2004 Joint Western Arctic Circulation Study and Beaufort Gyre Freshwater Experiment

Cruise Report

Beaufort Sea and Canada Basin
CCGS Louis S. St-Laurent
29 July – 2 September, 2004

Institute of Ocean Sciences Cruise 2004-16

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Overview

The ocean circulation and chemistry of the Canada Basin were studied for the month of August aboard the CCGS Louis S St Laurent through a multi-year international cooperation between the Institute of Ocean Sciences (IOS), the Woods Hole Oceanographic Institution (WHOI) and the Japan Marine Sciences and Technology Center (JAMSTEC). The principle investigators of this project are Eddy Carmack, Fiona McLaughlin, Andrey Proshutinsky and Koji Shimada. 16 scientists were on board to perform rosette, mooring, XCTD and net tow operations. Data will be used to address questions of freshwater storage in the Beaufort Gyre, water mass circulation, inter-annual variability of water properties, and distribution and concentration of bacteria and plankton.

Although ice conditions were heavier than last year, the cruise was still able to accomplish all the mooring work and almost all the planned Rosette/CTD casts. This cruise has provided substantial coverage of high resolution, full ocean-depth data over the Canada Basin.

Objectives

Freshwater Storage in the Beaufort Gyre

The factors behind the inter-annual variability of accumulation and release of fresh water in Beaufort Gyre are under investigation. A broad-scale pattern of wind-forcing over the Arctic is thought to force the accumulation and release of fresh water contained in the upper 250m. Multi-year data from moorings and CTDs will help show where the freshwater is stored, its volume and its connection to the atmosphere.

Water-Mass Circulation, Inter-Annual Variability and Climate Change

The pathways of relatively fresh water from the Pacific and the relatively warm water from the Atlantic spreading into the Canada Basin are being examined. Inter-annual variability of the pathways and the properties of these waters are also being studied. The central and northern regions of the Canada Basin have not been well sampled due to their inaccessibility from its thick ice cover. By using a Canadian Coast Guard icebreaker we plan to perform Rosette casts with a CTD and a Lowered Acoustic Doppler Profiler (LADCP), and to deploy XCTDs and moorings. From these activities, the distribution of temperature and salinity, enhanced with water sample geochemistry, can be mapped. These properties, in addition to the current speeds show how the Pacific and Atlantic water are advected through the basin. Comparisons with last years' results will build a stronger picture and provide a broad base for inter-annual comparisons with historical and future data.

Distribution and Concentration of the Zooplankton, Phytoplankton and Bacteria

The constituents of the lower food chain are being studied by assessing species distribution and concentration over the basin. How ocean circulation, ice cover, and water properties contribute to the distribution and concentration will be examined. Net

tows and water from the rosette will be used for this study in addition to measuring the amount of light in the air and water.

Activities

Location and time of events are listed in the appendices.

Transit from Halifax to Resolute

- 36 XCTDs
- 105 Drifter Bottles deployed

Transit in Canadian Archipelago (Resolute to Amundsen Gulf)

- 15 Rosettes in NorthWest Passage (Resolute to Amundsen Gulf) sampling salinity, nutrients and bacteria.
- 3 XCTDs in NorthWest Passage (Bellot Strait, #37 to #39)
- 49 Drifter Bottles deployed

Canada Basin

- 33 Rosettes and 2 CTDs

  CTD: The CTD was equipped with 2 temperature sensors, 2 conductivity sensors, SBE43 oxygen probe, transmissometer, fluorometer, bottom contact warning and an altimeter.

  Rosette: The full suite of water chemistry samples drawn from the bottles were salinity, dissolved oxygen, nitrate, silicate and phosphate, chlorophyll-a (filtered at 0.7, 5 and 10 um with Fo/Fa, chlorophyll-a and Phaeopigment values for each), POC/N, DOC/DON, TOC/TON, Biogenic Silica, phytoplankton cell size, DIC, C13, Bacteria, O18, Barium, and CDOM.

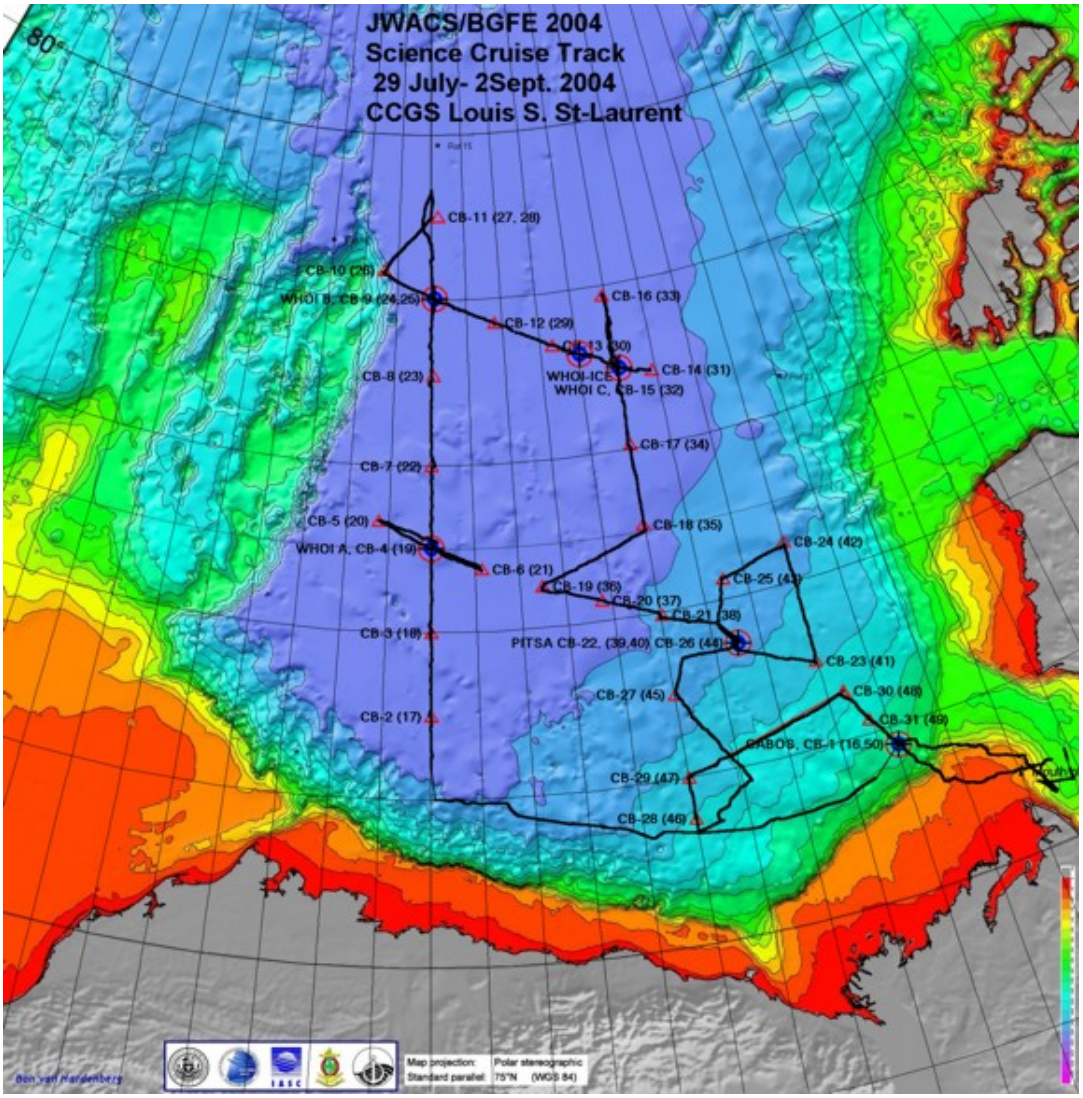
  LADCP: Current measurement from a downward looking sensor.
- 79 XCTDs (#40 to #119)
- 3 WHOI moorings serviced (Bottom depths 3824, 3821 and 3722m)
- 1 CABOS mooring serviced (Bottom depth 1121m)
- 1 Ice Tethered Profiler and Ice Mass Balance Buoy deployed
- 1 PITSA mooring recovered (Bottom depth 3133m)
- 2 buoys salvaged: JAMSTEC JCAD-7 buoy and a CRELL IMBB
- 64 Vertical Net Tows at 27 stations (56 were down to 100m and 8 were down to 500m). A SBE19 CTD (for pressure only) with a PAR sensor was attached to the wire at 22 of these stations.
- 83 Drifter Bottles deployed, typically 3 at each Rosette and CTD station.

Other

- 10^{th} year anniversary celebration of the 1994 crossing of the Arctic by the CCGS Louis S St-Laurent and the USCGC Polar Sea
- Slight detour near end of journey for medical evacuation.

Locations

Cruise track with CTD and Moorings shown. Locations are in the appendices. Triangles denote CTD/Rosette stations and circles show mooring and buoy locations.



Methods

The icebreaker, CCGS Louis S. St-Laurent, broke through first and multiyear ice to travel along four lines that roughly trace the shape of a box. The position of the box was predefined by the location of moorings already in place. The intent is to repeat this track in successive years.

Moorings

Four moorings were deployed in September 2003 to profile temperature, salinity, pressure and current. These moorings were recovered, serviced and redeployed. CTDs from the three WHOI mooring had an inter-comparison cast with the rosette's CTD. Afterward they were mounted back onto the profilers and redeployed. The CABOS mooring replaced the whole moored profiler thus there was no need for an at-sea calibration of the CTD. All mooring operations were performed in the presence of ice. The recovery technique was refined throughout the cruise and a procedural report regarding recovery procedures through the ice is being written by WHOI with input from Captain McNeill.

The PITSA mooring was recovered after a two year deployment. The mooring held an Ice Profiling Sensor (IPS) to measure the bottom depth of the ice, two current meters (RDI sentinel workhorse and an RCM-9), and a thermister chain with data loggers to record the temperature structure at the upper interface of the homogenous bottom layer. The mooring's light-weight fragile line, designed for recovery from the ice, required a cautious approach to bringing in the mooring. Although sea-ice was present and tangles in the line developed, the line did not break during the recovery due to careful ship-handling and deck-work.

An Ice Tethered Profiler (ITP) was set up along with an Ice Mass Balance Buoy (IMBB) on a slab of multiyear ice. The equipment and workers were flown to the ice, ~0.25 mile from the ship, with the helicopter. The two buoys were anchored into the 4m thick ice and by the following day we heard from the shore-based labs that both buoys were successfully transmitting data via satellite to shore. The ITP is a CTD, set up to profile between 5 and 800m. The IMBB measures ice thickness and temperature, and surface air temperature, pressure and snow accumulation.

Rosette/CTD Casts

Rosette casts were taken with a Seabird SBE911+ CTD, equipped with dual temperature sensors, dual conductivity sensors, SBE43 oxygen probe, transmissometer, pumped fluorometer, bottom contact warning device and an altimeter. In addition, a RDI lowered acoustic doppler profiler (LADCP) was mounted on the frame. 24 new 10 liter Niskin bottles were used to take chemistry samples: salinity, dissolved oxygen, nitrate (NO3), silicate (SiO4), phosphate (PO4), chlorophyll-a (filtered at 0.7, 5 and 10 um with Fo/Fa, chlorophyll-a and phaeopigment values for each), particulate organic carbon and nitrogen (POC/N), dissolved organic carbon and nitrogen (DOC/DON), total organic carbon and nitrogen (TOC/TON), biogenic silica, phytoplankton cell size, dissolved inorganic carbon (DIC), carbon 13 isotope (C-13), bacteria, oxygen 18 isotope (O18), Barium, and CDOM.

The rosette was lowered to 10m, the sensor pumps turned on and the package soaked for 3 minutes to equilibrate the oxygen sensor. The package was then raised to just below the surface and lowered to within 15m of the ocean floor. After closing the first bottle at the bottom of the cast, the package was raised at 50m/minute then slowed to 30m/minute for the upper 400m. Bottles were closed on the upcast without slowing the raising speed. This was done to capture the least disturbed water.

In the upper 400m, the sample depths were chosen to match a set of salinity values. During the downcast, the depths of the salinity values were noted so that on the upcast the bottle could be closed at the pre-determined depths.

Sampling took place immediately after each cast in the heated rosette room. The order of sampling was determined by drawing the samples most susceptible to temporal changes first.

Dissolved oxygen, nutrients, salinity, chlorophyll-a and phaeopigments were measured in laboratories on board. All other samples were prepared and stored for analysis on shore. Real-time analysis was critical for oxygen and important for the others due to the higher accuracy of the results achieved on board. Analysis at sea also allows time to respond to problems with equipment or sampling methods that may only be noticed after looking at results.

XCTD (Motoyo Itoh)

XCTDs (eXpendable Conductivity Temperature Depth made by Tsurumi Seiki) were deployed from the stern of the ship. They fall freely in water and measure temperature and conductivity every 0.15 m from the surface to 1100 m. Data was transmitted to the ship during the freefall by a thin conducting wire extending from the XCTD to an onboard computer. To prevent sea ice from cutting the wire of the XCTD, the ship slowed to 12 knots for the deployment in open water areas and completely stopped in heavy ice areas. It took 5 minutes for the XCTD to descend from the surface to 1100m. We had 120 XCTD stations during this cruise. Accuracy of XCTD is ±0.02 degrees in temperature, ±0.03 mS/cm in conductivity (approximately ±0.04psu in salinity) and ±5-20 m in depth. Salinity accuracy of XCTD is not good, however, it will be calibrated ±0.01psu using calibrated CTD (Conductivity Temperature Depth) data of this cruise.

Vertical Net Tows (Amanda Byrd)

Zooplankton sampling was undertaken using a modified Bongo net system. Two large bongo hoops were fitted with coarse mesh nets of 150μm and 236μm. A second set of smaller hoops were fitted perpendicular to the large hoops. These smaller hoops were fitted with finer 53μm mesh nets. The four nets were fitted with unidirectional flowmeters which measure the amount of water flowing through the hoops. The main sample depth was 100m, with 500m casts where possible.

The first samples collected from each Bongo set were preserved in formalin, the 53μm samples combined to form one sample. The 236μm and combined 53μm samples were preserved in 100% ethanol, and the 150μm sample was washed with 4% ammonium formate and dried at 50^{o}C for 24 hours. A 3rd cast to 500m was taken when possible, one 53μm sample was preserved in formalin, the other in ethanol, the 150μm was preserved in formalin and the 236μm preserved in ethanol.

LADCP (Waldemar Walczowski)

During the 200416 cruise of CCGS Louis S. St- Laurent measurements by means of the Lowered Acoustic Doppler Current Profiler (LADCP) were performed.

Measurements were conducted during every CTD cast. The self recording RDI, 307.2 kHz device nr 3313 was attached to the rosette frame. The down-looking LADCP measured currents in 20 depth cells, each cell (bin) 10 m thick. In vicinity of the bottom, bottom track were used. Vertical speed rate of the rosette was always less than 1 m s^{-1}. LADCP data were read directly after profiling. Additionally CTD records from Seabird 9/11 device were used to determine the ship position (from NMEA protocol registered every scan) and LADCP depth (from CTD pressure and time records). LADCP data were processed using LDEO software. 38 LADCP casts were performed.

Personnel

The research team includes both a shore and a ship component. The principle investigators of this project are Eddy Carmack, Fiona McLaughlin, Andrey Proshutinsky and Koji Shimada.

On Board

Name	Affiliation	Position
Sarah Zimmermann	IOS	Chief Scientist
Doug Sieberg	IOS	Chief Technician
Andrew Hamilton	IOS (Student)	CTD Watchleader
Bill Williams	IOS	CTD Watchstander
Waldek Walczowski	IOPAN	LADCP Principal Investigator, CTD operator
Janet Barwell-Clarke	IOS	Water Sample Manager
Linda White	IOS	Nutrient Analysis
Mary Steel	IOS	Oxygen Analysis
Ida Martin	IOS (Student)	Chlorophyll-a Analysis
Francoise Labonté	DFO (Student)	Chlorphyll-a Analysis
Rick Krishfield	WHOI	Mooring Analysis
John Kemp	WHOI	Mooring Technician
Kris Newhall	WHOI	Mooring Technician
Motoyo Itoh	JAMSTEC	CTD Watchleader, XCTD deployment
Masuo Hosono	JAMSTEC	CTD Watchstander, XCTD deployment
Amanda Byrd	UAF (Student)	Zooplankton Net Tows

Investigators on Shore

	Name	Affiliation	Program
1	Fiona McLaughlin	IOS	CTD and chemistry

2	Eddy Carmack	IOS	CTD and chemistry
3	Andrey Proshutinsky	WHOI	WHOI moorings
4	Koji Shimada	JAMSTEC	XCTD
5	Christine Michel	DFO	Chlorophyll-a samples
6	Chris Guay	OSU	Barium samples
7	Noriyuki Tanaka	IARC	O-18 samples
8	C.S. Wong	IOS	C-13 samples
9	Bill Li	BIO	Bacteria samples
10	Celine Gueguin	UBC/IOS	CDOM samples
11	Russ Hopcroft	UAF	Zooplankton net tows
12	John Nelson	UVic/DFO	Zooplankton net tows
13	Igor Polyakov	IARC	CABOS mooring
14	Rob Chadwell	IARC	CABOS mooring technician
15	Humfrey Melling	IOS	PITSA mooring
16	Mary-Louise Timmermann	WHOI	PITSA mooring

Affiliation Abbreviation

BIO	Bedford Institute of Oceanography, NS
DFO	Department of Fisheries and Oceans, Canada
IARC	International Arctic Research Center, Alaska
IOPAN	Institute of Oceanology Polish Academy of Sciences, Poland
IOS	Institute of Ocean Sciences, BC
JAMSTEC	Japan Agency for Marine-Earth Science Technology, Japan
UAF	University of Alaska Fairbanks, Alaska
UBC	Univerisity of British Columbia, BC
UVic	University of Victoria, BC
WHOI	Woods Hole Oceanographic Institution, Massachusetts

Ice and Weather

The weather and ice conditions slowed operations, but were not a severe hindrance except for travel through the Northwest Passage at the start of the mission with its 10/10ths ice coverage.

The mooring and CTD work through the ice was difficult, however the assistance from the daily satellite ice images, ice analysis and weather maps provided to the ship and local ice reconnaissance were tremendously helpful. When there was flexibility as to where the work occurred, the imagery helped suggest good locations with more open water. For the moorings, where the locations were fixed, the ice and weather information was used to help plan when we should try for the recovery, making the most efficient use of cruise time. In one example, of the two southeast moorings, one was recovered at the start of the cruise while the other was left for the end based on the imagery showing us one area near the ice edge with more openings and the other still in the solid pack. In another example, the imagery was used to help choose a location of solid multiyear ice for deploying the ice buoys. In this case, being able to asses a large area ahead of time allowed us to find good ice in the best location. The ice information was used

extensively for aiding navigation to help choose the most efficient route but its additional use in aiding science work was extremely helpful.

The discrepancy between the ice analysis charts and what we actually found made the satellite ice imagery and local reconnaissance even more important. If there are any means to improve the ground truthing to the ice analysis models for next summer's ice cover, it would be quite helpful.

Goals Not Completed

Remote stations

Heavy ice conditions at the start of our cruise delayed the ship by 7 days. The time constraints kept us from pursuing the stations farthest off our loop in the northern region. When we were granted 2 extra days for shiptime, we were able to complete all station in the southeast end of the cruise, mapping the predicted area of the Beaufort Gyre.

TOC samples

A protocol error of freezing samples in the -80°C freezer instead of the -10°C freezer led to broken glass sample vials. The majority of samples were lost until the error was discovered and corrected.

Acknowledgements

We would like to thank the captain and crew for all the work they put into the trip and its preparation. They put in the extra effort to make it a success and an enjoyable trip. In addition we would like to thank: The Canadian Ice Service for their support with the ice and weather information; the Coast Guard for making arrangement to alter crew change locations; to the CGCS Amundsen for help in the transfer of needed science equipment to the ship; and to the CGCS Sir Wilfred Laurier for accepting a transfer of science equipment and samples to be brought back to their home port.

Appendices

Table 1. Mooring Locations

Mooring Designation	Investigator	Water Depth (m)	Recovery Location	Recovery Time	Deployment Location	Deployment Time
BGFE-A	WHOI A. Proshutinsky	3824	75° 00.39'N 149° 58.752'W	10-Aug 14:34 UTC	75° 00.242' N 149° 57.742'W	12-Aug 19:58 UTC
BGFE-B	WHOI A. Proshutinsky	3821	78° 01.491'N 149° 49.378'W	15-Aug 13:23 UTC	78° 00.967'N 149° 51.544'W	17-Aug 17:59 UTC
BGFE-C	WHOI A. Proshutinsky	3722	76° 59.254'N 139° 54.229'W	20-Aug 18:57 UTC	76° 59.457'N 139° 58.407'W	22-Aug 19:31 UTC
ITP & IMB	WHOI A. Proshutinsky	(location is ship's position ~500 m from site)	x	x	77° 10.4'N 141° 13.0'W	19-Aug 15:00 UTC
CABOS	UAF/IARC I. Polyakov	1121	71° 46.672'N 131° 53.195'W	07-Aug 19:37 UTC	71° 46.506'N 131° 52.711'W	30-Aug 20:01 UTC
PITSA	IOS H. Melling	3133	73° 27.874'N 136° 59.816'W	25-Aug 16:00 UTC	x	x

Table 2. Rosette Sample Summary

Parameter	Sampled Cast (between 15 to 50)	Depths	Analyzed	Investigator
Salinity	All	all	ship and lab	Fiona McLaughlin (IOS)
Nutrients (Phosphate, Nitrate, Silicate)	All	all	ship	Fiona McLaughlin (IOS)
Oxygen	All	all	ship	Fiona McLaughlin (IOS)
Oxygen-18 isotope (O-18)	all except 25,40,44,49,50	0 to 250m and 1 deep	lab	Noriyuki Tanaka (IARC)
Barium (Ba)	all except 25,40,44,49,50	0 to 250m and 1 deep	lab	Chris Guay
Bacteria	all except 25,40,44,49,50	0 to 250m	lab	Bill Lee (BIO)
Carbon Dissolved Organic Material (CDOM)	17,19,20,24,27,28 (2 depths),30,31,33,34,35,	0 to 600m		Celine Gueguin (UBC/IOS)

Chlorphyll-a 0.7u filter	16,17,18,19,21,22,24,27,28(1 depth), 30,31,33,34,35,36,38,39,41,43,46,47,48	0 to 250m	ship	Christine Michel (DFO)/ Fiona McLaughlin (IOS)
Chlorophyll-a 5u filter	same as chlorophyll-a 0.7u filter	0 to 250m	ship	Christine Michel (DFO)
Chlorophyll-a 10u filter	same as chlorophyll-a 0.7u filter	0 to 250m	ship	Christine Michel (DFO)
Particulate Organic Carbon and Particulate Organic Nitrate (POC+PON)	same as chlorophyll-a 0.7u filter	0 to 250m	lab	Christine Michel (DFO)
Dissolved Organic Carbon and Dissolved Organic Nitrate (DOC+DON)	same as chlorophyll-a 0.7u filter	0 to 250m	lab	Christine Michel (DFO)
Cell Identification	same as chlorophyll-a 0.7u filter	0 to 250m	lab	Christine Michel (DFO)
Biogenic Silica	same as chlorophyll-a 0.7u filter	0 to 250m	lab	Christine Michel (DFO)
Carbon-13 isotope (C-13)	all surface and profiles at 28, 40	Surface and 2 profiles	lab	CS Wong (IOS)
Disolved Inorcanic Carbon (DIC)	all surface and profiles at 28, 40	2 profiles	lab	Fiona McLaughlin (IOS)
Total Organic Carbon (TOC)	46, 47, 48 (samples lost from other casts)	0 to 250m and 1 deep	lab	Fiona McLaughlin (IOS)

Table 3. Rosette Casts

Cast #	Station Name	CAST START TIME (UTC)	Lat Deg	Lat Min	Lon Deg	Lon Min	Cast Depth (db)	Sample #'s
			N	N	W	W		
1	1	2004/07/25 14:56	74	6.96	89	39.62	223	1 to 8
2	2	2004/07/25 19:33	73	16.21	90	38.34	340	9 TO 19
3	3	2004/07/26 00:00	71	59.96	93	54.56	75	20 TO 24
4	4	2004/07/26 04:00	71	59.88	94	23.88	57	25 TO 28
5	5	2004/07/26 04:30	72	0.36	94	34.56	98	29 TO 34
6	6	2004/07/26 05:26	71	59.18	94	52.45	215	35 TO 42
7	7	2004/07/26 06:53	71	57.5	95	13.91	106	43 TO 48
8	8	2004/07/27 20:24	71	57.77	95	11.49	248	49 TO 57

9	9	2004/07/27 21:11	71	58.52	95	3.63	394	58 TO 69
10	10	2004/07/28 16:14	74	16.11	91	25.5	322	70 TO 80
11	11	2004/07/28 17:19	74	15.7	91	24.54	300	81 TO 104
13	13	2004/08/03 18:32	68	41.76	103	45.79	99.5	105 - 110
14	14	2004/08/04 14:08	68	23.53	112	29.41	191	111 TO 118
15	15	2004/08/05 22:19	70	33.15	122	54.4	648	119 TO 142
16	CB-1	2004/08/07 14:31	71	46.6	131	46.16	1090	143 to 162
17	CB-2	2004/08/09 09:55	73	0.21	150	4.22	3740	163 to 186
18	CB-3	2004/08/09 22:35	73	56.22	150	1.53	3900	187 to 210
19	CB-4	2004/08/10 21:16	75	4.9	149	49.99	3831	211 to 234
20	CB-5	2004/08/11 09:32	75	19.86	152	28.37	3911	235 to 258
21	CB-6	2004/08/12 00:37	74	44.88	147	45.05	3865	259 TO 282
22	CB-7	2004/08/13 06:11	75	59.5	149	53.35	3824	283 to 306
23	CB-8	2004/08/13 23:05	76	59.2	150	5.87	3897	307 to 330
24	CB-9	2004/08/14 18:52	78	0.8	149	46.59	3894	331 to 354
25	CB-9(2)	2004/08/14 23:32	77	59.42	149	43.14	3893	355 to 378
26	CB-10	2004/08/16 00:27	78	19.06	152	52.44	3492	379 to 402
27	CB-11(1)	2004/08/16 13:02	79	0	150	0.38	206	403 to 412
28	CB11(2)	2004/08/16 14:30	78	59.98	150	0.02	3888	413 to 436
29	CB-12	2004/08/18 03:10	77	41.46	146	24.65	3879	437 to 460
30	CB-13	2004/08/18 14:23	77	22.42	143	22.58	3855	461 to 484
31	CB-14	2004/08/20 03:08	76	53.68	138	19.12	3755	485 TO 508
32	CB-15	2004/08/20 23:29	76	58.52	139	55.19	3790	509 to 532
33	CB-16	2004/08/21 17:34	77	53.3	140	10.08	3816	533 to 556
34	CB-17	2004/08/23 06:04	75	59.66	140	0.64	3761	557 to 580
35	CB-18	2004/08/23 17:20	74	59.82	140	0.87	3690	581 to 604
36	CB-19	2004/08/24 05:55	74	28.36	145	3.25	3805	605 to 628
37	CB-20	2004/08/24 13:41	74	15.06	142	24.62	3737	629 to 652
38	CB-21	2004/08/24 22:38	73	56.26	139	59.23	3548	653 to 676
39	CB-22	2004/08/25 20:23	73	23.54	137	10.11	300	677 to 689
40	CB-22(2)	2004/08/25 22:41	73	23.49	137	90.15	3143	690 to 713
41	CB-23	2004/08/26 08:43	72	59.34	134	5.08	2574	714 to 737
42	CB-24	2004/08/26 22:57	74	27.61	133	59.61	3196	738 to 761
43	CB-25	2004/08/27 09:15	74	15.49	137	3.87	3363	762 to 785
44	CB-26	2004/08/27 18:44	73	28.14	137	2.95	3174	786 to 809
45	CB-27	2004/08/28 05:46	72	59.35	139	54	3263	810 to 833
46	CB-28	2004/08/28 22:48	71	19.99	140	0.18	2355	834 to 857
47	CB-29	2004/08/29 06:55	72	0.37	139	56.14	2716	858 to 881
48	CB-30	2004/08/29 23:01	72	32.67	133	26.32	2169	882 to 905
49	CB-31	2004/08/30 04:45	72	10.32	132	40.06	1627	X
50	CB-32	2004/08/30 13:53	71	46.73	131	54.56	1139	X

Table 4. XCTD Locations

Filename	Date	Time	Latitude		Longitude	
000	2004/07/19	12:52:00	63 59.7140	N	54 59.3020	W
001	2004/07/19	14:21:00	64 19.3800	N	55 31.1070	W

002	2004/07/19	15:51:00	64	39.9300	N	56	3.8720	W
003	2004/07/19	17:19:00	64	59.9900	N	56	36.0330	W
004	2004/07/19	19:01:00	65	19.8960	N	57	7.9160	W
005	2004/07/19	20:29:00	65	40.0340	N	57	40.0890	W
006	2004/07/19	22:09:00	65	59.9200	N	58	11.8510	W
007	2004/07/19	23:56:00	66	19.8360	N	58	43.7300	W
008	2004/07/20	02:07:00	66	40.2190	N	59	16.0690	W
009	2004/07/20	04:10:00	66	59.7120	N	59	48.1040	W
010	2004/07/20	05:56:00	67	19.8140	N	60	19.1740	W
011	2004/07/20	09:00:00	67	39.5180	N	60	58.7850	W
012	2004/07/20	11:09:00	67	39.9240	N	60	7.8270	W
013	2004/07/20	13:25:00	67	39.8610	N	59	16.2680	W
014	2004/07/20	14:08:00	67	39.7660	N	58	47.3340	W
015	2004/07/20	14:49:00	67	39.9060	N	58	22.6370	W
016	2004/07/20	16:00:00	67	40.0180	N	57	30.9100	W
017	2004/07/20	19:34:00	68	19.9390	N	59	29.6630	W
018	2004/07/20	21:58:00	68	59.7490	N	59	29.6950	W
019	2004/07/21	02:17:00	69	41.2640	N	59	18.9210	W
020	2004/07/21	06:09:00	70	20.0310	N	59	28.0010	W
021	2004/07/21	09:13:00	70	59.8130	N	60	39.7270	W
022	2004/07/21	11:57:00	71	39.9530	N	61	20.0520	W
023	2004/07/21	14:26:00	72	1.8540	N	61	59.0610	W
024	2004/07/21	17:23:00	72	18.9060	N	63	30.2520	W
025	2004/07/21	20:41:00	72	35.8520	N	65	0.3650	W
026	2004/07/22	03:08:00	73	0.0680	N	67	30.2330	W
027	2004/07/22	06:57:00	73	22.9980	N	70	0.2040	W
027	2004/07/22	08:19:00	73	30.8990	N	70	59.3540	W
029	2004/07/22	09:38:00	73	39.0040	N	71	59.9670	W
030	2004/07/22	10:56:00	73	45.9000	N	72	59.3260	W
031	2004/07/22	12:05:00	73	53.1050	N	73	59.9490	W
032	2004/07/22	12:17:00	73	54.0950	N	74	8.2000	W
033	2004/07/22	13:23:00	73	59.9320	N	74	59.5370	W
034	2004/07/22	19:45:00	74	6.0800	N	79	58.8810	W
035	2004/07/24	01:15:00	74	12.0190	N	85	0.5560	W
036	2004/07/24	06:44:00	74	20.1600	N	90	2.8780	W
037	2004/07/28	00:21:00	71	59.237	N	94	52.8600	W
039	2004/07/28	00:35:00	72	0.058	N	94	45.7530	W
040	2004/07/28	03:29:00	72	12.9430	N	93	34.0350	W
041	2004/08/08	01:58:00	71	22.8220	N	133	59.1790	W
042	2004/08/08	04:38:00	71	17.7330	N	136	0.1330	W
043	2004/08/08	07:35:00	71	15.2740	N	138	0.1350	W
044	2004/08/08	10:08:00	71	19.5360	N	139	59.2410	W
045	2004/08/08	12:51:00	71	23.9530	N	142	0.3400	W
046	2004/08/08	15:45:00	71	35.9470	N	144	0.3070	W
047	2004/08/08	18:27:00	71	43.7070	N	145	59.1770	W
048	2004/08/08	21:41:00	71	56.6340	N	147	59.8240	W

049	2004/08/09	01:31:00	72	0.0910	N	149	57.1770	W
050	2004/08/09	02:34:00	72	7.4000	N	150	0.3680	W
051[	2004/08/09	03:31:00	72	14.8380	N	150	0.0580	W
052	2004/08/09	04:28:00	72	22.3760	N	149	59.9840	W
053	2004/08/09	04:25:00	72	29.9420	N	149	58.7160	W
054	2004/08/09	06:22:00	72	37.3210	N	149	59.9540	W
055	2004/08/09	07:14:00	72	44.9950	N	149	59.9140	W
056	2004/08/09	08:13:00	72	52.5830	N	150	0.2120	W
057	2004/08/09	13:37:00	73	7.0350	N	150	0.1300	W
058	2004/08/09	14:51:00	73	15.0400	N	150	0.1540	W
059	2004/08/09	15:55:00	73	22.2040	N	149	59.7370	W
060	2004/08/09	17:02:00	73	29.9690	N	149	59.5990	W
061	2004/08/09	17:06:00	73	29.9690	N	149	59.7110	W
062	2004/08/09	18:15:00	73	37.5760	N	150	0.2260	W
063	2004/08/09	19:25:00	73	45.0670	N	149	59.9580	W
064	2004/08/09	20:42:00	73	52.5350	N	149	59.5140	W
065	2004/08/10	03:44:00	74	7.5750	N	150	0.0610	W
066	2004/08/10	05:31:00	74	14.8840	N	149	59.2280	W
067	2004/08/10	06:22:00	74	22.5160	N	149	58.1550	W
068	2004/08/10	06:26:00	74	22.5360	N	149	57.8510	W
069	2004/08/10	07:44:00	74	29.9340	N	149	59.0510	W
070	2004/08/10	08:53:00	74	38.8670	N	149	59.3950	W
071	2004/08/10	08:57:00	74	36.8750	N	149	59.3800	W
072	2004/08/10	00:00:00	74	44.9730	N	149	59.7890	W
073	2004/08/10	11:11:00	74	52.7220	N	149	59.2740	W
074	2004/08/11	15:52:00	75	8.9990	N	151	5.4414	W
075	2004/08/12	22:56:00	75	19.8040	N	149	59.5380	W
076	2004/08/13	02:05:00	75	40.0330	N	149	57.1980	W
077	2004/08/13	12:41:00	76	19.9960	N	149	59.5400	W
078	2004/08/13	15:34:00	76	40.0910	N	149	59.5620	W
079	2004/08/14	03:55:00	77	9.9230	N	149	59.2120	W
080	2004/08/14	06:02:00	77	20.3920	N	149	59.8970	W
081	2004/08/14	09:14:00	77	40.2150	N	149	59.3530	W
082	2004/08/15	19:44:00	78	7.1050	N	150	58.749	W
083	2004/08/15	22:00:00	78	13.1200	N	152	0.100	W
084	2004/08/16	06:53:00	78	30.0020	N	152	17.3550	W
085	2004/08/16	07:03:00	78	30.0820	N	152	17.0470	W
086	2004/08/16	09:07:00	78	40.0280	N	151	31.6520	W
087	2004/08/16	22:49:00	79	19.5930	N	150	0.6450	W
088	2004/08/17	07:02:00	78	40.4280	N	149	58.7040	W
089	2004/08/17	09:48:00	78	20.6030	N	149	58.4160	W
090	2004/08/17	21:30:00	77	52.3980	N	148	18.7400	W
091	2004/08/18	09:00:00	77	32.3900	N	144	51.7350	W
092	2004/08/18	23:01:00	77	12.2120	N	141	45.8430	W
093	2004/08/21	21:40:00	77	39.7160	N	140	0.9560	W
094	2004/08/22	04:54:00	77	20.5810	N	140	10.3770	W

095	2004/08/22	22:50:00	76	39.7210	N	140	2.1460	W
096	2004/08/23	02:11:00	76	20.1120	N	140	1.5390	W
097	2004/08/23	11:15:00	75	40.0540	N	139	59.6870	W
098	2004/08/23	13:36:00	75	20.2140	N	140	0.7260	W
099	2004/08/23	23:16:00	74	49.9390	N	141	41.0680	W
100	2004/08/24	02:22:00	74	39.5350	N	143	22.2010	W
101	2004/08/24	11:00:00	74	22.0370	N	143	43.2280	W
102	2004/08/24	19:20:00	74	7.6040	N	141	0.8690	W
103	2004/08/25	04:15:00	73	50.1160	N	138	54.3490	W
104	2004/08/25	08:09:00	73	44.2930	N	137	39.5690	W
105	2004/08/26	03:35:00	73	15.6120	N	136	6.2710	W
106	2004/08/26	06:19:00	73	7.5670	N	135	1.1710	W
107	2004/08/26	14:40:00	73	29.8610	N	134	0.0180	W
108	2004/08/26	18:24:00	73	59.3910	N	133	59.1700	W
109	2004/08/27	05:34:00	74	22.1070	N	135	27.7310	W
110	2004/08/28	03:08:00	73	23.6050	N	139	25.2150	W
110	2004/08/28	09:42:00	72	39.7980	N	139	21.6580	W
111	2004/08/28	11:56:00	72	19.8870	N	138	35.9130	W
112	2004/08/29	02:58:00	71	39.8510	N	139	58.3600	W
113	2004/08/29	13:49:00	72	11.8910	N	137	46.2790	W
114	2004/08/29	18:10:00	72	23.4590	N	135	32.9200	W
115	2004/08/30	07:51:00	71	58.4860	N	132	16.4710	W
116	2004/08/30	22:15:00	71	34.9620	N	131	29.6580	W
117	2004/08/30	23:29:00	71	28.7110	N	131	16.2910	W
118	2004/08/31	00:35:00	71	23.3500	N	130	58.4670	W
119	2004/08/31	02:25:00	71	15.1540	N	130	43.5430	W

Table 5. Zooplankton Casts

Date	Station Name	Net event	Time (UTC)	Approx. Depth (m)	Lat (N)	Long (W)	Notes
			Hr.Min		Deg.DecimalMinute		
07/08/2004	CABOS	1	14.2	100	71.46.649	131.46.024	
		2	15.06	100	71.46.670	131.45.670	
09/08/2004	CB2	3	10.07	100	73.00.16	150.04.38	
		4	11	100	73.00.31	150.04.35	
		5	11.22	500	73.00.40	150.04.21	
09/08/2004	CB3	6	22.41	100	73.56.222	150.01.560	
		7	23.09	500	73.56.056	150.01.161	
		8	23.52	100	73.55.778	150.01.044	
10/08/2004	CB4	9	20.34	100	75.04.89	149.50.18	Sample not kept, nets not fished well
		10	21.05	100	75.04.842	149.51.823	
		11	21.17	100	75.04.907	149.49.805	
		12	22.39	500	75.04.922	149.46.343	

11/08/2004	CB5	13	9.57	100	75.19.840	152.27.377	
		14	10.25	100	75.19.804	152.26.213	
		15	10.51	500	75.19.743	152.25.140	
12/08/2004	CB6	16	0.57	100	74.44.656	147.45.817	
		17	1.25	100	74.44.471	147.44.278	Net not used, not fished well
		18	1.4	100	74.44.582	147.43.955	
		19	1.58	500	74.44.268	147.43.420	
13/08/2004	CB7	20	7.02	100	75.59.548	149.52.237	did not use net, no water on deck
		21	7.55	100	75.59.591	149.51.110	
		22	8.57	100	75.59.741	149.50.333	
13/08/2004	CB8	23	21.47	100	76.59.473	150.05.378	
		24	22.1	100	76.59.360	150.05.484	
14/08/2004	CB9	25	3.55	100	77.59.039	149.40.213	
		26	4.35	100	77.59.028	149.39.666	
15/08/2004	CB10	27	3.49	100	78.19.256	152.50.476	
		28	4.2	100	78.19.313	152.50.158	
		29	4.39	500	78.19.351	152.50.842	
16/08/2004	CB11	30	16.05	100	78.59.963	149.59.825	236 sample thrown away, too much ice
		31	17.5	100	78.59.967	149.59.689	
17/08/2004	CB13	32	17.24	100	77.22.643	143.19.637	
		33	17.45	100	77.22.665	143.19.378	
20/08/2004	CB15	34	23.53	500	76.58.487	139.55.075	
		35	3.15	100	76.58.087	139.54.748	
		36	3.28	100	76.58.074	139.54.813	
21/08/2004	CB16	37	16.1	500	77.53.726	140.09.598	
		38	16.52	100	77.53.528	140.09.937	
		39	17.09	100	77.53.412	140.09.888	
22/08/2004	CB17	40	5.23	100	75.59.696	140.00.167	
		41	5.44	100	75.59.676	140.00.400	
23/08/2004	CB18	42	16.12	100	75.00.021	140.00.275	
		43	16.51	100	75.00.014	140.00.371	
24/08/2004	CB19	44	6.01	100	74.28.346	145.03.226	
		45	6.2	100	74.28.623	145.03.190	
24/08/2004	CB21	46	22.05	100	73.56.44	139.58.82	
		47	22.21	100	73.56.352	139.58.989	
25/08/2004	CB22	48	20.37	100	73.23.555	137.10.168	
		49	20.54	100	73.23.545	137.10.342	
26/08/2004	CB23	50	9.54	100	72.59.156	134.04.927	
		51	10.13	100	72.59.090	134.04.808	
26/08/2004	CB24	52	22.16	100	74.27.682	133.59.871	
		53	22.31	100	74.27.670	133.59.826	
27/08/2004	CB25	54	11.49	100	74.15.220	137.01.487	
		55	12.06	100	74.15.180	137.01.202	
28/08/2004	CB27	56	5.53	100	72.59.358	139.54.003	
		57	6.1	100	72.59.424	139.54.128	
28/08/2004	CB28	58	22.32	100	71.19.983	140.00.303	
		59	22.5	100	71.20.015	140.00.165	
29/08/2004	CB29	60	6.59	100	72.00.419	139.56.214	

		61	7.31	100	72.00.572	139.56.100
29/08/2004	CB30	62	23.07	100	72.32.598	133.26.292
		63	23.27	100	72.32.346	133.26.187
30/08/2004	CABOS	64	20.25	100	71.46.295	131.49.201

Table 6. Drifter Bottle (Ice Chummy) Deployments

Bottle #				Time UTC	Latitude			Longitude			Depth
	yy	mo	day	hhmm	dd	mm.mm		ddd	mm.mm		m
1	4	7	19	12:52	63	59.7	N	54	59.4	W	
2	4	7	19	12:52	63	59.7	N	54	59.4	W	
3	4	7	19	12:52	63	59.7	N	54	59.4	W	
4	4	7	19	14:21	64	19.4	N	55	31.2	W	
5	4	7	19	14:21	64	19.4	N	55	31.2	W	
6	4	7	19	14:21	64	19.4	N	55	31.2	W	
7	4	7	19	15:52	64	39.967	N	56	3.94	W	897
8	4	7	19	15:52	64	39.967	N	56	3.94	W	897
9	4	7	19	15:52	64	39.967	N	56	3.94	W	897
10	4	7	19	17:20	65	0.1	N	56	36.2	W	657
11	4	7	19	17:20	65	0.1	N	56	36.2	W	657
12	4	7	19	17:20	65	0.1	N	56	36.2	W	657
13	4	7	19	19:00	65	20	N	57	8	W	607
14	4	7	19	19:00	65	20	N	57	8	W	607
15	4	7	19	19:00	65	20	N	57	8	W	607
16	4	7	19	20:30	65	40	N	57	40	W	589
17	4	7	19	20:30	65	40	N	57	40	W	589
18	4	7	19	20:30	65	40	N	57	40	W	589
19	4	7	19	22:10	66	0	N	58	12	W	565
20	4	7	19	22:10	66	0	N	58	12	W	565
21	4	7	19	22:10	66	0	N	58	12	W	565
22	4	7	19	23:57	66	19.9	N	58	43.8	W	
23	4	7	19	23:57	66	19.9	N	58	43.8	W	
24	4	7	19	23:57	66	19.9	N	58	43.8	W	
25	4	7	20	2:08	66	40.2	N	59	16.1	W	
26	4	7	20	2:08	66	40.2	N	59	16.1	W	
27	4	7	20	2:08	66	40.2	N	59	16.1	W	
28	4	7	20	4:12	67	0	N	59	48.6	W	
29	4	7	20	4:12	67	0	N	59	48.6	W	
30	4	7	20	4:12	67	0	N	59	48.6	W	
31	4	7	20	6:00	67	20	N	60	19.4	W	
32	4	7	20	7:00	67	20	N	60	19.4	W	
33	4	7	20	6:00	67	20	N	60	19.4	W	896?
34	4	7	20	9:00	67	39	N	60	59	W	1522
35	4	7	20	9:00	67	39	N	60	59	W	1522
36	4	7	20	9:00	67	39	N	60	59	W	1522
37	4	7	20	11:11	67	39.9	N	60	7.3	W	
38	4	7	20	11:11	67	39.9	N	60	7.3	W	

39	4	7	20	11:11	67	39.9	N	60	7.3	W	
40	4	7	20	13:24	67	40	N	59	16	W	1278
41	4	7	20	13:24	67	40	N	59	16	W	
42	4	7	20	13:24	67	40	N	59	16	W	
43	4	7	20	14:08	67	39.7	N	58	47.2	W	
44	4	7	20	14:08	67	39.7	N	58	47.2	W	
45	4	7	20	14:44	67	39.9	N	58	20	W	
46	4	7	20	17:00	67	40	N	57	30.8	W	231
47	4	7	20	17:00	67	40	N	57	30.8	W	231
48	4	7	20	17:00	67	40	N	57	30.8	W	231
49	4	7	20	19:30	68	20	N	59	30	W	533
50	4	7	20	19:30	68	20	N	59	30	W	533
51	4	7	20	19:30	68	20	N	59	30	W	533
52	4	7	20	22:00	69	0	N	59	30	W	1299
53	4	7	20	22:00	69	0	N	59	30	W	1299
54	4	7	20	22:00	69	0	N	59	30	W	1299
55	4	7	21	2:03	69	41	N	59	18.9	W	944
56	4	7	21	2:03	69	41	N	59	18.9	W	944
57	4	7	21	2:03	69	41	N	59	18.9	W	944
58	4	7	21	6:10	70	20	N	59	20	W	498
59	4	7	21	6:10	70	20	N	59	20	W	498
60	4	7	21	6:10	70	20	N	59	20	W	498
61	4	7	21	9:10	71	0	N	60	40	W	1047
62	4	7	21	9:10	71	0	N	60	40	W	1047
63	4	7	21	9:10	71	0	N	60	40	W	1047
64	4	7	21	11:57	71	39.9	N	61	20.1	W	
65	4	7	21	11:57	71	39.9	N	61	20.1	W	
66	4	7	21	11:57	71	39.9	N	61	20.1	W	
67	4	7	21	14:26	72	1.8	N	61	59.1	W	1233
68	4	7	21	14:26	72	1.8	N	61	59.1	W	1233
69	4	7	21	14:26	72	1.8	N	61	59.1	W	1233
70	4	7	21	17:23	72	18.8	N	63	30.3	W	
71	4	7	21	17:23	72	18.8	N	63	30.3	W	
72	4	7	21	17:23	72	18.8	N	63	30.3	W	
73	4	7	21	20:40	72	36	N	65	0	W	2300
74	4	7	21	20:40	72	36	N	65	0	W	2300
75	4	7	21	20:40	72	36	N	65	0	W	2300
76	4	7	22	3:08	73	0	N	67	30	W	2300
77	4	7	22	3:08	73	0	N	67	30	W	2300
78	4	7	22	3:08	73	0	N	67	30	W	2300
79	4	7	22	7:00	73	23	N	70	0	W	1688
80	4	7	22	7:00	73	23	N	70	0	W	1688
81	4	7	22	7:00	73	23	N	70	0	W	1688
82	4	7	22	8:20	73	31	N	70	46	W	1224
83	4	7	22	8:20	73	31	N	70	46	W	1224
84	4	7	22	8:20	73	31	N	70	46	W	1224
85	4	7	22	9:40	73	39	N	72	0	W	1092
86	4	7	22	9:40	73	39	N	72	0	W	1092
87	4	7	22	9:40	73	39	N	72	0	W	1092
88	4	7	22	10:56	73	45.9	N	72	59.5	W	
89	4	7	22	10:56	73	45.9	N	72	59.5	W	

90	4	7	22	10:56	73	45.9	N	72	59.5	W	
91	4	7	22	12:06	73	53.1	N	74	0.5	W	830
92	4	7	22	12:06	73	53.1	N	74	0.5	W	830
93	4	7	22	12:06	73	53.1	N	74	0.5	W	830
94	4	7	22	13:20	74	0	N	75	0	W	811
95	4	7	22	13:20	74	0	N	75	0	W	811
96	4	7	22	13:20	74	0	N	75	0	W	811
97	4	7	22	19:45	74	6	N	80	0	W	
98	4	7	22	19:45	74	6	N	80	0	W	
99	4	7	22	19:45	74	6	N	80	0	W	
105	4	7	23	22:16	74	12	N	84	1	W	533
101	4	7	23	22:16	74	12	N	84	1	W	533
102	4	7	23	22:16	74	12	N	84	1	W	533
103	4	7	23	4:46	74	20.1	N	89	2.9	W	296
104	4	7	23	4:46	74	20.1	N	89	2.9	W	296
100	4	7	23	4:46	74	20.1	N	89	2.9	W	296
106	4	7	23	19:58	71	55.68	N	95	25.75	W	115
107	4	7	23	19:58	71	55.68	N	95	25.75	W	115
108	4	7	23	19:58	71	55.68	N	95	25.75	W	115
109	4	7	23	19:58	71	55.68	N	95	25.75	W	115
110	4	7	23	19:58	71	55.68	N	95	25.75	W	115
111	4	7	23	19:58	71	55.68	N	95	25.75	W	115
112	4	7	27	20:40	71	57.8	N	95	11.1	W	200
113	4	7	27	20:40	71	57.8	N	95	11.1	W	200
114	4	7	27	20:40	71	57.8	N	95	11.1	W	200
117	4	7	27	20:40	71	57.8	N	95	11.1	W	200
115	4	7	27	21:00	71	58.5	N	95	3.6	W	
116	4	7	27	21:00	71	58.5	N	95	3.6	W	
118	4	7	27	21:00	71	58.5	N	95	3.6	W	
119	4	7	27	21:00	71	58.5	N	95	3.6	W	
120	4	7	27	21:00	71	58.5	N	95	3.6	W	
121	4	7	27	?	71	59	N	94	52	W	
122	4	7	27	?	71	59	N	94	52	W	
123	4	7	27	?	71	59	N	94	52	W	
124	4	7	27	?	71	59	N	94	52	W	
125	4	7	27	?	71	59	N	94	52	W	
126	4	7	27	?	71	59	N	94	52	W	
127	x	x	x	X	x	x	N	x	x	W	x
128	4	7	28	?	71	59	N	94	52	W	
129	4	7	28	?	71	59	N	94	52	W	
130	4	7	28	?	71	59	N	94	52	W	
131	4	7	28	0:40	72	0.2	N	94	44.5	W	152
132	4	7	28	0:40	72	0.2	N	94	44.5	W	152
133	4	7	28	0:40	72	0.2	N	94	44.5	W	152
134	4	7	28	3:31	71	12.9	N	93	33.7	W	129
135	4	7	28	3:31	71	12.9	N	93	33.7	W	129
136	4	7	28	3:31	71	12.9	N	93	33.7	W	129
137	4	7	28	3:31	71	12.9	N	93	33.7	W	129
138	4	7	28	3:31	71	12.9	N	93	33.7	W	129
139	4	7	28	3:31	71	12.9	N	93	33.7	W	129
140	4	7	28	3:31	71	12.9	N	93	33.7	W	129

141	?	?	?	?	?	?	N	?	?	W	?
142	?	?	?	?	?	?	N	?	?	W	?
143	?	?	?	?	?	?	N	?	?	W	?
144	?	?	?	?	?	?	N	?	?	W	?
145	4	8	3	4:32	69	40.153	N	99	48.825	W	
146	broken						N			W	
147	4	8	3	4:32	69	40.153	N	99	48.825	W	
148	4	8	3	19:04	68	42.7	N	103	54.1	W	
149	4	8	3	19:04	68	42.7	N	103	54.1	W	
150	4	8	3	19:04	68	42.7	N	103	54.1	W	
151	4	8	4	?	68	23.53	N	112	29	W	
152	4	8	4	?	68	23.53	N	112	29	W	
153	4	8	4	?	68	23.53	N	112	29	W	
154	4	8	5	23:40	70	32.8	N	122	54.9	W	
155	4	8	7	15:38	71	48.64	N	131	44.87	W	
156	4	8	7	15:38	71	48.64	N	131	44.87	W	
157	4	8	5	23:40	70	32.8	N	122	54.9	W	
158	4	8	5	23:40	70	32.8	N	122	54.9	W	
159	4	8	7	15:38	71	48.64	N	131	44.87	W	
160	4	8	8	12:48	73	1.527	N	150	2.777	W	
161	4	8	8	12:48	73	1.527	N	150	2.777	W	
162	4	8	10	1:53	73	55.871	N	150	0.9	W	
163	4	8	8	12:48	73	7.527	N	150	2.777	W	
164	4	8	10	1:53	73	55.871	N	150	0.9	W	
165	4	8	10	1:53	73	55.871	N	150	0.9	W	
166	4	8	11	0:32	75	4.97	N	149	42.868	W	
167	4	8	11	0:32	75	4.97	N	149	42.868	W	
168	4	8	11	0:32	75	4.97	N	149	42.868	W	
169	4	8	16	18:28	79	0.562	N	150	0.736	W	
170	4	8	16	23:21	79	17.203	N	150	2.251	W	
171	4	8	16	23:21	79	17.203	N	150	2.251	W	
172	4	8	16	23:21	79	17.203	N	150	2.251	W	
173	4	8	16	18:28	79	0.562	N	150	0.736	W	
174	4	8	16	18:28	79	0.562	N	150	0.736	W	
175	4	8	16	5:22	78	20.115	N	152	45.959	W	
176	4	8	16	5:22	78	20.115	N	152	45.959	W	
177	4	8	15	17:14	77	59.013	N	149	48.544	W	
178	4	8	15	17:14	77	59.013	N	149	48.544	W	
179	4	8	15	17:14	77	59.013	N	149	48.544	W	
180	4	8	16	5:22	78	20.115	N	152	45.959	W	
181	4	8	14	1:54	76	58.375	N	150	6.252	W	
182	4	8	13	9:32	76	0.509	N	149	49.413	W	
183	4	8	14	1:54	76	58.375	N	150	6.252	W	
184	4	8	14	1:54	76	58.375	N	150	6.252	W	
185	4	8	11	13:15	75	18.75	N	152	20.53	W	
186	4	8	11	13:15	75	18.75	N	152	20.53	W	
187	4	8	13	9:32	76	0.509	N	149	49.413	W	
188	4	8	13	9:32	76	0.509	N	149	49.413	W	
189	4	8	12	3:53	74	43.838	N	147	42.265	W	
190	4	8	11	13:15	75	18.75	N	152	20.53	W	
191	4	8	12	3:53	74	43.838	N	147	42.265	W	

192	4	8	12	3:53	74	43.838	N	147	42.265	W	
193	no entry						N			W	
194	noentry						N			W	
195	no entry						N			W	
196	4	8	29	9:14	74	1.008	N	139	54.364	W	
197	4	8	29	9:14	74	1.008	N	139	54.364	W	
198	4	8	29	9:14	74	1.008	N	139	54.364	W	
199	4	8	30	0:38	72	31.512	N	133	26.081	W	
200	4	8	30	0:38	72	31.512	N	133	26.081	W	
201	4	8	30	0:38	72	31.512	N	133	26.081	W	
202	4	8	30	5:55	72	10.029	N	132	40.259	W	
203	4	8	30	5:55	72	10.029	N	132	40.259	W	
204	4	8	30	5:55	72	10.029	N	132	40.259	W	
205	no entry						N			W	
206	no entry						N			W	
207	no entry						N			W	
208	no entry						N			W	
209	no entry						N			W	
210	no entry						N			W	
211	no entry						N			W	
212	no entry						N			W	
213	no entry						N			W	
214	no entry						N			W	
215	no entry						N			W	
216	no entry						N			W	
217	4	8	24	16:44	74	14.92	N	142	22.21	W	
218	4	8	24	16.44	74	14.92	N	142	22.21	W	
219	4	8	24	16:44	74	14.92	N	142	22.21	W	
220	4	8	25	?	73	56.605	N	140	0.803	W	
221	4	8	25	?	73	56.605	N	140	0.803	W	
222	4	8	25	?	73	56.605	N	140	0.803	W	
223	4	8	26	1:23	73	21.922	N	136	59.299	W	
224	4	8	26	1:23	73	21.922	N	136	59.299	W	
225	4	8	26	1:23	73	21.922	N	136	59.299	W	
226	4	8	26	10:42	72	59.331	N	134	5.146	W	
227	4	8	26	10:42	72	59.331	N	134	5.146	W	
228	4	8	26	10:42	72	59.331	N	134	5.146	W	
229	4	8	26	2:31	74	28.2	N	134	10.5	W	
230	4	8	26	2:31	74	28.2	N	134	10.5	W	
231	4	8	26	2:31	74	28.2	N	134	10.5	W	
232	4	8	27	12:42	74	12.316	N	137	6.605	W	
233	4	8	27	12:42	74	12.316	N	137	6.605	W	
234	4	8	27	12:42	74	12.316	N	137	6.605	W	
235	4	8	27	22:35	73	27.251	N	137	5.113	W	
236	4	8	27	22:35	73	27.251	N	137	5.113	W	
237	4	8	27	22:35	73	27.251	N	137	5.113	W	
238	4	8	28	7:55	73	0.052	N	139	53.908	W	
239	4	8	28	7:55	73	0.052	N	139	53.908	W	
240	4	8	28	7:55	73	0.052	N	139	53.908	W	