National Oceanography Centre, Southampton

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RV *Seward Johnson* Cruise SJ08-03 Leg 2

22-30 APR 2008

RAPID-MOC Spring 2008 Western Boundary moorings refurbishment cruises

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ABSTRACT

This report describes the mooring operations conducted on the RV *Seward Johnson* cruise SJ08-03 Leg 2 between 22nd April and 30th April 2008.

These mooring operations were completed as part of the United Kingdom Natural Environment Research Council (NERC) RAPID and RAPID-WATCH programmes to monitor the Atlantic Meridional Overturning Circulation at 26.5°N. The primary purpose of this cruise was to service the Western Boundary section of the 26.5°N mooring array first deployed in 2004 during RRS *Discovery* cruises D277 and D278 (SOC cruise report number 53).

Cruise SJ08-03 leg 2 sailed from Freeport, Grand Bahama to Ft. Pierce, Florida and serviced the moorings deployed on RB0701 (along with 2 landers deployed on RB0602). This cruise is the fourth annual refurbishment of the Western Boundary section of an array of moorings deployed across the Atlantic in order to set up a pre-operational prototype system to continuously observe the Atlantic Meridional Overturning Circulation (MOC). This array will be further refined and refurbished during subsequent years.

The instrumentation deployed on the array consists of a variety of current meters, bottom pressure recorders, CTD loggers and Inverted Echo Sounders, which, combined with time series measurements of the Florida Channel Current and wind stress estimates, will be used to determine the strength and structure of the MOC at 26.5°N.
(http://www.noc.soton.ac.uk/rapidmoc)

KEYWORDS

RAPID-MOC, thermohaline circulation, Atlantic Ocean, Western Boundary Current, *Seward Johnson*, cruise 2008, cruise SJ08-03, moorings, SeaBird, MicroCATS, bottom pressure recorders, CTD

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Table 1: Scientific and technical staff on Leg 2 of SJ08-03.

Name	*Task*	*Affiliation*
Torsten Kanzow	Principal Scientist	National Oceanography Centre Southampton (NOCS)
Stuart Cunningham	Senior Scientist	National Oceanography Centre Southampton (NOCS)
Craig Wallace	Scientist	National Oceanography Centre Southampton (NOCS)
Daniel Klocke	Scientist	Max Planck Institute for Meteorology (MPI)
Robert McLachlan	Mooring Technician	National Oceanography Centre Southampton (NOCS)
Christian Crowe	Mooring Technician	National Oceanography Centre Southampton (NOCS)
Colin Hutton	Mooring Technician	National Oceanography Centre Southampton (NOCS)
David Childs	Mooring Technician	National Oceanography Centre Southampton (NOCS)
Bill Johns	Co-Principal Scientist	Rosenstiel School of Marine and Atmospheric Sciences, University of Miami (RSMAS)
Jonathan Molina	Scientist	Rosenstiel School of Marine and Atmospheric Sciences, University of Miami (RSMAS)
Mark Graham	Mooring Technician	Rosenstiel School of Marine and Atmospheric Sciences, University of Miami (RSMAS)
Carlos Fonseca	Scientist	Atlantic Oceanographic and Meteorological Laboratory (AOML)
Andy Stefanick	Mooring Technician	Atlantic Oceanographic and Meteorological Laboratory (AOML)
Peter Lazarevich	Mooring Technician	Florida State University (FSU)
Eric Howarth	Mooring Technician	Florida State University (FSU)

Table 2: Ship's crew

Name	*Rank*
Timothy Michaele Askew, Jr.	Ch. Mate
Eric Finn Bergendahl	Ch. Eng.
Gerard Anthony Bilquin	Steward
Richard George Curren	2nd Asst. Eng.
George William Gunther	Captain
Logan Joseph Henderson	Seaman
Gregory Charles Klein	Steward Asst.
Wesley LeRoy Knight	Asst. Eng.
Loren Wolf Lange	Seaman
Mortimer Lawrence Smedley	Seaman
Daniel Patrick Timm	Mate
James Milton Lovin	Tech.
Donald Dwayne Cucchiara	Tech.

2. Description of vessel

R/V *Seward Johnson*

The R/V *Seward Johnson*, namesake of Harbor Branch founder J. Seward Johnson, Sr., is a 204 ft Oceanographic and Submersible-Support Research Vessel. Built in 1984, commissioned in 1985 and extensively rebuilt and stretched in 1994, the ship now displaces 1,282 tons. A 6,000 nautical mile range and a speed of 13 knots is delivered by two 850 hp engines. The vessel is capable of travelling and working in any of the world's oceans, while accommodating up to 40 people (29 investigators, sub crew, or technicians; 11 ship's crew).

The R/V *Seward Johnson* is one of two Harbor Branch owned research vessels that are operated by experienced personnel, expert in surface oceanographic procedures and submersible vehicle launch and recovery, supported by in-house ocean engineers. The R/V *Seward Johnson* is part of the University National Oceanographic Laboratory System (UNOLS).

The R/V *Seward Johnson* is primarily a submersible tender designed to support manned sub operations, as well as ROV operations. Specifically, occasionally the Clelia, and most often the Johnson-Sea-Link (JSL) submersibles are operated from this platform. Researchers choose which sub to use based on the depth of their planned dives. The Clelia is suited for shallow dives (1,000 ft maximum), and the JSL is capable of deeper dives (3,000 ft maximum). An 18-ton, A-frame crane system mounted on the stern of the ship launches and retrieves these submersibles.

Other deck equipment includes:
• A-frame on side, with forward (1.5 tons), center (10 tons), and after (5 tons) lift points
• Appleton crane, 10 ton capacity @ 38 foot outreach
• Appleton lightweight crane 3.5 ton capacity with 21 ft. outreach, installed if required
• 2 capstans at stern
• New England Trawler anchor windlass 2 anchors and 2 rope heads at bow
• Various trawl, hydrographic, conductor, CTD and constant tension tow winches available

The ship also includes a briefing room outfitted with a technical and science library, a conference table, video recorders, monitor, and photo lab.

3. Itinerary

Leg 1
Depart Ft. Pierce, Florida 4th April 2008, arrive Freeport, Gran Bahama 20th April 2008
Leg 2
Depart Freeport, Gran Bahama 22nd April 2008, arrive Ft. Pierce Florida 30th April 2008.

4. Acknowledgements

The captain and crew of the R/V *Seward Johnson* were professional and extremely helpful throughout the cruise. The NOC moorings team were professional throughout and liaised well with both scientists and the US moorings team. This led to smooth deployments and recoveries.

5. Introduction

RAPID-MOC is a joint UK/US programme to monitor the Atlantic Meridional Overturning Circulation at 26.5°N. There are three partners each contributing key observations. The Atlantic Oceanographic and Meteorological Laboratory (AOML) – part of the USA National Oceanic and Atmospheric Administration (NOAA) – leads a programme to monitor Florida Current transport using telephone cables. Frequent cruises are used to calibrate the cable measurements.

AOML also complete an annual CTD section across the Deep Western Boundary Current (DWBC) east of the Bahamas along 26.5°N to monitor long-term property changes.

The Rosenstiel School of Marine and Atmospheric Sciences (RSMAS), University of Miami maintains three moorings in the DWBC for transport measurements. The National Oceanography Centre, Southampton manages a transatlantic array of moorings to monitor the interior Atlantic circulation.

The goal of RAPID-MOC is to develop a pre-operational array to monitor the Atlantic Meridional Overturning Circulation at 26.5°N (http://www.noc.soton.ac.uk/rapidmoc). The programme is funded to make ten years of continuous observations between 2004 and 2014.

This cruise report describes the events that took place on Leg 2 of cruise SJ08-03 onboard the R/V *Seward Johnson*. Leg 2 was the refurbishment of the UK Western Boundary moorings. The US moorings were refurbished on Leg 1, information from which can be found in the Leg 1 cruise report (Johns, 2008)

6. Diary of events

April, 21st

Problems with the agent. Only after paying a visit to him, we were told that there were problems (unpaid bills from Flotec delivery, agent not officially assigned). Also one air freight item (releases and batteries from Southampton) had not cleared customs. After paying 288 USD for the Flotec issues, those were delivered to the vessel, as were the 4 containers. The air freight item got delivered (after 3 visits to the agent) at 17:30 finally.

April, 22nd

We left Freeport at 7am, sailing southeastward along Grand Bahama Island. There was a safety briefing at 11. After passing Hole in the Wall (Abaco Island) we sailed on a northward course and performed the first CTD (cal dip, release test) cast (#39) at 18:00, followed by the second (#40) during the night.

April, 23rd

We started at 7:00 to deploy Bills WB0 mooring that he had deployed and recovered on the previous leg due to an unresolved release problem. We then recovered WB1 (acoustics were quite bad) and then deployed WB1. Then we went westward to recover and deploy the WBADCP mooring at 600 m water depth (within good site of Abaco). Finally we turned into deep water again (former WBH2 site) and

started a CTD cast (#41). Some of the inductive MicroCATs downloaded from WB1, did not produce complete records and had to be downloaded again. After that, another CTD cast was done (#42). This had several MicroCATs (depth-rated to 3500m) go beyond their depth threshold, which caused no harm to the instruments.

April, 24th

The Lander WBL3 (at WB2) was released before breakfast and recovered. Compared to the day before, the wind had picked up significantly.
We then recovered WB2. Several of the new MicroCATs were missing one clamp (the one near the connector that does not press firmly on the wire). One RCM 11 had its transducer and pressure case missing. After lunch we built and deployed the lander WBL3.
Then a lander for Bill's site (WBLB) was built and deployed (all RAPID kit except for one of Bill's BPRs).

April, 25th

During the triangulation of WB1, the mooring was accidentally released at around 4am and had to be recovered when daylight set in. Since all drums were occupied with wire, the rest of the day was used to wind on WB2 and WBH2 and get glass prepared for the next day. A bathymetry survey for WBH2 to be deployed the next day (between WB2 and WB3) was carried out. CTD #43 was performed.

April, 26th

We deployed WB2 and WBH2, both without any problems. The WB2 deployment (anchor depth ~ 3900 m) started within good sight of Abaco Island - in only 1000 m water depth. The bathymetry falls off dramatically to the east. Also, triangulation surveys on both moorings were carried out, and a CTD cast (#44) mainly to get releases tested for the WB4 deployment planned the next day.

April, 27th

At 6:15am the WBL4 lander (near WB4) was released and surfaced an hour later. It was recovered (having some entanglement) and then WB4 was released. The main flotation did not surface, and no acoustic ranges were received with the normal IXSEA transducer. The new IXSEA “superducer” was tested and immediately good fixes were received. After a short search the mooring eventually was found at the surface (slightly to the east of the original deployment site). It was nicely stretched out. On recovery it turned out that the main steel buoyancy sphere was missing (and everything above it). The chain that connected the sphere to the cable below was stretched and broken (presumably due to an implosion). In total the main 48" sphere, a 28" sphere, 2 MicroCATs and 1 rcm went missing. Also 8 glass spheres imploded (3 @ 1200 m and 5 @ release). From looking at recorded pressures and velocities, a strong current event had gradually dragged the mooring down (probably beyond its depth allowance) so that it then imploded. The main float must have parted at that point, manifesting itself in an abrupt increase in recorded pressures. Due to this, the mooring WB4 planned to be deployed, was redesigned, so that no steel sphere was used any more (due to be deployed the next day). Then a search for the WB4 mooring that went missing the year before was started. That gave inconclusive results. Directly near the original drop site some acoustic fixes were received (differing largely in range). When looking further away, no fixes were received.

April, 28th

We deployed WB4 at the new site about 26 nm east of the old position with no problems. The

bathymetry is very flat there (~4710 m). A final CTD cast (#45) with the MicroCATs recovered the day before was carried out. Finally, the bottom lander WBL4 was deployed and a triangulation for WB4 was carried out. End of science programme.

April, 29th

Around 8 am we arrived in Freeport, and our containers were delivered an hour later so that we unloaded our gear and loaded Bill's equipment back on board.

7. Computing

A local area network formed the data processing backbone, consisting of three Mac mini's (Table 3) joined via an Ethernet switch. Data storage capacity for daily backups was increased using a Lacie 233 Gbyte external USB disk formatted as MacOS Extended (Journaled) – Rapid2. An identical spare external disk formatted as FAT32 was available for transferring files between Windows and MacOS operating systems – Rapid1. In practice a variety of USB memory sticks were used as a sneakernet for transferring data from instrument download computers. This local network was connected to the ship's network to access networked printers. However, lacking printer drivers we were unable to print to these. Fortunately a HP Photosmart 275 printer for which we had suitable drivers was added to the local network. The Mac minis enabled Personal File Sharing, Windows Sharing, Remote Login, FTP Access and Apple Remote Desktop. Each computer disk could then be mounted as an external Volume.

Table 3: Computer network, Mac processor details, disk capacity and Matlab versions.

Computer name	Processor	MacOS Version	Disk Capacity Gbytes	Matlab
Hydrosea	PowerPC G4, 1.42 GHz	10.3.9	74	7.0.4.352 (R14), Service Pack 2, Jan 29th 2005
Hydrosea2	PowerPC G4, 1.42 GHz	10.3.9	74	7.1.0.183 (R14), Service Pack 3, August 2005
Hydrosea3	Intel core duo, 1.83 GHz	10.4.11	74	7.4.0.287 (R2007a)

The Rapid data archive under /noc/ooc/rpdmoc was copied at NOCS directly to the Lacie external disk with MacOS formatting. This disk was mounted on a MacBook Pro along with the RAID disk /noc/ooc using a samba mount. The copy command used was *sudo cp –r –p /Volumes/ooc/rpdmoc/rapid/data /Volumes/Rapid2*, which is a recursive copy maintaining the file permissions. The rapid data set at NOCS is owned by surman in group hydro or ooc depending on the age of the files. Some files and directories did not have group read so these were first changed by surman by *find /noc/ooc/rpdmoc –type d –exec chmod 750 {}* \; to change directories to read,write,execute for surman and read,execute for group. Files were changed by *chmod –R ug+r /noc/ooc/rpdmoc/rapid.*

Data from external disk Rapid2 were copied to hydrosea3 and processing paths were set to these

files. Access from hydrosea and hydrosea2 was via the hydrosea3 disk mounted as an external Volume, so only one copy of the data and processing software was maintained and archived.

Matlab is used to process mooring instrument data (Sea-Bird SBE37 standard and inductive MicroCATs, bottom pressure gauges and Aanderaa RCM11 current meters). Each Mac has a stand alone Matlab license. Data are then processed using the processor on each Mac but data and programmes are accessed from hydrosea3.

No problems were encountered with the differing versions of the MacOS operating system or Matlab versions but it is recommended to unify all Mac minis to the latest version of the operating system and Matlab.

Raw instrument data files were downloaded to four different PCs, then transferred by sneakernet to hydrosea3. Considerable attention was given to ensuring all raw data files were accounted for. A separate report (Collins et.al) gives full details of the processing procedures for mooring data obtained under the Rapid programme.

Daily backups of data files on hydrosea3 were made to the disk Rapid2 using *cp* command. An additional backup of the sj06/raw data directory was also made to USB disk and a third external disk.

HiSeasNet – Internet for Oceanographic Ships at Sea

The R/V *Seward Johnson* is equipped with a satellite communications network called HiSeasNet that is designed specifically to provide continuous internet connectivity for oceanographic research ships and platforms. Access to the internet is an integral part of nearly every research lab and office on land; extending this access to oceanographic ships - our seagoing laboratories - is a benefit for seagoing research activities. HiSeasNet provides: transmission of data in real-time to shore-side collaborators; basic communications-email, voice and video teleconferencing for scientists, engineers and crew at sea; tools for real-time educational interactions between shipboard scientists, teachers and the classroom; as well as informal science and other education and outreach activities. This is an NSF funded system maintained by Scripps (www.hiseasnet.ucsd.edu). HiSeasNet provides internet service to ships operated by Scripps Institution of Oceanography, the University of Washington, the University of Hawaii, Woods Hole Oceanographic Institution, the Lamont-Doherty Earth Observatory of Columbia University, and the Graduate School of Oceanography at the University of Rhode Island. The system is designed to accommodate additional ships and moored ocean observatories while providing coverage over the entire Atlantic and Pacific Oceans.

8. CTD calibration dip casts

8.1. CTD operations

During the April 2008 survey, a total of 45 hydrographic stations were occupied in the Florida Straits and East of Abaco Island, Bahamas, of which 13 were calibration stations. Leg 2 performed 7 of these stations (Table 4). At each station, profiles of temperature, salinity (conductivity) and dissolved oxygen were collected to within approximately 20 m of the bottom. LADCP measurements were taken concurrently with CTD stations. Water samples for calibration of the salinity profiles were collected at each station. A full list of stations performed on both legs of the cruise can be found in Johns (2008).

Table 4: Station locations visited during Leg 2 of SJ08-03. *No LADCP data collected on cast. A list of which instruments were on each cast is given in Appendix E.

Station	Date (US)	Time (UTC)	Latitude (°N)	Longitude (°W)	Depth (m)
39	04/22/08	2212	26.041	76.837	3966
40	04/23/08	0329	26.212	76.740	3960
41	04/25/08	0040	26.500	76.599	3974
42	04/24/08	0541	26.482	76.598	3959
43	04/25/08	0155	26.460	76.635	3962
44*	04/27/08	0304	26.499	76.579	3998
45*	04/28/08	1546	26.393	75.676	3471

The Ship's CTD system was used to lower instruments, both prior to deployment and following recovery of previously deployed moorings. New instruments or those sent from stock were primarily "dipped" to perform functionality check, but also to provide a start-point calibration for conductivity and temperature. When a recovered instrument is redeployed, the post-deployment cast also acts as the pre-deployment calibration for the subsequent data set.

Recovered instruments are sometimes affected by bio-fouling, and also have their own inherent drift in sensor performance. By obtaining end-point calibrations and combining these with the start-point calibrations obtained from the deployment cruise, the drift of the conductivity and temperature sensors can be corrected. The calibration is of most use for the Sea-Bird MicroCAT CTDs, but the same procedure can be used on the RCM11 current meters as pre-deployment functionality checks.

Instruments were set to the fastest possible sampling rate, attached to the CTD frame and lowered to depth as per a normal CTD cast – post deployment casts were only conducted once the data had been downloaded and checked. Bottle stops on the upcast were extended to 5 minutes to provide time for the instruments to stabilise relative to the faster responding ship's CTD.

10 bottles were removed from the CTD rosette to accommodate the instruments which for this cruise were attached on ratchet straps (MicroCATs) or clamped in place of the bottle using hose clamps (RCM11s). All instruments were also lashed by safety lines to the CTD frame. Details of the CTD casts are given in Table 8.1. Details of which instruments were lowered on each CTD cast are given in Appendix E.

8.2. Standards and pre-cruise calibrations

The CTD/O_2 system is a real-time data acquisition system with the data from a Sea-Bird Electronics, Inc. (SBE) 9plus underwater unit transmitted via a conducting cable to a SBE 11plus deck unit. The serial data from the underwater unit is sent to the deck unit in RS-232 NRZ format. The deck unit decodes the serial data and sends it to a personal computer for display and storage in a disk file using Sea-Bird SEASOFT software.

The SBE 911plus system transmits data from primary and auxiliary sensors in the form of binary numbers equivalent to the frequency or voltage outputs from those sensors. These are referred to as the raw data. The SBE software performs the calculations required to convert raw data to engineering units.

The SBE 911plus system is electrically and mechanically compatible with the standard, unmodified carousel water sampler, also made by Sea-Bird Electronics, Inc. A modem and carousel interface allows the SBE 911plus system to control the operations of the carousel directly without interrupting the flow of data from the CTD.

The SBE 911plus underwater unit is configured with dual standard modular temperature (SBE 3) and conductivity (SBE 4) sensors, which are mounted near the lower end cap. The conductivity cell entrance is co-planar with the tip of the temperature sensor probe. The pressure sensor is mounted inside the underwater unit main housing. A centrifugal pump module flushes water through sensor tubing at a constant rate independent of the CTD's motion to improve dynamic performance. Dual dissolved oxygen sensors are added to the pumped sensor configuration following the temperature-conductivity (TC) pair.

8.2.1 Conductivity

The flow-through conductivity-sensing element is a glass tube (cell) with three platinum electrodes. The resistance measured between the center electrode and the end electrode pair is determined by the cell geometry and the specific conductance of the fluid within the cell, and controls the output frequency of a Wein Bridge circuit. The sensor has a frequency output of approximately 3 to 12 kHz corresponding to conductivity from 0 to 7 Siemens/meter (0 to 70 mmho/cm). The SBE 4 has a typical accuracy/stability of ±0.0003 S/m and resolution of 0.00004 S/m at 24 scans per second.

Two conductivity sensors were used during SJ08-03, serial numbers (s/n) 3338 and 2980. Pre-cruise sensor calibrations were performed at Sea-Bird Electronics, Inc. in Bellevue, Washington. The following coefficients were entered into SEASAVE® using the configuration file:

s/n 3338	**s/n 2980**
February 27, 2008	**February 27, 2008**
g = -9.97710595	*g = -1.00371736e+01*
h = 1.54292595	*h = 1.37071631*
I = -2.29418227e-03	*i = 2.08995419e-04*
j = 2.69175391e-04	*j = 5.33084088e-05*
ctcor = 3.2500e-06	*ctcor = 3.2500e-06*
cpcor = -9.5700e-08	*cpcor = -9.5700e-08*

Conductivity calibration certificates show an equation containing the appropriate pressure-dependent correction term to account for the effect of hydrostatic loading (pressure) on the conductivity cell:

$$C(Siemens/meter) = \frac{\left(g + h \cdot f^2 + i \cdot f^3 + j \cdot f^4\right)}{\left[10 \cdot \left(1 + ctcor \cdot t + cpcor \cdot p\right)\right]}$$

where *g*, *h*, *i*, *j*, *ctcor*, and *cpcor* are the calibrations coefficients shown above, *f* is the instrument frequency (kHz), *t* is the water temperature (degrees Celsius), and *p* is the water pressure (dbar). SEASAVE® automatically implements this equation.

8.2.2 Temperature

The temperature-sensing element is a glass-coated thermistor bead, pressure protected by a stainless steel tube. The sensor output frequency ranges from 5-13 kHz corresponding to temperature from –5 to 35 °C. The output frequency is inversely proportional to the square root of the thermistor

resistance, which controls the output of a patented Wein Bridge circuit. The thermistor resistance is exponentially related to temperature. The SBE 3 thermometer has a typical accuracy/stability of ±0.004°C per year and resolution of 0.0003 °C at 24 samples per second. The SBE 3 thermometer has a fast response time of 0.070 seconds.

The two temperature sensors used during SJ08-03 were s/n 2946 and 4799. Pre-cruise sensor calibrations were performed at Sea-Bird Electronics, Inc. in Bellevue, Washington. The following coefficients were entered into SEASAVE® using the configuration file:

s/n 2946	**s/n 4799**
March 5, 2008	**February 29, 2008**
g = 4.34407434e-03	*g = 4.36387750e-03*
h = 6.39246733e-04	*h = 6.36761170e-04*
I = 2.14558230e-05	*i = 2.07226875e-05*
j = 1.84832431e-06	*j = 1.71706246e-06*
f_0 *= 1000.0*	f_0 *= 1000.0*

Temperature (ITS-90) is computed according to:

$$T(^oC) = \frac{1}{\left\{ g + h \cdot \left[\ln\left(\frac{f_0}{f} \right) \right] + i \cdot \left[\ln^2\left(\frac{f_0}{f} \right) \right] + j \cdot \left[\ln^3\left(\frac{f_0}{f} \right) \right] \right\}} - 273.15$$

where *g*, *h*, *i*, *j* and f_0 are the calibration coefficients above and *f* is the instrument frequency (kHz). SEASAVE® automatically implements this equation and converts between ITS-90 and IPTS-68 temperature scales as desired.

8.2.3 Pressure

The Paroscientific series 4000 Digiquartz high pressure transducer uses a quartz crystal resonator whose frequency of oscillation varies with pressure induced stress measuring changes in pressure as small as 0.01 parts per million with an absolute range of 0 to 10,000 psia (0 to 6885 dbar). Repeatability, hysteresis and pressure conformance are 0.002% FS. The nominal pressure frequency (0 to full scale) is 34 to 38 kHz. The nominal temperature frequency is 172 kHz + 50 ppm/°C.

The two pressure sensors utilized during SJ08-03 were s/n 367 and 363. Pre-cruise sensor calibrations were performed at Sea-Bird Electronics, Inc. in Bellevue, Washington. The following coefficients were entered into SEASAVE® using the configuration file:

s/n 367	**s/n 363**
July 22, 2004	**August 12, 2005**
c_1 = -4.010525e+04	c_1 = -4.698871e+04
c_2 = 6.815307e-01	c_2 = 6.928599e-01
c_3 = 1.288650e-02	c_3 = 1.264330e-02
d_1 = 3.974700e-02	d_1 = 3.83200e-02
d_2 = 0.0	d_2 = 0.0
t_1 = 3.029263e+01	t_1 = 2.996944e+01
t_2 = -5.273358e-05	t_2 = -1.348850e-04

t_3 = 4.378350e-06	t_3 = 3.953500e-06
t_4 = 2.065070e-09	t_4 = 2.102330e-09
t_5 = 0.0	t_5 = 0.0
Slope = 0.99957	Slope = 1.0000500
Offset = -0.36860	Offset = -1.12900
AD590M = 1.12517e-02	AD590M = 1.1410e-02
AD590B = -8.82933	AD590B = -8.428130

Pressure coefficients are first formulated into:

$$c = c_1 + c_2 \cdot U + c_3 \cdot U^2$$
$$d = d_1 + d_2 \cdot U$$
$$t_0 = t_1 + t_2 \cdot U + t_3 \cdot U^2 + t_4 \cdot U^3 + t_5 \cdot U^4$$

where *U* is temperature in degrees Celsius. Pressure is computed according to:

$$P(psia) = c \cdot \left(1 - \frac{t_0^2}{t}\right) \cdot \left[1 - d \cdot \left(1 - \frac{t_0^2}{t}\right)\right]$$

where *t* is pressure period (μs). SEASAVE® automatically implements this equation.

8.2.4 Oxygen

The SBE 43 dissolved oxygen sensor uses a membrane polarographic oxygen detector (MPOD). Oxygen sensors determine the dissolved oxygen concentration by counting the number of oxygen molecules per second (flux) that diffuse through a membrane. By knowing the flux of oxygen and the geometry of the diffusion path, the concentration of oxygen can be computed. The permeability of the membrane to oxygen is a function of temperature and ambient pressure. In order to minimize the errors in the oxygen measurement due the temperature differences between the water and the oxygen sensor, a temperature compensation is calculated using a temperature measured near the active surface of the sensor. The interface electronics output voltages proportional to the temperature-compensated oxygen current. Initial computation of dissolved oxygen in engineering units is done in the software. The range for dissolved oxygen is 120% of surface saturation in all natural waters, fresh and salt and the nominal accuracy is 2% of saturation.

Oxygen sensors 1329, 703, 1348 and 140 were used during SJ08-03. The following oxygen calibrations were entered into SEASAVE® using the configuration file:

s/n 1329	**s/n 703**	**s/n 1348**	**s/n 140**
September 28, 2007	**March 21, 2008**	**December 28, 2007**	**February 24, 2007**
Soc = 3.5320e-01	*Soc = 4.1450e-01*	*Soc = 4.510e-01*	*Soc = 2.8700e-01*
Boc = 0.0	*Boc = 0.0*	*Boc = 0.0*	*Boc = 0.0*
Offset = -0.4914	*Offset = -0.5079*	*Offset = -0.5088*	*Offset = -0.6176*
tcor = 0.0017	*tcor = 0.0005*	*tcor = -0.0014*	*tcor = 0.0007*
pcor = 1.35e-04	*pcor = 1.35e-04*	*pcor = 1.35e-04*	*pcor = 1.35e-04*
tau= 0.0	*tau= 0.0*	*tau= 0.0*	*tau= 0.0*

Dissolved oxygen concentration is calculated according to:

$$O(ml/l) = \left\{ Soc \cdot \left[(V + Offset) + \left((tau \cdot \frac{dV}{dt} \right) \right] + Boc \cdot e^{(-0.03 \cdot T)} \right\} \cdot e^{(tcor \cdot T + pcor \cdot P)} \cdot OXSAT(T, S)$$

where *Soc*, *Boc*, *Offset*, *tcor*, *pcor*, and *tau* are the calibration coefficients above and *V* is the instrument voltage (V) and *dV/dt* (V/s) is the slope of the voltage. *T*, *S* and *P* are the temperature, salinity and pressure measured by the CTD and OXSAT is the oxygen saturation value calculated according to:

A1 = -173.4292 *A2* = 249.6339 *A3* = 143.3483 *A4* = -21.8492

B1 = -0.033096 *B2*= 0.014259 *B3* = -0.00170

$$OXSAT(\hat{I}_s, S) = \exp\left\{ A1 + A2 \cdot \left(\frac{100}{\hat{I}_s} \right) + A3 \cdot \ln\left(\frac{\hat{I}_s}{100} \right) + A4 \cdot \left(\frac{\hat{I}_s}{100} \right) + S \cdot \left[B1 + B2 \cdot \left(\frac{\hat{I}_s}{100} \right) + B3 \cdot \left(\frac{\hat{I}_s}{100} \right)^2 \right] \right\}$$

where θ is the absolute temperature (K). SEASAVE® automatically implements this equation.

8.3. Data acquisition

CTD/O_2 measurements were made using a SBE 9plus CTD with dual sensor configuration. Each set of sensors included a temperature, conductivity, and dissolved oxygen sensor. The sets were placed as mirror images to each other mounted low in the CTD main housing with the intakes approximately 6-8 inches apart. The TC pairs were monitored for calibration drift and shifts by examining the differences between the two pairs on each CTD and comparing CTD salinity values with bottle salinity measurements.

AOML's SBE 9plus CTD/O_2 s/n 367 (sampling rate 24Hz) was mounted in a 24-position frame and employed as the primary package for the first nine stations of SJ08-03 Leg 1, due to bottle closure confirmation problems it was replaced by s/n 363 for all other stations. Auxiliary sensors included a dual Lowered Acoustic Doppler Current Profiler (LADCP) and a Simrad altimeter. Water samples were collected using a SBE bottle carousel and 10-litre Niskin bottles. In order to accommodate the LADCP three bottle positions could not be used, also during the Sea-Bird MicroCAT calibration casts only 11 positions were used.

The package entered the water from the starboard side of the ship and was held within 10 meters of the surface for 1 minute in order to activate the pump and after that 2 more minutes in order to flush the plumbing system and remove potential air bubbles in it. The package then was brought back to the surface and lowered at a rate of 30m/min to 100 m, 45m/min between 100 and 150 m off the surface, and 60 m/min generally to within 20 meters of the bottom, slowing on the approach. The altimeter monitored the position of the package relative to the bottom, as well as a combination of a 12Khz pinger mounted on the CTD frame and the Knudsen system mounted on the vessel.

Upon completion of the cast, sensors were flushed repeatedly and stored with a deionized water solution in the plumbing. Niskin bottles were then sampled for oxygen and salinity.

A SBE 11plus deck unit received the data signal from the CTD. Digitized data were forwarded

to a personal computer equipped with SEASAVE® acquisition and processing software SBEDataProc® version 7.17. Preliminary temperature, salinity, and oxygen profiles were displayed in real time. Raw data files were archived to removable drives as well as to compact discs.

8.3.1 Data acquisition and system problems

In the first cast of SJ08-03 Leg 1 the primary oxygen sensor (s/n 1329) exhibited a difference of almost 3ml/l when compared with the secondary and it was replaced by s/n 703. Data acquisition problems incurred during the first nine casts of SJ08-03 Leg 1 (CTD s/n 367) were due to data flow interruption to the carousel but these problems did not compromise the data sampling or the CTD data. After the replacement of the CTD unit for the s/n 363 the performance of the sensors was outstanding. The secondary oxygen (s/n 1348) sensor spiked out at 2400 dbar during the downcast on the station 25 and never came back to normal. It was replaced by the sensor s/n 140.

8.3.2 Salinity analyses

Bottle salinity analyses were performed in the ship's temperature-controlled salinity laboratory using a Guildline Model 8400B inductive autosalinometer, and a dedicated PC. Software allowed the user to standardize the autosalinometer. IAPSO Standard Seawater was used as the standard. The autosal was standardized before each case of samples was analyzed, or every 24 samples.

Duplicate samples were taken on several casts. Bottle salinities were compared with preliminary CTD salinity values to monitor CTD conductivity cell performance and drift. The expected precision of the autosalinometer is 0.001 PSS, with an accuracy of ±0.0003 PSS.

8.3.3 Oxygen analyses

Bottle oxygen analyses were also performed in the ship's temperature-controlled salinity laboratory using a photometric automatic Winkler method titrator with a Carpenter modification, and a dedicated PC. The water samples are drawn (without air bubbles) from Niskin bottles immediately upon arrival on deck. Manganese sulfate (or chloride) is added to the sample, followed by the addition of an alkaline sodium hydroxide-sodium iodide solution. These solutions "pickle" the sample causing it to precipitate and react with the dissolved oxygen in the water sample. The sample is then dissolved and photometrically titrated to an end point with a standardized sodium thiosulphate solution. The content of oxygen is calculated utilizing the volume of the water sample bottle and the amount of added thiosulphate. Automated titrating systems can attain a precision of about ±4.46 μmol/kg (Friederich *et al.*, 1991).

8.4. At sea processing of CTD data

SBEDataProc® consists of modular menu driven routines for acquisition, display, processing, and archiving of oceanographic data acquired with SBE equipment. The software is designed to work with a PC with a Windows® operations system. Raw data are acquired from the instruments and are stored unmodified. The conversion module DATCNV uses the instrument configuration and pre-cruise factory calibration coefficients to create a converted engineering unit data file that is utilized by all SBEDataProc® post-processing modules. Unless otherwise noted, all calibration parameters given are factory default values recommended by Sea-Bird Electronics, Inc. The following is the SBEDataProc® processing module sequence and specifications used in the reduction of CTD/O_2 data

from this cruise:

- DATCNV converted the raw data to pressure, temperature, conductivity, oxygen voltage, and computed salinity, the time rate of change of oxygen voltage, and preliminary oxygen. DATCNV also extracted bottle information where scans were marked with a bottle confirmation bit during acquisition.

- ALIGNCTD aligns conductivity, temperature and oxygen in time relative to pressure to ensure that all calculations are made using measurements from the same parcel of water, which minimizes salinity spiking and density errors. The SBE 11plus deck unit has factory settings to advance the primary conductivity cell; therefore, ALIGNCTD was not performed on this cell. The secondary conductivity cell, however, is not advanced in the deck unit and so was advanced 0.073 seconds in the ALIGNCTD module. Since the SBE3 temperature sensor response is fast, (0.06 seconds), it is not necessary to advance temperature relative to pressure. Oxygen sensors s/n 0154 and s/n 0140 were advanced 4 seconds in ALIGNCTD.

- ROSSUM created a summary of the bottle data. Bottle position, date, and time were output automatically. Pressure, temperature, conductivity, salinity, oxygen voltage, rate of change of oxygen voltage, and preliminary oxygen values were averaged over a 2 second interval from 5 to 3 seconds prior to the confirm bit. ROSSUM computed potential temperature and sigma-theta.

- WILDEDIT marked extreme outliers in the data files. The first pass of WILDEDIT obtained an accurate estimate of the true standard deviation of the data. The data were read in blocks of 3000 scans. Data greater than two standard deviations were flagged. The second pass computed a standard deviation over the same 3000 scans excluding the flagged values. Values greater than 20 standard deviations were marked as bad values.

- FILTER performed a low pass filter on pressure data with a time constant of 0.15 seconds. In order to produce no time shift, the filter first runs forward through the data file and then runs backwards through the data file.

- CELLTM uses a recursive filter to remove conductivity cell thermal mass effects from measured conductivity. Both conductivity cells are epoxy coated and therefore the thermal anomaly amplitude (alpha) and the time constant (1/beta) were 0.03 and 9.0 respectively for each sensor.

- DERIVE was used to re-compute the rate of change of oxygen voltage (dv/dt) and oxygen (ml/l and µmol/kg) with a time window size of 2 seconds.

- LOOPEDIT marks data scans where the CTD package was moving less than a minimum velocity of 0.25 m/s or travelling backwards due to ship roll.

- BINAVG averages the data into 1 decibar (dbar) pressure bins starting at 1 dbar with no surface bin. The center value of the first bin was set to equal the bin size. The bin minimum and maximum values are the center value ± half the bin size. Scans with pressure values greater than the minimum and less than or equal to the maximum were averaged. Scans were interpolated so that a data record exists for every decibar. The number of points averaged in each bin was added to the variables listed in the data file.

- DERIVE recomputed salinity and calculates other oceanographic parameters (e.g. density).
- STRIP removed scan number from the data files.
- TRANS converted the data file format from binary to ASCII format.

9. Mooring operations

9.1. Mooring recoveries

A total of 6 moorings (4 taut-wire moorings and 2 bottom landers) were successfully recovered. These contained a mixture of current meters, Acoustic Doppler Current Profilers (ADCPs), temperature/salinity recorders and bottom pressure sensors. Information on these recoveries is given in Table 5.

Table 5: Mooring recoveries, positions and times.

Mooring	NMFD mooring number	Deployment cruise	Latitude	Longitude	Water Depth	Deployment date	Recovery date
WBADCP	2007/04	RB0701	26 29.79N	76 49.15W	601	28/03/07 17:37	23/04/08 21:37
WB1	2007/01	RB0701	26 29.9N	76 49.3W	1403	28/03/07 22:02	23/04/08 16:10
WB2	2007/02	RB0701	26 30.62N	76 44.66W	3892	29/03/07 19:37	24/04/08 14:57
WB4	2007/03	RB0701	26 32.36N	76 08.64W	4824	31/03/07 01:34	27/04/08 20:42
WBL3	2006/08	RB0602	26 30.62N	76 44.66W		24/03/06 01:18	24/04/08 12:02
WBL4	2006/05	RB0602	26 30.02N	76 02.95W	4810	22/03/06 22:22	27/04/08 11:49

9.2. Mooring deployments

A total of 9 moorings (6 taut-wire moorings and 3 bottom landers) were successfully deployed. These contained a mixture of current meters, Acoustic Doppler Current Profilers (ADCPs), temperature/salinity recorders and bottom pressure sensors. Information on these deployments is given in Table 6.

Table 6: Mooring deployments, positions and times.

Mooring	NMFD mooring number	Latitude	Longitude	Water Depth	Deployment date
WB0	N/A(Bill Johns mooring)	26 30.5N	76 50.58W		23/04/08 04:46
WBADCP	2008/05	26 31.52N	76 52.12W	598	23/04/08 23:07
WB1	2008/02	26 29.95N	76 49.26W	1396	23/04/08 20:17
WB2	2008/03	26 30.62N	76 44.36W	3891	26/04/08 17:21
WB4	2008/04	26 24.91N	75 41.89W	4705	28/04/08 15:18
WBH2	2008/08	26 28.32N	76 38.84W	4737	26/04/08 23:17
WBL3	2008/06	26 30.41N	76 44.66W	3887	24/04/08 18:58
WBL4	2006/07	26 24.25N	75 42.59W	4705	28/04/08 19:46
WBLB	2006/08	26 29.93N	76 29.64W	4857	24/04/08 21:20

9.3. Equipment losses

The implosion of the top sphere(s) of WB4 provided us with the most losses; this totalled 2 SBE 37s, serial numbers 3226 and 3227 and an RCM11 current meter, serial number 510. This also resulted in the loss of two steel spheres, two lights, SN's S01-179 and U11-019 and two Argos beacons, SN's 287 and T04-045.

9.4. WB4 implosion of Steel Sphere

Following the loss of the top section of WB4 an investigation into the cause of the loss was commissioned (Rayner et al, 2008). The conclusion of this study was that the mooring was subjected to a greater than predicted knockdown that caused the steel sphere to be pushed greater than its depth rating. Although the current profile at WB4 is generally steady it can experience strong currents that persist at depth due to offshore meandering of the Deep Western Boundary Current. The current profile used in the original design was too low when compared to such an event, with the resultant increased knockdown exacerbated by some length discrepancies of the mooring wires and chains, and a deeper deployment site.

Unfortunately the design for WB4 deployed in spring 2007 was completed prior to the analysis of the loss of wb4_3_200604. As such it was still underestimating the current profile. WB4 has since been redesigned using a much stronger current profile and using buoyancy that can withstand greater pressures with less risk of damage. This new design will be deployed in spring 2009. The replacement mooring deployed on this cruise had the intended steel spheres replaced with glass buoyancy that can withstand greater pressures.

9.5. The search for WB4_3_200604

Mooring WB4_3_200604 was deployed on the 22nd March 2006 at 26º 29.49' N 76º 04.16' W in water depth of 4800m (Rayner et al, 2007a). Recovery was planned for spring 2007 but despite several hours of searching the mooring could not be located (Rayner et al, 2007b).

WB4 is 4500m long, built from 6-8mm wire in the top 1000m and parafil below. The mooring has a two section top consisting of a 50" steel sphere at 250m, two 17" glass spheres at 100m and two 17" glass spheres at 50m. Further buoyancy was provided by 20x17" glass spheres in three clusters (twelve, four and six) at depths below 1000m. Instrumentation consists of five Aanderra RCM11 single point current meters, two InterOcean S4 electromagnetic current meters and 15 Sea-Bird SBE37 MicroCAT CTDs. The mooring was attached to the anchor using dual IXSEA releases AR861 (s/n 359) and an RT661 (s/n 244) in parallel. Note that battery life of the RT661 has expired. The AR861 should survive for a minimum of three years on the installed alkaline batteries, but will probably have sufficient power for five years, so the AR861 may be active until 2011.

Subsequent to the failure to find and recover in spring 2007, the mooring design was re-examined using a mooring design programme independent of that used for the initial design. In addition attention was paid to the profile of currents that were used for the initial design. Two results emerged. Firstly, it was likely that the initial current profile substantially underestimated the deep currents below 1000m, where short but intense events related to the Deep Western Boundary Current, causing substantially more drag on the mooring than allowed for initially. Therefore, the anchor weight was too light – possibly by 1000 to 1500kg. Secondly, the mooring was likely to have suffered

substantially more knockdown than predicted in the initial weaker current profile. From the experience of WB4_4_200703 recovered on this cruise, it is likely that knockdown would have been enough to sink the 50" sphere deeper than its maximum rated depth – causing implosion and possibly the collapse of the mooring to the seabed (Rayner et al, 2008).

The failure to locate the mooring in 2007 suggested it may have moved from the deployment location because of the underweight anchor, while the evidence from this cruise suggests it could have collapsed locally.

Therefore, we began a new search using the "superducer" that provides much better sensitivity than our standard over-the-side transducer for sending and receiving to and from the IXSEA releases. Starting at the deployment location we searched for the mooring at a grid of four stations 1nm from the location. From these sites we immediately received answers from the AR861. Ranges were in the region of 9000 to 10000m and the diagnostics were inconsistent, giving release horizontal or vertical at random with nonsensical reporting of the release voltage. A further grid of stations at a radius of 3nm from the deployment location did not detect any returns from the release. No response was obtained from the RT661. Because of the very inconsistent ranges returned on the inner survey grid with nothing on the outer grid, it may be that the mooring is lying on the seabed in the vicinity of the original deployment site. However, no definitive position was obtained.

10. Mooring Instrument Report

A summary of instruments recovered and deployed by mooring is listed in Table 10. Two SBE37 CTDs and one RCM11 were lost from WB4. One SBE37 was flooded on WB4 and one RCM11 on WB2. From recovered instruments all data records were complete from deployment to recovery. Data record lengths by instrument and mooring are tabulated in Appendix B.

Table 7: Summary of instruments recovered and deployed. RB0701 cruise report lists setup details of recovered instruments. Appendix D lists setup details of deployed instruments.

Instrument type	Manufacturer and model	Number recovered	Number lost	Total deployed
CTD	Sea-Bird SBE37 SMP MicroCAT	WB1: 6 WB2: 10 WB4: 12	 WB4: 3	WB1: 10 WB2: 11 WB4: 12
CTD	Sea-Bird SBE37 IMP MicroCAT	WB1: 9 WB2: 6		WB1: 5 WB2: 5 WBH2: 3 WB4: 3
Single point current meter	Aanderaa RCM11	WB1: 4 WB2: 5 WB4: 6	 WB2: 1 WB4: 1	WB1: 4 WB2: 7 WBH2: 5 WB4: 7
Current profiler	RD Instruments 75kHz ADCP	WBADCP: 1		WBADCP: 1
Bottom Pressure Recorder	Sea-Bird SBE26	WBL3: 2		WBL3: 2
Bottom Pressure Recorder	Sea-Bird SBE53	WBL4 :1		WBL4: 1

11. References

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Appendix A: Bridge Logs

HARBOR BRANCH OCEANOGRAPHIC INSTITUTION

R/V SEWARD JOHNSON

DECK LOG

22nd DAY OF _

LOCATION FREEPORT HARBOR, GBI BERTH #9

TIME		TIME	
	0000 - ALONGSIDE PIER, BERTH #9 - FREEPORT HARBOR		
0545	ASKEW & HENDERSON ON WATCH		
0655	CAST OFF - LOADED IN ACCORDANCE WITH USCG STABILITY LETTER		
0705	FREEPORT HARBOR JETTIES - OUTBOUND		
0745	GUNTHER & SMEDLEY ON WATCH		
1000	POS 26°16.324N / 078°17.434W COG 115 @ 10.2KTS		
1100	POS: 26°12.0N & 078°06.9W C-115°T @ 10.1KTS		
1145	Dimm & Large On Watch		
1200	Pos 26°07.93N 77°57.052W C-115 S-11.2		
1330	Pos 26°00.959N 77°40.979W C-116 S-12.0		
1430	Pos 25°55.296N 77°27.421W C-114 S-11.6		
1545	ASKEW & HENDERSON ON WATCH		
1604	POS 25°50.474'N 77°08.319'W cog 063°T @ 10.7 kts		
1701	POS 25°55.349'N 76°57.966'W cog 002°T @ 11.7 kts		
1808	DEPLOY CTD CAL #1 @ POS 26°02.456'N 76°58.215'W		
1945	Ge. GUNTHER & M. SMEDLEY ON WATCH		
2150	Recovery CTD @ 26°01.075N, & 076°49.728W		
2338	DEPLOYED CTD @ 26°12.686N & 076°49.391W		
2345	Dimm & Large On Watch		

	SHIPS CREW	TECHS / SUB CREW	SCIENCE GROUP	SCIENCE GROUP	PRESAILING CHECKS	
Master	George Gunther	Jim Levin	Bill Johns	PETER CAZAYEVICH	Drafts Fwd 12'0" Aft 11'10"	
Chief Mate	Tim Askew Jr.	Dan Cuchiara	Carlos Ferreira	Rob McMahon	Steering	✓
2nd Mate	Dan Timm		Mark Graham	JOHN WALLACE	Nav Gear	✓
Chief Engineer	Erik Bergendahl		Andrew Stefanik	JON MOLINA	Thrusters	✓
Asst. Engineer	Pete Knight		DAVID OHICES		Horn	✓
2nd Asst. Eng.	Dick Curran		CHRIS CROW		Radios	✓
Steward	Gerard Bilquin		STUART CUNNINGHAM		Radars	✓
Asst. Steward	Greg Stein					✓

FORM 1790 - PRINTING BY HEARN

23 APR

LOCATION: Abaco Island East Side

TIME	
0000	Underway as before. Dimm & L.Longe on watch In pos 26°12.656N 76°44.321W All Lights are fully energized & Burning Bright
0300	Recover CTD pos 26°12.924N 76°44.637W
0345	ASKEW & HENDERSON ON WATCH
0412	POS 26°18.279'N 76°46.426'W COG 345°T @ 6.3 kts
0507	POS 26°23.748'N 76°48.261'W COG 343°T @ 6.1 kts
0602	POS 26°28.911'N 76°49.997'W COG 344°T @ 5.8 kts
0715	BEGIN DEPLOYMENT "MOORING A"
0745	G.GUNTHER & M. SMEDLEY ON WATCH
0846	Deployed "Mooring A" @ 26°30.558'N E 076°50.580' SHIPS HEAD 331°T with a Drop-Distance of 580'. BEARING to SITE "A" was 149°T with @ 1.8 Kt current on surface. WAY Point #23 on NorthStar.
1145	Dimm & L.Longe on watch
1200	Recover the last of mooring pos 26°26.206N 76°47.487W
1305	Start Deployment of Mooring (A)
1545	ASKEW & HENDERSON ON WATCH
1617	DEPLOY ANCHOR WBA MOORING @ POS 26°29.942'N 76°49.252'W
1738	RECOVER "WBADCP" POS 26°30.48'N 76°52.17'W
1908	DEPLOY "WBADCP" POS 26°31.525'N 76°52.174'W

TIME	
1945	
2045	Deployed CTD @ 26°29.920'N & 076° 35.921'W.
2345	Dimm & L.Longe on watch

	SHIPS CREW	TECHS / SUB CREW	SCIENCE GROUP	SCIENCE GROUP
Master				
Chief Mate				
2nd Mate				
Chief Engineer				
Asst. Engineer				
2nd Asst. Eng.	As before	As before	As before	
Steward				
Asst. Steward				
Seaman				
Seaman				

PRESAILING CHECKS	WEATHER
Drafts Fwd ____ Aft ____	
Steering	
Nav Gear	
Thrusters	
Horn	
Radios	
Radars	
Alarms	
Anchors Ready	
Gear Secured	

HARBOR BRANCH OCEANOGRAPHIC INSTITUTION

R/V SEWARD JOHNSON

DECK LOG

24th

LOCATION East side of Great Abaco

TIME		TIME	
0000	Underway as before. Dimm & L Lange on watch. In pos 26°28.98'N 76°36.08'W C-5. All Lights are fully energized & Burning Bright	2345	Dimm & L Lange
0025	Recover CTD		
0200	Launch CTD		
0345	ASKEW & HENDERSON ON WATCH		
0511	RECOVER CTD		
0602	POS 26°28.808'N 76°40.491'W COG 293°T @ 6.5 kts		
0646	RELEASED "WBL3" from anchor POS 26°30.42'N 76°44.66'W		
	ESTIMATED 1 HOUR TO SURFACE		
0745	G. GUNTHER & M. SMEDley ON WATCH.		
0801	RECOVERED WBL3		
0910	COMMENCED RECOVERING WB3		
1145	Finish Recovering Mooring		
1146	Dimm & L. Lange on watch		
1300	POS 26°30.554'N 76°44.636'W C-15		
1500	Drop Leader Buoy 26°30.411'N 76°44.653'W		
1545	ASKEW & HENDERSON ON WATCH		
1720	DEPLOY LANDER "WBLB" POS 26°29.931'N 76°29.684'W		
1800	DRIFTING NEAR "LANDER B" POS 26°29.9'N 76°30.00'W		
1900	DRIFTING NEAR "LANDER B" POS 26°29.9'N 76°30.00'W		
1945	G. GUNTHER & M. SMEDley ON WATCH		
	DEPLOYED BTI @ 26°27.406'N & 076°38.183'W		

	SHIPS CREW	TECHS / SUB CREW	SCIENCE GROUP	SCIENCE GROUP	PRESAILING CH
Master					Drafts Fwd
Chief Mate					Steering
2nd Mate					Nav Gear
Chief Engineer					Thrusters
Asst. Engineer	AS	BEFORE			Horn
2nd Asst. Eng.					Radios
Steward					Radars

HARBOR BRANCH OCEANOGRAPHIC INSTITUTION — DECK LOG — 25th DAY OF Apr. 2008

LOCATION

TIME		TIME	
0000	Underway as before, D.Hummel, L.Longo on watch. 26° 26.951N 76° 38.424W. All Lights are fully energized & burning Bright		
0115	Recover CTD		
0200	pos 26°26.476N 76°43.582W C-270 S-5.4		
0300	pos 26°26.607N 76°49.293W C-0 S-4.1		
0345	ASKEW & HENDERSON ON WATCH		
0410	OBSERVED MOORING ON SURFACE - ACCIDENTAL RELEASE		
—	STANDING BY UNTIL DAYLIGHT FOR RECOVERY		
0745	G.GUNTHER & M.SMEDLEY ON WATCH.		
0746	COMMENCED RECOVERY of MOORING		
0937	MOORING WB1 ON DECK.		
1145	D.Hummel & L.Longo on watch		
1300	pos 26°30.448N 76°48.651W C-41 S-2.7		
1400	pos 26°32.719N 76°46.403W C-39 S-5.2		
1545	ASKEW & HENDERSON ON WATCH		
1626	BEGIN REDEPLOYMENT OF "WB1"		
1824	DEPLOYED ANCHOR FOR WB1 @ 26°30.159' & @76°49.347W. CURRENT 350°T @ .8.		
1905	TRANSDUCER OVER SIDE POS 26°29.693'N 76°49.700'W		
1915	RECOVER TRANSDUCER		
1944	TRANSDUCER DEPLOYED		
1945	G. GUNTHER & M. SMEDley ON WATCH		
2345	D.Hummel & L.Longo on watch		

	SHIPS CREW	TECHS / SUB CREW	SCIENCE GROUP	SCIENCE GROUP	PRESAILING CHECKS	WEATH
Master						
Chief Mate					Drafts Fwd ____ Aft ____	
2nd Mate					Steering	
Chief Engineer					Nav Gear	
Asst. Engineer	As Before	As Before			Thrusters	
2nd Asst. Eng.					Horn	
Steward					Radios	
Asst. Steward					Radars	
					Alarms	

HARBOR BRANCH OCEANOGRAPHIC INSTITUTION

DECK LOG

26th DA

TIME	LOCATION	TIME	
0000	Underway as before, Dlumm & L Lange on watch in pos 26°33.308N 76°44.646W C-72. All Lights Are fully energized & Burning bright	2345	Dlumm & L Lange
0200	pos 26°32.939N 76°42.449W C-222 S 4.0		
0345	ASKEW & HENDERSON ON WATCH		
0405	POS 26°28.678'N 76°45.828'W COG 039°T @ 1.4kts		
0504	POS 26°29.350'N 76°45.032'W COG 039°T @ 1.1kts		
0601	POS 26°30.030'N 76°44.225'W COG 037°T @ 1.3kts		
0707	POS 26°30.990'N 76°43.188'W COG 047°T @ 1.5kts		
0745	GUNTHER & SMEDLEY ON WATCH POS 26°31.348N & 76°43.108W / COG 282°T @ 3.6KTS		
0910	COMMENCED MOORING DEPLOYMENT FOR WBZ @ 26°31.100'N & 076°44.930'W CURRENT 330°T @ .8		
1145	Dlumm & L Lange on watch		
1320	Drop Anchor pos 26°30.620N 76°44.414W; WBZ		
1500	pos 26° 31.766N 76°42.000W C-322 S-8.4		
1545	ASKEW & HENDERSON ON WATCH		
1618	BEGIN DEPLOYMENT "WBH2"		
1917	DEPLOY ANCHOR "WBH2" POS 26°28.272'N 76°38.873'W		
1945	GUNTHER & SMEDLEY ON WATCH		
2009	COMMENCE TRIANGULATION POS 26°26.243 & 76°38.912 COG 007°T @ 1.0 KTS		

	SHIPS CREW	TECHS / SUB CREW	SCIENCE GROUP	SCIENCE GROUP
Master				
Chief Mate				
2nd Mate				
Chief Engineer				
Asst. Engineer				
2nd Asst. Eng.	As Before	As Before		
Steward				
Asst. Steward				

PRESAILING CHEC

Drafts Fwd	Aft
Steering	
Nav Gear	
Thrusters	
Horn	
Radios	
Radars	

HARBOR BRANCH OCEANOGRAPHIC INSTITUTION

R/V SEWARD JOHNSON

DECK LOG

27

LOCATION TIME		TIME	
0000	Underway as before, Dimm & L. Lange on watch. 26° 30.105N 76° 34.722W		
	All lights are fully energized & burning bright		
0300	Recover CTD		
0345	ASKEW & HENDERSON ON WATCH		
0402	POS 26° 29.600'N 76° 25.281'W COG 089°T @ 9.8 kts		
0506	POS 26° 29.815'N 76° 13.722W COG 090°T @ 9.8 kts		
0609	ARRIVE "WBL4" POS 26° 30.02'N 76° 02.95'W - XDUCER DEPLOYED		
0619	LANDER RELEASED - ESTIMATED 1 HR TO SURFACE		
0706	DRIFTING NEAR "WBL4"		
0733	RECOVER "WBL4"		
0745	GUNTHER & SMEDLEY ON WATCH		
1145	Dimm & L. Lange on watch		
1200	26° 32.270N 76° 09.018W		
1310	Start Recovery of WB4		
1545	ASKEW & HENDERSON ON WATCH		
1642	COMPLETE RECOVERY OF "WB4"		
1800	POS. 26° 31.033'N 76° 12.597'W COG 102.8°T Sp. 10.2 kts		
1901	HEAVE TO POS 26° 29.72'N 76° 04.19'W "WB4 2000"		
1945	GUNTHER & SMEDLEY ON WATCH		
	POS 26° 30.333'N & 76° 04.135'W COG 2°T @ 11.1 kts		
2125	Triangulation WB4		
2345	Dimm & L. Lange on watch		

	SHIPS CREW	TECHS / SUB CREW	SCIENCE GROUP	SCIENCE GROUP	PR
Master					Drafts F
Chief Mate					Steering
2nd Mate					Nav Gear
Chief Engineer					Thrusters
Asst. Engineer	As Before	As Before	As Before		Horn
2nd Asst. Eng.					Radios
Steward					Radars
Asst. Steward					

FORM 1790 - PRINTING BY SEARS

HARBOR BRANCH OCEANOGRAPHIC INSTITUTION

M/V SEWARD JOHNSON

DECK LOG

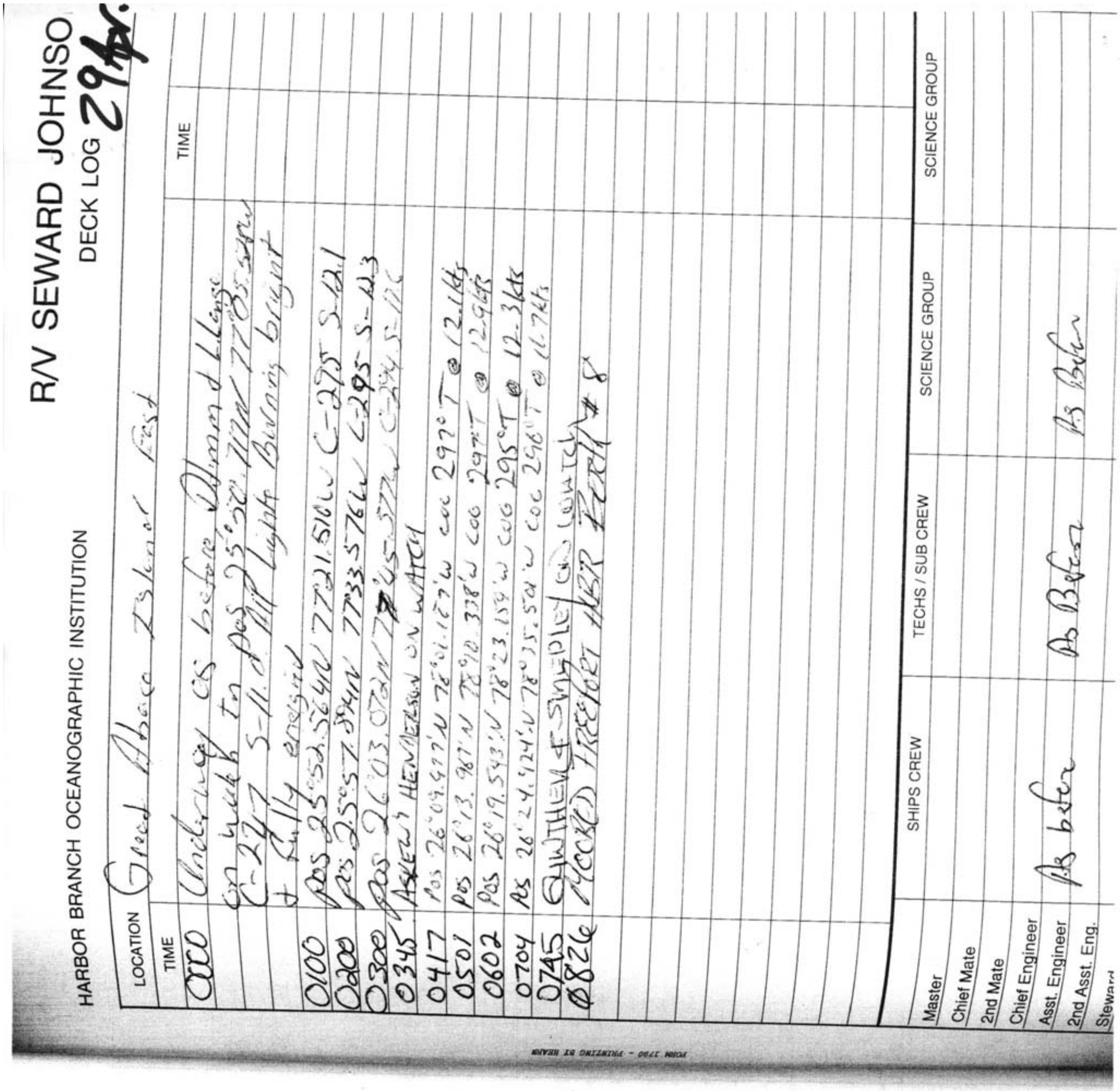
28th DAY OF April 2008

LOCATION ~ 60 NMS East of HAMILTON, BERMUDA

TIME		TIME	
0000	Underway as before, D/mm & L Longe on watch	1801	POS 26° 7.648'N 76°00.883'W COG 244°T @ 11
	In POS 26°32.897'N / 76°06.912'W C-97 S-9.2	1906	POS 26° 11.967'N 76°12.901'W COG 239°T @
	All Lights are burning Bright & fully Energized.	1945	GUNTHER & Smedley on watch
0100	POS 26°31.422'N 75°53.353'W C-98 S-9.8		POS 26°08.875'N 76°19.982'W COG 247°T @ 1
0200	POS 26°30.189'N 75°42.806'W C-95 S-10.0	2115	POS 26°02.542'N 76°36.143'W COG 250°T @ 1
0212	Arrive on Station, put transducer over side	2200	POS 25°59.4'N 076°43.6'W C-249°T @ 11
	POS 26°30.068'N 75°40.914'W "PIES 0"	2345	D/mm & L Longe on watch
0345	ASKEW & HENDERSON ON WATCH		
0522	RECOVER TRANSDUCER		
0600	POS 26°29.181'N 75°43.994'W COG 186°T @ 4.4 kts		
0700	POS 26°27.382'N 75°43.93'W COG 236°T @ 3.7 kts		
0743	BEGIN DEPLOYMENT "WB4" @ 26°26.940'N &		
	075°45.427'W. Course 122°T @ 1.6 kts.		
	Current 140°T @ 1.2 kts		
0745	CA-GUNTHER & M. SMEDLEY ON WATCH		
1125	DROPPED ANCHOR FOR "WB4" @ 26°24.922		
	@ 75°41.915'W.		
1145	D/mm & L Longe on watch		
1146	Launch CTD 26°23.591N 75°41.726W		
1449	Recover CTD		
1545	ASKEW & HENDERSON ON WATCH		
1546	DEPLOY "WB4" POS 26°24.248'N 75°42.605'W		
1623	U/W FREEPORT HARBOR		
1711	POS 26°22.079'N 75°51.102'W COG 244°T @ 11.3 kts		

	SHIPS CREW	TECHS / SUB CREW	SCIENCE GROUP	SCIENCE GROUP	PRESAILING CHECKS	WEATHER
Master					Drafts Fwd Aft	WINDS, East
Chief Mate					Steering	
2nd Mate					Nav Gear	
Chief Engineer					Thrusters	
Asst. Engineer	As Before	As Before	As Before		Horn	
2nd Asst. Eng.					Radios	
Steward					Radars	
Asst. Steward						

FORM 1740 - PRINTING BY HEARN



HARBOR BRANCH OCEANOGRAPHIC INSTITUTION

R/V SEWARD JOHNSO[N]

DECK LOG 29 Apr.

LOCATION Great Abaco Island East

TIME	
0000	Underway as before, Dummond Lange on watch to pos 25°50.717N 77°05.528W C-297 S-11.0 All Lights Burning bright + fully energized
0100	pos 25°52.564N 77°21.510W C-295 S-12.1
0200	pos 25°57.594N 77°33.576W C-295 S-12.3
0300	pos 26°03.072N 77°45.577W C-294 S-12.6
0345	ASKEW & HENDERSON ON WATCH
0417	Pos 26°09.477'N 78°01.127'W COG 297°T @ 12.1kts
0501	Pos 26°13.987'N 78°10.338'W COG 297°T @ 12.9kts
0602	Pos 26°19.543'N 78°23.159'W COG 295°T @ 12.3kts
0704	Pos 26°24.424'N 78°35.501'W COG 296°T @ 11.7kts
0745	GUWTHER & SHEPLEY ON WATCH
0826	MOORED FREEPORT HBR BERTH # 8

	SHIPS CREW	TECHS / SUB CREW	SCIENCE GROUP	SCIENCE GROUP
Master				
Chief Mate				
2nd Mate				
Chief Engineer				
Asst. Engineer	As before	As Before	As Before	
2nd Asst. Eng.				
Steward				

FORM 1790 - PRINTING BY BEAMS

Appendix B: Data recovered

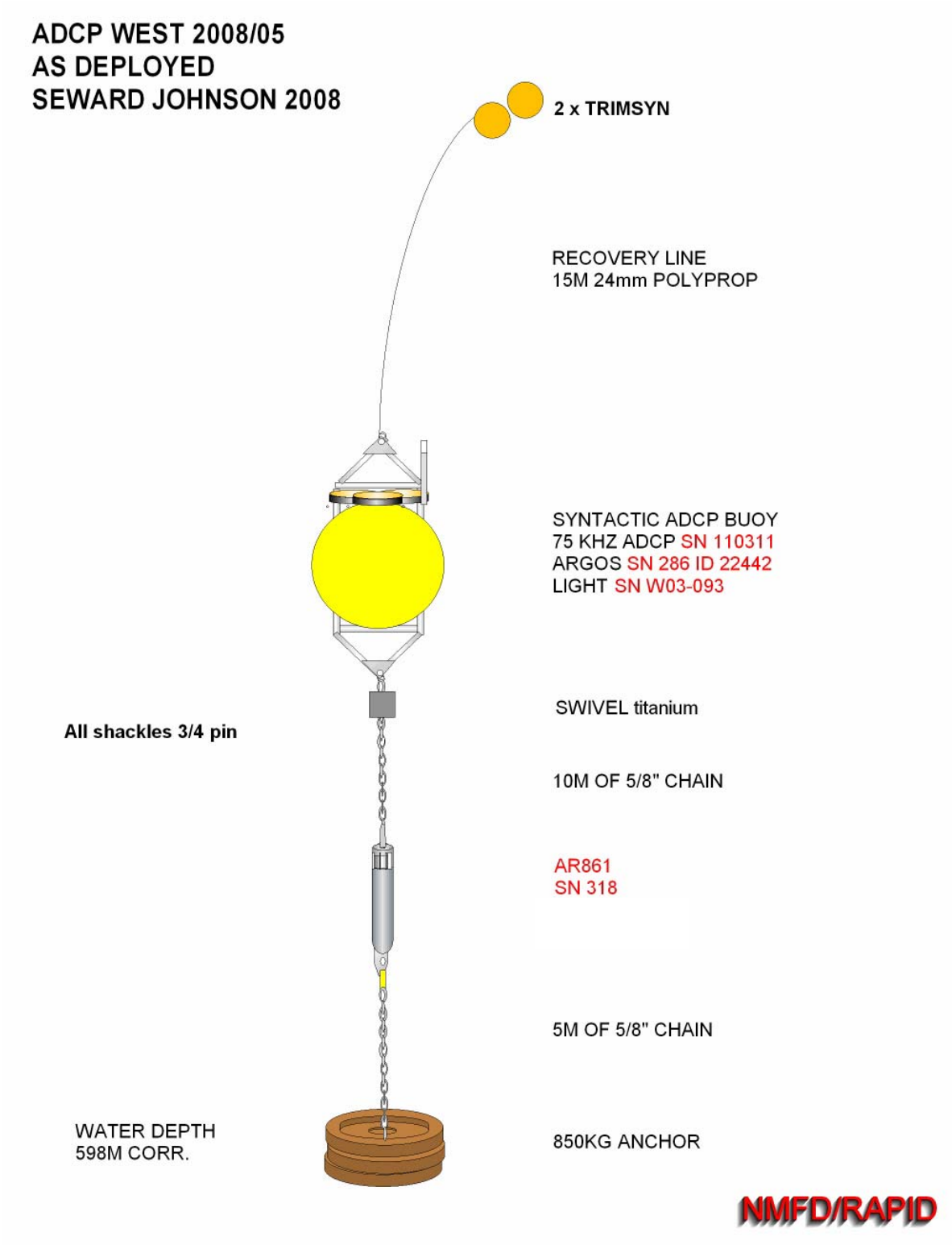
Instrument record lengths listed by mooring. Times in GMT taken from the first and last times in the .use files.

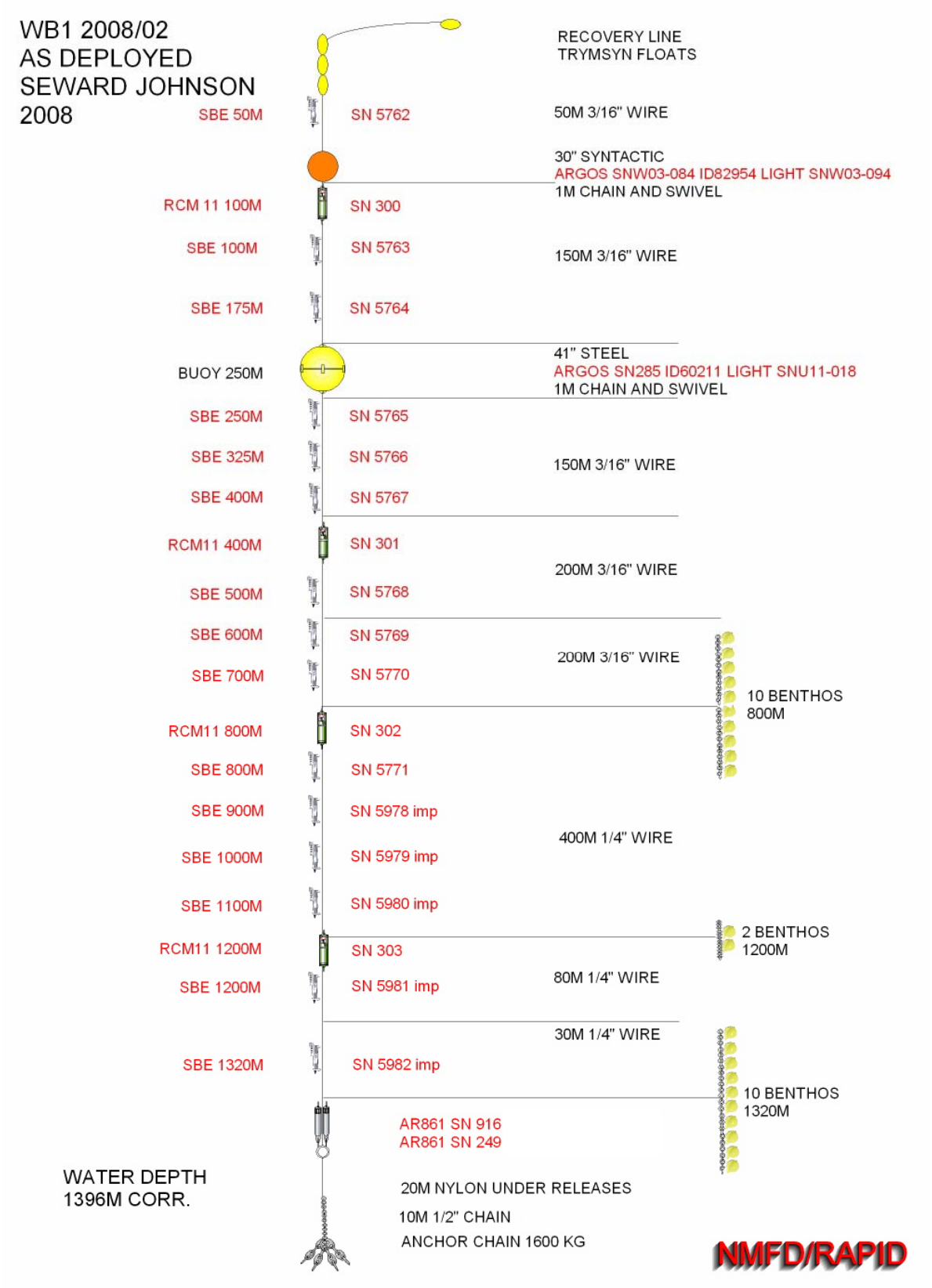
Mooring Name	Instrument	Serial Number	Approx Depth (m)	Date of first useable record	Date of last useable record	Note
WADCP	ADCP	5817	550-surface	26/3/07 @ 1630	23/4/08 @ 2200	first and last ensembles
WB1	SMP	3206	50	2007 03 28 24.0859	2008 04 23 22.3686	
	RCM	381	100	2007 03 28 22.51667	2008 04 23 13.88333	
	SMP	3219	100	2007 03 28 22.6618	2008 04 23 21.5726	
	SMP	3220	175	2007 03 28 21.5854	2008 04 23 19.3911	
	SMP	3221	250	2007 03 28 19.4249	2008 04 23 18.4229	
	SMP	3222	325	2007 03 28 18.5351	2008 04 23 18.0168	
	SMP	3223	400	2007 03 28 17.7611	2008 04 23 16.7245	
	RCM	383	400	2007 03 28 22.75000	2008 04 23 13.56667	
	IMP	3281	500	2007 03 28 15.6981	2008 04 23 14.2415	
	IMP	4797	600	2007 03 28 12.9008	2008 04 23 12.0733	
	IMP	4060	700	2007 03 28 9.9387	2008 04 23 9.2618	
	IMP	4062	800	2007 03 28 7.4195	2008 04 23 7.2809	
	RCM	395	800	2007 03 28 22.50000	2008 04 23 13.93333	
	IMP	4066	900	2007 03 28 6.5758	2008 04 23 6.1719	
	IMP	4068	1000	2007 03 28 5.3213	2008 04 23 5.4841	
	IMP	4070	1100	2007 03 28 4.6418	2008 04 23 5.1689	
	RCM	399	1200	2007 03 28 22.50000	2008 04 23 13.85000	
	IMP	4071	1200	2007 03 28 4.3224	2008 04 23 4.7353	
	IMP	4072	1380	2007 03 28 4.2195	2008 04 23 4.4767	
WB2	SMP	5238	50	2007 03 29 22.6638	2008 04 24 21.0092	
	RCM	426	100	2007 03 29 20.50000	2008 04 24 12.35000	
	SMP	5239	100	2007 03 29 22.1767	2008 04 24 19.7119	
	RCM	428	175	2007 03 29 20.50000	2008 04 24 12.38333	
	SMP	5240	175	2007 03 29 19.3965	2008 04 24 18.3390	
	SMP	5241	325	2007 03 29 17.8168	2008 04 24 16.0765	
	RCM	438	400	n/a	n/a	Flooded
	SMP	5242	500	2007 03 29 14.4783	2008 04 24 12.0063	
	SMP	5243	700	2007 03 29 9.0551	2008 04 24 8.0897	
	RCM	443	800	2007 03 29 20.81667	2008 04 24 12.18333	
	SMP	5244	900	2007 03 29 5.8061	2008 04 24 5.5891	
	SMP	5245	1100	2007 03 29 4.6277	2008 04 24 4.5568	
	RCM	444	1200	2007 03 29 20.88333	2008 04 24 12.33333	
	SMP	5246	1300	2007 03 29 4.0973	2008 04 24 4.0359	
	SMP	5247	1500	2007 03 29 3.9023	2008 04 24 3.7548	
	IMP	4184	1700	2007 03 29 3.7964	2008 04 24 3.7375	
	IMP	4473	1900	2007 03 29 3.6119	2008 04 24 3.5859	
	RCM	507	2050	2007 03 29 20.88333	2008 04 24 12.21667	
	IMP	4724	2300	2007 03 29 3.2788	2008 04 24 3.4269	
	IMP	4725	2800	2007 03 29 2.7056	2008 04 24 2.9564	
	IMP	4795	3300	2007 03 29 2.3040	2008 04 24 2.5918	

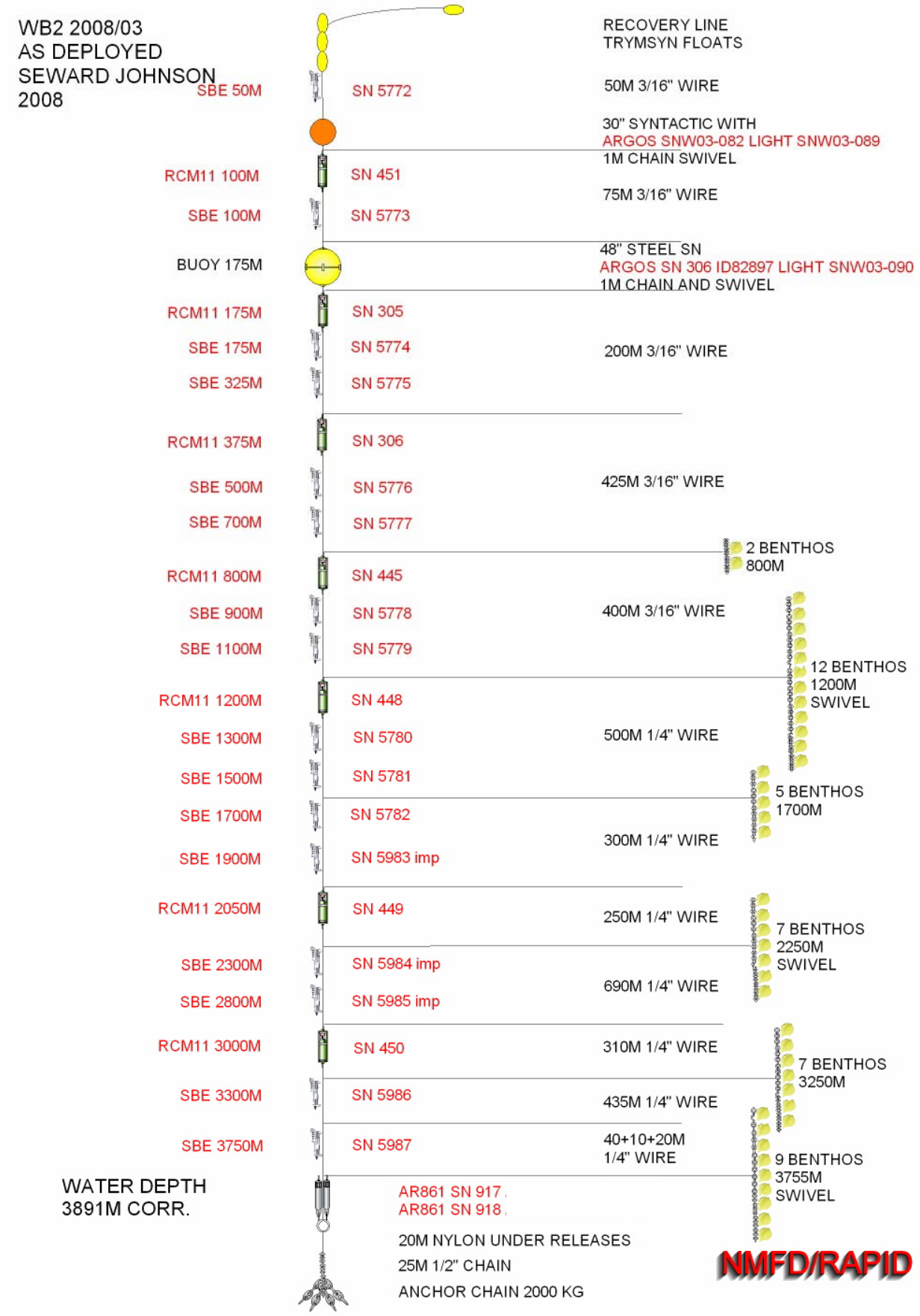
	IMP	4796	3850	2007 03 29 2.2553	2008 04 24 2.3217	
WB4	SMP	3226	50	n/a	n/a	Lost
	RCM	510	100	n/a	n/a	Lost
	SMP	3227	100	n/a	n/a	Lost
	SMP	3228	250	2007 03 31 3.00000	2008 04 31 12.50028	
	RCM	515	400	2007 03 31 3.28330	2008 04 27 12.88333	
	SMP	3229	400	2007 03 31 15.2306	2008 04 27 3.0128	
	SMP	3230	600	2007 03 31 11.1513	2008 04 27 3.0176	
	RCM	516	800	2007 03 31 3.16667	2008 04 27 13.00000	
	SMP	3231	800	2007 03 31 7.6469	2008 04 27 3.0457	
	SMP	3232	1000	2007 03 31 6.0042	2008 04 27 3.2183	
	RCM	518	1200	2007 03 31 3.3333	2008 04 27 12.8000	**
	SMP	3233	1200	2007 03 31 5.0858	2008 04 27 3.4307	
	SMP	3244	1600	2007 03 31 3.5609	2008 04 27 3.3601	
	RCM	519	2000	2007 03 31 3.05000	2008 04 27 12.73333	
	SMP	3487	2000	n/a	n/a	Flooded
	SMP	3905	2500	2007 03 31 2.7858	2008 04 27 2.6053	
	RCM	520	3000	2007 03 31 3.26667	2008 04 27 12.73333	
	SMP	3906	3000	2007 03 31 2.4828	2008 04 27 2.3676	
	SMP	3907	3500	2007 03 31 2.3094	2008 04 27 2.2742	
	RCM	304	4000	2007 03 31 3.06667	2008 04 27 12.96667	
	SMP	3908	4000	2007 03 31 2.2503	2008 04 27 2.2440	
	SMP	3258	4500	2007 03 31 2.2054	2008 04 27 2.1826	
WBL3	SBE26	395	3900	2006 03 25 2.01667	2008 04 24 10.01667	
	SBE26	396		2006 03 25 2.03333	2008 04 24 10.03333	
WBL4	SBE53	004	4810	2006 03 23 16.0833	2008 04 27 9.5833	

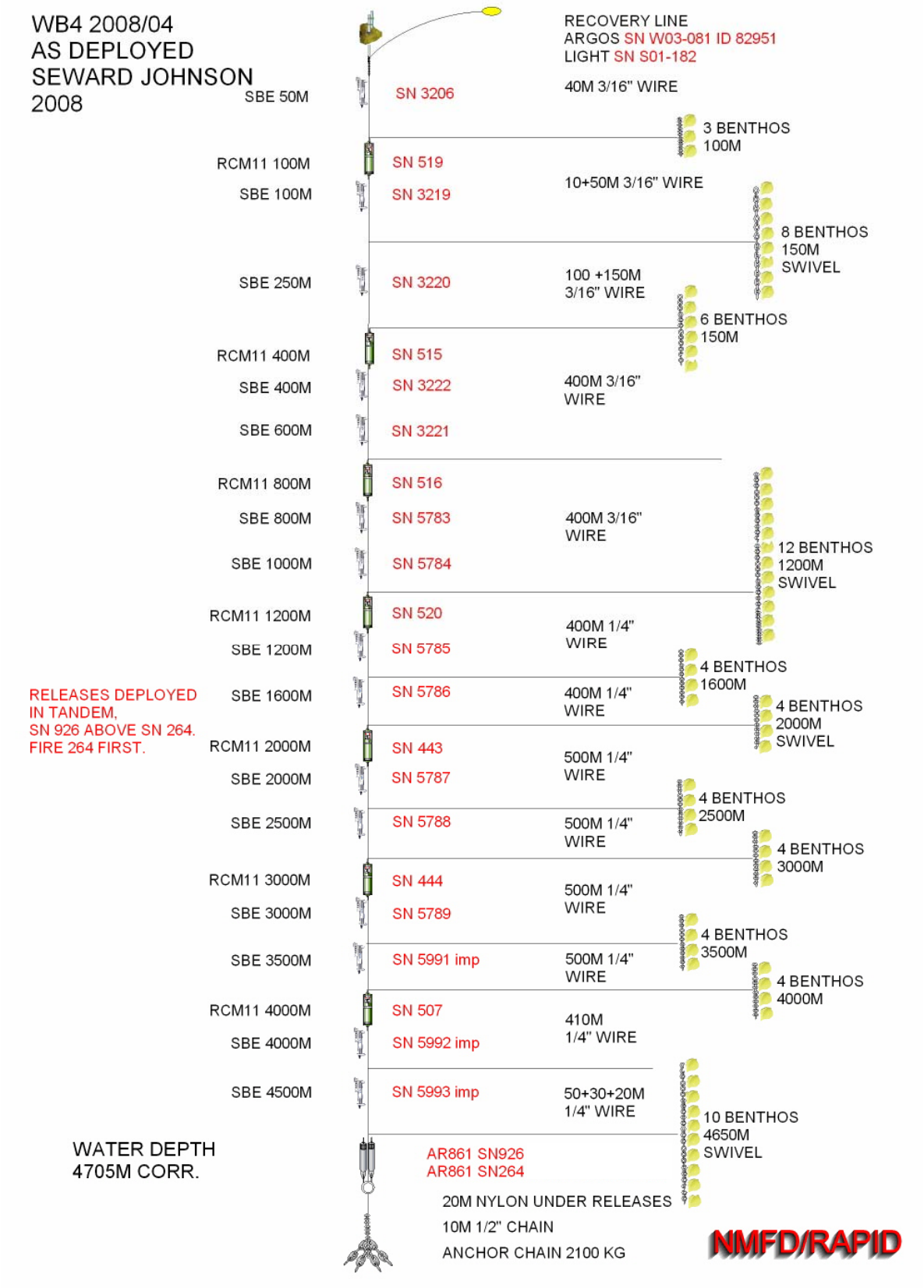
** Bad pressure and conductivity record

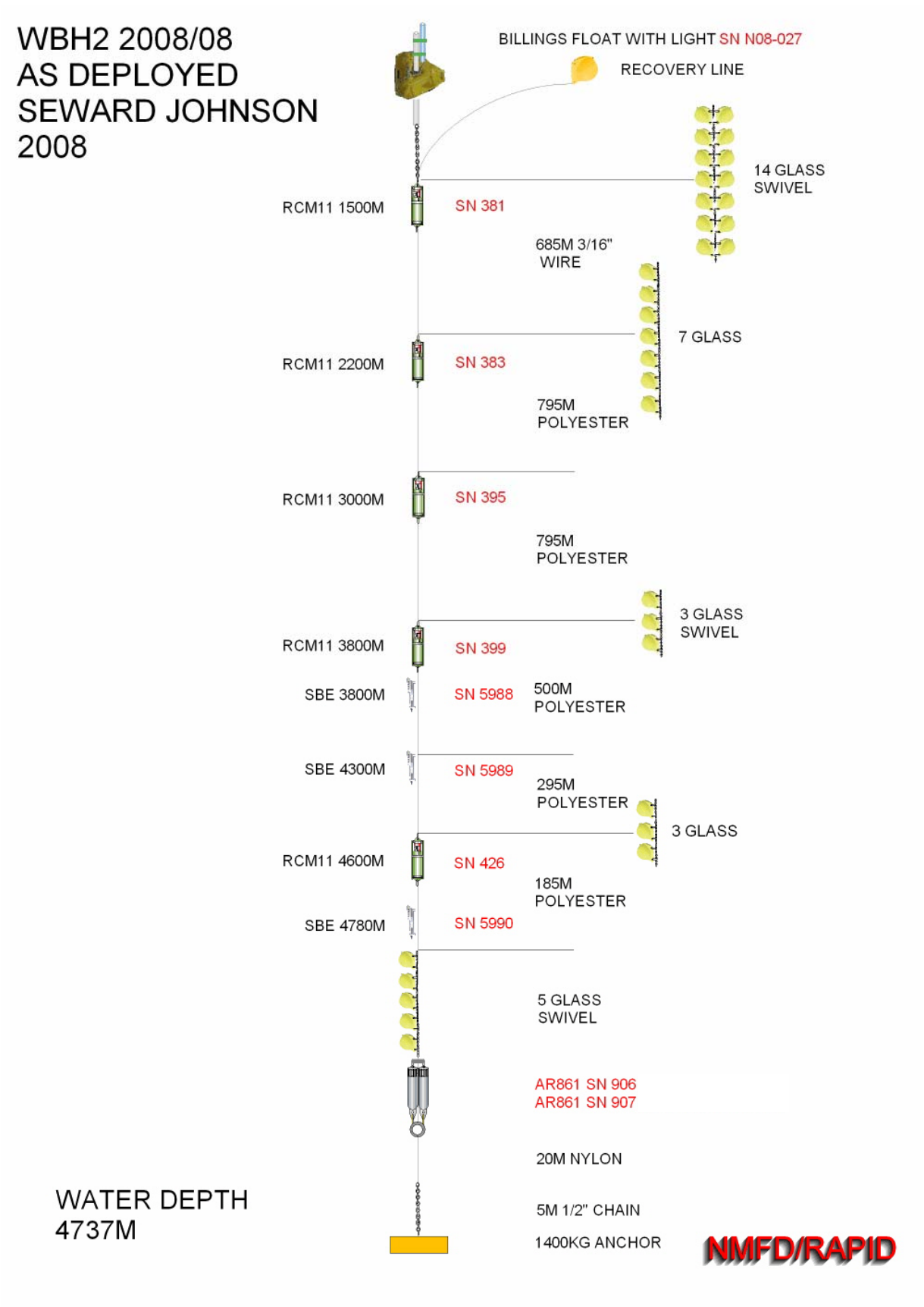
Appendix C: Mooring Drawings



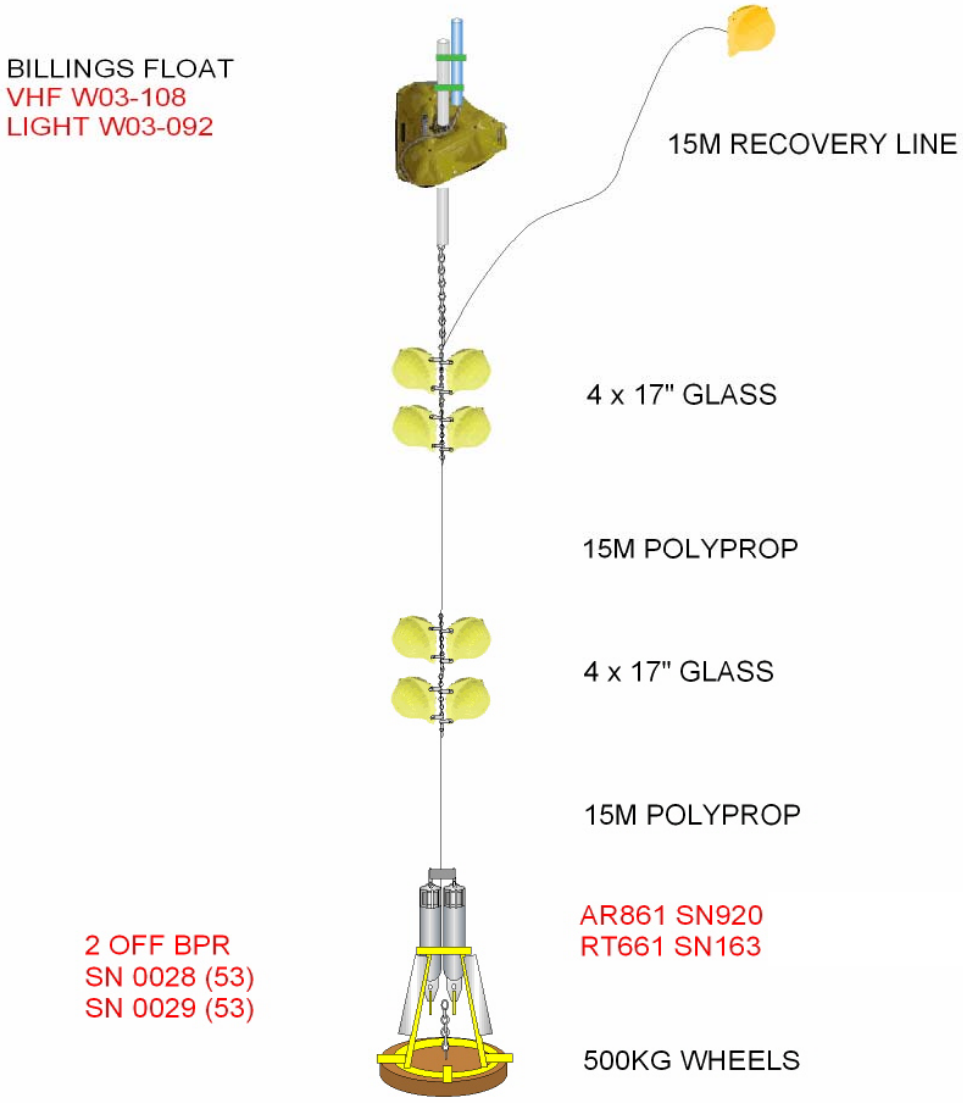

WB1 2008/02
AS DEPLOYED
SEWARD JOHNSON
2008
SBE 50M
SN 5762
RECOVERY LINE
TRYMSYN FLOATS
50M 3/16" WIRE
30" SYNTACTIC
ARGOS SNW03-084 ID82954 LIGHT SNW03-094
1M CHAIN AND SWIVEL
RCM 11 100M
SN 300
SBE 100M
SN 5763
150M 3/16" WIRE
SBE 175M
SN 5764
41" STEEL
BUOY 250M
ARGOS SN285 ID60211 LIGHT SNU11-018
1M CHAIN AND SWIVEL
SBE 250M
SN 5765
SBE 325M
SN 5766
150M 3/16" WIRE
SBE 400M
SN 5767
RCM11 400M
SN 301
200M 3/16" WIRE
SBE 500M
SN 5768
SBE 600M
SN 5769
200M 3/16" WIRE
SBE 700M
SN 5770
10 BENTHOS
800M
RCM11 800M
SN 302
SBE 800M
SN 5771
SBE 900M
SN 5978 imp
400M 1/4" WIRE
SBE 1000M
SN 5979 imp
SBE 1100M
SN 5980 imp
2 BENTHOS
1200M
RCM11 1200M
SN 303
SBE 1200M
SN 5981 imp
80M 1/4" WIRE
30M 1/4" WIRE
SBE 1320M
SN 5982 imp
10 BENTHOS
1320M
AR861 SN 916
AR861 SN 249
WATER DEPTH
1396M CORR.
20M NYLON UNDER RELEASES
10M 1/2" CHAIN
ANCHOR CHAIN 1600 KG
NMFD/RAPID


WB2 2008/03
AS DEPLOYED
SEWARD JOHNSON
2008
SBE 50M
SN 5772
RECOVERY LINE
TRYMSYN FLOATS
50M 3/16" WIRE
30" SYNTACTIC WITH
ARGOS SNW03-082 LIGHT SNW03-089
1M CHAIN SWIVEL
RCM11 100M
SN 451
75M 3/16" WIRE
SBE 100M
SN 5773
BUOY 175M
48" STEEL SN
ARGOS SN 306 ID82897 LIGHT SNW03-090
1M CHAIN AND SWIVEL
RCM11 175M
SN 305
SBE 175M
SN 5774
200M 3/16" WIRE
SBE 325M
SN 5775
RCM11 375M
SN 306
SBE 500M
SN 5776
425M 3/16" WIRE
SBE 700M
SN 5777
2 BENTHOS
800M
RCM11 800M
SN 445
SBE 900M
SN 5778
400M 3/16" WIRE
SBE 1100M
SN 5779
12 BENTHOS
1200M
SWIVEL
RCM11 1200M
SN 448
SBE 1300M
SN 5780
500M 1/4" WIRE
SBE 1500M
SN 5781
5 BENTHOS
1700M
SBE 1700M
SN 5782
300M 1/4" WIRE
SBE 1900M
SN 5983 imp
RCM11 2050M
SN 449
250M 1/4" WIRE
7 BENTHOS
2250M
SWIVEL
SBE 2300M
SN 5984 imp
690M 1/4" WIRE
SBE 2800M
SN 5985 imp
RCM11 3000M
SN 450
310M 1/4" WIRE
7 BENTHOS
3250M
SBE 3300M
SN 5986
435M 1/4" WIRE
SBE 3750M
SN 5987
40+10+20M
1/4" WIRE
9 BENTHOS
3755M
SWIVEL
WATER DEPTH
3891M CORR.
AR861 SN 917
AR861 SN 918
20M NYLON UNDER RELEASES
25M 1/2" CHAIN
ANCHOR CHAIN 2000 KG
NMFD/RAPID


WB4 2008/04
AS DEPLOYED
SEWARD JOHNSON
2008
RECOVERY LINE
ARGOS SN W03-081 ID 82951
LIGHT SN S01-182
SBE 50M
SN 3206
40M 3/16" WIRE
3 BENTHOS
100M
RCM11 100M
SN 519
SBE 100M
SN 3219
10+50M 3/16" WIRE
8 BENTHOS
150M
SWIVEL
SBE 250M
SN 3220
100 +150M
3/16" WIRE
6 BENTHOS
150M
RCM11 400M
SN 515
SBE 400M
SN 3222
400M 3/16"
WIRE
SBE 600M
SN 3221
RCM11 800M
SN 516
SBE 800M
SN 5783
400M 3/16"
WIRE
SBE 1000M
SN 5784
12 BENTHOS
1200M
SWIVEL
RCM11 1200M
SN 520
SBE 1200M
SN 5785
400M 1/4"
WIRE
4 BENTHOS
1600M
RELEASES DEPLOYED
IN TANDEM,
SN 926 ABOVE SN 264.
FIRE 264 FIRST.
SBE 1600M
SN 5786
400M 1/4"
WIRE
4 BENTHOS
2000M
SWIVEL
RCM11 2000M
SN 443
SBE 2000M
SN 5787
500M 1/4"
WIRE
4 BENTHOS
2500M
SBE 2500M
SN 5788
500M 1/4"
WIRE
4 BENTHOS
3000M
RCM11 3000M
SN 444
SBE 3000M
SN 5789
500M 1/4"
WIRE
4 BENTHOS
3500M
SBE 3500M
SN 5991 imp
500M 1/4"
WIRE
4 BENTHOS
4000M
RCM11 4000M
SN 507
SBE 4000M
SN 5992 imp
410M
1/4" WIRE
SBE 4500M
SN 5993 imp
50+30+20M
1/4" WIRE
10 BENTHOS
4650M
SWIVEL
WATER DEPTH
4705M CORR.
AR861 SN926
AR861 SN264
20M NYLON UNDER RELEASES
10M 1/2" CHAIN
ANCHOR CHAIN 2100 KG
NMFD/RAPID


WBH2 2008/08
AS DEPLOYED
SEWARD JOHNSON
2008
BILLINGS FLOAT WITH LIGHT SN N08-027
RECOVERY LINE
14 GLASS
SWIVEL
RCM11 1500M
SN 381
685M 3/16"
WIRE
7 GLASS
RCM11 2200M
SN 383
795M
POLYESTER
RCM11 3000M
SN 395
795M
POLYESTER
3 GLASS
SWIVEL
RCM11 3800M
SN 399
SBE 3800M
SN 5988
500M
POLYESTER
SBE 4300M
SN 5989
295M
POLYESTER
3 GLASS
RCM11 4600M
SN 426
185M
POLYESTER
SBE 4780M
SN 5990
5 GLASS
SWIVEL
AR861 SN 906
AR861 SN 907
20M NYLON
5M 1/2" CHAIN
1400KG ANCHOR
WATER DEPTH
4737M
NMFD/RAPID

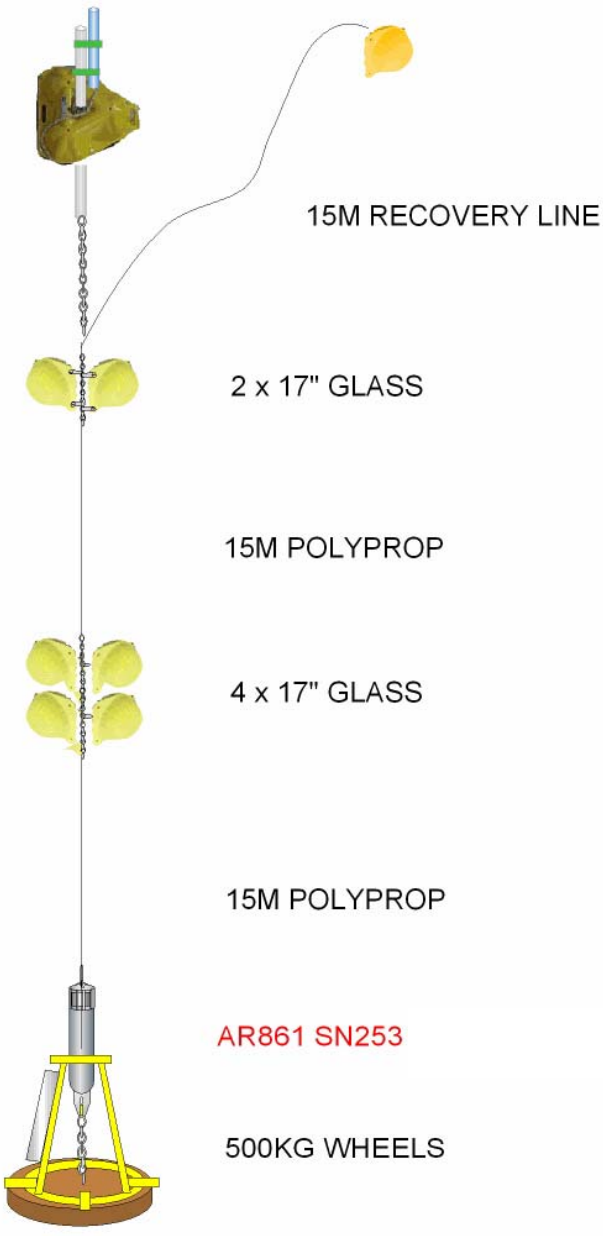
WBL3 2008/06
AS DEPLOYED
SEWARD JOHNSON
2008



WATER DEPTH
3887M

NMFD/RAPID

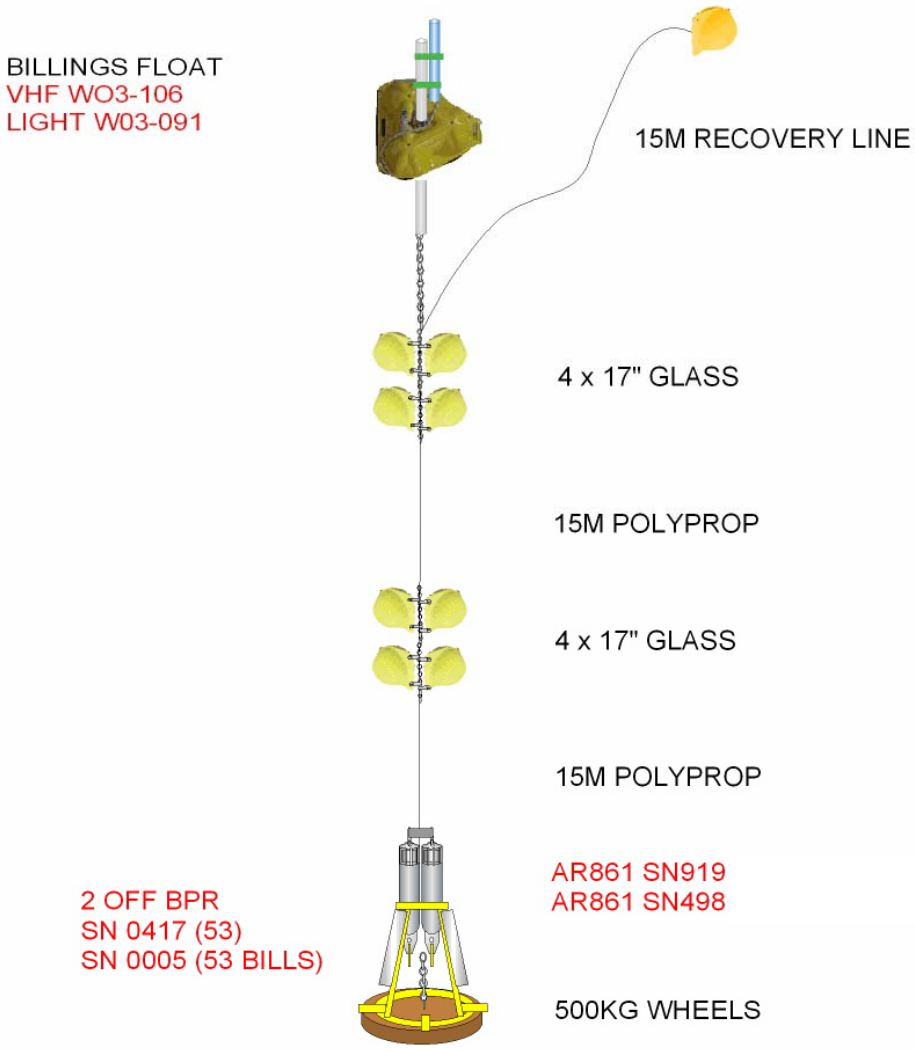
WBL4 2008/07
AS DEPLOYED
SEWARD JOHNSON
2008



WATER DEPTH
4705M

NMFD/RAPID

WBLB 2008/09
AS DEPLOYED
SEWARD JOHNSON
2008



WATER DEPTH
4857M

NMFD/RAPID

Appendix D: Instrument Setup Details

WBADCP

RD Instruments 75kHz Workhorse Longranger ADCP – Serial Number **10311**
- System frequency 76.8kHz
- Beam angle 20 degrees
- Water salinity 36ppt
- Depth of transducer 600m
- Heading alignment 0
- Heading bias 0
- Depth cell size 16.00m
- Number of depth cells 40
- Blank after transmit 7.04m
- Pings per ensemble 10
- Ambiguity velocity 175cm/s
- Time between ping groups 3 mins
- Time per ensemble 00:30:00
- Start date 23/04/08
- Start time 20:00:00
- Deployment name depl1

WB1

SBE37 MicroCAT SMP CTD unit, serial number **5762**
- Sample interval: 1800 seconds
- Start date: 23 04 2008 (DDMMYYYY)
- Start time: 16 00 00 (HHMMSS GMT)

Aanderaa RCM11 – serial number **300**
- Pings per ensemble 600
- Temperature range High
- Conductivity range 48-57
- Recording interval 30
- No of channels 8
- Mode Burst
- DSU serial number 13860
- Instrument started 23/04/08 14:00:00

SBE37 MicroCAT SMP CTD unit, serial number **5763**
- Sample interval: 1800 seconds
- Start date: 23 04 2008 (DDMMYYYY)
- Start time: 16 00 00 (HHMMSS GMT)

SBE37 MicroCAT SMP CTD unit, serial number **5764**
- Sample interval: 1800 seconds
- Start date: 25 04 2008 (DDMMYYYY)
- Start time: 14 00 00 (HHMMSS GMT)

SBE37 MicroCAT SMP CTD unit, serial number **5765**
Sample interval: 1800 seconds
Start date: 23 04 2008 (DDMMYYYY)
Start time: 16 00 00 (HHMMSS GMT)

SBE37 MicroCAT SMP CTD unit, serial number **5766**
Sample interval: 1800 seconds
Start date: 23 04 2008 (DDMMYYYY)
Start time: 16 00 00 (HHMMSS GMT)

SBE37 MicroCAT SMP CTD unit, serial number **5767**
Sample interval: 1800 seconds
Start date: 23 04 2008 (DDMMYYYY)
Start time: 16 00 00 (HHMMSS GMT)

Aanderaa RCM11 – serial number **301**
Pings per ensemble 600
Temperature range High
Conductivity range 44-51
Recording interval 30
No of channels 8
Mode Burst
DSU serial number 13883
Instrument started 23/04/08 14:00:00

SBE37 MicroCAT SMP CTD unit, serial number **5768**
Sample interval: 1800 seconds
Start date: 23 04 2008 (DDMMYYYY)
Start time: 16 00 00 (HHMMSS GMT)

SBE37 MicroCAT SMP CTD unit, serial number **5769**
Sample interval: 1800 seconds
Start date: 23 04 2008 (DDMMYYYY)
Start time: 16 00 00 (HHMMSS GMT)

SBE37 MicroCAT SMP CTD unit, serial number **5770**
Sample interval: 1800 seconds
Start date: 23 04 2008 (DDMMYYYY)
Start time: 16 00 00 (HHMMSS GMT)

Aanderaa RCM11 – serial number **302**
Pings per ensemble 600
Temperature range High
Conductivity range 34-41
Recording interval 30
No of channels 8
Mode Burst
DSU serial number 13884
Instrument started 23/04/08 14:00:00

SBE37 MicroCAT SMP CTD unit, serial number **5771**
Sample interval: 1800 seconds
Start date: 23 04 2008 (DDMMYYYY)
Start time: 16 00 00 (HHMMSS GMT)

SBE37 MicroCAT IMP CTD unit, serial number **5978**
Sample interval: 1800 seconds
Start date: 23 04 2008 (DDMMYYYY)
Start time: 16 00 00 (HHMMSS GMT)

SBE37 MicroCAT IMP CTD unit, serial number **5979**
Sample interval: 1800 seconds
Start date: 23 04 2008 (DDMMYYYY)
Start time: 16 00 00 (HHMMSS GMT)

SBE37 MicroCAT IMP CTD unit, serial number **5980**
Sample interval: 1800 seconds
Start date: 23 04 2008 (DDMMYYYY)
Start time: 16 00 00 (HHMMSS GMT)

Aanderaa RCM11 – serial number **303**
Pings per ensemble 600
Temperature range High
Conductivity range 32-35
Recording interval 30
No of channels 8
Mode Burst
DSU serial number 13885
Instrument started 23/04/08 14:00:00

SBE37 MicroCAT IMP CTD unit, serial number **5981**
Sample interval: 1800 seconds
Start date: 23 04 2008 (DDMMYYYY)
Start time: 16 00 00 (HHMMSS GMT)

SBE37 MicroCAT IMP CTD unit, serial number **5982**
Sample interval: 1800 seconds
Start date: 23 04 2008 (DDMMYYYY)
Start time: 16 00 00 (HHMMSS GMT)

WB2

SBE37 MicroCAT SMP CTD unit, serial number **5772**
Sample interval: 1800 seconds
Start date: 26 04 2008 (DDMMYYYY)
Start time: 13 00 00 (HHMMSS GMT)

Aanderaa RCM11 – serial number **451**
Pings per ensemble 600
Temperature range High
Conductivity range 47-58
Recording interval 30
No of channels 8
Mode Burst
DSU serial number 14570
Instrument started 26/04/08 13:00:00

SBE37 MicroCAT SMP CTD unit, serial number **5773**
Sample interval: 1800 seconds
Start date: 26 04 2008 (DDMMYYYY)
Start time: 13 00 00 (HHMMSS GMT)

Aanderaa RCM11 – serial number **305**
Pings per ensemble 600
Temperature range High
Conductivity range Not noted
Recording interval 30
No of channels 8
Mode Burst
DSU serial number 13887
Instrument started 26/04/08 13:00:00

SBE37 MicroCAT SMP CTD unit, serial number **5774**
Sample interval: 1800 seconds
Start date: 26 04 2008 (DDMMYYYY)
Start time: 13 00 00 (HHMMSS GMT)

SBE37 MicroCAT SMP CTD unit, serial number **5775**
Sample interval: 1800 seconds
Start date: 26 04 2008 (DDMMYYYY)
Start time: 13 00 00 (HHMMSS GMT)

Aanderaa RCM11 – serial number **306**
Pings per ensemble 600
Temperature range High
Conductivity range 41-50
Recording interval 30
No of channels 8
Mode Burst
DSU serial number 14573
Instrument started 26/04/08 13:00:00

SBE37 MicroCAT SMP CTD unit, serial number **5776**
Sample interval: 1800 seconds
Start date: 26 04 2008 (DDMMYYYY)
Start time: 13 00 00 (HHMMSS GMT)

SBE37 MicroCAT SMP CTD unit, serial number **5777**
Sample interval: 1800 seconds
Start date: 26 04 2008 (DDMMYYYY)
Start time: 13 00 00 (HHMMSS GMT)

Aanderaa RCM11 – serial number **445**
Pings per ensemble 600
Temperature range Low
Conductivity range 33-41
Recording interval 30
No of channels 8
Mode Burst
DSU serial number 14572
Instrument started 26/04/08 13:00:00

SBE37 MicroCAT SMP CTD unit, serial number **5778**
Sample interval: 1800 seconds
Start date: 26 04 2008 (DDMMYYYY)
Start time: 13 00 00 (HHMMSS GMT)

SBE37 MicroCAT SMP CTD unit, serial number **5779**
Sample interval: 1800 seconds
Start date: 26 04 2008 (DDMMYYYY)
Start time: 13 00 00 (HHMMSS GMT)

Aanderaa RCM11 – serial number **448**
Pings per ensemble 600
Temperature range Low
Conductivity range 32-36
Recording interval 30
No of channels 8
Mode Burst
DSU serial number 14571
Instrument started 26/04/08 13:30:00

SBE37 MicroCAT SMP CTD unit, serial number **5780**
Sample interval: 1800 seconds
Start date: 26 04 2008 (DDMMYYYY)
Start time: 13 00 00 (HHMMSS GMT)

SBE37 MicroCAT SMP CTD unit, serial number **5781**
Sample interval: 1800 seconds
Start date: 26 04 2008 (DDMMYYYY)
Start time: 13 00 00 (HHMMSS GMT)

SBE37 MicroCAT SMP CTD unit, serial number **5782**
Sample interval: 1800 seconds

Start date: 26 04 2008 (DDMMYYYY)
Start time: 13 00 00 (HHMMSS GMT)

SBE37 MicroCAT IMP CTD unit, serial number **5983**
Sample interval: 1800 seconds
Start date: 26 04 2008 (DDMMYYYY)
Start time: 14 00 00 (HHMMSS GMT)

Aanderaa RCM11 – serial number **449**
Pings per ensemble 600
Temperature range Arctic
Conductivity range 32-34
Recording interval 30
No of channels 8
Mode Burst
DSU serial number 14568
Instrument started 26/04/08 13:30:00

SBE37 MicroCAT IMP CTD unit, serial number **5984**
Sample interval: 1800 seconds
Start date: 26 04 2008 (DDMMYYYY)
Start time: 14 00 00 (HHMMSS GMT)

SBE37 MicroCAT IMP CTD unit, serial number **5985**
Sample interval: 1800 seconds
Start date: 26 04 2008 (DDMMYYYY)
Start time: 14 00 00 (HHMMSS GMT)

Aanderaa RCM11 – serial number **450**
Pings per ensemble 600
Temperature range Arctic
Conductivity range 32-34
Recording interval 30
No of channels 8
Mode Burst
DSU serial number 14722
Instrument started 26/04/08 13:30:00

SBE37 MicroCAT IMP CTD unit, serial number **5986**
Sample interval: 1800 seconds
Start date: 26 04 2008 (DDMMYYYY)
Start time: 14 00 00 (HHMMSS GMT)

SBE37 MicroCAT IMP CTD unit, serial number **5987**
Sample interval: 1800 seconds
Start date: 26 04 2008 (DDMMYYYY)
Start time: 14 00 00 (HHMMSS GMT)

WBL3

Seabird SBE53 BPR – serial number **0028**
Header WBL3_SJ_08
Tide sample interval 15 minutes
Tide measurement duration 15 minutes
Frequency of reference measurement
(every N tide samples) 96
Start date 24/04/08
Start time 17:00:00

Seabird SBE53 BPR – serial number **0029**
Header WBL3_SJ_08
Tide sample interval 15 minutes
Tide measurement duration 15 minutes
Frequency of reference measurement
(every N tide samples) 96
Start date 24/04/08
Start time 17:00:00

WBH2

Aanderaa RCM11 – serial number **381**
Pings per ensemble 600
Temperature range Low
Conductivity range – (broken sensor)
Recording interval 30
No of channels 8
Mode Burst
DSU serial number not recorded
Instrument started 26/04/08 20:00:00

Aanderaa RCM11 – serial number **383**
Pings per ensemble 600
Temperature range Arctic
Conductivity range 32-34
Recording interval 30
No of channels 8
Mode Burst
DSU serial number not recorded
Instrument started 26/04/08 20:00:00

Aanderaa RCM11 – serial number **395**
Pings per ensemble 600
Temperature range Arctic
Conductivity range 32-34
Recording interval 30
No of channels 8
Mode Burst

DSU serial number not recorded
Instrument started 26/04/08 20:00:00

Aanderaa RCM11 – serial number **399**
Pings per ensemble 600
Temperature range Arctic
Conductivity range 32-34
Recording interval 30
No of channels 8
Mode Burst
DSU serial number not recorded
Instrument started 26/04/08 20:00:00

SBE37 MicroCAT IMP CTD unit, serial number **5988**
Sample interval: 1800 seconds
Start date: 26 04 2008 (DDMMYYYY)
Start time: 20 30 00 (HHMMSS GMT)

SBE37 MicroCAT IMP CTD unit, serial number **5989**
Sample interval: 1800 seconds
Start date: 26 04 2008 (DDMMYYYY)
Start time: 20 30 00 (HHMMSS GMT)

Aanderaa RCM11 – serial number **426**
Pings per ensemble 600
Temperature range Arctic
Conductivity range – (broken sensor)
Recording interval 30
No of channels 8
Mode Burst
DSU serial number not recorded
Instrument started 26/04/08 20:00:00

SBE37 MicroCAT IMP CTD unit, serial number **5990**
Sample interval: 1800 seconds
Start date: 26 04 2008 (DDMMYYYY)
Start time: 20 30 00 (HHMMSS GMT)

WB4

SBE37 MicroCAT SMP CTD unit, serial number **3206**
Sample interval: 1800 seconds
Start date: 28 04 2008 (DDMMYYYY)
Start time: 11 00 00 (HHMMSS GMT)

Aanderaa RCM11 – serial number **519**
Pings per ensemble 600
Temperature range High
Conductivity range 47-58

Recording interval 30
No of channels 8
Mode Burst
DSU serial number not recorded
Instrument started 28/04/08 11:00:00

SBE37 MicroCAT SMP CTD unit, serial number **3219**
Sample interval: 1800 seconds
Start date: 28 04 2008 (DDMMYYYY)
Start time: 11 00 00 (HHMMSS GMT)

SBE37 MicroCAT SMP CTD unit, serial number **3220**
Sample interval: 1800 seconds
Start date: 28 04 2008 (DDMMYYYY)
Start time: 11 00 00 (HHMMSS GMT)

Aanderaa RCM11 – serial number **515**
Pings per ensemble 600
Temperature range High
Conductivity range 43-54
Recording interval 30
No of channels 8
Mode Burst
DSU serial number 14698
Instrument started 28/04/08 11:00:00

SBE37 MicroCAT SMP CTD unit, serial number **3222**
Sample interval: 1800 seconds
Start date: 28 04 2008 (DDMMYYYY)
Start time: 11 00 00 (HHMMSS GMT)

SBE37 MicroCAT SMP CTD unit, serial number **3221**
Sample interval: 1800 seconds
Start date: 28 04 2008 (DDMMYYYY)
Start time: 11 00 00 (HHMMSS GMT)

Aanderaa RCM11 – serial number **516**
Pings per ensemble 600
Temperature range Low
Conductivity range - Not used
Recording interval 30
No of channels 8
Mode Burst
DSU serial number 14699
Instrument started 28/04/08 11:00:00

SBE37 MicroCAT SMP CTD unit, serial number **5783**
Sample interval: 1800 seconds
Start date: 28 04 2008 (DDMMYYYY)
Start time: 11 00 00 (HHMMSS GMT)

SBE37 MicroCAT SMP CTD unit, serial number **5784**
Sample interval: 1800 seconds
Start date: 28 04 2008 (DDMMYYYY)
Start time: 11 00 00 (HHMMSS GMT)

Aanderaa RCM11 – serial number **520**
Pings per ensemble 600
Temperature range Low
Conductivity range 32-36
Recording interval 30
No of channels 8
Mode Burst
DSU serial number 14730
Instrument started 28/04/08 11:00:00

SBE37 MicroCAT SMP CTD unit, serial number **5785**
Sample interval: 1800 seconds
Start date: 28 04 2008 (DDMMYYYY)
Start time: 11 00 00 (HHMMSS GMT)

SBE37 MicroCAT SMP CTD unit, serial number **5786**
Sample interval: 1800 seconds
Start date: 28 04 2008 (DDMMYYYY)
Start time: 11 00 00 (HHMMSS GMT)

Aanderaa RCM11 – serial number **443**
Pings per ensemble 600
Temperature range Arctic
Conductivity range 32-34
Recording interval 30
No of channels 8
Mode Burst
DSU serial number 13430
Instrument started 28/04/08 11:00:00

SBE37 MicroCAT SMP CTD unit, serial number **5787**
Sample interval: 1800 seconds
Start date: 28 04 2008 (DDMMYYYY)
Start time: 11 00 00 (HHMMSS GMT)

SBE37 MicroCAT SMP CTD unit, serial number **5788**
Sample interval: 1800 seconds
Start date: 28 04 2008 (DDMMYYYY)
Start time: 11 00 00 (HHMMSS GMT)

Aanderaa RCM11 – serial number **444**
Pings per ensemble 600

Temperature range Arctic
Conductivity range 32-34
Recording interval 30
No of channels 8
Mode Burst
DSU serial number 14723
Instrument started 28/04/08 11:00:00

SBE37 MicroCAT SMP CTD unit, serial number **5789**
Sample interval: 1800 seconds
Start date: 28 04 2008 (DDMMYYYY)
Start time: 11 00 00 (HHMMSS GMT)

SBE37 MicroCAT IMP CTD unit, serial number **5991**
Sample interval: 1800 seconds
Start date: 28 04 2008 (DDMMYYYY)
Start time: 11 00 00 (HHMMSS GMT)

Aanderaa RCM11 – serial number **507**
Pings per ensemble 600
Temperature range Arctic
Conductivity range 32-34
Recording interval 30
No of channels 8
Mode Burst
DSU serial number 7869
Instrument started 28/04/08 11:00:00

SBE37 MicroCAT IMP CTD unit, serial number **5992**
Sample interval: 1800 seconds
Start date: 28 04 2008 (DDMMYYYY)
Start time: 11 00 00 (HHMMSS GMT)

SBE37 MicroCAT IMP CTD unit, serial number **5993**
Sample interval: 1800 seconds
Start date: 28 04 2008 (DDMMYYYY)
Start time: 11 00 00 (HHMMSS GMT)

WBL3

Seabird SBE53 BPR – serial number **0030**
Header WBL4_SJ_08
Tide sample interval 15 minutes
Tide measurement duration 15 minutes
Frequency of reference measurement
(every N tide samples) 96
Start date 27/04/08
Start time 18:00:00

Appendix E: Details of instruments lowered on CTD calibration casts

Cast	Instrument details		
	Type	Serial numbers	Calibration type
39	Sea Bird SBE37 SMP MicroCAT	5762	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5763	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5764	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5765	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5766	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5767	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5768	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5769	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5770	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5771	Pre-deployment
	Sea Bird SBE37 IMP MicroCAT	5978	Pre-deployment
	Sea Bird SBE37 IMP MicroCAT	5979	Pre-deployment
	Sea Bird SBE37 IMP MicroCAT	5980	Pre-deployment
	Sea Bird SBE37 IMP MicroCAT	5981	Pre-deployment
	Sea Bird SBE37 IMP MicroCAT	5982	Pre-deployment
40	Sea Bird SBE37 SMP MicroCAT	5772	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5773	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5774	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5775	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5776	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5777	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5778	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5779	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5780	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5781	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5782	Pre-deployment
	Sea Bird SBE37 IMP MicroCAT	5983	Pre-deployment
	Sea Bird SBE37 IMP MicroCAT	5984	Pre-deployment
	Sea Bird SBE37 IMP MicroCAT	5985	Pre-deployment
	Sea Bird SBE37 IMP MicroCAT	5986	Pre-deployment
	Sea Bird SBE37 IMP MicroCAT	5987	Pre-deployment
41	Sea Bird SBE37 SMP MicroCAT	3930	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	4305	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	4307	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5783	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5784	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5785	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5786	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5787	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5788	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5789	Pre-deployment

	Sea Bird SBE37 IMP MicroCAT	5988	Pre-deployment
	Sea Bird SBE37 IMP MicroCAT	5989	Pre-deployment
	Sea Bird SBE37 IMP MicroCAT	5990	Pre-deployment
	Sea Bird SBE37 IMP MicroCAT	5991	Pre-deployment
	Sea Bird SBE37 IMP MicroCAT	5992	Pre-deployment
	Sea Bird SBE37 IMP MicroCAT	5993	Pre-deployment
42	Sea Bird SBE37 SMP MicroCAT	3206	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	3219	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	3220	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	3221	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	3222	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	3223	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	3928	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	3931	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	3932	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	3933	Pre-deployment
	Sea Bird SBE37 SMP MicroCAT	3934	Pre-deployment
	Sea Bird SBE37 IMP MicroCAT	4062	Post- and pre-deployment
	Sea Bird SBE37 IMP MicroCAT	4070	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	4306	Pre-deployment
	Sea Bird SBE37 IMP MicroCAT	4470	Pre-deployment
	Sea Bird SBE37 IMP MicroCAT	4799	Pre-deployment
	Sea Bird SBE37 IMP MicroCAT	4800	Pre-deployment
43	Sea Bird SBE37 IMP MicroCAT	3281	Post- and pre-deployment
	Sea Bird SBE37 IMP MicroCAT	4060	Post- and pre-deployment
	Sea Bird SBE37 IMP MicroCAT	4071	Post- and pre-deployment
	Sea Bird SBE37 IMP MicroCAT	4072	Post- and pre-deployment
	Sea Bird SBE37 IMP MicroCAT	4184	Post- and pre-deployment
	Sea Bird SBE37 IMP MicroCAT	4473	Post- and pre-deployment
	Sea Bird SBE37 IMP MicroCAT	4724	Post- and pre-deployment
	Sea Bird SBE37 IMP MicroCAT	4797	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5238	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5239	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5240	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5241	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5242	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5243	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5244	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5245	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5246	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	5247	Post- and pre-deployment
44	Sea Bird SBE37 IMP MicroCAT	4725	Post- and pre-deployment
	Sea Bird SBE37 IMP MicroCAT	4795	Post- and pre-deployment
	Sea Bird SBE37 IMP MicroCAT	4796	Post- and pre-deployment
45	Sea Bird SBE37 SMP MicroCAT	3229	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	3230	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	3231	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	3232	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	3233	Post- and pre-deployment

	Sea Bird SBE37 SMP MicroCAT	3244	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	3905	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	3906	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	3907	Post- and pre-deployment
	Sea Bird SBE37 SMP MicroCAT	3908	Post- and pre-deployment
	Sea Bird SBE37 IMP MicroCAT	4068	Post- and pre-deployment

Appendix F: Mooring recovery logsheets

RAPID MOORINGS **CRUISE SJ08** **MRG ID: WB1**

Western Atlantic 26N RECOVERY **NMFD ID** 2007/01

LATITUDE 26°29.9N **DATE** 23/04/2008

LONGITUDE 76°49.3W **DAY**

NOTE ALL TIMES RECORDED IN GMT

DEPTH 1400m

Protocol taken by: Kanzow

COMMENCE TIME 14:30

COMPLETION TIME 16:10

ITEM	SER NO	COMMENT	TIME
Recovery line	n/a		
TRYMSYN floats	n/a		14:46
SBE37	3206	Heavy growth	14:48
30” SYNTACTIC			14:51
ARGOS	286	ID:22442	14:58
1M chain and swivel			
RCM11	381	Heavy growth	15:02
SBE37	3219	Heavy growth	15:02
SBE37	3220	Light growth	15:08
41” steel buoy			15:11
ARGOS BEACON	285	ID:60211	
1M chain and swivel			
SBE37	3221		15:18
SBE37	3222		15:19
SBE37	3223		15:23
RCM11	383		15:23
SBE37	3281		15:30
SBE37	4797		15:33
SBE37	4060		15:38
10 X 17” GLASS			15:42
RCM11	395		15:42
SBE37	4062		15:42
SBE37	4066		15:48
SBE37	4068		15:52
SBE37	4070		15:56
2 X 17” GLASS			15:58
RCM11	399		15:58
SBE37	4071		15:58
SBE37	4072		16:03
10 X 17” GLASS			16:04
Dual release	SN687		16:07
	SN223		16:07

COMMENTS 14:35 Mooring at surface

RAPID MOORINGS		**CRUISE SJ08**	**MRG ID:**	WBADCP
Western Atlantic 26N		RECOVERY	**NMFD ID**	2007/04
LATITUDE	26°29.79N		**DATE**	
LONGITUDE	76°49.15W		**DAY**	23/04/2008
NOTE ALL TIMES RECORDED IN GMT			**DEPTH**	600m
			Protocol taken by:	Kanzow
COMMENCE TIME	21:11			
COMPLETION TIME	21:37			

ITEM	SER NO	COMMENT	TIME
2 x TRIMSYN	N/A		21:26
15M POLYPROP 24mm	N/A		21:26
SYNTACTIC ADCP BUOY	N/A		21:26
75 KHZ ADCP	5817		21:26
ARGOS IOS	ID: 11033		21:26
Titanium swivel	N/A		21:26
10M 5/8” chain	N/A		21:26
Release (AR861)	253	ARM14AA REL1455	21:37

COMMENTS

RAPID MOORINGS CRUISE SJ08

MRG ID: WBL3

Western Atlantic 26N RECOVERY **NMFD ID** 2006/08

LATITUDE 26°30.62N **DATE** 24/04/2008

LONGITUDE 76°44.66 **DAY**

NOTE ALL TIMES RECORDED IN GMT **DEPTH** 3880

COMMENCE TIME 14:45 (released)

COMPLETION TIME 12:02

ITEM	SER NO	COMMENT	TIME
17" glass pickup float	n/a		11:51
Recovery line	n/a		11:51
Billings Float with VHF and Light	unknown	Vhf channel 72.	11:53
1M of 3/8" chain	n/a		11:53
15M polyprop	n/a		
6 x 17" glass	n/a		12:00
15m polyprop	n/a		12:00
Tripod with 2 x releases	AR861: 258 RT661: 370		12:02
And 2 x BPR	395 396		12:02

COMMENTS

Released AR861 Sn:258

10:42	3865m	
10:45	3842m	release OK
10:46:30	3749m	
10:48:30	3618m	~65min
11:40	on surface	

RAPID MOORINGS CRUISE SJ08

MRG ID: **WB2**

Western Atlantic 26N RECOVERY **NMFD ID** 2007/02

LATITUDE 26°30.62N **DATE** 24/04/08

LONGITUDE 76°44.66W **DAY**

DEPTH 2989m 7 (corr)

DATE Protocol 29/03/07

taken by; Kanzow

NOTE ALL TIMES RECORDED IN GMT

COMMENCE TIME 12:44 (release)

COMPLETION TIME 14:57

ITEM	SER NO	COMMENT	TIME
Recovery line			13:05
TRYMSYN floats			
SBE37	5238		13:15
30” SYNTACTIC			13:20
ARGOS BEACON	SN053	ID24329	13:20
LIGHT	N08-027		13:20
1M polyester			13:20
Swivel			13:20
RCM11	426		13:24
SBE37	5239		13:24
48” steel buoy			13:33
ARGOS BEACON	SN31	ID11443	13:33
LIGHT	S01-182		13:33
1M chain			13:33
Swivel			13:33
RCM11	428		13:41
SBE37	524O	10m below RCM11, 1 bracket missing	13:44
SBE37	5241	Bracket of above mc found here, 1 bracket missing	13:48
RCM11	438	Bracket of above mc found here, *	13:51
SBE37	5242	1 clamp fallen off	13:58
SBE37	5243	1 clamp fallen off	14:04
2 x 17” glass			14:08
RCM11	443		14:10
SBE37	5244		14:15
SBE37	5245	1 clamp missing	14:21
12 x 17” glass		Glass and RCM11 tangled up	14:24
RCM11	444		14:31
SBE37	5246		14:35
SBE37	5247		14:39
5 x 17” glass			14:44
SBE37	4184		14:47
SBE37	4473		14:54

RCM11	507		14:57
7 x 17” glass			
SBE37	4724		15:10
SBE37	4725		15:17
7 x 17” glass			15:28
SBE37	4795		15:35
SBE37	4796		15:41
8 x 17” glass			15:41
Dual release (both AR861s)	316	ARM14CC REL1455	15:41
	264	ARM14BS REL1455	15:41

COMMENTS

* Transducer head missing, pressure case not closed tight

RAPID MOORINGS CRUISE SJ08

MRG ID: WBL4

Western Atlantic 26N RECOVERY **NMFD ID** 2006/05

LATITUDE 26°30.02N **DATE** 27/04/2008

LONGITUDE 76°02.95W **DAY**

NOTE ALL TIMES RECORDED IN GMT **DEPTH** 4810m (corr)

COMMENCE TIME 10:18 Released

COMPLETION TIME 11:49 All on board

ITEM	SER NO	COMMENT	TIME
17” glass pickup float	n/a	Tangled up	11:29
Recovery line	n/a	Tangled up	
Billings Float with VHF and Light	unknown	Vhf channel 72. Tangled up	11:32
1M of 3/8” chain	n/a	Tangled up	
15M polyprop	n/a	Tangled up	
5 x 17” glass	n/a	Tangled up	11:32
15m polyprop	n/a		
Tripod with 1 x releases	AR861: 255		11:49
And 1 x BPR (SBE53)	0004		11:49

COMMENTS

Released OK 10:18 (no range)

On the surface 11:17

RAPID MOORINGS CRUISE SJ08

MRG ID: WB4

Western Atlantic 26N RECOVERY **NMFD ID** 2007/03

LATITUDE 26°32.36'N **DATE** 27/04/2008

LONGITUDE 76°08.64'W **DAY**

NOTE ALL TIMES RECORDED IN GMT

DEPTH 4824m (corr)

Protocol taken by: SCU

COMMENCE TIME

COMPLETION TIME 20:42

ITEM	SER NO	COMMENT	TIME
Recovery line			Not recovered
17 " Glass			Not recovered
SBE37	3226		Not recovered
28" steel buoy			Not recovered
ARGOS	SNT04-045	ID42749	Not recovered
LIGHT	S01-179		Not recovered
RCM11	510		Not recovered
SBE37	3227		Not recovered
28" steel buoy			Not recovered
ARGOS	SN287	ID22443	Not recovered
LIGHT	U11-019		Not recovered
1M chain			Not recovered
Swivel			Not recovered
SBE37	3228		18:56
RCM11	515		18:46
SBE37	3229		18:46
SBE37	3230		18:46
RCM11	516		18:29
SBE37	3231		18:39
SBE37	3232		18:20
RCM11	518		17:57
12 x 17" glass		2 of 12 impoloded (deepest 2) missing	18:04
SBE37	3233		17:58
4 x 17" glass			
SBE37	3244		19:18
4 x 17" glass			
RCM11	519		19:28
SBE37	3487	Flooded	19:31
4 x 17" glass			
SBE37	3905		19:44
4 x 17" glass			
RCM11	520		19:56
SBE37	3906		20:00
4 x 17" glass			
SBE37	3907		20:10
4 x 17" glass			

RCM11	304		20:21
SBE37	3908	Sn was wrong (3258)	20:24
SBE37	3258	Sn was wrong (3905)	20:32
10 x 17” glass			
Dual release (both AR861)	248	ARM14A5 REL1455	20:42
	216	ARMEC47 RELEC83	20:42

COMMENTS

Appendix G: Mooring deployment logsheets

RAPID MOORINGS CRUISE SJ08

MRG ID: WBADCP

Western Atlantic 26N DEPLOYMENT **NMFD ID**

LATITUDE 26°31.52 (Drop position) **DATE** 23/04/2008

LONGITUDE 76°52.12 **DAY**

NOTE ALL TIMES RECORDED IN GMT **DEPTH** 598m (corr)

Protocol taken by: Kanzow

COMMENCE TIME 22:46

COMPLETION TIME 23:07

ITEM	SER NO	COMMENT	TIME
2 x Trimsyn	n/a		22:46
15m Polyprop 24mm	n/a		22:47
Syntactic ADCP Buoy	n/a		22:48
75kHz ADCP			22:48
Argos Beacon	286	ID 22442	22:48
Titanium swivel	n/a		22:48
10m 5/8” chain	n/a		
Single Release	318		22:58
5m of 5/8” chain			
Anchor 850 KG	n/a		23:07

DEPLOYMENT METHOD COMMENTS

RAPID MOORINGS CRUISE SJ08

MRG ID: WBL3

Western Atlantic 26N DEPLOYMENT **NMFD ID**

LATITUDE 26°30,41'N **DATE** 24/04/2008

LONGITUDE 76°44,66'W **DAY**

NOTE ALL TIMES RECORDED IN GMT **DEPTH** 3887 (corr)

Protocol taken by: Kanzow

COMMENCE TIME 18:50

COMPLETION TIME 18:58

ITEM	SER NO	COMMENT	TIME
17" glass	n/a		15:53
15M polyprop	n/a		
Floater with VHF and			18:54
Light			18:54
1M of 3/8" chain	n/a		
4 x 17" glass	n/a		18:55
15m polyprop	n/a		
4 x 17" glass	n/a		18:55
15m polyprop	n/a		
Lander tripod	n/a		
2 x SBE BPR	0028		18:58
	0029		18:58
Dual release	920		18:58
	163		18:58
Anchor min. 500 KG	n/a		18:58

DEPLOYMENT METHOD

COMMENTS

RAPID MOORINGS CRUISE SJ08

MRG ID: WBLB

Western Atlantic 26N DEPLOYMENT **NMFD ID**

LATITUDE 26°29,93'N **DATE** 24/04/2008

LONGITUDE 76°29,64'W **DAY**

NOTE ALL TIMES RECORDED IN GMT **DEPTH** 4857 (corr)

COMMENCE TIME 21:12 **Protocol taken by:** Kanzow

COMPLETION TIME 21:20

ITEM	SER NO	COMMENT	TIME
17" glass	n/a		21:15
15M polyprop	n/a		21:15
Floater with VHF and	W03-106		21:16
Light	W03-091		21:16
1M of 3/8" chain	n/a		21:16
4 x 17" glass	n/a		21:18
15m polyprop	n/a		21:18
4 x 17" glass	n/a		21:19
15m polyprop	n/a		21:19
Lander tripod	n/a		21:20
2 x SBE BPR	417		21:20
	005	Bill Johns BPR	
Dual release	919		21:20
	498		21:20
Anchor min. 500 KG	n/a		21:20
			21:20

DEPLOYMENT METHOD

COMMENTS

RAPID MOORINGS CRUISE SJ08

MRG ID: WB1

Western Atlantic 26N DEPLOYMENT **NMFD ID**

LATITUDE 26°29.95 **DATE** 23/04/2008

LONGITUDE 76°49.26 Anchor dropped **DAY**

NOTE ALL TIMES RECORDED IN GMT

Triangulated latitude **DATE** 28/03/07

Triangulated longitude **DAY** Wednesday

DEPTH 1996m (corr)

COMMENCE TIME 17:54

COMPLETION TIME 20:17

Protocol taken by:

ITEM	SER NO	COMMENT	TIME
1x Trimsyn	n/a		17:54
Recovery line	n/a		17:54
TRYMSYN floats	n/a		17:55
SBE37 Microcat	5762		17:55
30” Syntactic with	n/a		17:58
Light and			17:58
Argos Beacon	82954		17:58
1m chain and swivel			17:58
RCM11	300		17:59
SBE37 Microcat	5763		18:01
SBE37 Microcat	5764		18:05
41” steel buoy with	n/a		18:12
Light and	U11-018		18:12
Argos beacon	285		18:12
1M chain and swivel	n/a		18:12
SBE37 Microcat	5765	5m below buoy	18:15
SBE37 Microcat	5766		18:18
RCM11	301		18:24
SBE37 Microcat	5767	Microcat just below RCM11	18:27
SBE37 Microcat	5768		18:32
SBE37 Microcat	5769		18:38
SBE37 Microcat	5770		18:42
10 x 17” glass	n/a		18:50
RCM11	302		18:54
SBE37 Microcat	5771		18:54
SBE37 Microcat	5978		19:01
SBE37 Microcat	5979		19:07
SBE37 Microcat	5980		19:13
2 x 17” glass	n/a		19:20
RCM11	303		19:21
SBE37 Microcat	5981		19:21
SBE37 Microcat	5982		19:30
10 x 17” glass	n/a		19:30

Dual release	916	Record both serial numbers	19:40
	249		
20m nylon	n/a		19:42
10m 1/2” chain	n/a		
Anchor chain 1600 KG	n/a		

DEPLOYMENT METHOD
COMMENTS

26°29.70N 1390m range; release upright
76°49.29W

RAPID MOORINGS CRUISE SJ08 MRG ID: WB2

Western Atlantic 26N DEPLOYMENT NMFD ID

LATITUDE 26°30.62N **DATE** 26/04/2008

LONGITUDE 76°44.36W **DAY**

Triangulated latitude 26°30.502 **DATE 29/03/07** 29/03/07

Triangulated longitude 76°44.742 **DATE 29/03/07** 29/03/07 3891m

NOTE ALL TIMES RECORDED IN GMT **DEPTH** (corr)

Protocol taken by: Kanzow

COMMENCE TIME 13:51

COMPLETION TIME 17:21

ITEM	SER NO	COMMENT	TIME
1 x Trimsyn	n/a		13:51
Recovery line	n/a		
3 x Trimsyns	n/a		13:57
SBE37 Microcat	5772		13:57
30” Syntactic with	n/a		14:01
Light and			14:01
Argos Beacon			14:01
1m 5/8” chain	n/a		14:01
Swivel			14:01
RCM11	451		14:01
SBE37 Microcat	5773		14:02
48” steel buoy with	n/a		14:09
Light and			14:09
Argos beacon			14:09
1M chain	n/a		14:09
Swivel	n/a		14:09
RCM11	305		14:09
SBE37 Microcat	5774		14:11
SBE37 Microcat	5775		14:15
RCM11	306		14:22
SBE37 Microcat	5776		14:25
SBE37 Microcat	5777		14:32
2 x 17” glass	n/a		14:37
RCM11	445		14:47
SBE37 Microcat	5778		14:40
SBE37 Microcat	5779		14:43
12 x 17” glass	n/a		14:52
RCM11	448		14:59
SBE37 Microcat	5780		15:01
SBE37 Microcat	5781		15:12
5 x 17” glass	n/a		15:19
SBE37 Microcat	5782		15:21
SBE37 Microcat	5983		15:28
RCM11	449		15:32

7 x 17” glass	n/a		15:46
SBE37 Microcat	5984	No mark, instrument put ~50m below joint	15:46
SBE37 Microcat	5985		16:02
RCM11	450		16:11
7 x 17” glass	n/a		16:22
SBE37 Microcat	5986		16:28
SBE37 Microcat	5987		16:45
9 x 17” glass	n/a		16:51
Dual release	317	Record both serial numbers	16:54
	318		16:54
20m nylon	n/a		
25m 1/2” chain	n/a		17:10
Anchor chain 2000 kg	n/a		17:21

DEPLOYMENT METHOD

COMMENTS

RAPID MOORINGS CRUISE SJ08 MRG ID: WBH2

Western Atlantic 26N DEPLOYMENT **NMFD ID**

LATITUDE 26°28.32N **DATE** 6/04//2008

LONGITUDE 76°38.84W **DAY**

Triangulated latitude 26°27.9N **DATE** 29/03/07

Triangulated longitude 76°.39.3W **DATE** 29/03/07 4737m

NOTE ALL TIMES RECORDED IN GMT **DEPTH** (corr)

Protocol

COMMENCE TIME 20:18 **taken by:** Kanzow

COMPLETION TIME 23:17

ITEM	SER NO	COMMENT	TIME
1 x 17" glass	n/a		20:18
Recovery line	n/a		20:18
Billings float with	n/a		20:20
Light and	W08-027		
Argos Beacon			
14 x 17" glass	n/a		20:21
Swivel	n/a		20:22
RCM11	381		20:22
7 x 17" glass	n/a		20:47
RCM11	383		20:52
RCM11	395		21:22
3 x 17" glass	n/a		21:57
Swivel	n/a		21:57
RCM11	399		21:57
SBE37 Microcat	5988		21:58
SBE37 Microcat	5989		22:23
3 x 17" glass	n/a		22:42
RCM11	426		22:42
SBE37 Microcat	5990		22:50
5 x 17" glass	n/a		23:00
Swivel	n/a		23:00
Dual Release	907	Record both serial numbers	23:00
	906		23:00
20m Nylon			23:00
5m ½" chain	n/a		
Anchor chain 1400kg	n/a		23:17

DEPLOYMENT METHOD

COMMENTS

RAPID MOORINGS CRUISE SJ08

MRG ID: WB4

Western Atlantic 26N DEPLOYMENT **NMFD ID**

LATITUDE 26°24.91'N **DATE** 28/04/08

LONGITUDE 75°41.89'W **DAY**

Triangulated latitude **DEPTH** 4705 (corr)

Triangulated longitude

NOTE ALL TIMES RECORDED IN GMT

COMMENCE TIME 11:46 **Protocol taken by:** Kanzow

COMPLETION TIME 15:18

ITEM	SER NO	COMMENT	TIME
Single Trimsyn	n/a		11:46
Recovery line	n/a		11:46
4 x Billings	n/a		11:46
SBE37 Microcat	3206		11:47
3x17"	n/a		
Light and	So1-182		
Argos Beacon	W03-81		
RCM11	519		
SBE37 Microcat	3219		11:51
8x17"Benthos	n/a		11:52
swivel	n/a		
SBE37 Microcat	3220		12:08
6x17" Benthos			
RCM11	515		12:15
SBE37 Microcat	3222		12:17
SBE37 Microcat	3221		12:21
RCM11	516		12:27
SBE37 Microcat	5783		12:28
SBE37 Microcat	5784		12:35
12 x 17" glass	n/a		12:44
Swivel	n/a		
RCM11	520		12:48
SBE37 Microcat	5785		12:49
4 x 17" glass	n/a		13:01
SBE37 Microcat	5786		13:01
4 x 17" glass	n/a		13:13
RCM11	443		13:13
SBE37 Microcat	5787		13:14
4 x 17" glass	n/a		13:22
SBE37 Microcat	5788		13:22
4 x 17" glass	n/a		13:47
RCM11	444		13:47
SBE37 Microcat	5789		13:47
4 x 17" glass	n/a		14:06

SBE37 Microcat	5991		14:06
4 x 17” glass	n/a		14:22
RCM11	507		14:23
SBE37 Microcat	5992		14:23
SBE37 Microcat	5993		14:42
10 x 17” glass	n/a		15:00
Dual release	926	Record both serial numbers *	15:00
	264		15:00
20m Nylon	n/a		15:18
10m 1/2” chain	n/a		15:18
Chain Anchor 2100 kg	n/a		

DEPLOYMENT METHOD
COMMENTS * Releases deployed in line #926 above 264 => #264 should be released first

RAPID MOORINGS CRUISE SJ08

MRG ID: WBL4

Western Atlantic 26N DEPLOYMENT **NMFD ID**

LATITUDE 26°24.25'N **DATE** 28/04/08

LONGITUDE 75°42.59'W **DAY**

NOTE ALL TIMES RECORDED IN GMT **DEPTH** 4705 (corr)

Protocol taken by: Kanzow

COMMENCE TIME 19:41

COMPLETION TIME 19:46

ITEM	SER NO	COMMENT	TIME
17" glass	n/a		19:41
15M polyprop	n/a		19:41
Billings Float with VHF and	W03-109		19:42
Light	S01-185		19:42
1M of 3/8" chain	n/a		19:42
2 x 17" glass	n/a		19:42
15m polyprop	n/a		19:42
4 x 17" glass	n/a		19:44
15m polyprop	n/a		19:44
Lander tripod	n/a		19:46
1 x SBE BPR	30		19:46
Single release 861	253		19:46
Anchor min. 500 KG	n/a		19:46

DEPLOYMENT METHOD

COMMENTS