HLY-03-03, SBI Mooring Cruise. 11 Sep – 19 Oct, 2003
CTD and Water Sampling Summary

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Introduction

This report describes the hydrographic sampling program carried out on the 2003 Shelf-Basin Interactions (SBI) mooring cruise. This was the second in a series of cruises designed to study the manner in which the Arctic shelves and the open Arctic communicate with each other and how this might be influenced by climate variability. The cruise took place from 11 September through 19 October, 2003. The principal investigator was Rebecca Woodgate, University of Washington, Seattle. Co-principal investigator was Robert Pickart of the Woods Hole Oceanographic Institution (WHOI), Woods Hole, Massachusetts.

A total of 321 CTD stations with bottom depths ranging from 25m-–3000m were collected on the cruise. Water samples were taken at 172 of the stations. Water sample measurements included dissolved oxygen, salinity, nutrients, chlorophyll and phaeopigments, although not all samples were collected from every bottle. CTD casts typically went to within 2m–5m of the ocean floor; however, in the deeper water certain sets of stations were only lowered to 600m. CTD casts taken for the purpose of calibrating the temperature and salinity sensors on the profiling moorings were not lowered to the full bottom depth.

CTD Package

CTD and water sample data were collected using a Seabird 911+ system operating at 24Hz scan rate, with a 24-position rosette package and 22 10-liter Niskin bottles. In addition to a dual set of pumped temperature and conductivity sensors, the CTD had a SBE43 oxygen sensor pumped in-line with the primary temperature and conductivity sensors, a WetLabs CST transmissometer, an Aquatraka fluorometer, and a Simrad altimeter. For some of the stations an SBE35 temperature sensor, attached near the CTD's temperature sensors, acquired data at the bottle-stops, but the data were kept apart from the CTD data and downloaded to separate files. Separate from the CTD system, the frame also carried internally recording upward- and downward-looking RDI workhorse ADCPs and their common battery pack. A backup frame with mounted CTD and auxiliary sensors was onboard, but fortunately its use was never required. See Appendix A for sensor serial numbers and other details on CTD configuration.

Data Acquisition and Processing Procedures

Upon reaching station, the rosette was brought out of the hanger and the CTD was powered on and data acquisition started. The sensors were soaked for three minutes at 10m after the pumps turned on. The CTD frame was then raised back to the near–surface (between 2m and 5m) and lowered at 30m/min to 100m and then at 60m/min deeper than this. The descent rate was slowed to 30m/min approximately 60m off the bottom, and slowed further at 10m off the bottom. The consistently good performance of the altimeter provided by Scripps along with the careful attention of the CTD and winch operators made it possible for maximum CTD depths within 1 to 5m of the bottom, depending on sea state. The bottom bottle was fired immediately and subsequent bottles were closed after waiting 30 seconds at each stop. The 'surface' bottle was taken at 10m to avoid the extremely large surface gradients and the change in water properties due to ship's presence (for example, the propeller wash). The CTD was turned off after the package was landed on deck, and the water sampler was then rinsed with fresh water and the package returned to the heated hanger for sampling.

The CTD data were acquired and processed with Seabird software on a PC platform with further processing using routines written in Matlab® (The MathWorks Inc.) Acquisition occurred in real time through a conducting cable from the CTD to a PC running Seasave-Win32_V5_27c. The ship's GPS position was added to each data scan via the National Marine Electronics Association (NMEA) interface. Upon completion of the station, the data were copied via the ship's network to the processing PC. Seabird's Windows-based processing software, SBEDataProcessing-Win32_V5_29b, was then used to produce 1decibar-averaged downcast and upcast profiles. The standard processing steps followed at sea were: sensor alignment through advancing conductivity; spike removal; a correction for the thermal mass of the temperature sensors; filtering; removal of pressure reversals; calculation of oxygen; averaging to 1 db levels; calculation of other derived properties; and separation of each station file into downcast and upcast profiles.

Data Files

*.dcc CTD downcast, 1-m averaged, one file per station.
*.nut Water sample file per station with CTD data from upcast bottle stops
Cruise summary file of all CTD stations, which includes comments per station
Event log of XBTs
Event log of Moorings
Event log of VPR casts
Event log of Net tows

CTD Data Quality

Overview

The CTD system performed very well. The dual sensors played an important role in data quality checking, helping to distinguish between sensor error and a real signal, and providing continuity when water samples were not taken. Factors that affected the data quality were as follows.

- Although outside air temperatures were often just below freezing, the sensors did not experience any noticeable cold weather problems.

- Jellyfish, with their long tentacles, became entangled in the frame regularly and temporary errors in sensor data were predominantly due to this biofouling

- There were density inversions over short pressure intervals in the raw downcast data and differences in salinity seen between the downcast and upcast profiles (comparable to pressure offsets of 5–10m). These were both thought to be due to the combination of large vertical gradients in salinity in the upper 200m and the fluid dynamics around the frame. A reduction in the inversions was observed when unused Niskin bottles were left off the frame, presumably reducing the turbulence associated with the package moving through the water. The majority of inversions were removed through the standard Seabird data processing steps and do not appear in the processed data. The remaining inversions were manually interpolated over**.** This is covered in detail later in the report. The downcast profile is more accurate than the upcast profile because of its reduced wake disturbance around the CTD sensors. At the bottle stops, the 30–second wait before closing bottles shows the upcast measurements to return to the downcast values.

The complete station-by-station comments can be found in Appendix C. The 'highlights' are:

- A wire re-termination after station 1, and after a jarring roll during deployment of station 254.
- CTD frame had contact with the bottom at 60m/min at station 180. Comparisons of the dual sensors and down and up profiles show no consequences from this inadvertent landing.
- Station 79 and 80, lowering rate reduced to 10m/m to examine a density inversion issue.
- Station 100, inversion
- Station 156, sensors flushed to remove jellyfish parts. After station 263, jellyfish parts removed from the tygon tubing between the oxygen sensor and the pump from the primary system.
- Station 212 and 213, high sediment load in water due to a recent storm compromised oxygen and nutrient water samples.
- Stations 215, Primary T and C bad between 20 and 50m. Uptrace OK
- Station 225, 140m odd downcast
- Station 271 to 321, bottles were cocked in a new way with endcaps further away from the bottle openings. This alternate way provided a greater opening for better bottle flushing, however it resulted in two bottles improperly closing.
- Sta 284 to 286 oxygen reagent bottles cleaned
- Sta 288 real feature at 190 to 200db

Conductivity

Sensors were calibrated by Sea-Bird Electronics, Inc. in May 2003. Throughout the cruise, deep stations were taken intermittently to provide suitable conductivity data for in-situ calibration. Only one calibration was needed for the entire cruise. The results are shown in the table below. Due to the existence of steep gradients in the shallow parts of the profile, it was decided that only bottle salinity measurements taken deeper than 300 db would be used to calibrate CTD salinity. Calibration coefficients were generated using 135 bottle salinities from the following 28 stations: 31-34, 119, 120, 122, 123, 195, 219-226, 272-279, and 282-284. Six bottle salinity measurements were not used since their differences exceeded the average by more than 2.8 times the standard deviation. After applying calibrations, deep conductivities from the primary sensor were determined to be accurate to 0.0015 mS/cm with deep salinities accurate to 0.0019 PSU. These are within the manufacturer's specified accuracy of 0.003 mS/cm for conductivity. Sensor performance at these conductivities is very similar to that observed during AWS02 (0.007 PSU), and it is assumed that performance at lower conductivities (i.e., higher in the water column) was similar too. See the report for a complete explanation. For the secondary sensor, deeper conductivities are accurate to less than .001 mS/cm and deeper salinities to .0013 PSU (excluding stations 221 to 224, which gave inaccurate data likely due to bio-fouling.)

Table 1. Conductivity Calibration Results

Sensor	#pts	totl	stddev	bias	slope	Pressure correction
Primary	129	135	0.00091	0.007345	0.999862	-6.7876E-07
Secondary	107	135	0.00079	0.002306	1.000091	-4.2237E-07

Conductivity calibration terms are applied in formula:
calibrated conductivity = (raw conductivity * slope) + bias + (pressure correction coefficient * ctd pressure)

Temperature

Temperature sensors were calibrated by Sea-Bird Electronics, Inc. in May 2003. The primary and secondary temperature sensors were extremely stable throughout the cruise. Using bottle trip depths as comparison points, the difference between the primary and secondary temperatures in the low gradient water below 300 db (between –0.5°C and 1ºC) were examined and showed negligible differences (mean of 0.00008ºC and a standard deviation of 0.0004ºC). A linear fit to the differences over the length of the cruise show no drift (a total change of -0.0003ºC), well within the sensor's expected accuracy of .001ºC.

Oxygen

The oxygen sensor has received a basic calibration using water samples from all depths following the Seabird Application Note Number 64-2. Two of the six coefficients, Soc and Voffset, were determined and the two coefficients tau and Boc were set to zero as suggested in the notes. Results of the calibration are shown in the table below. The results look good between 50 and 1000 dbar, with an offset of -0.03 and a standard deviation of 0.01. However there is a drift over time where CTD oxygens are reading 0.07 higher by the end of the cruise. Below 1000 dbar there is a pressure dependence that affects the samples strongly (0.4ml/l at 3000 dbar). An oxygen dependence could explain why the mean changes by 0.06 between the upper 50dbar (highest oxygen) and the 50-1000db region below.

Table 2. Oxygen Calibration. Results of single calibration to full depth are summarized by pressure intervals.

Pressure Interval (dbar)	Oxygen Range (ml/l)	#pts	total	Stddev (CTD-Bottle)	Mean (CTD-Bottle)
0-50	5.5 to 9.5	431	828	0.27	-0.03
50-1000	5.0 to 7.0	363	828	0.10	0.03
1000-3000	6.5 to 7.0	34	828	0.10	0.14
0-3000 (full)	5.0 to 9.5	828	828	0.21	0.01

Transmissometer

Transmissometer windows were wiped and cleaned intermittently and therefore the data should be used with caution. Prior to cleaning, the full–scale in-air reading could read 70 to 80% transmission. After cleaning, in-air reading was 95%. Window wiping was performed fairly regularly between stations 91 and 117 and less regularly for the rest of the cruise. Windows were washed with triton-X soap prior to stations 118, 123, 147, 176, and 298.

Fluorometer

The fluorometer windows received intermittent cleaning as well, with more regular window wiping between stations 91-117 and less frequent thereafter.

Density Inversions

Final processing of the data occurred after the cruise. First, it was necessary to manipulate water sample files using perl scripts to format the data for compatibility with the Matlab-based conductivity calibration routine. Next, differences between bottle conductivity and CTD conductivity for both sensors were calculated, plotted, and used to calibrate the conductivity sensors. Profiles of bottle salinity versus pressure were overlaid on profiles of CTD salinity to verify agreement. Finally, profiles of density were created to review data for density inversions caused by instrument problems (e.g. clogged sensors) or turbulence. Density inversions were found in twelve stations. Profiles of downtrace- and uptrace-, primary- and secondary-salinity versus pressure were compared to help determine primary salinity values that needed to be removed to eliminate the inversions. Table 3 shows the pressure values at which salinities were interpolated for the twelve stations.

Table 3: Salinities interpolated to remove density inversions.

Calibrated downcast file	Pressures of interpolated salinities
sbi03126.dcc	336,343,354
sbi03128.dcc	680
sbi03134.dcc	591
sbi03145.dcc	333,342
sbi03195.dcc	Note: bump at 816 looks suspicious but appears in both sensors and is within uptrace salinity range
sbi03196.dcc	322,327,329-330,348
sbi03197.dcc	287-318, 413-420
sbi03198.dcc	331-334,343,346,348-354
sbi03207.dcc	304-313,334-350,371-379,585-592
sbi03223.dcc	432
sbi03230.dcc	549,561
sbi03300.dcc	341-343

The final CTD data files consist of 1-dbar averaged downtrace profiles for each station. In these files, the primary salinity is calibrated and inversions interpolated over; the oxygen data have had a rudimentary calibration performed (see below); and the fluorometer and transmissometer data are unedited.

Final Data Product

For ease of distribution, it was decided that quality –controlled final data files would be converted to WOCE Hydrographic Programme format. For these data, bad data flags were inserted and the quality word set to 9 to indicate despiked. Oxygen units were converted from ml/l to umol/kg. See the document "Final Data Description.pdf" for a complete description.

Water Sample Acquisition and Analyses

Overview

Water sampling began as soon as the CTD frame was brought into the hanger. Oxygens were sampled first, followed by chlorophyll, nutrients and salinity. Except for the last four stations, samples were analyzed on board and the results merged by Niskin bottle number with the CTD data to produce a single water sample file. Nutrients from the last four stations, 318 to 321, were frozen and analyzed ashore. See Appendix D for details on methods used for salinity, nutrient, and oxygen water samples.

Individual .nut files were created for each station in WOCE format. These files contain CTD pressure, temperature, and pre-calibrated salinity, along with bottle salinity, oxygen, and nutrients as sampled for each station.

Chlorophyll and Phaeopigments

Dean Stockwell, University of Alaska, Fairbanks

In-line Sampling from Uncontaminated Sea-water Line:

Sampling started on 21 Sept after the in-line fluorometer was turned on, and terminated on 17 Oct. Samples were collected approximately 4 times a day at 0500, 1100, 1700, and 2300 local. A total of 108 samples were collected and frozen. Samples will be analyzed ashore.

Appendix A. CTD Configuration.

Sensor Information

Primary CTD	**S/N**	**Last Cal**
SBE 9+	069	
Pressure	83012	9 Jan 01
Primary Temperature	2841	4 May 03
Primary Conductivity	2561	2 May 03
Secondary Temperature	2945	1 May 03
Secondary Conductivity	2575	2 May 03
Oxygen SBE43	458	21 May 03
Trans. Wetlabs CST	390DR	16 Apr 01
Fluor. Aquatracka	88234	19 Mar 01

Altimeter Simrad, 300m range (Scripps)

Sensor Heights on Frame

All heights are referenced from the bottom of the rosette frame.

Altimeter	2cm
Primary Temperature	9cm
Secondary Temperature	9cm
Pressure Port	18cm
Fluorometer	11cm
Transmissometer	32cm
LADCP Upper Head	83cm
LADCP Lower Head	2cm
Bottle Mid-point	111cm

TSG:

Jeremy Kasper compared TSG data with 10m CTD profile data and salinity samples taken from the flow through system.

Results are under tsg_calibration\tsg_aft_calsheet.xls

SBE35:

High resolution and accuracy temperature sensor brought out by Scripps.

Added at Station 119. Mounted directly over T+C intake, ~4 inches. It record data for 11 scans after bottle fire.

Appendix B-1. Individual Station Notes

CTD Stn #	Comments
1	Retermination after cast: Strand in cable jacket came loose during recovery. Data look fine.
2	
3	
4	
5	
6	
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8	
9	On deck 20 minutes before going in water.
10	On deck, primary conductivity reading higher than secondary conductivity.
11	
12	Niskin bottles 2 and 3 have noisy air intakes
13	
14	
15	
16	
17	
18	Cast at mooring site (Barrow Canyon)
19	Cast at mooring site (Chukchi Shelf)
20	Ladcp added prior to cast.
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22	
23	
24	
25	
26	
27	
28	Niskin1 on wrong latch, no sample.
29	
30	Cast at mooring site (Chukchi Shelf). No LADCP
31	Comparison cast with mounted EMCTD. 2 minute bottle stops
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46	May have touched bottom, altimeter read less than 1 m., CTD collected data 2-3 minutes before going in water.
47	
48	
49	Niskin 1 to 4 had vents left open. Oxy not drawn but other samples were taken.
50	
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62	Package redunked at end of cast to remove jellyfish
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78	
79	Lowering rate of 10m/m for this cast.
80	Lowering rate of 10m/m for this cast. All bottles removed from frame for stations 80-90.
81	
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83	
84	
85	
86	
87	
88	No good depth source
89	No good depth source
90	No good depth source
91	Cast at mooring site (Chukchi Shelf Break). New 10-bottle configuration on frame.
92	
93	
94	
95	

96	
97	
98	
99	Station 99 and 101 are in same location.
100	Cast at mooring site. Cast done out of section order. Its location is between stations 98 and 99.
101	Station 99 and 101 are in same location.
102	
103	
904	CTD data bad on first cast (renamed 904) so brought to the surface and relowered.
104	CTD data bad on first cast (renamed 904) so brought to the surface and relowered.
105	
106	
107	
108	Waited 2 minutes per bottle stop. Tested EMCTDs on this station.
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116	No valid depth reading; Oxygen samples may be compromised by having too much reagent MnCl2. Pipette setting should be on 1 but it may have been on 2.
117	No valid depth reading; Oxygen sample from Niskin 1 was compromised by having too much reagent MnCl2. Pipette setting should be on 1 but it may have been on 2.
118	Cast used to get good sound speed profile.
119	Comparison Cast with EMCTD 1337 and 1340. SBE35 temperature probe added to package. Bottle fire is wait 1 minute, fire, wait 1 minute then raise. 16 bottle fires, but only 10 water samples. LADCP removed from package.
120	Comparison Cast with EMCTD 1337 and 1358
121	Cast at mooring site BS7 for calibration purposes; No LADCP.
122	Comparison Cast with EMCTD 1313, 1337, 1355 and 1332.
123	Comparison Cast with EMCTDs 1333, 1343,1344,1346.
124	Comparion Cast with EMCTDs 1333, 1343, 1344, 1346. 13 bottle trips but no samples.
125	Comparison Cast with EMCTDs 1333,1337,1363,1346.
126	Comparison Cast with EMCTD 1341, 1343, 1344,1345.
127	Comparison Cast with EMCTDs 1332,1358,1355,1346.
128	Comparion Cast with EMCTDs 1313,1363,1341,1345.
129	Stopped at 1900m, started coming up, but then stopped and went back down to bottom. Confusion due to new operator matching pressure to bottom depth instead of using altimeter for bottom approach.
130	
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141	
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143	
144	Comparison Cast with Microcats. Bottle Stop 1.5 min wait, fire, 1 min wait. Ascent rate 30m/m. 2 Salts drawn but no other samples.
145	Comparison Cast with Microcats.
146	Comparison Cast with Microcats.
147	
148	
149	
150	
151	
152	Dunked a few times at surface to dislodge jelly fish.
153	
154	
155	
156	Prior to deployment, T+C sensors flushed to dislodge jelly fish bits.
157	
158	
159	
160	
161	Prior to deplyment, bottom contact alarm rang from the deck unit. Moisture was wiped out from between the pin and dummy plug to correct the situation. No following problems during cast.
162	
163	
164	
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171	
172	Comparison Cast with EMCTD 1313. Cast started in water at 10m soak.
173	
174	Comparison Cast with EMCTD 1313. Cast started in water at 10m soak.
175	Comparison Cast with EMCTD 1313
176	
177	Starting with this cast, the MSTs will be wiping the transmissometer and fluorometer windows, typically prior to deployment.
178	
179	
180	Touched bottom, at 60m/m. No obvious pre to post bottom shift. Seabeam had been reading incorrect depth of 651 prior to cast. (Last record is bad (320db), need to be removed or set equal to 319.)
181	
182	
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187	
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190	Comparison Cast with Microcat, 2 min bottle stop.
191	
192	
193	Comparison Cast with Microcat
194	
195	Comparison Cast with Microcat
196	
197	
198	
199	Depth finders are not working well, depth is suspect.
200	
201	
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206	
207	
208	
209	Seabeam depths are 976,874,945 at beginning, bottom and end of cast. Drift, wire angle as well.
210	LADCP back on package. Top of water sampler soaked in simple-green soapy bath prior to station to unstick releases (release 22 which operated bottle 21 was sticking)
211	
212	Beaufort Line restarted after break for bad weather. Sediments entrained in shallow water due to rough weather compromised oxygen and nutrient samples for first part of section.
213	
214	
215	Primary T+C Sensors bad on downtrace (between 20m and 50m) uptrace looks fine.
216	
217	
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219	
220	Corrected Bathy is 812. Depth discrepancy between Seabeam and Bathy
221	Corrected Bathy is 960. Depth discrepancy between Seabeam and Bathy.
222	
223	Bottle 13 did not trip.
224	
225	
226	
227	Only down to 600m
228	No LADCP for these stations.
229	
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231	
232	10 bottles removed, 12 left on. Vent plugs removed from those left on so bottles did not need to be cocked.
233	
234	

235	CTD sat on deck ~10 min before deployment.
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254	Start up LADCP again. Block swung hard during deployment due to the swell lifting the package then letting it fall, giving the wire a sharp flex and stress. No spikes or errors seen in data.
255	Wire reterminated prior to cast due to frayed cable wires near termination, probably a result of sharp rise and fall during station 254 deployment.
256	
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263	Jelly fish pulled out of tygon tubing between oxy and pump in Primary system. May not have affected anything. Noisy data at interface could be due to wake effects.
264	
265	
266	
267	
268	Jelly fish strands wrapped around vent plugs on recovery. Thoroughly hosed prior to next station.
269	Bottles 9 and 14 came up with bottom endcaps closed due to weak tension on lanyards. Rob tightened lanyards after cast. These bottles were not being used, so not an issue for water samples on this cast.
270	Test: extra bottles fired that had been cocked a more 'open' way. Bottle closed successfully without hanging up.
271	Starting this station, start cocking bottle in this alternate 'open' way.
272	
273	
274	
275	
276	Bottom-most 2 bottles are for nutrient analysis use
277	
278	
279	

280	Niskin 1-6 vents accidentally left open
281	CTD only down to 300m, not full depth
282	Package lowered past 10m soaking stage, so brought back to 10m for soak. Between 200 and 500 package lowered at 20m/m to see oxy sensor response at slower lowering rate.
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311	Niskin 3, bottom endcap did not close properly, likely due to the new way of cocking the bottles.
312	Went to bottom, came up 10m, went back down to bottom, firing a second bottle. First bottle is not good.
313	
314	
315	
316	
317	
318	No more LADCPs
319	
320	
321	

Appendix B-2. Additional Station Notes and informal XBT comments

Station 49: Transmissometer and Fluorometer window wiped after station
Station 9: New 10 bottle configuration on frame that leave a gap over the CTD sensors.
Stations 221-224: Secondary conductivity is very low compared to bottles, however primary conductivity looks fine.

Proccessing notes

Station 44

Salinity bottle 6 was sampled at a later time and thus the autosal drift correction program sets the value to nan. Edited the output 044.sal file with the correct salinity and 0 autosal drift.

Station 174

Pressure spike at 266db on uptrace. Removed from datcnv *.cnv file. Alters time base, but only by 1/24th of a second.

Station 265

Two autosalinometer readings made for sample taken for Niskin 1. Edited the output 265.sal file by removing first sample.

XBT

There were three bad/partial casts. These are included.

94 broke at 70m
99 T7 was bad (the Td at 99 which is at a different location, is ok)
146 is bad.

If you are checking consecutive numbers, these are missing:
104, 114, 120, 127, 129
These are double: 99, 113, 123

XBTs start at 91 and end at 155, for a total of 63 files.
(155-91+1)=65 less the 5 missing=60 plus the 3 doubles=63

Appendix D. Hydrographic Team Activity Report

CTD Sampling

A total of 548 samples were taken from CTD casts, with the depths chosen by the Chief Scientist. Of these samples, 48 were frozen for analysis ashore. The sample analysis protocol followed is the same as for the 2003 SBI process cruises as outlined on the JOSS webpage.

Salinity

A total of 1044 salinity samples were analyzed.

Materials and Methods

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

A Guildline Autosal 8400B #65-715, standardized with IAPSO Standard Seawater (SSW) batch P-141, was used to measure the salinities. Prior to the analyses, the samples were stored to permit equilibration to laboratory temperature, usually 8-20 hours. The salinometer contained a Guildline-supplied interface with ODF-developed acquisition software for computer-aided measurement. The salinometer was standardized with a new vial of standard seawater at the beginning and end of each run. The SSW vial at the end of the run was used as an unknown to check for drift. The salinometer cell was flushed until two successive readings met software criteria for consistency; these were then averaged for a final result. The estimated accuracy of bottle salinities run at sea is usually better than 0.002 PSU relative to the particular standard seawater batch used. A cursory review of the salinity data has been performed post-cruise. There are a couple questionable salinity runs and the data need further investigation.

Laboratory Temperature

The temperature stability in the salinometer laboratory was fair, sometimes varying as much as 4.5ºC during a run of samples. The laboratory temperature was generally 1-2ºC lower than the Autosal bath temperature.

Oxygen

A total of 839 samples were analyzed for oxygen.

Materials and Methods

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

Sampling and Data Processing

Samples were collected for dissolved oxygen analyses soon after the rosette was brought on board. Using a Tygon drawing tube, the nominal 125ml volume-calibrated iodine flasks were rinsed, then filled and allowed to overflow for at least three flask volumes. The sample draw temperature was measured with a small platinum resistance thermometer embedded in the drawing tube. Reagents were added to fix the oxygen before stoppering. The flasks were shaken twice to assure thorough dispersion of the precipitate—once immediately after drawing, and then again after about 20 minutes. The samples were usually analyzed within a few hours of collection. Thiosulfate normalities were calculated from each standardization and corrected to 20ºC. The 20ºC normalities and the blanks were plotted versus time and were reviewed for possible problems. New thiosulfate normalities were recalculated as a linear function of time, if warranted. The oxygen data were recalculated using the smoothed normality and an averaged reagent blank. Some problems were encountered during standardizations; however, deletion of errant standard values during post cruise data processing revealed an analytical error of less than one percent for the Thiosufate normality (and thus the samples). Oxygens were converted from milliliters per liter to micromoles per kilogram using the sampling temperature.

Volumetric Calibration

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

Standards

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

Nutrients

A total of 1036 samples were analyzed for nutrients.

Materials and Methods

Nutrient analyses (nitrate+nitrite, nitrite, ortho-phosphate, and silicate) were performed on an ODF-modified 4-channel Technicon AutoAnalyzer II, generally within a few hours after sample collection. Occasionally samples were refrigerated for longer periods, and the data are annotated if it was felt that this storage time had a significant effect. The analog outputs from each of the four channels were digitized and logged automatically by computer (PC) at 2-second intervals.

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

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

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

Sampling and Data Processing

Nutrient samples were drawn into 45 ml polypropylene, screw-capped “oak-ridge type” centrifuge tubes. The tubes were cleaned with 10% HCl and rinsed with sample three times before filling. Standardizations were performed at the beginning and end of each group of analyses (typically 6-24 samples) with an intermediate concentration mixed nutrient standard prepared prior to each run from a secondary standard in a low-nutrient seawater matrix. The secondary standards were prepared aboard ship by dilution from primary standard solutions. Dry standards were pre-weighed at the laboratory at ODF, and transported to the vessel for dilution to the primary standard. Sets of 7 different standard concentrations covering the range of sample concentrations were analyzed periodically to determine the deviation from linearity, if any, as a function of concentration for each nutrient analysis. A 3^{rd}-order correction for non-linearity was applied to the final nutrient concentrations when necessary. After each group of samples was analyzed, the raw data file was processed to produce another file of response factors, baseline values, and absorbances. Computer-produced absorbance readings were checked for accuracy against values taken from a strip chart recording. A stable deep seawater check-sample was run frequently as a substandard check.

Nutrients, when reported in micromoles per kilogram, were converted from micromoles per liter by dividing by sample density calculated at 1 atm pressure (0 db), *in situ* salinity, and an assumed laboratory temperature of 25ºC.

Nutrient Standards

Na_2SiF_6, the silicate primary standard, was obtained from Johnson Matthey Company and Fisher Scientific and was reported by the suppliers to be >98% pure. Primary standards for nitrate (KNO3), nitrite ($NaNO_2$), and phosphate (KH_2PO_4) were obtained from Johnson Matthey Chemical Company. The supplier reported purities of 99.999%, 97%, and 99.999%, respectively.

References for Water Sample Summaries

Armstrong, F. A. J., Stearns, C. R., and Strickland, D. H., “The measurement of upwelling and subsequent biological processes by means of the Technicon AutoAnalyzer and associated equipment,” *Deep-Sea Research*, 14, pp. 381-389, (1967).

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

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

Appendix D. Cruise Summary

USCGC HEALY CRUISE **HLY-03** SHELF BASIN INTERACTIONS

SHIP/CRS EXPO	STN	CAST	CAST TYPE	UTC DATE	TIME	EVENT CODE	POSITION LATITUDE	POSITION LONGITUDE	UNC DEPTH	MAX PRESS	HT ABOVE BOTTOM	NO. OF BOTTLES	PARAMETERS	COMMENTS
HLY03	1	1	CTD	Sep 14 2003	0021	BE	71 22.91 N	160 9.83 W						
HLY03	1	1	CTD			BO			45	42.16	5.09	5	Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	Barrow Canyon 1-17. Retermination after cast.
HLY03	1	1	CTD	Sep 14 2003	0037	EN	71 22.86 N	160 9.90 W						
HLY03	2	1	CTD	Sep 14 2003	0420	BE	71 21.29 N	160 6.67 W						
HLY03	2	1	CTD			BO			46	41.56	4.82	5	Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03	2	1	CTD	Sep 14 2003	0437	EN	71 21.21 N	160 6.75 W						
HLY03	3	1	CTD	Sep 14 2003	0549	BE	71 19.50 N	160 3.53 W						
HLY03	3	1	CTD			BO			49	45.11	4.68	4	Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03	3	1	CTD	Sep 14 2003	0604	EN	71 19.46 N	160 3.64 W						
HLY03	4	1	CTD	Sep 14 2003	0648	BE	71 17.91 N	160 0.10 W						
HLY03	4	1	CTD			BO			50	47.9	3.69	5	Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03	4	1	CTD	Sep 14 2003	0705	EN	71 17.76 N	159 59.92 W						
HLY03	5	1	CTD	Sep 14 2003	0742	BE	71 16.17 N	159 56.82 W						
HLY03	5	1	CTD			BO			57	54.41	3.82	4	Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03	5	1	CTD	Sep 14 2003	0758	EN	71 16.15 N	159 56.83 W						
HLY03	6	1	CTD	Sep 14 2003	0837	BE	71 14.47 N	159 53.51 W						
HLY03	6	1	CTD			BO			57	52.85	3.04	5	Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03	6	1	CTD	Sep 14 2003	0851	EN	71 14.48 N	159 53.46 W						
HLY03	7	1	CTD	Sep 14 2003	0930	BE	71 12.83 N	159 50.39 W						
HLY03	7	1	CTD			BO			53	50.8	2.64	5	Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03	7	1	CTD	Sep 14 2003	0944	EN	71 12.81 N	159 50.21 W						
HLY03	8	1	CTD	Sep 14 2003	1021	BE	71 11.11 N	159 47.23 W						
HLY03	8	1	CTD			BO			59	56.6	2.01	5	Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03	8	1	CTD	Sep 14 2003	1035	EN	71 11.07 N	159 46.94 W						
HLY03	9	1	CTD	Sep 14 2003	1153	BE	71 9.41 N	159 44.12 W						
HLY03	9	1	CTD			BO			79	76.55	1.98	6	Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	On deck 20 minutes before going in water.
HLY03	9	1	CTD	Sep 14 2003	1212	EN	71 9.40 N	159 43.13 W						
HLY03	10	1	CTD	Sep 14 2003	1323	BE	71 7.92 N	159 41.35 W						
HLY03	10	1	CTD			BO			60	57.53	2.88	5	Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	"On deck
HLY03	10	1	CTD	Sep 14 2003	1340	EN	71 7.95 N	159 40.62 W						
HLY03	11	1	CTD	Sep 14 2003	1431	BE	71 6.02 N	159 37.53 W						
HLY03	11	1	CTD			BO			61	57.75	3.55	5	Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03	11	1	CTD	Sep 14 2003	1451	EN	71 6.04 N	159 36.62 W						

HLY03 12 1	CTD	Sep 14 2003	1534	BE 71 4.44 N 159 34.68 W					
HLY03 12 1	CTD			BO	76	73.28	3.85	5 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	Niskin bottles 2 and 3 have noisy air intakes
HLY03 12 1	CTD	Sep 14 2003	1554	EN 71 4.37 N 159 34.00 W					
HLY03 13 1	CTD	Sep 14 2003	1636	BE 71 2.80 N 159 31.37 W					
HLY03 13 1	CTD			BO	77	72.72	3.24	6 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 13 1	CTD	Sep 14 2003	1658	EN 71 2.76 N 159 31.12 W					
HLY03 14 1	CTD	Sep 14 2003	1742	BE 71 1.02 N 159 28.21 W					
HLY03 14 1	CTD			BO	68	66.72	2.88	5 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 14 1	CTD	Sep 14 2003	1803	EN 71 1.08 N 159 27.81 W					
HLY03 15 1	CTD	Sep 14 2003	1846	BE 70 59.33 N 159 25.55 W					
HLY03 15 1	CTD			BO	55	51.59	3.01	5 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 15 1	CTD	Sep 14 2003	1906	EN 70 59.34 N 159 24.86 W					
HLY03 16 1	CTD	Sep 14 2003	1954	BE 70 57.74 N 159 22.27 W					
HLY03 16 1	CTD			BO	47	46.43	2.83	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 16 1	CTD	Sep 14 2003	2010	EN 70 57.84 N 159 21.48 W					
HLY03 17 1	CTD	Sep 14 2003	2047	BE 70 56.20 N 159 19.57 W					
HLY03 17 1	CTD			BO	36	34	2.34	5 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 17 1	CTD	Sep 14 2003	2104	EN 70 56.37 N 159 18.57 W					
HLY03 18 1	CTD	Sep 14 2003	2327	BE 71 3.00 N 159 31.16 W					
HLY03 18 1	CTD			BO	75	72.57	2.8	0	Cast at mooring site
HLY03 18 1	CTD	Sep 14 2003	2340	EN 71 3.03 N 159 30.12 W					
HLY03 19 1	CTD	Sep 15 2003	1813	BE 73 20.27 N 166 4.58 W					
HLY03 19 1	CTD			BO	68	66.59	2.09	0	Cast at mooring site
HLY03 19 1	CTD	Sep 15 2003	1826	EN 73 20.23 N 166 4.28 W					
HLY03 20 1	CTD	Sep 16 2003	0948	BE 72 59.97 N 166 54.52 W					
HLY03 20 1	CTD			BO	61			5	Chukchi Shelfbreak 20 - 29
HLY03 20 1	CTD			EN					Extra bottles removed at some point. Ladcp added for 20.
HLY03 21 1	CTD	Sep 16 2003	1125	BE 73 06.23 N 167 02.98 W					
HLY03 21 1	CTD			BO	62			4	
HLY03 21 1	CTD			EN					
HLY03 22 1	CTD	Sep 16 2003	1249	BE 73 12.48 N 167 12.23 W					
HLY03 22 1	CTD			BO	65			5	
HLY03 22 1	CTD			EN					
HLY03 23 1	CTD	Sep 16 2003	1414	BE 73 18.88 N 167 20.99 W					
HLY03 23 1	CTD			BO	807				
HLY03 23 1	CTD			EN					

HLY03 24 1	CTD	Sep 16 2003	1537	BE	73 25.26 N 167 29.58 W					
HLY03 24 1	CTD			BO		104			8	
HLY03 24 1	CTD			EN						
HLY03 25 1	CTD	Sep 16 2003	1700	BE	73 31.78 N 167 38.54 W					
HLY03 25 1	CTD			BO		120			10	
HLY03 25 1	CTD			EN						
HLY03 26 1	CTD	Sep 16 2003	1858	BE	73 38.24 N 167 47.86 W					
HLY03 26 1	CTD			BO		141			8	
HLY03 26 1	CTD			EN						
HLY03 27 1	CTD	Sep 16 2003	2039	BE	73 44.79 N 167 57.52 W					
HLY03 27 1	CTD			BO		161			8	
HLY03 27 1	CTD			EN						
HLY03 28 1	CTD	Sep 16 2003	2225	BE	73 51.17 N 168 07.12 W					
HLY03 28 1	CTD			BO		175			9	Niskin1 on wrong latch
HLY03 28 1	CTD			EN						
HLY03 29 1	CTD	Sep 17 2003	0038	BE	73 57.58 N 168 16.50 W					
HLY03 29 1	CTD			BO		188			8	
HLY03 29 1	CTD			EN						
HLY03 30 1	CTD	Sep 17 2003	1605	BE	73 36.96 N 166 02.29 W					
HLY03 30 1	CTD			BO		106				Cast at mooring site No LADCP
HLY03 30 1	CTD			EN						
HLY03 31 1	CTD	Sep 18 2003	0749	BE	74 34.19 N 163 35.51 W					
HLY03 31 1	CTD			BO		1013	1010.94	4.18	15 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	Comparison cast with mounted EMCTD.
HLY03 31 1	CTD	Sep 18 2003	0905	EN	74 34.20 N 163 35.57 W					Two-minute bottle stops
HLY03 32 1	CTD	Sep 18 2003	1027	BE	74 29.48 N 163 59.90 W					
HLY03 32 1	CTD			BO		619	618.59	4.11	8 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 32 1	CTD	Sep 18 2003	1109	EN	74 29.48 N 163 59.84 W					
HLY03 33 1	CTD	Sep 18 2003	1230	BE	74 24.72 N 164 24.58 W					
HLY03 33 1	CTD			BO		426	423	4.34	6 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 33 1	CTD	Sep 18 2003	1305	EN	74 24.74 N 164 23.87 W					
HLY03 34 1	CTD	Sep 18 2003	1419	BE	74 19.89 N 164 48.67 W					
HLY03 34 1	CTD			BO		339	341.08	5.67	6 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 34 1	CTD	Sep 18 2003	1449	EN	74 19.92 N 164 48.10 W					
HLY03 35 1	CTD	Sep 18 2003	1606	BE	74 14.92 N 165 12.50 W					
HLY03 35 1	CTD			BO		291	286.39	6.05	6 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 35 1	CTD	Sep 18 2003	1632	EN	74 14.83 N 165 12.50 W					

HLY03 36 1	CTD	Sep 18 2003	1745	BE 74 10.01 N 165 36.50 W					
HLY03 36 1	CTD			BO	235	236.38	4.76	7 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 36 1	CTD	Sep 18 2003	1816	EN 74 9.82 N 165 36.53 W					
HLY03 37 1	CTD	Sep 18 2003	1932	BE 74 5.12 N 166 0.36 W					
HLY03 37 1	CTD			BO	212	210.22	2.87	7 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 37 1	CTD	Sep 18 2003	2002	EN 74 4.99 N 166 0.19 W					
HLY03 38 1	CTD	Sep 18 2003	2102	BE 74 0.24 N 165 59.69 W					
HLY03 38 1	CTD			BO	170	169.23	2.77	6 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 38 1	CTD	Sep 18 2003	2128	EN 74 0.20 N 166 0.08 W					
HLY03 39 1	CTD	Sep 18 2003	2223	BE 73 55.29 N 165 59.77 W					
HLY03 39 1	CTD			BO	153	154.11	2.98	6 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 39 1	CTD	Sep 18 2003	2247	EN 73 55.32 N 165 59.65 W					
HLY03 40 1	CTD	Sep 19 2003	0018	BE 73 50.33 N 166 0.24 W					
HLY03 40 1	CTD			BO	136	133.8	1.99	6 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 40 1	CTD	Sep 19 2003	0040	EN 73 50.27 N 165 59.75 W					
HLY03 41 1	CTD	Sep 19 2003	0149	BE 73 45.16 N 165 59.81 W					
HLY03 41 1	CTD			BO	119	118.17	2.58	6 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 41 1	CTD	Sep 19 2003	0212	EN 73 45.20 N 166 0.04 W					
HLY03 42 1	CTD	Sep 19 2003	0258	BE 73 40.38 N 166 0.10 W					
HLY03 42 1	CTD			BO	112	111.62	2.01	6 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 42 1	CTD	Sep 19 2003	0322	EN 73 40.39 N 166 0.23 W					
HLY03 43 1	CTD	Sep 19 2003	0421	BE 73 36.38 N 166 2.11 W					
HLY03 43 1	CTD			BO	104	103.24	2.73	6 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 43 1	CTD	Sep 19 2003	0445	EN 73 36.35 N 166 2.16 W					
HLY03 44 1	CTD	Sep 19 2003	0541	BE 73 30.47 N 165 59.91 W					
HLY03 44 1	CTD			BO	89	87.83	2.19	6 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 44 1	CTD	Sep 19 2003	0602	EN 73 30.45 N 165 59.97 W					
HLY03 45 1	CTD	Sep 19 2003	0652	BE 73 25.57 N 165 59.91 W					
HLY03 45 1	CTD			BO	78	76.28	2.78	5 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 45 1	CTD	Sep 19 2003	0713	EN 73 25.62 N 165 59.89 W					
HLY03 46 1	CTD	Sep 19 2003	0859	BE 73 20.15 N 166 2.93 W					
HLY03 46 1	CTD			BO	70	67.69	1	5 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	May have touched bottom
HLY03 46 1	CTD	Sep 19 2003	0916	EN 73 20.15 N 166 2.80 W					
HLY03 47 1	CTD	Sep 19 2003	1036	BE 73 15.74 N 166 0.10 W					
HLY03 47 1	CTD			BO	68	63.43	1.87	6 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 47 1	CTD	Sep 19 2003	1054	EN 73 15.78 N 165 59.66 W					

HLY03 48 1	CTD	Sep 19 2003	1157	BE	73 10.85 N 166 0.13 W					
HLY03 48 1	CTD			BO		64	59.3	3.89	6 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 48 1	CTD	Sep 19 2003	1214	EN	73 10.85 N 165 59.80 W					
HLY03 49 1	CTD	Sep 19 2003	1334	BE	73 5.81 N 166 0.07 W					
HLY03 49 1	CTD			BO		61	57.08	3.74	6 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	Niskin 1 to 4 had vents left open. Oxy not. drawn but other samples were drawn
HLY03 49 1	CTD	Sep 19 2003	1350	EN	73 5.82 N 166 0.00 W					
HLY03 50 1	CTD	Sep 19 2003	1449	BE	73 0.90 N 165 59.97 W					
HLY03 50 1	CTD			BO		61	55.93	3.34	6 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 50 1	CTD	Sep 19 2003	1505	EN	73 0.95 N 166 0.05 W					
HLY03 51 1	CTD	Sep 19 2003	1623	BE	72 56.02 N 165 59.16 W					
HLY03 51 1	CTD			BO		60	53.16	4.01	0	
HLY03 51 1	CTD	Sep 19 2003	1637	EN	72 55.98 N 165 59.23 W					
HLY03 52 1	CTD	Sep 19 2003	1728	BE	72 50.99 N 165 59.06 W					
HLY03 52 1	CTD			BO		59	52.91	3.61	5 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 52 1	CTD	Sep 19 2003	1745	EN	72 50.90 N 165 59.28 W					
HLY03 53 1	CTD	Sep 19 2003	1833	BE	72 46.17 N 165 59.87 W					
HLY03 53 1	CTD			BO		59	52.02	3.46	0	
HLY03 53 1	CTD	Sep 19 2003	1848	EN	72 46.05 N 165 59.75 W					
HLY03 54 1	CTD	Sep 19 2003	1940	BE	72 41.24 N 166 0.08 W					
HLY03 54 1	CTD			BO		53	51.25	2.61	5 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 54 1	CTD	Sep 19 2003	1959	EN	72 41.15 N 166 0.14 W					
HLY03 55 1	CTD	Sep 19 2003	2126	BE	72 36.31 N 166 0.15 W					
HLY03 55 1	CTD			BO		55	50.03	2.27	0	
HLY03 55 1	CTD	Sep 19 2003	2136	EN	72 36.30 N 166 0.09 W					
HLY03 56 1	CTD	Sep 19 2003	2228	BE	72 31.45 N 165 59.85 W					
HLY03 56 1	CTD			BO		52	48.28	2.63	5 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 56 1	CTD	Sep 19 2003	2246	EN	72 31.40 N 166 0.03 W					
HLY03 57 1	CTD	Sep 19 2003	2337	BE	72 29.58 N 165 44.11 W					
HLY03 57 1	CTD			BO		52	47.29	2.78	0	
HLY03 57 1	CTD	Sep 19 2003	2346	EN	72 29.57 N 165 44.04 W					
HLY03 58 1	CTD	Sep 20 2003	0039	BE	72 27.69 N 165 29.52 W					
HLY03 58 1	CTD			BO		52	47.19	2.46	0	
HLY03 58 1	CTD	Sep 20 2003	0047	EN	72 27.64 N 165 29.34 W					
HLY03 59 1	CTD	Sep 20 2003	0143	BE	72 25.83 N 165 14.36 W					
HLY03 59 1	CTD			BO		51	47.02	1.89	0	
HLY03 59 1	CTD	Sep 20 2003	0151	EN	72 25.80 N 165 14.25 W					

HLY03 60 1	CTD	Sep 20 2003	0237	BE 72 24.07 N 164 59.10 W					
HLY03 60 1	CTD			BO	50	45.96	2.61	0	
HLY03 60 1	CTD	Sep 20 2003	0246	EN 72 24.04 N 164 59.17 W					
HLY03 61 1	CTD	Sep 20 2003	0330	BE 72 22.27 N 164 43.38 W					
HLY03 61 1	CTD			BO	49	44.49	2.08	0	
HLY03 61 1	CTD	Sep 20 2003	0339	EN 72 22.23 N 164 43.31 W					
HLY03 62 1	CTD	Sep 20 2003	0430	BE 72 20.40 N 164 28.46 W					
HLY03 62 1	CTD			BO	50	43.03	2.06	0	Package redunked at end of cast to remove jellyfish
HLY03 62 1	CTD	Sep 20 2003	0439	EN 72 20.40 N 164 28.34 W					
HLY03 63 1	CTD	Sep 20 2003	0530	BE 72 18.65 N 164 13.55 W					
HLY03 63 1	CTD			BO	46(b)	41.69	1.68	0	
HLY03 63 1	CTD	Sep 20 2003	0538	EN 72 18.62 N 164 13.63 W					
HLY03 64 1	CTD	Sep 20 2003	0629	BE 72 16.85 N 163 58.39 W					
HLY03 64 1	CTD			BO	45(b)	40.48	1.27	0	
HLY03 64 1	CTD	Sep 20 2003	0638	EN 72 16.80 N 163 58.53 W					
HLY03 65 1	CTD	Sep 20 2003	0725	BE 72 15.14 N 163 43.38 W					
HLY03 65 1	CTD			BO	43(b)	38.2	2.49	0	
HLY03 65 1	CTD	Sep 20 2003	0734	EN 72 15.12 N 163 43.55 W					
HLY03 66 1	CTD	Sep 20 2003	0828	BE 72 13.46 N 163 28.73 W					
HLY03 66 1	CTD			BO	42(b)	37.33	2.55	0	
HLY03 66 1	CTD	Sep 20 2003	0833	EN 72 13.42 N 163 28.93 W					
HLY03 67 1	CTD	Sep 20 2003	0925	BE 72 11.62 N 163 13.81 W					
HLY03 67 1	CTD			BO	41(b)	37.73	1.49	0	
HLY03 67 1	CTD	Sep 20 2003	0935	EN 72 11.55 N 163 14.38 W					
HLY03 68 1	CTD	Sep 20 2003	1020	BE 72 9.94 N 162 58.81 W					
HLY03 68 1	CTD			BO	40(b)	36.64	1.35	0	
HLY03 68 1	CTD	Sep 20 2003	1028	EN 72 9.93 N 162 59.01 W					
HLY03 69 1	CTD	Sep 20 2003	1117	BE 72 8.13 N 162 43.81 W					
HLY03 69 1	CTD			BO	39(b)	35.23	2.36	0	
HLY03 69 1	CTD	Sep 20 2003	1126	EN 72 8.10 N 162 44.09 W					
HLY03 70 1	CTD	Sep 20 2003	1215	BE 72 6.56 N 162 29.24 W					
HLY03 70 1	CTD			BO	39(b)	32.76	3.06	0	
HLY03 70 1	CTD	Sep 20 2003	1224	EN 72 6.57 N 162 29.40 W					
HLY03 71 1	CTD	Sep 20 2003	1316	BE 72 4.78 N 162 14.92 W					
HLY03 71 1	CTD			BO	53(b)	25.18	4.58	0	
HLY03 71 1	CTD	Sep 20 2003	1325	EN 72 4.80 N 162 14.94 W					

HLY03 72 1	CTD	Sep 20 2003	1604	BE 72 0.06 N 162 4.39 W				
HLY03 72 1	CTD			BO	34	29.79	3.3	0
HLY03 72 1	CTD	Sep 20 2003	1613	EN 72 0.11 N 162 4.65 W				
HLY03 73 1	CTD	Sep 20 2003	1658	BE 71 58.31 N 161 59.10 W				
HLY03 73 1	CTD			BO	33	30.9	3.6	0
HLY03 73 1	CTD	Sep 20 2003	1707	EN 71 58.35 N 161 59.35 W				
HLY03 74 1	CTD	Sep 20 2003	1805	BE 71 53.40 N 161 57.77 W				
HLY03 74 1	CTD			BO	40	34.81	3.43	0
HLY03 74 1	CTD	Sep 20 2003	1813	EN 71 53.46 N 161 58.03 W				
HLY03 75 1	CTD	Sep 20 2003	1905	BE 71 48.39 N 161 56.41 W				
HLY03 75 1	CTD			BO	43	38.74	3.57	0
HLY03 75 1	CTD	Sep 20 2003	1913	EN 71 48.42 N 161 56.54 W				
HLY03 76 1	CTD	Sep 20 2003	1958	BE 71 43.33 N 161 55.56 W				
HLY03 76 1	CTD			BO	43	40.84	2.1	0
HLY03 76 1	CTD	Sep 20 2003	2009	EN 71 43.36 N 161 55.58 W				
HLY03 77 1	CTD	Sep 20 2003	2142	BE 71 33.63 N 161 53.04 W				
HLY03 77 1	CTD			BO	46	42.59	2.55	0
HLY03 77 1	CTD	Sep 20 2003	2151	EN 71 33.68 N 161 53.08 W				
HLY03 78 1	CTD	Sep 20 2003	2319	BE 71 23.67 N 161 50.74 W				
HLY03 78 1	CTD			BO	42	40.11	2.28	0
HLY03 78 1	CTD	Sep 20 2003	2332	EN 71 23.79 N 161 50.79 W				
HLY03 79 1	CTD	Sep 21 2003	0048	BE 71 13.98 N 161 48.55 W				
HLY03 79 1	CTD			BO	48	44.9	2.31	0
HLY03 79 1	CTD	Sep 21 2003	0100	EN 71 14.06 N 161 48.55 W				
HLY03 80 1	CTD	Sep 21 2003	0215	BE 71 3.94 N 161 46.33 W				
HLY03 80 1	CTD			BO	43	42.48	2.85	0
HLY03 80 1	CTD	Sep 21 2003	0226	EN 71 4.10 N 161 46.46 W				
HLY03 81 1	CTD	Sep 21 2003	0345	BE 70 54.32 N 161 44.25 W				
HLY03 81 1	CTD			BO	43	42.28	2.75	0
HLY03 81 1	CTD	Sep 21 2003	0355	EN 70 54.45 N 161 44.36 W				
HLY03 82 1	CTD	Sep 21 2003	0449	BE 70 48.85 N 161 43.50 W				
HLY03 82 1	CTD			BO	44	41.76	1.83	0
HLY03 82 1	CTD	Sep 21 2003	0458	EN 70 48.98 N 161 43.65 W				
HLY03 83 1	CTD	Sep 21 2003	0533	BE 70 46.18 N 161 42.32 W				
HLY03 83 1	CTD			BO	42	40.84	1.77	0
HLY03 83 1	CTD	Sep 21 2003	0542	EN 70 46.31 N 161 42.44 W				

HLY03 84 1	CTD	Sep 21 2003	0621	BE	70 43.36 N 161 41.79 W					
HLY03 84 1	CTD			BO		41	39.17	2.29	0	
HLY03 84 1	CTD	Sep 21 2003	0629	EN	70 43.43 N 161 42.14 W					
HLY03 85 1	CTD	Sep 21 2003	0706	BE	70 40.81 N 161 41.09 W					
HLY03 85 1	CTD			BO		41	38.98	2.03	0	
HLY03 85 1	CTD	Sep 21 2003	0715	EN	70 40.81 N 161 41.55 W					
HLY03 86 1	CTD	Sep 21 2003	0800	BE	70 38.11 N 161 40.78 W					
HLY03 86 1	CTD			BO		40	37.16	2.64	0	
HLY03 86 1	CTD	Sep 21 2003	0810	EN	70 38.24 N 161 41.06 W					
HLY03 87 1	CTD	Sep 21 2003	0857	BE	70 35.43 N 161 40.97 W					
HLY03 87 1	CTD			BO		36(b)	33.42	2.49	0	
HLY03 87 1	CTD	Sep 21 2003	0905	EN	70 35.54 N 161 41.21 W					
HLY03 88 1	CTD	Sep 21 2003	1026	BE	70 32.63 N 161 39.62 W					
HLY03 88 1	CTD			BO		x	27.09	2.15	0	No good depth source
HLY03 88 1	CTD	Sep 21 2003	1033	EN	70 32.71 N 161 39.88 W					
HLY03 89 1	CTD	Sep 21 2003	1110	BE	70 30.00 N 161 39.08 W					
HLY03 89 1	CTD			BO		x	24.79	1.81	0	No good depth source
HLY03 89 1	CTD	Sep 21 2003	1117	EN	70 29.98 N 161 39.39 W					
HLY03 90 1	CTD	Sep 21 2003	1154	BE	70 27.33 N 161 38.61 W					
HLY03 90 1	CTD			BO		x	19.41	4.08	0	No good depth source
HLY03 90 1	CTD	Sep 21 2003	1202	EN	70 27.27 N 161 39.01 W					
HLY03 91 1	CTD	Sep 21 2003	2121	BE	70 40.50 N 167 4.73 W					
HLY03 91 1	CTD			BO		53(b)	47.8	4.32	5 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 91 1	CTD	Sep 21 2003	2138	EN	70 40.55 N 167 4.92 W					
HLY03 92 1	CTD	Sep 22 2003	0610	BE	70 42.13 N 168 50.18 W					
HLY03 92 1	CTD			BO		56(b)	29.14	1.54	3 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 92 1	CTD	Sep 22 2003	0622	EN	70 42.26 N 168 50.75 W					
HLY03 93 1	CTD	Sep 22 2003	0754	BE	70 42.07 N 168 33.70 W					
HLY03 93 1	CTD			BO		39	36.58	1.49	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 93 1	CTD	Sep 22 2003	0808	EN	70 42.24 N 168 33.92 W					
HLY03 94 1	CTD	Sep 22 2003	0858	BE	70 41.94 N 168 16.94 W					
HLY03 94 1	CTD			BO		43	41.69	1.68	5 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 94 1	CTD	Sep 22 2003	0912	EN	70 42.16 N 168 16.97 W					
HLY03 95 1	CTD	Sep 22 2003	1026	BE	70 41.85 N 168 0.83 W					
HLY03 95 1	CTD			BO		46	44.01	2.14	5 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 95 1	CTD	Sep 22 2003	1040	EN	70 41.98 N 168 1.12 W					

HLY03 96 1 CTD	Sep 22 2003	1153	BE 70 42.06 N 167 44.41 W					
HLY03 96 1 CTD			BO	53(b)	48.92	3.05	5 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 96 1 CTD	Sep 22 2003	1211	EN 70 42.44 N 167 44.43 W					
HLY03 97 1 CTD	Sep 22 2003	1321	BE 70 41.92 N 167 28.37 W					
HLY03 97 1 CTD			BO	55(b)	50.43	2.86	5 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 97 1 CTD	Sep 22 2003	1337	EN 70 42.07 N 167 29.11 W					
HLY03 98 1 CTD	Sep 22 2003	1425	BE 70 41.88 N 167 11.80 W					
HLY03 98 1 CTD			BO	54(b)	50.12	3.28	5 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 98 1 CTD	Sep 22 2003	1442	EN 70 41.99 N 167 12.41 W					
HLY03 99 1 CTD	Sep 22 2003	1554	BE 70 42.05 N 166 55.18 W					
HLY03 99 1 CTD			BO	49(b)	45.13	2.6	5 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 99 1 CTD	Sep 22 2003	1609	EN 70 42.15 N 166 55.59 W					
HLY03 100 1 CTD	Sep 22 2003	1737	BE 70 40.74 N 167 3.69 W					
HLY03 100 1 CTD			BO	53(b)	48.47	2.64	0	Cast at mooring site
HLY03 100 1 CTD	Sep 22 2003	1747	EN 70 40.89 N 167 3.60 W					
HLY03 101 1 CTD	Sep 22 2003	1825	BE 70 42.07 N 166 55.62 W					
HLY03 101 1 CTD			BO	49(b)	45.4	3.69	5 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 101 1 CTD	Sep 22 2003	1840	EN 70 42.27 N 166 55.93 W					
HLY03 102 1 CTD	Sep 22 2003	1938	BE 70 42.10 N 166 39.39 W					
HLY03 102 1 CTD			BO	45	43.47	2.87	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 102 1 CTD	Sep 22 2003	1954	EN 70 42.33 N 166 39.82 W					
HLY03 103 1 CTD	Sep 22 2003	2105	BE 70 41.65 N 166 22.50 W					
HLY03 103 1 CTD			BO	40	38.56	1.85	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 103 1 CTD	Sep 22 2003	2120	EN 70 41.79 N 166 22.78 W					
HLY03 104 1 CTD	Sep 22 2003	2229	BE 70 41.99 N 166 5.76 W					
HLY03 104 1 CTD			BO	40	38.15	2.58	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	CTD data bad on first cast (renamed 904)
HLY03 104 1 CTD	Sep 22 2003	2246	EN 70 42.19 N 166 5.97 W					so brought to the surface and relowered.
HLY03 105 1 CTD	Sep 22 2003	2347	BE 70 41.83 N 165 49.79 W					
HLY03 105 1 CTD			BO	40	39	2.24	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 105 1 CTD	Sep 23 2003	0003	EN 70 41.93 N 165 49.89 W					
HLY03 106 1 CTD	Sep 23 2003	0050	BE 70 41.96 N 165 34.17 W					
HLY03 106 1 CTD			BO	43	40.88	2.63	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 106 1 CTD	Sep 23 2003	0105	EN 70 42.08 N 165 33.58 W					

HLY03 107 1	CTD	Sep 23 2003	0315	BE 70 37.27 N 165 16.00 W					
HLY03 107 1	CTD			BO	43	40.84	2	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 107 1	CTD	Sep 23 2003	0329	EN 70 37.45 N 165 15.58 W					
HLY03 108 1	CTD	Sep 23 2003	0429	BE 70 32.38 N 164 58.24 W					
HLY03 108 1	CTD			BO	44	41.15	1.77	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	Waited 2 minutes per bottle stop. Tested EMCTDs on this station.
HLY03 108 1	CTD	Sep 23 2003	0448	EN 70 32.57 N 164 57.57 W					
HLY03 109 1	CTD	Sep 23 2003	0548	BE 70 27.45 N 164 40.27 W					
HLY03 109 1	CTD			BO	47	43.26	2.55	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 109 1	CTD	Sep 23 2003	0603	EN 70 27.65 N 164 39.94 W					
HLY03 110 1	CTD	Sep 23 2003	0705	BE 70 22.70 N 164 22.86 W					
HLY03 110 1	CTD			BO	44	40.67	1.5	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 110 1	CTD	Sep 23 2003	0718	EN 70 22.84 N 164 22.57 W					
HLY03 111 1	CTD	Sep 23 2003	0801	BE 70 20.54 N 164 14.23 W					
HLY03 111 1	CTD			BO	41	38.56	1.47	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 111 1	CTD	Sep 23 2003	0812	EN 70 20.61 N 164 14.04 W					
HLY03 112 1	CTD	Sep 23 2003	0850	BE 70 18.16 N 164 5.59 W					
HLY03 112 1	CTD			BO	38	36.31	2.37	4 Sal/Sil/NO3/NO2/PO4 Chl. Phaeo.	
HLY03 112 1	CTD	Sep 23 2003	0903	EN 70 18.27 N 164 5.25 W					
HLY03 113 1	CTD	Sep 23 2003	0937	BE 70 15.61 N 163 57.24 W					
HLY03 113 1	CTD			BO	37	34.62	1.63	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 113 1	CTD	Sep 23 2003	0950	EN 70 15.68 N 163 57.01 W					
HLY03 114 1	CTD	Sep 23 2003	1025	BE 70 13.25 N 163 48.09 W					
HLY03 114 1	CTD			BO	35(b)	31.67	1.73	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 114 1	CTD	Sep 23 2003	1036	EN 70 13.29 N 163 47.83 W					
HLY03 115 1	CTD	Sep 23 2003	1115	BE 70 10.85 N 163 39.56 W					
HLY03 115 1	CTD			BO	28(b)	27.34	2.4	3 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 115 1	CTD	Sep 23 2003	1125	EN 70 10.88 N 163 39.30 W					
HLY03 116 1	CTD	Sep 23 2003	1156	BE 70 8.61 N 163 31.49 W					
HLY03 116 1	CTD			BO	x	26.45	3	3 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	No valid depth reading; Oxygen samples may be comprimised by having too much reagent MnCl2. Pipet setting should be on 1 but it may have been on 2.
HLY03 116 1	CTD	Sep 23 2003	1208	EN 70 8.61 N 163 31.08 W					
HLY03 117 1	CTD	Sep 23 2003	1246	BE 70 6.39 N 163 22.80 W					
HLY03 117 1	CTD			BO	x	25.42	2.98	3 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	No valid depth reading; Oxygen sample from Niskin 1 was comprimised by having too much reagent MnCl2. Pipet setting should be on 1 but it may have been on 2.
HLY03 117 1	CTD	Sep 23 2003	1257	EN 70 6.34 N 163 22.49 W					

HLY03 118 1	CTD	Sep 24 2003	0821	BE 71 32.02 N 151 56.67 W					
HLY03 118 1	CTD			BO	599	582.47	2.4	0	Cast used to get good sound speed profile.
HLY03 118 1	CTD	Sep 24 2003	0850	EN 71 31.95 N 151 56.77 W					
HLY03 119 1	CTD	Sep 25 2003	0356	BE 71 50.02 N 151 40.06 W					
HLY03 119 1	CTD			BO	2217	2233.16	9.51	16 Sal	Comparison Cast with EMCTD 1337 and 1340. SBE35 temperature probe added to package. Bottle fire is wait 1 minute
HLY03 119 1	CTD	Sep 25 2003	0559	EN 71 51.17 N 151 38.94 W					
HLY03 120 1	CTD	Sep 25 2003	0855	BE 71 49.56 N 151 41.00 W					
HLY03 120 1	CTD			BO	2180	1002.78	343.78	10 Sal	Comparison Cast with EMCTD 1337 and 1358
HLY03 120 1	CTD	Sep 25 2003	0958	EN 71 49.96 N 151 40.89 W					
HLY03 121 1	CTD	Sep 26 2003	0300	BE 71 34.05 N 151 54.68 W					
HLY03 121 1	CTD			BO	834	809.31	9.89	0	Cast at mooring site BS7 for calibration purposes; No LADCP.
HLY03 121 1	CTD	Sep 26 2003	0337	EN 71 34.10 N 151 53.85 W					
HLY03 122 1	CTD	Sep 26 2003	0538	BE 71 49.63 N 151 41.02 W					
HLY03 122 1	CTD			BO	2180	2192.03	15.14	12 Sal	Comparison Cast with EMCTD 1313
HLY03 122 1	CTD	Sep 26 2003	0736	EN 71 49.00 N 151 36.70 W					
HLY03 123 1	CTD	Sep 26 2003	0938	BE 71 40.09 N 151 49.95 W					
HLY03 123 1	CTD			BO	1466	1001.59	431.52	13 Sal	Comparison Cast with EMCTDs 1333
HLY03 123 1	CTD	Sep 26 2003	1059	EN 71 39.89 N 151 50.40 W					
HLY03 124 1	CTD	Sep 27 2003	1034	BE 71 40.11 N 151 49.37 W					
HLY03 124 1	CTD			BO	1432	1001.26	344.98	0	Comparion Cast with EMCTDs 1333.
HLY03 124 1	CTD	Sep 27 2003	1149	EN 71 40.31 N 151 47.40 W					
HLY03 125 1	CTD	Sep 27 2003	1317	BE 71 39.95 N 151 49.31 W					
HLY03 125 1	CTD			BO	1422	999.59	362.25	0	Comparison Cast with EMCTDs 1333
HLY03 125 1	CTD	Sep 27 2003	1441	EN 71 40.02 N 151 46.95					

HLY03 126 1	CTD	Sep 28 2003	0409	BE 71 39.88 N 151 49.77 W					
HLY03 126 1	CTD			BO	1411	1000.98	353.11	0	Comparison Cast with EMCTD 1341
HLY03 126 1	CTD	Sep 28 2003	0527	EN 71 39.81 N 151 48.70 W					
HLY03 127 1	CTD	Sep 28 2003	0608	BE 71 40.09 N 151 50.37 W					
HLY03 127 1	CTD			BO	1438	999.83	369.65	0	Comparison Cast with EMCTDs 1332
HLY03 127 1	CTD	Sep 28 2003	0725	EN 71 40.11 N 151 50.08 W					
HLY03 128 1	CTD	Sep 28 2003	0822	BE 71 40.20 N 151 50.06 W					
HLY03 128 1	CTD			BO	1432	999.89	393.45	0	Comparion Cast with EMCTDs 1313
HLY03 128 1	CTD	Sep 28 2003	0937	EN 71 40.12 N 151 50.43 W					
HLY03 129 1	CTD	Sep 28 2003	1113	BE 71 50.23 N 151 40.85 W					
HLY03 129 1	CTD			BO	2197	2216.68	8.5	0	Beaufort Line Deep to Shallow stations 129-143."
HLY03 129 1	CTD	Sep 28 2003	1247	EN 71 50.26 N 151 41.26 W					
HLY03 130 1	CTD	Sep 28 2003	1329	BE 71 47.67 N 151 42.85 W					
HLY03 130 1	CTD			BO	2088	2083.89	4.85	0	
HLY03 130 1	CTD	Sep 28 2003	1449	EN 71 47.66 N 151 43.02 W					
HLY03 131 1	CTD	Sep 28 2003	1534	BE 71 45.00 N 151 45.18 W					
HLY03 131 1	CTD			BO	1840	1855.35	4.79	0	
HLY03 131 1	CTD	Sep 28 2003	1648	EN 71 45.06 N 151 44.92 W					
HLY03 132 1	CTD	Sep 28 2003	1723	BE 71 42.42 N 151 47.64 W					
HLY03 132 1	CTD			BO	1610	1622.86	5.14	0	
HLY03 132 1	CTD	Sep 28 2003	1826	EN 71 42.64 N 151 46.71 W					
HLY03 133 1	CTD	Sep 28 2003	1909	BE 71 39.81 N 151 49.62 W					
HLY03 133 1	CTD			BO	1409	1400.56	3.93	0	
HLY03 133 1	CTD	Sep 28 2003	2006	EN 71 39.88 N 151 48.74 W					
HLY03 134 1	CTD	Sep 28 2003	2054	BE 71 37.23 N 151 51.80 W					
HLY03 134 1	CTD			BO	920	901.11	3.61	0	
HLY03 134 1	CTD	Sep 28 2003	2134	EN 71 37.33 N 151 50.66 W					
HLY03 135 1	CTD	Sep 28 2003	2218	BE 71 34.70 N 151 54.95 W					
HLY03 135 1	CTD			BO	827	825.8	3.04	0	
HLY03 135 1	CTD	Sep 28 2003	2255	EN 71 34.89 N 151 54.22 W					
HLY03 136 1	CTD	Sep 28 2003	2344	BE 71 32.10 N 151 56.50 W					
HLY03 136 1	CTD			BO	601	595.55	2.69	0	
HLY03 136 1	CTD	Sep 29 2003	0025	EN 71 32.13 N 151 56.14 W					
HLY03 137 1	CTD	Sep 29 2003	0101	BE 71 29.16 N 151 58.66 W					
HLY03 137 1	CTD			BO	290	285.26	3.98	0	
HLY03 137 1	CTD	Sep 29 2003	0121	EN 71 29.20 N 151 58.17 W					

HLY03 138 1	CTD	Sep 29 2003	0211	BE	71 26.66 N	152 1.39 W					
HLY03 138 1	CTD			BO			201	199.34	3.83	0	
HLY03 138 1	CTD	Sep 29 2003	0231	EN	71 26.67 N	152 1.32 W					
HLY03 139 1	CTD	Sep 29 2003	0315	BE	71 24.04 N	152 3.46 W					
HLY03 139 1	CTD			BO			158	156.41	2.57	0	
HLY03 139 1	CTD	Sep 29 2003	0334	EN	71 24.17 N	152 3.65 W					
HLY03 140 1	CTD	Sep 29 2003	0425	BE	71 21.45 N	152 5.80 W					
HLY03 140 1	CTD			BO			76	74.5	1.3	0	
HLY03 140 1	CTD	Sep 29 2003	0437	EN	71 21.56 N	152 6.07 W					
HLY03 141 1	CTD	Sep 29 2003	0514	BE	71 18.87 N	152 7.78 W					
HLY03 141 1	CTD			BO			60	56.86	2.24	0	
HLY03 141 1	CTD	Sep 29 2003	0526	EN	71 18.95 N	152 8.25 W					
HLY03 142 1	CTD	Sep 29 2003	0604	BE	71 16.19 N	152 10.22 W					
HLY03 142 1	CTD			BO			49	43.67	2.19	0	
HLY03 142 1	CTD	Sep 29 2003	0613	EN	71 16.14 N	152 10.71 W					
HLY03 143 1	CTD	Sep 29 2003	0648	BE	71 13.63 N	152 11.79 W					
HLY03 143 1	CTD			BO			43	39.73	2.2	0	
HLY03 143 1	CTD	Sep 29 2003	0658	EN	71 13.67 N	152 12.37 W					
HLY03 144 1	CTD	Sep 29 2003	1022	BE	71 39.86 N	151 49.85 W					
HLY03 144 1	CTD			BO			1425	1001.01	368.53	0	Comparison Cast with Microcats.
HLY03 144 1	CTD	Sep 29 2003	1203	EN	71 39.99 N	151 49.51 W					Bottle Stop 1.5 min wait
HLY03 145 1	CTD	Sep 29 2003	1305	BE	71 40.05 N	151 49.79 W					
HLY03 145 1	CTD			BO			1432	348.23	5000		Comparison Cast with.
HLY03 145 1	CTD	Sep 29 2003	1401	EN	71 40.14 N	151 50.32 W					Microcats
HLY03 146 1	CTD	Sep 29 2003	1450	BE	71 39.84 N	151 50.02 W					
HLY03 146 1	CTD			BO			1413	101.33	351.14	0	Comparison Cast with Microcats.
HLY03 146 1	CTD	Sep 29 2003	1529	EN	71 39.79 N	151 50.78 W					
HLY03 147 1	CTD	Sep 29 2003	2254	BE	71 50.22 N	151 40.83 W					
HLY03 147 1	CTD			BO			2187	608.35	356.57	0	Synoptic Beaufort Line Section
HLY03 147 1	CTD	Sep 29 2003	2325	EN	71 50.07 N	151 40.80 W					only down to 600m. Stations 147-161.
HLY03 148 1	CTD	Sep 30 2003	0012	BE	71 47.60 N	151 43.24 W					
HLY03 148 1	CTD			BO			2046	608.68	312.39	0	
HLY03 148 1	CTD	Sep 30 2003	0044	EN	71 47.54 N	151 43.52 W					
HLY03 149 1	CTD	Sep 30 2003	0115	BE	71 45.00 N	151 44.92 W					
HLY03 149 1	CTD			BO			1834	622.54	5000		
HLY03 149 1	CTD	Sep 30 2003	0142	EN	71 44.83 N	151 44.98 W					

HLY03 150 1	CTD	Sep 30 2003	0212	BE 71 42.43 N 151 47.38 W					
HLY03 150 1	CTD			BO	1601	608.24	424.61	0	
HLY03 150 1	CTD	Sep 30 2003	0242	EN 71 42.22 N 151 47.30 W					
HLY03 151 1	CTD	Sep 30 2003	0310	BE 71 39.76 N 151 49.66 W					
HLY03 151 1	CTD			BO	1372	609.43	363.86	0	
HLY03 151 1	CTD	Sep 30 2003	0341	EN 71 39.70 N 151 49.28 W					
HLY03 152 1	CTD	Sep 30 2003	0416	BE 71 37.16 N 151 52.42 W					
HLY03 152 1	CTD			BO	945	602.29	322.78	0	Dunked a few times at surface to dislodge jelly fish.
HLY03 152 1	CTD	Sep 30 2003	0446	EN 71 37.05 N 151 52.46 W					
HLY03 153 1	CTD	Sep 30 2003	0518	BE 71 34.62 N 151 54.49 W					
HLY03 153 1	CTD			BO	815	603.9	214.32	0	
HLY03 153 1	CTD	Sep 30 2003	0547	EN 71 34.62 N 151 54.31 W					
HLY03 154 1	CTD	Sep 30 2003	0622	BE 71 32.03 N 151 56.63 W					
HLY03 154 1	CTD			BO	588	592.33	2.95	0	
HLY03 154 1	CTD	Sep 30 2003	0654	EN 71 32.09 N 151 56.40 W					
HLY03 155 1	CTD	Sep 30 2003	0726	BE 71 29.30 N 151 58.78 W					
HLY03 155 1	CTD			BO	294	287.92	2.42	0	
HLY03 155 1	CTD	Sep 30 2003	0747	EN 71 29.34 N 151 58.69 W					
HLY03 156 1	CTD	Sep 30 2003	0820	BE 71 26.74 N 152 1.06 W					
HLY03 156 1	CTD			BO	205	204.79	2.27	0	Prior to deployment
HLY03 156 1	CTD	Sep 30 2003	0842	EN 71 26.75 N 152 0.83 W					
HLY03 157 1	CTD	Sep 30 2003	0917	BE 71 24.08 N 152 3.31 W					
HLY03 157 1	CTD			BO	160	157.57	2.12	0	
HLY03 157 1	CTD	Sep 30 2003	0935	EN 71 24.07 N 152 3.07 W					
HLY03 158 1	CTD	Sep 30 2003	1004	BE 71 21.53 N 152 5.45 W					
HLY03 158 1	CTD			BO	82	79.53	1.91	0	
HLY03 158 1	CTD	Sep 30 2003	1016	EN 71 21.49 N 152 5.25 W					
HLY03 159 1	CTD	Sep 30 2003	1048	BE 71 18.75 N 152 7.50 W					
HLY03 159 1	CTD			BO	59	57.04	2.43	0	
HLY03 159 1	CTD	Sep 30 2003	1057	EN 71 18.75 N 152 7.42 W					
HLY03 160 1	CTD	Sep 30 2003	1128	BE 71 16.27 N 152 9.83 W					
HLY03 160 1	CTD			BO	49	47.14	2.46	0	
HLY03 160 1	CTD	Sep 30 2003	1137	EN 71 16.24 N 152 9.73 W					
HLY03 161 1	CTD	Sep 30 2003	1348	BE 71 13.71 N 152 12.12 W					
HLY03 161 1	CTD			BO	45	31.33	2.67	0	Prior to deplyment
HLY03 161 1	CTD	Sep 30 2003	1358	EN 71 13.70 N 152 12.08 W					

HLY03 162 1	CTD	Sep 30 2003	1535	BE 71 18.76 N 151 40.55 W					
HLY03 162 1	CTD			BO	64	60.94	2.41	0	Beaufort Line offset to East.
HLY03 162 1	CTD	Sep 30 2003	1544	EN 71 18.78 N 151 40.71 W					Stations 162 to 175.
HLY03 163 1	CTD	Sep 30 2003	1614	BE 71 19.86 N 151 39.33 W					
HLY03 163 1	CTD			BO	66	65	2.08	0	
HLY03 163 1	CTD	Sep 30 2003	1626	EN 71 19.82 N 151 39.78 W					
HLY03 164 1	CTD	Sep 30 2003	1655	BE 71 21.26 N 151 38.76 W					
HLY03 164 1	CTD			BO	124	117.77	3.42	0	
HLY03 164 1	CTD	Sep 30 2003	1711	EN 71 21.13 N 151 38.76 W					
HLY03 165 1	CTD	Sep 30 2003	1752	BE 71 22.76 N 151 37.84 W					
HLY03 165 1	CTD			BO	167	167.04	2.54	0	
HLY03 165 1	CTD	Sep 30 2003	1810	EN 71 22.73 N 151 38.02 W					
HLY03 166	CTD	Sep 30 2003	1843	BE 71 23.99 N 151 36.89 W					
HLY03 166	CTD			BO	189	182	2.89	0	
HLY03 166	CTD	Sep 30 2003	1905	EN 71 23.86 N 151 36.92 W					
HLY03 167 1	CTD	Sep 30 2003	1943	BE 71 25.34 N 151 35.80 W					
HLY03 167 1	CTD			BO	220	214.22	3.65	0	
HLY03 167 1	CTD	Sep 30 2003	2005	EN 71 25.30 N 151 35.76 W					
HLY03 168 1	CTD	Sep 30 2003	2039	BE 71 26.73 N 151 34.63 W					
HLY03 168 1	CTD			BO	288	285.72	2.88	0	
HLY03 168 1	CTD	Sep 30 2003	2104	EN 71 26.74 N 151 34.53 W					
HLY03 169 1	CTD	Sep 30 2003	2136	BE 71 29.18 N 151 32.73 W					
HLY03 169 1	CTD			BO	777	608.9	185.45	0	
HLY03 169 1	CTD	Sep 30 2003	2204	EN 71 29.24 N 151 32.76 W					
HLY03 170 1	CTD	Sep 30 2003	2240	BE 71 31.97 N 151 30.70 W					
HLY03 170 1	CTD			BO	1340	609.89	368.56	0	
HLY03 170 1	CTD	Sep 30 2003	2308	EN 71 32.01 N 151 30.74 W					
HLY03 171 1	CTD	Sep 30 2003	2339	BE 71 34.52 N 151 29.28 W					
HLY03 171 1	CTD			BO	1578	604.69	396.24	0	
HLY03 171 1	CTD	Oct 01 2003	0008	EN 71 34.66 N 151 28.15 W					
HLY03 172 1	CTD	Oct 01 2003	0044	BE 71 37.12 N 151 27.06 W					
HLY03 172 1	CTD			BO	1672	1001.91	491.99	0	Comparison Cast with EMCTD
HLY03 172 1	CTD	Oct 01 2003	0138	EN 71 37.15 N 151 26.50 W					1313. Started in water at 10m soak.
HLY03 173 1	CTD	Oct 01 2003	0210	BE 71 39.78 N 151 25.11 W					
HLY03 173 1	CTD			BO	1395	610.55	353.31	0	
HLY03 173 1	CTD	Oct 01 2003	0241	EN 71 39.75 N 151 25.17 W					

HLY03 174 1	CTD	Oct 01 2003	0314	BE	71 42.35 N	151 23.16 W					
HLY03 174 1	CTD			BO			1660	1008.65	384.45	0	Comparison Cast with EMCTD. 1313. Started in water at 10m soak
HLY03 174 1	CTD	Oct 01 2003	0436	EN	71 42.88 N	151 23.10 W					
HLY03 175 1	CTD	Oct 01 2003	0502	BE	71 45.03 N	151 21.24 W					
HLY03 175 1	CTD			BO			2272	600.19	476.95	0	Comparison Cast with EMCTD 1313
HLY03 175 1	CTD	Oct 01 2003	0537	EN	71 45.27 N	151 20.88 W					
HLY03 176 1	CTD	Oct 01 2003	0649	BE	71 46.34 N	152 4.28 W					
HLY03 176 1	CTD			BO			1568	600.26	347.68	0	Beaufort Line offset to West.
HLY03 176 1	CTD	Oct 01 2003	0721	EN	71 46.21 N	152 4.87 W					
HLY03 177 1	CTD	Oct 01 2003	0755	BE	71 44.18 N	152 6.38 W					
HLY03 177 1	CTD			BO			1423	601.23	360.7	0	Starting with this cast
HLY03 177 1	CTD	Oct 01 2003	0822	EN	71 44.20 N	152 7.03 W					
HLY03 178 1	CTD	Oct 01 2003	0913	BE	71 41.47 N	152 9.03 W					
HLY03 178 1	CTD			BO			1216(b)	605.22	443.93	0	
HLY03 178 1	CTD	Oct 01 2003	0940	EN	71 41.48 N	152 9.75 W					
HLY03 179 1	CTD	Oct 01 2003	1030	BE	71 38.79 N	152 11.53 W					
HLY03 179 1	CTD			BO			924(b)	601.46	298.64	0	
HLY03 179 1	CTD	Oct 01 2003	1057	EN	71 38.51 N	152 12.09 W					
HLY03 180 1	CTD	Oct 01 2003	1152	BE	71 35.98 N	152 14.33 W					
HLY03 180 1	CTD			BO			368	2.39	593.91	0	Touched bottom
HLY03 180 1	CTD	Oct 01 2003	1215	EN	71 35.97 N	152 14.70 W					
HLY03 181 1	CTD	Oct 01 2003	1327	BE	71 33.59 N	152 15.68 W					
HLY03 181 1	CTD			BO			217	212.95	3.74	0	
HLY03 181 1	CTD	Oct 01 2003	1346	EN	71 33.46 N	152 15.60 W					
HLY03 182 1	CTD	Oct 01 2003	1431	BE	71 31.00 N	152 18.94 W					
HLY03 182 1	CTD			BO			155	149.58	2.7	0	
HLY03 182 1	CTD	Oct 01 2003	1449	EN	71 30.97 N	152 19.10 W					
HLY03 183 1	CTD	Oct 01 2003	1550	BE	71 28.50 N	152 21.13 W					
HLY03 183 1	CTD			BO			236	118.18	4.82	0	
HLY03 183 1	CTD	Oct 01 2003	1604	EN	71 28.55 N	152 21.55 W					
HLY03 184 1	CTD	Oct 01 2003	1731	BE	71 26.08 N	152 23.81 W					
HLY03 184 1	CTD			BO			143	133.49	3.36	0	
HLY03 184 1	CTD	Oct 01 2003	1748	EN	71 26.24 N	152 24.45 W					
HLY03 185 1	CTD	Oct 01 2003	1832	BE	71 23.20 N	152 25.70 W					
HLY03 185 1	CTD			BO			113	113.59	3.14	0	
HLY03 185 1	CTD	Oct 01 2003	1848	EN	71 23.33 N	152 26.12 W					

HLY03	186	1	CTD	Oct 01 2003	1949	BE	71 20.74 N	152 28.98 W					
HLY03	186	1	CTD			BO			80(K)	67.45	9.84	0	
HLY03	186	1	CTD	Oct 01 2003	1959	EN	71 20.88 N	152 29.40 W					
HLY03	187	1	CTD	Oct 02 2003	0142	BE	71 13.79 N	152 12.71 W					
HLY03	187	1	CTD			BO			43(K)	36.2	5.88	0	
HLY03	187	1	CTD	Oct 02 2003	0152	EN	71 13.81 N	152 12.89 W					
HLY03	188	1	CTD	Oct 02 2003	0231	BE	71 15.99 N	152 10.98 W					
HLY03	188	1	CTD			BO			49(K)	42.53	5.31	0	
HLY03	188	1	CTD	Oct 02 2003	0238	EN	71 16.00 N	152 11.07 W					
HLY03	189	1	CTD	Oct 02 2003	0316	BE	71 18.73 N	152 8.07 W					
HLY03	189	1	CTD			BO			59(K)	52.24	4.52	0	
HLY03	189	1	CTD	Oct 02 2003	0324	EN	71 18.72 N	152 8.31 W					
HLY03	190	1	CTD	Oct 02 2003	0411	BE	71 21.60 N	152 6.21 W					
HLY03	190	1	CTD			BO			73	63.33	8.99	0	Comparison Cast with Microcat
HLY03	190	1	CTD	Oct 02 2003	0443	EN	71 21.84 N	152 7.37 W					37. 2 min bottle stop.
HLY03	191	1	CTD	Oct 02 2003	0527	BE	71 24.15 N	152 3.49 W					
HLY03	191	1	CTD			BO			158	154.03	10.62	0	
HLY03	191	1	CTD	Oct 02 2003	0543	EN	71 24.12 N	152 4.10 W					
HLY03	192	1	CTD	Oct 02 2003	0629	BE	71 26.65 N	152 1.42 W					
HLY03	192	1	CTD			BO			198	189.16	9.77	0	
HLY03	192	1	CTD	Oct 02 2003	0647	EN	71 26.68 N	152 1.59 W					
HLY03	193	1	CTD	Oct 02 2003	0747	BE	71 29.25 N	151 58.83 W					
HLY03	193	1	CTD			BO			285	270.5	10.09	0	Comparison Cast with Microcat?
HLY03	193	1	CTD	Oct 02 2003	0841	EN	71 29.20 N	151 59.57 W					
HLY03	194	1	CTD	Oct 02 2003	0918	BE	71 32.06 N	151 56.81 W					
HLY03	194	1	CTD			BO			591	570.71	10.86	0	
HLY03	194	1	CTD	Oct 02 2003	0951	EN	71 32.18 N	151 56.61 W					
HLY03	195	1	CTD	Oct 02 2003	1028	BE	71 34.57 N	151 54.69 W					
HLY03	195	1	CTD			BO			820	827.01	3.4	9 Sal	Comparison Cast with Microcat?
HLY03	195	1	CTD	Oct 02 2003	1136	EN	71 34.89 N	151 56.41 W					
HLY03	196	1	CTD	Oct 02 2003	1208	BE	71 37.38 N	151 51.69 W					
HLY03	196	1	CTD			BO			754(K)	601.54	337.22	0	
HLY03	196	1	CTD	Oct 02 2003	1239	EN	71 37.43 N	151 51.73 W					
HLY03	197	1	CTD	Oct 02 2003	1311	BE	71 39.84 N	151 49.96 W					
HLY03	197	1	CTD			BO			1108	560.55	408.52	0	
HLY03	197	1	CTD	Oct 02 2003	1338	EN	71 39.87 N	151 50.13 W					

HLY03 198 1	CTD	Oct 02 2003	1414	BE 71 42.36 N 151 47.67 W				
HLY03 198 1	CTD			BO	1597	601.4	296.56	0
HLY03 198 1	CTD	Oct 02 2003	1443	EN 71 42.29 N 151 47.84 W				
HLY03 199 1	CTD	Oct 02 2003	1522	BE 71 44.98 N 151 45.35 W				
HLY03 199 1	CTD			BO	1867(b) 600.75 380.96			0	Depth finders not working well
HLY03 199 1	CTD	Oct 02 2003	1551	EN 71 44.95 N 151 45.05 W				
HLY03 200 1	CTD	Oct 04 2003	1225	BE 71 13.50 N 152 12.14 W				
HLY03 200 1	CTD			BO	45	35.76	4.52	0
HLY03 200 1	CTD	Oct 04 2003	1234	EN 71 13.31 N 152 12.16 W				
HLY03 201 1	CTD	Oct 04 2003	1319	BE 71 16.27 N 152 10.10 W				
HLY03 201 1	CTD			BO	49	44.97	4.51	0
HLY03 201 1	CTD	Oct 04 2003	1329	EN 71 16.09 N 152 10.32 W				
HLY03 202 1	CTD	Oct 04 2003	1407	BE 71 18.85 N 152 7.96 W				
HLY03 202 1	CTD			BO	60	53.45	5.88	0
HLY03 202 1	CTD	Oct 04 2003	1417	EN 71 18.67 N 152 8.11 W				
HLY03 203 1	CTD	Oct 04 2003	1454	BE 71 21.54 N 152 5.46 W				
HLY03 203 1	CTD			BO	78	76.89	4.32	0
HLY03 203 1	CTD	Oct 04 2003	1506	EN 71 21.34 N 152 5.22 W				
HLY03 204 1	CTD	Oct 04 2003	1550	BE 71 24.06 N 152 4.00 W				
HLY03 204 1	CTD			BO	162	157.71	4.59	0
HLY03 204 1	CTD	Oct 04 2003	1605	EN 71 23.92 N 152 4.24 W				
HLY03 205 1	CTD	Oct 04 2003	1643	BE 71 26.50 N 152 1.41 W				
HLY03 205 1	CTD			BO	197	188.82	3.96	0
HLY03 205 1	CTD	Oct 04 2003	1657	EN 71 26.30 N 152 0.99 W				
HLY03 206 1	CTD	Oct 04 2003	1742	BE 71 29.04 N 151 58.95 W				
HLY03 206 1	CTD			BO	290	270.41	4.21	0
HLY03 206 1	CTD	Oct 04 2003	1800	EN 71 28.79 N 151 59.35 W				
HLY03 207 1	CTD	Oct 04 2003	1838	BE 71 31.89 N 151 56.34 W				
HLY03 207 1	CTD			BO	599	592.98	6	0
HLY03 207 1	CTD	Oct 04 2003	1910	EN 71 31.29 N 151 56.55 W				
HLY03 208 1	CTD	Oct 04 2003	1955	BE 71 34.87 N 151 54.30 W				
HLY03 208 1	CTD			BO	810	604.57	217.28	0
HLY03 208 1	CTD	Oct 04 2003	2026	EN 71 34.20 N 151 54.08 W				
HLY03 209 1	CTD	Oct 04 2003	2118	BE 71 37.23 N 151 52.57 W				
HLY03 209 1	CTD			BO	x	571.06	332.28	0	Seabeam depths are 976
HLY03 209 1	CTD	Oct 04 2003	2148	EN 71 36.72 N 151 51.97 W				

HLY03 210 1	CTD	Oct 06 2003	0629	BE 71 13.74 N 152 12.69 W					
HLY03 210 1	CTD			BO	43	36.81	4.71	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	Beaufort Line fully sampled LADCP back on package. Top of water sampler soaked in simplegreen soapy bath prior to station to unstick sticky releases (release 22 bottle 21)
HLY03 210 1	CTD	Oct 06 2003	0644	EN 71 13.80 N 152 12.78 W					
HLY03 211 1	CTD	Oct 06 2003	0805	BE 71 16.35 N 152 9.82 W					
HLY03 211 1	CTD			BO	48	45.32	4.65	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 211 1	CTD	Oct 06 2003	0821	EN 71 16.48 N 152 10.45 W					
HLY03 212 1	CTD	Oct 08 2003	0508	BE 71 13.74 N 152 12.22 W					
HLY03 212 1	CTD			BO	42	38.22	3.06	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 212 1	CTD	Oct 08 2003	0525	EN 71 13.69 N 152 12.38 W					
HLY03 213 1	CTD	Oct 08 2003	0606	BE 71 16.29 N 152 9.96 W					
HLY03 213 1	CTD			BO	48	46.27	2.67	4 Sal Oxy. Chl. Phaeo.	
HLY03 213 1	CTD	Oct 08 2003	0624	EN 71 16.31 N 152 9.84 W					
HLY03 214 1	CTD	Oct 08 2003	0734	BE 71 18.90 N 152 7.72 W					
HLY03 214 1	CTD			BO	45	56.64	2.25	4 Sal Oxy. Chl. Phaeo.	
HLY03 214 1	CTD	Oct 08 2003	0751	EN 71 18.88 N 152 7.76 W					
HLY03 215 1	CTD	Oct 08 2003	0841	BE 71 21.54 N 152 5.66 W					
HLY03 215 1	CTD			BO	79	75.76	2.37	5 Sal Oxy. Chl. Phaeo.	Primary T+C Sensors go bad on downtrace (between 20m and 50m) uptrace looks fine.
HLY03 215 1	CTD	Oct 08 2003	0901	EN 71 21.56 N 152 5.49 W					
HLY03 216 1	CTD	Oct 08 2003	1030	BE 71 24.15 N 152 3.41 W					
HLY03 216 1	CTD			BO	160	157.36	2.66	7 Sal Oxy. Chl. Phaeo.	
HLY03 216 1	CTD	Oct 08 2003	1056	EN 71 24.15 N 152 3.79 W					
HLY03 217 1	CTD	Oct 08 2003	1308	BE 71 26.66 N 152 1.22 W					
HLY03 217 1	CTD			BO	200	198.72	2.73	9 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 217 1	CTD	Oct 08 2003	1340	EN 71 26.65 N 152 1.41 W					
HLY03 218 1	CTD	Oct 08 2003	1618	BE 71 29.47 N 151 59.03 W					
HLY03 218 1	CTD			BO	293	286.72	2.09	12 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 218 1	CTD	Oct 08 2003	1658	EN 71 29.38 N 151 59.21 W					
HLY03 219 1	CTD	Oct 08 2003	1946	BE 71 32.18 N 151 56.94 W					
HLY03 219 1	CTD			BO	565	567.91	2.3	16 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 219 1	CTD	Oct 08 2003	2035	EN 71 32.21 N 151 57.24 W					
HLY03 220 1	CTD	Oct 08 2003	2314	BE 71 34.69 N 151 54.40 W					
HLY03 220 1	CTD			BO	820	818.52	2	12 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	Corrected Bathy is 812. Depth discrepancy.
HLY03 220 1	CTD	Oct 09 2003	0006	EN 71 34.88 N 151 53.64 W					

HLY03 221 1	CTD	Oct 09 2003	0120	BE 71 37.23 N 151 51.99 W					
HLY03 221 1	CTD			BO	913	926.33	3.4	12 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	Corrected Bathy is 960. Depth
HLY03 221 1	CTD	Oct 09 2003	0215	EN 71 37.20 N 151 52.14 W					discrepancy.
HLY03 222 1	CTD	Oct 09 2003	0336	BE 71 39.77 N 151 49.52 W					
HLY03 222 1	CTD			BO	1388	1398.04 2.84		12 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 222 1	CTD	Oct 09 2003	0445	EN 71 39.57 N 151 50.12 W					
HLY03 223 1	CTD	Oct 09 2003	0612	BE 71 42.27 N 151 47.61 W					
HLY03 223 1	CTD			BO	1585	1606.69 3.06		14 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	Bottle 13 did not trip.
HLY03 223 1	CTD	Oct 09 2003	0728	EN 71 42.06 N 151 47.52 W					
HLY03 224 1	CTD	Oct 09 2003	0848	BE 71 44.96 N 151 45.36 W					
HLY03 224 1	CTD			BO	1784	1824.99 8.49		17 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 224 1	CTD	Oct 09 2003	1021	EN 71 44.96 N 151 47.45 W					
HLY03 225 1	CTD	Oct 09 2003	1143	BE 71 47.51 N 151 42.65 W					
HLY03 225 1	CTD			BO	2049	2076.81 2.76		18 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 225 1	CTD	Oct 09 2003	1331	EN 71 46.60 N 151 42.37 W					
HLY03 226 1	CTD	Oct 09 2003	1507	BE 71 50.44 N 151 40.82 W					
HLY03 226 1	CTD			BO	2187	2224.21 3.58		18 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 226 1	CTD	Oct 09 2003	1659	EN 71 49.81 N 151 40.93 W					
HLY03 227 1	CTD	Oct 09 2003	1844	BE 71 52.80 N 151 38.76 W					
HLY03 227 1	CTD			BO	2290	602.05	376.08	0	Only down to 600m
HLY03 227 1	CTD	Oct 09 2003	1915	EN 71 52.72 N 151 39.35 W					
HLY03 228 1	CTD	Oct 09 2003	2000	BE 71 55.38 N 151 36.14 W					
HLY03 228 1	CTD			BO	2341	2.04	343.55	0	No LADCP for these
HLY03 228 1	CTD	Oct 09 2003	2028	EN 71 55.23 N 151 37.05 W					stations.
HLY03 229 1	CTD	Oct 09 2003	2111	BE 71 58.07 N 151 33.03 W					
HLY03 229 1	CTD			BO	2372	601.5	5000		
HLY03 229 1	CTD	Oct 09 2003	2140	EN 71 57.99 N 151 33.56 W					
HLY03 230 1	CTD	Oct 09 2003	2214	BE 72 0.65 N 151 30.72 W					
HLY03 230 1	CTD			BO	2393	605.65	502.56	0	
HLY03 230 1	CTD	Oct 09 2003	2244	EN 72 0.50 N 151 31.62 W					
HLY03 231 1	CTD	Oct 09 2003	2319	BE 72 3.25 N 151 28.37 W					
HLY03 231 1	CTD			BO	2603	607.1	5000		
HLY03 231 1	CTD	Oct 09 2003	2349	EN 72 3.11 N 151 29.23 W					
HLY03 232 1	CTD	Oct 10 2003	2210	BE 71 7.03 N 158 15.59 W					
HLY03 232 1	CTD			BO	38	37.29	2.51	0	Barrow Canyon Section.
HLY03 232 1	CTD	Oct 10 2003	2220	EN 71 7.06 N 158 16.09 W					Stations 232 to 247
									10 bottles removed

HLY03 233 1	CTD	Oct 10 2003	2249	BE 71 8.70 N 158 17.95 W					
HLY03 233 1	CTD			BO	38	36.3	2.87	0	
HLY03 233 1	CTD	Oct 10 2003	2300	EN 71 8.73 N 158 17.90 W					
HLY03 234 1	CTD	Oct 10 2003	2345	BE 71 10.47 N 158 20.96 W					
HLY03 234 1	CTD			BO	47	45.88	2.54	0	
HLY03 234 1	CTD	Oct 10 2003	2355	EN 71 10.47 N 158 20.85 W					
HLY03 235 1	CTD	Oct 11 2003	0028	BE 71 11.99 N 158 24.08 W					
HLY03 235 1	CTD			BO	69	69.69	1.67	0	CTD sat on deck ~10 min before deployment.
HLY03 235 1	CTD	Oct 11 2003	0039	EN 71 12.07 N 158 24.01 W					
HLY03 236 1	CTD	Oct 11 2003	0104	BE 71 13.53 N 158 26.94 W					
HLY03 236 1	CTD			BO	96	95.26	2.82	0	
HLY03 236 1	CTD	Oct 11 2003	0115	EN 71 13.63 N 158 26.95 W					
HLY03 237 1	CTD	Oct 11 2003	0205	BE 71 15.22 N 158 30.30 W					
HLY03 237 1	CTD			BO	110	109.98	2.38	0	
HLY03 237 1	CTD	Oct 11 2003	0219	EN 71 15.29 N 158 30.14 W					
HLY03 238 1	CTD	Oct 11 2003	0252	BE 71 16.86 N 158 33.16 W					
HLY03 238 1	CTD			BO	110	109.77	2.05	0	
HLY03 238 1	CTD	Oct 11 2003	0305	EN 71 16.82 N 158 33.40 W					
HLY03 239 1	CTD	Oct 11 2003	0337	BE 71 18.48 N 158 35.98 W					
HLY03 239 1	CTD			BO	108	107.64	1.71	0	
HLY03 239 1	CTD	Oct 11 2003	0350	EN 71 18.52 N 158 36.07 W					
HLY03 240 1	CTD	Oct 11 2003	0418	BE 71 20.21 N 158 38.52 W					
HLY03 240 1	CTD			BO	78	76.34	2.85	0	
HLY03 240 1	CTD	Oct 11 2003	0430	EN 71 20.27 N 158 38.79 W					
HLY03 241 1	CTD	Oct 11 2003	0500	BE 71 21.83 N 158 41.10 W					
HLY03 241 1	CTD			BO	57	54.87	2.28	0	
HLY03 241 1	CTD	Oct 11 2003	0511	EN 71 21.91 N 158 41.56 W					
HLY03 242 1	CTD	Oct 11 2003	0537	BE 71 23.16 N 158 44.30 W					
HLY03 242 1	CTD			BO	56	54.46	1.68	0	
HLY03 242 1	CTD	Oct 11 2003	0547	EN 71 23.08 N 158 44.85 W					
HLY03 243 1	CTD	Oct 11 2003	0615	BE 71 24.85 N 158 47.82 W					
HLY03 243 1	CTD			BO	62	60.44	1.61	0	
HLY03 243 1	CTD	Oct 11 2003	0625	EN 71 24.82 N 158 48.65 W					
HLY03 244 1	CTD	Oct 11 2003	0655	BE 71 26.53 N 158 51.03 W					
HLY03 244 1	CTD			BO	54	52.27	2.58	0	
HLY03 244 1	CTD	Oct 11 2003	0705	EN 71 26.55 N 158 51.83 W					

HLY03 245 1	CTD	Oct 11 2003	0739	BE 71 28.46 N 158 54.24 W					
HLY03 245 1	CTD			BO	53	51.73	2.31	0	
HLY03 245 1	CTD	Oct 11 2003	0749	EN 71 28.62 N 158 54.89 W					
HLY03 246 1	CTD	Oct 11 2003	0810	BE 71 29.81 N 158 57.30 W					
HLY03 246 1	CTD			BO	53	50.64	2.16	0	
HLY03 246 1	CTD	Oct 11 2003	0819	EN 71 29.95 N 158 57.99 W					
HLY03 247 1	CTD	Oct 11 2003	0841	BE 71 31.33 N 159 0.12 W					
HLY03 247 1	CTD			BO	52	50.6	1.89	0	
HLY03 247 1	CTD	Oct 11 2003	0849	EN 71 31.48 N 159 0.69 W					
HLY03 248 1	CTD	Oct 11 2003	1001	BE 71 36.83 N 159 26.17 W					
HLY03 248 1	CTD			BO	51	47.68	2.32	4 Sal/O2/Sil/NO3/NO2/PO4	Edge of Barrow Canyon to Hannah Shoal
HLY03 248 1	CTD	Oct 11 2003	1015	EN 71 37.06 N 159 27.09 W					
HLY03 249 1	CTD	Oct 11 2003	1120	BE 71 42.05 N 159 51.99 W					
HLY03 249 1	CTD			BO	49	47.66	2.59	4 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 249 1	CTD	Oct 11 2003	1132	EN 71 42.02 N 159 52.91 W					
HLY03 250 1	CTD	Oct 11 2003	1250	BE 71 47.36 N 160 18.48 W					
HLY03 250 1	CTD			BO	50	42.99	3.14	4 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 250 1	CTD	Oct 11 2003	1304	EN 71 47.61 N 160 19.45 W					
HLY03 251 1	CTD	Oct 11 2003	1416	BE 71 52.59 N 160 44.53 W					
HLY03 251 1	CTD			BO	43	38.18	4.01	4 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 251 1	CTD	Oct 11 2003	1430	EN 71 52.60 N 160 45.77 W					
HLY03 252 1	CTD	Oct 11 2003	1540	BE 71 58.03 N 161 10.88 W					
HLY03 252 1	CTD			BO	34	33.1	3.56	3 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 252 1	CTD	Oct 11 2003	1553	EN 71 58.17 N 161 11.91 W					
HLY03 253 1	CTD	Oct 11 2003	1705	BE 72 3.45 N 161 38.84 W					
HLY03 253 1	CTD			BO	29	26.09	3.99	3 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 253 1	CTD	Oct 11 2003	1717	EN 72 3.67 N 161 39.70 W					
HLY03 254 1	CTD	Oct 11 2003	1834	BE 72 9.20 N 162 6.91 W					
HLY03 254 1	CTD			BO	27	24.21	4.82	3 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	Start up LADCP again.
HLY03 254 1	CTD	Oct 11 2003	1853	EN 72 9.34 N 162 8.12 W					
HLY03 255 1	CTD	Oct 12 2003	0338	BE 72 13.76 N 162 0.81 W					
HLY03 255 1	CTD			BO	33	31.68	2.25	3 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 255 1	CTD	Oct 12 2003	0353	EN 72 13.71 N 162 0.80 W					
HLY03 256 1	CTD	Oct 12 2003	0454	BE 72 18.17 N 161 53.02 W					
HLY03 256 1	CTD			BO	40	36.81	1.55	3 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 256 1	CTD	Oct 12 2003	0510	EN 72 18.09 N 161 52.90 W					

HLY03 257 1	CTD	Oct 12 2003	0617	BE 72 22.69 N 161 46.04 W					
HLY03 257 1	CTD			BO	44	39.74	2.12	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 257 1	CTD	Oct 12 2003	0630	EN 72 22.65 N 161 46.21 W					
HLY03 258 1	CTD	Oct 12 2003	0723	BE 72 26.96 N 161 38.19 W					
HLY03 258 1	CTD			BO	40	41.08	2.67	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 258 1	CTD	Oct 12 2003	0739	EN 72 26.98 N 161 38.57 W					
HLY03 259 1	CTD	Oct 12 2003	0823	BE 72 31.46 N 161 30.87 W					
HLY03 259 1	CTD			BO	45	42.4	3.15	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 259 1	CTD	Oct 12 2003	0838	EN 72 31.41 N 161 31.17 W					
HLY03 260 1	CTD	Oct 12 2003	0924	BE 72 35.81 N 161 23.70 W					
HLY03 260 1	CTD			BO	49	42.79	2.27	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 260 1	CTD	Oct 12 2003	0938	EN 72 35.92 N 161 24.67 W					
HLY03 261 1	CTD	Oct 12 2003	1018	BE 72 40.09 N 161 15.53 W					
HLY03 261 1	CTD			BO	51	45.35	2.11	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 261 1	CTD	Oct 12 2003	1033	EN 72 40.33 N 161 16.06 W					
HLY03 262 1	CTD	Oct 12 2003	1110	BE 72 44.45 N 161 7.55 W					
HLY03 262 1	CTD			BO	54	48.41	2.23	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 262 1	CTD	Oct 12 2003	1125	EN 72 44.54 N 161 8.36 W					
HLY03 263 1	CTD	Oct 12 2003	1215	BE 72 48.82 N 161 0.01 W					
HLY03 263 1	CTD			BO	54	49.59	2.7	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	Jelly fish pulled out of tygon tubing between oxy and pump in Primary system. May not have been affecting anything. Noisy data at interface could be due to wake effects.
HLY03 263 1	CTD	Oct 12 2003	1228	EN 72 48.90 N 161 0.67 W					
HLY03 264 1	CTD	Oct 12 2003	1311	BE 72 51.18 N 160 56.23 W					
HLY03 264 1	CTD			BO	58	49.57	4.05	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 264 1	CTD	Oct 12 2003	1325	EN 72 51.25 N 160 57.15 W					
HLY03 265 1	CTD	Oct 12 2003	1402	BE 72 53.52 N 160 51.48 W					
HLY03 265 1	CTD			BO	55	50.83	4.8	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 265 1	CTD	Oct 12 2003	1417	EN 72 53.56 N 160 52.04 W					
HLY03 266 1	CTD	Oct 12 2003	1453	BE 72 56.11 N 160 47.84 W					
HLY03 266 1	CTD			BO	71	64.89	2.27	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 266 1	CTD	Oct 12 2003	1510	EN 72 56.07 N 160 47.80 W					
HLY03 267 1	CTD	Oct 12 2003	1549	BE 72 58.37 N 160 43.73 W					
HLY03 267 1	CTD			BO	75	72.27	2.9	5 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 267 1	CTD	Oct 12 2003	1606	EN 72 58.36 N 160 43.99 W					

HLY03 268 1	CTD	Oct 12 2003	1734	BE 73 0.98 N 160 39.59 W					
HLY03 268 1	CTD			BO	140	134.23	3.33	6 Sal/O2/Sil/NO3/NO2/PO4	Jelly fish strands wrapped around vent. plugs on recovery. Thouroughly hosed prior to next station
HLY03 268 1	CTD	Oct 12 2003	1756	EN 73 0.88 N 160 39.48 W					
HLY03 269 1	CTD	Oct 12 2003	1840	BE 73 3.37 N 160 35.46 W					
HLY03 269 1	CTD			BO	160	156.86	2.82	6 Sal/O2/Sil/NO3/NO2/PO4	Bottles 9 and 14 came up with bottom encaps closed due to weak tension on lanyards. Rob tightened lanyards after cast. These bottles were not being used so not an issue for this casts water samples.
HLY03 269 1	CTD	Oct 12 2003	1905	EN 73 3.37 N 160 35.47 W					
HLY03 270 1	CTD	Oct 12 2003	1947	BE 73 5.63 N 160 31.22 W					
HLY03 270 1	CTD			BO	211	201.69	2.25	11 Sal/O2/Sil/NO3/NO2/PO4	Extra bottles fired that had been cocked a more 'open' way. Bottle closed successfully without hanging up.
HLY03 270 1	CTD	Oct 12 2003	2018	EN 73 5.56 N 160 31.24 W					
HLY03 271 1	CTD	Oct 12 2003	2119	BE 73 8.18 N 160 26.75 W					
HLY03 271 1	CTD			BO	264	262.52	2.04	7 Sal/O2/Sil/NO3/NO2/PO4	Starting this station
HLY03 271 1	CTD	Oct 12 2003	2150	EN 73 8.57 N 160 27.71 W					
HLY03 272 1	CTD	Oct 12 2003	2332	BE 73 10.46 N 160 23.06 W					
HLY03 272 1	CTD			BO	300	306.1	2.07	8 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 272 1	CTD	Oct 13 2003	0003	EN 73 10.58 N 160 24.10 W					
HLY03 273 1	CTD	Oct 13 2003	0052	BE 73 12.94 N 160 18.39 W					
HLY03 273 1	CTD			BO	416	419.96	2.64	8 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 273 1	CTD	Oct 13 2003	0131	EN 73 13.08 N 160 18.61 W					
HLY03 274 1	CTD	Oct 13 2003	0246	BE 73 15.27 N 160 14.30 W					
HLY03 274 1	CTD			BO	828	791.09	4.44	8 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 274 1	CTD	Oct 13 2003	0331	EN 73 15.43 N 160 13.88 W					
HLY03 275 1	CTD	Oct 13 2003	0427	BE 73 17.63 N 160 10.05 W					
HLY03 275 1	CTD			BO	1103	1112.82	11.11	8 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 275 1	CTD	Oct 13 2003	0522	EN 73 17.90 N 160 10.02 W					
HLY03 276 1	CTD	Oct 13 2003	0612	BE 73 20.11 N 160 5.44 W					
HLY03 276 1	CTD			BO	1316	1319.86	8.85	10 Sal/O2/Sil/NO3/NO2/PO4	Bottom 2 bottles are blank water for nutrient analysis use
HLY03 276 1	CTD	Oct 13 2003	0718	EN 73 20.32 N 160 5.34 W					
HLY03 277 1	CTD	Oct 13 2003	0807	BE 73 22.47 N 160 1.51 W					
HLY03 277 1	CTD			BO	1476	1462.21	10.21	10 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 277 1	CTD	Oct 13 2003	0915	EN 73 22.54 N 160 1.12 W					
HLY03 278 1	CTD	Oct 13 2003	1025	BE 73 24.96 N 159 56.97 W					
HLY03 278 1	CTD			BO	1625	1617.01	9.95	12 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 278 1	CTD	Oct 13 2003	1142	EN 73 24.94 N 159 56.54 W					
HLY03 279 1	CTD	Oct 13 2003	1250	BE 73 29.25 N 159 49.23 W					
HLY03 279 1	CTD			BO	1951	1958.82	6.03	12 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 279 1	CTD	Oct 13 2003	1428	EN 73 29.26 N 159 49.21 W					

HLY03 280 1	CTD	Oct 13 2003	1553	BE	73 33.65 N	159 41.29 W					
HLY03 280 1	CTD			BO			2256	2255.34	6.36	12 Sal/O2/Sil/NO3/NO2/PO4	Niskin 1-6 vents left open
HLY03 280 1	CTD	Oct 13 2003	1736	EN	73 33.64 N	159 41.15 W					
HLY03 281 1	CTD	Oct 13 2003	1839	BE	73 33.62 N	159 41.34 W					
HLY03 281 1	CTD			BO			2259	300.64	487.94	6 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 281 1	CTD	Oct 13 2003	1911	EN	73 33.63 N	159 41.33 W					
HLY03 282 1	CTD	Oct 13 2003	2025	BE	73 38.00 N	159 33.22 W					
HLY03 282 1	CTD			BO			2499	2523.5	3.48	13 Sal/O2/Sil/NO3/NO2/PO4	Package lowered past 10m soaking stage
HLY03 282 1	CTD	Oct 13 2003	2229	EN	73 38.02 N	159 33.07 W					
HLY03 283 1	CTD	Oct 14 2003	0113	BE	73 42.43 N	159 25.34 W					
HLY03 283 1	CTD			BO			2742	2781.02	3.8	12 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 283 1	CTD	Oct 14 2003	0312	EN	73 42.57 N	159 24.78 W					
HLY03 284 1	CTD	Oct 14 2003	0441	BE	73 46.72 N	159 17.02 W					
HLY03 284 1	CTD			BO			2978	3012	14.98	12 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 284 1	CTD	Oct 14 2003	0644	EN	73 46.76 N	159 17.02 W					
HLY03 285 1	CTD	Oct 14 2003	0914	BE	73 32.25 N	159 34.17 W					
HLY03 285 1	CTD			BO			2250	600.87	348.21	4 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 285 1	CTD	Oct 14 2003	0953	EN	73 32.25 N	159 33.62 W					
HLY03 286 1	CTD	Oct 14 2003	1100	BE	73 29.29 N	159 19.43 W					
HLY03 286 1	CTD			BO			2300	610.54	372.95	4 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 286 1	CTD	Oct 14 2003	1135	EN	73 29.27 N	159 18.97 W					
HLY03 287 1	CTD	Oct 14 2003	1253	BE	73 26.33 N	159 5.24 W					
HLY03 287 1	CTD			BO			2204(b)	602.33	372.31	4 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 287 1	CTD	Oct 14 2003	1332	EN	73 26.34 N	159 5.13 W					
HLY03 288 1	CTD	Oct 14 2003	1425	BE	73 23.47 N	158 51.19 W					
HLY03 288 1	CTD			BO			2187	600.75	340.14	4 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 288 1	CTD	Oct 14 2003	1505	EN	73 23.96 N	158 49.28 W					
HLY03 289 1	CTD	Oct 14 2003	1556	BE	73 20.51 N	158 36.58 W					
HLY03 289 1	CTD			BO			2129	608.54	399.43	4 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 289 1	CTD	Oct 14 2003	1639	EN	73 20.50 N	158 36.57 W					
HLY03 290 1	CTD	Oct 14 2003	1723	BE	73 17.31 N	158 22.52 W					
HLY03 290 1	CTD			BO			2174	598	396.44	4 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 290 1	CTD	Oct 14 2003	1803	EN	73 17.83 N	158 21.86 W					
HLY03 291 1	CTD	Oct 14 2003	1901	BE	73 14.57 N	158 8.22 W					
HLY03 291 1	CTD			BO			2331(b)	600.91	371.15	4 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 291 1	CTD	Oct 14 2003	1940	EN	73 14.54 N	158 7.48 W					

HLY03 292 1	CTD	Oct 14 2003	2030	BE 73 11.71 N 157 54.15 W					
HLY03 292 1	CTD			BO	2475	612.15	352.55	4 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 292 1	CTD	Oct 14 2003	2105	EN 73 11.75 N 157 54.22 W					
HLY03 293 1	CTD	Oct 14 2003	2157	BE 73 8.83 N 157 40.29 W					
HLY03 293 1	CTD			BO	2449	623.14	363.87	5 Sal/O2/Sil/NO3/NO2/PO4	Last Bottle tag needs to be removed. Only 4 bottles
HLY03 293 1	CTD	Oct 14 2003	2235	EN 73 9.05 N 157 40.05 W					
HLY03 294 1	CTD	Oct 14 2003	2332	BE 73 5.80 N 157 26.42 W					
HLY03 294 1	CTD			BO	2651	599.31	358.03	4 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 294 1	CTD	Oct 15 2003	0007	EN 73 6.13 N 157 25.91 W					
HLY03 295 1	CTD	Oct 15 2003	0054	BE 73 2.68 N 157 12.38 W					
HLY03 295 1	CTD			BO	2558	609.17	500	4 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 295 1	CTD	Oct 15 2003	0129	EN 73 2.78 N 157 12.26 W					
HLY03 296 1	CTD	Oct 15 2003	0219	BE 72 59.80 N 156 58.40 W					
HLY03 296 1	CTD			BO	2364	601.66	500	4 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 296 1	CTD	Oct 15 2003	0252	EN 73 0.08 N 156 58.29 W					
HLY03 297 1	CTD	Oct 15 2003	0336	BE 72 56.90 N 156 44.16 W					
HLY03 297 1	CTD			BO	2449	603.28	485.28	4 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 297 1	CTD	Oct 15 2003	0413	EN 72 57.27 N 156 43.61 W					
HLY03 298 1	CTD	Oct 15 2003	1916	BE 72 56.93 N 156 43.78 W					
HLY03 298 1	CTD			BO	2428	2481.39 3.55		11 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 298 1	CTD	Oct 15 2003	2105	EN 72 56.86 N 156 45.51 W					
HLY03 299 1	CTD	Oct 15 2003	2221	BE 72 53.25 N 156 56.24 W					
HLY03 299 1	CTD			BO	2098	603.23	360.65	6 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 299 1	CTD	Oct 15 2003	2300	EN 72 53.36 N 156 56.71 W					
HLY03 300 1	CTD	Oct 15 2003	2351	BE 72 49.86 N 157 8.12 W					
HLY03 300 1	CTD			BO	1729	603.73	500	6 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 300 1	CTD	Oct 16 2003	0033	EN 72 50.18 N 157 8.86 W					
HLY03 301 1	CTD	Oct 16 2003	0121	BE 72 46.52 N 157 19.01 W					
HLY03 301 1	CTD			BO	1113	605.12	500	6 Sal/O2/Sil/NO3/NO2/PO4/Chl/Phaeo	
HLY03 301 1	CTD	Oct 16 2003	0156	EN 72 46.96 N 157 20.22 W					
HLY03 302 1	CTD	Oct 16 2003	0320	BE 72 44.62 N 157 26.17 W					
HLY03 302 1	CTD			BO	567	534.54	4.07	6 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 302 1	CTD	Oct 16 2003	0355	EN 72 44.97 N 157 26.09 W					
HLY03 303 1	CTD	Oct 16 2003	0434	BE 72 42.57 N 157 32.40 W					
HLY03 303 1	CTD			BO	408	391.45	5.76	6 Sal/O2/Sil/NO3/NO2/PO4	
HLY03 303 1	CTD	Oct 16 2003	0504	EN 72 42.82 N 157 32.85 W					

HLY03 304 1	CTD	Oct 16 2003	0550	BE 72 40.57 N 157 38.92 W						
HLY03 304 1	CTD			BO	352	341.4	4.84	6 Sal/O2/Sil/NO3/NO2/PO4		
HLY03 304 1	CTD	Oct 16 2003	0618	EN 72 40.69 N 157 39.92 W						
HLY03 305 1	CTD	Oct 16 2003	0653	BE 72 38.75 N 157 44.93 W						
HLY03 305 1	CTD			BO	296	288.25	5.57	6 Sal/O2/Sil/NO3/NO2/PO4		
HLY03 305 1	CTD	Oct 16 2003	0720	EN 72 38.95 N 157 45.92 W						
HLY03 306 1	CTD	Oct 16 2003	0808	BE 72 36.87 N 157 51.44 W						
HLY03 306 1	CTD			BO	246	237.49	5	6 Sal/O2/Sil/NO3/NO2/PO4		
HLY03 306 1	CTD	Oct 16 2003	0836	EN 72 37.01 N 157 53.33 W						
HLY03 307 1	CTD	Oct 16 2003	0919	BE 72 35.13 N 157 57.21 W						
HLY03 307 1	CTD			BO	200	189.39	8.73	6 Sal/O2/Sil/NO3/NO2/PO4		
HLY03 307 1	CTD	Oct 16 2003	0944	EN 72 35.21 N 157 59.42 W						
HLY03 308 1	CTD	Oct 16 2003	1023	BE 72 33.09 N 158 3.41 W						
HLY03 308 1	CTD			BO	165	152.08	10.62	6 Sal/Sil/NO3/NO2/PO4		
HLY03 308 1	CTD	Oct 16 2003	1046	EN 72 33.13 N 158 5.64 W						
HLY03 309 1	CTD	Oct 16 2003	1149	BE 72 31.07 N 158 10.37 W						
HLY03 309 1	CTD			BO	108	99.41	2.74	6 Sal/Sil/NO3/NO2/PO4		
HLY03 309 1	CTD	Oct 16 2003	1208	EN 72 31.16 N 158 10.59 W						
HLY03 310 1	CTD	Oct 16 2003	1247	BE 72 29.21 N 158 16.44 W						
HLY03 310 1	CTD			BO	71	66.21	3.35	6 Sal/O2/Sil/NO3/NO2/PO4		
HLY03 310 1	CTD	Oct 16 2003	1304	EN 72 29.22 N 158 16.92 W						
HLY03 311 1	CTD	Oct 16 2003	1343	BE 72 27.32 N 158 22.88						
HLY03 311 1	CTD			BO	61	56.73	2.68	6 Sal/O2/Sil/NO3/NO2/PO4	Niskin 3	
HLY03 311 1	CTD	Oct 16 2003	1400	EN 72 27.33 N 158 23.37 W						
HLY03 312 1	CTD	Oct 16 2003	1452	BE 72 25.31 N 158 29.45 W						
HLY03 312 1	CTD			BO	56	52.9	3.27	5 Sal/O2/Sil/NO3/NO2/PO4	Went to bottom	
HLY03 312 1	CTD	Oct 16 2003	1505	EN 72 25.30 N 158 29.49 W						
HLY03 313 1	CTD	Oct 16 2003	1544	BE 72 23.39 N 158 35.09 W						
HLY03 313 1	CTD			BO	54	51.27	3.04	4 Sal/O2/Sil/NO3/NO2/PO4		
HLY03 313 1	CTD	Oct 16 2003	1601	EN 72 23.35 N 158 35.82 W						
HLY03 314 1	CTD	Oct 16 2003	1741	BE 72 19.33 N 159 15.99 W						
HLY03 314 1	CTD			BO	49	44.12	5.54	4 Sal/O2/Sil/NO3/NO2/PO4		
HLY03 314 1	CTD	Oct 16 2003	1801	EN 72 19.39 N 159 16.03 W						
HLY03 315 1	CTD	Oct 16 2003	1917	BE 72 15.31 N 159 55.19 W						
HLY03 315 1	CTD			BO	47	41.24	2.9	4 Sal/O2/Sil/NO3/NO2/PO4		
HLY03 315 1	CTD	Oct 16 2003	1930	EN 72 15.29 N 159 55.22 W						

HLY03 316 1	CTD	Oct 16 2003	2039	BE 72 11.19 N 160 34.53 W					
HLY03 316 1	CTD			BO	403	5.4	4.95	3 Sal/Sil/NO3/NO2/PO4	
HLY03 316 1	CTD	Oct 16 2003	2055	EN 72 11.25 N 160 34.48 W					
HLY03 317 1	CTD	Oct 16 2003	2213	BE 72 7.23 N 161 13.72 W					
HLY03 317 1	CTD			BO	28	27.71	1.68	3 Sil/NO3/NO2/PO4	
HLY03 317 1	CTD	Oct 16 2003	2225	EN 72 7.26 N 161 13.72 W					
HLY03 318 1	CTD	Oct 17 2003	0013	BE 72 6.48 N 162 28.91 W					
HLY03 318 1	CTD			BO	34	31.8	3.06	4 Frozen samples Chl/Phaeo.	No more LADCPs
HLY03 318 1	CTD	Oct 17 2003	0026	EN 72 6.50 N 162 29.36 W					
HLY03 319 1	CTD	Oct 17 2003	0121	BE 72 9.84 N 162 59.25 W					
HLY03 319 1	CTD			BO	39	34.57	4.02	4 Frozen samples Chl/Phaeo.	
HLY03 319 1	CTD	Oct 17 2003	0134	EN 72 9.90 N 162 59.28 W					
HLY03 320 1	CTD	Oct 17 2003	0232	BE 72 13.47 N 163 28.95 W					
HLY03 320 1	CTD			BO	37	35.08	3.61	4 Frozen samples Chl/Phaeo.	
HLY03 320 1	CTD	Oct 17 2003	0247	EN 72 13.48 N 163 29.24 W					
HLY03 321 1	CTD	Oct 17 2003	0343	BE 72 17.03 N 163 58.88 W					
HLY03 321 1	CTD			BO	36(b)	38.2	3.45	4 Frozen samples Chl/Phaeo.	
HLY03 321 1	CTD	Oct 17 2003	0358	EN 72 17.04 N 163 59.16 W					
HLY03 904 1	CTD	Sep 22 2003	2203	BE 70 41.71 N 166 5.88 W					
HLY03 904 1	CTD			BO	37.8	2.25	0		
HLY03 904 1	CTD	Sep 22 2003	2210	EN 70 41.75 N 166 5.77 W					

Key to Abbreviations:
(b) = depth taken from bathymetric chart
(K) = depth taken from Knudsen