6	265.3
5 Aug 93	1359	07 30.0 N	178 59.6 E	2984	0	518.9	266.2
5 Aug 93	2215	07 00.1 N	179 00.1 E	3018	0	516.0	265.7
5 Aug 93	2226	07 00.1 N	179 00.1 E	3019	0	521.8	265.4
5 Aug 93	2238	07 00.1 N	179 00.1 E	3020	0	522.5	263.8
6 Aug 93	1825	06 00.1 N	178 59.9 E	3092	0	516.6	265.3
6 Aug 93	1837	06 00.1 N	178 59.9 E	3093	0	518.4	265.2
6 Aug 93	1848	06 00.1 N	178 59.9 E	3094	0	515.5	265.4
7 Aug 93	0528	05 29.8 N	178 59.8 E	3135	0	520.0	265.1
7 Aug 93	0540	05 29.8 N	178 59.8 E	3136	0	517.9	264.8
7 Aug 93	0551	05 29.8 N	178 59.8 E	3137	20000	508.5F	263.7
7 Aug 93	0613	05 29.8 N	178 59.8 E	3139	0	517.9	265.1
7 Aug 93	1526	04 59.8 N	178 59.9 E	3173	0	527.4	270.5
7 Aug 93	1537	04 59.8 N	178 59.9 E	3174	0	517.8	264.6
7 Aug 93	1548	04 59.8 N	178 59.9 E	3175	0	521.0	269.4
7 Aug 93	1601	04 59.8 N	178 59.9 E	3176	0	519.4	264.9
8 Aug 93	2148	03 29.7 N	179 00.3 E	3293	0	520.7	264.7
8 Aug 93	2213	03 29.7 N	179 00.3 E	3295	0	514.2	264.2
8 Aug 93	2224	03 29.7 N	179 00.3 E	3296	0	517.7	264.5
9 Aug 93	0633	03 05.7 N	178 39.5 E	3332	0	509.6	264.1
9 Aug 93	0645	03 05.7 N	178 39.5 E	3333	0	513.9	264.7
9 Aug 93	0656	03 05.7 N	178 39.5 E	3334	0	512.7	264.0
9 Aug 93	0708	03 05.7 N	178 39.5 E	3335	0	515.6	265.0
14 Aug 93	1636	02 21.7 N	176 56.1 E	3358	0	517.0	263.8
14 Aug 93	1648	02 21.7 N	176 56.1 E	3359	0	514.0	263.1
14 Aug 93	1659	02 21.7 N	176 56.1 E	3360	0	513.9	262.9
15 Aug 93	0427	02 59.8 N	179 01.0 E	3380	0	516.0	263.5
15 Aug 93	0438	02 59.8 N	179 01.0 E	3381	0	516.0	263.7
15 Aug 93	0449	02 59.8 N	179 01.0 E	3382	0	517.6	263.0
15 Aug 93	2055	02 12.4 N	179 00.8 E	3444	0	516.9	263.6
15 Aug 93	2106	02 12.4 N	179 00.8 E	3445	0	517.0	263.4
15 Aug 93	2118	02 12.4 N	179 00.8 E	3446	0	516.1	263.8
16 Aug 93	1924	01 00.4 N	179 00.1 E	3524	0	513.4	264.5
16 Aug 93	1935	01 00.4 N	179 00.1 E	3525	0	515.8	263.2
16 Aug 93	1947	01 00.4 N	179 00.1 E	3526	0	513.8	263.7
17 Aug 93	1611	00 10.8 N	179 00.1 E	3599	0	516.3	261.0
17 Aug 93	1623	00 10.8 N	179 00.1 E	3600	0	517.4	262.5
17 Aug 93	1634	00 10.8 N	179 00.1 E	3601	0	518.9	263.3
17 Aug 93	1646	00 10.8 N	179 00.1 E	3602	0	519.8	263.7
18 Aug 93	1301	00 00.2 N	179 29.9 E	3643	0	514.2	263.3
18 Aug 93	1313	00 00.2 N	179 29.9 E	3644	0	513.6	263.5
18 Aug 93	1324	00 00.2 N	179 29.9 E	3645	0	513.9	264.0
19 Aug 93	1730	01 00.1 S	179 00.0 E	3750	0	514.9	263.8
19 Aug 93	1744	01 00.1 S	179 00.0 E	3751	0	516.2	264.0
19 Aug 93	1755	01 00.1 S	179 00.0 E	3752	0	510.5	263.4
20 Aug 93	0426	01 21.9 S	178 59.5 E	3793	0	515.4	263.4

Table 4: ATMOSPHERIC CFC MEASUREMENTS

Date	Time (hhmm)	Latitude	Longitude	FREON RUN NUMBER	FREON FLAG	F12 PPT	F11 PPT
20 Aug 93	0448	01 21.9 S	178 59.5 E	3795	0	514.7	264.6
20 Aug 93	0523	01 21.9 S	178 59.5 E	3798	0	522.2	269.8
20 Aug 93	1801	01 52.0 S	178 56.3 E	3848	0	513.1	263.2
20 Aug 93	1811	01 52.0 S	178 56.3 E	3849	0	516.0	263.6
20 Aug 93	1835	01 52.0 S	178 56.3 E	3851	0	513.3	264.0
21 Aug 93	1043	02 30.0 S	179 00.0 E	3890	0	521.1	263.0
21 Aug 93	1054	02 30.0 S	179 00.0 E	3891	0	518.7	264.0
21 Aug 93	1106	02 30.0 S	179 00.0 E	3892	0	519.9	263.2
22 Aug 93	1502	03 57.7 S	179 00.1 E	3999	0	517.6	263.8
22 Aug 93	1514	03 57.7 S	179 00.1 E	4000	0	516.2	263.7
22 Aug 93	1525	03 57.7 S	179 00.1 E	4001	0	520.4	265.6
23 Aug 93	1327	05 00.5 S	179 00.0 E	4084	0	510.4	263.4
23 Aug 93	1342	05 00.5 S	179 00.0 E	4085	0	515.5	263.9
23 Aug 93	1353	05 00.5 S	179 00.0 E	4086	0	514.3	263.9
24 Aug 93	0033	06 00.5 S	179 00.3 E	4136	0	513.4	263.9
24 Aug 93	0042	06 00.5 S	179 00.3 E	4137	0	515.8	265.4
24 Aug 93	0115	06 00.5 S	179 00.3 E	4140	0	516.4	264.4
25 Aug 93	0126	08 17.7 S	178 56.4 E	4237	0	511.5	262.8
25 Aug 93	0137	08 17.7 S	178 56.4 E	4238	0	513.0	262.8
25 Aug 93	0149	08 17.7 S	178 56.4 E	4239	0	514.0	263.3
25 Aug 93	1410	08 37.0 S	178 58.4 E	4303	0	513.9	263.0
25 Aug 93	1422	08 37.0 S	178 58.4 E	4304	0	514.0	263.4
25 Aug 93	1433	08 37.0 S	178 58.4 E	4305	0	512.7	263.7
26 Aug 93	0720	09 00.0 S	178 59.9 E	4370	0	517.1	263.4
26 Aug 93	0732	09 00.0 S	178 59.9 E	4371	0	513.6	262.2
26 Aug 93	0743	09 00.0 S	178 59.9 E	4372	0	514.1	262.4
27 Aug 93	1636	12 21.7 S	179 00.0 E	4506	0	510.6	263.2
27 Aug 93	1647	12 21.7 S	179 00.0 E	4507	0	510.9	263.2
27 Aug 93	1659	12 21.7 S	179 00.0 E	4508	0	508.2	263.5
28 Aug 93	0654	13 59.9 S	179 00.0 E	4578	0	520.4	262.7
28 Aug 93	0705	13 59.9 S	179 00.0 E	4579	0	518.1	262.5
28 Aug 93	0717	13 59.9 S	179 00.0 E	4580	0	516.2	262.2
28 Aug 93	1538	14 59.8 S	178 59.7 E	4613	0	514.9	261.5
28 Aug 93	1601	14 59.8 S	178 59.7 E	4615	0	515.1	261.3
28 Aug 93	1612	14 59.8 S	178 59.7 E	4616	0	514.0	260.7
29 Aug 93	0015	16 00.0 S	179 00.0 E	4652	0	513.5	263.0
29 Aug 93	0026	16 00.0 S	179 00.0 E	4653	0	511.8	261.6
29 Aug 93	0037	16 00.0 S	179 00.0 E	4654	0	506.5	258.9
29 Aug 93	0100	16 00.0 S	179 00.0 E	4656	0	518.2	263.4
29 Aug 93	0124	16 00.0 S	179 00.0 E	4658	0	518.8	263.5

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C. DATA QUALITY EVALUATION

C.1 Final CFC Data Quality Evaluation (DQE)

Dec 2000
(David Wisegarver)

During the initial DQE review of the CFC data, a small number of samples were given QUALT2 flags which differed from the initial QUALT1 flags assigned by the PI. After discussion, the PI concurred with the DQE assigned flags and updated the QUAL1 flags for these samples.

The CFC concentrations have been adjusted to the SIO98 calibration Scale (Prinn et al. 2000) so that all of the Pacific WOCE CFC data will be on a common calibration scale.

For further information, comments or questions, please, contact the CFC PI for this section

(mwarner@ocean.washington.edu)
or
David Wisegarver (wise@pmel.noaa.gov).

Additional information on WOCE CFC synthesis may be available at:
http://www.pmel.noaa.gov/cfc.

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Appendix A

WOCE93-P14N: CTD Temperature and Conductivity Corrections Summary

Sta/ Cast	PRT Response Time (secs)	ITS-90 Temperature Coefficients corT = t2∗T^2 + t1∗T + t0 t2	t1	t0	Conductivity Coefficients corC = c1∗C + c0 c1	c0
001/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01471
002/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01471
003/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01471
004/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01173
005/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01172
006/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01155
007/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01014
008/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01119
009/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01104
010/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01248
011/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01256
012/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01157
013/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01206
014/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01324
015/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01300
016/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01322
017/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01382
018/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01382
019/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01098
020/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01166
021/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01233
022/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01233
023/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01385
024/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01228
025/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01285
026/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01121
027/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01008
028/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01139
029/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01161
030/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01149
031/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01143
032/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01117
033/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01176
034/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01092
035/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01588
036/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01558
037/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.02042
038/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01599
039/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01593

Sta/ Cast	PRT Response Time (secs)	ITS-90 Temperature Coefficients corT = t2∗T^2 + t1∗T + t0 t2	t1	t0	Conductivity Coefficients corC = c1∗C + c0 c1	c0
040/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01254
041/03	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01252
042/02	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01256
043/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01222
044/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01176
045/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01105
046/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01119
047/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-5.07003e-04	0.01049
048/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01491
049/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01415
050/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01352
051/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01450
052/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01480
053/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01492
054/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01574
055/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01536
056/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01570
057/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01533
058/02	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01442
059/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01374
060/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01434
061/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01552
062/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01531
063/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01657
064/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01468
065/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01468
651/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01510
652/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01510
653/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01593
066/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01497
067/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01573
068/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01593
069/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01509
070/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01423
071/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01524
072/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01540
073/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01429
074/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01417
075/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01597
076/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01381
077/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01419

Sta/ Cast	PRT Response Time (secs)	ITS-90 Temperature Coefficients corT = t2∗T^2 + t1∗T + t0 t2	t1	t0	Conductivity Coefficients corC = c1∗C + c0 c1	c0
078/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01474
079/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01505
080/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01513
081/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01504
082/02	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01473
083/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01492
084/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01534
085/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01453
086/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01358
087/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01370
088/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01529
089/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01529
090/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01435
091/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01469
092/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01373
093/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01418
094/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01504
095/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01535
096/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01416
097/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01412
098/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01381
099/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01507
100/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01411
101/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01408
102/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01486
103/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01470
104/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01456
105/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01578
106/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01533
107/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01498
108/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01517
109/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01487
110/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01563
111/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01577
112/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01557
113/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01605
114/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01607
115/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01517
116/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01514
117/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01616
118/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01533
119/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01651

Sta/ Cast	PRT Response Time (secs)	ITS-90 Temperature Coefficients corT = t2∗T^2 + t1∗T + t0 t2	t1	t0	Conductivity Coefficients corC = c1∗C + c0 c1	c0
120/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01537
121/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01541
122/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01489
123/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01532
124/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01577
125/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01619
126/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01560
127/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01559
128/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01600
129/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01524
130/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01494
131/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01509
132/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01630
133/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01564
134/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01515
135/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01493
136/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01484
137/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01638
138/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01635
139/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01552
140/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01502
141/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01482
142/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01463
800/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01514
801/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01505
802/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01635
803/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01522
143/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01503
144/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01513
145/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01645
146/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01514
147/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01534
148/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01556
149/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01566
150/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01558
151/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01726
152/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01669
153/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01633
154/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01796
155/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01643
156/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01655
157/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01606

Sta/ Cast	PRT Response Time (secs)	ITS-90 Temperature Coefficients corT = t2∗T^2 + t1∗T + t0			Conductivity Coefficients corC = c1∗C + c0	
		t2	t1	t0	c1	c0
158/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01581
159/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01587
160/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01820
161/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01726
162/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01719
163/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01719
164/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01807
165/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01701
166/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01682
167/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01700
168/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01925
169/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01714
170/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01652
900/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01660
900/02	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01660
900/03	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01660
900/04	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01750
900/05	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01660
900/06	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01660
171/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01805
172/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01799
173/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01730
174/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01770
175/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01780
176/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01757
177/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01781
178/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01753
179/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01779
180/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01830
181/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01809
182/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01682
183/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01923
184/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01923
185/01	.30	2.18360e-05	-8.70830e-04	-1.48250	-7.62972e-04	0.01946

Appendix B

Summary of WOCE93-P14N CTD Oxygen Time Constants

Temperature		Press.	O2 Grad.
Fast(tauTF)	Slow(tauTS)	(tauP)	(tauOG)
10.0	400.0	16.0	16.0

WOCE93-P14N CTD Oxygen: O2 Conversion Equation Coefficients
(refer to Equation 1.6.0)

Sta/ Cast	Slope (c1)	Offset (c2)	Pcoeff (c3)	TFcoeff (c4)	TScoeff (c5)	OGcoeff (c6)
001/01	9.03205e-04	2.22160e-01	-3.84902e-04	-5.90926e-04	-1.26245e-02	1.77119e-07
002/01	5.72594e-04	3.49141e-01	-1.32797e-04	2.64532e-02	-1.20655e-02	7.98970e-06
003/01	1.32012e-03	-4.11370e-03	1.52537e-04	-9.27140e-03	-8.87230e-03	-2.30375e-05
004/01	1.46579e-03	-8.26449e-03	1.41945e-04	6.64804e-03	-5.36062e-02	1.55359e-05
005/01	1.31606e-03	-8.09242e-03	1.55040e-04	-7.41188e-03	-8.45274e-03	-2.79246e-05
006/01	1.41301e-03	-1.13434e-02	1.41870e-04	-1.34748e-02	-1.50663e-02	-8.46308e-06
007/01	1.40425e-03	-1.06680e-02	1.49726e-04	1.81415e-03	-4.52019e-02	1.67742e-05
008/01	1.47175e-03	-1.09463e-02	1.43235e-04	1.46446e-03	-5.19462e-02	2.11852e-05
009/01	1.51391e-03	-4.24354e-03	1.30138e-04	1.34116e-02	-7.23143e-02	-4.11079e-06
010/01	1.58514e-03	-7.19497e-03	1.26454e-04	2.29762e-03	-6.75231e-02	9.03354e-06
011/01	1.43484e-03	-3.94853e-03	1.31620e-04	-6.85656e-03	-2.17464e-02	-1.27498e-05
012/01	1.39509e-03	-4.53551e-03	1.50881e-04	-8.47989e-03	-4.00571e-02	1.04195e-05
013/01	1.60686e-03	-6.79621e-03	1.25180e-04	-5.44501e-03	-6.69089e-02	2.49827e-05
014/01	1.81404e-03	-9.76445e-03	1.01950e-04	-2.02382e-02	-8.03046e-02	4.15224e-06
015/01	1.38635e-03	-1.76264e-03	1.39446e-04	-4.37129e-02	1.32884e-02	-2.15239e-05
016/01	1.76679e-03	-4.39388e-03	1.03720e-04	2.45381e-02	-1.19062e-01	1.94149e-05
017/01	2.18024e-03	-4.05469e-03	3.37205e-05	6.72338e-02	-1.86318e-01	-8.45198e-07
018/01	3.14113e-03	-3.44063e-02	3.55666e-05	4.86544e-02	-2.49466e-01	-1.10341e-05
019/01	3.37677e-03	1.07924e-02	-1.22709e-04	5.71378e-03	-2.46256e-01	-1.20876e-05
020/01	1.55267e-03	-7.14250e-04	1.20695e-04	4.01789e-02	-1.13684e-01	1.39800e-06
021/01	1.66923e-03	-1.06858e-02	1.10888e-04	1.42224e-02	-8.22405e-02	-2.62184e-05
022/01	1.50907e-03	-2.62051e-03	1.28559e-04	-5.89131e-03	-4.48084e-02	-7.27151e-07
023/01	1.48722e-03	3.55949e-03	1.26175e-04	1.75391e-01	-2.25150e-01	-2.98670e-06
024/01	1.50886e-03	-9.71791e-03	1.34607e-04	9.78788e-04	-5.39409e-02	5.04931e-06
025/01	1.56139e-03	-1.57741e-02	1.31465e-04	2.04977e-03	-5.55510e-02	9.03188e-06
026/01	1.44395e-03	-4.57876e-03	1.38718e-04	6.67958e-03	-4.78942e-02	7.10847e-06
027/01	1.61450e-03	-1.50110e-02	1.24882e-04	6.28108e-02	-1.21932e-01	-1.27991e-05
028/01	1.46291e-03	-8.05474e-03	1.33087e-04	-8.10795e-03	-1.80865e-02	-4.51925e-06
029/01	1.51751e-03	-1.78650e-02	1.39508e-04	3.60799e-03	-5.45667e-02	4.67986e-06
030/01	1.53479e-03	-8.67512e-03	1.30590e-04	5.40930e-03	-5.77665e-02	6.84732e-06
031/01	1.46665e-03	-3.98645e-03	1.35978e-04	2.24236e-02	-6.75739e-02	2.63481e-06

Sta/ Cast	Slope (c1)	Offset (c2)	Pcoeff (c3)	TFcoeff (c4)	TScoeff (c5)	OGcoeff (c6)
032/01	1.47891e-03	-6.99981e-03	1.34555e-04	2.45420e-04	-4.87296e-02	3.58205e-06
033/01	1.48420e-03	-1.35228e-02	1.39481e-04	-2.40598e-03	-4.59551e-02	7.62459e-06
034/01	1.48722e-03	-1.26215e-02	1.37551e-04	3.16020e-03	-4.67698e-02	9.76834e-07
035/01	1.39924e-03	-6.86798e-03	1.45087e-04	1.09157e-03	-4.18143e-02	1.26064e-05
036/01	1.45795e-03	-7.24770e-03	1.37400e-04	-4.85302e-03	-4.21070e-02	-1.41104e-05
037/01	1.50667e-03	-1.33665e-02	1.36353e-04	-1.08354e-02	-4.16879e-02	-4.99139e-06
038/01	1.54085e-03	-2.72179e-02	1.40653e-04	-2.13183e-02	-4.37451e-02	-1.07129e-03
039/01	1.43428e-03	-6.71607e-03	1.37720e-04	2.01952e-02	-6.42384e-02	4.55586e-03
040/01	1.41731e-03	-1.86582e-02	1.36557e-04	9.02790e-02	-1.23643e-01	1.27558e-03
041/03	1.42160e-03	-5.80250e-03	1.38602e-04	-2.23784e-03	-3.72004e-02	1.78914e-05
042/02	1.41358e-03	-6.45484e-03	1.42571e-04	-2.59182e-02	-2.01467e-02	-5.09921e-05
043/01	1.27554e-03	-2.44302e-02	1.49638e-04	1.09917e-02	-4.97320e-02	-4.11266e-05
044/01	1.33535e-03	-2.02670e-02	1.41479e-04	3.18725e-03	-4.57396e-02	-1.24896e-05
045/01	1.35329e-03	-2.33358e-02	1.42661e-04	-1.87068e-02	-2.71494e-02	1.40182e-06
046/01	1.34308e-03	-1.11694e-02	1.34708e-04	-4.94117e-03	-4.05552e-02	-6.08651e-06
047/01	1.36910e-03	-2.41451e-02	1.41487e-04	-1.40737e-02	-3.43414e-02	-2.08130e-05
048/01	1.33721e-03	-1.89669e-02	1.41666e-04	-2.72464e-02	-2.32334e-02	-3.62274e-05
049/01	1.38967e-03	-3.18922e-02	1.43959e-04	-3.65081e-02	-1.63085e-02	-9.10786e-06
050/01	1.34191e-03	-2.22895e-02	1.39475e-04	2.76679e-02	-6.68612e-02	-3.56350e-03
051/01	1.28737e-03	-1.79837e-02	1.48066e-04	-1.86903e-02	-2.60741e-02	-1.52099e-05
052/01	1.38513e-03	-1.52298e-02	1.29768e-04	-1.85160e-02	-2.57582e-02	-9.60780e-06
053/01	1.36346e-03	-1.50430e-02	1.36254e-04	-4.42351e-02	-8.41339e-03	-8.09282e-06
054/01	1.40336e-03	-1.51155e-02	1.24744e-04	1.03625e-03	-4.04602e-02	-1.25434e-04
055/01	1.31129e-03	-1.45051e-02	1.40911e-04	-1.03987e-02	-2.70662e-02	-7.01822e-05
056/01	1.61712e-03	-2.33579e-02	8.19937e-05	1.82620e-02	-6.21687e-02	4.67180e-04
057/01	8.90025e-04	-4.60093e-03	2.90636e-04	-2.14858e-02	-1.78786e-03	-1.11354e-05
058/02	1.67490e-03	-3.74733e-02	1.09340e-04	7.72602e-04	-4.83049e-02	-3.25427e-06
059/01	1.53224e-03	-1.83441e-02	1.22684e-04	1.08165e-03	-4.00298e-02	-6.73569e-06
060/01	1.45066e-03	-1.22686e-02	1.31045e-04	2.13259e-03	-3.62693e-02	2.75528e-06
061/01	1.41823e-03	-9.92408e-03	1.33886e-04	8.34144e-03	-4.15433e-02	-6.68173e-06
062/01	1.22399e-03	-3.51505e-03	1.44988e-04	-4.67524e-03	-2.68575e-02	-7.25471e-07
063/01	1.26813e-03	-4.99851e-03	1.39135e-04	-6.92374e-03	-2.66440e-02	-2.39521e-05
064/01	1.30550e-03	-2.58439e-03	1.31994e-04	2.26529e-03	-3.36958e-02	1.11635e-06
065/01	1.27209e-03	-7.84301e-03	1.40921e-04	-2.38024e-03	-2.92283e-02	5.58085e-06
651/01	1.32114e-03	7.19183e-03	1.00748e-04	-7.47280e-04	-3.12614e-02	-3.76907e-07
652/01	7.73094e-04	2.44178e-01	7.06524e-05	-4.06143e-03	-1.33186e-02	1.86992e-05
653/01	1.22350e-03	3.62097e-04	1.55069e-04	-1.05097e-02	-2.37170e-02	-7.76838e-06
066/01	1.23995e-03	-7.27635e-04	1.37174e-04	9.48399e-03	-3.50217e-02	-8.03180e-06
067/01	1.23352e-03	-3.98986e-03	1.42774e-04	-9.91599e-04	-2.85333e-02	-1.76272e-06
068/01	1.28078e-03	-6.83198e-03	1.37178e-04	9.23796e-04	-3.15347e-02	1.13084e-05
069/01	1.30080e-03	-9.15587e-03	1.38191e-04	-3.06033e-03	-3.07422e-02	-2.55419e-06
070/01	1.18348e-03	1.10718e-02	1.38930e-04	9.08529e-03	-3.34744e-02	2.57074e-06
071/01	1.27154e-03	-9.75697e-03	1.40473e-04	1.07687e-03	-3.08110e-02	8.01591e-06

Sta/ Cast	Slope (c1)	Offset (c2)	Pcoeff (c3)	TFcoeff (c4)	TScoeff (c5)	OGcoeff (c6)
072/01	1.25957e-03	1.88982e-03	1.36438e-04	-5.45638e-03	-2.79540e-02	9.49709e-06
073/01	1.23256e-03	-5.00180e-03	1.43909e-04	-1.12971e-05	-2.98514e-02	-5.63255e-06
074/01	1.25925e-03	-8.06268e-03	1.41852e-04	3.44119e-03	-3.24606e-02	-2.11731e-06
075/01	1.20177e-03	5.46644e-03	1.42013e-04	5.81327e-03	-3.22417e-02	5.57132e-06
076/01	1.25593e-03	-8.60245e-03	1.44839e-04	-5.01476e-03	-2.72796e-02	-8.40657e-06
077/01	1.26632e-03	2.07247e-04	1.35896e-04	4.10234e-03	-3.33215e-02	3.22980e-06
078/01	1.30614e-03	-1.15847e-02	1.39190e-04	-1.57525e-03	-3.08534e-02	-5.83214e-06
079/01	1.21633e-03	2.74615e-03	1.41853e-04	-1.89090e-03	-2.73123e-02	4.52448e-06
080/01	1.20280e-03	1.00489e-02	1.39705e-04	-3.52280e-03	-2.62537e-02	-2.61515e-06
081/01	1.32876e-03	-4.92577e-03	1.27576e-04	-2.17015e-03	-3.08878e-02	7.90028e-07
082/02	1.33866e-03	2.35773e-03	1.12194e-04	-5.61629e-04	-3.05231e-02	1.27164e-06
083/01	1.25690e-03	-5.18770e-04	1.35661e-04	7.29867e-04	-2.98770e-02	1.34626e-06
084/01	1.11546e-03	2.16005e-02	1.50721e-04	-7.32188e-04	-2.45277e-02	6.32829e-07
085/01	1.32120e-03	-2.09014e-02	1.41342e-04	3.96614e-03	-3.55466e-02	-5.07134e-06
086/01	1.13816e-03	2.01260e-02	1.41675e-04	-2.83430e-04	-2.59025e-02	1.13692e-06
087/01	1.28052e-03	-1.36163e-02	1.43871e-04	3.49175e-03	-3.40279e-02	-1.26723e-06
088/01	1.26240e-03	-5.97916e-03	1.41448e-04	4.86696e-04	-3.14248e-02	1.43582e-06
089/01	1.22108e-03	3.58836e-03	1.41421e-04	-1.73459e-03	-2.81509e-02	4.69307e-06
090/01	1.37969e-03	-2.56767e-02	1.35350e-04	2.67866e-03	-3.57470e-02	1.81010e-06
091/01	1.15657e-03	1.45345e-02	1.45276e-04	2.34613e-03	-2.88627e-02	4.90029e-06
092/01	1.16082e-03	1.39322e-02	1.44480e-04	-5.57113e-03	-2.44945e-02	-7.16360e-06
093/01	1.12174e-03	3.01718e-02	1.36065e-04	8.99726e-03	-3.45062e-02	-6.04233e-06
094/01	1.24099e-03	5.89048e-03	1.37643e-04	-1.22700e-03	-2.91169e-02	-7.66030e-06
095/01	1.19726e-03	1.53796e-02	1.36862e-04	3.36224e-03	-3.12677e-02	-5.92345e-06
096/01	1.21951e-03	7.64613e-03	1.39862e-04	-6.76038e-03	-2.40886e-02	-1.29340e-06
097/01	1.31550e-03	-2.08747e-02	1.43546e-04	6.92187e-03	-3.93168e-02	3.96047e-06
098/01	1.13593e-03	1.33258e-02	1.52283e-04	1.64983e-03	-2.84370e-02	9.31756e-07
099/01	1.18674e-03	7.31378e-03	1.46425e-04	2.48948e-03	-3.12085e-02	-4.31325e-06
100/01	1.22419e-03	3.01573e-03	1.38917e-04	5.88104e-03	-3.45301e-02	3.37750e-07
101/01	1.38230e-03	-3.53842e-02	1.41789e-04	6.97859e-03	-3.93675e-02	-2.65886e-06
102/01	1.17193e-03	9.41886e-03	1.44277e-04	4.16844e-03	-3.20901e-02	2.66147e-06
103/01	1.25105e-03	-1.01816e-02	1.45089e-04	8.48883e-03	-3.78746e-02	-1.83910e-05
104/01	1.29076e-03	-1.45609e-02	1.42622e-04	1.13681e-02	-4.14871e-02	-6.91269e-06
105/01	1.36629e-03	-2.96724e-02	1.41983e-04	4.98631e-03	-3.73722e-02	4.95777e-06
106/01	1.28282e-03	-4.62269e-03	1.37286e-04	6.91485e-03	-3.83464e-02	-2.12213e-06
107/01	1.29151e-03	-4.60149e-03	1.35416e-04	1.05984e-02	-4.09016e-02	2.62981e-05
108/01	1.32724e-03	-1.22670e-02	1.34561e-04	1.76503e-02	-4.74183e-02	3.33893e-06
109/01	1.36337e-03	-2.38269e-02	1.37253e-04	1.26824e-02	-4.33897e-02	2.43166e-06
110/01	1.33306e-03	-1.83185e-02	1.38994e-04	9.89799e-03	-3.99092e-02	6.67721e-06
111/01	1.21528e-03	9.81562e-03	1.38148e-04	-4.13091e-05	-2.70014e-02	1.02391e-05
112/01	1.28661e-03	-9.06819e-03	1.38937e-04	4.43078e-03	-3.39464e-02	1.81740e-05
113/01	1.34473e-03	-2.20543e-02	1.38999e-04	7.05994e-03	-3.72317e-02	-1.33171e-05
114/01	1.22446e-03	-9.87614e-05	1.42649e-04	1.16435e-02	-3.85224e-02	8.43927e-06

Sta/ Cast	Slope (c1)	Offset (c2)	Pcoeff (c3)	TFcoeff (c4)	TScoeff (c5)	OGcoeff (c6)
115/01	1.21203e-03	5.18587e-03	1.41770e-04	2.36333e-03	-3.09166e-02	-4.86475e-06
116/01	1.18494e-03	1.16754e-02	1.41543e-04	5.94718e-03	-3.16090e-02	6.11824e-06
117/01	1.21576e-03	3.41766e-03	1.41904e-04	2.07316e-03	-2.93877e-02	2.63325e-05
118/01	1.20810e-03	1.20442e-02	1.37295e-04	9.33720e-03	-3.69411e-02	3.56342e-06
119/01	1.26440e-03	-5.22096e-03	1.40183e-04	4.72747e-03	-3.31906e-02	1.04034e-05
120/01	1.18594e-03	1.21507e-02	1.40169e-04	2.52421e-03	-2.81195e-02	8.77609e-06
121/01	1.24576e-03	2.88221e-03	1.38878e-04	-8.72489e-05	-2.98011e-02	5.08300e-07
122/01	1.23449e-03	-2.85981e-03	1.43272e-04	2.54253e-03	-3.05127e-02	-1.57282e-04
123/01	1.30396e-03	-2.05433e-02	1.44131e-04	7.36800e-03	-3.50660e-02	1.08399e-05
124/01	1.25810e-03	-1.07654e-02	1.45498e-04	5.73322e-03	-3.29876e-02	1.67422e-05
125/01	1.23888e-03	3.13520e-03	1.40210e-04	2.88726e-03	-3.19280e-02	5.87782e-06
126/01	1.26775e-03	-7.34129e-03	1.42696e-04	-4.40816e-04	-2.69292e-02	4.99612e-04
127/01	1.30388e-03	-1.48415e-02	1.41011e-04	7.12219e-03	-3.42208e-02	1.93191e-05
128/01	1.23381e-03	-2.16489e-03	1.42935e-04	6.45727e-03	-3.27581e-02	-2.51499e-06
129/01	1.27008e-03	-1.13079e-02	1.45064e-04	1.86981e-03	-3.00282e-02	4.11374e-06
130/01	1.33275e-03	-2.54458e-02	1.44636e-04	1.17075e-03	-3.22555e-02	6.89464e-06
131/01	1.24919e-03	-5.26664e-03	1.39376e-04	-4.60560e-06	-2.82176e-02	1.09252e-05
132/01	1.28513e-03	-1.81230e-02	1.42023e-04	3.81205e-03	-3.07101e-02	1.05167e-05
133/01	1.03037e-03	2.98799e-02	1.51699e-04	7.97126e-03	-2.76810e-02	-3.59970e-06
134/01	1.24807e-03	-6.25029e-03	1.41584e-04	1.40379e-03	-3.02368e-02	1.68866e-05
135/01	1.16672e-03	1.22186e-02	1.41626e-04	1.29891e-03	-2.65178e-02	9.92383e-06
136/01	1.20510e-03	7.04400e-03	1.39119e-04	4.78179e-03	-3.12682e-02	5.43353e-06
137/01	1.33772e-03	-2.21326e-02	1.39391e-04	-3.22693e-03	-2.51407e-02	3.28503e-05
138/01	1.21779e-03	-9.91337e-04	1.42187e-04	3.79770e-03	-3.02053e-02	6.83045e-06
139/01	1.21844e-03	5.43905e-04	1.41501e-04	4.65144e-03	-3.12549e-02	5.54144e-06
140/01	1.18902e-03	7.32504e-03	1.41893e-04	7.08688e-04	-2.64184e-02	8.41317e-06
141/01	1.22122e-03	-2.01888e-03	1.42451e-04	4.20307e-03	-3.05423e-02	1.08956e-05
142/01	1.20357e-03	5.92188e-04	1.43279e-04	1.48358e-03	-2.73691e-02	5.66794e-06
800/01	1.03528e-03	3.06020e-02	1.48961e-04	2.03643e-03	-2.44243e-02	1.41772e-05
801/01	1.23414e-03	-3.44538e-03	1.40974e-04	4.28433e-03	-3.12910e-02	2.22126e-06
802/01	1.20623e-03	-3.87014e-04	1.44031e-04	-1.01085e-04	-2.76020e-02	4.80810e-06
803/01	1.23114e-03	-1.54167e-03	1.41495e-04	1.62174e-03	-2.93205e-02	1.18182e-05
143/01	1.09681e-03	2.92615e-02	1.40924e-04	1.29933e-03	-2.64428e-02	1.78419e-05
144/01	1.23472e-03	-3.46447e-03	1.42150e-04	-1.05678e-04	-2.97241e-02	9.04777e-06
145/01	1.22782e-03	-6.25565e-03	1.43991e-04	1.78259e-03	-2.95610e-02	2.40556e-05
146/01	1.18276e-03	8.23057e-03	1.41232e-04	6.14164e-03	-3.16055e-02	1.17432e-05
147/01	1.27318e-03	-9.67633e-03	1.40114e-04	3.62698e-03	-3.19521e-02	2.60971e-05
148/01	1.20777e-03	1.75645e-04	1.43399e-04	4.13287e-03	-3.05599e-02	2.07173e-05
149/01	1.07452e-03	3.20333e-02	1.42446e-04	-8.62977e-04	-2.32359e-02	1.01253e-05
150/01	1.17509e-03	8.09233e-03	1.42760e-04	5.16926e-03	-3.08457e-02	2.76048e-06
151/01	1.09117e-03	1.64228e-02	1.49160e-04	3.33659e-03	-2.69042e-02	1.17600e-06
152/01	1.18540e-03	3.46043e-03	1.45099e-04	7.46379e-04	-2.82213e-02	6.92384e-06
153/01	1.13234e-03	1.50431e-02	1.45153e-04	5.22553e-04	-2.56371e-02	-7.60410e-06

Sta/ Cast	Slope (c1)	Offset (c2)	Pcoeff (c3)	TFcoeff (c4)	TScoeff (c5)	OGcoeff (c6)
154/01	1.27028e-03	-1.59155e-02	1.44396e-04	-2.27715e-04	-2.84635e-02	2.15370e-05
155/01	1.20945e-03	-2.05977e-03	1.44705e-04	2.97270e-03	-2.95699e-02	-6.62327e-07
156/01	1.11124e-03	1.19104e-02	1.50762e-04	-3.35107e-05	-2.28864e-02	1.60925e-05
157/01	8.82242e-04	7.89678e-02	1.41366e-04	2.13600e-03	-1.92269e-02	3.67099e-05
158/01	1.26632e-03	-2.42087e-02	1.50532e-04	6.75962e-03	-3.39086e-02	3.16454e-05
159/01	1.13751e-03	1.31712e-02	1.44544e-04	8.81022e-04	-2.71418e-02	3.38559e-06
160/01	1.15898e-03	1.05035e-02	1.43325e-04	4.51732e-03	-3.02130e-02	7.51688e-06
161/01	1.23713e-03	-6.17343e-03	1.41944e-04	9.87052e-04	-3.02945e-02	2.84528e-06
162/01	1.20213e-03	-1.28222e-02	1.56889e-04	2.90472e-03	-3.00910e-02	5.80300e-06
163/01	1.37671e-03	-5.30711e-02	1.52153e-04	3.99886e-05	-3.20618e-02	2.96594e-05
164/01	1.20195e-03	-1.03055e-02	1.50586e-04	8.72187e-04	-2.97444e-02	4.76813e-06
165/01	1.25782e-03	-2.12484e-02	1.50230e-04	7.87126e-04	-2.98141e-02	7.04627e-06
166/01	1.20386e-03	-9.98070e-03	1.49459e-04	1.85956e-03	-2.97755e-02	4.50119e-06
167/01	1.28072e-03	-2.75316e-02	1.50431e-04	2.98482e-03	-3.16326e-02	1.06411e-06
168/01	1.59850e-03	-1.40337e-01	1.97758e-04	-1.03149e-03	-3.38631e-02	6.23692e-06
169/01	1.24784e-03	-2.10590e-02	1.51956e-04	-7.22620e-04	-2.77964e-02	1.91056e-05
170/01	1.41247e-03	-5.92518e-02	1.39013e-04	-3.09526e-03	-3.14257e-02	-3.68887e-06
900/01	1.27687e-03	-3.98918e-02	1.69477e-04	-2.35388e-03	-2.75407e-02	4.40311e-05
900/02	1.83352e-03	-2.21349e-01	2.27111e-04	-7.89545e-03	-3.26320e-02	2.77771e-05
900/03	1.34876e-03	-5.75627e-02	1.67688e-04	4.66288e-05	-2.97025e-02	5.64764e-06
900/04	1.28189e-03	-4.21366e-02	1.66359e-04	-8.13028e-04	-2.79085e-02	5.54033e-06
900/05	1.38589e-03	-8.07107e-02	1.89148e-04	-6.26520e-03	-2.88777e-02	-1.23232e-06
900/06	1.38579e-03	-4.38436e-02	1.51204e-04	-4.81162e-03	-2.77283e-02	4.80197e-05
171/01	1.24950e-03	-2.29044e-02	1.51400e-04	1.27019e-03	-3.12167e-02	6.66869e-06
172/01	1.22879e-03	-2.08062e-02	1.53482e-04	-1.24266e-03	-2.90341e-02	1.25611e-05
173/01	1.21793e-03	-1.78822e-02	1.54172e-04	-6.15404e-04	-2.79676e-02	-4.73697e-06
174/01	1.12295e-03	6.10865e-03	1.55146e-04	-1.14759e-03	-2.39925e-02	1.28596e-05
175/01	1.30487e-03	-4.85705e-02	1.65973e-04	-4.87468e-03	-2.63544e-02	1.44546e-05
176/01	9.12150e-04	9.44405e-02	1.14089e-04	2.87463e-03	-2.47375e-02	-1.38497e-05
177/01	1.37500e-03	-6.91816e-02	1.63310e-04	-4.19484e-03	-2.99924e-02	-4.02728e-06
178/01	1.41643e-03	-1.03908e-01	1.97758e-04	-7.04043e-03	-2.88091e-02	-3.77798e-07
179/01	1.51173e-03	-2.92465e-02	5.29643e-05	-1.03786e-04	-3.65830e-02	1.35921e-05
180/01	1.47546e-03	-1.09801e-01	1.92425e-04	-2.51322e-03	-3.41601e-02	3.14606e-06
181/01	1.51154e-03	-4.05728e-02	6.82381e-05	-1.38542e-03	-3.59918e-02	-4.88308e-06
182/01	1.50266e-03	-1.16565e-01	1.86873e-04	1.20339e-03	-3.73481e-02	-2.63478e-06
183/01	1.38423e-03	-7.62286e-02	1.70821e-04	9.32773e-04	-3.45574e-02	-5.14092e-06
184/01	1.11713e-03	2.39450e-02	1.34421e-04	-3.98560e-03	-2.47023e-02	7.70182e-06
185/01	1.52617e-03	-3.19511e-02	3.99528e-05	-4.18924e-03	-3.55629e-02	-1.70735e-05

Appendix C

WOCE93-P14N: CTD Shipboard and Processing Comments

Key to Problem/Comment Abbreviations	
CO	conductivity offset
CS	conductivity noisy: frequent spikes down-cast, shifts middle of up-cast or frequent multiple +/- shifts on all of up-cast (.003 to .010 mmho/cm)
DI	density inversion: data consistent/smooth in time-series CTD, possibly real
HO	high oxygen signal in surface area (from surface down to max.50db); not seen in up-cast
HT	CTD left in sun between casts: internal CTD temperature unusually high
LO	low oxygen signal in surface area (from surface down to max.50-100db); not seen in up-cast or up-cast noisy
ND	noise in all raw channels, especially oxygen
NO	oxygen signal 0/cuts out at surface up to 12db, then high values down to max.100db
OD	short, smooth drop in raw oxygen signal; not seen in up-cast, possibly real unless otherwise noted
ON	oxygen signal noisy
SR	rough weather, excessive shiproll
SS	probable sea slime on conductivity sensor

Key to Solution/Action Abbreviations	
AT	adjusted initial CTD internal temperature value for pressure correction
DO	despike oxygen
DS	despike salinity (change temperature and/or conductivity)
NR	cast not processed, not reported with final data
O3	code 3 oxygen in .ctd file for pressures specified
O4	code 4 oxygen in .ctd file for pressures specified
RP	re-process cast from raw data using additional oxy filter, tighter P/T/C filters
S3	code 3 salinity in .ctd file for pressures specified
T3	code 3 temperature in .ctd file for pressures specified
TD	truncate down-cast at first bottom approach (2db shallower than bottom bottle)
U3	code 3 for CTD salinity (up-cast) in .sea file - not applicable to .ctd file (down-cast)
UP	use up-cast

Cast	Problem/Comment	Solution/Action
998/01	TEST cast	NR
001/01	yoyo 110-83db down	TD
003/01	-.020 CO/SS 816-2966db down	UP
005/01	-.004 CO/SS 2281-2708db down	UP
006/01	-.075 CO/SS 2315-3673db down	UP
008/01	ND	RP,DO
009/01	ND	RP,DO
010/01	yoyo 3842-3649db down	TD
011/01	-.003 CO/SS 2107-3789db down; ND; yoyo 3676-3801db: inflection in oxy at 3670db	UP; RP,DO; no action

Cast	Problem/Comment	Solution/Action
012/01	ND	RP,DO
013/01	ND	RP,DO
014/01	ND	RP,DO
015/01	-.008 CO/SS 2997db down to bottom; ND	UP; RP,DO
016/01	ND,SR	RP,DS,DO; T3/S3/O3 0-28db
017/01	ND	RP,DO
018/01	ND	RP,DO
019/01	ND	RP,DO
020/01	ND; DI	RP,DO; S3 676-680 db
021/01	ND	RP,DO
022/01	ND	RP,DO
023/01	ND; SS on rosette	RP,DO; cond ok, no action
024/01	ND; SS on rosette	RP,DO; cond ok, no action
025/01	ND	RP,DO
026/01	ND	RP,DO; sprayed off cond sensor before cast
027/01	ND	RP,DO
028/01	-.002 CO/SS 4698-5521db down; ND	UP; RP,DO
029/01	ND	RP,DO
030/01	ND	RP,DO
031/01	ND	RP,DO
032/01	ND,SR; CO/SS 212-232db	RP,DO; DS
033/01	ND,SR	RP,DO
034/01	ND,SR; CS/SS	RP,DO; U3
035/01	ND,SR; CS/SS	RP,DO; U3
036/01	ND,SR; CS/SS	RP,DO; U3
037/01	ND,SR,NO; CS/SS; CO/SS 1824-2094db	RP,DO; U3; DS+S3 because 270db long
038/01	ND,SR,NO; CS/SS	RP,DO; DS,U3
039/01	ND,SR,NO; CS/SS	RP,DO+O4 0-66db; DS,U3
040/01	ND,NO,ON,SR - cast delayed 2 hrs, extremely noisy signal; CS/SS	RP,DS,DO+O4 0-78db; U3
041/01	ABORTED cast - cond intermittent	NR; reterminated wire
041/02	ABORTED cast - noisy signal	NR; changed deck unit; cleaned transm/altimeter connectors
041/03	CS/SS,SR; DIx2	DS,U3; S3 260-262 db, T3/S3 436 db; replaced winch slip-rings after sta 41
042/01	ABORTED cast - transm problems	NR
042/02	CS/SS,SR; ON top 20-40db; no altimeter this cast	DS,U3; DO+O3 0-34db, replaced oxy bulkhead connector on CTD endcap after cast
043/01	CS/SS,SR; ON top 20-40db	DS,U3; DO+O3 0-40db
044/01	CS/SS,SR	DS,U3
045/01	CS/SS,SR	DS,U3
046/01	CS/SS,SR	DS,U3
047/01	CS/SS,SR	DS,U3; slimy cond probe cleaned with alcohol after cast
048/01	SR; NO; noisy cond: acclimating after cleaning	DO+O3 0-22db; DS
049/01	NO	DO
050/01	NO	DO+O3 0-98db
051/01	NO	DO

Cast	Problem/Comment	Solution/Action
052/01	NO	DO
053/01	NO	DO
054/01	NO	DO+O4 0-36db
055/01	NO	DO+O4 0-34db
056/01	NO	DO+O4 0-66db
057/01	NO	DO
058/01	ABORTED cast ~1700db: no oxy signal	NR; oxy sensor ok, bad oxy cable replaced after cast
058/02	ON	DO
059/01	CO/SS 2616-2672db	DS
060/01	ON ~2900-3200db down	DO
061/01	ON ~2700-3800db down	DO; new oxy sensor installed after cast
065/01	DI	T3/S3 6 db
652/01	LO	DO+O3 0-14db
072/01		replaced transm bulkhead connector on CTD endcap prior to cast
082/01	TEST cast for transm #100D	NR
087/01	ON top 350db	DO
089/01	ON top 300db; stop cast 3 mins. at 508db, transm temp-equilibration test	DO; oxy looks ok at 508db
090/01	OD	O3 1156-1182db
096/01	DI	T3/S3 206-208 db
097/01	OD	O3 10-18db
098/01	ND; transm noisy 1200db down to bottom	DS,DO
099/01	OD; ND	O3 6-12db; DS,DO - reterminated wire 2x after cast
100/01	OD	O3 4-22db
104/01	OD 5480db: lowering rate slowed 5478-84db	O3 5350-5500db
105/01	OD	O3 0-18db
107/01	HT; DIx2	AT; T3/S3 130-132 db + 140-142 db
111/01	HT; OD	AT; O3 4-12db
118/01	DI	T3/S3 98-100 db
121/01	HT	AT
122/01	LO	DO+O3 0-66db
123/01	DI	T3/S3 80-82 db
126/01	LO, also seen in up as slows for surface approach	DO+O3 0-38db
129/01	OD 3594db: winch power out, stop cast 13 mins	O3 3592-3966db
132/01	LO, also seen in up as slows for surface approach	DO+O3 0-38db
137/01	LO; stop cast 1.5 mins. at 3410db	DO+O3 0-38db; oxy ok at 3410db, no action
140/01	rosette slimy end of last few stas	
141/01	LO, also seen in up as slows for surface approach;	DO+O3 0-18db; dried out/reseated transm connectors prior to cast, data quality improved
800/01	DI	T3/S3 4 db
145/01	LO	DO+O3 0-28db
146/01	LO	DO+O3 0-40db
147/01	LO	DO+O3 0-32db

Cast	Problem/Comment	Solution/Action
148/01	LO	DO+O3 0-32db
149/01	LO	DO+O3 0-34db
150/01	lost signal 311db up, shorts in 2 wires ~500m apart in middle of drum	cut off 4500m wire after cast
	no bottles above 400db for oxy fit: wire shorted	stas 149/151 bottle oxys used for fit above 400db
151/01		used backup winch/wire beginning this cast
153/01	HO	DO+O3 0-10db
154/01	LO	DO+O3 0-50db
157/01	LO	DO+O3 0-26db
158/01	LO; double yoyo 704-597-649-498db	DO+O3 0-58db; oxy ok at 704db - no action
163/01	LO, jumps up between 54-58db	DO+O3 0-56db
167/01	slightly HO	O3 5050-5130db
169/01	LO	DO+O3 0-30db
900/01	LO	DO+O3 0-36db
900/02	LO, possibly also in up-cast	DO+O3 0-34db
900/06	LO	DO+O3 0-46db; changed transm cable prior to cast
184/01	LO, raw oxy jumps up at 98db	DO+O3 0-98db
185/01	HO	O3 0-34db

Appendix D

Bottle Quality Comments

Remarks for deleted samples, missing samples, and WOCE codes other than 2 from WOCE P14N TN023/024. Investigation of data may include comparison of bottle salinity and oxygen data with CTD data, review of data plots of the station profile and adjoining stations, and rereading of charts (i.e., nutrients). Comments from the Sample Logs and the results of ODF's investigations are included in this report. Units stated in these comments are milliliters per liter for oxygen and micromoles per liter for Silicate, Nitrate, and Phosphate, unless otherwise noted. The first number before the comment is the cast number (CASTNO) times 100 plus the bottle number (BTLNBR).

Station 001

Cast 1	Marine Tech log: "Due to tripping problems, went down for 2nd bottom approach, then up again. 8 bottles tripped on deck."

Station 003

120	Sample log: "Leaking from top." Samples appear to be okay.
112-113	This value offscale for sil. No rerun. Silicate low, footnote silicate bad.
101	Delta-S at 3041db is 0.0035, salinity is 34.655. Salinity agrees with adjoining station, leave as is. Oxygen low, leave as is. NO2 high, rechecked data and NO2 has higher peak. Footnote NO2 questionable.

Station 004

Cast 1	Sample log: "salt and nuts sampled before tritium." This would not affect ODF samples.

Station 005

136 (No Pressure)	Nuts log: "no sample." Suspect this was intended, several no-confirms, but no comment that bottle 36 was suppose to have water in it. Data appears to be okay for the rest of the cast, too.
118	Oxygen high, bubble? Analyst indicated a low endpoint, footnote oxygen questionable.
102	Oxygen high. No indication of a problem, footnote oxygen questionable.
101	Delta-S at 3512db is 0.0038, salinity is 34.668. Other samples are acceptable, salinity does not fit WOCE specs, therefore, footnote salinity questionable.

Station 007

Cast 1	There were many "no confirms" on this station. It appears that two bottles were to be tripped at the bottom, but only one did. Pressures appear to have been reassigned correctly, and bottle 36 was not tripped. Footnote bottle did not trip as scheduled. This was done to alert the DQE that there were tripping problems.
136 (No Pressure)	Sample log: "Not closed." See Cast 1 tripping comments.
102-135	See Cast 1 tripping comments. Footnote bottle did not trip as scheduled.

Station 008

125	Sample log: "Leaking from bottom." Marine Tech log: "leaking from end cap. Debris in o-ring." Oxygen .3 ml/l, 2.4 umol/kg high, nuts and salt a little low. Delta-S at 461db is -0.0281, salinity is 34.027. Footnote bottle leaking, samples bad.
120	Sample log: "Leaking from top." Oxygen as well as other samples are acceptable.
112	Delta-S at 1817db is -0.0077, salinity is 34.552. Gradient area, agrees with adjoining stations vs. pressure. Salinity is lower than adjoining stations when compared using potential temperature. Footnote salinity questionable.

111 Delta-S at 2020db is -0.0115, salinity is 34.573. Gradient area, agrees with adjoining stations vs. pressure. Salinity is lower than adjoining stations when compared using potential temperature. Footnote salinity questionable.

110 Delta-S at 2227db is -0.0056, salinity is 34.600. Gradient area, agrees with adjoining stations vs. pressure. Salinity is lower than adjoining stations when compared using potential temperature. Footnote salinity questionable.

109 Delta-S at 2435db is -0.0065, salinity is 34.614. Gradient area, agrees with adjoining stations vs. pressure. Salinity is lower than adjoining stations when compared using potential temperature. Footnote salinity questionable.

107 Delta-S at 2850db is -0.1089, salinity is 34.535. Salt low. Bad salinity (really bad). Footnote salinity bad, no analysis problem observed. Other samples are acceptable.

Station 009

135 Delta-S at 36db is 0.0318, salinity is 33.104. CTD salinity has a spike in up trace, footnote CTD salinity bad. Other samples are acceptable. No CTDO is calculated because the CTD Salinity is coded bad.

130 Pre-tripped (looks like ~407db). Footnote bottle leaking, samples bad.

120 Sample log: "Leaks before venting." Marine Tech log: "Air leak - all looks ok." Oxygen and other samples are acceptable.

Station 010

130 Sample log: "leaks before venting. upper o-ring." Marine Tech log: "leaks." Oxygen as well as other samples are acceptable.

120 Sample log: "leaks." Marine Tech log: "leaks." Oxygen as well as other samples are acceptable.

118 Sample log: "Leaking from bottom." Marine Tech log: "leaks." Oxygen as well as other samples are acceptable.

107 PO4 high. PO4 appears high on charts. No obvious reason. Footnote PO4 questionable.

Station 011

135 Delta-S at 36db is 0.0327, salinity is 33.073. Other data are acceptable. Gradient area, water mixing during bottle trip.

111 NO3 value looks a bit high. No obvious reason. Footnote NO3 questionable.

101 Oxygen is 0.8 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 012

Cast 1 There were many "no confirms" on this station. It appears that two bottles were to be tripped at the bottom, but only one did. Pressures appear to have been reassigned correctly, and bottle 36 was not tripped. Footnote bottle did not trip as scheduled. This was done to alert the DQE that there were tripping problems.

136 (No Pressure)

Nuts.notes: "no3 f1's seem high." Checked charts and comp files. No obvious problems. NO3 higher than adjoining stations, within spec of measurement. Sample log: "Not closed. No water." Marine Tech log: "bottle came up open. Pylon tripping problem."

106 Delta-S at 2818db is 0.0036, salinity is 34.647. Autosal took a few tries to come up with 2 readings that agreed. Footnote salinity bad, other samples are acceptable.

102-135 See Cast 1 tripping comments. Footnote bottle did not trip as scheduled.

Station 013

Cast 1	Intended to change the bottle sequence to verify Freon signal seen in bottom bottles. However, this did not go as scheduled. Pressure have been reassigned and appear to be correct unless noted on individual bottles. Footnote bottle did not trip as scheduled.
136	Silicate low, could have tripped 200db shallower in the water column, but then other data would not fit the station profile or adjoining station comparisons. Footnote silicate bad.
131-136	See Cast 1 tripping comments. Footnote bottle did not trip as scheduled.
130	Samples indicate this bottle tripped between 3050db and 3400db. Delta-S is 1.3456. Footnote bottle leaking and samples bad for this level. ODF recommends deletion of all water samples.
111-129	See Cast 1 tripping comments. Footnote bottle did not trip as scheduled.
110	Sample log: "Not closed. No sample." This level is included and assigned with just CTD data. This was done so the DQE has additional information to double-check that pressure assignments were done correctly. Footnote bottle no samples taken.
102	Silicate low, could have tripped 200db shallower in the water column, but then other data would not fit the station profile or adjoining station comparisons. Footnote silicate bad.
101-109	See Cast 1 tripping comments. Footnote bottle did not trip as scheduled.
Station 015	
124	Bad salt. No analytical problem noted, footnote salinity bad. Delta-S at 409db is 0.1634, salinity is 34.043.
115	NO3 little low. NO3: "checked. No obvious analytical problem." Within WOCE specs, NO3 is acceptable.
108	PO4 high. Spike in peak, footnote PO4 bad.
Station 016	
136	CTDO Processor: "Top 28db CTD oxygen questionable."
118	Oxygen a little high, but agrees with next station, data is acceptable. Nuts: "Checked no3. No obvious problem." NO3 a little low. No notes. NO3 is acceptable.
115	O2 value off. No obvious problem, agrees with previous stations. O2 is acceptable. NO3 value high. No obvious problem. Footnote NO3 questionable. PO4 value off. No obvious problem. Footnote PO4 questionable.
Station 017	
125	Sample log: "Helium resampled." Oxygen as well as other data are acceptable.
122	Sample log: "Valve leaks." Oxygen as well as other data are acceptable.
120	NO3 value odd. NO3 appears low compared with station profile, however, agrees with adjoining stations. Footnote NO3 questionable.
118-119	NO3 high. Nuts: "Checked. no obvious reason." Suspect that 120 may be low, footnote no3 questionable.
118	PO4 high, footnote PO4 questionable. Nuts: "Checked. no obvious reason."
103	Sample log: "upper vent open." Oxygen as well as other data are acceptable.
Station 018	
136	Sample log: "didn’t close." See 35 tripping comment. Footnote bottle no samples taken at 859db.
135	Sample log: "didn’t close." Bottles 14-36 did not trip as scheduled. This level is included and assigned with just CTD data just as a stop of the CTD and an attempted trip level at 85db. This was done so the DQE has additional information to double-check that pressure assignments were done correctly. Footnote bottle no samples taken.

131	Sample log: "Leaking from bottom." Oxygen and other samples are acceptable.
121	Sample log: "vents open." Oxygen and other samples are acceptable.
119	Sample log: "vents open." Oxygen and other samples are acceptable.
115-134	See 114 tripping comment. Footnote bottle did not trip as scheduled.
115	Sil a little high. sil: no obvious reason. Footnote SiO3 questionable. Delta-S at 760db is 0.0069, salinity is 34.271. Autosal took several tries before getting two readings to agree. This is an indication of sample contamination, footnote salinity questionable. Other samples are acceptable.
114	Bottles tripped one level shallower than planned. Pressures were reassigned and samples appear to be okay. Footnote bottle did not trip as scheduled.
113	Sample log: "vents open." Oxygen and other samples are acceptable.
111	Delta-S at 1012db is 0.0091, salinity is 34.374. No analytical problem noted. However, there were a few times the Autosal tried to get two conductivity readings to agree. Suspect there could be a drawing problem. Other samples are acceptable. Footnote salinity questionable.
107	Sample log: "vents open." Oxygen high on station profile, but agrees with Station 017. This is within WOCE specs, data are acceptable.
106	Delta-S at 1519db is 0.0075, salinity is 34.424. Footnote salinity questionable, could be a drawing error with bottle 05. Oxygen is acceptable.
104	Sil 2 micromoles/kg high. Sil: no obvious reason. This level the SiO3 agrees with Station 017. Footnote SiO3 questionable.
Station 019	
Cast 1	Sample log: "no time to shake o2's 2nd time." Marine Tech log: "changed pylon before station." Oxygens appear to be acceptable.
131	Sample log: "Leaking from bottom." Oxygen as well as other samples are acceptable.
130 (No Pressure)	Sample log: "No bottle."
117	Sample log: "Leaked." Oxygen low, nuts and salt high. Pretrip? Footnote bottle leaking, samples bad.
116	Sample log: "Bottom o-ring caught. No sample." This level is included and assigned with just CTD data. This was done so the DQE has additional information to double-check that pressure assignments were done correctly. Footnote bottle no samples taken.
106	Sil ~3 um/l, 1.43 um/kg high. nuts: no obvious reason. Footnote Sil questionable.
Station 020	
Cast 1	Sample log: "o2 late second shake." Oxygen agree with CTDO, data are acceptable.
131	Sample log: "dripping bottom seal." Oxygen appears slightly low, CTDO has a lot of structure in this area. Will leave oxygen and bottle codes as acceptable.
122	Sample log: "stopcock drips." Oxygen as well as other samples appear are acceptable.
112	Sample log: "Helium resampled 2X." Does not appear to have affected oxygen sample.
111	Salt low. Same as 112. Looks like misdraw. Delta-S at 1720db is -0.0171, salinity is 34.538. Footnote salinity bad.
Station 021	
Cast 1	Excessive standard drift on all salinities. Thermistor on Autosal 55-654 replaced after this run. Footnote salinity bad.
127	PO4 value high. NO3 value high. Sil value off. No obvious analytical problem. See Cast 1 salinity comment. Footnote oxygen and nutrients questionable, salinity bad.

126 Oxy, sil, salt high; NO3, PO4 low. No sample log notes. Pretrip? See Cast 1 salinity comment. Footnote oxygen and nutrients questionable, salinity bad.

121 Sil low; same as 122. Misdraw? Nuts: "No obvious analytical problem." Footnote silicate questionable. Delta-S at 815db is -0.0164, salinity is 34.295.

118 Sil low; same as 119. Misdraw? Nuts: "No obvious analytical problem." Footnote silicate questionable. Delta-S at 1117db is -0.008, salinity is 34.411.

Station 022

132 Sample log: "Leaking from Bottom." Data looks okay.

131 Sample log: "Leaking from Bottom." Data looks okay.

125 Sample log: "Pre-tripped." Footnote bottle leaking, samples bad.

109 Delta-S at 3255db is -0.0058, salinity is 34.662. No analytical problem noted, but obviously there is a problem, does not fit CTD profile or adjoining station station comparison. Salinity appears to have been misdrawn from 10, footnote salinity bad. Other data are acceptable.

107 Truly Bad Salt. Autosal took 3 tries to get two readings to agree, suspect salt crystal contamination, footnote salinity bad.

106 Sil looks 3 um/l, 4.46 umol/kg high. sil: no obvious peak or calculation problem. Footnote silicate questionable.

104 Truly Bad Salt. Autosal took 6 tries to get two readings to agree, suspect salt crystal contamination, footnote salinity bad.

101 Delta-S at 4627db is 0.0058, salinity is 34.694. No analytical problem noted. Salinity does not agree with duplicate trip level or adjoining stations. Footnote salinity bad, other data are acceptable.

Station 023

102 Salinity analyst indicated some kind of problem with salinity run, it appears he restarted the run, but lost sample 2. Footnote salinity lost.

Station 024

102 Delta-S at 5842db is 0.0064, salinity is 34.696. Autosal took 6 tries before getting two readings to agree. NO3 high, PO4 high, but within WOCE specs. Oxygen agrees with station profile and adjoining stations. Suspect that sea slime contaminated salinity samples. Footnote salinity bad, other samples acceptable.

101 Delta-S at 6153db is 0.0048, salinity is 34.695. Autosal took 5 tries before getting two readings to agree. NO3 high, PO4 high, but within WOCE specs. Oxygen agrees with station profile and adjoining stations. Suspect that sea slime contaminated salinity samples. Footnote salinity bad, other samples acceptable.

Station 025

125 Sample log: "o2 1219 from 25; 1218 from 25?" Duplicate oxygen drawn from bottle 25. There is a .04 ml/l, 2 um/kg difference between the two. Footnote oxygen acceptable.

123-130 See 122 CTDO processor comment. Footnote oxygen questionable.

122 Oxy .05 ml/l, 1.0 umol/kg low. Same as 123. Looks like misdraw. Footnote oxygen bad. Other samples are acceptable. CTDO Processor: "After processing ctdoxy: it appears that bottle 122 (913db) is ok, but bottle 123 (813db) is the one double-drawn off 122. Then it seems as if all were drawn one off until perhaps 207db. See the plot of the fit - there’s an obvious jump if 813db is left in, but 913 looks just fine for the same oxy value. This should be looked at." As per CTD Processor comment, change flag to acceptable and flag 123-130 as questionable. Initial shipboard comment does not appear to be correct.

119	Delta-S at 1421db is 0.0055, salinity is 34.569. Autosal took 5 tries to get two readings to agree, suspect salt crystal contamination, footnote salinity bad. Other samples are acceptable.
104	Sample log: "drips at bottom o-ring." Oxygen as well as other data are acceptable.
Station 026	
133-134	Both (33 & 34) at same level. High gradient surface waters - data shows considerable difference between the two. Console Ops: "Accidentally closed both at same level."
Station 027	
127	PO4 slightly low. Could be real. po4: no obvious analytical problem. Other samples are acceptable, PO4 within WOCE specs, okay as is.
116	Delta-S at 2036db is -0.0033, salinity is 34.603. No analytical problem noted, salinity agrees with next station. Other samples are acceptable. Accept salinity as is.
111	Delta-S at 3058db is -0.003, salinity is 34.660. No analytical problem noted, salinity agrees with next station. Other samples are acceptable. Accept salinity as is.
108	Delta-S at 3673db is -0.003, salinity is 34.675. No analytical problem noted, salinity agrees with next station. Other samples are acceptable. Accept salinity as is.
104	Delta-S at 4496db is -0.0039, salinity is 34.682. No analytical problem noted, salinity lower than adjoining stations. Sil is higher than adjoining stations. Footnote salinity and silicate questionable. Other samples are acceptable.
103	Delta-S at 4703db is -0.0037, salinity is 34.683. No analytical problem noted, salinity lower than adjoining stations. Other samples are acceptable. Footnote salinity questionable.
Station 028	
131	Sample log: "Leaking from bottom." Oxygen as well as other data are acceptable.
110	Salt low. No salinity analytical problems noted. Autosal took 4 tries to get two readings to agree, suspect salt crystal contamination, footnote salinity bad. Delta-S at 3363db is -0.0101, salinity is 34.660. Other data are acceptable.
Station 029	
114	Delta-S at 2239db is -0.0034, salinity is 34.618. Autosal took 3 tries to get two readings to agree, suspect salt crystal contamination, footnote salinity bad.
Station 030	
135	Delta-S at 37db is -0.0316, salinity is 32.923. Spike in CTD salinity, footnote CTD salinity bad. Salinity as well as other data are acceptable. No CTDO is calculated because the CTD Salinity is coded bad.
131	Sample log: "Leaking at bottom." Oxygen as well as other data are acceptable.
124	Sample log: "Bottom did not close." This level is included and assigned with just CTD data. This was done so the DQE has additional information to double-check that pressure assignments were done correctly. Footnote bottle no samples taken.
122	Sample log: "Leaking at spigot." Oxygen as well as other data are acceptable.
108	Sample log: "Leaking at spigot." Oxygen as well as other data are acceptable.
Station 031	
Cast 1	Tripping problems a trip was scheduled at ~4300db there was a confirm, but evidently a bottle did not collect water at this level.
136	Sample log: "didn’t close." Bottles 14-08 did not trip as scheduled. This level is included and assigned with just CTD data just as a stop of the CTD and an attempted trip level at ~4300db. This was done so the DQE has additional information to double-check that pressure assignments

were done correctly. Footnote bottle no samples taken.

134 Delta-S at 40db is 0.0326, salinity is 32.979. No analytical problem noted. Other data are acceptable. Thermocline, salinity is acceptable.

125-135 See Cast 1 tripping comment. Footnote bottle did not trip as scheduled.

124 Sample log: "got hung up, no water". This level is included and assigned with just CTD data. This was done so the DQE has additional information to double-check that pressure assignments were done correctly. Footnote bottle no samples taken.

115 Delta-S at 2034db is -0.0032, salinity is 34.601. No analytical problem noted. Other data are acceptable. Footnote salinity questionable.

114 Delta-S at 2240db is -0.0036, salinity is 34.618. No analytical problem noted. Other data are acceptable. Footnote salinity questionable.

110 Delta-S at 3054db is -0.003, salinity is 34.660. No analytical problem noted. Other data are acceptable. Footnote salinity questionable.

108-123 See Cast 1 tripping comment. Footnote bottle did not trip as scheduled.

106 Salinity was drawn per Sample Log, but salinity analyst did not analyze it or comment on a problem. Footnote salinity lost.

Station 032

135 Delta-S at 38db is -0.0252, salinity is 33.000. Spike in CTD up trace, footnote CTD salinity bad. Bottle salinity and other data are acceptable. No CTDO is calculated because the CTD Salinity is coded bad.

132 Delta-S at 129db is -0.0428, salinity is 33.349. Spike in CTD up trace, footnote CTD salinity bad. Bottle salinity and other data are acceptable. No CTDO is calculated because the CTD Salinity is coded bad.

122 Oxy .2 ml/l, 5.8 umol/kg high. Oxygen: bubble. Footnote oxygen bad. Other data except NO3 are acceptable.

119 Oxy .3 ml/l, 11.9 umol/kg high. No oxygen analytical problems noted. Footnote oxygen questionable, other data except NO3 are acceptable.

101-121 Deep (>1000db) NO3 low, footnote NO3 questionable.

Station 033

124 Sample log: "Bottle not closed." Marine Tech log: "Lower end cap hung up. Lower hose clamp loose." This level is included and assigned with just CTD data. This was done so the DQE has additional information to double-check that pressure assignments were done correctly. Footnote bottle no samples drawn.

105 Sample log: "Leaking." Delta-S at 4908db is -0.0033, salinity is 34.683. Silicate is too high. Oxygen as well as other data are acceptable. Footnote salinity and silicate questionable.

Station 034

Cast 1 A bad vial of standard seawater was probably used at the the beginning of the run to standardize the Autosal. The standard dial was changed by -12 units from previous run and -18 units from the next run. The next run was started 10 minutes later while the previous run was completed an hour earlier. The ending standard seawater analysis indicated a drift, however, we will correct this to reflect the 18 units different in the standardization.

116-136 Offset in CTD salinity uptrace, suspect there is slime on the sensor. It was cleaned at Station 047 which corrected the problem. Footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad.

105	Sample log: "Leaking from bottom." Marine Tech log: "tightened spring tension to 25 lbs before sta." Delta-S at 4902db is -0.003, salinity is 34.683. No analytical problems noted during salinity analysis. Other data are acceptable. Footnote salinity questionable.
102	Oxy .2 ml/l, 8.4 umol/kg high. No oxygen analytical problems noted. Footnote oxygen questionable. Other data are acceptable.
Station 035	
Cast 1	Console Ops Log: "Due to possible electronics error, pylon indicated the first bottle tripped was 18." Data verifies that 18 was the deepest bottle, but there are quite a few large salinity differences.
136	Sample log: "Dripping out bottom." Oxygen is acceptable, it is not any further off than any other bottles, therefore, it does not appear that comment on Sample Log affected this bottle.
129-136	Offset in CTD salinity uptrace > 1.330 potential temperature, suspect there is slime on the sensor. It was cleaned after Station 047 which corrected the problem. Footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad.
129	Oxy .1 ml/l, 1.0 umol/kg high. No oxygen analytical problems noted. Footnote oxygen questionable. Delta-S at 3055db is 0.0081, salinity is 34.646.
119-130	Salinity is lower than adjoining stations, too. Footnote salinity questionable. The lab temperature changed 2 degrees in about an hour. This could cause a problem in the salinity analysis.
115	Sample log: "o2 sampled before helium." The Sample Log comment would affect the helium, oxygen is acceptable.
111	Oxy .09 ml/l, 3.8 umol/kg low. Same level as 112. Footnote oxygen questionable.
110	Salinity appears ~0.005 low compared with adjoining stations. The lab temperature changed 2 degrees in about an hour. This could cause a problem in the salinity analysis. Footnote salinity questionable.
105	Sample log: "Leaking from bottom." Oxygen is acceptable, it is not any further off than any other bottles, therefore, it does not appear that comment on Sample Log affected this bottle.
102	PO4 high. Nuts sheet: PO4 problems. Footnote PO4 bad. Delta-S at 1221db is 0.0075, salinity is 34.435.
101-117	Offset in CTD salinity uptrace > 1.330 potential temperature, suspect there is slime on the sensor. It was cleaned after Station 047 which corrected the problem. Footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad.
101	See 102 PO4 comment. Footnote PO4 bad.
Station 036	
118	Sample log: "Lanyard caught in bottom. No water: salt and nuts taken from leak." Footnote bottle leaking, samples bad. Oxygen not drawn.
101-136	Offset in CTD salinity upcast, suspect there is slime on the sensor. It was cleaned after Station 047 which corrected the problem. Footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad.
Station 037	
Cast 1	Offset in CTD salinity uptrace, suspect there is slime on the sensor. It was cleaned after Station 047 which corrected the problem. Footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad.
129	Bottle pre-tripped. Footnote bottle leaking, samples bad.
111	PO4 ~07 um/l, 0.04 um/kg high. Nuts sheet: PO4 problems. Footnote PO4 bad. Delta-S at 3055db is -0.0031, salinity is 34.653. No analytical problem noted. Salinity agrees with adjoining

	stations. See Cast 1 CTD Salinity comment.
106	Sample log: "resampled Helium after o2." Oxygen as well as other data are acceptable.
104	Sample log: "drips." Oxygen as well as other data are acceptable.
102	Sample log: "resampled Helium before o2." Oxygen is ~007 ml/l, 0.3 umol/kg higher than replicate, but this is within specs of the measurement.
Station 038	
Cast 1	Offset in CTD salinity uptrace, suspect there is slime on the sensor. It was cleaned after Station 047 which corrected the problem. Footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad.
Station 039	
Cast 1	Offset in CTD salinity uptrace, suspect there is slime on the sensor. It was cleaned after Station 047 which corrected the problem. Footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad.
135-136	CTDO Processor: "Top 66db CTD oxygen bad." No CTDO is calculated because the CTD Salinity is coded bad.
133	Salinity not analyzed, no reason noted as to why. Footnote salinity lost.
132-133	Oxygen is ~4-5 um/kg lower than Station 038 and 040. Footnote oxygen questionable.
131	Oxygen is ~8.0 um/kg higher than Station 038 and 040. Footnote oxygen questionable.
123	Oxy ~15, 5.8 umol/kg high. No oxygen analytical problems noted. Footnote oxygen questionable, other data are acceptable.
Station 040	
Cast 1	Offset in CTD salinity uptrace, suspect there was slime on the sensor. It was cleaned after Station 047 which corrected the problem. Footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad. Problems with NO2 prior to this run, cannot determine if end or beginning standards are bad. Footnote NO2 questionable.
135-136	CTDO Processor: "Top 78db CTD oxygen bad." No CTDO is calculated because the CTD Salinity is coded bad.
134	Sample log: "Leaking; samples lost." Marine Tech log: " pretripped on deck twice prior to cast." No samples were drawn. This level is included and assigned with just CTD data. This was done so the DQE has additional information to double-check that pressure assignments were done correctly. Footnote bottle no samples taken.
122	Sample log: "Leaking; samples lost." Marine Tech log: "leaking. o-ring came out of groove." No samples were drawn.
118	Sample log: "Helium sampled and then resampled." Oxygen as well as other data are acceptable.
Station 041	
Cast 3	Offset in CTD salinity uptrace, suspect there is slime on the sensor. It was cleaned after Station 047 which corrected the problem. Footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad.
Cast 1	Marine Tech log: "wire reterminated prior to cast." Cast aborted.
Cast 2	Marine Tech log: "cast terminated." Cast aborted.
Station 042	
Cast 2	Offset in CTD salinity uptrace, suspect there is slime on the sensor. It was cleaned after Station 047 which corrected the problem. Footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad. Nuts.notes: po4 f1’s seem low. SW used for stds was 6%. The

use of dilute sw caused a change in the salt effect usually seen in PO4. It is not known how this may affect the data. Footnote PO4 questionable.

236 Marine Tech log: "bottle suspect. o-ring, cap out of groove." Oxygen as well as other data except PO4 are within specs. CTDO Processor: "Top 34db CTD oxygen questionable." No CTDO is calculated because the CTD Salinity is coded bad.

224 Sample log: "Bottle leaking (lanyard hung). No water." Marine Tech log: "no sample. hung up." This level is included and assigned with just CTD data. This was done so the DQE has additional information to double-check that pressure assignments were done correctly. Footnote bottle no samples taken.

Station 043

Cast 1 Nuts.notes: "po4 f1's seem low." SW used to make stds was 6%. The use of dilute sw altered the salt effect usually seen in PO4. It is not known how the dilution affects the data. Footnote PO4 questionable. Offset in CTD salinity uptrace, suspect there is slime on the sensor. It was cleaned after Station 047 which corrected the problem. Footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad.

136 Sample log: "Leaking." Oxygen as well as other data except PO4 are acceptable. CTDO Processor: "Top 40db CTD oxygen questionable." No CTDO is calculated because the CTD Salinity is coded bad.

122 Sample log: "Leaking from spigot." Oxygen as well as other data except PO4 are acceptable.

Station 044

Cast 1 Sw used to make stds was diluted to 6%. The use of dilute sw altered the salt effect usually seen in po4. It is not known how the data was affected. Footnote PO4 questionable. PO4 agrees with Station 043, but both are higher than Station 048. Offset in CTD salinity uptrace, suspect there is slime on the sensor. It was cleaned after Station 047 which corrected the problem. Footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad.

Station 045

Cast 1 Offset in CTD salinity uptrace, suspect there is slime on the sensor. It was cleaned after Station 047 which corrected the problem. Footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad. Nuts.notes: "no3 f1e seems high." Nuts.notes: "po4 f1s seem low." NO3 possible error in std pipetting. Footnote NO3 questionable. NO2 possible error in std pipetting. Footnote NO2 questionable. Sil-possible error in std pipetting. Footnote Sil questionable. SW used in PO4 stds was 6%. Use of dilute sw caused a change in the salt effect usually seen in po4. It is not known how the data was affected. Footnote PO4 questionable.

134 Sample log: "Leaking from top." Oxygen low compared with adjoining stations, but agrees with CTDO. Salinity, and oxygen are acceptable.

Station 046

Cast 1 Offset in CTD salinity uptrace, suspect there is slime on the sensor. It was cleaned after Station 047 which corrected the problem. Footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad. Nuts.notes: "po4 f1's look low. sw used to make stds was 6%. The use of dilute sw caused a change in the salt effect usually seen in po4. It is not know how the shift in response affected the data." PO4 low compared with Stas 045, 047 and 048. NO3 low compared with Stas 045 and 047. SIL low compared with adjoining stations. NO3, SIL, PO4, possible error in std pipetting. Footnote NO3,SIL,PO4,NO2 questionable.

115 Delta-S at 2167db is -0.003, salinity is 34.598. No analytical problems noted during salinity run. Gradient area, salinity and oxygen are acceptable.

114 Sample log: "leaks, bottom hook not attached." Gradient area, salinity and oxygen are acceptable.

105	Sample log: "leaks, bottom hook not attached." Gradient area, salinity and oxygen are acceptable.
Station 047	
Cast 1	Offset in CTD salinity uptrace, suspect there is slime on the sensor. It was cleaned after Station 047 which corrected the problem. Footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad. Marine Tech log: "Cond. looks bad on 47. ET cleaned probe with cotton swab. Found sea snot on outside but pretty clean on inside of cond. probe." Nuts.notes: "no3f1e seems high." Checked NO3, high, no obvious reason, possible pipetting error. Footnote NO3 and NO2 questionable. Sil possible std pipetting error. Footnote SIL questionable. nuts.notes: "po4 f1's look low." SW used to make stds was 6%. The use of dilute sw caused a change in the salt effect usually seen in PO4. It is not known how this affected the data. Footnote PO4 questionable.
101	Oxygen: "Forgot acid, sample lost."
Station 048	
135-136	CTDO Processor: "Top 22db CTD oxygen questionable."
135	Sample log: "vent open." Oxygen as well as other samples are acceptable.
125	Delta-S at 513db is -0.0216, salinity is 33.934. No analytical problems noted. Salinity is low compared with adjoining stations. Other data are acceptable. Footnote salinity questionable.
102	Sample log: "Leaking from bottom." Oxygen as well as other samples are acceptable. Replicate with 01.
Station 049	
Cast 1	Sw used to make stds was 6%. The use of dilute sw caused a shift in the salt effect usually seen in PO4. It is not known how this shift affected the data. Footnote PO4 questionable. PO4 is higher than adjoining stations.
135	Delta-S at 3db is 0.1025, salinity is 34.280. Spike in CTD up trace, footnote CTD salinity bad. Salinity as well as other data except PO4 are acceptable. No CTDO is calculated because the CTD Salinity is coded bad.
134	Delta-S at 40db is -0.0311, salinity is 34.305. Spike in CTD up trace, footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad. Salinity as well as other data except PO4 are acceptable.
133	PO4 low. PO4 agrees with adjoining stations. See Cast 1 PO4 comments. Footnote PO4 questionable.
127-128	PO4 high. PO4 agrees with adjoining stations. See Cast 1 PO4 comments. Footnote PO4 questionable.
116	Sample log: "Leaking from bottom (o-ring)." Leaky bottle. sample log entry incorrect. Nuts samples taken. Footnote bottle leaking, nutrient samples bad, salinity and oxygen not drawn.
109	NO3 high. PO4 low. No analytical problems noted for nitrate. Footnote NO3 questionable.
Station 050	
136	Marine Tech log: "top o-ring rolled out." Sample log: "leaked before venting." Oxygen as well as other data are acceptable.
133-136	CTDO Processor: "Top 98db CTD oxygen questionable."
104	Sample log: "lanyard on therm rack partially hung up." Oxygen as well as other data are acceptable.
102	Marine Tech log: "crack in outer o-ring ridge. slow leak." Sample log: "Leaking." Oxygen as well as other data agree with 01 replicate.

Station 051

101 PO4 slightly low (.01) Within specs of the measurement, data is acceptable. Oxygen is 0.5 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 053

132 Sample log: "Leaking from top." Oxygen as well as other data are acceptable.

104 Sample Log Noted "Therm rack came up sideways."

101 PO4 0.02 low. Replicates 01 and 02 agree, .02 is within specs of measurement. Oxygen is 0.4 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 054

136 (No Pressure)
Marine Tech log: "bottle intentionally not tripped."

134-135 CTDO Processor: "Top 36db CTD oxygen bad."

Station 055

136 CTDO Processor: "Top 34db CTD oxygen bad."

135 Delta-S at 36db is -0.0379, salinity is 34.827. No analytical problems noted, other data are acceptable. Footnote salinity questionable.

118 Delta-S at 1116db is 0.0101, salinity is 34.313. No analytical problems noted, other data are acceptable. Footnote salinity questionable.

104 Sample log: "nipple leaks." Oxygen as well as other data are acceptable.

Station 056

136 Sample log: "Leaking from top." Oxygen as well as other data are acceptable.

134-136 CTDO Processor: "Top 66db CTD oxygen bad."

Station 057

127-129 CTD Processor: "3 btls all the same at different pressures 96-156 db??." No analytical problem noted in Oxygen. Silicate also fairly uniform. Oxygen is acceptable.

Station 058 Marine Tech log: "aborted cast, bad o2 cable. replaced."

Station 059

101 Oxygen is 0.5 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 060

117 Sample log: "Leaking from top." Oxygen as well as other data are acceptable.

101-125 CTD Processor: "Salinities on the cast are low compared to nearby casts. 36 samples run in 50 minutes does seem a little fast for a good rinse and fill between samples." Salinities are within specs of the measurement, however, salinities analyzed on this expedition have a better agreement with the CTD and adjoining stations than this cast. Footnote salinities as questionable, they are usable but just not as good as they could be.

Station 061

111 Sample log: "Leaking from top." Oxygen as well as other data are acceptable.

Station 062

110 Sample log: "Lanyard hung up. No water." This level is included and assigned with just CTD data. This was done so the DQE has additional information to double-check that pressure

assignments were done correctly. Footnote bottle no samples taken.

104 Delta-S at 4471db is -0.003, salinity is 34.684. No analytical problem noted, accept salinity. Other data are acceptable.

Station 063

130 Sample log: "unsnapped at bottom." Oxygen as well as other data are acceptable.

117 Sample log: "leaks." Oxygen as well as other data are acceptable.

108 Oxy slightly high ~07 ml/l, 1.2 umol/kg. Checked CTDO, no similar feature. No analytical problem noted, footnote oxygen questionable. Oxygen does agree with adjoining stations, appears high on station profile. Other data are acceptable.

Station 065

101 Oxygen is 0.6 umol/kg high compared with bottle 02, bottle 2 is 1.6db shallower, but these two bottles are at a similar potential temperature. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 651

136 Sample log: "leaking before venting - o-ring." Oxygen as well as other data are acceptable.

135 Leaked. Oxygen as well as other data are acceptable.

114 (No Pressure)

No water. Lids broke. No sample.

109 Sample log: "lanyard caught in top, leaking". Oxy, salt high; Nuts low. Footnote bottle leaking, sample bad. Delta-S at 1110db is 0.0266, salinity is 34.417.

Station 652

118-119 CTDO Processor: "Top 14db CTD oxygen questionable."

Station 653

130 Sample log: "unlatched." Not sure what was meant by the comment on Sample Log. Oxygen as well as other data are acceptable.

116 Delta-S at 752db is -0.0080, salinity is 34.0946. Autosal took 3 tries before getting two readings to agree. Footnote salinity bad.

109 Sil slightly low. Footnote silicate questionable.

Station 066

136 Sample log: "leaker- upper cap." Oxygen as well as other data are acceptable.

Station 067

111 Sample log: "Leaking from top." Oxygen as well as other data are acceptable.

109 Sample log: "Lanyard caught in upper lid." Caught lanyard. All values off. Delta-S at 3348db is -0.0263, salinity is 34.646. Footnote bottle leaking, samples bad.

104 Sample log: "Leaking from spigot." Oxygen as well as other data are acceptable.

Station 068

136 Sample log: "O-ring caught in top." Oxygen ~11 ml/l, 4.9 umol/kg lower than duplicate trip, 35. Other samples agree with duplicate trip, footnote oxygen bad. No other gas samples collected so no need to footnote bottle.

109 Sample log: "Lanyard caught in top." Delta-S at 3354db is -0.0098, salinity is 34.663. Footnote bottle leaking, samples bad. ODF recommends deletion of water samples.

105 Delta-S at 4578db is -0.0058, salinity is 34.684. No problem indicated during salinity analysis, all other samples are acceptable. Salinity does not agree with adjoining stations. Footnote salinity

	questionable.
104	Delta-S at 4886db is -0.0056, salinity is 34.686. No problem indicated during salinity analysis, all other samples are acceptable. Salinity does not agree with adjoining stations. Footnote salinity questionable.
Station 069	
123	CTD Processor: "btl o2 high at 710db." Oxygen appears 10 umol/kg high compared with adjoining Stations 067, 070 and 071. Footnote oxygen questionable.
101	Oxygen is 0.4 umol/kg high compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 070	
108	PO4 low. Footnote PO4 questionable.
104	Sample log: "stopcock leaks." Oxygen as well as other data are acceptable.
Station 071	
110	Sil low. Footnote silicate questionable.
106	Sample log: "Bottle open. No water." This level is included and assigned with just CTD data. This was done so the DQE has additional information to double-check that pressure assignments were done correctly. Footnote bottle no samples taken.
Station 072	
Cast 1	Marine Tech log: "bulkhead connector, transmissometer replaced."
135	Spike in CTD profile. Footnote CTD salinity bad. Delta-S at 37db is 0.0811, salinity is 35.089. After further examination, the bottle salinity appears low vs. adjoining stations (71, 73, 74). It is high vs CTD salinity. The salinity is similar to sample 34. Suspect a drawing error, remove flag from CTD salinity. Flag bottle salinity as questionable.
124	See 123 Oxygen comment. Footnote oxygen questionable.
123	CTD Processor: "btl o2 low at 711db." Oxygen agrees with adjoining stations. However, 124 oxygen appears high.
117	CTD Processor: "btl o2 high at 1825db." Oxygen analyst made a comment regarding the end-point. Oxygen appears ~2.5-4.7 umol/kg high compared with Stations 071 and 073. Footnote oxygen questionable.
104	Sample log: "therm rack sideways." Oxygen as well as other data are acceptable.
101	Sample log: "redrew o2 sample." Oxygen as well as other data are acceptable.
Station 073	
105	Sample log: "leaked before venting." Oxygen as well as other data are acceptable.
104	Sample log: "stopcock leaks." Oxygen as well as other data are acceptable.
101	Oxy .35 ml/l, 14.5 umol/kg high. Footnote oxygen bad, does not agree with duplicate trip (O2). No analytical oxygen problems noted.
Station 075	
132	Sample log: "Leaking from bottom." Oxygen as well as other data are acceptable.
117	Sample log: "Leaking from bottom." Oxygen as well as other data are acceptable.
104	Delta-S at 5200db is -0.003, salinity is 34.692. No analytical problems noted. Salinity is acceptable.
Station 076	

120	Sil low compared with adjoining stations. Footnote silicate questionable.
118	Oxy may be slightly high ~1 ml/l, 7.7 umol/kg. Checked vs. CTDO, gradient. Footnote oxygen questionable.
117	Oxy may be slightly high ~1 ml/l, 8.4 umol/kg. Checked vs. CTDO, gradient. Footnote oxygen questionable.
115	Oxy may be slightly high ~04 ml/l, 2.4 umol/kg. Checked vs. CTDO, gradient. Footnote oxygen questionable.
Station 077	
Cast 1	Int. and deep NO3 systematically ~3 um/l .05 umol/kg high. Footnote NO3 questionable. NO3: possible air bubble in system.
129	Delta-S at 259db is 0.0347, salinity is 34.869. No analytical problems noted. Gradient area, salinity as well as other parameters are acceptable.
117	Sample log: "Bottle leaked." "Major leaker." Footnote bottle leaking, oxygen not sampled, other samples bad.
110	Sil ~3 um/l, 4.46 umol/kg high (either-or 09) Sil slightly low. Footnote silicate questionable.
109	Sil ~3 um/l, 4.25 umol/kg high (either-or 10) Sil slightly low. Footnote silicate questionable.
Station 078	
136	Sample log: "Top o-ring not seated." Oxygen as well as other data are acceptable.
117	Sample log: "Leaking from top." NO3 too low. Footnote NO3 bad.
104	Sample log: "therm: looks like wrong depth." Data are acceptable, thermometer malfunction.
Station 079	
122	Sample log: "leaky spigot." Oxygen as well as other data are acceptable.
111	PO4 odd. no obvious reason. PO4 is .02 higher than adjoining stations which is within specs of measurement. PO4 is acceptable.
110	NO3 slightly low. Footnote NO3 questionable.
103-104	PO4 slightly high. Footnote PO4 questionable.
Station 080	
136	Marine Tech log: "new spring and spring lanyard. old spring" had bare metal exposed." Data are acceptable.
Station 081	
Cast 1	Marine Tech log: "LADCP put in rosette. New transmissometer SN 151D replaced old transmissometer SN 100D."
111	Sample log: "Bottle leaking (o-ring). No samples taken." Sample log is in error. Samples were taken for nutrients, but should be disregarded. Footnote bottle leaking, nutrients bad, no salinity or oxygen drawn.
Station 082	
236	Sample log: "no salts, no nuts. Not enough water." No nuts. Not enough water? Ran out of water before nuts and salts.
226	Sample log: "slow leak from stopcock." Oxygen as well as other data except NO3 are acceptable.
201-235	Cd column needed replacement. NO3 high, footnote NO3 bad.
Station 083	
130-132	NO2 values seem high. Air bubble? Footnote NO2 questionable.

120	Salt same as 119. Duplicate draw? Footnote salinity bad.
111	Lanyard caught. Oxy not affected. Sample log: "Lanyard caught in top. Bottle leaked." Footnote bottle leaking, samples bad except for oxygen.
109	Sample log: "Lanyard caught in top. Bottle leaked." Lanyard caught. Oxy not affected. Footnote bottle leaking, samples bad except for oxygen.
Station 084	
124	O2 log: "Over-titrate option crashed PC, @ sample 24." Oxy lost. Computer hangup.
Station 085	
126	Sample log: "leaker. bottom o-ring." Oxygen as well as other data are acceptable.
120	PO4 low. Footnote PO4 questionable.
Station 086	
116	Salt same as 117. Looks like misdraw. Delta-S at 2010db is -0.0161, salinity is 34.602. Footnote salinity bad, ODF recommends deletion of salinity.
112	Sample log: "Bottle leaking from bottom." Oxygen as well as other data are acceptable. Delta-S at 2818db is -0.0032, salinity is 34.656.
107	PO4 value looks odd. No obvious analytical reason. PO4 is .02 lower than adjoining stations, within specs and acceptable.
105	Sample log: "Bottle leaking from top." Oxygen as well as other data are acceptable.
Station 087	
122	Sample log: "Leaking from bottom." Oxygen as well as other data are acceptable.
106	Duplicate salt draw of 105. Footnote salinity bad.
101	Oxygen: "Computer crashed, oxygen lost."
Station 088	
114	Sample log: "could be contaminated. (Why?)" Oxygen as well as other data are acceptable.
107	PO4 high. Footnote PO4 questionable.
101	Sample log: "Leaking from bottom." Oxygen .02 ml/l, 1.0 umol/kg lower than replicate (02) sample, within 1% data are acceptable. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 089	
136	Sample log: "vent open." Data are acceptable.
122	Sil high. Footnote sil questionable. This feature seen in sta 85-93. Could be real. CTD o2 substantiates this.
120	PO4 low. This feature seen in sta 85-93. Could be real. Footnote PO4 questionable. CTD o2 substantiates this.
Station 091	
105	Sample log: "leaking, top o-ring." Oxygen as well as other data are acceptable.
101	Oxygen is 0.9 umol/kg high compared with bottle 02, bottle 2 is 1.5db shallower, potential temperature is different Oxygen is 0.8 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 092	
131	Looks like misdraw. Dup salt draw from 130. Footnote salinity bad.

122	PO4 high. Footnote PO4 questionable.
104	Sample log: "therm rack sideways." Oxygen as well as other data are acceptable.
103	PO4 high. Footnote PO4 questionable.
Station 093	
120	Sample log: "leaked when vented." Oxygen as well as other data are acceptable.
Station 094	
122	Sample log: "slight leak." Oxygen as well as other data are acceptable.
120	Nuts log: "trip problems. no3, po4, sil low." Sample log: "Leaking from bottom. " Major leaker. Only nuts sampled. Ran out of water. Footnote bottle leaking, nutrients bad, oxygen and salinity not drawn.
105	Oxy same as 104. Looks like misdraw. Footnote oxygen bad.
104	Sample log: "stopcock leaks." Oxygen as well as other data are acceptable.
101	Oxygen is 1.6 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 095	
Cast 1	NO2: Large drift during run. Footnote NO2 bad. Salts are all +.003 high. Footnote salinity questionable, out of spec. Suspect bad vial of standard seawater. Sample log: "late 2nd shake for o2 samples."
104	Sample log: "therm temp not recorded." Oxygen as well as other data except salinity are acceptable.
101	Oxygen is 0.9 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 096	
Cast 1	NO2: Bad standards, as well as bubbles stuck in flowcell. Footnote NO2 questionable.
127	Sample log: "lid put in and delay before pickling." Oxygen as well as other data except NO2 are acceptable.
126	Salt local max seems high. Corresponds with local oxygen max. Seems high compared to subsequent stations. Sdiff = -.0005 psu. Looks real.
114	Sample log: "air bubble in flask after pickling." Oxy high. Bubble. Footnote oxygen bad.
101	Oxygen is 1.9 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 097	
120	Sample log: "Leaking from top." Oxygen as well as other data are acceptable.
106	Sample log: "Pretripped." Footnote bottle leaking, samples bad.
103	Nuts log: "trip prob? looks like Sample log: "Lanyard hung in endcap." Footnote bottle leaking, samples bad.
101	Oxygen is 1.2 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 098	
134	Sample log: "Leaking from top." Oxygen as well as other data are acceptable.
120	Sample log: "Leaking from top." Oxygen as well as other data are acceptable.
101	Oxygen is 1.4 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 099	
101	Oxygen is 1.3 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 100	
136	Sample log: "lower cap drip." Oxygen as well as other data are acceptable.
134	Sample log: "upper cap leak." Oxygen as well as other data are acceptable.
124	Sample log: "opened before helium drawn." Oxygen as well as other data are acceptable.
Station 101	
Cast 1	NO2: Big drift during run. End standards bad, as well as bubbles in flowcell. Footnote NO2 questionable.
Station 102	
Cast 1	Sample log: "therm rack sideways."
136	Sample log: "slight air leak." Marine Tech log: "torn o-ring." Oxygen as well as other data are acceptable.
131	Marine Tech log: "possible leak." Oxygen as well as other data are acceptable.
124	Sample log: "o2 drawn twice. Accidentally dumped 1st sample." Oxygen as well as other data are acceptable.
120	Sample log: "air leak from top." Marine Tech log: "Possible leak. Bottom end cap slightly dented." Oxygen as well as other data are acceptable.
114	Sample log: "Leaking from bottom." Marine Tech log: "Leaked. Possibly lower lanyard twisted around handle." Oxygen as well as other data are acceptable.
Station 103	
136	Sample log: "leaks." Oxygen as well as other data are acceptable.
109	Dup salt draw (110). Salt misdraw. Same as 110. Delta-S at 3354db is -0.0068, salinity is 34.671. Footnote salinity bad.
101	Oxygen is 1.8 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 104	
Cast 1	Nuts: "Silicate had an air bubble in line. All samples may have been affected." Attempts to recalculate data did not yield good plots. Nutrient analyst indicates the bubble occurred between samples 21 through 10. Footnote silicate bad.
103	CTDO Processor: "From 5350db to 550db CTD oxygen questionable."
101	Oxygen is 0.4 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 105	
Cast 1	nuts.notes: sil problems? checked. No obvious problems.
136	Sample log: "o-ring did not seat at top." Oxygen as well as other data are acceptable. CTDO Processor: "Top 18db CTD oxygen questionable."
134	Sample log: "Leaking from top." Oxygen as well as other data are acceptable.
122	Nuts log: "mistrip?" Oxygen also looks high on station profile, however, it agrees with next two stations NO3 is ~6 um/l, ~45 um/kg low on station profile, but agrees with next few stations. PO4 and SiO3 are within measurement specs therefore acceptable. Salinity agrees with adjoining stations and CTD.

117	Sample log: "Leaking from top." Oxygen as well as other data are acceptable.
104	Sample log: "Leaking." Leaker - salt, oxy bad. Delta-S at 5178db is -0.0054, salinity is 34.696. Footnote bottle leaking, samples bad.
101	Oxygen is 1.3 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 106	
134	Top O-ring damaged. Air-leak. Oxygen as well as other data are acceptable.
128	Sample log: "air leak on top." Oxygen as well as other data are acceptable.
102	Salt low. No salinity analytical problems noted. Delta-S at 5823db is -0.0056, salinity is 34.697. Footnote salinity questionable.
101	Oxygen is 1.8 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 107	
111	Sample log: "Leaking from top." Oxygen as well as other data are acceptable.
101	Bad salt (wrong sample) Delta-S at 6008db is -0.0428, salinity is 34.660. Footnote salinity bad.
Station 108	
117	Sample log: "Leaking from top." Oxygen as well as other data are acceptable.
Station 109	
135	Sample log: "Lanyard caught in top." Oxygen as well as other data are acceptable.
133	Sample log: "Leaking from top." Oxygen as well as other data are acceptable.
126	Sample log: "leaking from bottom (slight)." Oxygen as well as other data are acceptable.
122	Sample log: "Leaking from bottom." Oxygen as well as other data are acceptable.
104	Sample log: "Leaking from bottom." Oxygen as well as other data are acceptable.
Station 110	
115	Salt misdrawn from 14. Delta-S at 2226db is 0.006, salinity is 34.653. Other samples appear to be okay. Footnote salinity bad.
101	Oxygen is 0.8 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 111	
125	PO4 slightly high on station profile. PO4 high compared with adjoining stations. There is a slight feature in other parameters, but footnote PO4 questionable.
124	PO4 slightly high on station profile. PO4 high compared with adjoining stations. There is a slight feature in other parameters, but footnote PO4 questionable.
120	CTD Processor: "btl o2 high at 1013db." Oxygen analyst indicates a large bubble in the sample. Evidentally, this had an effect on the sample. Footnote oxygen questionable.
101	Oxygen is 1.7 umol/kg low compared with duplicate trip. CTD Oxygen and adjoining stations also indicate this is low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 113	
117	Sample log: "Leaking from top." Oxygen as well as other data are acceptable.
108	Sample log: "Spigot opened and closed before o2 drawn." Oxygen as well as other data are acceptable.

101	Oxygen is 1.0 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 114	
101	Oxygen is 0.8 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 115	
Cast 1	Marine Tech log:"at surface 3 bottles open. 2 bottles tripped Trip arm between 34 & 35." GO Pylon problems. All trips were off by 2. Reassignment of pressures appears correct. Footnote bottles did not trip as scheduled.
136	Sample log: "didn't close." Bottles 01-36 did not trip as scheduled. This level is included and assigned with just CTD data just as a stop of the CTD and an attempted trip level at 5600db. This was done so the DQE has additional information to double-check that pressure assignments were done correctly. Footnote bottle no samples taken.
121	Sample log: "valves open." Oxygen as well as other data are acceptable.
120	Nuts log: "po4, sil low. leak?" Sample log: "valves open." Oxygen is high compared with Sta 114 and low compared with Sta 116, PO4 and Sil are within specs of measurements. Code data and bottle as acceptable.
109	Sample Log: "Lanyard from 108 hung in lid. Bottle leaked." Footnote bottle leaking, samples bad.
Station 116	
Cast 1	Marine Tech log: "36 test trips on deck. OK but slow trip at 2 or 3 spots e.g. 15-16."
133	Sample log: "Upper o-ring out of groove." Oxygen as well as other data are acceptable.
117	Marine Tech log: "air leak. top lid twisted 90 degrees off." Sample log: "air leak." Oxygen as well as other data are acceptable.
101	Oxygen is 1.2 umol/kg low compared with duplicate trip. CTD Oxygen and adjoining stations also indicate this is low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 117	
122	Sample log: "Leaking from bottom." Oxygen as well as other data are acceptable.
101	Oxy .04 ml/l, 0.8 umol/kg low. No oxygen analytical problems noted. There is a difference of .03 to .05 ml/l, 0.8 to 3.x umol/kg in some of the stations where 2 bottles were tripped at the greatest depth as scheduled by the PI to assess variability. It appears that bottle 1 (one) was always lower if there was a difference between these two bottles. No analytical error could explain a lower oxygen, therefore at the request of the PI these oxygen values are coded acceptable.
Station 118	
136	Sample log: "Did not close. Check nuts to sort depths and find skipped sample." Bottle didn't close. Bottles 03-36 did not trip as scheduled. This level is included and assigned with just CTD data just as a stop of the CTD and an attempted trip level at 5500db. Footnote bottle no samples taken.
133	Sample log: "upper o-ring did not seat." Oxygen as well as other data are acceptable.
103-135	CTDO Processor: "btl pressure assignments wrong: 103-105 belong one level higher: 5500db is the missed level, not 4578. Plots of o2/sil/no3 seem to improve greatly with this reassignment." Code bottle did not trip correctly, data is acceptable unless otherwise noted. Footnote bottles did not trip as scheduled.

Station 119

134	Delta-S at 70db is -0.0198, salinity is 34.460. Spike in CTD data, footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad. Bottle salinity agrees with adjoining stations, salinity as well as other data are acceptable.
133	Sample log: "Missing o-ring." Delta-S at 101db is -0.0324, salinity is 34.711. Spike in CTD data, footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad. Bottle salinity agrees with adjoining stations, salinity as well as other data are acceptable.
101	Oxy .05 ml/l, 1.8 umol/kg low, no analytical problem noted. Bottle 02 is 86db shallower, but at the same potential temperature. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable. Other data are acceptable.

Station 120

133	Delta-S at 98db is -0.0401, salinity is 34.513. Spike in CTD salinity up trace, footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad. Autosal took 3 tries to get two readings to agree. However, salinity agrees with adjoining stations.
124	CTD Processor: "btl o2 low at 711db." Oxygen does appear low, ~4 umol/kg compared with adjoining stations. Footnote oxygen questionable.
112	NO3 low. Footnote NO3 questionable, other data are acceptable.
108	CTD processor: "btl o2 high at 3965db." Oxygen appears to agree with Stations 118-121, but the the potential temperature is either slightly higher or lower. It is high, ~4 umol/kg, compared with Station 122 where the potential temperature is almost the same. Footnote oxygen questionable.
101	Oxygen is 1.2 umol/kg low compared with duplicate trip. CTD Oxygen and adjoining stations also indicate this is low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 121

101	O2 log: "flask 1134 was opened and acidified before noted that stir motor no good. This sample sat open during replacement of motor." Oxygen .04 ml/l, 1.5 umol/kg low compared with CTDO and adjoining stations. Footnote oxygen bad, other data are acceptable.

Station 122

Cast 1	Cd column changed and not broken in. Footnote NO3 bad, high.
135-136	CTDO Processor: "Top 66db CTD oxygen questionable."
133	Sample log: "Leaking from top." Oxygen as well as other data except NO3 are acceptable.
116	Sample log: "spigot leaking." Oxygen as well as other data except NO3 are acceptable.
112	Sample log: "Leaking from top." Oxygen as well as other data except NO3 are acceptable.
105	Sample log: "Leaking from top." Oxygen as well as other data except NO3 are acceptable.
101	Oxygen is 0.8 umol/kg low compared with duplicate trip. CTD Oxygen and adjoining stations also indicate this is low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 123

Cast 1	nuts: "Cd column not equilibrated." Footnote NO3 bad, high.
133	Sample log: "Leaking from top." Oxygen as well as other data except NO3 are acceptable.
128	Sample log: "leaking from vent." Oxygen as well as other data except NO3 are acceptable.
102	Sample log: "Leaking from bottom." Oxygen as well as other data except NO3 are acceptable.

Station 124

136	Sample log: "Leaking from top." Oxygen as well as other data are acceptable.
122	Sample log: "bottom valve leaking, top valve not seated." Oxygen as well as other data are acceptable.
114	Sample log: "slow leak bottom valve." Oxygen as well as other data are acceptable.
Station 125	
136	Sample log: "Top o-ring popped-out." Oxygen as well as other data are acceptable.
135	O2 log: "Overtitrate option crashed system, oxygen lost."
105	Sample log: "air leak." Oxygen as well as other data are acceptable.
101	Oxy .03 ml/l, 1.5 umol/kg low. Oxygen lower than duplicate trip (02), other data are acceptable. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 126	
136	Sample log: "Top o-ring popped out." Oxygen as well as other data are acceptable. CTDO Processor: "Top 38db CTD oxygen questionable."
126	Sample log: "2 bottles (25 & 26) tripped at 700M." See 125 comment.
125	Sample log: "2 bottles (25 & 26) tripped at 700M." Data agree with each other.
105	Sample log: "air leak." Oxygen as well as other data are acceptable.
101	Oxygen is 1.0 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 127	
122	Sample log: "leaks at spigot." Oxygen as well as other data are acceptable.
103	Sample log: "Caught lanyard." Bottle not closed (lanyard hung). Footnote bottle leaking, samples bad.
101	Oxygen is 1.8 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 128	
Cast 1	NO2: Bubbles in flowcell and beginning baselines bad. Footnote NO2 questionable.
128	Sample log: "Leaking from vent." O2 and salinity agree with CTD. PO4 and NO3 appear low, but Sil agrees with station profile and adjoining stations. Data are acceptable.
122	Sample log: "Leaking from top." Oxygen as well as other data agree are acceptable.
105	Sample log: "Leaking from top." Oxygen as well as other data agree are acceptable.
101	Oxy .1 ml/l, 4.7 umol/kg high. Oxygen higher than duplicate trip, CTDO and adjoining stations. No analytical problems noted. Other data are acceptable. Oxygen is 0.8 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 129	
Cast 1	NO2: Suspect contamination, Footnote NO2 questionable.
128	Sample log: "Vent not closed." Oxygen as well as other data except NO2 are acceptable.
122	Sample log: "Leaking from bottom." Oxygen as well as other data except NO2 are acceptable.
120	Sample log: "Leaking from top." Oxygen as well as other data except NO2 are acceptable.
109	CTDO Processor: "From 3592db to 3966db CTD oxygen questionable."
101	Bottle leaked or closed near surface. Nuts log: "Ron says not right trip 1". Footnote bottle leaking, samples bad. See Cast 1 NO2 comment, however, NO2 should be coded as bad because of the bottle problem.

Station 130

Cast 1 NO2: Bad end standards, bubbles during run; however peaks do look real. Suspect contamination, footnote NO2 questionable.

133 Sample log: "bad top o-ring seal." Oxygen as well as other data except NO2 are acceptable.

106 Sample log: "Leaking from bottom." Oxygen as well as other data except NO2 are acceptable.

101 Oxy .04 ml/l, 1.5 umol/kg low. Oxygen lower than duplicate trip (02), other data are acceptable. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 131

126 Sample log: "slight leak." Oxygen agrees with CTDO although it appears ~5 ml/l, ~20 umol/kg low, salinity agrees with CTD. NO3 appears ~2. um/l, 2.1 um/kg high, PO4 .1 um/l, .14 um/kg high, Sil is acceptable. Suspect this feature is real. Oxygen as well as other data are acceptable.

105 Lanyard caught. Sample log: "Lanyard caught in top." Footnote bottle leaking, samples bad.

104 Sample log: "Bottom lanyard caught in lid. No sample." This level is included and assigned with just CTD data. This was done so the DQE has additional information to double-check that pressure assignments were done correctly. Footnote bottle no samples taken.

101 Oxygen is 1.8 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 132

136 CTDO Processor: "Top 38db CTD oxygen questionable."

135 Delta-S at 39db is 0.0403, salinity is 34.006. Autosal took 3 tries to get two readings to agree, suspect salt crystal contamination, footnote salinity bad. Other data are acceptable.

120 Sample log: "Leaking." Oxygen as well as other data are acceptable.

105 Sample log: "Leaking from bottom (o-ring)." Oxygen as well as other data are acceptable.

Station 133

134 Delta-S at 61db is 0.0263, salinity is 34.403. Salinity as well as other data are acceptable. Gradient area, water mixing during bottle trip.

122 Sample log: "Leaking from bottom." Oxygen as well as other data are acceptable.

116 Sample log: "Leaking from bottom." Oxygen as well as other data are acceptable.

111 Sample log: "Leaking from top." Oxygen as well as other data are acceptable.

109 Sample log: "leaking from vent." Oxygen as well as other data are acceptable.

101 Oxygen is 1.5 umol/kg low compared with duplicate trip. CTD Oxygen and adjoining stations also indicate this is low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 134

131 Delta-S at 159db is -0.0648, salinity is 34.818. Spike in CTD data, footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad. Salinity as well as other data are acceptable.

128 Sample log: "Leaking from top." Oxygen as well as other samples are acceptable.

101 Oxygen is 1.4 umol/kg low compared with duplicate trip. CTD Oxygen and adjoining stations also indicate this is low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 135

136	Delta-S at 2db is 0.0821, salinity is 33.891. Salinity as well as other data are acceptable. Gradient area, water mixing during bottle trip.
126	Sample log: "Leaking from bottom." Oxygen as well as other data are acceptable.
116	Sample log: "Leaking from bottom." Oxygen as well as other data are acceptable.
112	Sample log: "Leaking from bottom." Oxygen as well as other data are acceptable.
111	Sample log: "Leaking from top o-ring." Salt and PO4 same as 112. Oxy close. Sample log indicates leaking. Mistrip? Delta-S at 3041db is -0.0048, salinity is 34.666. Salinity and oxygen are low, all other data are acceptable. Footnote bottle leaking, salinity and oxygen bad.
102	Sample log: "Leaking from bottom." Nuts Log: "no. 2 leaky?" Data agrees with adjoining station and duplicate trip (01). Oxygen as well as other data are acceptable.
Station 136	
134	Sample log: "Leaking." Delta-S at 68db is 0.0356, salinity is 34.848. Gradient area, salinity and oxygen as well as other data are acceptable.
133	Delta-S at 98db is -0.0964, salinity is 35.065. Autosal took 3 tries to get two readings to agree, suspect salt crystal contamination, footnote salinity bad.
116	Sample log: "Leaking from bottom." Oxygen as well as other data are acceptable.
111	Sample log: "air leak." Oxygen as well as other data are acceptable.
101	Oxygen is 0.7 umol/kg low compared with duplicate trip. CTD Oxygen and adjoining stations also indicate this is low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 137	
136	CTDO Processor: "Top 30db CTD oxygen questionable."
135-136	Sample log: "slime strands over bottles." Oxygen as well as other data are acceptable.
134	Sample log: "slime strands over bottles." Sample log: "Leaking." Oxygen as well as other data are acceptable.
133	Sample log: "slime strands over bottles." Oxygen as well as other data except salinity are acceptable. Delta-S at 91db is 0.0568, salinity is 35.111. Autosal took 3 tries to get two readings to agree, suspect salt crystal contamination, footnote salinity bad.
132	Sample log: "slime strands over bottles." Oxygen as well as other data are acceptable.
131	Sample log: "slime strands over bottles." Oxygen as well as other data are acceptable.
104	Sample log: "Leaking from bottom." Oxygen as well as other data are acceptable.
Station 138	
112	Sample log: "overshot depth at 12." Oxygen as well as other data are acceptable.
Station 139	
134	Sample log: "Leaking from top." Delta-S at 68db is 0.0601, salinity is 34.643. Oxygen as well as other data are acceptable.
122	Sample log: "slow leak on draw valve." Oxygen as well as other data are acceptable.
114	Sample log: "Leaking from bottom." Oxygen as well as other data are acceptable.
101	Oxy .08 ml/l, 3.2 umol/kg low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 140	
Cast 1	Marine Tech log: "checked pinger batteries, found ok (faint PDR trace...) slime in water may be responsible for messy transmissometer data. Much slime on rosette. rinsed cond. probe w/ DI.

	looked ok. started cart out before ADCP unhook, pulled RS232 cable connection loose in lab. Stopped before damage to wires."
134	Sample log: "Leaking from top." Delta-S at 74db is 0.0297, salinity is 34.838. Oxygen as well as other data are acceptable.
101	Oxygen is 1.2 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 141	
Cast 1	Marine Tech log: "dried out and reseated transmissometer connections looks better." Marine Tech log: "rosette tapped ship coming out of water on recovery."
136	CTDO Processor: "Top 18db CTD oxygen questionable."
133	Delta-S at 91db is -0.0811, salinity is 35.189. Spike in CTD trace, footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad. Salinity as well as other data are acceptable
130	Salt looks like 129. Misdraw? Salinity inversion seen in CTD trace as well as difference between the down and up trace. Salinity is lower than adjoining stations comparisons. Footnote salinity questionable. Other data are acceptable.
101	Oxygen is 2.3 umol/kg low compared with duplicate trip. CTD Oxygen and adjoining stations also indicate this is low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 142	
130	Delta-S at 203db is -0.0407, salinity is 35.011. Spike in CTD salinity up trace, footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad. Bottle salinity as well as other data are acceptable.
101	Oxy .04 ml/l, 1.9 umol/kg low. See Station 117 bottle 01 oxygen comment. CTD Oxygen and adjoining stations also indicate this is low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 800	
129	Delta-S at 214db is -0.0381, salinity is 35.014. Footnote salinity questionable, other data are acceptable.
119	Bottle pre-tripped. Footnote bottle leaking, samples bad.
118	No salinity analytical problems noted. Delta-S at 1420db is 0.0338, salinity is 34.627. Footnote salinity questionable, other data are acceptable.
102	O2 log: "OT option crashed o2 program." Oxy value lost. Computer crashed.
101	CTD Processor: "btl o2 low at btm (btl 101)-not exclusive to this cast." Oxygen .08 ml/l, 3.6 umol/kg low compared with adjoining stations also low compared with CTD. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 801	
133	Salt same (32 & 33). Misdraw? This feature shows in adjoining stations and the salinity agrees with the CTD in these shallow waters.
132	Salt same (32 & 33). Misdraw? This feature shows in adjoining stations and the salinity agrees with the CTD in these shallow waters.
113	Sil value looks odd. no obvious reason. Silicate agrees with adjoining stations.
105	Nuts same as 106. Misdraw. Footnote nutrients bad.
101	Oxygen is 0.5 umol/kg low compared with duplicate trip. Adjoining stations also indicate this is low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 802	
134	Sample log: "Leaking from top." Oxygen as well as other data are acceptable.
133	Delta-S at 99db is -0.0589, salinity is 35.251. Feature in CTD data, bottle could have tripped deeper in water column (not more than 20 m), suspect data are acceptable.
126-127	COL log: "duplicates." Data are acceptable, duplicate trip was scheduled.
104	Sample log: "Leaking from bottom." Oxygen as well as other data are acceptable.
101	Oxygen is 2.0 umol/kg low compared with duplicate trip. Adjoining stations also indicate this is low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 803	
113	Lanyard caught in lid. NO3 ~7 um/l, .02 um/kg low, SiO3 ~15 um/l, .35 um/kg low, PO4 is reasonable, O2 also agrees with adjoining stations. Delta-S at 2414db is 0.0078, salinity is 34.663. Footnote bottle leaking and samples bad.
101	Oxygen is 0.9 umol/kg low compared with duplicate trip. Adjoining stations also indicate this is low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 143	
136	Sample log: "vents not closed." Oxygen as well as other data except salinity are acceptable. Delta-S at 4db is -0.0158, salinity is 34.122. No salinity analytical problems noted. Footnote salinity questionable.
134	Sample log: "vents not closed." Oxygen as well as other data are acceptable.
133	Sample log: "vents not closed." Delta-S at 67db is 0.045, salinity is 34.722. Oxygen as well as other data are acceptable.
101	See Station 117 bottle 01 oxygen comment. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 144	
135	Sample log: "Lanyard caught in end-cap (leaking)." Oxygen as well as other data are acceptable.
101	Oxygen is 0.8 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 145	
136	CTDO Processor: "Top 28db CTD oxygen questionable."
114	Sample log: "lower cap." Oxygen as well as other data are acceptable.
103	Sample log: "air leak on top." Oxygen as well as other data are acceptable.
101	Oxygen is 1.6 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 146	
135-136	CTDO Processor: "Top 40db CTD oxygen questionable."
130	Delta-S at 204db is -0.0297, salinity is 35.112. Spike in CTD salinity up trace, footnote CTD salinity bad. Bottle salinity and other data are acceptable. No CTDO is calculated because the CTD Salinity is coded bad.
101	Oxygen is 0.6 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 147	
136	CTDO Processor: "Top 32db CTD oxygen questionable."

109	Nuts log: "leaker bottle?" Lanyard caught in top lid. Delta-S at 3658db is 0.0131, salinity is 34.696. Footnote bottle leaking, samples bad.
Station 148	
136	CTDO Processor: "Top 32db CTD oxygen questionable."
134	Delta-S at 68db is 0.0252, salinity is 35.202. Bottle salinity as well as other data are acceptable. Gradient area, water mixing during bottle trip.
101	Oxygen is 2.0 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 149	
136	CTDO Processor: "Top 34db CTD oxygen questionable."
133	Sample log: "upper o-ring not seated." Oxygen as well as other data except salinity are acceptable. Delta-S at 98db is 0.0522, salinity is 35.360. Footnote salinity bad.
113	Sample log: "double trip at 2600." Data is acceptable.
101	Oxy .04 low. No obvious reason. Similar feature, lower oxygen, seen in previous stations. O2 is acceptable.
Station 150	
Cast 1	Marine Tech log: "CTD wire went bad ~500 M from surface on up cast. cut off ~4500 M wire because of 2 shorts in middle of drum. Switched winches to have enough wire." Console Ops Log: "Lost signal approx. 330db up & terminated upcast at that point; ended up cutting off 4500m wire because shorts in 2 wires about 500m apart in middle of drum."
111	Nuts Log: "leaked from bottom cap." Sample log: "Leaking from bottom." Leaker. Footnote bottle leaking, samples bad.
Station 151	
101	Oxy 0.03 ml/l, 1.1 umol/kg low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 152	
131	Delta-S at 153db is -0.0397, salinity is 35.679. Autosal took 3 tries to get two readings to agree, could be salt crystal contamination, footnote salinity questionable.
110	NO3 low. No obvious reason. Footnote NO3 questionable.
101	Oxygen is 1.8 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 153	
136	CTDO Processor: "Top 10db CTD oxygen questionable."
135	Delta-S at 31db is 0.0489, salinity is 34.741. Data are acceptable. Gradient area, water mixing during bottle trip.
132	Delta-S at 120db is 0.0488, salinity is 35.581. Spike in CTD salinity up trace, footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad. Other data are acceptable.
131	Delta-S at 150db is 0.0342, salinity is 35.920. Spike in CTD salinity up trace, footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad. Other data are acceptable.
108	Delta-S at 3652db is -0.003, salinity is 34.683. Salinities from 3000db to 4860db are lower than adjoining stations and CTD. This salinity value is out of WOCE specs, the others are within spec. No analytical problem noted. Footnote salinity questionable.

Station 154

135-136 CTDO Processor: "Top 50db CTD oxygen questionable."

132 Sample log: "Bottle not closed. No sample." This level is included and assigned with just CTD data. This was done so the DQE has additional information to double-check that pressure assignments were done correctly. Footnote bottle no samples taken.

123 Sample log: "Leaking from top." Oxygen as well as other data are acceptable.

114 CTD Processor: "btl o2 high at 2429db (btl 114)-doesn't match , upcast either." Oxygen is ~4.6 umol/kg high compared with Stations 153 and 155. No analytical problems noted. Footnote oxygen questionable.

104 Sample Log Noted "?" with respect to therm listings.

101 Oxygen is 0.7 umol/kg low compared with duplicate trip. CTD Oxygen and adjoining stations also indicate this is low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 155

130 Delta-S at 207db is -0.0303, salinity is 35.097. Autosal took 4 tries to get two readings to agree, suspect salt crystal contamination, footnote salinity bad. Other data are acceptable.

123 Sample log: "top cap unseated." Oxygen as well as other data are acceptable.

120 Sample log: "loose top cap." Oxygen as well as other data are acceptable.

109 Sample log: "Lanyard caught in top valve." Nuts log: "bad sample. leak?" Footnote bottle leaking, samples bad.

107 Sample log: "Lanyard caught in top cap." Footnote bottle leaking, samples bad.

101 Oxygen is 1.0 umol/kg low compared with duplicate trip. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 156

123 Marine Tech log: "replaced top end cap." Sample log: "Leaking from top." Oxygen as well as other data are acceptable.

Station 157

136 CTDO Processor: "Top 26db CTD oxygen questionable."

124 Marine Tech log: "Slight leak. Dripping (small drips around o-ring)." Oxygen as well as other data are acceptable.

102 Bottle appears to have tripped at 5167db with bottle 3. Leave as is, and let PI or DQE decide with non-ODF data.

101 Marine Tech log: "number 1 took a dry hit. Looks ok." Data does not agree with duplicate trip (02); Sil higher. Footnote Sil questionable. Let PI or DQE decide on quality of data. Bottle 02 actually agrees with bottle 03. Oxygen is 1.6 umol/kg low compared with duplicate trip and low compared with adjoining stations. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 158

136 Delta-S at 3db is -0.1136, salinity is 34.468. Salinity low compared with adjoining stations. Footnote salinity bad, other data are acceptable.

135-136 CTDO Processor: "Top 58db CTD oxygen questionable."

133 Delta-S at 91db is 0.0323, salinity is 35.220. Salinity and other data are acceptable. Gradient area, water mixing during bottle trip.

131 Delta-S at 151db is 0.0321, salinity is 35.900. Spike in CTD up trace, footnote CTD salinity bad. Salinity and other data are acceptable. No CTDO is calculated because the CTD Salinity is coded bad.

109 Sample log: "Lanyard caught in top." Footnote bottle leaking, samples bad.

102 Sample log: "Leaking from bottom." O2 ~023 ml/l, 1.0 umol/kg lower than duplicate trip (01), within 1% of specs of measurement. Data are acceptable.

101 Oxygen is 1.0 umol/kg low compared with duplicate trip. Adjoining stations also indicate this is low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 159

132 Sample log: "Leaking from top." Oxygen as well as other data are acceptable.

124 Sample log: "slow leak from bottom." O2 ~3 um/l, 10.9 umol/kg low, PO4 ~1 um/l, 0.12 umol/kg high, NO3 ~2. um/l, 1.9 umol/kg high, Sil ~3. um/l, 4.8 umol/kg high, salinity agrees with adjoining stations and CTD. Footnote bottle leaking, samples bad.

101 Oxy .04 ml/l, 1.7 umol/kg low compared with duplicate trip (02) and adjoining stations. Other data are acceptable. Adjoining stations also indicate this is low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 160

136 Sample log: "Bottle not closed (no sample)." This level is included and assigned with just CTD data. This was done so the DQE has additional information to double-check that pressure assignments were done correctly. Footnote bottle no samples taken.

132 Sample log: "Bad O-ring, leaking from vent." Oxygen as well as other data are acceptable.

120 Nuts log: "bad sample. Leak?" Data are acceptable.

114 Sample log: "Bottle leaking." Oxygen as well as other data are acceptable.

112 Sample log: "Bottle leaking from valve." Oxygen as well as other data are acceptable.

Station 161

124 Sample log: "slow o-ring leak on bottom." Data are acceptable.

116 Delta-S at 1810db is 0.014, salinity is 34.636. Appears to be a drawing error with salinity from 15. Footnote salinity bad.

Station 162

133 Delta-S at 60db is -0.0346, salinity is 34.435. Bottle salinity as well as other data are acceptable. Gradient area, water mixing during bottle trip.

129 Delta-S at 200db is -0.0289, salinity is 35.364. Bottle salinity as well as other data are acceptable. Gradient area, water mixing during bottle trip.

106 NO2: Possible contamination. Footnote NO2 questionable.

101 Oxygen is 0.4 umol/kg low compared with duplicate trip. Adjoining stations also indicate this is low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 163

135-136 CTDO Processor: "Top 56db CTD oxygen questionable."

104 Sample log: "Bottle leaking." Oxygen as well as other data are acceptable.

Station 164

101 Oxygen is 0.6 umol/kg low compared with duplicate trip. Adjoining stations also indicate this is low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 165

134	Delta-S at 67db is 0.25, salinity is 34.729. Bottle salinity and other data are acceptable. Gradient area, water mixing during bottle trip.
130	Delta-S at 207db is -0.034, salinity is 35.385. Bottle salinity and other data are acceptable. Gradient area, water mixing during bottle trip.
101	Oxygen is 1.9 umol/kg low compared with duplicate trip. Adjoining stations also indicate this is low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 166

107	CTD Processor: "btl o2 high at 3961db (compared to ctd and nearby discrete). Oxygen is ~7 umol/kg high compared to Station 165 similar potemp. Footnote oxygen questionable.
106	CTD Processor: "btl o2 high at 4266db (compared to ctd and nearby discrete)." Oxygen is ~2.8 umol/kg high compared to Station 167 similar potemp. Oxygen is high compared with Station 165, potemp 0.04 higher. Footnote oxygen questionable.
104	Sample log: "Bottle leaking." Oxygen as well as other data are acceptable.
101	PO4 high, within specs, but deep values are low compared with adjoining stations which is just within spec. Oxygen is 2.3 umol/kg low compared with duplicate trip. CTD Oxygen and adjoining stations also indicate this is low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 167

134	Delta-S at 61db is 0.0754, salinity is 34.490. Autosal took 3 tries to get two readings to agree, suspect salt crystal contamination, footnote salinity bad.
133	Delta-S at 91db is 0.0597, salinity is 35.523. Autosal took 3 tries to get two readings to agree, suspect salt crystal contamination, footnote salinity bad.
130	Delta-S at 201db is -0.0591, salinity is 35.567. Autosal took 3 tries to get two readings to agree, suspect salt crystal contamination, footnote salinity bad.
112	COL: no confirm, no trip. Appears to be okay, tried and apparently succeeded on second tripping try.
106	Sample log: "Not closed. No sample." No water. This level is included and assigned with just CTD data. This was done so the DQE has additional information to double-check that pressure assignments were done correctly. Footnote bottle no samples taken.
101	Oxygen is 1.7 umol/kg low compared with duplicate trip. Adjoining stations also indicate this is low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 168

136	Salt values (35 & 36) the same. CTD trace indicates a constant salinity. Bottle salinity as well as other data are acceptable. Gradient area, water mixing during bottle trip.
135	Salt values (35 & 36) the same. CTD trace indicates a constant salinity. Bottle salinity as well as other data are acceptable. Gradient area, water mixing during bottle trip.
128	Delta-S at 184db is 0.0284, salinity is 35.895. Spike in CTD salinity up trace, footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad. Bottle salinity as well as other data are acceptable.
127	Delta-S at 204db is -0.0267, salinity is 35.592. Spike in CTD salinity up trace, footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad. Bottle salinity as well as other data are acceptable.
110	Looks like a leaker. No notes on sample log. O2 ~2 ml/l, 2.4 um/kg high, NO3 ~1. um/l, .41 um/kg low, PO4 ~09 um/l, .06 um/kg low, Sil agrees with adjoining station. Salinity ~002 high.

	CTD plot shows a feature at that level. Footnote bottle leaking and data bad.
Station 169	
Cast 1	NO2: Big drift during run. Footnote NO2 questionable.
136	CTDO Processor: "Top 30db CTD oxygen questionable."
114	Sample log: "Bottle leaking." Oxygen as well as other data except NO2 are acceptable.
Station 170	
130	Sample log: "bad top o-ring." Oxygen as well as other data are acceptable.
104	Sample log: "bottom leaks." Oxygen as well as other data are acceptable.
Station 900	
6all	Marine Tech log: "changed transmissometer cable for this cast."
617-618	CTDO Processor: "Top 46db CTD oxygen questionable."
612	Delta-S at 205db is 0.0271, salinity is 35.501. Autosal took 3 tries to get two readings to agree, suspect salt crystal contamination, footnote salinity bad.
507	Sample log: "Lanyard caught in top (leaking)." Footnote bottle leaking, samples bad. ODF recommends deletion of all samples. Delta-S at 806db is 0.0581, salinity is 34.576.
503	Sample log: "Top vent open." Oxygen as well as other data are acceptable.
Cast 4	Sample log: "therm rack came up sideways." Oxygen as well as other data are acceptable.
316	Sample log: "Bottle leaking." Delta-S at 60db is -0.047, salinity is 35.248. Oxygen as well as nutrients are acceptable.
309	Sample log: "Vent was open." Oxygen as well as nutrients are acceptable.
307	Sample log: "Vent was open." Oxygen as well as nutrients are acceptable. Delta-S at 809db is -0.0358, salinity is 34.484.
301-318	Salts contaminated (not rinsed). Footnote salinity bad.
218	Sample log: "Bottle leaking from bottom." Oxygen as well as other data are acceptable.
217-218	CTDO Processor: "Top 34db CTD oxygen questionable."
216	Delta-S at 61db is 0.0468, salinity is 34.455. Autosal took 3 tries to get two readings to agree, suspect salt crystal contamination, footnote salinity bad.
202	NO2 much too high. Footnote NO2 bad.
117-118	CTDO Processor: "Top 36db CTD oxygen questionable."
116	Sample log: "This bottle has a big chip breaking off top end cap." Delta-S at 61db is -0.0756, salinity is 34.482. Autosal took 3 tries to get two readings to agree, suspect salt crystal contamination, footnote salinity bad.
115	Delta-S at 91db is 0.046, salinity is 35.838. Autosal took 3 tries to get two readings to agree, suspect salt crystal contamination, footnote salinity bad.
104	Marine Tech log: "cleaned some stuff off bottom of lid which was probably the cause of the leak/drip." Sample log: "Bottle leaked after venting." Oxygen as well as other data are acceptable.
Station 171	
135	Delta-S at 31db is 0.0256, salinity is 34.331. Autosal took 3 tries to get two readings to agree, suspect salt crystal contamination, footnote salinity bad. Other data are acceptable.
134	Delta-S at 61db is 0.2541, salinity is 34.859. Autosal took 5 tries to get two readings to agree, but salinity agrees with adjoining stations. Bottle salinity as well as other data are acceptable. Gradient area, water mixing during bottle trip.

117 Sample log: "Vent open." Footnote bottle leaked, samples bad.

115 Sample log: "vent open." Oxygen as well as other data are acceptable.

Station 172

133 Delta-S at 61db is 0.0853, salinity is 34.968. Autosal took 3 tries to get two readings to agree, suspect salt crystal contamination, footnote salinity bad. Other data are acceptable.

132 Sample log: "lower cap slight leak." Oxygen as well as other data are acceptable.

128 Sample log: "upper o-ring." Oxygen as well as other data are acceptable.

117 Sample log: "Bottle leaking." Oxygen as well as other data are acceptable.

101 Oxygen is 1.4 umol/kg low compared with duplicate trip. CTD Oxygen and adjoining stations also indicate this is low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 173

Cast 1 NO2: Bubble in flowcell, large drift during run. Footnote NO2 bad.

134 Delta-S at 67db is 0.0343, salinity is 35.014. Other data except NO2 are acceptable. Gradient area, water mixing during bottle trip.

131 Delta-S at 157db is 0.0259, salinity is 36.042. Gradient area, spike in CTD up trace, footnote CTD salinity bad. Other data except NO2 are acceptable. No CTDO is calculated because the CTD Salinity is coded bad.

130 Delta-S at 207db is -0.0273, salinity is 35.578. Other data except NO2 are acceptable. Gradient area, water mixing during bottle trip.

117 Sample log: "Bottle leaking." Oxygen as well as other data except NO2 are acceptable.

Station 174

134 Sample log: "top o-ring rolled off." Oxygen as well as other data are acceptable.

132 Delta-S at 66db is 0.1117, salinity is 34.825. Bottle salinity as well as other data are acceptable. Gradient area, water mixing during bottle trip.

117 Sample log: "Leaking from bottom." Marine Tech log: "tightened spring." Oxygen as well as other data are acceptable.

101 Oxygen is 0.4 umol/kg low compared with duplicate trip. Adjoining stations also indicate this is low. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.

Station 175

132 Sample log: "bottom o-ring." Oxygen as well as other data are acceptable.

130 Delta-S at 200db is -0.0581, salinity is 35.778. Bottle salinity and other data agree with adjoining stations, data are acceptable. Gradient area, water mixing during bottle trip.

108 Sample log: "Lost bottom o-ring. No water." This level is included and assigned with just CTD data. This was done so the DQE has additional information to double-check that pressure assignments were done correctly. Footnote bottle no samples taken.

Station 176

132 Sample log: "lower cap." Oxygen as well as other data are acceptable.

Station 177

133 Delta-S at 91db is 0.1506, salinity is 35.036. Autosal took 3 tries to get two readings to agree, suspect salt crystal contamination, footnote salinity bad. Other data are acceptable.

108 PO4 .40 um/l, .02 um/kg low. NO3 1.0 um/l, .05 um/kg high. KP error? nuts: "checked. No obvious analytical problem." This was a reading error in NO3 and there must have been an error

	which is no fixed in PO4. Data are acceptable.
103	Sample log: "Lanyard caught in top." Footnote bottle leaking, samples bad.
Station 178	
111	Sample log: "Lanyard caught in top." Leaked. Footnote bottle leaking, samples bad.
107	Sample log: "Leaking from top." Delta-S at 2214db is 0.0029, salinity is 34.643. Oxygen draw temperature a little low, but oxygen appears to be okay. Code data as acceptable.
Station 179	
130	Delta-S at 146db is -0.2307, salinity is 35.911. No salinity analytical problems noted. Footnote salinity bad, does not agree with adjoining stations.
Station 180	
107	Lanyard caught in top. Leaked. Lanyard caught. Footnote bottle leaking, samples bad.
104	Sample Log Noted "Therm rack sideways."
103	Lanyard caught in top. Leaked. Lanyard caught. Footnote bottle leaking, samples bad.
Station 181	
132	Delta-S at 100db is 0.031, salinity is 35.329. Autosal took 3 tries to get two readings to agree, suspect salt crystal contamination, footnote salinity bad.
130	Sample log: "slow drip." Oxygen as well as other data are acceptable.
120	Delta-S at 351db is -0.0572, salinity is 35.020. Autosal took 3 tries to get two readings to agree, suspect salt crystal contamination, footnote salinity bad.
114	Delta-S at 659db is 0.0144, salinity is 34.404. Salinity is a little high, adjoining stations do not indicate this feature. Footnote salinity questionable and other data acceptable.
Station 182	
133	Delta-S at 95db is -0.2115, salinity is 35.110. See 129 salinity comment, suspect this salinity was drawn from bottle 34. Footnote salinity bad.
132	Delta-S at 125db is -0.5171, salinity is 35.422. See 129 salinity comment, suspect this salinity was drawn from bottle 33. Footnote salinity bad.
131	Delta-S at 154db is -0.0904, salinity is 35.991. See 129 salinity comment, suspect this salinity was drawn from bottle 32. Footnote salinity bad.
130	Delta-S at 204db is 0.0618, salinity is 36.086. Autosal took 3 tries to get two readings to agree. See 129 salinity comment, suspect this salinity was drawn from bottle 31. Footnote salinity bad.
129	Delta-S at 256db is 0.3016, salinity is 36.010. Autosal took 3 tries to get two readings to agree. Suspect a drawing error and that a salinity was not drawn from this bottle. A salinity was drawn twice from bottle 34 and this one was missed. Footnote salinity bad.
Station 183	
101	Oxygen is 0.4 umol/kg high compared with duplicate trip. Adjoining stations also indicate this is high. ODF suggests oxygen is questionable. PI has deemed oxygen acceptable.
Station 184	
133-136	CTDO Processor: "Top 98db CTD oxygen questionable."
133	Delta-S at 95db is 0.1408, salinity is 35.272. Footnote salinity questionable, other data are acceptable.
130	Delta-S at 205db is -0.1097, salinity is 35.698. Station profile plot indicates a higher NO3 and PO4 and lower SiO3. NO3 is higher than adjoining station comparison. PO4 is higher than adjoining stations, but that is within the specs of the measurement. Footnote salinity, and nitrate

questionable.

110 No salinity analytical problems noted. Sil um/l low too. Delta-S at 1822db is -0.0145, salinity is 34.594. Oxygen, phosphate and nitrate are acceptable. Footnote salinity and silicate questionable.

Station 185

134-136 CTDO Processor: "Top 34db CTD oxygen questionable."

132 Delta-S at 84db is 0.1121, salinity is 35.448. Other data are acceptable. Gradient area, water mixing during bottle trip.

120 Sample log: "Leaking from bottom." Delta-S is .0162, spike in CTD up trace, footnote CTD salinity bad. No CTDO is calculated because the CTD Salinity is coded bad. Other data are acceptable.

104 Sample log: "Leaking from bottom." Oxygen as well as other data are acceptable.

103 Sil low ~3 um/l, 6.5 um/kg. Footnote silicate questionable.

APPENDIX E: CRUISE UPDATES

WEEKLY REPORT 1
1993 JUL 10

Left Dutch Harbor on 5 July and headed northwest to 59 N, 174 W. Made an instrument test station on the way, by lowering the CTD and tripping 12 Rosette bottles each at 2260 m, 500 m and 100 m to check on repeatability of results, with good success. Minor difficulties with the pylon were resolved quickly. From 59 N, 174 W the ship turned SSW toward Amchitka Pass, making the first high- resolution, top-to-bottom hydrographic section through the deep Bering Sea. There is a hint of measurable freons and increased oxygens below about 3300 m. suggesting possible ventilation of the bottom waters. If this preliminary finding is upheld by further careful analysis, it will require revising some previously held notions about deep water formation in the Bering Sea. - Roden

WEEKLY REPORT 2
1993 JUL 18

Left the Bering Sea through Amchitka Pass, transected the subarctic domain and crossed the subarctic front at 41-30 N. The subarctic front was marked by the outcrop of the subarctic halocline, the disappearance of the sub-surface temperature minimum and the rapid southward descent of the sound channel axis. As expected, there was a marked decrease in silicate concentrations when crossing from the Bering Sea into the North Pacific. In Amchitka Pass, strong currents and tidal mixing caused low surface temperatures and sharply reduced the intensity of the oxygen minimum.

The weather was good during the first 12 days and we averaged 4 stations a day. Then we were beset by winds of 40 - 50 kn and seas of 20 - 30 ft. This resulted in only a single station per day. The outlook is for improving weather and already the winds have decreased to 30 kn and the seas subsided to under 20 ft and the spirit aboard is high. There have been no major equipment problems so far. - Roden

WEEKLY REPORT 3
1993 JUL 26

Transected the subarctic-subtropical transition zone and encountered Kuroshio origin waters near 35.30 N. Preliminary geostrophic calculations indicate an eastward current component of about 40 cm/s. It is not yet clear, whether this is a branch of the Kuroshio or an energetic eddy shed by it. The subtropical front was crossed at about 31.30 N. It was marked by a temperature difference of 3 C, a salinity difference of 0.6 psu and an eastward flow component of about 30 cm/s. The front was located about 180 nm north of the tradewind boundary, which occurred near 28.30 N.

The weather during the last week has been exceptionally good and the work is progressing on schedule and the equipment is working satisfactorily. In these remote subtropical latitudes the night sky is very clear, with a beautiful display of the Milky Way and thousands upon thousands of bright stars visible to the unaided eye. Venus is so bright that when it is near the horizon, it can be mistaken for a ship's light. - Roden.

WEEKLY REPORT 4
1993 AUG 1

Reached latitude 15 N today on the transect through the subtropical gyre. A preliminary examination of the section completed so far showed several regions of strong zonal flow components. Maximum geostrophic speeds were 54 cm/s in the Alaska Stream, 30 cm/s in the subarctic current near 42 N, 48 cm/s in the Kuroshio extension near 35.30N, and 41 cm/s in the vicinity of the subtropical front near 32 N. Several mesoscale eddies with speeds in the 20-30 cm/s range were observed also.

The light transmissometer does not work well in tropical latitudes. It shows consistently a prominent minimum between 400 and 1200 m. First I thought it might be real, but after a week of thinking I could not come up with a plausible answer. Then I noticed that the feature occurred only on the downtrace, not the uptrace. Finally, we decided to stop the CTD at 700 m, where the minimum was most pronounced and see what happens. Sure enough, in about 5 minutes, the minimum disappeared. This obviously is a temperature compensation effect on the instrument. One obviously can design any kind of transmission minimum trace by simply varying the lowering speed. This clearly is not acceptable. So I urge all WOCE participants using the light transmissometer in tropical latitudes to take the results with two grains of salt and lots of water. -Roden

WEEKLY REPORT 5
1993 AUG 8

Working in the doldrums at a rate of 4 to 5 stations a day, spaced at intervals of 15 nm. A very sharp transition between the North Pacific intermediate salinity minimum and the subsurface salinity maximum from the South Pacific occurred at 11 N. The doldrum trough started at 9 N and at 5 N we are still in it. So far, there has not been any sign of a well defined north equatorial counter current, but I expect to encounter it soon.

There is a conspicuous absence of seabirds at this longitude. Between 50 N and 5 N I have seen only a dozen birds or so. Flying fish are very scarce here, too, and only an occasional school of mahi-mahi and tuna has been sighted. Squid, however, are plentiful.-Roden

WEEKLY REPORT 6
1993 AUG 14

After 38 days at sea put into Tarawa on 11 August to change some of the scientific and ship's crew. We have completed 130 stations so far, without the loss of a single station due to weather. In Tarawa, invited 10 government ministers aboard the ship for lunch, stated the intent of our visit, the goal of our research and explained to them the scope of WOCE. They greatly appreciated this information and I found this is the least we could do for them for granting us clearance to do research in their economic interest zone. The government officials reciprocated this courtesy by inviting us for a first class performance of their traditional songs and dances of war, fishing and young people's yearnings. An expedition is more than just scientists counting the number of completed stations and administrators counting the total of leftover cents. It also involves person-to-person contact, the building of goodwill between nations and the sharing of scientific information with them for the betterment of their economic status. - Roden

WEEKLY REPORT NO.7
1993 AUG 22

Crossed the equator on the way south and added five stations along the equator to understand better the circulation and property distributions. At the equator itself, strong eastward flow was observed both at the surface and the core of the undercurrent, with a minimum in between. The weather at the equator was unsettled, with frequent heavy showers and generally light and variable winds, except neat squall lines, where they were brisk. The thermohaline structure between 2 N and 2 S is exceedingly complex in the upper 1500 m, with many step- like features, apparently created by a combination of shear induced turbulence and frontal interleaving. Between 5 and 3 N general eastward flow was observed.

After taking 150 stations, the CTD wire developed multiple shorts and 4300 m had to be cut off, leaving 4500 m on the drum. Fortunately we have another winch with 8500 m of CTD wire aboard, so this will not affect our top-to-bottom sampling.

At latitude 0 degrees, longitude 180 degrees we had a traditional golden shellback ceremony, initiating 12 neophytes, this P.I. included, into the realm of King Neptune and Queen Amphitrite - Roden

WEEKLY REPORT 8
1993 AUG 29

After working stations from the frigid waters of the northern Bering Sea to the balmy South Pacific, covering more than 11000 km, took the last station of P14N in view of Vanua Levu island, Fiji. A fishing net blocked our way, so found it prudent to shift the station 2 miles north, to avoid entangling the CTD in the net. All together, we have made 199 CTD casts to the bottom, took 40 tritium/helium samples, determined chlorofluorocarbons at 125 stations and C02 and alkalinity at 73 stations, deployed 12 Rafos and 12 Alace floats, lowered the ADCP, depth permitting, more than 100 times and kept a detailed meteorological log at each station66.146. With the exception of the light transmissometer, which failed in the tropics, all the instruments worked well. The successful conclusion of a cruise of such complexity is due to the high competence and the team spirit of the diverse scientific groups aboard and to the unstingy help of the Captain and crew of the R/V Thomas G. Thompson. To each and all of them, I give my heartfelt thanks. - Roden

LIGHT TRANSMISSION PROBLEM
1993 AUG 19
(Wilf Gardner, Mary Jo Richardson)

In a recent report on WOCE P14N progress Gunner Roden commented on a prominent minimum in light transmission between 400 and 1200 m which occurred on the downtrace, but not on the uptrace with the CTD. We have been aware of this problem (disaffectionately known as "the nose") and have been working with the manufacturer-- "Pl4N thought we had isolated the problem to excessive heating of the transmissometer by exposure to the sun prior to deployment because during an equatorial cruise last year, 30 profiles out of 130 contained the transmission minimum, and 29 of them were made during daylight hours. We relayed this information to ODF personnel, but they still had the problem when the rosette was completely protected from the sun between deployments. The problem still seems related to temperature differentials and may involve moisture condensation. In any case, the minimum is not repeated on the upcast after the instrument has been at relatively constant temperatures for a long period of time. For that reason, we use the upcast data when the minimum occurs. This makes our data processing more time consuming, because we also use temperature- time algorithms on time-based (rather than pressure- based) data, but ODF has been very helpful in providing the necessary information to produce accurate data. These data have resulted in the publication of two theses and several papers. We understand that this problem does not occur with the 2000 m transmissometers and have encouraged SeaTech to resolve the problem with the deep units ASAP.

WHPO Data Processing Notes

Date	Contact	Data Type	Data Status Summary
2/4/98	Top	TRITUM	Submitted
2/6/98	Top	TRITUM	More Data Rcvd
8/17/98	Roden	CTD/BTL	Data are Public
11/24/98	Diggs	CTD/BTL*	Public except: CFCs/He/Tr *S/O, NUTs

Your data (both bottle and ctd) files are now unencryted on the WHPO website. The CFCs, Helium and Tritium values have been removed and we would like to know if these parameters should be included in the public bottle files.

Date	Contact	Data Type	Data Status Summary
2/7/99	Anderson	NUTs/S/O	DQE Begun
2/10/99	Anderson	SUM/BTL	Reformatted by WHPO

I have reformatted P12 (S04, SR03, PR12). Arnold is DQEing that line now.
I have reformatted P14N. George will DQE that line next.

.sum
* Changed EXPOCODE from 325023/1 and 325024/1 to 325023_1 and 325024_1.
* Adding and/deleting columns to make conform with the WHPO standard format.
* Added time stamp.
* Ran over sumchk with no errors.

.sea
* Changed EXPOCODE from 325023/1-24/1 to 325023_1-24_1.
* Format looks ok
* Added time stamp.
* Ran over wocecvt with no errors.

Date	Contact	Data Type	Data Status Summary
4/6/99	Bartolacci	BTL	Data Update

Changed date from 082285 TO 082993 to 082293 TO 082993
moved current .hy file to original/p14nhy_moved1999.04.06.txt
moved current .su file to original/p14nsu_moved1999.04.06.txt_ANDERSON/P12 or P14N

Date	Contact	Data Type	Data Status Summary
1/11/00	Bartolacci	BTL	Data Update; file w/ non-pub params reformatted

Because it appears that Sarliee reformatted a version of the bottle file that had parameters "masked out" (which means that they were replaced with 9's) and not encrypted, and the old file which contained all the original values was not clearly marked, the file called p14nhy_ALL_PARAMETERS_1998.11.24.txt was reformatted according to her comments below, run thru wocecvt with no errors and renamed p14nhy_ALL_PARAMETERS_1998.11.24_edt.txt. This file which appears to have all current values in it was then copied to p14nhy_2000.01.11_usd_to_mask.txt.

This file was copied once, had helium and tritium data masked out and was moved to the parent directory and renamed p14nhy.txt.

p14nhy_2000.01.11_usd_to_mask.txt was also encrypted to make the new nonpublic version of the entire data set, renamed p14nhy.asc and moved to the parent directory.

p14nhy_2000.01.11_usd_to_mask.txt is the most recent version of the bottle file at this date in time!

Date	Contact	Data Type	Data Status Summary
1/11/00	Bartolacci	CFCs	Data are Public
4/19/00	Bartolacci	DELC14	Website Updated

P14N Changed to indicate no samples collected.

5/9/00	Kozyr	CO2	Final Data Rcvd @ WHPO

TCARBN, ALKALI, and pHI have put the final CO2-related data file for the Pacific Ocean WOCE Section P14N to the WHPO ftp INCOMING area. There are three CO2 parameters in the file: Total CO2, Total Alkalinity, and pH (measured @25deg.C) with quality flags. Please let me know if you received the data okay.

I still owe you P6E,W,C carbon data, but I do not have any words from Doug Wallace yet.

Marilyn Roberts from NOAA/PMEL will send you their data from P16N, P18, and P14S 15S cruises soon. So, we almost done for the Pacific.

6/30/00	Bartolacci	CO2	Website Updated

new carbon data merged/onlineBottle: (tcarbn, alkali, ph, qualt1, qualt2)

Carbon data sent by Alex Kozyr on 2000.05.09 was merged into current bottle file. Original data file sent by Kozyr had incorrect header on both TCARBN and ALKALI and needed editing (as per his email). One version of merged bottle file was encrypted and one version had he/tr data masked out (public file). All files and tables were updated to reflect the new values. Merging notes are located in README file in "original" subdirectory for this line.

8/23/00	Warner	DOC	Doc Update

cfc reports submittedThe directory this information has been stored in is:
20000823.165536_WARNER_P14N

The format type is: ASCII

The data type is: DOCFile Other Type of Data

Here is the information regarding the 'OTHER' format:
Submitting only CFC data with Sample = 100*Castno +BottleNo

The Bottle File has the following parameters: CFC-11, CFC-12
WARNER, MARK would like the data PUBLIC.
And would like the following done to the data: Merge data, update data files

4/11/01	Crease	Cruise ID	Clarification Request

Maintain current Expocodes; see note: They seem to have numbered cruises from launch in 1991. As the ship schedule for 1993 shows them as two separate cruises (both under Roden) it makes sense to go with the 23 24 numbering you have, Jerry.

06/19/01	Swift	CTDTMP	Update Needed

An oceanographically-insignificant error in CTDTMP data for this cruise has been found (ca. -0.00024*T - 0.00036 degC). A data update is forthcoming. In the interim the corrected data files can be obtained from: ftp://odf.ucsd.edu/pub/HydroData/woce/crs

06/20/01	Johnson	CTD	Data Update; Processing error corrected

revised data available by ftp ODF has discovered a small error in the algorithm used to convert ITS90 temperature calibration data to IPTS68. This error affects reported Mark III CTD temperature data for most cruises that occurred in 1992-1999. A complete list of affected data sets appears below.

ODF temperature calibrations are reported on the ITS90 temperature scale. ODF internally maintains these calibrations for CTD data processing on the IPTS68 scale. The error involved converting ITS90 calibrations to IPTS68. The amount of error is close to linear with temperature: approximately -0.00024 degC/degC, with a -0.00036 degC offset at 0 degC. Previously reported data were low by 0.00756 degC at 30 degC, decreasing to 0.00036 degC low at 0 degC. Data reported as ITS90 were also affected by a similar amount. CTD conductivity calibrations have been recalculated to account for the temperature change. Reported CTD salinity and oxygen data were not significantly affected.

Revised final data sets have been prepared and will be available soon from ODF (ftp://odf.ucsd.edu/pub/HydroData). The data will eventually be updated on the whpo.ucsd.edu website as well. IPTS68 temperatures are reported for PCM11 and Antarktis X/5, as originally submitted to their chief scientists. ITS90 temperatures are reported for all other cruises.

Changes in the final data vs. previous release (other than temperature and negligible differences in salinity/oxygen):

S04P: 694/03 CTD data were not reported, but CTD values were reported with the bottle data. No conductivity correction was applied to these values in the original .sea file. This release uses the same conductivity correction as the two nearest casts to correct salinity.

AO94: Eight CTD casts were fit for ctdoxy (previously uncalibrated) and resubmitted to the P.I. since the original release. The WHP- format bottle file was not regenerated. The CTDOXY for the following stations should be significantly different than the original .sea file values:

009/01
013/02
017/01
018/01
026/04
033/01
036/01
036/02

I09N: The 243/01 original CTD data file was not rewritten after updating the ctdoxy fit. This release uses the correct ctdoxy data for the .ctd file. The original .sea file was written after the update occurred, so the ctdoxy values reported with bottle data should be minimally different.

DATA SETS AFFECTED:

WOCE Final Data - NEW RELEASE AVAILABLE:

WOCE Section ID	P.I.	Cruise Dates
S04P	(Koshlyakov/Richman)	Feb.-Apr. 1992
P14C	(Roemmich)	Sept. 1992
PCM11	(Rudnick)	Sept. 1992
P16A/P17A (JUNO1)	(Reid)	Oct.-Nov. 1992
P17E/P19S (JUNO2)	(Swift)	Dec. 1992 - Jan. 1993

P19C	(Talley)	Feb.-Apr. 1993
P17N	(Musgrave)	May-June 1993
P14N	(Roden)	July-Aug. 1993
P31	(Roemmich)	Jan.-Feb. 1994
A15/AR15	(Smethie)	Apr.-May 1994
I09N	(Gordon)	Jan.-Mar. 1995
I08N/I05E	(Talley)	Mar.-Apr. 1995
I03	(Nowlin)	Apr.-June 1995
I04/I05W/I07C	(Toole)	June-July 1995
I07N	(Olson)	July-Aug. 1995
I10	(Bray/Sprintall)	Nov. 1995
ICM03	(Whitworth)	Jan.-Feb. 1997

non-WOCE Final Data - NEW RELEASE AVAILABLE:

Cruise Name	P.I.	Cruise Dates
Antarktis X/5	(Peterson)	Aug.-Sept. 1992
Arctic Ocean 94	(Swift)	July-Sept. 1994

Preliminary Data - WILL BE CORRECTED FOR FINAL RELEASE ONLY

NOT YET AVAILABLE:

Cruise Name	P.I.	Cruise Dates
WOCE-S04I	(Whitworth)	May-July 1996
Arctic Ocean 97	(Swift)	Sept.-Oct. 1997
HNRO7	(Talley)	June-July 1999
KH36	(Talley)	July-Sept. 1999

"Final" Data from cruise dates prior to 1992, or cruises which did not use NBIS CTDs, are NOT AFFECTED.

Post-1991 Preliminary Data NOT AFFECTED:

Cruise Name	P.I.	Cruise Dates
Arctic Ocean 96	(Swift)	July-Sept. 1996
WOCE-A24 (ACCE)	(Talley)	May-July 1997
XP99	(Talley)	Aug.-Sept. 1999
KH38	(Talley)	Feb.-Mar. 2000
XP00	(Talley)	June-July 2000

6/22/01 Uribe CTD/BTL Website Updated

CSV File AddedCTD and Bottle files in exchange format have been put online

8/29/01 Top NEON Data are Public

Status changed to PublicZafer - Is it safe to assume that all WOCE One-Time Survey neon data from you are now public? Jim

Yes they are. Zafer

9/26/01	Top	He/Tr	Data are Public

Zafer Top

Steve: Yes, you did bug me before about this! All data should have been public since 1998, and if they haven't then they should be!

From Steve Diggs:

I was asked the following question regarding Roden's 1993 cruise from Fiji aboard the Thompson:

"Steve, The table says P14N HeTr are still Non-Public and has both an encrypted file and a public bottle file. Data History has note from Zafer Top saying neon data is public (Aug 29, 2001) but can see no mention of Helium or Tritium. Do I need to merge the CFCs into both the Public and Non-Public Bottle files or is there chance that the data is now all public? Dave"

So, are your He/Tr data for P14N public, or would you like for them to be held as encrypted data? Please let me know and sorry if we've bugged you about this before.

10/1/01	Muus	BTL/CFC	Data Merged into BTL file

CFC's merged into BTL, CSV File Added, He/Tr now publicMerged July 2001 CFCs into bottle file, made new exchange file and placed both on web. Helium and Tritium are now public.

Notes on P14N CFC merging Sept 28, 2001. D. Muus

1. New CFC-11 and CFC-12 from:

   /usr/export/html-public/data/onetime/pacific/p14/p14n/original/20010709_CFC_UPDT_WISEGARVER_P14N/20010709.173146_WISEGARVER_P14N/20010709.173146_WISEGARVER_P14N_p14n_CFC_DQE.dat

   merged into encrypted SEA file taken from web Sept 26, 2001 (20000628WHPOSIODMB)

2. Helium & Tritium data confirmed public by Zafer Top Sept 26, 2001, so newly merged file need not be encrypted.

   All "1"s in QUALT1 changed to "9"s and QUALT2 replaced by new QUALT1 prior to merging.

3. Exchange file checked using Java Ocean Atlas.

1/15/02	Uribe	CTD	Website Updated

CSV File AddedCTD has been converted to exchange using the new code and put online.

3/22/02	Anderson	NUTs/S/O	Cannot do DQE

JK emailed J.Swift for alternatesI checked my files at ODF for information on P14N. It would appear that I never got to the DQE work on this cruise. I got the files and was ready to roll, when I got pulled off ODF work to work for my present boss. His funding was restored to a level where I could work for him full time and he insisted on it.

I don't know if there is anyone else who could work on this cruise, but I certainly couldn't get to it before August. I can talk to Jim about this if you like, but doing the DQE work on this cruise soon isn't likely.