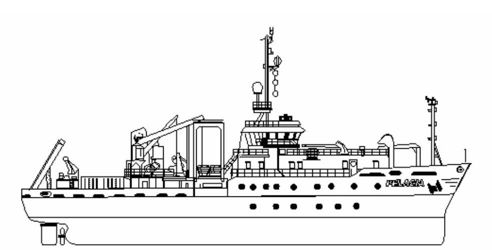
RV Pelagia Shipboard Report:

Cruise 64PE169, Project CLIVARNET Atlantic Monitoring Programme (CAMP)

H.M. van Aken
Chief Scientist



CAMP 2000

NIOZ, Texel, 2000

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The research reported here is part of the NIOZ contribution to the Dutch Clivar programme CLIVARNET.

1 Cruise Narrative

1.1 Highlights

a: Re-survey of WOCE Hydrographic Program Repeat Section A1/AR7E, RV Pelagia cruise 169 between Ireland and Greenland

b: Expedition Designation (EXPOCODE): 64PE169

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d: Ship: RV Pelagia, Call Sign: PGRQ
length 66 m.
beam 12.8 m
draft 4 m
maximum speed 12.5 knots

e: Ports of Call: Texel to Texel

f: Cruise dates: September 26 to October 19, 2000 AD

1.2 Cruise Summary Information

Summary

Early before noon of 26 September RV Pelagia left the quay in the NIOZ harbour at Texel, and headed for the Irish continental shelf. Underway hauls with the plankton net at four stations were performed. The hydrographic programme with stations along the former WOCE line A1E/AR7E started early in the evening of 30 September. Due to too strong winds and high waves three times the survey was interrupted. This caused the skipping of four planned stations. Station 43 at the end of the section over the Greenland continental shelf was occupied in the afternoon of 10 October. From there course was set to the western slope of the Mid Atlantic Ridge to carry out measurements at two hydrographic stations which were skipped before due to bad weather. After finishing these stations course was set to the home port of RV Pelagia at Texel. At part of the

hydrographic stations covering a range of North Atlantic hydrographic regimes plankton net casts were carried out. During the homeward bound part of the cruise additional net casts were performed over the continental shelf. A summary of the hydrographic and plankton net stations is given in the appendix. During the whole survey the Vessel Mounted ADCP (VMADCP) was switched on. Sea surface temperature, salinity, echo sounder depth, meteorological parameters and navigation information were recorded continuously.

Cruise Track

The cruise was carried out in the North Atlantic Ocean. The cruise track is shown in figure 1.

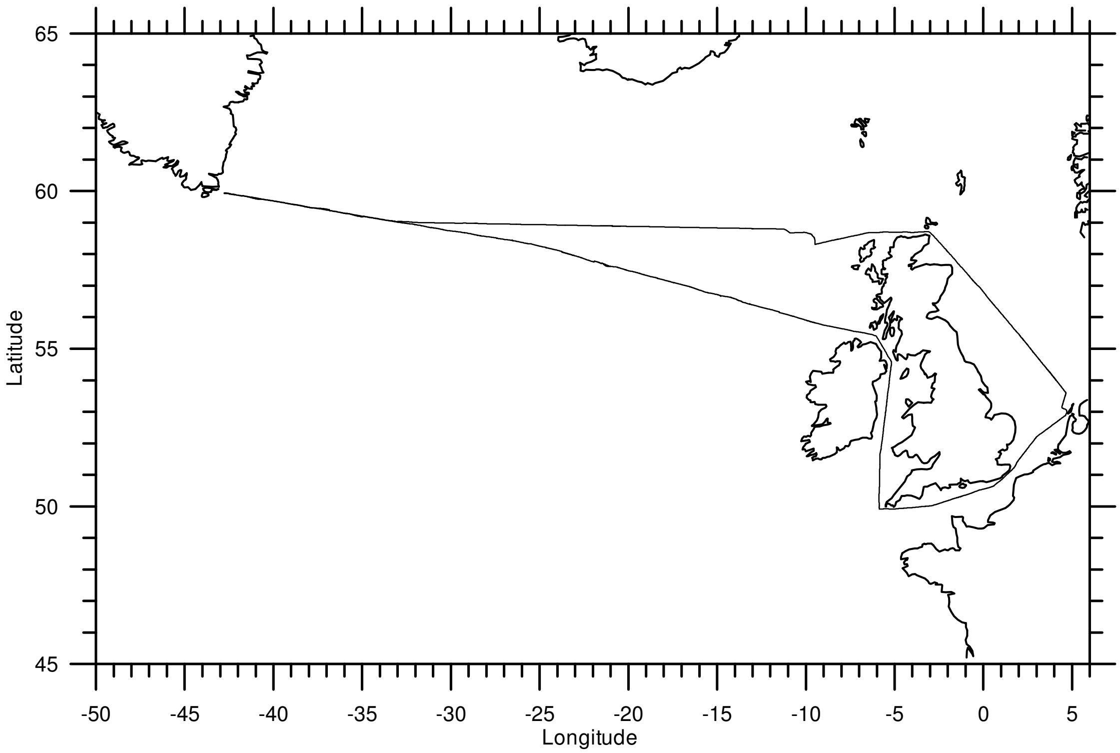

Figure 1. Cruise track of RV Pelagia cruise 64PE169

Number of Hydrographic Stations

A total of 41 CTD casts was recorded on the research line. On 39 of these casts, water samples were taken for the determination of salinity and dissolved bio-geochemical components. Three water samplers in the rosette system were fitted with reversing electronic pressure sensors. The positions of the hydrographic stations are indicated in figure 2.

At the hydrographic stations the SBE9/11+ CTD was lowered with a speed of about 1 m/s. Due to the use of a bottom indicator switch we were able to sample to within quite a short distance from the bottom (10 m).

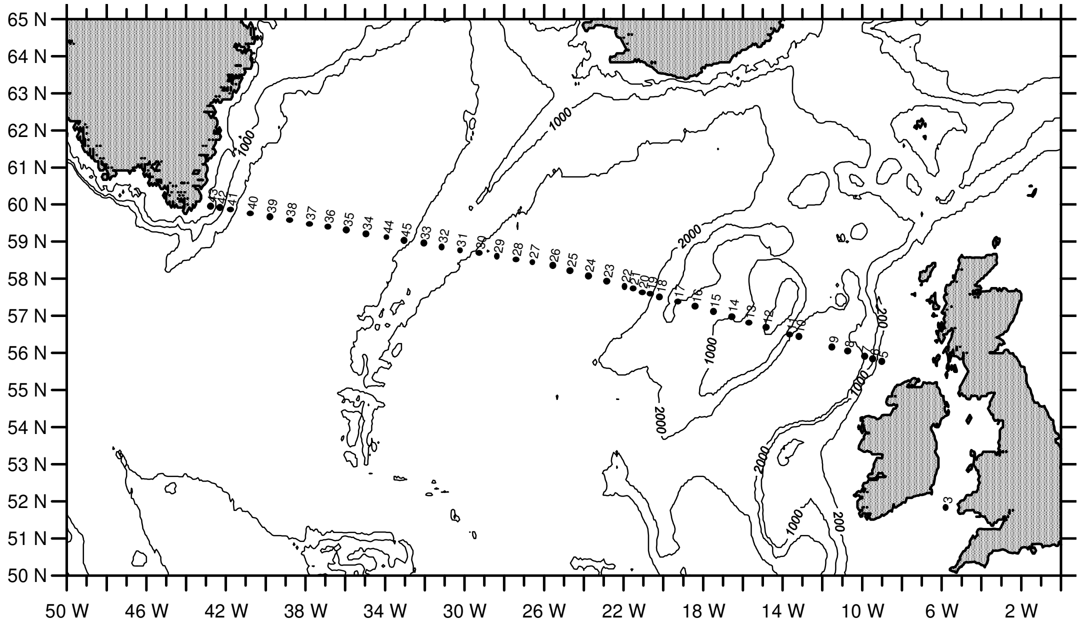

Figure 2. Distribution of hydrographic stations.

Hydrographic Sampling

During the up-cast of each CTD/rosette station water up to 24 samples were taken at regular depth intervals. The samples were analysed for salinity, oxygen and nutrients. For test purposes also Dissolved Inorganic Carbon (DIC) was determined from the samples collected on the hydrographic section. The vertical distribution of the sampling locations is indicated in figure 3.

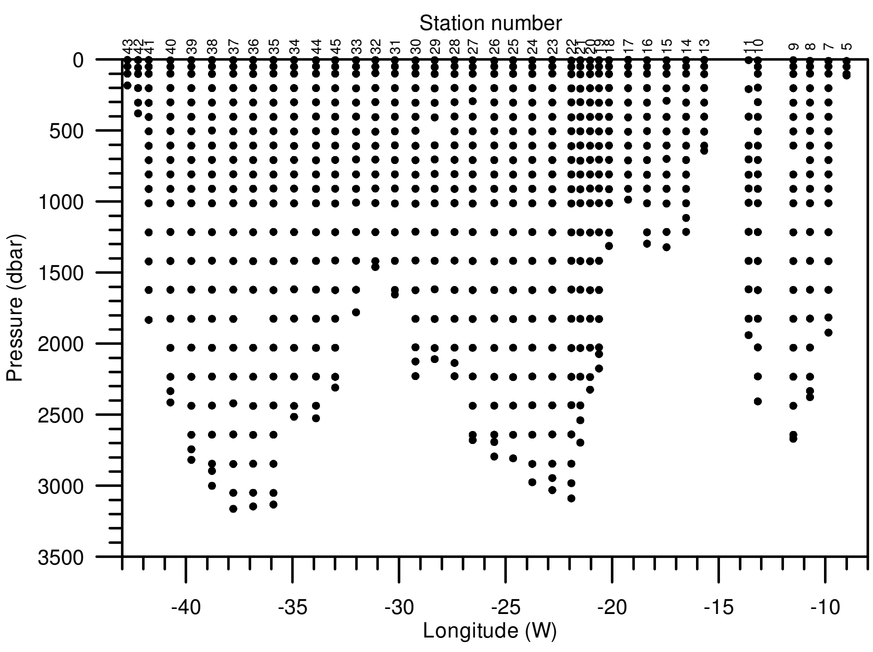

Figure 3. Vertical distribution of the water samples versus longitude and station number.

Number of Plankton Net Casts

At 23 positions along the hydrographic section and during outward and homeward transit one or more plankton net casts were performed. Vertical hauls were taken using a plankton net with a diameter of 1 meter and a mesh size of 500 µm. Sampling depth varied between 300 and 24 meters, depending on the depth of the station and the density of the plankton. The net was hauled at a speed of 15 to 20 m/min. When back on board he catch was carefully washed into a bucket with a gentle flow of sea water. The organisms in this sample were then concentrated by pouring the content of the bucket through a sieve.

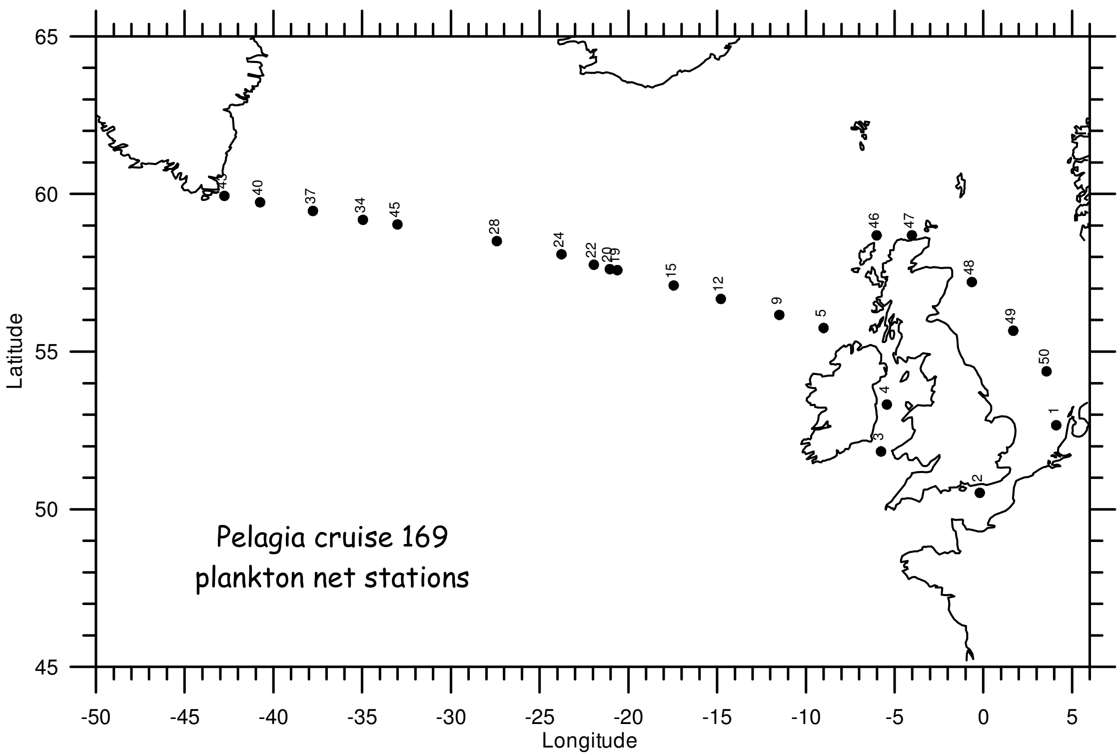

Figure 4. Distribution of the plankton net casts.

1.3 List of Principal Investigators

Name	Responsibility	Affiliation
Dr. H.M. van Aken	Ocean hydrography & climate	NIOZ/Texel
Drs. K. T.C.A Peijnenburg	Population genetics	UvA/Amsterdam

1.4 Scientific Programme and Methods

The goal of the research carried out during the cruise was to establish the hydrography along a zonal section between Ireland and Greenland. This section is the former A1E/AR7E section of the WOCE Hydrographic Programme, which has been surveyed annually since 1990. The re-survey of this section is carried out in order to determine climate related inter-annual changes of the hydrographic structure in the

North Atlantic Ocean. This survey is carried out in co-ordination with Dr. K. P. Koltermann (BSH, Hamburg) who is in charge of similar surveys along sections located further to the south.

The CTD-rosette frame was fitted with weights in order to secure a fast enough falling rate. This package was lowered with a velocity of about 1 m/s, except in the lowest 100 m, where the veering velocity was reduced. Measurements during the down-cast went on to within 10 m from the bottom, until the bottom switch indicated the proximity of the bottom. During the up-cast water samples where taken at prescribed depths, when the CTD winch was stopped. After each cast the CTD/rosette frame was placed on deck. Subsequently water samples were drawn for the determination of dissolved oxygen, nutrients, and salinity, and the readings of the reversing electronic pressure sensors were recorded. The CTD frame was also fitted with an LADCP which measures velocity profiles.

As an additional programme biological sampling was carried out with a plankton net. The plankton samples will be used for the study of the genetic population structure of chaetognaths. The plankton net was lowered to depths of 24 to 300 m.

Preliminary Results

At the end of the cruise the data are available in raw form and in partially processed form, but without final calibration applied. Oxygen and nutrients are still in volumetric concentrations and should be transformed into densimetric concentrations and corrected for sea water blanks and standards. However already from the partially processed data, presented in figures 5 to 10, some insight can be gained of the hydrographic situation along the hydrographic section.

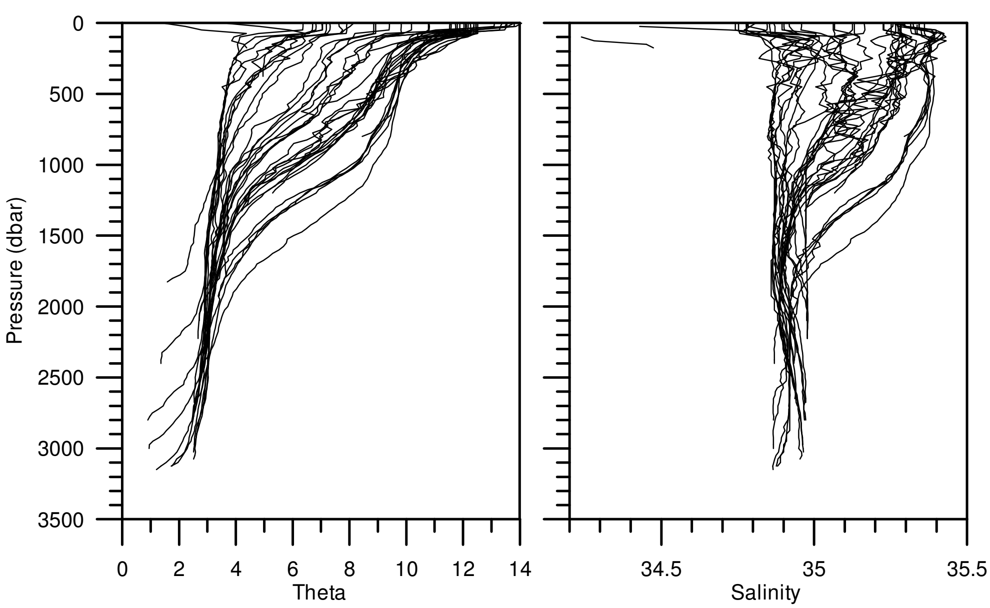

Figure 5. Profiles of potential temperature (Theta) and salinity at the successive stations

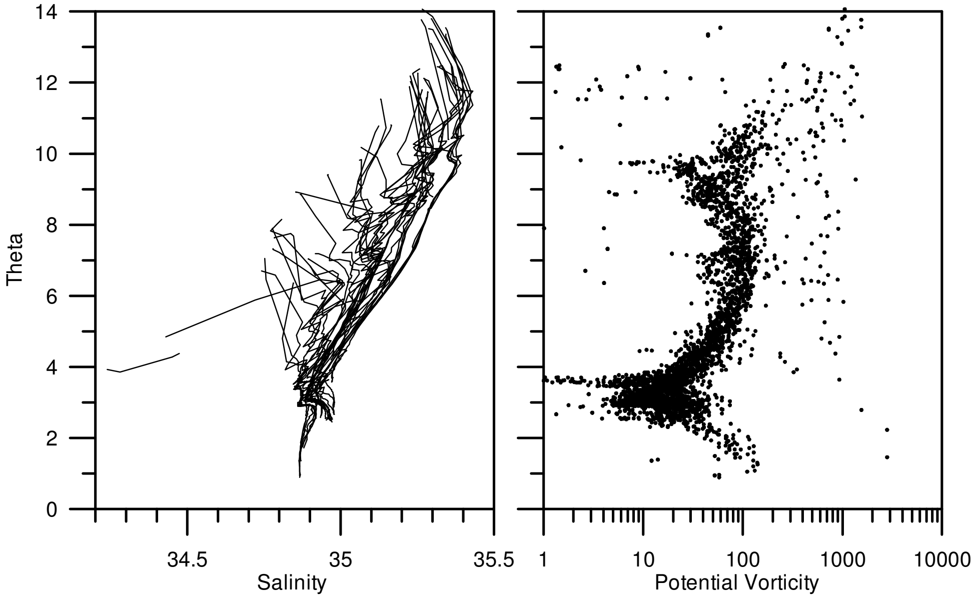

Figure 6. Diagrams of salinity and potential vorticity versus potential temperature. The data are from the CTD casts, sub-sampled every 25 dbar.

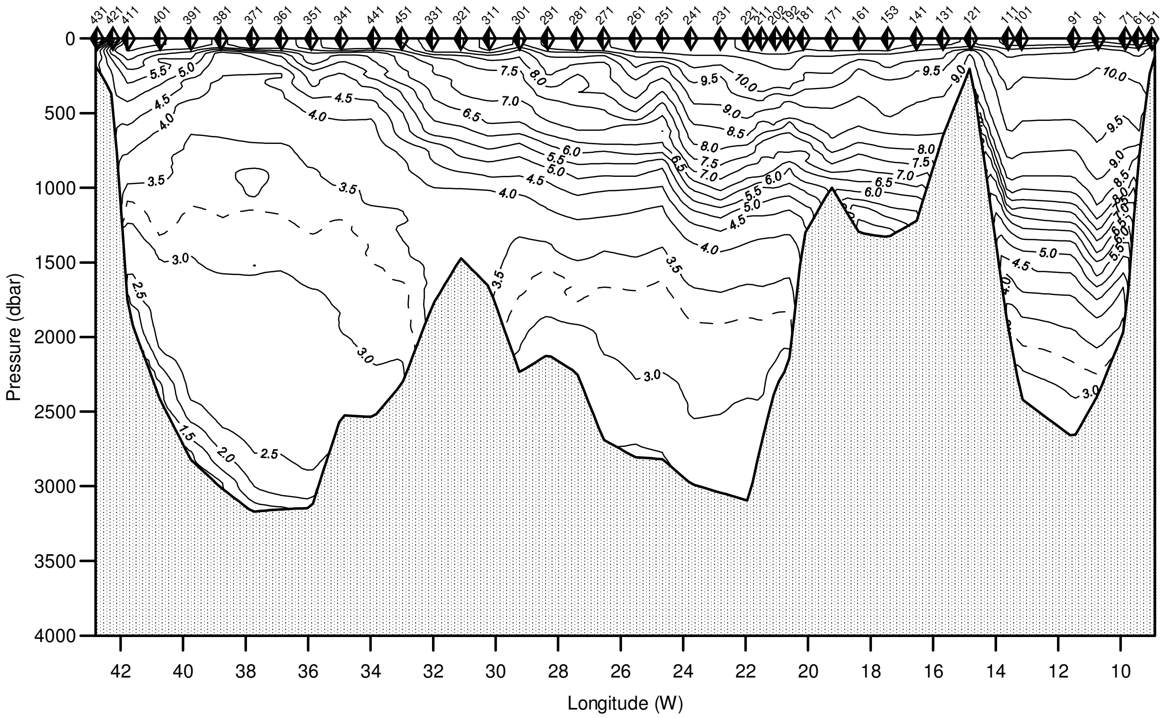

Figure 7 Section of the potential temperature (°C).

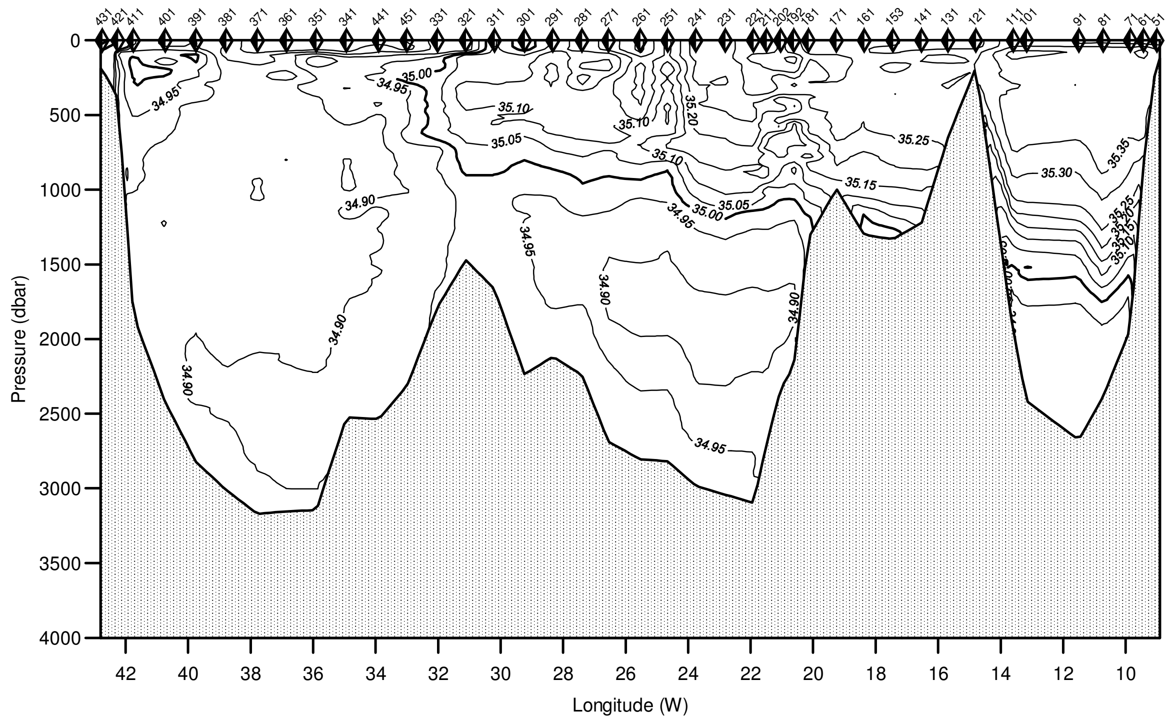

Figure 8 Section of salinity (pss-78).

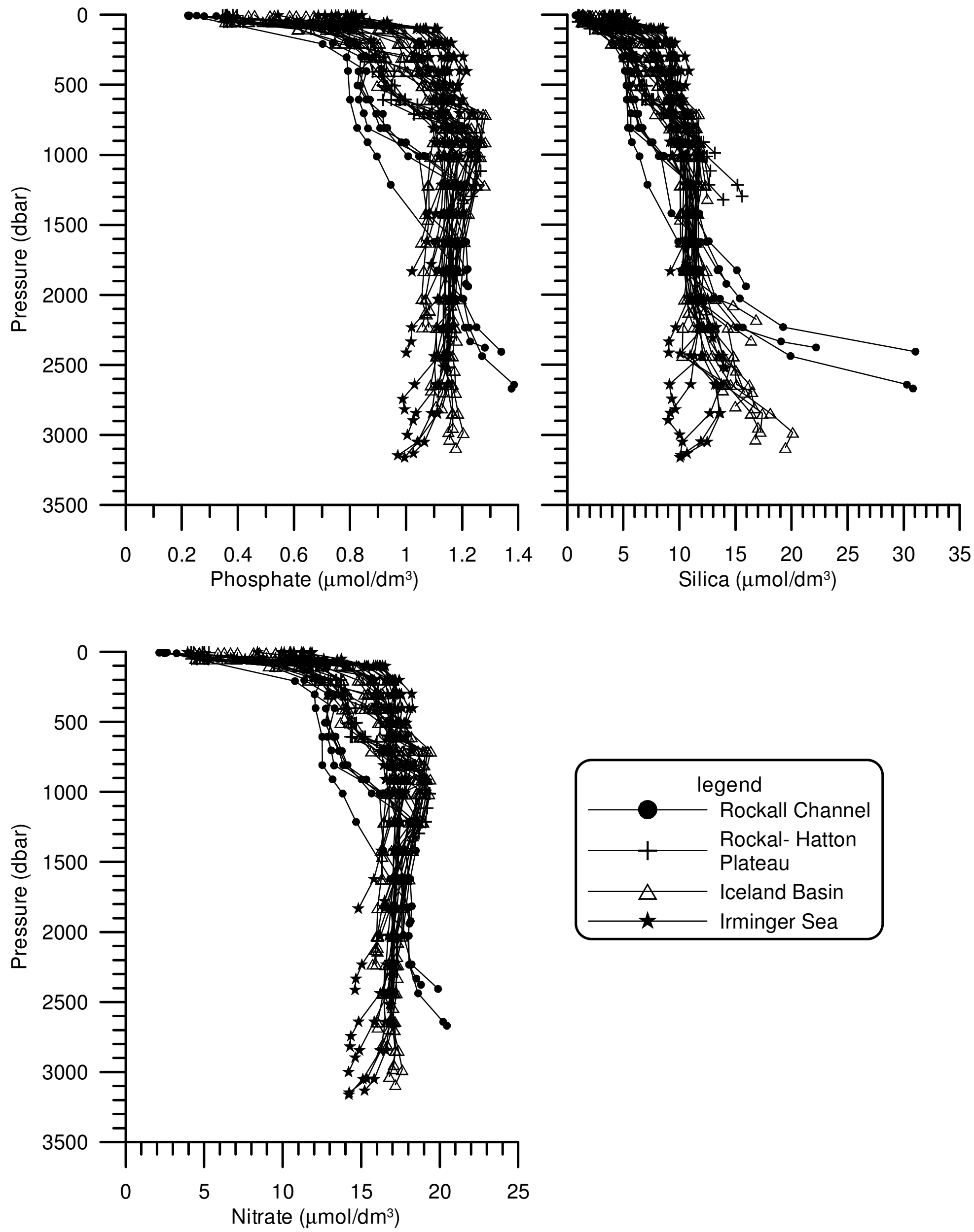

Figure 9. Plots of the dissolved nutrient concentrations versus pressure, for the different hydrographic regimes

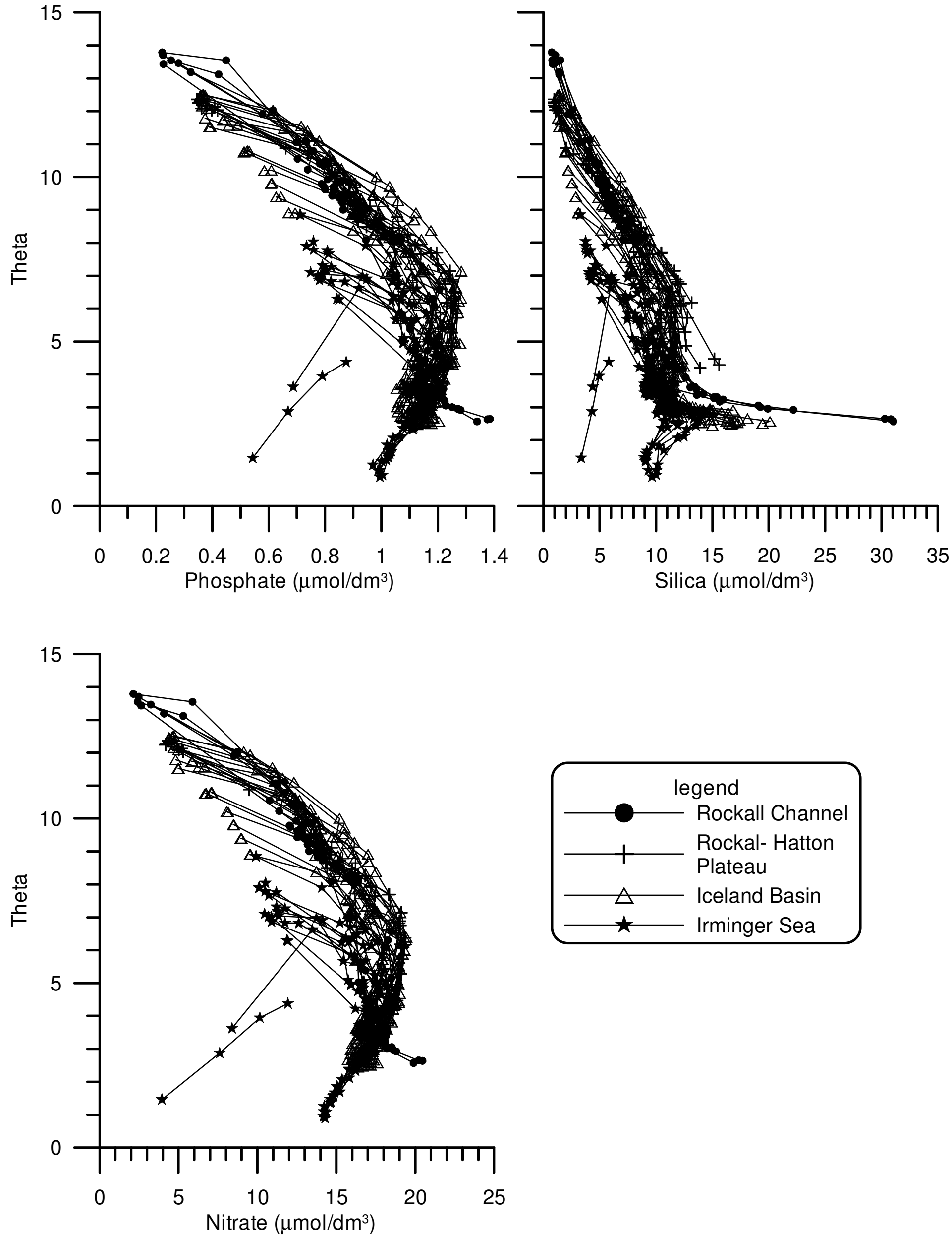

Figure 10. Plots of the dissolved nutrient concentration versus the potential temperature, for the different hydrographic regimes.

1.5 Major Problems Encountered during the Cruise

Especially in the early stages of the survey many sampler bottles did not close satisfactorily because the thickness of the O-rings in the sampler lids were not according to specifications. Intense servicing and selecting O-rings from the spare parts for accurate size solved most of these problems. Ultimately 7% of the samples had to be rejected because of sampler failure. It is recommended that for future cruises enough quality controlled spare O-rings are available, preferentially rings made of a softer type of rubber.

Temperature control in laboratory container 1 initially caused problems. Since for the use of the salinometer a tight temperature range in the laboratory is required, this malfunction hindered the progress of the salinity determinations. Only after establishing contact with the department of marine technology at NIOZ the problems could be overcome. It is recommended that in future cases where container 1 is used the technical staff on board RV Pelagia is informed ahead of the required settings of the air-conditioning.

In the auto-analyzer laboratory containers the air conditioned functioned well. However the direct flow of cool air along the auto-analyzers caused unstable measuring conditions. It is recommended to study how the air flow along the instrumentation can be controlled by means of adapting the position of the air inlet and the blower of the air-conditioning.

It appeared during the cruise that both the oxygen sensor and the fluorimeter of the Aquaflow thermo-salinograph system malfunctioned. It should be considered to replace these sensors on short term.

1.6 Lists of Cruise Participants

Scientific crew

person	**responsibility**	**Institute**
H.M. van Aken	Chief Scientist	NIOZ
K. Bakker	Nutrient & DIC determination	NIOZ
J. Derksen	Electronic engineer, hydrowatch	NIOZ
E. K. van Haastrecht	Biological sampling	UvA
M. Hiehle	Hydro watch, Salinity determination	NIOZ
M.T.J. Hillebrand	Hydro watch, LADCP	NIOZ
R.X. de Koster	Hydro watch, Data management	NIOZ
S. Ober	Hydro watch, VMADCP	NIOZ
K. T.C.A Peijnenburg	Biological sampling	UvA
D. Volkov	Oxygen	NIOZ

NIOZ: Netherlands Institute for Sea Research, Texel

UvA: University of Amsterdam

Ships crew

J.C. Groot	captain
E.A. Puyman	first mate
G. de Ruiter	second mate
J. Seepma	first engineer
J. Brandsma	second engineer
M. Garlinus	cook
C.T. Stevens	ships technician
R. van der Heide	ships technician
G. Struik	sailor AB
G.L.J. Betsema	sailor AB

2 Underway Measurements

2.1 Navigation

A differential GPS receiver was used for the determination of the position. The data from the receiver were recorded every ten seconds in the underway data logging system. After removal of a few spikes and application of a 5 min. running mean these data were sub-sampled every five minutes.

2.2 Echo Sounding

The 3.5 kHz echo sounder was used on board to determine the water depth. The uncorrected depths from this echo sounder were recorded in the underway data logging system. In rough seas the depth digitizer of the echo sounder was occasionally not able to find a reliable depth.

2.3 Thermo-Salinograph Measurements

The Sea Surface Temperature, Salinity, and dissolved Oxygen concentration were measured continuously with an AQUAFLOW thermo-salinograph with the water intake at a depth of about 3 m. For the calibration of the salinity sensor, water samples were taken one to three times per day.

2.4 Meteorological data

Air temperature and humidity, relative wind velocity and direction as well as air pressure were measured and recorded by the underway logging system.

3 Hydrographic measurements - Descriptions, Techniques, and Calibrations

3.1 Rosette Sampler and Sampler Bottles

A 24 position rosette sampler was used, fitted with 5 and 10 litre NOEX sampler bottles. A multi-valve system, developed at NIOZ, allowed closing the sampler bottles by computer command from the CTD operator. The general behaviour of the samplers was good, although repeated failure of a single sampler occurred. Such samples are identified to be suspect because of sampler failure. As soon as such failure was reported the sampler was serviced in order to overcome the problem

3.2 Temperature Measurements (S. Ober)

Mounted on the CTD-rack was a high precision SBE35 reference temperature sensor, which recorded the temperature every time a sampler was closed. The data, obtained with this sensor are used to control, and if necessary to correct the calibration of the CTD temperature sensor. The final calibration of the temperature sensor S/N 2211 was completed before the end of the cruise.

3.3 Pressure Measurements (S. Ober)

On sampler bottles 4, 11, and 16 thermometer racks were mounted, fitted with SIS reversing electronic pressure sensors. On deck, prior to the CTD cast, these pressure sensors corrected internally for zero pressure. The readings of these sensors are used to control, and if necessary to correct the calibration of the CTD pressure sensor. The final calibration of the pressure sensor SBE-247 was completed before the end of the cruise. No further corrections of the calibration are required.

3.4 Salinity Measurements (M. Hiehle)

Water was drawn from the samplers into a 0.25 litre glass sample bottle for the salinity determination after 3 times rinsing. The sample bottles had a stopper as well as a screw lid. The salinity of water samples (SALNTY) was determined by means of an Guildline Autosal 8400B salinometer. The salinometer was installed in a laboratory container, fitted with an air conditioning system. This kept the surrounding air temperature constant within 1°C. Initially the salinometer suffered from electro-magnetically induced instability, but these problems were at least partially overcome. The source of the problems could not be located. Homeward bound we were able to complete the salinity measurements. The final calibration of the conductivity sensor, based on these samples, was completed before the end of the cruise.

From some deep CTD/rosette casts an extra duplicate sample was drawn. Salinity determinations from the duplicate samples obtained from independent runs are used to determine the reproducibility of the salinity determination.

3.5 Oxygen Measurements (D. Volkov)

For the oxygen determination water samples were drawn in volume calibrated 120 ml pyrex glass bottles. Before drawing the sample each bottle was flushed with at least 3 times its volume. When the samples were drawn the temperature of the sample was determined. The determination of the volumetric dissolved oxygen concentration of water samples was carried out by means of a spectro-photometer technique, recently developed at NIOZ. Before and after the cruise the spectro-photometer will be inter-calibrated with a automatic end point determination Winkler method. It appeared that the software used to calculate the oxygen concentration from the measurements contained a flaw. The final calculations will be done at NIOZ.

At each cast where samples for the oxygen determination were drawn, duplicate samples were drawn from the deepest water sampler in order to determine the precision of the analysis.

3.6 Nutrient and TIC Measurements (K. Bakker)

From al sampler bottles samples were drawn for the determination of the nutrients silica, nitrite, nitrate and phosphate as well as TIC. The samples were collected in polyethylene sample bottles after three times rinsing. The samples were stored dark and cool at 4°C.

Nutrients

All samples were analysed for the nutrients silicate, phosphate, nitrate and nitrite within 10 hours with an autoanalyzer based on colorimetry. The lab container was equipped with a Technicon TRAACS 800 auto-analyzer. The different nutrients were measured colorimetrical as described by Grashoff (1983). The samples, taken from the refrigerator, were directly poured into open polyethylene vials (6 ml) and put in the auto sampler-trays. A maximum of 60 samples in each run was analysed. The samples were not filtered before analysis.

The different nutrients were measured colorimetrical as described by Grashoff (1983);

* Silicate reacts with ammoniummolybdate to a yellow complex, after reduction with ascorbic acid the obtained blue silica-molybdenum complex was measured at 800nm (oxalic acid was used to prevent formation of the blue phosphate-molybdenum).
* Phosphate reacts with ammoniummolybdate at pH 1.0, and potassiumantimonyltartrate was used as an inhibitor. The yellow phosphate-molybdenum complex was reduced by ascorbic acid to blue and measured at 880nm.
* Nitrate was mixed with a buffer imidazole at pH 7.5 and reduced by a copperized-cadmium coil (efficiency> 98%) to nitrite, and measured as nitrite (see nitrite). The reduction-efficiency of the cadmium-column was measured in each run.
* Nitrite was diazotated with sulphanilamide and naftylethylenediamine to a pink coloured complex and measured at 550nm.
* The difference of the last two measurements gave the nitrate content

Standards were prepared by diluting stock solutions of the different nutrients in the same nutrient depleted surface ocean water as used for the baseline water. The standards were kept dark and cool in the same refrigerator as the samples. Standards were prepared fresh every two days. Each run of the system had a correlation coefficient for the standards off at least 0.9998. The samples were measured from the surface to the bottom to get the smallest possible carry-over-effects. In every run a mixed nutrient standard containing silicate, phosphate and nitrate in a constant and well known ratio, a so-called nutrient-cocktail, was measured in duplicate. This cocktail is used as a guide to check the performance of the analysis. The reduction-efficiency of the cadmium-column in the nitrate lane was measured in each run.

TIC

Total inorganic Carbon (TIC) was measured with a Technicon Traacs 800 rapid flow auto-analyzer. The sample rate was set at 45 samples per hour, measuring all the CTD-Rosette samples, approx. 800 samples in total. All measurements were calibrated with a stock solution of Sodiumcarbonate diluted to Dickson-seawater containing a well-known concentration of TIC. The method used is still in a test case and has to be improved to work proper on ships.

On a manifold the continuos sample or wash stream is acidified (pH below 1) before flowing over a dialyser. The dialyser contains a silicon membrane, separating the acidified sample-stream and the slightly alkaline coloured detection stream. In the sample stream the TIC is transferred to CO_2 and forced by the low pH to the other side of the membrane in the slightly alkaline stream. This alkaline detection stream is coloured purple with Phenolphtaleine, by reaction with CO_2 the pH drops and the solution will be de-coloured depending on the concentration of CO_2 passing the membrane. This absorbing of CO_2 is a kind of titration resulting in 2^{nd} order calibration curves. The colour is measured in a flow-cell at 550nm. Due to obtain better statistical values the method is chemically tuned for the field range from 2000 to 2300 μM.

The calibration standards were prepared fresh daily by diluting the TIC stock (200µM) using electronic pipettes with high reproducibility, into four calibrated volumetric flasks. The seawater used for diluting is the TIC standard seawater prepared by Dickson. Overall temperature to calculate from µmol/dm^3 to µmol/kg was 22°C. As a reference, aged seawater was poisoned with Mercurychloride to make it "biology stable" and during the cruise being bottled for coulometric titration at home to check for any drifts.

3.7 CTD Data Collection and Processing (R.X. de Koster, S. Ober)

For the data collection the Seasave software, produced by SBE, was used. The CTD data were recorded with a frequency of 24 data cycles per second. After each CTD cast the data were copied to a hard disk of the ship's computer network, and a daily back-up copy was made on tape.

On board the up-cast data files were sub-sampled to produce files with CTD data corresponding to each water sample, taken with the rosette sampler. The CTD data were processed with the preliminary calibration data, and reduced to 0.5 s average ASCII files, which were used for the preliminary analysis of the data. Full data processing with the final calibration values will be completed at NIOZ, Texel.

3.8 LADCP Data Collection and Processing (M.T.J. Hillebrand)

Current velocity and direction data from the entire water column were measured with two synchronized self-contained 300 kHz ADCP's mounted on the CTD frame. One of the two is downward looking, the other one upward-looking. Data collection takes place during the up and down cast of the CTD. The data are subsequently stored in solid state memory.

The LDACP data collections was started a few minutes before the deployments of the CTD and was stopped immediately after the CTD was back on deck. Then the data were transferred from the internal solid state memory to the dedicated service computers, and subsequently copied in the appropriate directory on the ships computer network.

A MATLAB master script file developed by Martin Visbeck, LDEO, version 4.0 Jan. 2000, has been used for data processing, data reduction and calculations of the current velocity and direction profiles. The master script file refers to several other sub-script files. Each of these sub-script files has a specific task controlled by the master script. Essential in the calculations are the correct input of start and stop times and start and stop positions of the CTD. The MATLAB programme plots the results of the measurements and calculations as well as several quality parameters. The content of the master script and the results of the water profile and bottom track calculations are also stored in three separate ASCII files.

Malfunctioning of one of the ADCP's during a CTD cast, even for a short period is the cause of unreliable and wrong velocity/direction profiles. In such a case a manual inspection of the data with the RDI programme BBlist provides adapted start/stop times. One of the problems that occurred was to find the corresponding times and positions in the CTD file. The problem was tackled by Ronald de Koster through the development of a programme that is able to search the CTD file for the desired times and generates corresponding positions and depth as output.

3.9 VMADCP Data Collection and Processing (S. Ober)

The VMADCP data were collected with a dedicated service computer, together with the appropriate navigational data and the data from the pitch and roll sensor. Daily these data were transferred to the appropriate directory of the ships computer network. Data processing will take place at NIOZ after the cruise. Effort was spent during the cruise on improving and extending quality control and de-spiking of the stored navigational data in the VMADCP files.

3.10 Plankton Net Processing (K. Peijnenburg, E. van Haastrecht)

Speciation in the marine environment is generally thought to be slow. However, genetic population structure (the blueprint for speciation) of marine organisms is not well understood. The aim of this project is to gain more insight into the population structure of planktonic organisms, in particular of chaetognaths. Chaetognaths are hermaphroditic carnivorous planktonic organisms, which feed mainly on copepods. Particularly we are interested to compare the genetic structure of two species of chaetognaths, *Sagitta setosa* and *S. elegans. S. setosa* has a disjunct distribution occurring in coastal areas of the North Sea, Mediterranean and Black Sea. *S. elegans* has a circum-Antarctic distribution, occurring in the North Atlantic and North Pacific.

Sagitta setosa was found in the North Sea, English Channel, Celtic Sea and Irish Sea (as expected). *S. elegans* was found in the Celtic Sea and the Irish Sea, but was not present in any of the North Atlantic samples. In the NorthEast Atlantic, at the start of the transect, *S. serratodentata* was present. In the western part of the section, especially in the Irminger Sea, we found *Eukrohnia hamata* and *Sagitta maxima. S. lyra* was found on two occasions along the section. Live and intact specimens were preserved individually in lysis buffer for future DNA-analyses in the lab. Damaged, parasitized or unidentified individuals were preserved in formalin (4%) for morphological studies. From most stations a complete plankton sample has been preserved in formalin.

3.11 Data Management (R.X. de Koster, J. Derksen, M. Hiehle)

All raw data were copied to a cruise directory on the network computer in different groups of sub-directories. Subsequent processed data, final products, documents and figures were copied to separate sub-directories within the cruise directory. Daily back ups were made on magnetic tape. At the end of the cruise copies of the whole cruise directory have been made on CD-ROM. By help of a range of measurement forms all data were tracked. A final overview of the hydrographic stations, water samples, and the available raw date was made in a cruise summary file and a water sample file.

4 Acknowledgements

The hydrographic research reported here is part of the NIOZ contribution to the Dutch CLIVAR programme (CLIVARNET). The plankton research is part of a PhD project by Katja Peijnenburg and a master's project by Eline van Haastrecht, carried out at the University of Amsterdam.

I thank the ships crew for their professional support and active participation in the preparation and execution of the CAMP programme. The contributions of the colleagues from the NIOZ department of Physical Oceanography and from the supporting engineering and administrative departments are highly acknowledged.

Appendix

Cruise summary list

CAMP 2000

Cruise Summary Pelagia cruise 64PE169

Cast types:	Event codes:		Parameters:
CTD ctd	BE	begin	1 salinity
ROS ctd-rosette	BO	bottom	2 oxygen
PNET planktonnet	EN	end	3-7 nutrients
			23 DIC

EXPOCODE	STNNBR	CASTNO	CAST TYPE	DATE	TIME	EVENT CODE	LATITUDE Deg	Min.	H	LONGITUDE Deg.	Min.	H	UNC. DEPTH	COMMENTS	CTD DATA file	LADCP DATA file
64PE169	001	01	PNET	26-Sep-2000	14:13	BE	52	39.90	N	004	06.25	E	24	FAILED		
64PE169	001	02	PNET	26-Sep-2000	14:19	BE	52	39.99	N	004	06.35	E	24			
64PE169	002	01	PNET	27-Sep-2000	13:04	BE	50	31.31	N	000	12.11	W	64			
64PE169	002	02	PNET	27-Sep-2000	13:16	BE	50	31.31	N	000	12.29	W	65			
64PE169	003	01	ROS	29-Sep-2000	07:12	BE	51	48.84	N	005	46.02	W				
64PE169	003	01	ROS	29-Sep-2000	07:15	BO	51	48.90	N	005	45.99	W	117	TEST		
64PE169	003	01	ROS	29-Sep-2000	07:27	EN	51	49.47	N	005	45.97	W				
64PE169	003	02	PNET	29-Sep-2000	07:36	BE	51	49.94	N	005	45.95	W	117			
64PE169	004	01	PNET	29-Sep-2000	17:10	BE	53	19.31	N	005	26.10	W	102			
64PE169	004	02	PNET	29-Sep-2000	17:22	BE	53	19.03	N	005	26.12	W	100			
64PE169	005	01	ROS	30-Sep-2000	16:29	BE	55	45.00	N	008	59.98	W				
64PE169	005	01	ROS	30-Sep-2000	16:32	BO	55	45.01	N	008	59.99	W	124	1-7, 23	P169051	C005
64PE169	005	01	ROS	30-Sep-2000	16:37	EN	55	45.00	N	008	59.96	W				
64PE169	005	02	PNET	30-Sep-2000	17:47	BE	55	44.97	N	009	00.00	W	124			
64PE169	006	01	CTD	30-Sep-2000	18:41	BE	55	49.00	N	009	25.97	W				
64PE169	006	01	CTD	30-Sep-2000	18:56	BO	55	48.97	N	009	25.98	W	824		P169061	C006
64PE169	006	01	CTD	30-Sep-2000	19:11	EN	55	48.91	N	009	25.93	W				
64PE169	007	01	ROS	30-Sep-2000	20:51	BE	55	53.03	N	009	51.09	W				
64PE169	007	01	ROS	30-Sep-2000	21:25	BO	55	52.89	N	009	51.24	W	1920	1-7, 23	P169071	C007
64PE169	007	01	ROS	30-Sep-2000	22:19	EN	55	52.78	N	009	51.85	W				
64PE169	008	01	ROS	01-Oct-2000	01:21	BE	56	01.97	N	010	43.03	W				
64PE169	008	01	ROS	01-Oct-2000	02:04	BO	56	01.82	N	010	43.25	W	2359	1-7, 23	P169081	C008
64PE169	008	01	ROS	01-Oct-2000	03:14	EN	56	01.75	N	010	43.55	W				
64PE169	009	01	ROS	01-Oct-2000	06:13	BE	56	09.04	N	011	30.05	W				
64PE169	009	01	ROS	01-Oct-2000	06:57	BO	56	09.34	N	011	29.81	W	2640	1-7, 23	P169091	C009
64PE169	009	01	ROS	01-Oct-2000	07:59	EN	56	09.80	N	011	29.55	W				
64PE169	009	02	PNET	01-Oct-2000	08:10	BE	56	09.93	N	011	29.60	W	2640	FAILED		

64PE169	009	03	PNET	01-Oct-2000	08:23	BE	56 10.08 N	011 29.60 W	2640		
64PE169	010	01	ROS	01-Oct-2000	14:32	BE	56 25.02 N	013 10.00 W			
64PE169	010	01	ROS	01-Oct-2000	15:13	BO	56 24.92 N	013 09.51 W	2393 1-7, 23	P169101	C010
64PE169	010	01	ROS	01-Oct-2000	16:20	EN	56 24.54 N	013 08.58 W			
64PE169	011	01	ROS	01-Oct-2000	18:20	BE	56 29.03 N	013 35.93 W			
64PE169	011	01	ROS	01-Oct-2000	18:54	BO	56 29.22 N	013 35.95 W	1924 1-7, 23	P169111	C011
64PE169	011	01	ROS	01-Oct-2000	19:42	EN	56 29.50 N	013 36.87 W			
64PE169	012	01	CTD	02-Oct-2000	09:13	BE	56 40.15 N	014 47.70 W			
64PE169	012	01	CTD	02-Oct-2000	09:16	BO	56 40.18 N	014 47.60 W	185	P169121	C012
64PE169	012	01	CTD	02-Oct-2000	09:20	EN	56 40.23 N	014 47.53 W			
64PE169	012	02	PNET	02-Oct-2000	09:28	BE	56 40.31 N	014 47.31 W	185 to 50 m		
64PE169	012	03	PNET	02-Oct-2000	09:40	BE	56 40.41 N	014 47.16 W	185 to 100 m		
64PE169	013	01	ROS	02-Oct-2000	13:52	BE	56 48.01 N	015 40.83 W			
64PE169	013	01	ROS	02-Oct-2000	14:04	BO	56 47.95 N	015 40.69 W	648 1-7, 23	P169131	C013
64PE169	013	01	ROS	02-Oct-2000	14:23	EN	56 47.82 N	015 40.56 W			
64PE169	014	01	ROS	02-Oct-2000	18:27	BE	56 58.01 N	016 31.97 W			
64PE169	014	01	ROS	02-Oct-2000	18:50	BO	56 57.96 N	016 31.99 W	1218 1-7, 23	P169141	C014
64PE169	014	01	ROS	02-Oct-2000	19:29	EN	56 58.02 N	016 31.98 W			
64PE169	015	01	PNET	02-Oct-2000	23:33	BE	57 05.94 N	017 26.84 W	1325		
64PE169	015	02	PNET	02-Oct-2000	23:47	BE	57 05.93 N	017 26.89 W	1325		
64PE169	015	03	ROS	03-Oct-2000	00:00	BE	57 05.88 N	017 26.93 W			
64PE169	015	03	ROS	03-Oct-2000	00:24	BO	57 05.79 N	017 27.04 W	1325 1-7, 23	P169153	C015
64PE169	015	03	ROS	03-Oct-2000	01:08	EN	57 05.79 N	017 27.05 W			
64PE169	016	01	ROS	03-Oct-2000	05:18	BE	57 14.00 N	018 21.91 W			
64PE169	016	01	ROS	03-Oct-2000	05:44	BO	57 14.15 N	018 21.74 W	1301 1-7, 23	P169161	C016
64PE169	016	01	ROS	03-Oct-2000	06:27	EN	57 14.38 N	018 21.45 W			
64PE169	017	01	ROS	03-Oct-2000	11:07	BE	57 21.99 N	019 15.17 W			
64PE169	017	01	ROS	03-Oct-2000	11:25	BO	57 21.97 N	019 15.98 W	992 1-7, 23	P169171	C017
64PE169	017	01	ROS	03-Oct-2000	11:54	EN	57 21.97 N	019 15.37 W			
64PE169	018	01	ROS	03-Oct-2000	17:14	BE	57 30.01 N	020 08.98 W			
64PE169	018	01	ROS	03-Oct-2000	17:37	BO	57 30.04 N	020 08.87 W	1319 1-7, 23	P169181	C018
64PE169	018	01	ROS	03-Oct-2000	18:15	EN	57 30.24 N	020 08.75 W			
64PE169	019	01	PNET	03-Oct-2000	20:35	BE	57 35.02 N	020 37.16 W	2166		
64PE169	019	02	ROS	03-Oct-2000	20:49	BE	57 34.98 N	020 37.25 W			
64PE169	019	02	ROS	03-Oct-2000	21:27	BO	57 35.19 N	020 37.41 W	2166 1-7, 23	P169192	C019
64PE169	019	02	ROS	03-Oct-2000	22:28	EN	57 35.60 N	020 37.84 W			
64PE169	020	01	PNET	04-Oct-2000	08:20	BE	57 37.01 N	021 02.63 W	2321		
64PE169	020	02	ROS	04-Oct-2000	08:35	BE	57 36.99 N	021 02.43 W			

64PE169	020	02	ROS	04-Oct-2000	09:16	BO	57	36.98 N	021	01.96 W	2311	1-7, 23	P169202	C020
64PE169	020	02	ROS	04-Oct-2000	10:10	EN	57	36.68 N	021	01.18 W				
64PE169	021	01	ROS	04-Oct-2000	13:34	BE	57	42.92 N	021	29.77 W				
64PE169	021	01	ROS	04-Oct-2000	14:25	BO	57	42.48 N	021	30.20 W	2670	1-7, 23	P169211	C021
64PE169	021	01	ROS	04-Oct-2000	15:29	EN	57	41.94 N	021	30.44 W				
64PE169	022	01	ROS	04-Oct-2000	18:31	BE	57	46.96 N	021	54.99 W				
64PE169	022	01	ROS	04-Oct-2000	19:29	BO	57	46.44 N	021	55.10 W	3061	1-7, 23	P169221	
64PE169	022	01	ROS	04-Oct-2000	20:52	EN	57	45.40 N	021	56.49 W			no LADCP	
64PE169	022	02	PNET	04-Oct-2000	21:04	BE	57	45.23 N	021	56.66 W	3061			
64PE169	023	01	ROS	05-Oct-2000	00:57	BE	57	54.96 N	022	48.69 W				
64PE169	023	01	ROS	05-Oct-2000	01:50	BO	57	54.91 N	022	48.99 W	3000	1-7, 23	P169231	C023
64PE169	023	01	ROS	05-Oct-2000	03:16	EN	57	55.14 N	022	48.94 W				
64PE169	024	01	ROS	05-Oct-2000	07:06	BE	58	04.06 N	023	45.01 W				
64PE169	024	01	ROS	05-Oct-2000	07:55	BO	58	04.66 N	023	45.04 W	2948	1-7, 23	P169241	C023
64PE169	024	01	ROS	05-Oct-2000	09:05	EN	58	05.23 N	023	45.98 W				
64PE169	024	02	PNET	05-Oct-2000	09:24	BE	58	05.29 N	023	46.09 W	2938			
64PE169	025	01	ROS	05-Oct-2000	12:53	BE	58	12.06 N	024	38.86 W				
64PE169	025	01	ROS	05-Oct-2000	13:41	BO	58	12.30 N	024	38.31 W	2795	1-7, 23	P169251	C025
64PE169	025	01	ROS	05-Oct-2000	14:43	EN	58	12.63 N	024	37.66 W				
64PE169	026	01	ROS	05-Oct-2000	18:07	BE	58	20.02 N	025	32.07 W				
64PE169	026	01	ROS	05-Oct-2000	18:54	BO	58	19.89 N	025	32.37 W	2785	1-7, 23	P169261	C026
64PE169	026	01	ROS	05-Oct-2000	20:08	EN	58	19.55 N	025	32.89 W				
64PE169	027	01	ROS	06-Oct-2000	00:23	BE	58	25.93 N	026	32.92 W				
64PE169	027	01	ROS	06-Oct-2000	01:09	BO	58	25.98 N	026	32.77 W	2663	1-7, 23	P169271	C027
64PE169	027	01	ROS	06-Oct-2000	02:24	EN	58	26.26 N	026	32.36 W				
64PE169	028	01	ROS	06-Oct-2000	06:04	BE	58	30.03 N	027	23.96 W				
64PE169	028	01	ROS	06-Oct-2000	06:48	BO	58	30.16 N	027	24.29 W	2224	1-7, 23	P169281	C028
64PE169	028	01	ROS	06-Oct-2000	07:54	EN	58	30.22 N	027	24.70 W				
64PE169	028	02	PNET	06-Oct-2000	08:08	BE	58	30.22 N	027	24.62 W	2224	failed		
64PE169	028	03	PNET	06-Oct-2000	08:30	BE	58	30.49 N	027	24.27 W	2224	to 200 m		
64PE169	029	01	ROS	06-Oct-2000	12:28	BE	58	34.99 N	028	19.89 W				
64PE169	029	01	ROS	06-Oct-2000	13:07	BO	58	34.98 N	028	19.58 W	2112	1-7, 23	P169291	C029
64PE169	029	01	ROS	06-Oct-2000	13:53	EN	58	34.94 N	028	19.45 W				
64PE169	030	01	ROS	06-Oct-2000	17:50	BE	58	41.02 N	029	14.01 W				
64PE169	030	01	ROS	06-Oct-2000	18:27	BO	58	40.99 N	029	13.94 W	2229	1-7, 23	P169301	C030
64PE169	030	01	ROS	06-Oct-2000	19:29	EN	58	40.73 N	029	13.73 W				
64PE169	031	01	ROS	06-Oct-2000	23:36	BE	58	44.99 N	030	11.89 W				
64PE169	031	01	ROS	07-Oct-2000	00:05	BO	58	44.98 N	030	11.63 W	1693	1-7, 23	P169311	C031

64PE169	031	01	ROS	07-Oct-2000	00:52	EN	58	44.99 N	030	11.55 W				
64PE169	032	01	ROS	07-Oct-2000	05:10	BE	58	50.98 N	031	06.91 W				
64PE169	032	01	ROS	07-Oct-2000	05:35	BO	58	50.83 N	031	06.68 W	1480	1-7, 23	P169321	C032
64PE169	032	01	ROS	07-Oct-2000	06:20	EN	58	50.37 N	031	06.84 W				
64PE169	033	01	ROS	07-Oct-2000	10:38	BE	58	56.05 N	032	01.23 W				
64PE169	033	01	ROS	07-Oct-2000	11:06	BO	58	56.15 N	032	01.50 W	1790	1-7, 23	P169331	C033
64PE169	033	01	ROS	07-Oct-2000	11:48	EN	58	56.31 N	032	01.30 W				
64PE169	034	01	ROS	08-Oct-2000	17:58	BE	59	11.99 N	034	55.97 W				
64PE169	034	01	ROS	08-Oct-2000	18:40	BO	59	11.77 N	034	56.20 W	2530	1-7, 23	P169341	C034
64PE169	034	01	ROS	08-Oct-2000	19:48	EN	59	11.05 N	034	56.97 W				
64PE169	034	02	PNET	08-Oct-2000	20:01	BE	59	10.90 N	034	57.27 W	2530			
64PE169	035	01	ROS	09-Oct-2000	00:17	BE	59	17.96 N	035	53.80 W				
64PE169	035	01	ROS	09-Oct-2000	01:12	BO	59	17.78 N	035	53.73 W	3117	1-7, 23	P169351	C035
64PE169	035	01	ROS	09-Oct-2000	02:35	EN	59	17.26 N	035	53.72 W				
64PE169	036	01	ROS	09-Oct-2000	06:31	BE	59	23.01 N	036	51.00 W				
64PE169	036	01	ROS	09-Oct-2000	07:27	BO	59	23.49 N	036	51.00 W	3127	1-7, 23	P169361	C036
64PE169	036	01	ROS	09-Oct-2000	08:45	EN	59	24.55 N	036	50.33 W				
64PE169	037	01	ROS	09-Oct-2000	12:21	BE	59	27.98 N	037	46.87 W				
64PE169	037	01	ROS	09-Oct-2000	13:16	BO	59	27.92 N	037	46.70 W	3142	1-7, 23	P169371	C037
64PE169	037	01	ROS	09-Oct-2000	14:26	EN	59	27.81 N	037	46.52 W				
64PE169	037	02	PNET	09-Oct-2000	14:38	BE	59	27.81 N	037	46.51 W	3142 to 200 m			
64PE169	038	01	ROS	09-Oct-2000	18:37	BE	59	34.09 N	038	46.89 W				
64PE169	038	01	ROS	09-Oct-2000	19:29	BO	59	34.20 N	038	46.32 W	2989	1-7, 23	P169381	C038
64PE169	038	01	ROS	09-Oct-2000	20:49	EN	59	33.76 N	038	45.83 W				
64PE169	039	01	ROS	10-Oct-2000	00:19	BE	59	40.01 N	039	44.99 W				
64PE169	039	01	ROS	10-Oct-2000	01:04	BO	59	40.04 N	039	44.69 W	2806	1-7, 23	P169391	C039
64PE169	039	01	ROS	10-Oct-2000	02:22	EN	59	40.10 N	039	44.24 W				
64PE169	040	01	ROS	10-Oct-2000	05:39	BE	59	44.98 N	040	44.03 W				
64PE169	040	01	ROS	10-Oct-2000	06:23	BO	59	44.69 N	040	44.61 W	2413	1-7, 23	P169401	C040
64PE169	040	01	ROS	10-Oct-2000	07:32	EN	59	44.23 N	040	44.95 W				
64PE169	040	02	PNET	10-Oct-2000	07:44	BE	59	44.15 N	040	45.03 W	2408			
64PE169	041	01	ROS	10-Oct-2000	11:18	BE	59	51.02 N	041	45.00 W				
64PE169	041	01	ROS	10-Oct-2000	11:52	BO	59	50.68 N	041	44.86 W	1846	1-7, 23	P169411	C041
64PE169	041	01	ROS	10-Oct-2000	12:36	EN	59	50.31 N	041	44.77 W				
64PE169	042	01	ROS	10-Oct-2000	14:21	BE	59	53.99 N	042	15.07 W				
64PE169	042	01	ROS	10-Oct-2000	14:29	BO	59	53.89 N	042	15.10 W	391	1-7, 23	P169421	C042
64PE169	042	01	ROS	10-Oct-2000	14:39	EN	59	53.84 N	042	15.13 W				
64PE169	043	01	ROS	10-Oct-2000	16:24	BE	59	56.97 N	042	45.02 W				

64PE169	043	01	ROS	10-Oct-2000	16:28	BO	59	56.89 N	042	45.13 W	193 1-7, 23	P169431	C043
64PE169	043	01	ROS	10-Oct-2000	16:36	EN	59	56.75 N	042	45.29 W			
64PE169	043	02	PNET	10-Oct-2000	16:50	BE	59	56.50 N	042	45.75 W	189 to 185 m		
64PE169	043	03	PNET	10-Oct-2000	17:13	BE	59	56.11 N	042	46.51 W	189 to 185 m		
64PE169	044	01	ROS	11-Oct-2000	23:32	BE	59	06.00 N	033	53.92 W			
64PE169	044	01	ROS	12-Oct-2000	00:16	BO	59	06.01 N	033	53.71 W	2512 1-7, 23	P169441	C044
64PE169	044	01	ROS	12-Oct-2000	01:21	EN	59	06.28 N	033	53.38 W			
64PE169	045	01	ROS	12-Oct-2000	04:15	BE	59	00.99 N	033	00.00 W			
64PE169	045	01	ROS	12-Oct-2000	04:53	BO	59	01.33 N	033	00.01 W	2298 1-7, 23	P169451	C045
64PE169	045	01	ROS	12-Oct-2000	05:54	EN	59	01.91 N	033	00.61 W			
64PE169	045	02	PNET	12-Oct-2000	06:08	BE	59	02.13 N	033	00.59 W	2341 to 200 m		
64PE169	046	01	PNET	16-Oct-2000	08:07	BE	58	41.18 N	006	00.70 W	123 to bottom		
64PE169	047	01	PNET	16-Oct-2000	16:37	BE	58	41.32 N	004	01.35 W	115 to bottom		
64PE169	047	02	PNET	16-Oct-2000	16:53	BE	58	41.24 N	004	01.53 W	114 to bottom		
64PE169	048	01	PNET	17-Oct-2000	06:32	BE	57	12.45 N	000	38.83 W	69 to bottom		
64PE169	049	01	PNET	17-Oct-2000	18:34	BE	55	39.78 N	001	41.25 E	75 to bottom		
64PE169	050	01	PNET	18-Oct-2000	06:20	BE	54	22.44 N	003	33.72 E	46 to bottom		