LORD NELSON: CRUISE LN684
21-28 January 2008

CRUISE REPORT

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Plymouth Marine Laboratory

SAMS

Newcastle University

H.M.S. Challenger under Sail, 1874.

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GALWAY-MAYO INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA NA GAILLIMHE-MAIGH EO

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The Challenger Society for Marine Science

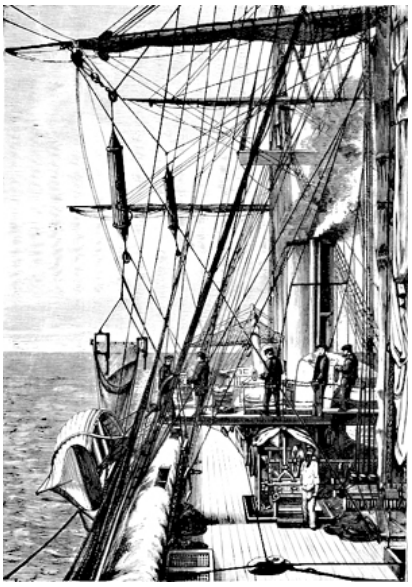
ENVISION

Acknowlegments

This cruise would not have been possible without the support and assistance of the following:

- The Challenger Society (especially the Hon. Sec.)
- The Jubilee Sailing Trust
- The Captain and Permanent Crew of the Lord Nelson
- The scientists who volunteered to take part
- The Voyage Crew

Further copies of this report may be obtained from the Chief Scientist (john.patching@nuigalway.ie)



HMS Challenger 1872-1876

Sampling from Tall Ships

STS Lord Nelson 2008

STS Lord Nelson Cruise LN684: Ships Complement

Permanent Crew:

Captain	Claire Cupples		
1st Mate	Neil Duncan	**Med. Purser**	Rachel Denton
2nd Mate	Roger Whitley	**Cook**	Dave Stanley
Bosun	Vernon Hocking	**Bosun's Mate 1**	Lesley Sale
Chief Engineer	Marco Michelagnoli	**Bosun's Mate 2**	Ellen Fenna
2nd Engineer	Paul Brent	**BM/Eng.**	Dave James
Supplementary OOW	Francis Kent	**Supplementary OOW**	Nicholette Gordon

Voyage Crew (by watch)

Forward Port
Ruth McGrath
Frank Attrill
Robert Morgan
Damien Guilhen
Johnathan Dean
Claire Roulston
Arlene Rowan
Susan Gebbles
Anna Davis

Forward Starboard
Peter Allin
Janet Townsend
Helen Stalker
Tamsin Smith
Judy Foster-Smith
Andrew Sewell
Jane Moore
Cynthia Harcombe
Eleutheria Du Breuil
Gary Caldwell

Aft Port
Donal O'Reilly
Cillian Roden
Mandy Fry
John Patching
Bill Brookes
Caroline Mc Grath
Katherine Crawfurd
Melinda Barham
Colin Nnadi

Aft Starboard
Ken Byatt
Christine Deardon
Carol Deaville
Nick Bigwood
Lesley Williams
Colm Moriarty
Hazel Farrell
Evelyn Keady
Sandra Lyons

CONTENTS **PAGE**

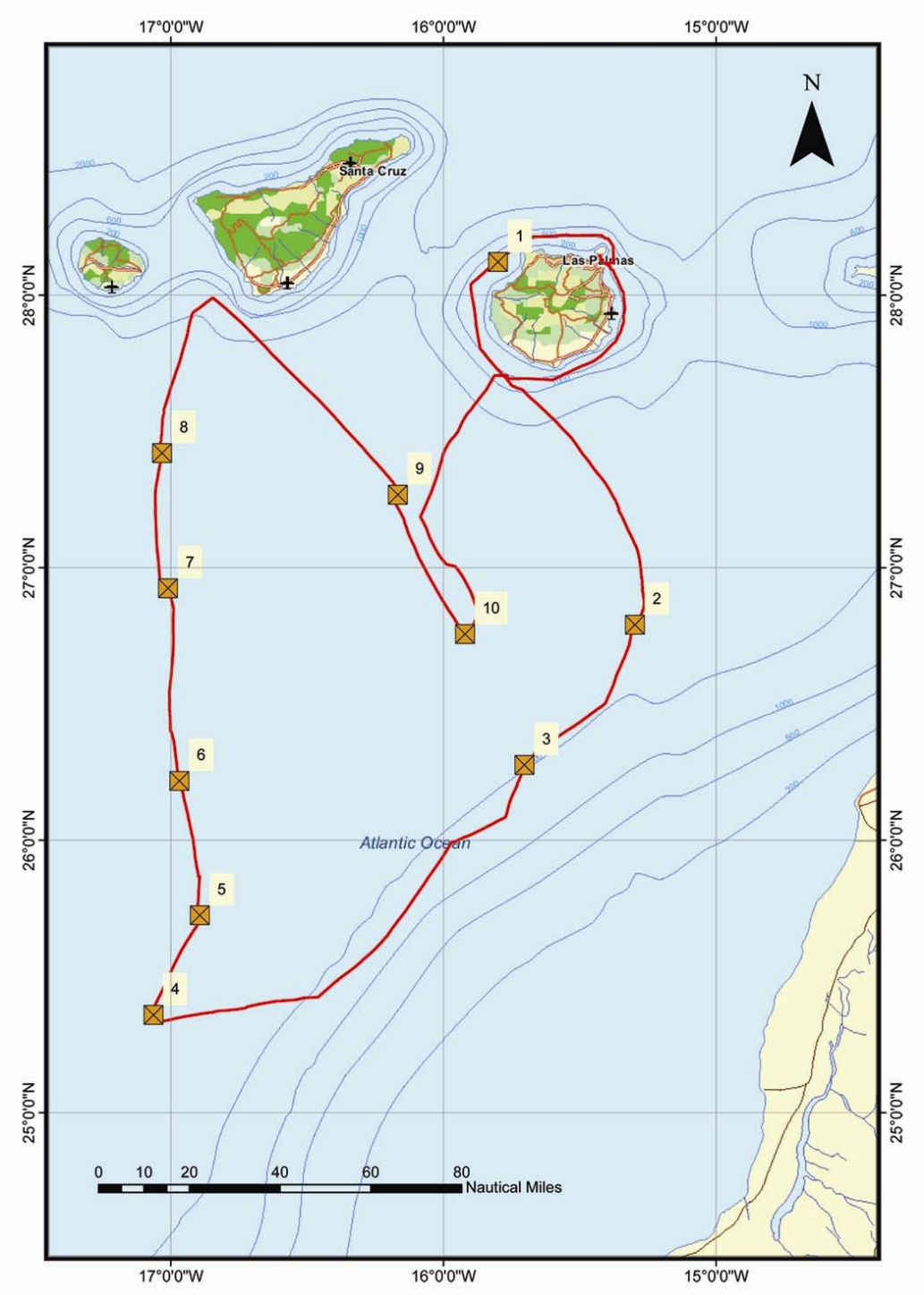


Figure 1: LN684 Cruise Track showing Locations of Stations (1-10)

Introduction and Objectives

Research vessels mirrored the commercial changeover from sail to power which occurred in the early 20th century, so that there are very few tall ships in the present global research fleet. A web search reveals only three vessels which could be said to fall into this category*.

In spite of the present situation, there is a growing interest in the use of tall ships for marine research. Sailing vessels offer the potential advantages of an "eco-friendly" method of propulsion with a minimal carbon footprint. Further, the quieter, vibration - free environment of a vessel under sail may be useful when attempting observations of marine mammals or working with optical or acoustic instrumentation etc. The use of tall ships for teaching teamwork and leadership skills is growing as are the numbers of those who enjoy sailing on them. A combination of educational and recreational uses and scientific research may act synergistically. The ambitious proposal of the UK-based Future Ship Project of the 21st Century shows how this could be achieved in a large custom-designed vessel, but there are immediate opportunities. Carrying out scientific research from sail training tall ships provides marine scientists a cheap and convenient method of carry out open ocean studies, offers "non –scientific" participants a chance to learn something of the marine ecosystem and how it is studied and allows operators to maximise the productive use of their vessels

Following discussions between the Challenger Society and The Jubilee Sailing Trust (JST) an announcement was made at the September 2007 meeting of the Society that there would be a one week scientific cruise on the tall ship STS Lord Nelson. Those interested in carrying out scientific research were asked to contact the society with their proposed scientific objectives. Thanks to the efforts of the Challenger Society's Honorary Secretary Rachel Shreeve arrangements were made for a team of scientific volunteers (Table 1) to participate in Lord Nelson Cruise LN 684 which was scheduled to sail from/to Las Palmas, Grand Canaria on January 21-27 2008.

The main scientific objectives of this cruise were:

- To investigate phytoplankton and zooplankton communities and stratification of the surface waters of the deep Atlantic in the area of the Canary Islands
- To study the response of natural phytoplankton communities to elevated levels of carbon dioxide.
- To carry out observations on cetacean distribution.
- To investigate the biological agents of methanogenesis in surface waters
- To observe the underwater acoustic characteristics of the ship's hull under different sail regimes

As well as these objectives if was intended that this cruise would investigate the logistics of carrying out scientific research under sail in tall ships.

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* The RV Oceania (http://www.iopan.gda.pl/oceania/oceania.html) is a 370T displacement, 49.9 m long research vessel owned by the Polish Academy of Science. It carries 3 single square rigged sails on 3 32m masts. The sails are raised and set by hydraulic winches.
The Sea Education Association, Woods Hole, USA (SEA: http://www.sea.edu/shipscrew/index.asp) operates two 280-300T displacement, 40.8m long brigantine rigged vessels, the SSV's Corwith Cramer and Robert C. Seamans. Though certified by the USCG as Sailing School Vessels, these were both designed for research.

Name	Affiliation*	Function
Prof. John Patching	MRI	Chief Scientist
Colm Moriarty	MRI	Technical Assistance
Dr.Cilian Roden	GMIT	Phytoplankton - Genus *Histioneis*
Hazel Farrell	MRI	Phytoplankton-Dinoflagellates/Coccolithophores
Sandra Lyons	MRI	Phytoplankton-Dinoflagellates/ Coccolithophores
Evelyn Keady	NDC	Phytoplankton-Dinoflagellates/ Coccolithophores
Damien Guihen	EOS	Temperature/salinity profiles, GIS
Katherine Crawfurd	PML	On deck phytoplankton incubations
Dr Gary Caldwell	NU	Zooplankton
Susan Gebbels	DML	Community outreach. Bird/Cetacean observations
Tamsin Smith	NU	Acoustics
Eleuthera du Breuil	NU	Acoustics/Zooplankton
Dr Judy Foster-Smith	EM	Cetacean observations
Dr Arlene Rowan	SAMS	Methanogenisis in the pelagos

Table 1: Scientists recruited by the Challenger Society to participate in Cruise LN684

*Abbreviations: MRI – Martin Ryan Institute, National University of Ireland, Galway, Ireland; GMIT – Galway Mayo Institute of Technology, Galway. Ireland; NDC – National Diagnostics Centre, National University of Ireland. Galway. Ireland; IOS – Earth and Ocean Sciences, National University of Ireland, Galway. Ireland; PML – Plymouth Marine Laboratory, UK; DML - Dove Marine Laboratory, Newcastle University, Cullercoats, Tyne and Wear, NE30 4PZ, UK; NU – School of Marine Science and Technology, Newcastle University, UK; EM - Envision Mapping Ltd., Horsley, Northumberland, UK; SAMS – Scottish Association for Marine Science, Dunstaffnage, Scotland.

Narrative

See also Cruise Track (Page 2:Fig 1) and Station List (Appendix 1).
All times GMT. All courses are true (Gyro Compass)

Monday January 21st

Lord Nelson was moored at Santa Catalina East, Porto de la Luz, Las Palmas. The voyage crew embarked at 16:00-18:00 and were given general and scientific briefings. A case of scientific equipment for the on-deck incubations had not arrived (held up in Madrid). An alternative vacuum pump for this work was sourced by the mate from equipment on board (a hand-drill-driven centrifugal pump). Scientific and personal gear was stowed and the combination microscope/digital camera system was set up in the midships on-deck disabled heads.

Tuesday January 22nd

A safety briefing and going aloft practice were carried out. Lord Nelson set off under power at 12:30. Full watches were commenced by the voyage crew. A shakedown station (1) consisting of vertical plankton hauls was worked at 17:20 in shallow water (100m) near to the NW coast of Grand Canaria. Full sails were set at watch changeover (24:00: Position 27°32'0 N 15°35'1W) on a fine clear night with wind ENE Force 2-3. Course set at 125°.

Wednesday January 23rd

Continued under sail with the course changing to 160° by 08:00 as the wind (initially force 5 decreasing to 3 to 4) veered to E. All hands were called to bracing stations at 08:30. The ship was hove to (main course handed and mainsails backed) and ready to work station 2 by 09:00.As well as a full suite of CTD/plankton hauls, surface water was collected by bucket and used to set up on-deck incubations (see Page 21), and a spare phytoplankton net was towed through the surface waters by the ship's drift in order to take a qualitative sample. The station was left at 10:00 and the ship's course set at 195°. Several groups of cetaceans were spotted and logged during the course of the afternoon. The wind remained at force 3 to 4 and continued to veer to the SSE, necessitating course changes to 225° by 16:15 when the ship hove to for station 3 (CTD/plankton hauls). In this instance the foresails were backed and the course handed. This was found to result in decreased sideways drift and was thus adopted for all further stations worked under square sails. Several whales were spotted in the vicinity. One appeared very near to haul 3#4 as it approached the surface. On recovery the net traces were found to be damaged and twisted; we presume due to whale activity. The station was left at 17:22 (course 190°) as the wind backed to the NE . At 19:30 a ship 30nm ahead reported a small craft potentially prepared to engage in piracy. At 20:30 the Lord Nelson was locked down, anti-piracy measures instituted and the course changed to 240° to avoid contact. At 22:00 the course was changed to 210° (wind force 3 to 4 ENE veering to E) and Lord Nelson assisted the Las Palmas search and rescue service in locating the small craft which contained illegal immigrants and was drifting.

Thursday January 24th

The day commenced with the wind from the E force 4 to 5 and increasing cloud cover. At 04:00 the course was changed to 260°.Station 4 was reached by 08:50 and the ship hove to on the starboard tack. Recovery of gear at this station was carried out by use of the powered capstans rather than by manual hauling. This proved successful and was adopted for all future stations. Following a full set of CTD/plankton hauls, the yards were braced and sailing recommenced, close hauled on the starboard tack (course: 040°). From 15:30 a "show and tell" session was organised by the zooplankton and phytoplankton groups. Microscopes were set up on deck and in the mess and bar areas and the ship's complement was invited to observe samples and ask questions. Station 5 (CTD/plankton hauls) was worked from 16:00 to 17:30 after which a course for Tenerife was set (015°). The wind decreased to force 3 but backed to ENE, necessitating a course change to 355°. Distant thunderstorms were observed before the ship hove to on Station 6 at 23:35. A line test of a "budget price" strobe light was carried out in conjunction with sampling at this station. Its case integrity appeared to be maintained at depths to 200m (WO) but the strobe ceased functioning, possibly because of a loss of battery power.

Friday January 25th

Work on Station 6 (CTD/plankton hauls) was completed and sailing recommenced at 01:00 on a course of 010o (later 015o), with a reduction of sail (the royals were handed) at 04:00. The wind was initially ENE force 5 but veered to E by N and moderated to force 4 by 08:50 when the ship hove to for Station 7 (CTD/plankton hauls) Sailing continued (course 015°) under clear skies with an E by N wind (force 4) and moderate to low sea and swell. A further "show and tell" session was organised for those crew members who had been unavailable on the previous day. Station 8 (CTD/Plankton hauls) was occupied and worked (16:10 to 17:10). Several Portugese men o'war and medusae were observed in the water at this station. At this point the ship was approximately 50nm south of the sound between Gomera and Tenerife, and sailing continued towards Tenerife as the wind permitted (Mainly E force 3 to 4 moderating Force 2 to 3)

Saturday January 26th

At 00:15 with the ship approximately 10nm west of the most southern. point of Tenerife, all square sails were handed and the voyage continued in a south easterly direction (135°) under power. At 09:00 the ship hove to (head to a wind of force 4 E by S) for station 9 under power and fore and aft sails by backing the jib and initially running the starboard engine at tickover forward. Station keeping proved difficult to control with occasional drifting astern which was controlled by engine use. CTD/plankton hauls were carried out and the ship left station at 10:00 under power on a course of 150°. (winds generally from an easterly direction, increasing to force 6). The final station of this cruise (station 10) was worked from 16:25 to 17:40. As well as CTD/Plankton hauls, a successful test deployment of a messenger-triggered Niskin 2L water sampler was carried out to a depth of approximately 100m (WO) using 6mm braided polypropylene rope unwound directly from the manufacturer's drum (not a recommended practice!). Station keeping was achieved in a similar fashion to station 9 but by making small changes in sail trim and the use of engines (both dead slow ahead) good station keeping (sideways drift of <1kn)was achieved in spite of an initial

force 6 easterly wind. After station 10, all sails were set and the ship proceeded on a course of 350^{o}, with the wind decreasing to force 3 and backing to the NE.

Sunday January 27th

All square sails were handed at change of watch (00:00) and a course set under power for Grand Canaria, finally docking at Porto de la Luz (Muelle Grande) at 16:30. A scientific debriefing was then held. Voyage crew signed off and demobilised with luggage and equipment on Monday January 28th.

Gear and Topic Reports

Physical Oceanography

Damien Guihen*

Methods: A Seabird Electronics 37-IM MicroCAT was attached to the sampling net cable, just above the net. The MicroCAT measured temperature, conductivity and pressure at a rate of one sample every five seconds, the unit's lowest achievable interval.
The pressure measurements were used to indicate the true depth of each deployment. The maximum depth achieved was 189 metres. Due to water currents and the constant movement of the vessel, most casts reached between 140 and 160 metres depth on 200 metres of cable.
Salinity was calculated using the polynomial fit of Perkins and Lewis, IEEE journal of Oceanic Engineering, vol OE.5(1),1980 with temperature, conductivity and pressure. Density was calculated using the Fofonoff and Millard method with salinity and temperature.

Initial Results: Sea surface temperatures varied little with the highest surface temperature at station 5 (20.055 ^{0}C) and the lowest at station 2 (19.001 ^{0}C) . The mean sea surface temperature was 19.7 ^{0}C with station 2 being considerably cooler than the others (Figure 2).

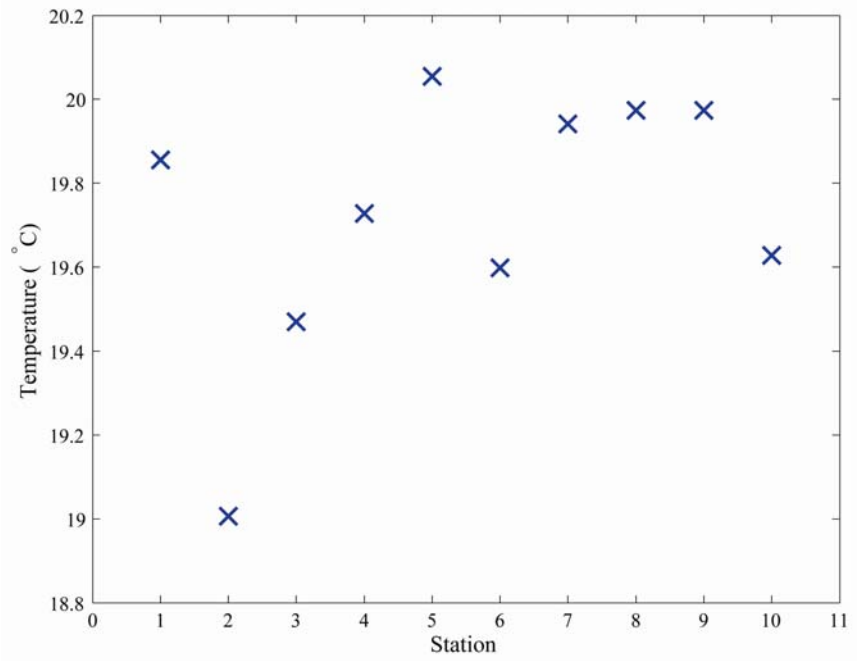

Figure 2. Sea surface temperature at each station.

* Earth and Ocean Sciences, National University of Ireland, Galway, Ireland

The profiles for each station are shown in Appendix 2. Initial results show that the upper surface is well mixed with very stable temperature and salinity profiles. Between 90 and 110 metres, most of the profiles experience a decrease in temperature and salinity. The stabilization of the water column is not seen even at the deepest sampled depths, in which case the change is occurring over 60 metres. It is likely that this is an effect of upwelling along the Moroccan coast. The deepest discontinuity is seen at station 4 which is the furthest from any land. Stations closer to both the African margin and the Canary islands exhibit a shallower and shallower discontinuity. This indicates that the depth of the discontinuity is largely topographically controlled .

Further work: At stations such as 8 and 9, there is a large degree of fluctuation in values of both temperature and salinity (and consequently density) at depth below 130 metres (station 8) and 115 metres (station 9). Stations 8 and 9 were the closest to land, excluding station 1 which did not sample below 45 metres. It should also be noted that station 9, which shows the larges variance, consisted of five deployments of the MicroCAT and took the longest time during which the vessel would have travelled a couple of nautical miles. Further work should break up the stations into individual dives and georeference these, using the onboard timing of the MicroCAT against the GPS track log. This will provide fewer fluctuations in the profiles and potentially increase the geospatial coverage of temperature and salinity.

Acoustic investigation of hull hydrodynamics under different sail regimes

Tamsin Smith*,

Description of acoustic equipment: The acoustic study on this cruise was carried out using a *DolphinEAR* 7Hz-22000Hz omnidirectional hydrophone. At each station (except station 6) the hydrophone was deployed for 2 minute intervals at the bow, stern and port and starboard mid-ships whilst the ship was hove to. Acoustic sampling was attempted when under way, but the drag on the small hydrophone prevented it from sinking to depth. On station the hydrophone was kept at 1-2m depth by three shackles that remained attached to it throughout the cruise in order to ensure a relatively constant background noise (which will be computationally removed for analysis). The weight of the shackles was taken by a rope to which the hydrophone cable was attached with cable ties. This enabled the lowering and hauling of the hydrophone to be done by two people and reduced damage to the hydrophone cable. The hydrophone sound data was recorded on a *Sanyo* compact cassette recorder to be downloaded into the analytical software at a later date.

Initial results: It was found that the location of the water pumps (which turned on and off intermittently) and generators at mid-ships produced an extremely high level of background noise. The *STS Lord Nelson* has two 200HP Mitzubishi (V8) engines with an inward turning outboard (no bow thrusters) which produces a very large amount of background noise from the stern of the boat when under engine. Under sail

* School of Marine Science and Technology, Newcastle University, NE1 7RU. UK

the stern provided a perfect platform for acoustic sounding, but other scientific equipment had to be hauled out of the water before acoustic listening could commence. In this way the stern of a research tall ship could quickly become over crowded with modern scientific equipment, so the use of a towed hydrophone should be considered from a mid-ship arm.

A difference was found between the background noise at the port and starboard mid-ships. This seemed to correlate with the tack of the ship (which side of the ship the wind was on), where a lower ambient noise was generally found on the leeward side. This would be due to ship heeling as well as leeward drift producing turbulence on the windward side of the hull. Setting a larger number of sails reduced this difference, possibly due to the greater stability (caused by the larger sail area) which acted to counteract the ship's heel. The bow of the tall ship produced the lowest level of background noise and a future tall ship designed specifically for ocean science could have a hydrophone built into the bow design.

Hydrophone data will be analysed using spectrographic software so that quantitative differences in background noise at port and starboard mid-ships, on different tacks and with different sail area, can be described.

Acknowledgements: I am particularly grateful to Eleuthera du Breuil, Roger Whitley and other cruise members who assisted with lowering and hauling the hydrophone and untangling ropes during the cruise. I am also grateful to the *STS Lord Nelson* crew who allowed us to work off the bow sprit and patiently remained hove-to for two extra minutes at each station to allow stern measurements to be taken.

Phytoplankton

Killian Roden[1], Hazel Farrell[2], Sandra Lyons[2] and Evelyn Keady[3]

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Phytoplankton net samples were collected from all ten stations occupied . At all stations except station 1, nominal 50m depth and 200m depth vertical hauls were made using a 30µm net. Samples were divided and preserved in lugol's iodine or neutralized formalin. Live samples were examined on board, at X 10 and X 40 using both an Olympus laboratory microscope and a Swift portable microscope.
At station 10 a water bottle sample was taken at 50m depth and a sub sample was preserved in 4% neutralized formalin and counted on shore using a Nikon inverted microscope.

Initial results

The distribution of biomass: Net hauls do not provide accurate information on phytoplankton abundance, but hauls made through a diatom bloom are easily distinguished from hauls made in more biomass poor water. Judging by net hauls, diatom blooms were present at stations 3, 6 and 8, while little plankton was taken at stations 2, 9 and 10. The remaining stations show intermediate quantities of diatoms.

[1] Mayo Institute of Technology, Galway. Ireland
[2] Martin Ryan Institute, National University of Ireland, Galway, Ireland
[3] National Diagnostics Centre, National University of Ireland. Galway. Ireland

Figure 3 shows approximate station positions superimposed on an ocean color image of the cruise area for 17-24/1/2008.The very patchy distribution of chlorophyll or phytoplankton biomass shown in this figure reflects the differing quantities of plankton taken at each station. To an extent the low biomass stations (2, 9, 10) can be matched to areas of low chlorophyll shown in figure 3 , but further work would be required to demonstrate a correlation between the two types of data.
The single water bottle sample (from station 10) when counted gave a diatom and dinoflagellate cell density of less than 10,000 cells per litre, which also indicates the comparatively low biomass at this station.

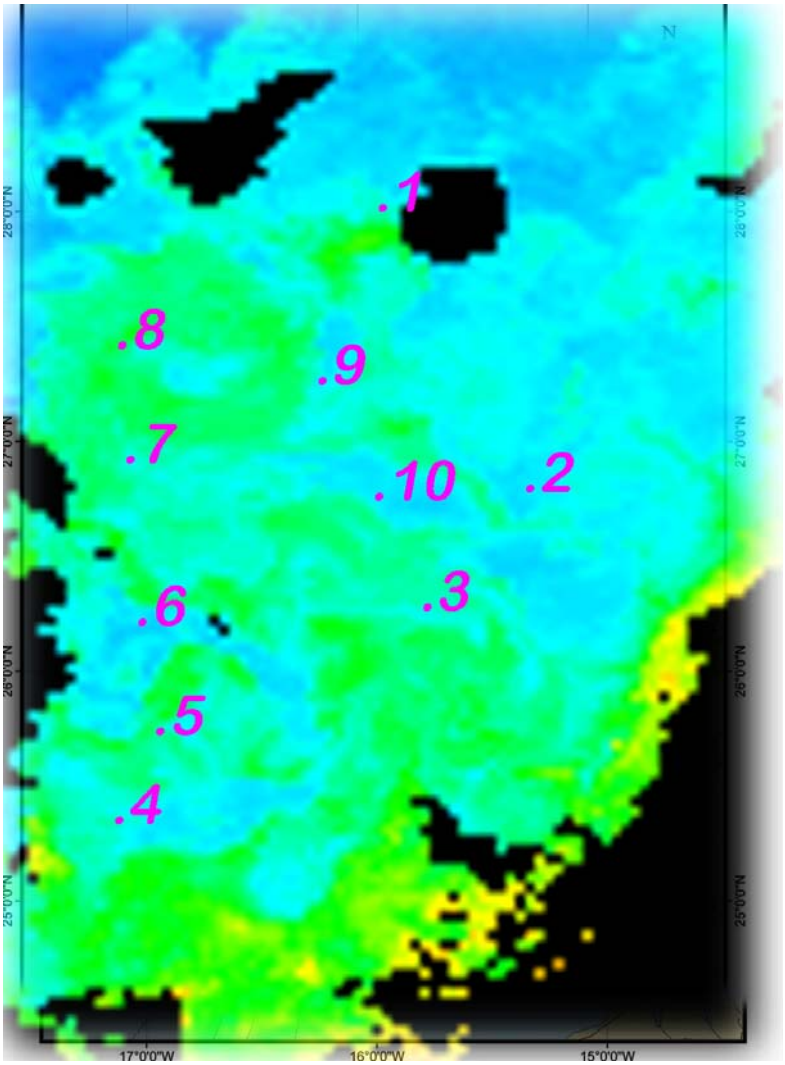

Figure 3. LN684 stations superimposed on the ocean color chlorophyll image for the week 17-24/01/2008.

Species present: All samples have been examined and preliminary lists made of certain dinoflagellate genera (*Amphisolenia, Ceratium, Dinophysis, Histioneis, Ornithocercus, Podolampas*). Table 2 shows species number per genus at each station.

Station	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Amphisolenia	1			1	1	1		1	1	1
Ceratium	11	17	12	15	16	14	15	15	11	20
Dinophysis	6	6	7	6	8	4	8	5	2	8
Histioneis	2	1		1	1		1		1	1
Ornithocercus	1	4		2	3	3	2	1	3	1
Podolampas	2	3	2	3	3	1	2	2	2	3
Total species no.	23	31	21	28	32	23	28	24	20	34

Table 2: Species number of selected dinoflagellate genera at each station.

A species list (incomplete) is provided in Table 3 and a more detailed station by station description may be found in Appendix 3.

Amphisolenia thrinax	*Dinophysis acuminata*
A.bidentata	*D. acuta*
Ceratium arietinum	*D. caudata*
C. azoricum	*D. dens*
C. belone	*D. hastata*
C. breve	*D. mucronata*
C. candelabrum	*D. nasutum*
C. cf. *falcatum*	*D. ovum*
C. extensum	*D. porodictum*
C. furca	*D. pulchella*
C. fusus	*D. rapa*
C. geniculatum	*D. rotundata*
C. gravidum	*D. rotundatum*
C. hexacanthum	*D. tripos*
C. horridum	*Histioneis depressa*
C. inflatum	*H. pulchra*
C. lineatum	*H. hippoperoides*
C. longirostrum	*Histioneis sp.*
C. longissimum	*Kofoidinium sp.*
C. macroceros	*Noctiluca scintillans*
C. massiliense	*Ornithocercus magnificus*
C. minutum	*O. steinii*
C. pentagonum	*O. splendidus*
C. setaceum	*O. heteroporus*
C. symmetricum	*O. quadratus*
C. teres	*Oxytoxum* sp.
C. trichoceros	*Parahistioneis sp.*
C. tripos	*Podolampas bipes*
Ceratocorys horrida.	*P. elgans*
Ceratocorys spp.	*P. palmipes*
Ceratoperidinium sp.	*Phalacroma favus*

Table 3: Partial list of dinoflagellate species collected at stations 1-10.

As might be expected in sub-tropical waters, species diversity is high, however combined counts of all *Histioneis* and *Ornithocercus* species in 5 ml sub samples of each net haul never exceeded 25 individuals, suggesting an extremely low standing crop for many of the species present.

Discussion: The data obtained during the cruise present a good qualitative picture of the phytoplankton in the study area. The main features include a wide diversity of species, both of diatoms, dinoflagellates, the larger coccolithophorids and cyanobacteria (*Trichodesmium* sp.). Variations between stations in species composition suggest a large degree of patchiness possibly due to variations in upwelling along the nearby Moroccan coast. (Longhurst, A. 1998 *Ecological Geography of the Sea*, Academic Press, San Diego).
The *Lord Nelson* proved to be a suitable working platform for phytoplankton sampling both with nets and at one station using a water bottle. We also showed that preliminary examination-including photography (see figure 4)- of the samples on board was possible using either a standard desk microscope or a portable hand held instrument. Perhaps the greatest advantage of the LN for phytoplankton work is that it permitted scientists and other crew to study living material collected in comparatively remote waters without the need for a full equipped oceanographic research vessel. However due to the necessity of watch keeping and other duties, this opportunity was not fully exploited . In future cruises, some provision for a system of scientific watches would ensure that the collected material was also routinely examined when it is of greatest value, that is when it is still alive.
. Since the time of Ernst Haeckel (1834-1919), if not even earlier, the visual beauty of the plankton has been widely recognized. While not easily incorporated into modern ecology, this beauty is an entry point into marine biology and as such is invaluable for public appreciation of marine science. Along with whale and bird studies, plankton sampling and examination can provide an attractive activity on marine education cruises. Cruise LN684 has demonstrated that useful plankton studies, education and sail training can be combined in a very successful manner.

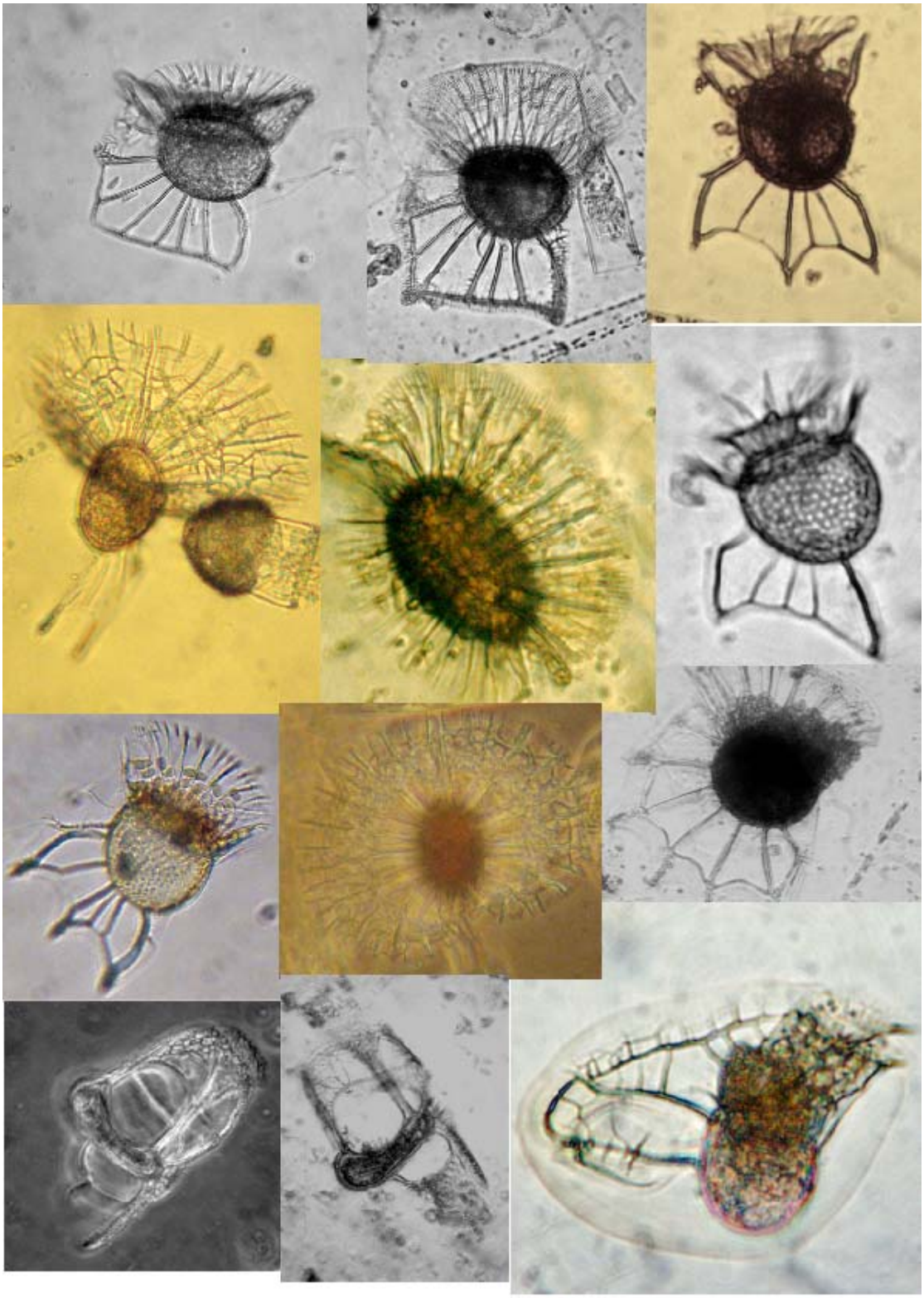

Figure 3: *Ornithocercus* and *Histioneis* species from Cruise LN684.
Row 1 (left to right), *O.quadratus* with cyanobacteria attached to sulcal list, *O.quadratus*, *O.magnificus*. Row 2 *O.splendidus*, showing large cingular lists, *O. quadratus* cingular lists with symbiotic cyanobacteria, *O.heteroporus*. Row 3, *O. magnificus*, living material from station 2, photographed using a Swift portable microscope at X 100, *O. splendidus* cingular list, *O. steini*..Row 4, *Histioneis sp*., *H. pulchra*, *H. hippoperoides*-note cyanobacteria in chamber above reddish cell body.

Zooplankton

Gary Caldwell*

Background: The drifting organisms that inhabit the pelagic realm of the oceans are referred to as the plankton. Plankton is broadly divided into two categories, the phytoplankton (photosynthetic organisms) and the zooplankton (the animal component). Marine plankton plays a vital role in food webs and in the cycling of chemical elements in the sea. Zooplankton is composed of an enormous variety of taxonomic groupings including animals that spend their entire lifecycle as plankton (holoplankton) and those that only spend a portion of their lifecycles in the plankton (meroplankton). Such high biodiversity, combined with the fact that the local abundance of plankton varies horizontally, vertically and seasonally, represents a distinct challenge when researching zooplankton communities and dynamics.

Methods: Zooplankton were collected by vertically hauling nets of 200 µm mesh size with mouth diameters of 50 and 40 cm, recovered either manually (stations 1-4) or mechanically using the forward capstan (stations 5-10). The 50 cm net was used for stations 1-3 and the 40 cm net for subsequent stations. The first net was damaged on recovery at station 3 and deemed unsafe to use. Two hauls were taken at stations 2-4 with a single haul at all other stations. The nets were deployed from the stern platform. 200 m of rope was paid out (apart from station 1); however due to drag from the current and ship motion the 200 m depth was never achieved. Station 1 was limited to 50 m. A single sample was taken at night to determine whether any pattern of nocturnal diel vertical migration could be determined. Upon recovery, the nets were rinsed through with seawater and the sample collected in a bucket for visual analysis using a stereo dissecting microscope. Where appropriate, individual zooplankers were isolated and photographed using a hand held digital camera fitted with a macro lens. The samples were split in two and fixed in ethanol for identification at a later date.

Preliminary observations: Figure 5 shows examples of the material which was retrieved. Copepods were the dominant metazoan group, with small calanoids most frequently encountered. A number of larger calanoids were collected including several *Calocalanus* sp. As expected, the gelatinous zooplankton were not adequately represented in the hauls due to their extreme delicacy and would have been destroyed by the net. Larval stages were also well represented within the hauls and covered a wide range of taxa. The ichthyoplankton was also poorly sampled. Captured specimens included a larval stage of an unidentified mesopelagic fish.

Acknowledgements:I am indebted to Dr Arlene Rowan for sharing facilities and samples; Claire Roulston for photography; and all who graciously and selflessly helped retrieve the nets

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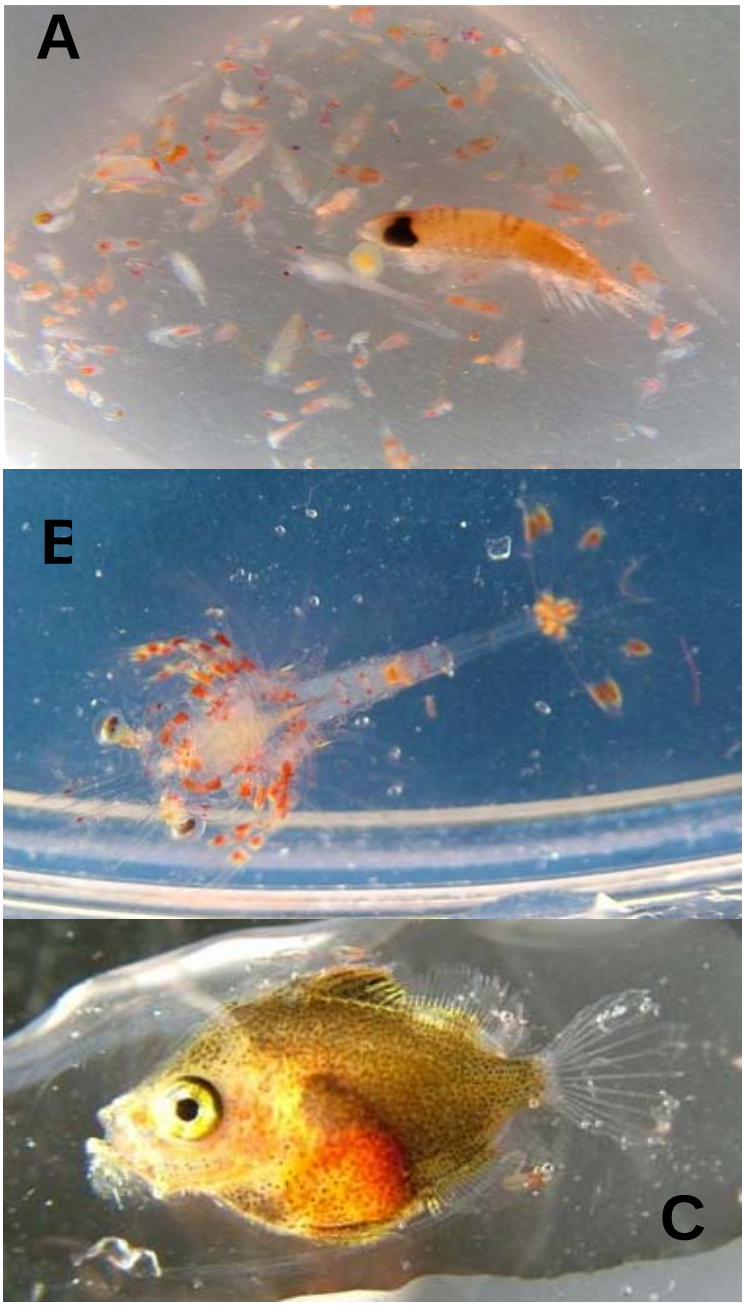

Figure 5: Zooplankton samples
A) Typical zooplankton sample dominated by small calanoid copepods and various larval stages, B) Protozoeal larva of unidentified decapod
C) Unidentified fish larva.
Photos courtesy of Claire Roulston**.**

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Cetaceans

Dr Judy Foster-Smith*

Background: Our knowledge of cetaceans (whales and dolphins) relies on observations at sea. In recent years there has been increased interest in these animals, largely driven by recognition of the need to protect them from being hunted, from pollution and from being accidentally killed in fishing gear. A growing number of organisations, such as the European Cetacean Society (www.europeancetaceansociety.eu/ecs/), the Seawatch Foundation (www.seawatchfoundation.org.uk), and the Whale and Dolphin Conservation Society (www.wdcs.org) have produced cetacean recording schemes and are keen to obtain sighting data to add to their information base and to improve understanding of these marine mammals.

The sea area surrounding the Canary Islands is important for cetaceans, with at least 21 species having been recorded in the region (Ritter, 2001). Some species, such as short-finned pilot whales, are known to be resident in the area, whilst others, such as humpback whales, pass through the region on their migrations to and from feeding or breeding grounds at different times of the year. However, much more needs to be known about them in this locality.

The Lord Nelson 'Scientific Cruise' presented an ideal opportunity to pursue certain objectives relating to cetacean monitoring. Firstly, to provide more information on cetacean biology (distribution, behaviour etc.) in the region of the Canary islands; secondly, to provide a particular educational aspect to the voyage, enabling voyagers to become involved in the data collecting process and in doing so, to become more aware of the ecology of this fascinating group of marine organisms, and, in addition, to assess the feasibility of carrying out this type of research from a square-rigger.

Methods: The Seawatch Foundation recording forms, readily available online, were felt to be especially appropriate for the purposes of the Lord Nelson voyage. Both of the available 'vessel-based' recording forms were used: one on which to record 'search effort' (Appendix 3A), and one on which to record actual sightings of dolphins or whales (Appendix 3B). As pointed out on the Seawatch Foundation website, it is equally important to document 'no-sighting' data as it is to record actual sightings of cetaceans. If an area has been thoroughly searched and no sightings have been made then that tells us something too. Hence the need to document 'search effort'.

As part of the standard running of the ship, the voyage crew had already been organised into different watches to provide continuous 'look-out' from the bridge. This provided a perfect opportunity to carry out continuous (day-time and night-time) cetacean watching. At the start of the voyage, the voyage crew were briefed on how to record the information, using the forms provided, and they were shown short video clips of some of the species that were expected to be seen in the area. Some literature was also provided (see reference list) for species identification purposes. Everyone was also invited to participate by taking photographs of any cetaceans that were observed. (As it is not always easy to recognise the animals, particularly if they

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emerge only momentarily, then photographs can be of critical use in helping to identify the species). Each watch allocated one or two of its team to be responsible for documenting (a) the data 'log' on a half-hourly basis, in the case of the 'search effort' recording and (b) details of any sightings. Searches were made by regularly scanning the sea area by eye, and also by using 10 x 40 waterproof binoculars. Position data were later (post-voyage) processed and presented spatially using MapInfo™ software.

Results: The objectives for this part of the scientific cruise were successfully achieved. A considerable amount of data were gathered, including 19 sightings of cetaceans or of their 'blows' (i.e. spouting of seawater from their blowholes) and, also, much educational progress was made: at least, by the end of the voyage, everyone on board knew what was meant by the word 'cetacean' (a very good start!). Voyagers were extremely diligent in making their records. The 'search effort' log information (i.e. position, speed and course of vessel, sea condition, visibility and any presence of other vessels) was documented at approximately half-hourly intervals for virtually the whole of the voyage. It was only during time of 'heaving to', when the vessel was changing course or preparing for a sampling session and watch members were tending the rigging, that recording was more infrequent. Such frequent recording of log data enabled a 'track' of the voyage route, indicating the 'search effort' area, to be produced (Figure 6).
Details of any sightings were also accurately noted. Four different species were recorded during the voyage: short-finned pilot whales (which were spotted by a sharp-eyed voyager, even before the formal recording began, during the first evening meal. This caused general havoc in the mess as the keenest cetacean watchers scrambled across tables and stepped into puddings in a bid to get the best view of the beasts!); minke whales, common dolphins and a single porpoise. The former two species were observed during daylight, the latter two at night. Fortunately, the cruise occurred during a period of full moon and this helped the night-time watches enormously. Minke whales were the most commonly recorded species, having been sighted on 9 separate occasions. In addition, characteristic minke 'blows' were seen on 7 occasions. Each of the other three species was seen only once.
The positions at which the sightings were made were spread throughout the voyage route and were not confined to any localised area (Figure 5). Interestingly, however, a cluster of 6 sightings of minke whales and 3 'blows' (which were most likely to be minke) (see inset in Figure 6) occurred in a small area due south of Gran Canaria. This coincided with a region where the shallow continental shelf of the African coast drops away sharply into deep (3,000m +) water (Figure 7) and which is, presumably, therefore, a region of up-welling and good feeding grounds.

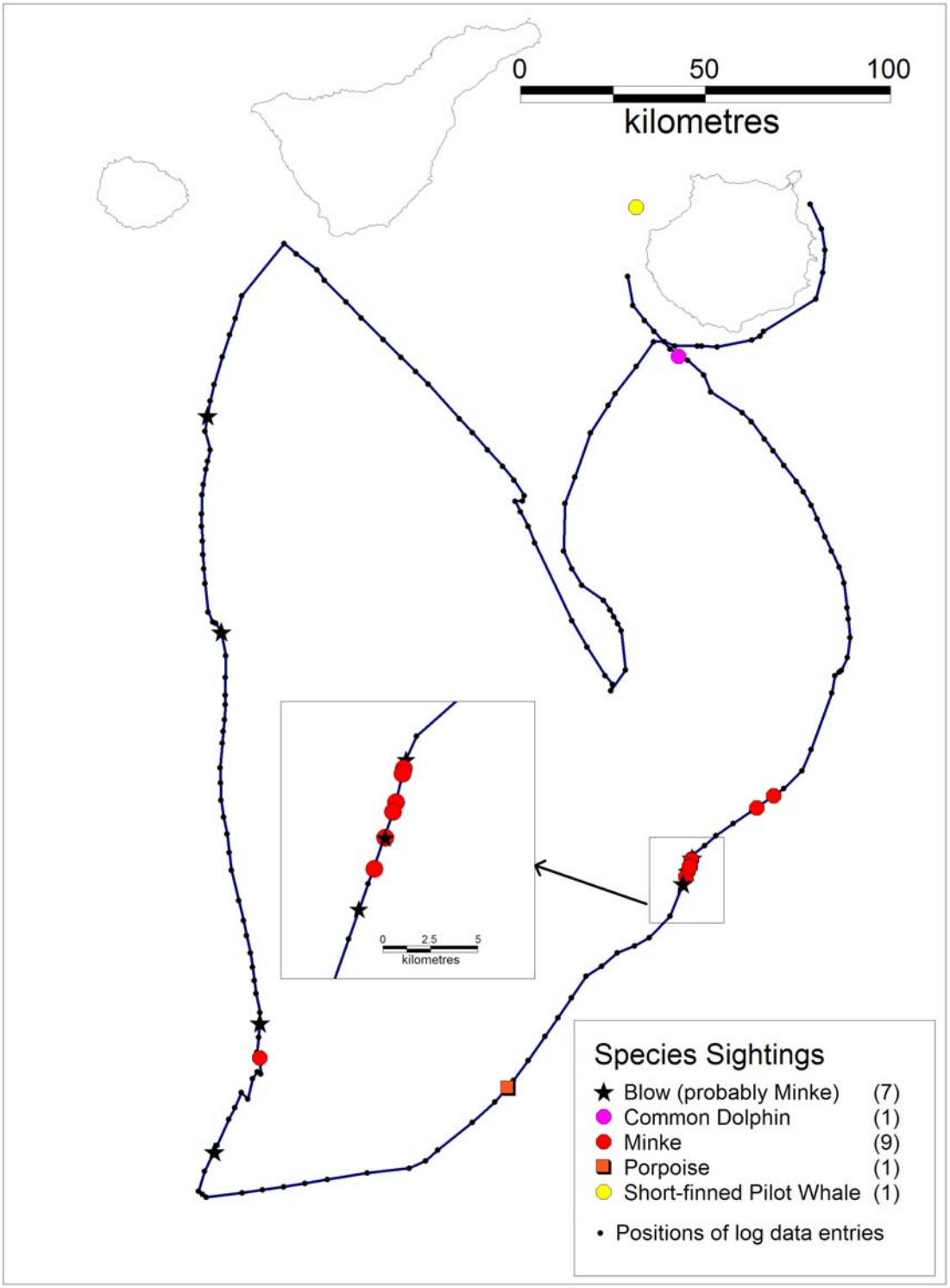

Figure 6: The positions of data log entries (black dots) and of cetacean sightings (coloured dots). See key for species. Figures in brackets are the numbers of sightings.

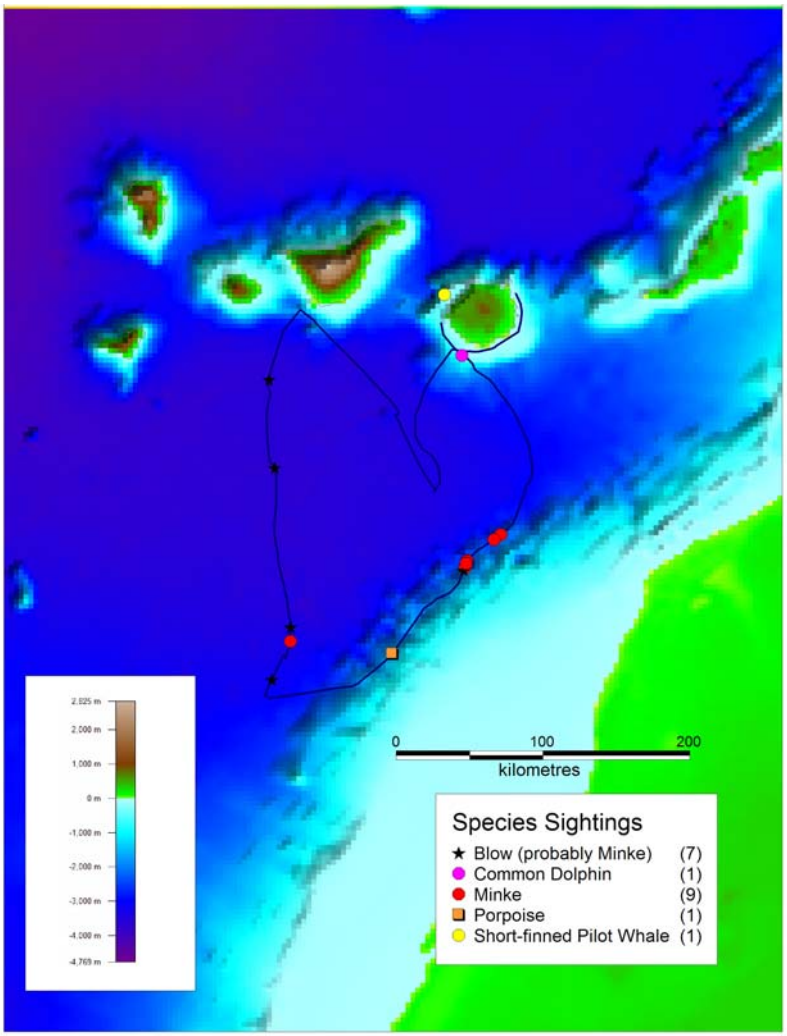

Figure 7: Bathmetry of Canary Island region (www.ngdc.noaa.gov/mgg/gebco/) with overlay of LN684 voyage route and cetacean sightings.
See keys for depths and species. Figures in parentheses are the numbers of sightings.

As well as producing good quality data, voyagers were able to contribute to the project in other ways. Some provided anecdotal information on cetaceans from past sailing experience, which could be documented. One, for example, told how he had been 'on watch' during a dark night alongside a blind person who had detected the presence of some dolphins by his acute hearing ability. This had made him look alongside the vessel where he saw a pod of several dolphins swimming by; he felt sure he would not have noticed them otherwise. He drew attention to the fact that cetaceans are around at night as well as by day, and also to the importance of listening.
Importantly too, there were signs that the Captain had quickly acquired the knack of spotting whales. In fact, she inadvertently discovered a great new technique for getting 'all hands on deck' in record time, by simply announcing "whale spouting off starboard midships" (or whatever relevant position) and waiting for the rush!
The information gathered will be made available to the Seawatch Foundation and any other organisations to whom it would be of use.

Conclusions: This short exercise showed that it is perfectly feasible to carry out cetacean recording, which requires very little in the way of equipment, from a square rigger. Importantly, all of the voyage crew can be involved in the process in different ways and have opportunity to learn and contribute. It is hoped that the Jubilee Sailing Trust will consider including this activity on future voyages, not only to give added interest to their voyagers, but also to provide valuable cetacean data.

Acknowledgements: Voyagers on voyage LN684 are congratulated and thanked for their extreme conscientiousness in completing the data sheets. I am grateful to Seawatch Foundation for having made available on their website such appropriate recording sheets. Thanks also to the Lord Nelson permanent crew for skilfully sailing us over a variety of seabed landscapes, helping to optimise our chances of spotting different species.

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Deck incubation experiment

Kate Crawfurd*

Introduction: The concentration of carbon dioxide in the atmosphere is higher today than it has been for the past 650,000 years and is still rising rapidly. Since the beginning of the industrial era atmospheric carbon dioxide (CO_2) has risen from 280 parts per million (ppm) to 380 ppm. In their most recent report the Intergovernmental Panel on Climate Change (IPCC, 2007) models predict levels of between 550 ppm and 1000 ppm by the end of this century depending on mitigation strategies employed. The oceans absorb a large proportion of this CO_2 which, when dissolved, forms carbonic acid. Over the past 150 years the pH of the ocean has fallen by 0.12 units and will fall a further 0.3 units by 2100. Both the decrease in pH and rise in CO_2 may have important consequences for life in the ocean. (All these statistics are taken from IPCC, 2007)

Marine phytoplankton, the primary producers of the ocean and base of marine food webs, are a diverse group of microscopic algae. Cyanobacteria, the most ancient group, evolved in an atmosphere rich with CO_2 into which oxygen was released by

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their photosynthesis. Other groups evolved as levels of oxygen rose and CO_2 dwindled, most have carbon concentrating mechanisms to compensate for the present low CO_2 levels.
The phytoplankton play a key role in biogeochemical cycling and the effect of increased CO_2 or decreased pH on them is largely unknown. The following experiment sets out to examine the effects of CO_2 at 760 ppm on a natural phytoplankton community from oligotrophic waters.

Methods

Apparatus: A cylinder of air with 760 ppm CO_2 and a deck incubator containing six 20 litre Nalgene® bottles, restrained with elastic cord, were lashed to the rail of the aft deck of STS Lord Nelson. The bottles were filled using a bucket and funnel with a 50 µm gauze secured around the end of a piece of wide bore plastic tubing attached to the funnel. This apparatus aimed to remove large grazers, damage smaller grazers and lower the phytoplankton gently to the bottom of the bottles. Water was taken from the surface layer at station 2: 26° 47.40' N 15° 17.82' W at 08:53 on 23.1.08.
The deck incubator was filled with seawater and the temperature monitored. If it rose above the sea temperature it was refreshed with seawater. Occasionally the apparatus was covered with a thin white sheet if it was in full sun.
All bottles were aerated using glass diffusers attached to the air or gas supply: bottles 1, 2 and 3 with air at 760 ppm CO_2; 4, 5 and 6 with air via a small air pump (Figure 8). The bottles were incubated on the aft deck for the remaining 5 days of the voyage.

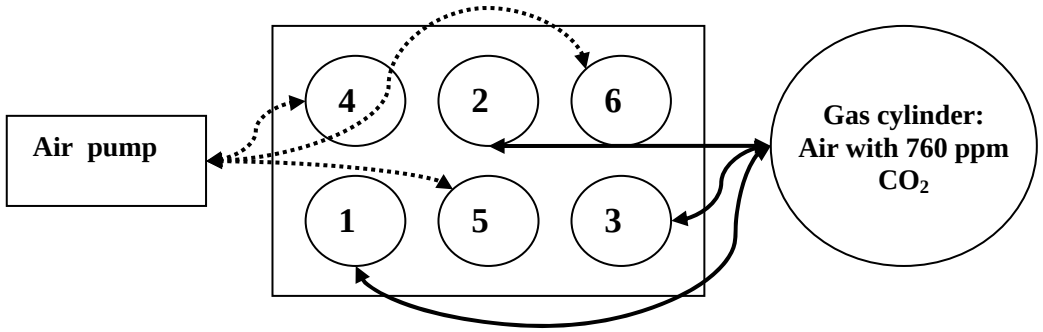

Figure 8: Deck incubation apparatus. 1-6 represent 20 litre Nalgene bottles containing seawater, 1-3 aerated with an air mix with CO_2 at 760 ppm, 4-6 aerated with air.

Sampling: Each day at 10 a.m. (GMT), approximately two hours after sunrise the pH and temperature of each bottle were measured and samples taken as described in Table 4:

Purpose	**Method**
Flow Cytometry	Duplicate 2 ml samples preserved with formalin (1% final conc.)
Total Alkalinity	100ml samples preserved with mercuric chloride
Chlorophyll a	1 L filtered through a GFF filter. Filters frozen (Days 0, 2,4 and 5)

Table 4: Samples taken from deck incubations

On 28.1.08 the remaining water was filtered onto 0.2 µm Sterivex® cartridge filters. 5 litres from each bottle was preserved with RNAlater for RuBisCO and carbonic anhydrase gene expression, to examine photosynthetic activity and carbon acquisition. Triplicate 4 litre filters from each bottle were frozen for DNA analysis, to look at community structure. All frozen samples were returned to the UK on dry ice and frozen at -80^{O}C.

Preliminary Results: pH decreased in the 760 ppm CO_2 aerated bottles (Figure 9).

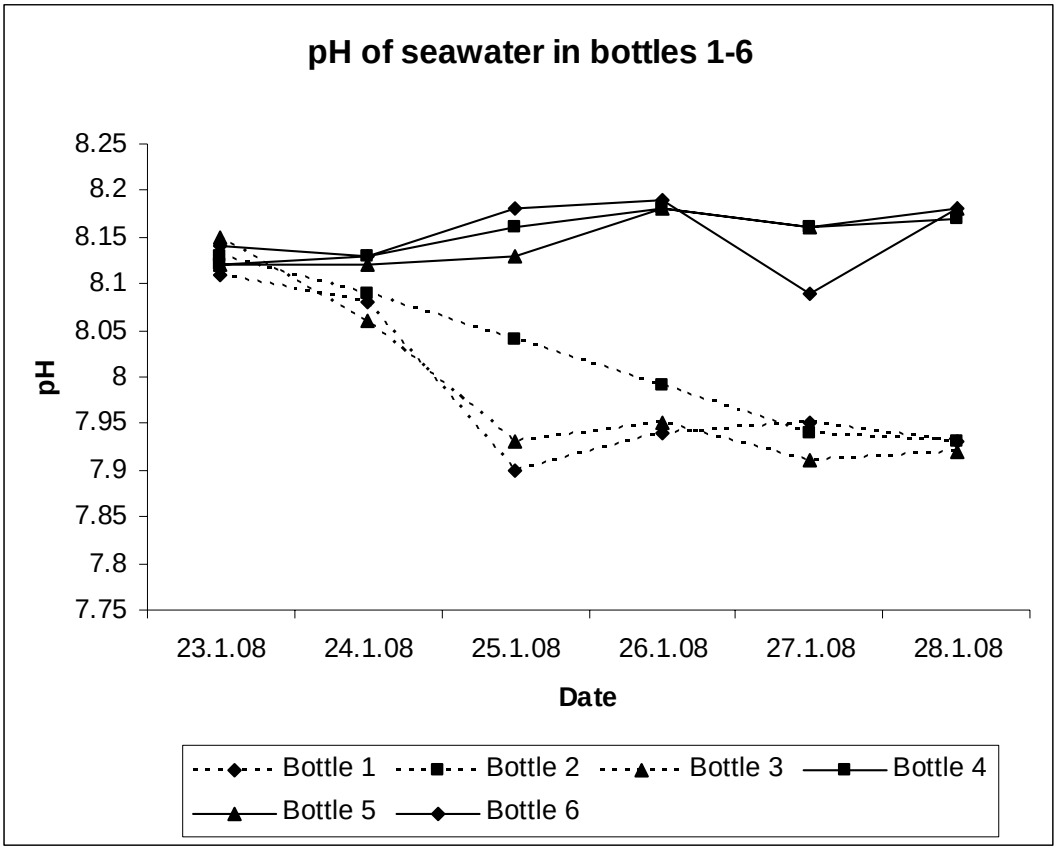

Figure 9: pH changes during on deck incubations
Bottles 1-3 aerated with air at 760 ppm CO_2, 4-6 with ambient air.

Acknowledgements: This experiment could not have been carried out without the help of my able research assistant Cynthia Harcombe, the technical support of Neil Duncan, the patience of Captain Clare Cupples and a fantastic support team; Melinda Barham, Nick Bigwood, Bill Brookes, Gary Caldwell, Mandy Fry, Evelyn Keady, Caroline McGrath, Jane Moore, Colin Nnadi, Donal O'Reilly,Claire Roulston and Robert Morgan. Thanks to all the permanent crew for their help and support in making this scientific voyage a success and very memorable experience. Many thanks to the Jubilee Sailing Trust and Challenger Society for organising the voyage.

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Methanogensis

Arlene Rowan*

Background: The oceanic methane paradox: The world's upper oceans are typically supersaturated with dissolved methane, thought to result from *in situ* microbial methane production. This observed supersaturation has been termed the 'oceanic methane paradox' because the microorganisms (methanogenic archaea) primarily responsible for methane production (methanogensis) are strict anaerobes and the upper oceans are highly oxygenated. Recent evidence has suggested that anaerobic microsites within marine zooplankton, their excreted faecal pellets and sedimentary material may provide a suitable habitat for methanogensis and could hence be sites for methane production in the upper ocean.
Methanogenic archaea, have been identified in faecal pellets and sedimentary material (work at SAMS). This has lead to an insight into the pathways involved in methane production in the pelagic environment. Different phylogenetic groups of methanogens can utilize different substrates (CO_2, acetate and methylated substrates). The methanogens identified at SAMS are known for their unique ability to utilize methylated substrates. One group of methylated compounds that may represent substrates for pelagic methanogens is the phytoplankton derived C_1-compunds consumed by copepods, dimethylsulphide (DMS) and the methylamines (MA). DMS and MA are climatic feedback gases thus this work has important consequences for our understanding of the role the oceans and oceanic gases play in climate change. The scientific aim of this cruise was to obtain samples (copepods and faecal pellets) from different tropical localities to further understand the natural diversity of methanogens and processes involved in methane production in the pelagic environment.

Sampling: Zooplankton were sampled using a using a 200µm mesh zooplankton net (2 nets were used diameters 50cm (1) and 40cm (2); net 1 was used for samples 1- 3 and net 2 for the rest). The net was lower, using a rope (16mm x 220m leaded seasteel), by hand to an approximate depth of 200 meters (depth varied due to angle of rope, Note- station 1 depth was only 50m due to water depth). Ten samples were taken over the course of the cruise; the first 4 were hauled up by hand and the last 6 were hauled initially by hand then wound round a mooring capstan (hauling took approx.10-15 mins). The number of copepods in the first haul was low so the decision was taken to do two hauls at stations 2-4 (more copepods were found at the later stations so only a single haul was require for stations 5-10).
Zooplankton were collected in buckets and left to defecate for a couple of hours. Following this, the samples were filtered through a 100µm filter. The residues from the filters were carefully washed, using 100ml of 50% ethanol seawater mix, into 2 x 50ml sample tubes. Labeled sample tubes were sealed and placed into storage in the ship freezer. Samples were double labeled to ensure correct identification on return to the lab. On the day of departure samples were removed from the freezer and half of the samples were stored in a cool box with cold freezer blocks ready for shipment back to the UK. Once back in the UK the bacterial and archaeal populations (focussing on methanogenic archaea) in the different samples will be examined, using

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culture-independent methods (DNA extraction and amplification, gel analysis to determine community structure and diversity, sequencing to determine phylogeny and quantification methods).

Acknowledgements: I am grateful to Dr Gary Caldwell for advice on all things zooplankton; Claire Roulston for help with sample processing; and the crew of LN684 for being so enthusiastic and keen to help.

Public Understanding of Science -The value of a two way process.

Susan Gebbels*

Introduction: The importance of public understanding of science attracts support in theory from almost everyone. However finding agreement about exactly what counts as understanding and how to achieve it is much more difficult. Most people see the bulk of scientific knowledge as simply irrelevant to their needs and interests and under current portrayals, they are probably right. More emphasis should be placed on a general understanding of "the nature of science" and of the interactions between science and society rather than on the ability of people to answer complex questions about scientific knowledge. Communication between the 'expert 'and 'lay person' must be a two-way process, if people see an opportunity to participate, then understanding will follow. During the Lord Nelson cruise half the voyage crew were 'non-scientists' however by the end of the trip this label had been dropped as they had become an invaluable part of the team who quickly understood the scientific methodology that was being used and how best to achieve the tasks at hand.

Voyage Crew: Many of the voyage crew had signed up for the cruise because it was going to be a scientific trip, although most had very little idea about what would be involved. Several said that they were participating anyway and that the scientific aspect of the trip was a bonus.
At the beginning of the voyage the non-scientists were asked several questions including; "do you think that people from non scientific backgrounds can help obtain valid data" and "do you expect to be able to contribute to the sampling"? Everyone responded positively to each question. One comment was that science is driven by the public and therefore the more involvement that they have the better it is for the scientific community. It was generally felt that lay people could take part along side and, under the guidance of, scientists and that both could learn from the process. There was no rivalry between the two groups, everyone supported each other. Without the willingness of the non-scientists to pull in the net lines by hand, coil ropes and occasionally undertake the bulk of the watch duties, the sampling would have been much slower.
The voyage crew made positive comments about the compatibility of the sailing and the science. Several felt that it was "wonderful to be at sea for a purpose" and "to be free of the hassle of going in and out of harbour" One JST veteran commented that they had never seen the boat with so much canvas out. At the end of the cruise they

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were asked what they had learnt. The responses were varied and diverse, most people did not realise what plankton are and the important role they play within the oceans. Generally, whales and dolphins are thought to be elusive creatures that are scarce and difficult to see, however, the frequent sightings of several species seen on the cruise changed many of these perceptions. The sightings started numerous discussions ranging from practical talks about distribution, feeding and mating through to more philosophical debates as to whether whales should be hunted for food and research.

Scientists: The scientists were asked at the beginning of the trip if they thought that they could achieve their aims. Most people were confident that their sampling could be carried out effectively although it would probably be a learning curve. The logistics of getting samples was not a problem and small snags soon sorted themselves out as there was plenty of help from the permanent and voyage crew. The majority of the scientists felt that the results would be valid; however a good multidisciplinary approach would be needed.
Some individuals said that the trip had been valuable from more than just a scientific point of view. There were comments that scientists should endeavour to mix and work more with non-scientists as it helps with public relations, and to over come the negative public portrayal of scientists in society. There was a general feeling that the science had been a great deal of fun, with excellent interactions between people from different establishments and positive comments that it would be of benefit to all if students, professors, and lay people could work together in the future. One observation was that the trip had been a fantastic way to arouse people's passions about marine science. Another, that it had been wonderful and humbling to have had a flavour of some of the first and great scientific explorations undertaken by Darwin and his colleagues who conducted much of their research from tall ships.
Various scientists planned to write articles for their Universities internal newsletters and to try and gain some publicity in the local press to promote the JST, its aims and the outreach value of the cruise.

The Permanent Crew: The permanent crew had a few concerns at the beginning of the voyage as it was the first scientific cruise that the ship had embarked upon. There were concerns that when the boat hove to it may travel to leeward too fast to make sampling possible. This however was rarely the case and the problems were soon overcome. The captain commented that the boat had never hove to so much as it had during this particular cruise.
Another positive aspect of the trip for the Lord Nelson's crew was the opportunity for them to sail outside her normal cruising grounds. The mate commented that in 10 years sailing on the Lord Nelson he had never been as far south. The crew where helpful and inventive in providing space for a lab, improvised well when equipment was lost or broken and quickly sorted out the sampling apparatus.

Conclusion: The realization that people are travelling as never before compels the conclusion that the positive and negative effects of tourism on marine environments are too potent to ignore. A tall ship cruise is an excellent learning environment and provides unique opportunities to raise awareness and educate travellers about environmental and scientific issues in a perfect setting. It is also a great public relations exercise for science, it further goes to show that given the right environment, scientists and lay people can gain mutually beneficial experiences through interaction a scientific context.

Epilogue and observations on carrying out scientific studies from the Lord Nelson

John Patching*

In general this cruise proved successful from a scientific point of view and also provided valuable insights into the practicalities of working from a tall ship. One obvious disadvantage of a research cruise under sail is the key influence of wind speed and direction on reaching and holding stations. Sailing ships cannot sail directly into the wind but must tack to windward (steer a zig-zag course). It is less convenient to do this with a square rigged ship than one equipped with fore and aft sails (as on a dinghy or yacht) since they are less able to "point up" (sail obliquely against the wind)and tacking at the end of each leg to windward involves a considerable effort by the crew to brace the yards for the new course. The original cruise plan was to investigate waters to the north and west of Grand Canaria , but since weather forecasts immediately prior to embarkation showed that the wind direction would not favour this, the area of study was switched to the south of the island. This decision was made jointly by the Chief Scientist and the Master and was based on the facts that there was no necessity to sample at specific stations and that a main motivation for those who had signed up as voyage crew was to spend as much time as possible under sail. By subsequently making minor adjustments to the cruise plan to allow for wind changes etc. it was possible in to satisfy the needs of scientific sampling whilst providing the voyage crew the sailing experience they had paid for. The majority (>90%) of the cruise took place under sail, with most of this under sail alone (see Table 5). Table 5 also contains average speeds for the cruise under sail or power. These include time on station and are thus lower than speeds achieved when under way. Cruise plans calling for specific station locations and under time constraints could necessitate a greater use of the engines, either alone or in combination with sails, not so much for the increase in speed but for the ability to travel into the wind.

	hr	*Time %*	*Distance (nm)*	*Dist %*	*Stations worked*	*Average Speed (kn)*
Sail	77	62	374	59	7	4.9
Motor sail	39	31	211	33	2	5.4
Motor only	8	6	52	8	1	6.5
TOTAL	124	100	637	100	10	5.1

Table 5: Statistics for activities carried out under different forms of propulsion (Derived from the ship's log)

Heaving to for sampling was a new experience for the captain and crew (both permanent and temporary) who are normally concerned with keeping the ship moving as fast as possible rather than stopping it, but they learnt fast. I was told the Lord Nelson had been hove to more times during this cruise than in all the rest of her

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career! Most sampling took place in force 4-6 winds with a sideways drift of about 1.7 knots (occasionally 2 or so and latterly 1 or less). Surprisingly it was heaving to when under engines with only fore-and-aft sails that initially caused the most problems. This involved backing the jib and running the engines in forward gear and initially gave a few worrying moments when the ship drifted astern! Under sail only it was necessary to furl a course (one of the large square sails) and back the foremast sails to heave to. This was fairly physical stuff involving two watches, but could be done in about 20 minutes once watches got into the routine.

A good team evolved for sampling, centred round Colm Morarty (the Galway technician), Damien Guihern (Physical oceanographer, responsible for the CTD) and the Mate Neil Duncan. The aft deck was an ideal location for sampling, and the Mate had rigged up a davit facing astern with a system of blocks so that the 16 mm rope used for carrying out the vertical plankton hauls could be handled on the side deck. Initially launch and recovery were by hand - the latter most impressive with a team of "volunteers" walking the rope forward, peeling off and moving to the back to take up the rope again. Latterly the mooring capstans were used for hauling. The large diameter rope was used for its ease of manual handling, but it took up a considerable space and also caused drag in the water. This coupled with the drift of the vessel when on station and the fact that it was a floating rope gave rise to angles which were well removed from the ideal "up and down" alignment when paying out or recovering. A summary comparison of nominal (“wire out”) and true sampling depths (Table 6) shows the problems of sampling sub-surface water layers with the present system The use of wire or smaller diameter braided rope and heavier weights on the end of the line could improve matters, but this would rule out veering and hauling by hand and would involved some form of small demountable powered cable drum.

Nominal Depth	*True Depth*			
	Maximum	Minimum	Average	Median
50	49	29	43.5	45.5
200	186	113	154.6	158

Table 6: Comparison of nominal and true sampling depths.
All depths are in metres. Nominal depths are derived from rope paid out. True depths were measured by means of a Seabird Electronics 37-IM MicroCAT (see Page 8). Analysis is of 10 nominal 50m hauls and 21 nominal 200m hauls.

As is typical for tall ships designed for sail training, the Lord Nelson has virtually no spare space either on or below decks which can be dedicated to on board scientific activities. One of the on-deck disabled heads was fitted with a table (thanks to the Mate) where the NUIG team set up their research microscope and camera system and the tank for phytoplankton incubations (see Page 22) was set up on the aft deck, but, generally, microscopes and other gear were taken out, used wherever (and whenever) space was available and stowed away afterwards. Thanks to good weather, small raised “tables” each side of the main mast could be routinely used for sample handling and low power microscopy and the lower mess tables were also available between meals, provided care was taken not to disturb those with bunks in the mess walls.

An important aspect of the cruise was the interaction and collaboration between and within the permanent (13) and voyage crew (37). In accordance with the Jubilee Sailing Trust's objectives the voyage crew contained several disabled participants, though it was decided not to accept wheelchair users for this cruise. Fifteen of the voyage crew had been recruited by the Challenger Society to carry out specific scientific research but the majority (22)had paid to join the cruise as individuals. An informal survey showed that they had done so for two main reasons: firstly to spend a week at sea with plenty of sailing instead of participating in island-hopping and secondly, because they were interested in the science that might be taking place. Feedback indicates that they were satisfied on both counts. Appendix 4 (The Alternative Cruise Report) provides an indication of the feelings of the voyage crew as they participated in the cruise.

The Lord Nelson needs the full participation both permanent and voyage crews to navigate and sail successfully and to keep in good order. All scientists were expected to play their part in standing watches, steering, handling sails, scrubbing and cleaning and standing mess duty etc. They all did so, enjoyed it (I think) and managed to cope with it and their scientific work without becoming completely exhausted, though if the cruise had been longer it might have been a different story. If future cruises are planned it must be remembered that there is no room for "passengers" on the Lord Nelson. The other interaction, not normally found on research vessels concerned the science. Scientists were advised to be outgoing in describing their research to the rest of the crew. In the event the "non-scientists" were keen to ask questions and participate in what was going on, helping with sample recovery and processing, the cetacean survey etc. Short talks on subjects of general interest (sailing etc) are usually organized for the evenings on Lord Nelson, but because of the extra burden of the science on the ships schedule these were largely abandoned, so there was no opportunity to use this method of communication, apart from an initial presentation by the chief scientist. Katherine Crawfurd put up a poster of her work in the bar and two "show and tell" sessions were organized when all the microscopes were set up and both permanent and voyage crew were invited to "come and see". A lot of scientific discussion took place amongst both the temporary and permanent crew during watches, in the bar etc., and arose from genuine interest and excitement with what we were doing.

In conclusion, praise is due to the permanent crew for their excellent response to the challenge of facilitating the scientific work and fitting it into what is a finely tuned and established schedule for sailing the ship and keeping it in good order. They showed great enthusiasm, adaptability and good humour. I believe that a strong message will be sent to JST by them and the voyage crew that, provided the limitations of the ship and its operation are appreciated, research cruises are a good thing, great fun and worth doing again!

Appendix 1: Station Log

The full designation of a deployment should be in the form Cruise:Station#Haul. The first deployment of this cruise is thus LN684:1#1. References in this report omit the cruise designation.
WO refers to the length of rope paid out. Differences between this and the depth by CTD are caused by the rope not paying out vertically due to drift.
Deployment and recovery were carried out manually for the first three stations. Powered capstans were subsequently use for recovery.

Gear Codes used in station log

CTD	Conductivity-temperature-depth probe (Seabird Electronics 37-IM MicroCAT)
Phyto	Phytoplankton net (30μm mesh: 30cm diameter) used for vertical plankton haul (except for 2#5)
Zoo	Zooplankton net (200μm mesh) used for vertical plankton haul. Net diameters 50cm (Stations1-3) and 40cm (stations 7-10)
Bucket	Plastic bucket on rope used to take surface water sample
Niskin	2 L Niskin water sampler triggered by messenger

LN684 Station Log

All times are GMT (time zone Z)

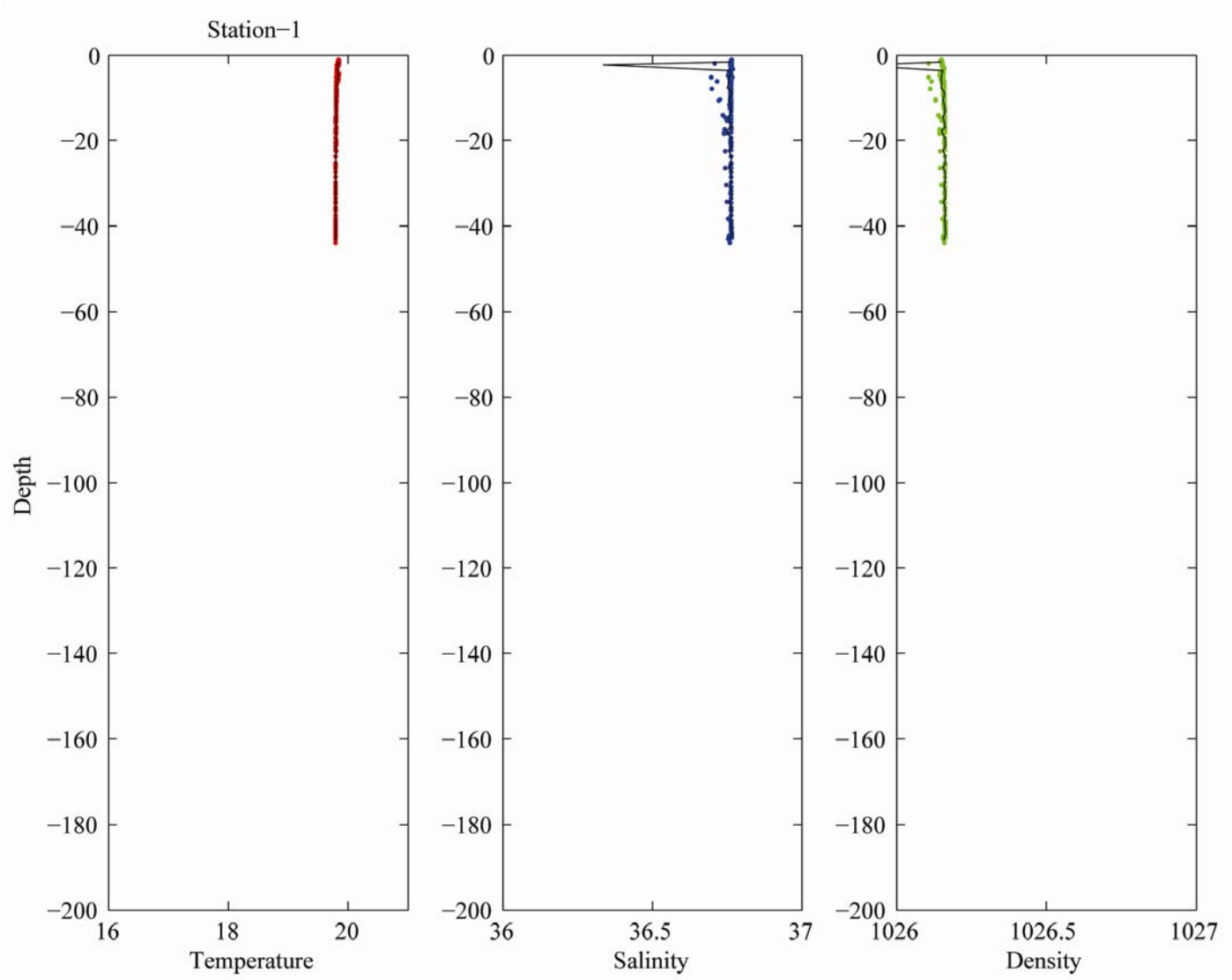
Station	Date	Lat. N degrees	Lat. N minutes	Long. W degrees	Long. W minutes	Secchi Depth (m)	Haul	Gear	Deployment time	Recovery time	Deployment WO (m)	Deployment depth (m:ex CTD)	Comments
1	22/01/2007	28	7.32	15	47.99	15.5	1	Phyto/CTD	17:20	17:27	50	43	
Shakedown Station. Calm. Not under sail			100m	water depth			2	Zoo/CTD	17:30	17:37	50	44	
Acoustic studies													
2	23/01/2007	26	47.41	15	17.82	9	1	Buckets	08.50-9.50		0		Water for Incubation Experiments
Wind force 4. Main course furled mainsails backed							2	Phyto/CTD	09:00	09:10	50	29	Drifting at up to 2.5kn
Acousticstudies							3	Phyto/CTD	09:10	09:30	200	125	Drfifting sideways 1.6kn
In african upwelling?							4	Phyto	09:30	09:40	0		Qualitative surface trawl. (Spare net)
							5	Zoo/CTD	09:30	09:40	200	132	Drift 1.6kn sideways
							6	Zoo/CTD	09:40	09:50	200	113	Drift 1.7kn sideways
3	23/01/2008	26	16.54	15	42.16	10	1	Phyto/CTD	16:23	16:28	50	46	
Wind force 4	Foresails backed, course furled						2	Phyto/CTD	16:30	16:40	200	170	
Drift up to 1 kn							3	Zoo/CTD	16:40	16:50	200	168	
Acoustic studies							4	Zoo/CTD	16:50	17:00	200	167	Whale spotted close to net on recovery. Traces damaged and twisted
4	24/01/2008	25	21.5	17	3.84	7.5	1	Phyto/CTD	09:07	09:12	50	38	
Wind force 4	Foresails backed, course furled						2	Phyto/CTD	09:15	09:38	200	145	
Drift 0.7kn							3	Zoo/CTD	09:40	09:55	200	146	
Capstans used for retrieving nets from this station onwards							4	Zoo/CTD	09:55	10:07	200	147	
Acoustic studies													
5	24/01/2008	25	43.42	16	53.61	10.75	1	Phyto/CTD	16:10	16:20	50	46	
Wind force 4	Foresails backed, course furled						2	Phyto/CTD	16:20	16:55	200	162	
Drift 0.9kn							3	Zoo/CTD	17:00	17:15	200	159	
Acoustic studies													
6	24/01/2008	26	13.03	16	58.14	-	1	Phyto/CTD	23:50	23:55	50	45	
Wind force 4	Foresails backed, course furled						2	Phyto/CTD	00:00	00:20	200	142	
Drift 0.7to1.2kn							3	Zoo/CTD	00:25	00:37	200	170	
Strobe light attached to all hauls (equipment test)													
7	25/01/2008	26	55.46	17	0.61	8	1	Phyto/CTD	08:55	09:00	50	48	
Wind force 4	Foresails backed, course furled						2	Phyto/CTD	09:00	09:35	200	148	
Drift 1.6kn							3	Zoo/CTD	09:35	09:50	200	163	
Acoustic studies													
8	25/01/2008	27	25.25	17	1.94	11	1	Phyto	16:15	16:25	50		
Wind force 6	Foresails backed, course furled						2	Phyto/CTD	16:30	16:55	200	156	
Drift 1.2kn							3	Zoo/CTD	16:55	17:07	200	146	
Acoustic studies	veral Portugese MOW + medusae in wate												
9	26/01/2008	27	16.08	16	10.05	8	1	Phyto/CTD	09:12	09:18	50	47	
Wind force 5-6	Under engine and fore and aft sails. Jib backed.						2	Phyto/CTD	09:25	09:43	200	175	
Head to wind	Stbd engine initially tickover						3	Zoo/CTD	09:45	09:56	200	158	
Drift 1.5 to 2.5kn,	diff. to control - sometimes backwards												

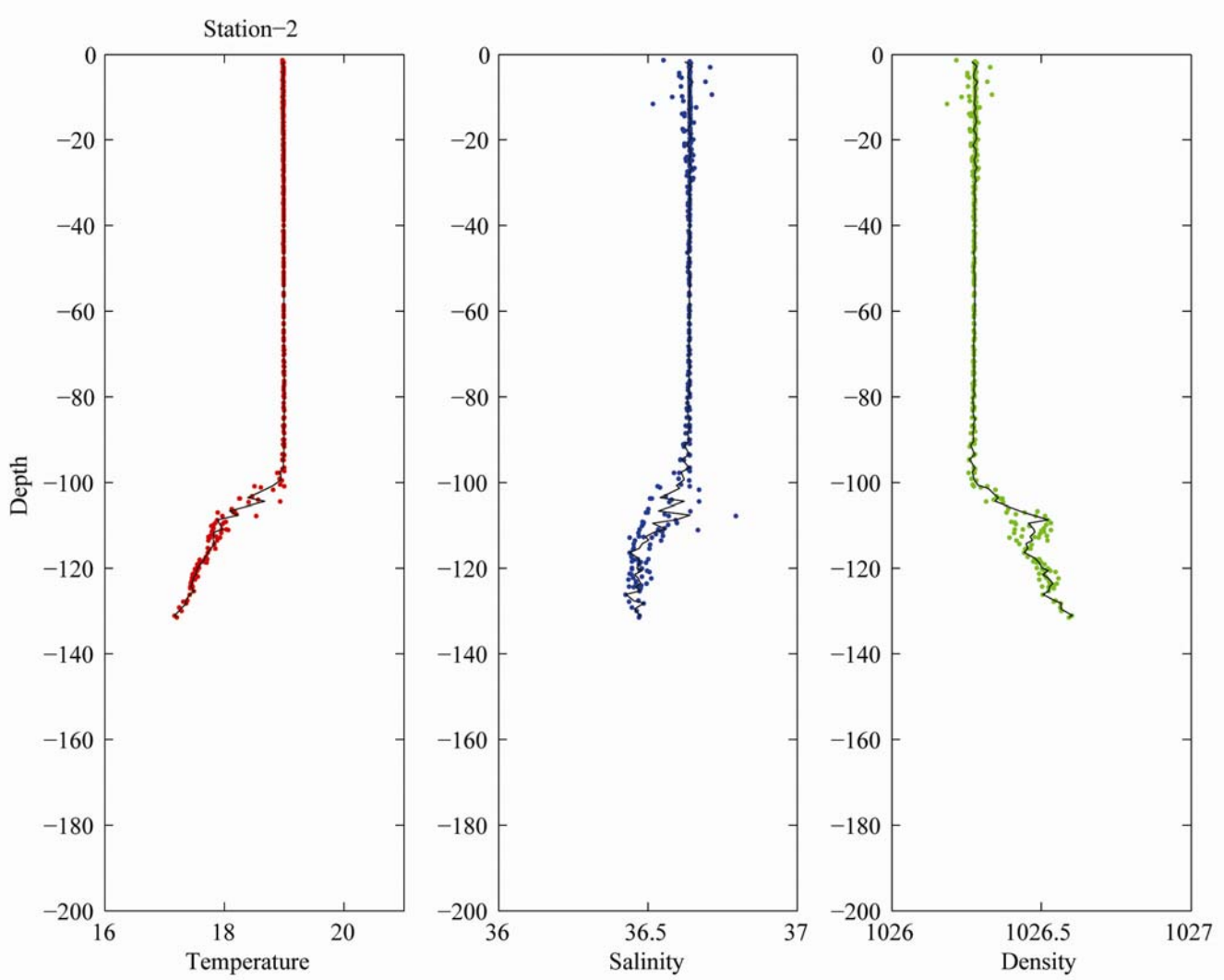
Acoustic Studies

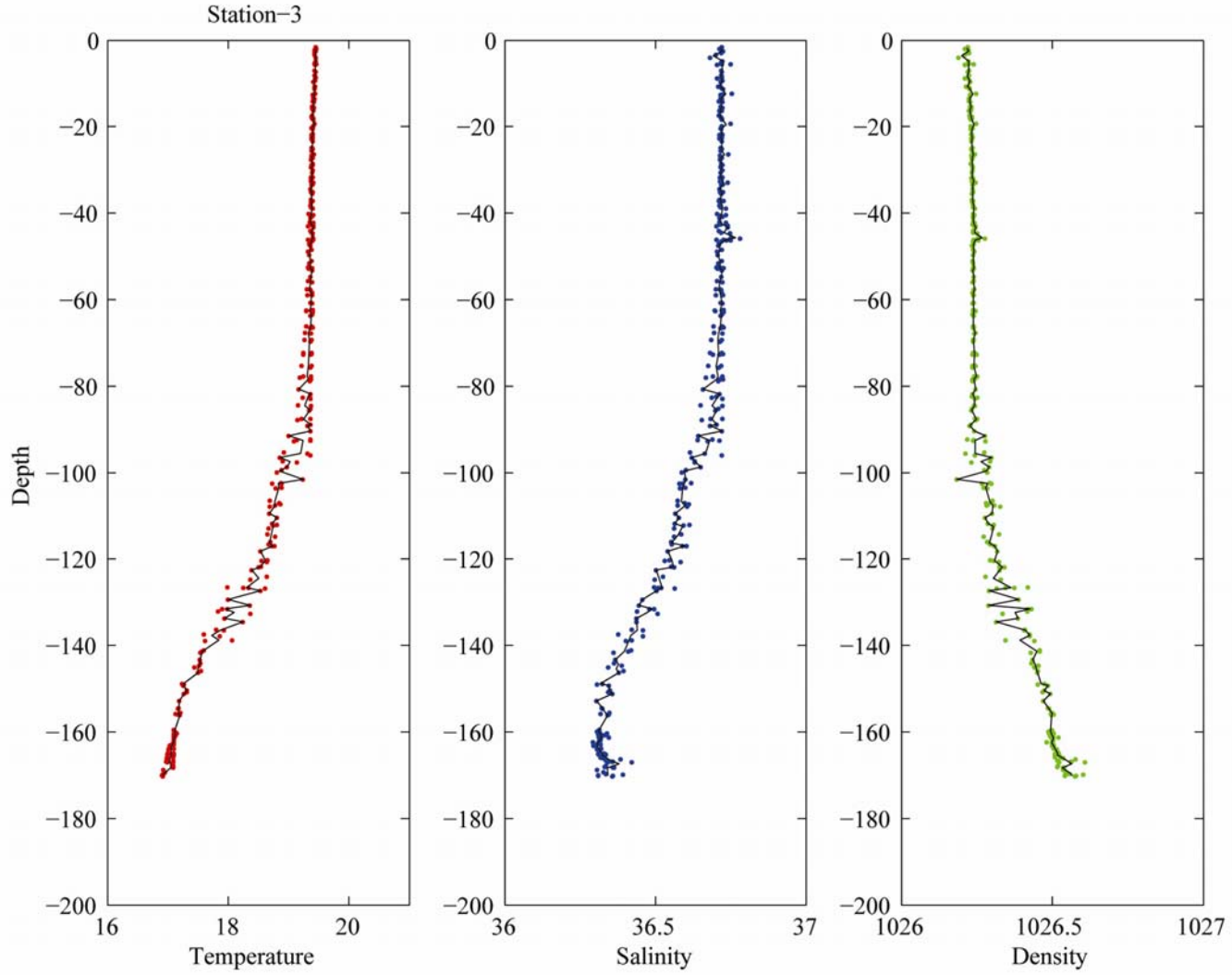
10	26/01/2008	26	45.36	15	55.24	9	1	Phyto/CTD	16:25	16:35	50	49
Wind force 5-6	Under engine and fore and aft sails. Jib backed.						2	Phyto/CTD	16:35	16:52	200	186
Head to wind	Both engines dead slow ahead						3	Zoo/CTD	17:05	17:15	200	169
drift<1kn	best station keeping of cruise!						4	Niskin	17:30	17:40	150?	153
Acoustic studies												

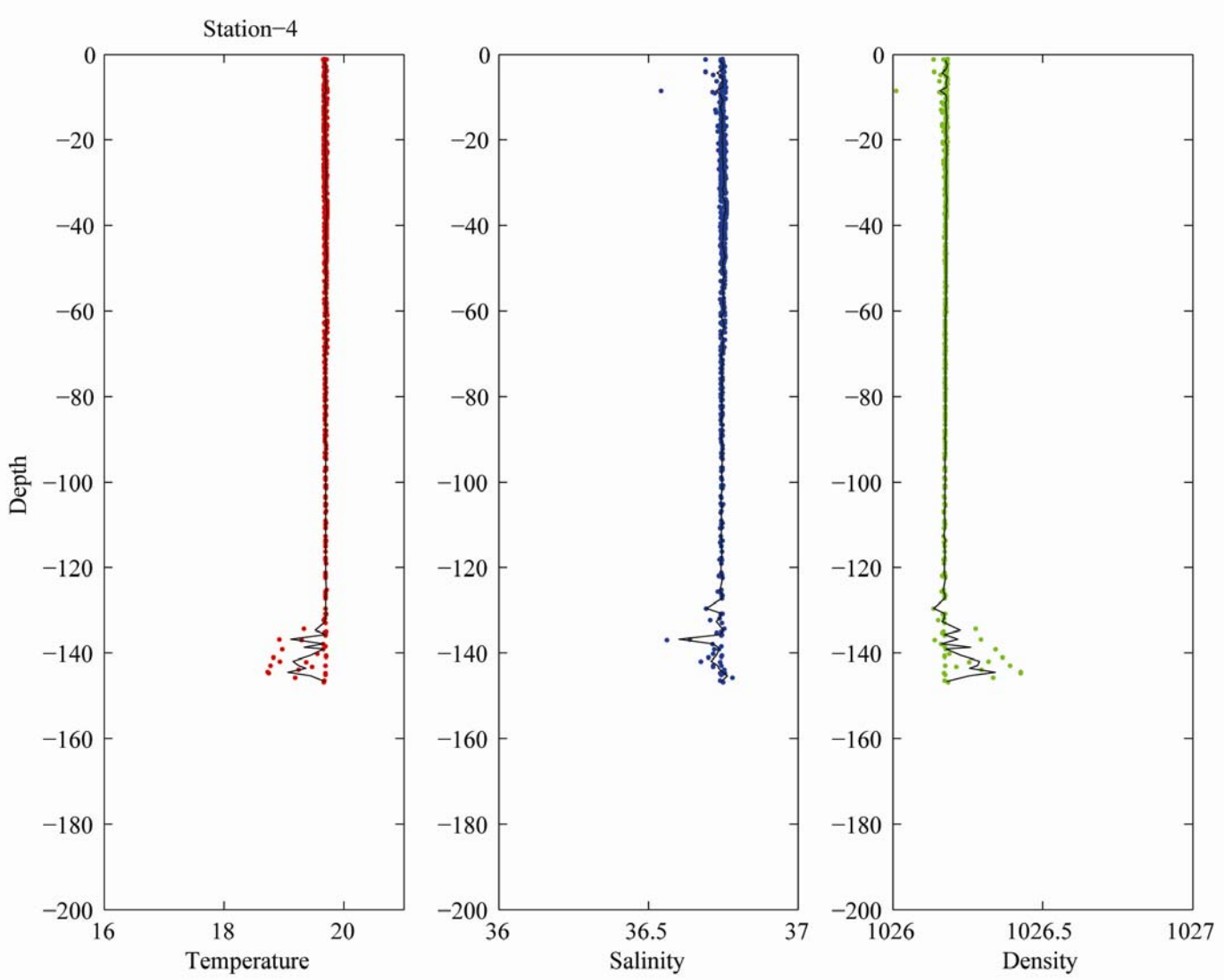
Appendix 2: Composite temperature, salinity and density profiles for each station.

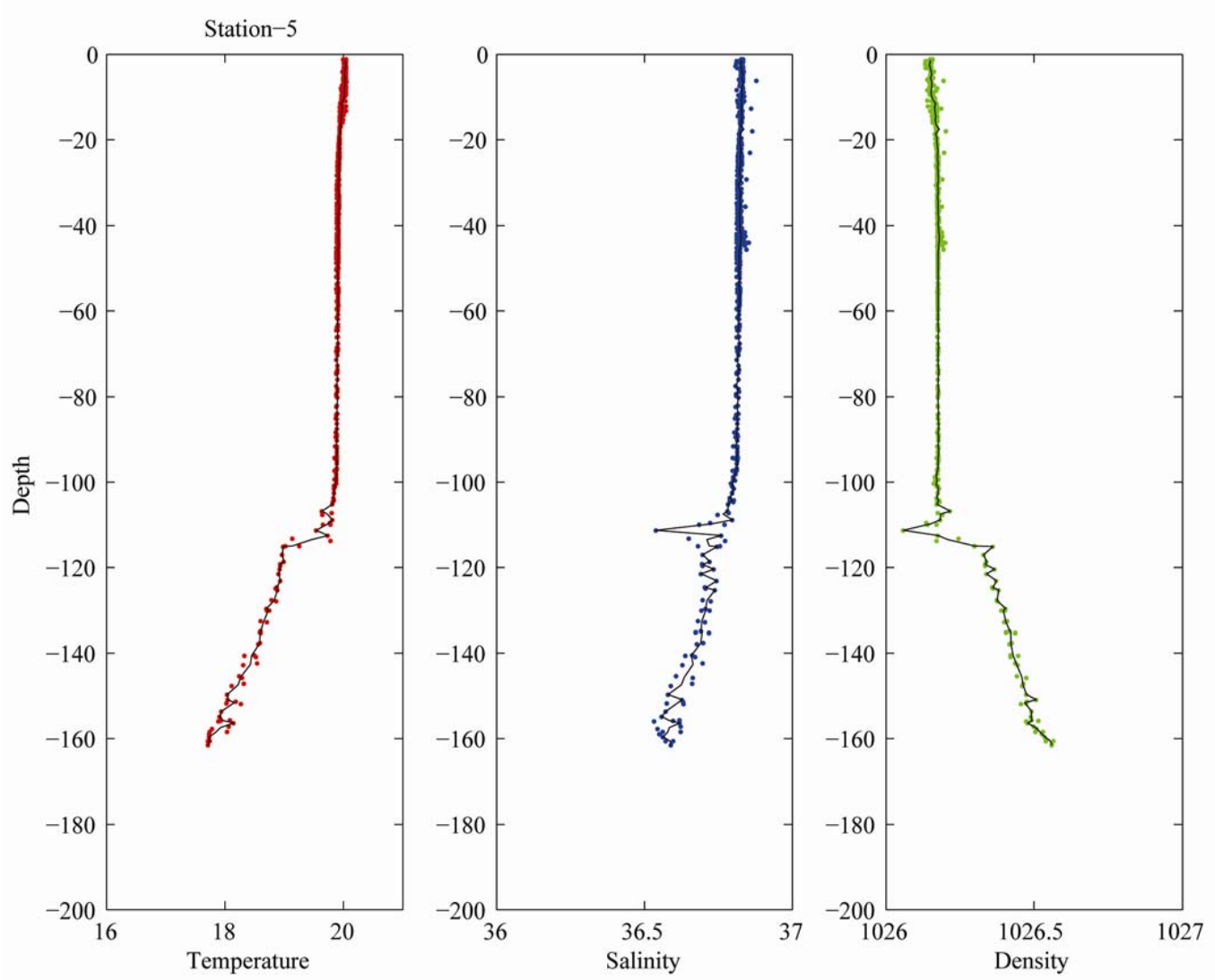
Individual data points are marked with a dot while the mean for each metre of depth is shown with a black line. Fluctuations at depths, such as at stations 8 and 9, are due to the moment of the vessel through water masses.

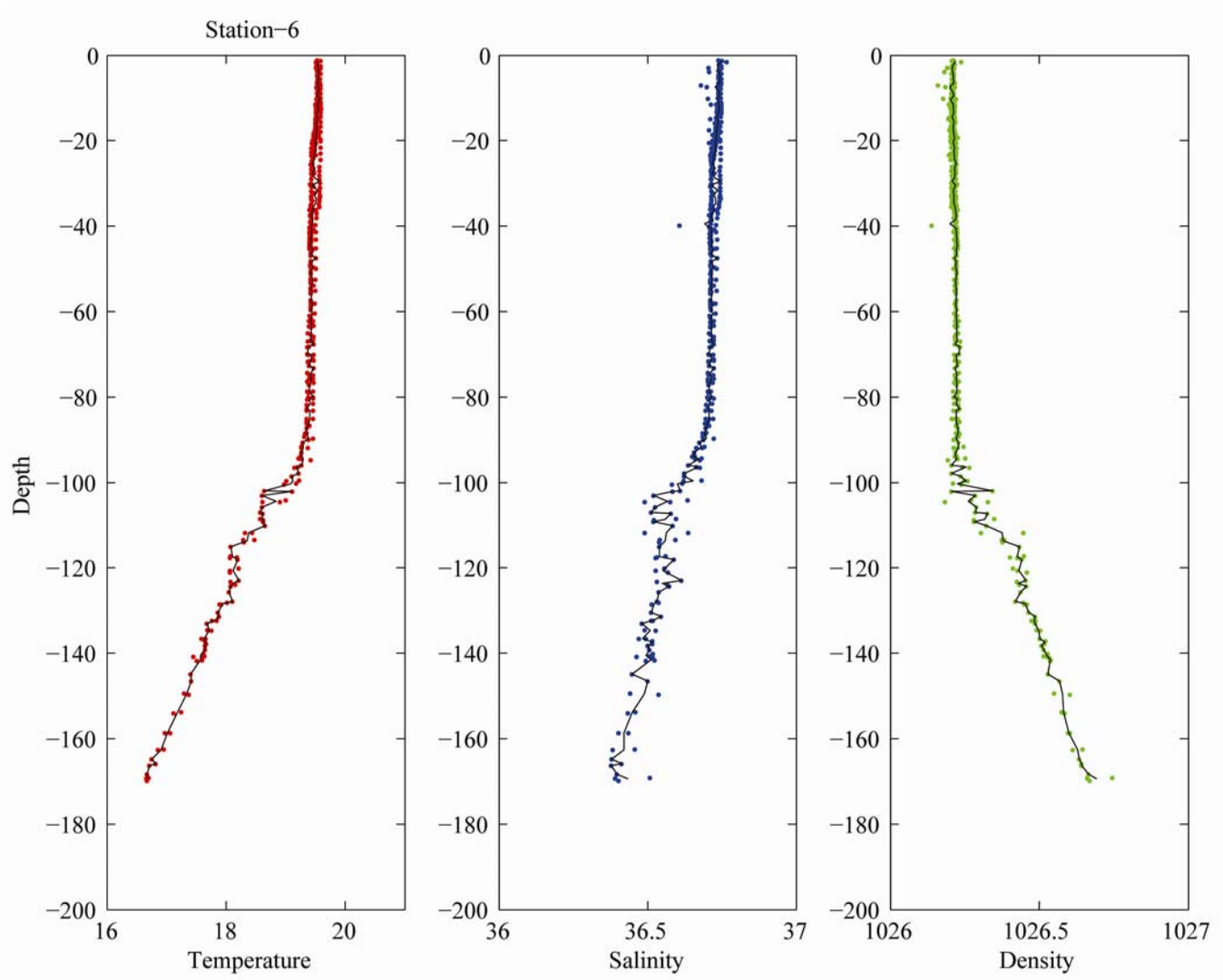

Station−1
Depth
0
−20
−40
−60
−80
−100
−120
−140
−160
−180
−200
16
18
20
Temperature
36
36.5
37
Salinity
1026
1026.5
1027
Density

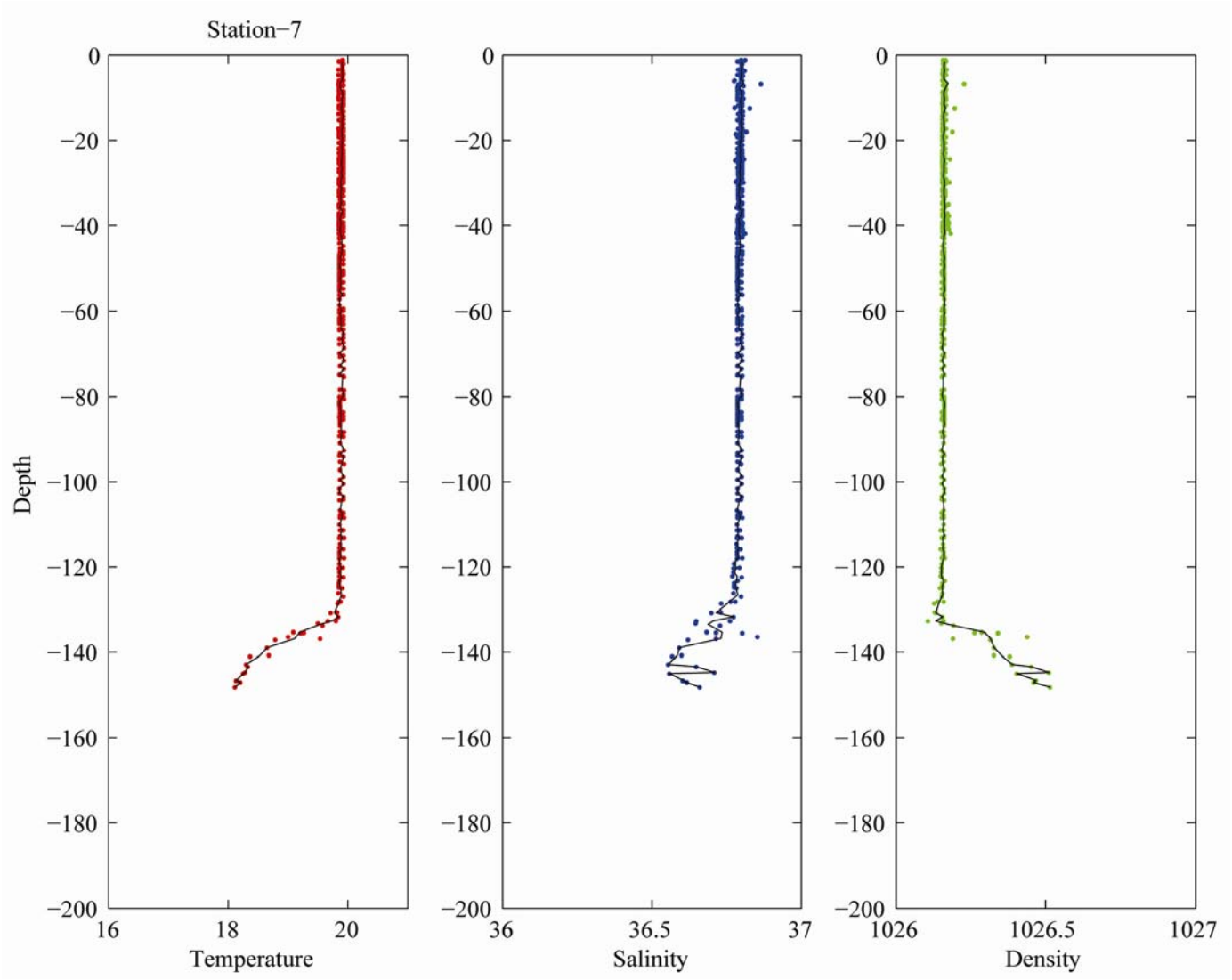

Station−2
Depth
0
−20
−40
−60
−80
−100
−120
−140
−160
−180
−200
16
18
20
Temperature
36
36.5
37
Salinity
1026
1026.5
1027
Density

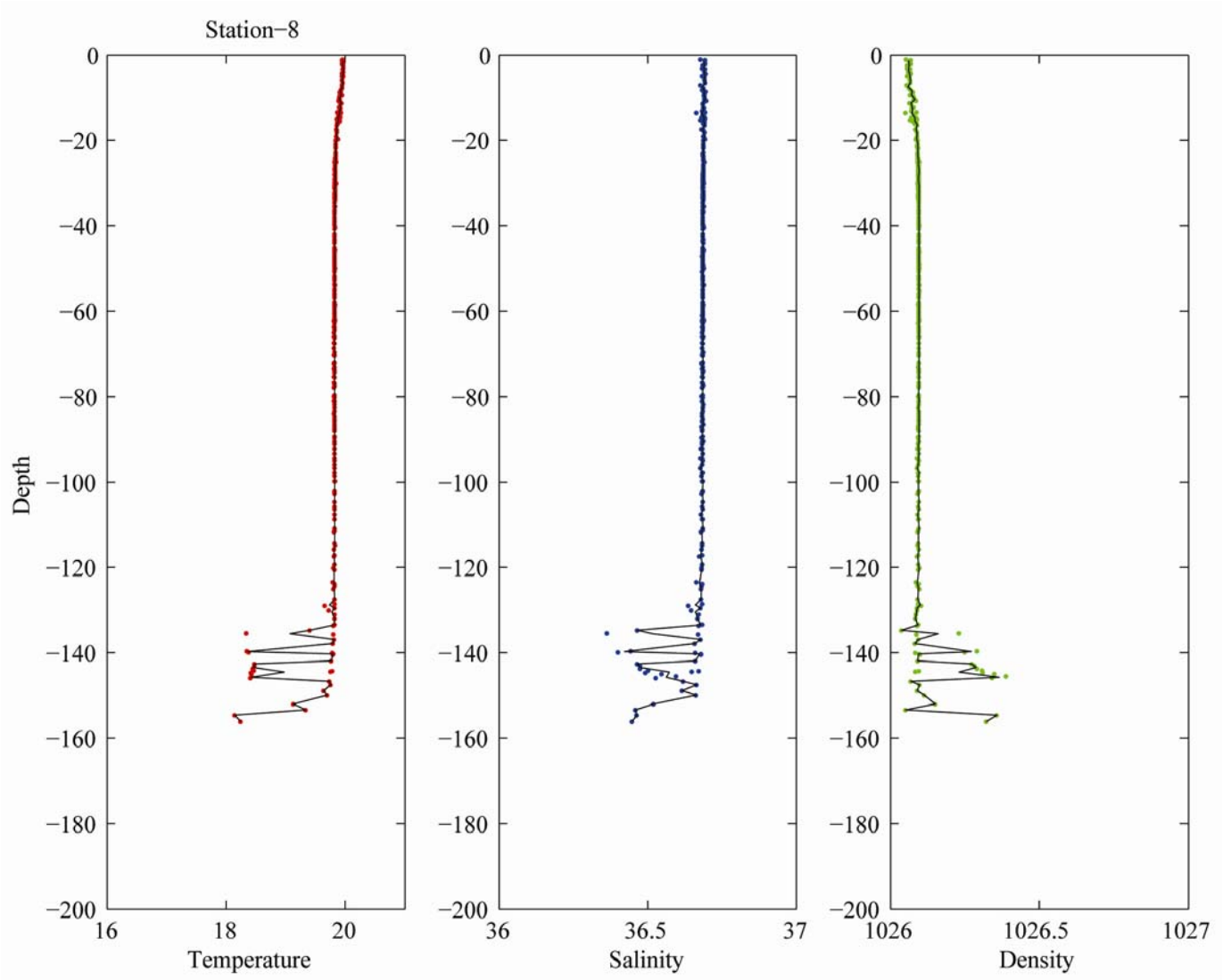

Station−3
Depth
0
−20
−40
−60
−80
−100
−120
−140
−160
−180
−200
16
18
20
Temperature
36
36.5
37
Salinity
1026
1026.5
1027
Density

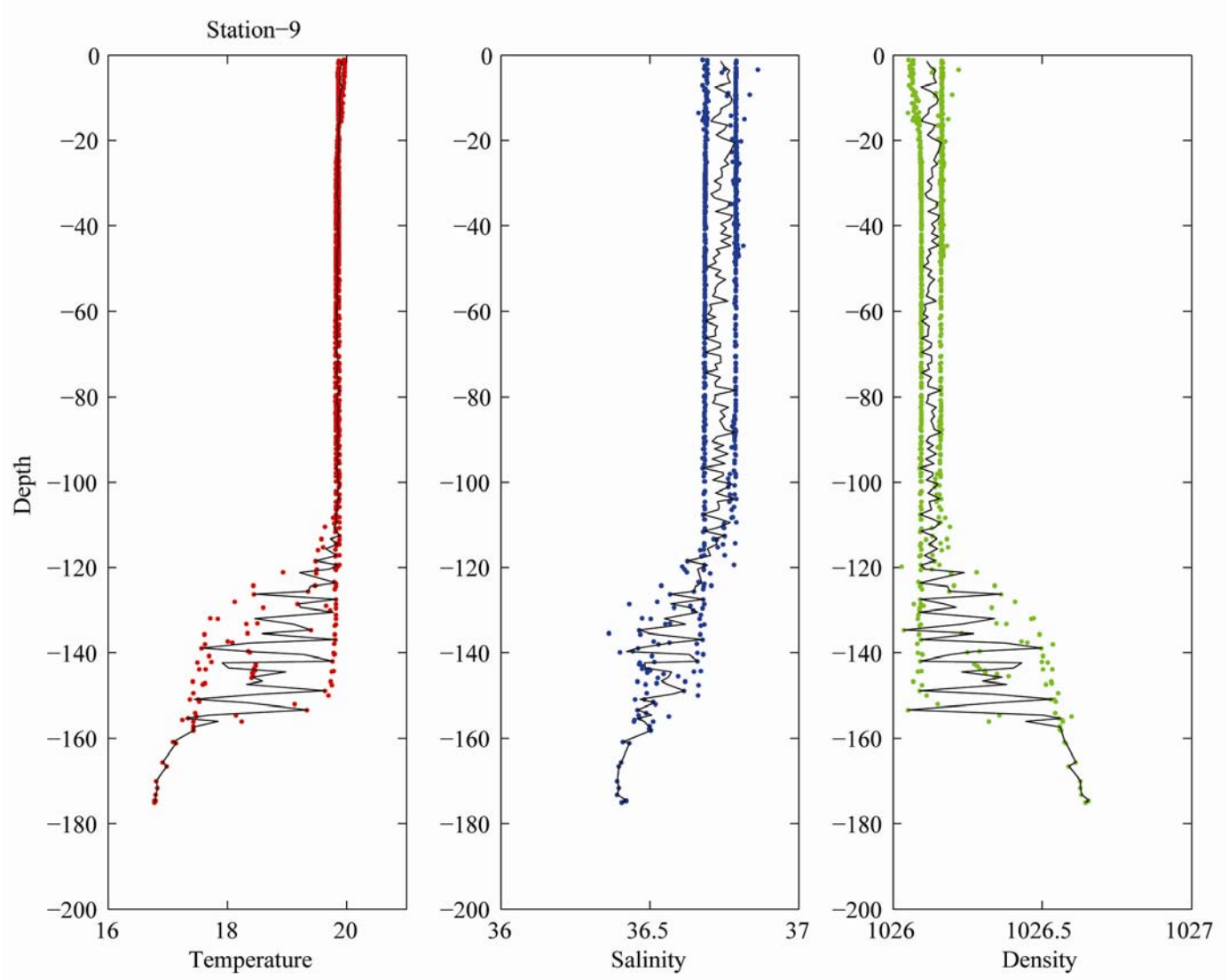

Station−4
Depth
0
−20
−40
−60
−80
−100
−120
−140
−160
−180
−200
16
18
20
Temperature
36
36.5
37
Salinity
1026
1026.5
1027
Density

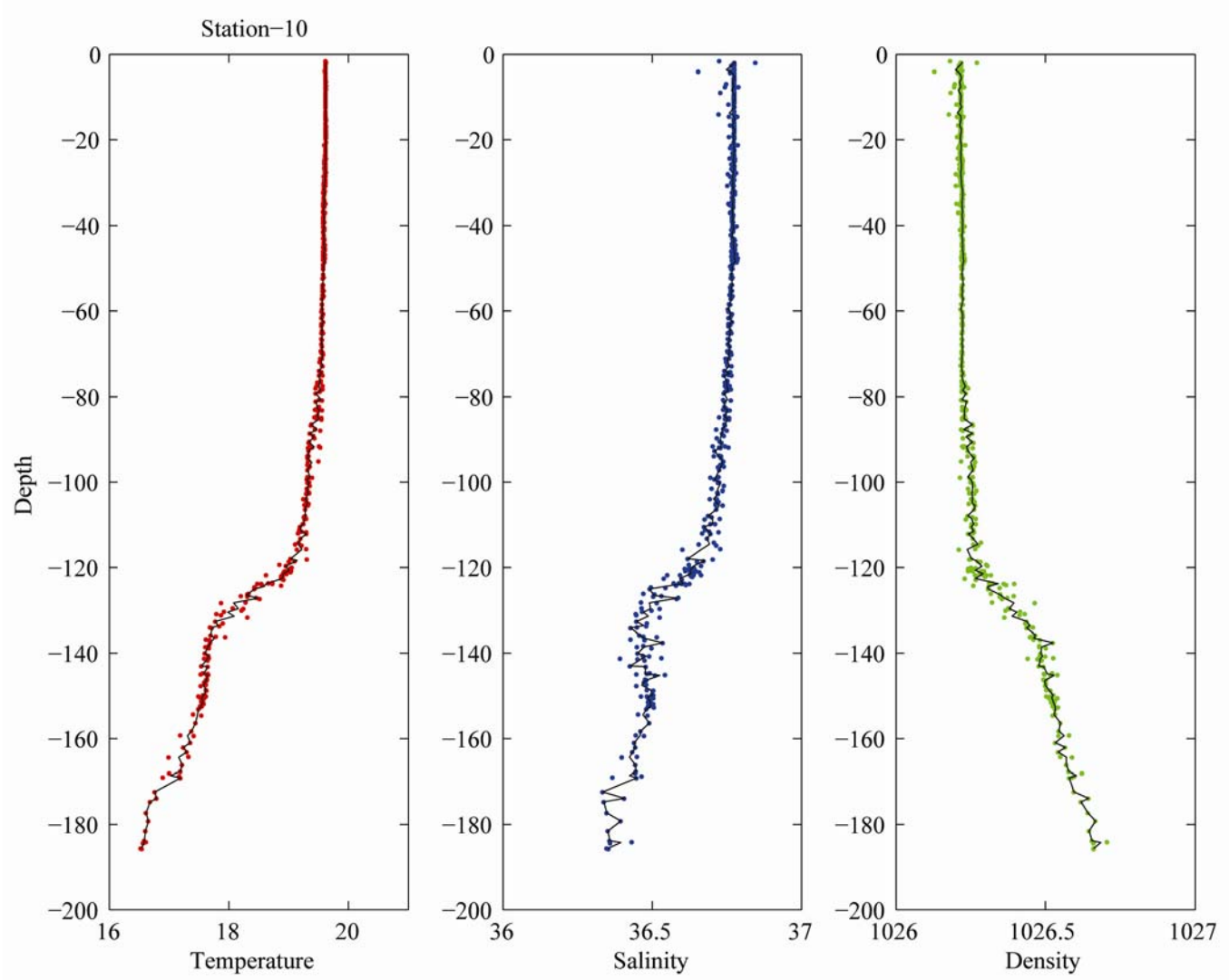

Station−5
Depth
0
−20
−40
−60
−80
−100
−120
−140
−160
−180
−200
16
18
20
Temperature
36
36.5
37
Salinity
1026
1026.5
1027
Density


Station−6
Depth
0
−20
−40
−60
−80
−100
−120
−140
−160
−180
−200
16
18
20
Temperature
36
36.5
37
Salinity
1026
1026.5
1027
Density


Station−7
Depth
0
−20
−40
−60
−80
−100
−120
−140
−160
−180
−200
16
18
20
Temperature
36
36.5
37
Salinity
1026
1026.5
1027
Density


Station−8
Depth
0
−20
−40
−60
−80
−100
−120
−140
−160
−180
−200
16
18
20
Temperature
36
36.5
37
Salinity
1026
1026.5
1027
Density


Station−9
Depth
0
−20
−40
−60
−80
−100
−120
−140
−160
−180
−200
16
18
20
Temperature
36
36.5
37
Salinity
1026
1026.5
1027
Density


Station−10
Depth
0
−20
−40
−60
−80
−100
−120
−140
−160
−180
−200
16
18
20
Temperature
36
36.5
37
Salinity
1026
1026.5
1027
Density

Appendix 3:

Species Summary – Phytoplankton Net Hauls

Station: 1

Haul: 1
Depth: 45 m
Lat: 28 N 7.32
Long: 15 W 47.99
Date: 22/01/08
Time 17:20 (GMT)

Species observed included: *Pseudo-nitzschia delicatissima* and *P. seriata, Leptocylindrus minimus, Leptocylindrus danicus* and *Leptocylindrus mediterraneus, Rhizosolenia shrubsolei/imbricata, Chaetoceros* spp. *Prorocentrum cf. micans, Guinardia striata* and *Ceratium* cf. *longirostrum.*

Station: 2

Haul: 2
Depth: 50 m
Lat: 26 N 47.41
Long: 15 W 17.82
Date: 23/01/08
Time 09:00 (GMT)

Haul: 3
Depth: 200 m
Lat: 26 N 47.41
Long: 15 W 17.82
Date: 23/01/08
Time 09:10 (GMT)

Both deep and shallow samples had a similar species composition.
Overall, samples were diatom dominated especially with *P. delicatissima* and *Chaetoceros* spp. Also observed were large numbers of Tintinnids and Radiolarians. Other species observed included elongated *Ceratium fusus* types, *Cerataulina pelagica*, *Rhizosolenia hebetata*, *Thalassiosira* spp., *Ditylum brightwelli*, *Skeletonema costatum*, *Rh. imbricata*, *Oxytoxum* spp. *Dinophysis* cf. *rotundata*, *Proboscia alata*, *Chaetoceros peruvianus*, *Dinophysis* cf. *caudata*, *Ceratium* cf. *arietinum, C. horridum, Podolampus* sp., *Hisitoneis* sp., *Ornithocercus* sp. *Protoperidinium* spp., *Ceratocorys* sp. and what look to be ecdysed *Gonyaulax* spp.

Station: 3

Haul: 1
Depth: 50 m
Lat: 26 N 16.54
Long: 15 W 42.16
Date: 23/01/08
Time 16:23 (GMT)

Haul: 2
Depth: 200 m
Lat: 26 N 16.54
Long: 15 W 42.16
Date: 23/01/08
Time 16:30 (GMT)

Colour of sample was very green – diatom dominated. Both deep and shallow samples had a similar species composition.
Pseudo-nitschia delicatissima, Chaetoceros spp., and *Leptocylindrus danicus* dominated the samples. There were also small blooms of *Phaeocystis pouchetii* observed within the sample. Other species observed included: *Thalassionema nitzschioides, Skeletonema costatum, Guinardia delicatula, Guinardia striata, Cylindrotheca closterium, Eucampia zodiacus* and *Protoperidinium* spp, with a small number of small naked dinoflagellates.

Station: 4

Samples were dominated by zooplankton with threads of mucilage throughout

Haul: 1
Depth: 50 m
Lat: 25 N 21.5
Long: 17 W 3.84
Date: 24/01/08
Time 09:07 (GMT)

Many radiolarians, ciliates and tintinnids were present. Species observed included *Rh. imbricata, Thalassiosira* spp., *Pseudo-nitzschia delicatissima, Chaetoceros* spp., *Protoperidinium* spp., *Histioneis* spp. *Oxytoxum scolopax, Pronoctiluca* sp. *Podolampus* sp. and *Ceratium gravidum* with a small number of naked dinoflagellates.

Haul: 2
Depth: 200 m
Lat: 25 N 21.5
Long: 17 W 3.84
Date: 24/01/08
Time 09:15 (GMT)

Large number of *Ceratium* spp present including *C. tripos* types, *C. fusus* types and *C. furca*. Other species observed included *Ornithocercus* spp., *Protoperidinium* spp., *Dinophysis caudata, Oxytoxum* spp., *Thalassiosira* spp. *Gonyaulax* spp. *Scrippsiella* spp., *Ceratocorys* spp., *Podolampus* sp. *Guinardia striata, Chaetoceros* spp. *P. alata, D. tripos, Gonyaulax* spp. *D. rotundata, Amphisolenia* sp., *Eucampia zodiacus, Diplopsalis* sp.

Station: 5

Very similar to the previous station – dominated by zooplankton and radiolarians.

Haul:	1
Depth:	50 m
Lat:	25 N 43.42
Long:	16 W 53.16
Date:	24/01/08
Time	16:10 (GMT)

Dominant species include *Ceratium* spp, *P. seriata*, *Gonyaulax* sp. Other species observed included *Protoperidinium* spp. *Guinardia striata, Oxytoxum* spp. *Chaetoceros* spp. *Rh. hebetata, P. alata, O. scolopax, Guinardia delicatula* and *Eucampia* spp.

Haul:	2
Depth:	200 m
Lat:	25 N 43.42
Long:	16 W 53.16
Date:	24/01/08
Time	16:20 (GMT)

Species observed included *Guinardia striata, Lauderia/Detonula, Gonyaulax* spp. *Pyrocystis pseudo-lunula, C. fusus, P. alata, Ch. peruvianus, D. ovum, Alexandrium* sp., *C. furca, P. seriata, P. delicatissima, C. pelagica, Thalassiosira* spp. *Chaetoceros* spp. *Ceratium cephalatum, Thalassionema* spp.

Station: 6

Lots of diatoms present, small amount of bioluminescence (night station)

Haul: 1
Depth: 50 m
Lat: 26 N 13.03
Long: 16 W 58.14
Date: 24/01/08
Time 23:50 (GMT)

Lots of tintinnids, radiolarians zooplankton and ciliates, sample dominated by *P. seriata, P. delicatissima, G. delicatula, P. alata, Coccolithus pelagicus* and long thin cells. Other species observed include *Skeletonema costatum, Guinardia delicatula, G. striata, L. minimus, C. fusus, Rh. Hebetata, Amphisolenia* sp., *Thalassiosira* spp. *Chaetoceros* spp. *C. lineatum., Ceratocorys* sp. *Protoperidinium* spp., *C. tripos, Ch. peruvianus, Podolampus* sp., *Eucampia cylindricornis*

Haul: 2
Depth: 200 m
Lat: 26 N 13.03
Long: 16 W 58.14
Date: 25/01/08
Time 00:00 (GMT)

Dominated by *P. delicatissima* and *P. seriata.* Also observed: *Thalassiosira* spp., Tintinnids, *L. danicus, Oxytoxum scolopax, G. striata, Rh. Imbricata, C. furca, Ceratium* spp. *Ch. laciniosus* and *Kofoidinium* sp.

Station: 7

Diatom dominated sample – cells caught up in gelatinous zooplankton mucilage and *Chaetoceros* setae. Also a lot of tintinnids and radiolarians present.

Haul:	1
Depth:	50 m
Lat:	26 N 55.46
Long:	17 W 0.16
Date:	25/01/08
Time	08:55 (GMT)

Dominant species include: *P. delicatissima, P. seriata, G. delicatula, Chaetoceros* spp. Other species observed include *G. striata, Thalassionema* sp. (longer than nitzschioides), *Pronoctiluca* spp. *P. alata, Protoperidinium* spp., *Ceratocorys* sp. *Ceratium tripos* type, *D. fibula, Ceratium horridum/macroceros, D. hastata, D. caudata, Gonyaulax* spp. and *Ceratium hexacanthum*.

Haul:	2
Depth:	200 m
Lat:	26 N 55.46
Long:	17 W 0.16
Date:	25/01/08
Time	09:00 (GMT)

Species observed included *Ceratocorys* sp., *Protoperidinium* spp. *C. fusus, P. steinii, P. delicatissima, P. seriata, G. striata, L. minimus* and *L. danicus, Gonyaulax* spp. *Eucampia zodiacus, C. tripos, Rhizosolenia* spp.

Station: 8

Diatom dominated, very few dinoflagellates. Very long chains of species.

Haul: 1
Depth: 50 m
Lat: 27 N 25.25
Long: 17 W 1.94
Date: 25/01/08
Time 16:15 (GMT)

Dominant cells include: *Chaetoceros* spp., *P. delicatula* and *P. seriata, T. nitzschioides* and *Thalassiosira* spp. Also observed: *G. delicatula, G. striata, S. costatum, L. mediterraneus, Rh. hebetata* and *Coccolithus pelagicus*.

Haul: 2
Depth: 200 m
Lat: 27 N 25.25
Long: 17 W 1.94
Date: 25/01/08
Time 16:30 (GMT)

Dominated by *P. delicatissima, P. seriata, G. delicatula, Chaetoceros* spp, *Thalassionema* sp. (long species) and *S. costatum*. Other species observed include: *Podolampus* sp., *C. closterium, Ceratium macroceros/horridium, D. speculum, P. alata, D. rotundata*, Pennate diatoms, tintinnids, *Protoperidinium* spp., *C. lineatum* and *C. tripos* type.

Station: 9

Diatom dominated sample very few cells present. Zooplankton were all dead in zooplankton haul at this station. Phytoplankton had lots of empty thecae and ecdysed cells.

Haul: 1
Depth: 50 m
Lat: 27 N 16.08
Long: 16 W 10.05
Date: 26/01/08
Time 09:12 (GMT)

Sample dominated by *P. delicatissima,* Radiolarians, *Chaetoceros* spp. Other species observed include: *Pyrophacus* spp., Tintinnids, *Thalassiosira* spp. *L. danicus, S. costatum, Protoperidinium* spp., *Ceratium fusus* type (long), pennate diatoms, *C. closterium, P. alata, Rh. Imbricata, Ceratocorys* spp., *Gonyaulax* spp. *G. striata*, *Podolampus* spp.

Haul: 2
Depth: 200 m
Lat: 27 N 16.08
Long: 16 W 10.05
Date: 26/01/08
Time 09:25 (GMT)

Cells observed included: *C. fusus, G. delicatula, C. tripos, P. seriata*, Ciliates, *P. delicatissima, Protoperidinium* spp., *Ceratium* sp. cf. *digitatum, Podolampus* sp. *C. furca*, *Diplopsalis* sp. *Thalassiosira* spp. *Gonyaulax* spp. *Prorocentrum* spp. *D. rotundata*. *P. steinii, Coccolithus pelagicus*, *Ceratocorys* sp.

Station: 10

Very similar to the previous station - diatom dominated sample, but with a variety of dinoflagellates.

Haul: 1
Depth: 50 m
Lat: 26 N 45.36
Long: 15 W 55.24
Date: 26/01/08
Time 16:25 (GMT)

Cells observed: *P seriata, G. delicatula, Gonyaulax* spp. *P. delicatissima, Protoperidinium* spp. *C. fusus* (very long), *C. tripos, P. alata, Chaetoceros* spp. *Eucampia* sp. *Oxytoxum* sp. *Amphisolenia* sp. (short), *C. fusus* (short), cf *D. hastata* (bridge at base), *Gyrodinium* (large), ciliates and tintinnids, *Pronoctiluca* sp. *D. caudata, D. rotundata, Podolampus* sp. *Polykrikos* sp. *D. ovum, Thalassiosira* sp.

Haul: 2
Depth: 200 m
Lat: 26 N 45.36
Long: 15 W 55.24
Date: 26/01/08
Time 16:35 (GMT)

Sample dominated by *Chaetoceros* spp., *P. delicatissima* and *L. danicus*. Other cells include: *G. striata, P. alata, Thalassiosira* spp. *Podolampus* spp., Radiolarians, *P. seriata, L. minimus, D. rotundata, Ceratium tripos* shape, *O. scolopax*, Tintinnids, *Rh. imbricata* and *C. pelagica.*

Appendix 4: Seawatch Foundation Recording Forms

A: Vessel-based effort recording form

B: Vessel-based sightings recording form

4A

WF/RF 5 Apr 2006 Page ..... of .....

VESSEL-BASED EFFORT RECORDING FORM

RECORD AS MUCH INFORMATION AS POSSIBLE, BUT REMEMBER THAT EVEN PARTIAL DATA MAY BE HELPFUL! CONTINUE ON SEPARATE SHEET IF NECESSARY.

Date (dd/mm/yyyy): ..... Vessel: ..... Contact Name/Address: .....

Tel/E-mail: ..... Observer names: .....

Start Time ..... GMT / BST End Time ..... Total Time ..... Observer Height Above Sea Level (m) ..... Field of View: 180° fwd; 90°L; 90°R; 360° (tick)

TIME GMT/BST	LATITUDE (degrees, decimal minutes)	LONGITUDE (degrees, decimal minutes)	BOAT COURSE	SPEED (knots)	EFFORT TYPE	SEA STATE	SWELL HEIGHT	VISIBILITY	BOAT ACTIVITY	SIGHT. REF.

DATA DEFINITIONS: *Use categories provided below where possible*

Time: 24-hour clock; specify GMT or BST. **Location:** Record latitude and longitude (deg., decimal min. preferred) every 15 minutes or when course changes. If lat/long unavailable, note location in relation to local landmarks. **Boat course:** Record course as vessel heading not course over ground (as deg. magnetic). **Speed:** Record in knots, if available. **Effort Type:** OFF = end of effort or not watching; CASW = casual watching; DEDS = dedicated search; LINE = line transect. **Sea State:** 0 = mirror calm; 1 = slight ripples, no foam crests; 2 = small wavelets, glassy crests, but no whitecaps; 3 = large wavelets, crests begin to break, few whitecaps; 4 = longer waves, many whitecaps; 5 = moderate waves of longer form, some spray; 6 = large waves, whitecaps everywhere, frequent spray; 7 = sea heaps up, white foam blows in streaks; 8 = long, high waves edges breaking, foam blows in streaks; 9 = high waves, sea begins to roll, dense foam streaks. **Swell Height:** Light = 0-1 m; Moderate = 1-2 m; Heavy = >2 m. **Visibility:** <1 km; 1-5 km; 6-10 km; >10 km. **Boat Activity:** Record No of each and type: NB = No boats, VE = unspecified vessel, YA = yacht, RB = row boat or kayak, JS = jet ski, SB = speed boat, MB = motor boat, FI = fishing boat, FE = ferry, LS = large ship , SV = seismic vessel, WS = warship. **Sighting Reference:** Refer to number(s) on Sighting Record Form.

Please return to Sea Watch Foundation, Paragon House, Wellington Place, New Quay SA45 9NR or to your Regional Group Co-ordinator
For more info contact info@seawatchfoundation.org.uk or call 01545 561227 or visit www.seawatchfoundation.org.uk

4B

SWF/RF 2 Apr 2006 Page ..... of .....

VESSEL-BASED SIGHTINGS RECORDING FORM

RECORD AS MUCH INFORMATION AS POSSIBLE, BUT REMEMBER THAT EVEN PARTIAL DATA MAY BE HELPFUL! CONTINUE ON SEPARATE SHEET IF NECESSARY.

Date (dd/mm/yyy) ..... Contact name / address .....

E-mail: ..... Phone ..... Boat name .....

Ref. No.	TIME BST/GMT	LOCATION (Latitude & longitude)	SPECIES	CONF.	TOTAL NO.	NO. CALVES	NO. JUVES	BEARING ANIMAL	DIST. TO ANIMAL	BEHAVI OUR	REACTION	ANIMAL HEADING	ASSOC. SEABIRDS	OBSERV NAME

DATA DEFINITIONS: *Use categories provided where possible.*

Reference No.: Number each sighting sequentially to allow for cross-reference with effort or additional notes. If a repeat sighting, use the same number as for the first sighting of the group. **Time**: 24-hour clock; circle BST or GMT. **Location**: Record latitude and longitude (deg., decimal min. preferred), if lat/long unavailable, note location in relation to local landmarks. **Species**: Give the best judgement of species ID; use general categories if unsure (e.g. dolphin species). **Confidence**: Definite; Probable; Possible. **Total No.**: Give range if unsure of exact number. **Calves/Juveniles**: Estimate counts of different–sized animals relative to adult body size (calves up to 50% adult size, juveniles 50-75%). **Bearing**: Degrees (magnetic). **Distance to animal**: Metres. **Behaviour**: Surfacing; Normal Swim; Fast Swim; Blowing; Feeding; Leap/breaching; Tail slap; Spy-hop; Bow-ride; Rest/Milling; Aggression; Sexual. **Reaction**: POS (attracted to boat); NEG (avoided boat); NON (no response observed). **Animal heading**: Note general direction of movement, or whether direction is variable. **Seabirds**: Note seabirds closely associated with the animals; record species of bird, if known, and number of birds.

Please return to Sea Watch Foundation, Paragon House, Wellington Place, New Quay SA45 9NR or to your Regional Group Co-ordinator

For more info contact info@seawatchfoundation.org.uk or call 01545 561227 or visit www.seawatchfoundation.org.uk

Appendix 5: The Alternative Cruise Report.

The following are unedited copies of daily reports which were emailed to JST and published on their website. The reports are the personal views of members of the voyage crew.

Lord Nelson	21-01-2008

LN 684 Gran Canaria to Gran Canaria

Scientific Voyage

Day One

So here we are at the beginning of what looks to be a very promising and interesting week. As soon as everyone had arrived on board, the voyage crew of LN684 were invited to meet in the lower mess to begin the introductions. Captain Clare Cupples introduced the permanent members of the crew: Neil the Mate, Roger the 2nd Mate, Vernon the Bosun, Nicky the Super Numery Officer of the Watch, Marco and Mr Chipps the Engineers, with Taff the Engineering Assistant, Rachel the Medical Purser, Lesley and Ellen Bosun's Mates and not forgetting the main man Dave the Cook.

Then Captain Clare introduced John Patching, the senior scientist on this voyage who explained just what they hoped to be doing and how we can all be involved in this.

The starboard upper deck head has turned into a laboratory and sampling gear can be found off the stern of the ship and a number of gadgets and curiosities have started to emerge.

There really is great excitement and anticipation amongst the permanent crew, voyage crew and scientists. We hope to gain a new understanding of our planet's oceans by examining the microscopic plants, animal life and larger sea creatures. The aim is to find out how this all influences the life cycles around us. We also want to find out what effect global warming has had on the micro organisms -oh and of course, sailing a tall ship!

Update By: Rachel MP LN

Lord Nelson	22-01-2008

Day Two. Tuesday.

The scientists and voyage crew started the day with a hearty breakfast, which was followed by several safety briefings. We learnt how to evacuate the ship, what to do in a fire and the correct way to be sick; (down wind of course!) The next task was to be fitted into our climbing harnesses so "all hands could go aloft". We gingerly climbed up to the first crows nest, and then the more foolhardy sailors crept along the topsail yard to untie the gaskets to release the sail.

The boat left harbour around mid-day and under engine power travelled north out of Gran Canaria. The scientists on board got out the various bits of equipment they had brought and checked that nothing had been damaged on the journey from the U.K.. During the late afternoon the first of the sampling got underway. One project involved "listening" to the sound of the water in different parts of the boat. When placing hydro-foils on research vessels it is important to know which is the best place to put them to get accurate acoustic readings.

Several scientists deployed equipment to sample phytoplankton, tiny marine plants, two others sampled for zooplankton, tiny marine animals. The final project is looking at the physical ocean and readings were taken of the seas temperature, salinity and other variables to create a profile of the water column.

As the sun was setting we were fortunate to see a pod of 6 or 7 short fin pilot whales, this sighting was recorded and will be fed into a national data base.

Update By: Susan Geebels

Lord Nelson	23-01-2008

LN684 Gran Canaria- Gran Canaria

Scientific Voyage

Day Three 23rd January 2008

The science has really taken off today. The stern platform transformed into an outdoor science lab with samples of water being carefully filtered through a Heath Robinson contraption! There has still been time for the usual JST delights of happy hour and bracing stations, particularly as we have to heave too for the scientific samples. All of which leads to an interesting sight even for the more experienced sailors of seeing the foresails full of wind whilst the mainsails are backed up. Just when you thought you'd got the hang of steering-the course is replaced with 'steer 70 degrees off the wind' as there is no clear destination except for deep ocean water.

Tonight we have had the excitement of an anti-piracy drill but rather than this being the alert we anticipated (no Johnny Depp I'm afraid) we were able to assist in the search and rescue of a number of illegal immigrants.

Update By: Mandy Fry Aft Port

Lord Nelson	24-01-2008

LN684 Gran Canaria- Gran Canaria

Scientific Voyage

Day 4 24th January 2008

After an excellent moonlit, rolling sail, continuing on a south westerly course, we reached our southern most point of the voyage around 187 miles south of Las Palmas and about 120 miles off the Moroccan/Mauritanian border. Today we have covered roughly 97 nautical miles all blissfully under sail, with all square sails set, giving us a very satisfying travelling speed of 4 knots (max of 7.8). We have travelled in a starboard tack, making our way back to Tenerife. On two occasions we heaved to, to allow our scientists to take further samples. Dedicated searches for 'cetaceans' (whales and dolphins) have been carried out from the bridge. A porpoise was spotted leaping from the waves alongside the ship in the early hours and we have had several tantalising sightings of Minke whale 'blows'. Captain Clare has inadvertently discovered a great new technique for getting 'all hands on deck' by simply shouting 'whale spout off starboard midships' and waiting for the rush!! We have also had sightings of a Hoopoe and a Portuguese Man of War. Now amidst the quiet chatter in the bar the weary companions settle into another night beyond the 3000m contour of the Atlantic Ocean.

Update By: Judy Foster Smith Fwd Stbd

Lord Nelson	25-01-2008

Day 5 Friday

Another sunny day with barely a cloud in the sky as we continued under sail towards La Gomera and then Tenerife. We now have the technique for "Heaving to" down to a fine art and everyone seems to appear in the right places at the right time! Another 2 collections were made today so another few millions Diatoms are now safely on board!

It is good to see little huddles all over the ship with passionate scientists showing their latest finds to interested non scientists (who will now think carefully before swallowing sea water in future!)

There was great excitement in early afternoon when the ship was buzzed by a plane which was presumably from the local coastguard. On its last pass it was below the top of the mast and Kate (who was climbing the ratlines at the time) could almost reach up and shake hands. We couldn't decide if they were thinking we were the missing refugees or whether it was hoping to parachute a few onto deck to get rid of them! During the afternoon a few Portugese Man-O War sailed by but not a lot else happened as people sunbathed on the deck and caught up on much needed sleep.

As we sailed close to Tenerife it was like torture for Evelyn and Sandra who were desperate to go ashore for some nightlife and we had to stop them from swimming for it!

The night was rounded off by a rendition of Happy Birthday for Evelyn at one minute past midnight.

Update By: Aft Starboard Watch

Lord Nelson	28-01-2008

LN684 Gran Canaria- Gran Canaria

Scientific Voyage

28th January 2008

Wow what a voyage and what a wonderful week! On day one the customs at Madrid unfortunately held up some of the vital equipment for this 'scientific voyage' but in true Heath Robinson style, Neil the Mate and Chipps, Marco and Taff the engineers could be seen working late in the engineers workshop, using drills, parts of Charlie and no end of gaffer tape to make it all happen – well done!

Over the week, the number of voyage crew on board grew at times from 50 to 50 million with the various zooplankton (microscopic beasties), phytoplankton (microscopic marine plants) and other such life being welcomed, examined and photographed. This of course brought with it various levels of excitement and despair amongst the scientists as the zooplankton wanted to ingest the phytoplankton – high drama indeed!

Talking of high drama, there was one night when going on watch really did bring some sobriety (albeit briefly) and out us in mind of 'spotting the perils out there' with

greater vigilance, as a piracy alert was received from a passing ship. A full drill ensued in which the ship was made safe – but as midnight broke, we learnt that the 'pirates' were in fact illegal immigrants and Lord Nelson was able to successfully contribute to the Spanish coastguard 'search and rescue' operation.

Each day has begun in true JST fashion with Dave the Cook, rustling up a hearty breakfast, so energy-stacked we have been able to 'heave to' the ship so that the daily samplings have been able to take place. Apparently we have set the record for the number of times Nellie has heaved too in a week.

This voyage has involved all the crew which has been great for the non-scientists amongst and once the samples have been safely decanted on board and scrutinised under the microscopes in the 'laboratory' (aka the Port side deck head), comments about never drinking sea water again have been plentiful and even Roger the 2nd mate said he would keep his mouth shut!

But amongst all the new activity on board, we have found the same camaraderie and willingness to muck into the ship's routine of mess duty, happy hour, bracing the yards and climbing the rigging and of course, doing the watches and helming the ship – a full week you'll agree but one where we'll be talking for many evenings to come.

Update By: Rachel Medical Purser