UNIVERSITY OF ABERDEEN

Oceanlab

Cruise Report

RRS JAMES COOK CRUISE 048

ECOMAR
Ecosystem of the Mid-Atlantic Ridge at the Sub-Polar Front and Charlie Gibbs Fracture Zone.

26 May – 3 July 2010

Principal Scientists

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http://www.oceanlab.abdn.ac.uk/research/ecomar.php

http://www.mar-eco.no/

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Cover Photograph: **Head of Enteropneust worm, Southern Purple type. Probably a new species.**

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The Ship's Company

Front row, left to right:
David Shale, Peter Robinson, Jessica Craig, David Edge, Helena Wiklund, Mark Shields, Claudia Alt

2nd row, left to right:
Andrew Gooday, Ian Douglas, Pedro Ribeiro, Philip Appleton, Peter Sarjeant, George Parkinson, Andrey Gebruk, John Wynar, Deborah Crockard, Stephen Day, Peter Mason, Geoffrey Wigham

3rd row, left to right:
Antonina Rogacheva, Paul Lucas, Malcolm Graves, Christopher Uttley, Monty Priede, Dean Hope, MarshYoungbluth, William Handley, Philip Bagley, Daniel Jones, Darren Caines, Thomas Linley, Brian Conteh, Benjamin Wigham, James Cooper, Grant Duffy, Simon Dodd

SCIENTIFIC PERSONNEL

PRIEDE Imants (Monty) G. (Principal Scientist)	U. Aberdeen	UK
BAGLEY Philip M. .	U. Aberdeen	UK
SHIELDS Mark A.	U. Aberdeen	UK
LINLEY Thomas D.	U. Aberdeen	UK
CRAIG Jessica	U. Aberdeen	UK
DOUGLAS Ian R.	U. Aberdeen	UK
CROCKARD Deborah	U. Aberdeen	UK
GOODAY Andrew J.	NOC Southampton	UK
JONES Daniel O.	NOC Southampton	UK
BOORMAN Benjamin	NOC Southampton	UK
ALT Claudia	NOC Southampton	UK
DUFFY Grant A.	NOC Southampton	UK
GEBRUK Andrey	Shirshov Moscow Russia	
ROGACHEVA Antonina	Shirshov Moscow Russia	
YOUNGBLUTH Marsh J.	Harbor Branch	USA
WIGHAM Benjamin D.	U. Newcastle	UK
WIGHAM Geoffrey D.	U. Plymouth	UK
WIKLUND Helena	NHM London	UK
RIBEIRO Pedro M.	U. of Azores	Portugal
SHALE David M.		UK
MASON Peter J.	NMFS Sea Systems	UK
DODD Simon E.	NMFS Sea Systems	UK
WYNAR John B.	NMFS Sea Systems	UK
POOLE Benjamin	NMFS Sea Systems	UK
COOPER James A.	NMFS Sea Systems	UK
EDGE David	NMFS Sea Systems	UK
HANDLEY William H.	NMFS Sea Systems	UK
KEOGH Robert T.	NMFS Sea Systems	UK
WHITTLE Stephen P.	NMFS Sea Systems	UK
MYERS Michael J.	NMFS Sea Systems	UK

SHIP'S PERSONNEL

SARJEANT, Peter G.	Master
WARNER, Richard A.	Chief Officer
GRAVES, Malcolm	2nd Officer
LAIDLOW, Vanessa R.	3rd Officer
PARKINSON, George G.	Chief Engineer
KEMP, Christopher	2nd Engineer
UTTLEY, Christopher	3rd Engineer
WYTHE, Vivian M.	Deck Engineer
APPLETON, Philip	Elec Tech Officer
LUCAS, Paul	Purser
THOMSON, Ian Norman	CPO Deck
MINNOCK, Michael.	CPO Scientific
DALE, John E.	PO (Deck)
MacDONALD, John E.	Seaman
DAY, Stephen P.	Seaman
HODGSON, John A.	Seaman
GALLAGHER Steven J.	Seaman
WILLIAMS, Emlyn G.	Engine Room PO
CAINES, Darren A.	Head Chef
HOPE, Dean A.	Chef
ROBINSON, Peter W.	Steward
CONTEH Brian	Assistant Steward

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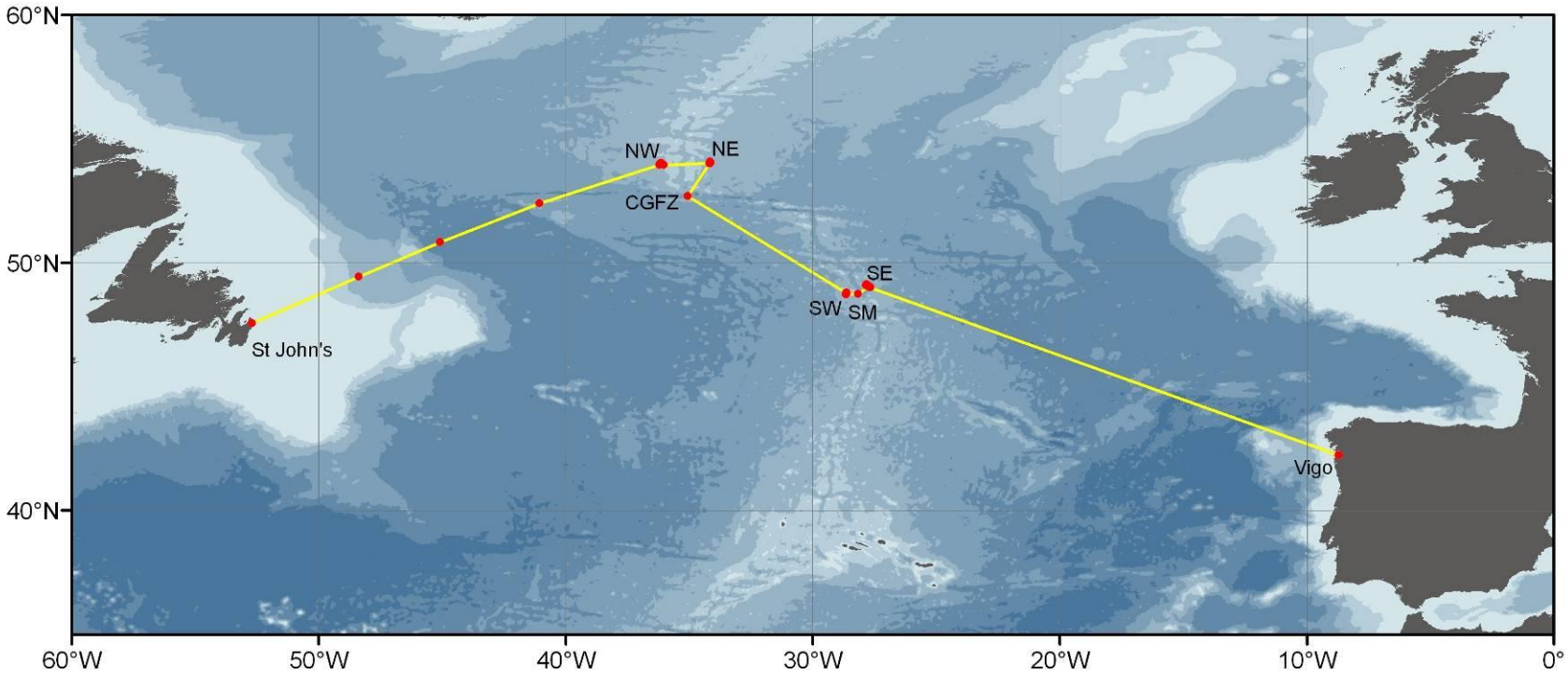

Figure 1 JC048 Cruise track. Sailed from St John's, 26 May, arrived Vigo, Spain, 3 July 2010.
Red points - stations. Yellow line between stations (not necessarily the true ship's track). NW, NE, SW & SE – the four superstations.
CGFZ – Charlie Gibbs Fracture Zone DOBO location. SM – unnamed seamount at the southern transect.

ITINERARY

Depart:	St John's, Newfoundland, Canada	Wednesday, 26 May 2010
Arrive:	Vigo, Spain	Saturday, 3 July 2010

OBJECTIVES

The fourth cruise to the Mid-Atlantic Ridge was conducted as part of the NERC-funded consortium project (NE/C512961/1) entitled **ECOMAR - Ecosystem of the Mid-Atlantic Ridge at the Sub-Polar Front and Charlie Gibbs Fracture Zone.** http://www.oceanlab.abdn.ac.uk/ecomar/index.php

Previous cruises in the series were:

1. *RRS James Cook*	JC011 13 July – 18 August 2007:	PSO- Imants G. Priede
2. *RRS Discovery*	D331T 24 July – 15 August 2008:	PSO- Phil Bagley
3. *RRS James Cook*	JC037 1 August – 9 September 2009:	PSO- Imants G. Priede

ECOMAR forms part of the Census of Marine Life MAR-ECO project, which is an international study of life in the northern mid-Atlantic Ocean with scientists from 16 nations participating in research of the waters around the mid-Atlantic Ridge from Iceland to the Azores (http://www.mar-eco.no).

ECOMAR is focussed on patterns and processes in an area approximately half way between Iceland and the Azores in the vicinity of the Charlie-Gibbs Fracture Zone. The fracture zone represents a major discontinuity in the structure of the ridge but is also the latitude at which the north Atlantic current crosses the ridge from west to east, delineating the position of the sub-polar front with cooler productive waters to the north and warmer, more oligotrophic waters to the south. A voyage of the *RV GO Sars* in 2004 had indicated important differences in fauna across this boundary. Cruise JC011 had made detailed bathymetric surveys of 4 main stations at 2500m depth at *ca*. 49°N and 54°N with two stations west of the ridge axis and two stations east of the ridge axis, i.e., SW, NW, SE and NE, on cross ridge transects north and south of the Charlie Gibbs Fracture Zone. *RRS James Cook* cruise 037 continued detailed studies at these four stations using conventional sampling methods, baited traps, trawls, landers and acoustic survey methods. Long term moorings with current meters, sediments traps and other sensors had been established in 2007 at each of the four main stations, which have been serviced on subsequent cruises.

The specific objectives of Cruise JC048 were to:

1. Recover moorings equipped with sediment traps and other instrumentation at each of the four super stations NW, NE, SW and SE.
2. Observe and record sounds of benthic fauna attracted to baits at each of the four super stations using a lander.
3. Obtain samples of sediment and its fauna at each of the 4 superstations with a megacorer.
4. Capture motile benthic epifauna by means of free fall traps at each of the four superstations.
5. Profile the water column with CTD casts at each of the 4 superstations.
6. Isis ROV to conduct swath bathymetry surveys of representative topography at each of the four superstations.
7. Isis ROV to retrieve whale bones deployed at the NE and NW stations during cruise D331T in 2008.
8. Isis ROV to recover the DOBO lander deployed in the Charlie Gibbs Fracture Zone during JC011 in 2007.
9. Isis ROV for HDTV video transect surveys of flat, sloping and steep terrain at each of the 4 superstations.
10. Isis ROV survey of seamount.
11. Isis ROV collection of voucher specimens of benthic fauna.
12. Isis ROV pelagic dives to observe and collect mid-water fauna.
13. ICDeep observations of pelagic bioluminescence using the CTD Yoyo technique.
14. ICDeep observations of benthic bioluminescence by real-time observation with the Isis ROV.
15. Benthic fauna observations using the Isis ROV with the field of view illuminated using red light.

List of Gears Used

Amphitrap - A free fall baited trap with acoustic releases and buoyancy.

CTD - Conventional conductivity, temperature depth rosette sampler with 24 bottles, ADCP and other sensors.

CTD YoYo+ICDeep - The CTD rosette deployed for repeated cycles with the ICDeep camera to study bioluminescence in the water column.

EK60 - Kongsberg multi-frequency echosounder for measuring targets in the water column.

EM120 - Kongsberg swath bathymetry system coupled to an OLEX display.

HALO - Halo (Highlighted pArticLe Observation) Experiment attached to the Isis ROV to count particles in the water. A quadrat illuminated by a shaft of white light within the bounded area.

HDTV - High definition television.

ICDeep - ICDeep high sensitivity video camera for observing bioluminescence.

Isis ROV- Isis Remotely Operated Vehicle.

Megacorer - A multi-corer for sampling sediment.

PAL - Photographic Acoustic lander.

SVP - Sound Velocity Profiler.

Moorings - 4 moorings equipped with sediment traps, current meters and other instrumentation. One mooring at each of the 4 super stations.

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CRUISE NARRATIVE

All times are ship's time which is UTC/ GMT, except at the beginning of the cruise up to 28 May and from 30 June at the end of the cruise when local times were followed as indicated.

Wednesday, 26 May,
Newfoundland time (GMT-2.5h)

0715h St Johns Newfoundland. Depart and move across to fuelling jetty.
Weather sunny and clear.
0800h Vessel alongside refuelling jetty.
1840h Fuelling completed, lines cast off ready for departure.
1906h Moved away from quay.
2030h Course *ca*. 55°N toward the first station, ship moving well at 10knots,
Sunny evening, gentle swell.

Thursday, 27 May,
(Clocks forward 30 min- Time GMT-2h)

0800h Calm but foggy morning ship moving easy at 10 knots.

1540h Ship heaves to for test of the Isis ROV.
1525h Rails down.
1555h Commenced lifting. A pod of pilot whales appeared near the ship.

1601h **Station JC048/001 Isis Dive 155 2257m 49°26.71'N 48°23.48'W**
Isis in the water for a test dive.

1607h Floats all on the tether.
1609h Commenced descent.
1631h Isis developed hydraulic leaks and other problems and it was decided to retrieve it in board.
1707h Isis secure on deck.
There was then a delay in resuming passage owing to jamming of the azimuth thruster in the down position.
Eventually the thruster was retracted by manual control and USBL boom was also retrieved.
1810h The vessel resumed passage to the north west station while work continued on the ROV.
2000h All the main faults on the ROV had been rectified and a repeat test was proposed for the next morning. Weather continued fine and calm with the ship making good speed.

Friday, 28 May
(Clocks forward 60 min- Time GMT-1h)

0900h Vessel continuing progress to the North West Station. The ROV was prepared for the next dive. The ship's engineers required a test of the azimuth thruster.
0940h The vessel hove to for tests on the azimuth thruster. The system was reset and found to be working fine. Preparations began for launching the Isis ROV.

1011h Commenced moving Isis out on the gantry.

1014h **Station JC048/002 Isis Dive 156 4151m 50°49.8'N 45°05.3'W**
Isis in the water for a test dive.

1020h Floats attached to the tether.
1022h Descent began.
1033h An oil leak appeared and the ROV was brought back to the surface.
1055h Isis in board end of dive.

1120h **Station JC048/002 (Resumed) Isis Dive 157 4151m 50°49.78'N 45°05.29'W**
Isis test dive in the water.
1133h An oil leak appeared at 130m, it was decided to continue the dive but eventually the dive had to be aborted owing to loss of oil.
1150h Isis on board.
1400h The vessel resumed passage to the ECOMAR NW Station.

Saturday, 29 May
(Clocks forward 60 min- Time GMT)

0845h The vessel hove to for a proposed Isis test dive at 0900h.

0911h **Station JC048/003 Isis Dive 158 3500m 52°23.46'N 41°03.74'W**
Isis in the water.

0916h Commenced dive.
1122h On the bottom at 3500m.
1128h Ascended to 20m above the sea floor for the start of a swath transect. Delay while time synchronisation of computers was resolved.
1212h Commenced first leg of acoustic swath run, 20m above bottom, 0.4knots.
1300h End first acoustic swath run.
1315h Commenced return leg of acoustic swath run, 20m above bottom, 0.4 knots.
1356h End of acoustic swath.
1400h Benthic survey commenced, sea floor observations.
1530h End benthic survey.
1540h Tested red lights and the ICDeep camera.
1602h Successful manipulator trials.
1602h ROV called back to surface due to bad weather.
1803h On the surface 52°23.24'N 41°03.75'W

1819h Isis on board.
1830h Continue passage to NW site.

Sunday, 30 May

0800h Making slow progress towards the NW station at 6 knots against the wind and sea.
0400h Making 7.3 knots at 90 rpm with two engines.
0600h Increased the motors to 112 rpm and speed to 10.1 knots.
1200h Travelling comfortably at 10.7 knots with following wind and sea.

1800h Arrived at NW site, assess weather.

1820h **Station JC048/004 CTD1 + SVP + wire test 2572m 53°59.36'N 36°07.99' W**
4 Oceanlab releases, 1 NOC release.

1950h Test acoustic releases
2134h CTD on deck. Four releases failed to actuate, one Oceanlab (8Khz) release operated correctly. Water samples taken for Ben Wigham and Ian Douglas
2150h Move to Mega Core site and assess weather.
2245h Wind constant 30 knots gusting to 40 knots, swell forecast to build. Work suspended for assessment at 0600h 31/05/2010.

Monday, 31 May

0600h Continuing to wait on the weather. Wind steady from the west at over 30 knots. The vessel was hove to at the proposed megacoring site.
0627h The azimuth thruster was retracted.

1100h Weather worsening with 8m swell and winds of 40-45knots. Attempts at station keeping had been abandoned the vessel travelled at 2-3knots upwind on a westerly course.
1200h Continuing to wait on the weather.
1600h Weather continuing to worsen with gusts over 50 knots. Mooring and ballast broke free and were loose on the aft deck. Conditions were too dangerous for crew to attempt to secure. Galley, bond, and main lab were in disarray caused by significant ship roll.
1730h Food still delivered on time despite upheaval, thanks to galley staff.
2000h Weather moderating, crew on aft securing loose mooring and ballast. The vessel continued westwards against the seas to remain stable.

Tuesday, 01 June

0600h The vessel was back at the proposed megacorer station, holding position on DP in moderating winds but seas were still too rough for work.
0700h In view of continuing rough conditions the CTD was deployed rather than the megacorer.

0903h **Station JC048/005 CTD2 + wire test 2608m 54°0.71 36'N, 36°07.51' W**
3 Oceanlab releases, 1 NOC release. Repeat of test at sta. 4.

1045h CTD on the bottom commenced testing the releases.
1108h All the releases were activated and hauling began.
1220h CTD on deck with all the releases having worked successfully.

The vessel moved off to the Isis dive location.

1319h Arrived at Isis site 53°58.78'N; 36°11.488'N depth 2538m. Isis Dive #159. Mini Cam system (recording stills every minute) not working due to failure of computer.

1327h **Station JC048/006 Isis Dive 159 3500m 53°58.78'N 36°11.49'W**
Isis in water.
1338h Isis started its descent.
1512h Isis arrives at sea floor.
1545h Start of photo transect over 1000m of flat sea floor. Isis altimeter height of 2.9m gives correct camera view, speed 0.2m/s.
1713h End photo survey.
1723h Start movement towards whale bone (WP1).
1747h Target found on Kongsberg MS1000 sonar. Isis white lights turned off approach whale bone on red light only.
1821h Visual location of whale bone under red light.
1830h Although previously working there was no video feed from the ICDEEP camera. ICDEEP switched to internal recording as a backup. Whale bone fauna observed.
1840h White light survey of whale bone.
1900h Start collection and outreach video survey up terrace. Faunal collections and Niskin water samples taken.
2300h End of survey (site 53°59.409'N; 36°12.164'W depth 2292m.
2305h Isis commenced ascent.

Wednesday, 02 June

0035h Isis on deck. 53°59.41'N 36°12.17'W.
The vessel moved off to the megacorer site.

0109h Hove to at the coring station.

0131h **Station JC048/007 Megacorer 2628m 54°01.00'N 36°08.20'W**
Megacorer deployed with 8 large tubes and 2 multi-corer tubes at the same site as sampled by JC011 in 2007. There was a delay owing winch spooling problems.
0258h Near the bottom.
0303h Commenced hauling.
0427h Megacorer inboard with 3 Mega-core and 2 multi-core samples.

0506h The vessel arrived on site for deployment of the amphitrap. Dull cloudy weather with rain.
0530h Commenced deployment.

0542h **Station JC048/008 Amphitrap 2628m 53°59.32'N 36°08.07'W**
New amphitrap with 4 cylindrical traps at different heights was deployed.

0612h On station and commencing deployment of the PAL lander.

0626h **Station JC048/009 PAL Lander 2524m 53°58.40'N 36°08.22'W**
PAL lander deployed.

The vessel returned to the coring site.

0720h **Station JC048/010 Megacorer 2619m 54°01.01'N 36°08.36'W**

The megacorer was deployed with the same dual (8+2) configuration of core tubes.

0845h Pull out from the sea floor.
1000h Megacorer in board with 3 good mega-cores and 1 multicore.

The vessel moved off to the site for recovery of the NW sediment trap mooring.

On station JC037/055 (deployed 26 Aug 2009) at 53°59.34'N 36°07.38'W for recovery of the NW mooring. Moderate sea conditions with occasional rain.

1031h Acoustic command sent and release responded with execute message.
1050h Pellet float surfaced. Recovery proceeded.
1312h The mooring was fully recovered with no loss of gear.

1400h Vessel hove to on Isis station.

1509h **Station JC048/011 Isis Dive 160 2500m 53°56.47'N 36°12.38'W**
Isis in water.

1515h Isis start descent
1640h On sea floor. Topography difficult, ascend 40m to obtain an easier terrace wall to photo transect.
2250h Isis cut out. 7h 41 min into dive. Estimated time for this work was 3h 48 min. It is clear the time required on rough terrain needs to be doubled. (Assume 0.2 knots for all work).
2339h Commenced recovery of Isis at an initial haul rate of 10m/min.

Thursday, 03 June

0010h Isis being recovered at 30m/min.
0110h 354m of wire out, Isis haul rate reduced to 20m/min.
0126h On the surface waiting to unhook floats from the tether. 53°57.6'N 36°12.1'W
0140h Isis out of the water.
0150h Isis in board all lashed down end of Sta. 11, dive 160. The vessel proceeded to the megacoring station.

0235h On station for megacoring. Calm night, slight drizzle.

0243h **Station JC048/012 Megacorer 2619m 54°01.00'N 36°08.36'W**
The megacorer was deployed with the (8+2) configuration of core tubes.

0405h On the bottom and commenced hauling.
0530h In board with only one megacore, which was disturbed and had to be disposed. This site has a very high failure rate for coring.

0625h Recovery of Sta. JC048/008 Amphitrap. Sent first interrogation signals to the release.

0806h After continuously trying to activate the release using different transmitters it was concluded that the lander was stuck on the sea floor. The vessel then moved to the PAL lander location.

0837h Recovery of Sta. JC048/009 PAL Lander first command signals sent.
0838h Confirmation of release.
0924h PAL Lander on the surface.
0947h Grappled PAL Lander.
1006h All in board

1015h A fault was discovered in the Isis umbilical cable, 1 of the 3 optical fibres was broken 5m from the ROV end of the cable. It was decided to re-terminate the cable, but first, a full depth test should be conducted to relieve any stresses in the cable.

1024h The ship auto-positioned onto 53°58.96'N 36°08.59'W for the wire test.
1030h Deployment commenced of the wire with a weight attached.
1152h Full depth commenced veering.
1320h Wire in board test complete.

1417h Deployed CTD for Yoyo CTD with ICDEEP camera. However, ICDEEP program started before it had reached the profile start depth (500m). At these light levels it was possible the ICDEEP would have shutdown due to high light levels. Therefore, the CTD was returned to the surface.

1545h **Station JC048/013 Yoyo CTD + ICDeep 2436m 53°58.962'N 36° 08.584'W**
ICDeep reprogrammed with a longer start delay. Eight CTD profiles from 400m to 2400m at 60m.min^{-1}, with ICDeep varied gain.

Friday, 04 June

0225h CTD out of water. End of Sta. JC048/013 YoYo CTD.
0228h CTD secure in board.

The vessel started moving towards the proposed megacorer station.

0323h **Station JC048/014 Megacorer 2550m 53°59.55'N 36°08.78'W**
Megacorer in the water. The station was displaced approximately one mile south of the previous standard station used in the NW to determine if better results could be obtained.
0429h On the bottom commenced hauling.
0557h Megacorer on board. Retrieved with only one core tube full which drained away as it was moved in board.

0600h The wind was blowing at 30 knots from the west and swell was building. Scientific work was suspended owing to inclement conditions.

0830h Continuing bad weather, wind speed 30-40 knots.
1200h Proposed repeat Yoyo CTD delayed due to continuing bad weather.
1330h Conditions reviewed, weather still too rough to continue work.

1530h Continuing bad weather, wind speed 40-45 knots.
2100h All work abandoned for the night due to poor weather conditions.

Saturday, 05 June

0400h Continuing inclement weather but decreasing wind speed from 35-40 knots at midnight to 28-35knots. The vessel was holding station near the proposed ROV station.
0800h Conditions were considered OK for work. The vessel moved into position for the NW survey dive resuming the work of dive 160. The proposed CTD YoYo experiment was cancelled.

0903h **Station JC048/015 Isis Dive 161 2173m 53°57.858'N 36°12.492'W**
ROV in the water to complete the survey work dive 160.
1019h Bottom detected at 400m range.
1036h Arrived on the bottom *Antimora rostrata* swimming in the field of view. Sandy bottom on the crest of the ridge. The ROV was moved over the edge of the ridge to survey the vertical face. Chimaera approached the vehicle.
1047h Start of line transect 5 along a spectacular cliff face.
1300h End of line 5, during transit to line 3 navigation systems crashed causing a delay.
1411h Start of line transect 3, 10^{o} gradient.
1523h End of line 3.
1548h Start transit to line 9, swath 20m above bottom.
1830h End of swath.
1839h Start of line transect 9.
1938h End of transect 9.
1950h During transit to line 11, all communication was lost with the Isis. Start to recover to the surface to recover a dead vehicle. During the recovery the whole vehicle was rebooted by switching the topside power off than back on again. All communication was resumed, and Isis moved back to the start of line 11.
2105h Start transect 11.
2213h End line 11.
2241h Start line 10.
2339h End line 10.

Sunday, 06 June 2010

0041h Start line 4, depth of vehicle 2476m with 3m altitude.
0149h End line 4, accomplished speed of $0.13 m.s^{-1}$ = ca. 0.25 knots, Photographed an enteropneust at the end of the line with the ROV static.
0233h Start line 1.
0340h End of line 1, transit line 2.
0403h Hit the sea floor as the bottom sloped upwards to 2400m.
0416h Start line 2.
0522h End of line 2.

0528h Head for the amphitrap station JC048/008 some 3000m distant at 53°59.3'N 36°08.1'W.

0800h Approaching the amphitrap site and commenced a search pattern 200m SW of the deployment location moving in a straight line towards and beyond the deployment position.

0819h A pause while the Isis navigation system was rebooted.
0840h Passed through the deployment position and no sign of the lander.
0910h Started a second search line 30m west of the previous line.

0917h Clear target seen on the sonar.

0922h Visual contact, 3 large chimaeras swimming around the lander frame and numerous amphipods. The release was closely inspected using the HD zoom pan and tilt camera. The release appeared to have partially opened but balanced in the stable state retaining the ballast.

0947h The ship was repositioned.
0955h The lander was released by shaking using the Isis manipulator arm.
1102h Amphitrap station JC048/008 on the surface. A fine, but overcast day with a 16 knot breeze from the west. Recovery of the trap inboard had to await recovery of the ROV.

1129h ROV on the surface. End of Dive 161 Sta. JC048/016, 53°59.193'N 36°08.265'W.

1135h Isis secure on board. The vessel then moved to recover the amphitrap.

1158h Trap grappled.
1212h Recovered in board.
1220h The vessel moved off on passage to the next Isis dive while ROV equipment was prepared for observing and collecting the whale bone.

1500h Set up for ROV dive 162 complete, commence pre dive checks.
1620h Pre-dive checks complete.

1638h **Station JC048/016 Isis Dive 162 2450m 53°59.417'N 36°11.668'W**
Isis in water.
1810h Arrived at sea floor
1815h Commence approach to whale bone way point, distance 70m.
1845h Arrived at way point, no acoustic or visual detection. Search commenced.
1900h Navigation system restarted.
1938h After search and assessment returned towards waypoint A03_3_3 to retrace route of first detection.
2015h Target detected on MS1000 sonar.
2030h 10m from target, started ICDEEP recording. Then approach under red light, then white light. No visual on whale bone. Started local search under white lights.
2110h Abandoned search for whale bone (3 h).
2126h Started image and voucher specimen collection survey.
2223h Arrived at terrace, continued image and voucher specimen collection.

Monday, 07 June 2010

0100h Collecting continued on the cliff face at 2398m depth, 53°59.326'N 36°11.911'W

0144h A problem became apparent with the Sonardyne map display, the map was displaced the SW by *ca*. 1nM.
0230h On cliff face collecting a stalked crinoid 2398m depth.
0300h On a scree slope taking a second crinoid 2394m depth.
0330h On a cliff face taking an echinoid off a ledge using the suction sampler.
0400h At the top of the scarp slope attempting to take a basket star 2285m depth.
0430h Moved up over the edge of the cliff on flat sediment covered ground ready to collect xenophyophores.
0452h Successfully captured xenophyophores in push cores, depth 2272m, 53°59.378'N 36°12.293'W
0500h Collecting sponges.
0544h Turned to the SSW (course 195°) to search on flat ground along the top of the terrace.
0630h End of dive, Isis ascended to the surface.
0808h Isis on the surface in relatively calm conditions, wind 6.5knots, 288°. 53°59.348'N 36°12.343'W. End of Sta. JC048/016 Isis Dive 162.

0816h Isis on deck, the *RRS James Cook* hove to while samples were removed and preparations began for the next dive. A thruster was replaced.

1204h **Station JC048/017 Isis Dive 163 2450m 53°59.441'N 36°11.646'W**
Isis in the water.
1212h Started to dive.
1331h ROV on sea floor, 100m north east of whale bone.
1343h Started search for whale bone.
1400h On whale bone waypoint, no target on MS1000 sonar or visually. Moved to the east to replicate original track when whale bone was located (i.e., approach in an up slope direction).
1440h Started up slope search from east towards the whale bone waypoint.
1540h At whalebone waypoint. No contact on MS1000 sonar or visually.
1541h Started 360^{o} visual survey around waypoint. Move 10m and repeat.
1613h Started box search around whale bone waypoint. First line start north of waypoint on a parallel course 50 metre to the west and 30m to the north.
1621h Observed an Isis footprint on the sea floor.
1630h Turn south to a position 50m east and 60m south of the whale bone waypoint.
1640h Turn west to complete another parallel line 30m south of the whale bone waypoint.
1550h Complete box, no sonar or visual contact.
1700h Small box search in north west corner of search area.
1730h Search for whale bone abandoned (4 h).
1735h Start voucher specimen collection
1818h Finished collection, end of Dive
1950h Isis on surface.
2002h Isis on board.

2010h Ship heading for swath waypoint start position.

2055h **Station JC048/018 EM120 Swath 2497m 53°56.769'N 36°01.818'W**
Waypoint 1, start of swath run to fill in gaps in the previous surveys and broaden the strip transect across the mid Atlantic ridge at ca. 54°N.

2210h Passed waypoint 2 54°02.904'N 35°55.896'W pause in logging while the ship made the turn. Calm sea, negligible wind.

Tuesday, 08 June 2010

0334h Approaching swath waypoint 3 stop logging End of Sta, JC048/018.
54°02.904'N 34°14.525'W
The settings on the EM 120 are different on this voyage compared with JC011 when most previous data were collected so the swath width is narrower with denser pattern of data points. The swaths therefore failed to overlap during the transit across the ridge.
0344h Started logging data again on the EM 120 after the turn at waypoint 3. Moved to the NE CTD station.

0356h The vessel arrived at the NE CTD station.

0420h **Station JC048/019 CTD 2497m 54°01.112'N 34°10.647'W**
CTD in the water.
0524h On the bottom commenced hauling taking water samples on the ascent.
0630h CTD in board and the vessel moved off to the mooring recovery site.
0730h Vessel on station for recovery, release commands sent.
0735h Station JC037/081 NE mooring 54°00.05'N 34°10.58'W. First floats on the surface.
0827h Grappled once all the floats were at the surface, Recovery proceeded in perfect calm conditions with less that 5 knots of wind.

1015h All in board. The vessel moved to the amphitrap position.
1104h Commenced deployment.

1114h **Station JC048/020 Amphitrap 2505m 54°03.95'N 34°09.12'W**
Trap deployed, with modified acoustic release configuration to avoid repeat of jamming problems on the previous deployment.

The vessel moved one mile north to the PAL lander deployment position.
1150h Began deployment of PAL Lander.

1154h **Station JC048/021 PAL Lander 2506m 54°04.920'N 34°0869'W**
PAL Lander flag sank below the surface. Continuing calm weather.

The vessel then moved into position for deployment of Isis to recover the NE whale bone experiment.

1312h Isis deployment, Dive 164 to recover whale bone. Isis deployed to 250m, however significant problems with interference on video monitors delays further work.

1430h Dive abandoned, Isis returning to surface.
1457h Isis on board.
1500h Use ship's crane to store mooring equipment above ROV containers. Ship hove to.

1607h **Station JC048/022 Megacorer 2510m 54°00.650'N 34°10.421'W**

1725h Megacorer at sea floor.

1845h Successful megacorer, 10 cores, one broken.

1939h ICDEEP camera switched on.

1944h **Station JC048/023 Yoyo CTD, 2510m 54°00.651'N 34°10.426'W.**
CTD with downward looking ICDeep camera and splat screen. Program altered to prevent recording durations of over 2h. A number of short 10 min recordings programmed on each downcast. Each of the 8 downcasts had an altered ICDeep gain.

Wednesday, 09 June 2010

0300h The Isis ROV team had worked through the night. The fault had been traced to water ingress via a bulkhead connector that damaged a fibre optic cable. A spare was borrowed from the SHRIMP vehicle, with modifications repairs were effected and Isis ROV was ready to be deployed. It was decided to complete the planned CTD casts.

0547h Last of 8 Yoyo CTD downcasts completed.
0645h CTD In board, water collected during the ascent. End of Station JC048/023. A foggy morning, very humid but calm weather.

0700h Deployment of Isis was planned after breakfast but new problems appeared with the Sonardyne navigation system used to track the ROV. Deployment of the ROV was delayed.
0940h There were still problems with the ROV, so it was decided to recover the Amphitrap. Station JC/048/20.

1028h The vessel arrived at the amphitrap location in calm overcast weather. Release commands were transmitted via the keel transducer.
1030h The trap was released.
1123h Surfaced.
1155h The trap was recovered in board with an abundant catch of amphipods.

It was decided to recover the amphitrap and the vessel moved onto station for this purpose. The Isis team solved the problem by borrowing a navigation

computation unit (NCU) from the ship's sonardyne system. It was hoped to deploy the ROV after the amphitrap recovery.

1240h With the repair to the ROV NCU continuing, the ship was manoeuvred to the PAL Lander location (JC048/021) and released.
1342h PAL Lander sighted on the surface. The conditions were calm but very foggy. It was assumed the PAL had been on the surface for approximately 5 to 10 mins. The radio beacon did not transmit. A 0.5knot subsea current (ADCP) drifted the PAL Lander to the east of the deployment location.
1425h PAL Lander on deck.

1547h **Station JC048/024 Isis dive 165, 2501m 54°01.030'N 34°09.445'W.**
ROV dive to image pelagic fauna and complete a benthic photo and voucher sample collection transect.

1612h Start Pelagic visual survey.
1840h Isis at sea floor.
1842h Start voucher sample collection mission.
2300h Isis arrived at terrace.

Thursday, 10 June 2010

0100h Continuing collecting samples on the terrace about 100m up from the bottom at 2398m depth. Sediment-draped slopes with rocky outcrops.

0200h At 2352m collecting stalked crinoids on a cliff face.
0245h Over the top onto smooth ground.
0305h End of collection with taking of a push core with a discoid forameniferan.

The vessel then positioned onto WP05_14 for the start of a swath transect.

0324h Start of line 1 swath bathymetry transect on the top of the NE terrace at 54°00.963'N 34°09.024'W. The ROV altitude was 20m.
0413h End of line 1 at WP A05 13 54°01.081'N 34°09.024'W. The line deviated significantly as the ROV passed down a steep cliff; it had not been possible to successfully follow the ground.

A second line was set up 50m south of line 1.

0428h Start of swath line 2.
0521h End of swath line 2. A more successful, straighter transect line.

0523h Isis began its ascent to the surface.
0652h ROV on the surface. End of Isis dive 165 Sta. JC048/24.
54°00.922'N 36°08.992'W on calm morning with good weather.
0705h Isis on deck.

0721h The vessel moved to the megacorer station.

0800h **Station JC048/025 Megacorer 2508m 54°00.650'N 34°10.417'W**
Megacorer deployed
0912h On the bottom commenced hauling.
1022h On the surface. A perfect set of 10 cores from the centre of the NE station.

1107h The Isis ROV was launched for dive 166. 54°02.39'N 34°08.50'W at the proposed station 26 to undertake studies in midwater followed by 12 video transects on the sea floor.

1105h Started to dive.

1142h The vertical high definition video camera intended for the survey stopped working shortly after launch. It was decided to abort the dive, return to the surface and effect repairs.

1226h Isis on the surface.

1237h Isis stowed and latched in board for repairs.

1330h Isis fault identified and repaired (dirty fibre optic connector), ship transited back to dive site.

1411h **Station JC048/026 Isis dive 167 2364m 54°02.414'N 34°08.452'W**
Dive to conduct 11 photo transects of terrace, slope and flat areas of the NE sector. Pelagic observations and sampling during descent. No mini-cam recordings due to computer failure.
1645h Finish pelagic sampling, Isis on sea floor.
1735h Started video line transect 5 (steep).
1835h End of line 5. It was subsequently found that the survey deviated from the intended course of 194° onto 137° and missed the steep slope it had intended to survey.
1911h Start transit to the start of line 6. On the way operate ICDEEP with splat screen with no light, alternated with HD camera observing the same size screen illuminated under white light (200m ICDEEP, no light; 200m HD white light, 200m ICDEEP no light, 200m HD white light).
2038h Finished ICDEEP work, continue transit to start of line 6.
2152h Arrived at the start of line 6.
2201h Start line 6.
2305h End of line 6.
2333h Start of line 7 (steep).

Friday, 11 June 2010

0121h Holding a depth of 2394m passing very steep cliffs.
0155h End on line 7 and continued on transit to line 8.
0306h Started line 8 at 2404m depth.
0310h The Isis was traversing sideways viewing vertical grey featureless cliff faces. Small grenadier fish were observed swimming against the rock face.
0326h The terrain changed to a broken cliff face with much sediment.

0357h More solid cliff. Isis was maintaining and autodepth of 2393m.
0416h End of line 8.
0427h The ROV then repositioned on flat ground at the foot of the slope at 2488m to fit splat screens. 34°9.279'W 54°1.046'W.

0453h Isis started the splat screen transect to the start of line 9.
0504h Travelling at maximum speed 0.3m/s at 20m altitude with a depth of 2477m no lights on.
0550h Control was lost of the ICDeep camera so it was left on and the run was completed with no lights on at different altitudes.

0601h End of splat transect on arrival at the waypoint for line 9.
0625h Start Line 9, the first of 4 on flat ground.
Enteropneusts were much in evidence and patchy distribution of small holothurians.
0728h End of line 9.
0756h Start line 11.
Dead sponges were observed.
0900h End of line 11.
0919h Start of line 10, depth 2492m.
1026h End of line 10.
1101h Start Line 12
1205h End of line 12. All the flat ground survey was now complete and the ROV was prepared for a splat screen transect to the start of line 6 on 10° slopes.
1218h Start transit to A05_2_2. During transit used ICDEEP with splat screen and no lights alternated with white lights and HD camera.
1440h End ICDEEP transit.
1451h Start line 2 (10^o slope) photo transect.
1558h End of line 2.
1635h Start of line 3 (10^o slope) photo transect.
1741h End of line 3.
1759h Start of line 4 (10^o slope) photo transect.
1908h End of line 4.
1931h Start of line 1 (10^o slope) photo transect.
2039h End of line 1 and end of photo transect survey.
2040h Correct HD camera colour balance using Sony software supplied by Dave Edge, and David Shale's imaging talent!
2057h Start Isis ascent.
2200h Isis Video feed lost. All monitors using the video fibre optic were displaying white bars of noise during all of this dive. At a depth of 200m during the ascent, the video connection was lost. ROV team investigating.
2230h Isis ROV recovered on deck (end position JC048/026 Isis dive 167 2404m 53°59.721'N 34°11.508'W).

2310h **Station JC048/027 Megacorer 2508m 54°00.666'N 34°10.422'W**
Wind speed increasing to 25 knots.

Saturday, 12 June 2010

1220h Megacorer on the bottom commenced hauling.

0127h Some delays owing to spooling problems on the winch.
0221h Megacorer inboard with 9 out of 10 good cores. By this time the wind had increased to 35 knots and work was suspended owing to inclement weather conditions. In the mean time the Isis team were continuing investigating the problem with the video system.

0600h Wind speed 40 knots 240°. The Isis had been repaired and was ready to be deployed for the next dive to retrieve the whale bone.

0700h The barometric pressure began increasing and there were signs that the wind speed was decreasing.

1230h Wind speed continually decreasing 27knots 270° but the *RRS James Cook* was pitching badly on rough seas, holding station in the NE working area 53°59.70'N 34°09.10'W.

1600h Weather continuing to improve, ship starts move back to ROV dive position. Isis fibre optic attenuation problem fixed (fibre optic cable with crushed outer causing high attenuation).

1845h **Station JC048/028 Isis dive 168 2445m 54°01.477'N 34°10.642'W**
Pelagic sampling during descent, whale bone sampling and general collections.

1852h Isis starts descent, and pelagic survey.
2119h Isis at sea floor 50m away from whale bone position.
2126h Start search for NE whale bone. Initially, directly through whale bone waypoint and 50 m beyond. Then commence a spiral search increasing in distance away from the waypoint in 50m steps.
2220h Problem with the USBL not maintaining the same track as the Doppler. There were only a few satellites on the horizon and it was thought the GPS accuracy may not be ideal. Used Doppler for navigation from this point forward.
2337h Whale bone not found. Continued on the search spiral path but also collected specimens from the sea floor.

Sunday, 13 June 2010

0030h Continuing observing and collecting fauna on the flat plain around the NE whalebone deployment site. 2426m depth 54°01.571'N 34°10.675'N.
0144h Collected complete enteropneust using the suction sampler.
0220h Moving back to the central whale bone way point.
0239h Collected xenophyophore using a push corer.
0250h Spotted target on sonar that might be the whalebone but this proved to be a coil of metal cable on the sea floor.
0330h Arrived at the whalebone waypoint. Filmed a remarkable sequence of a holothurian defecating and swimming away from the ROV. Scanned around 360° on the sonar to spot the whale bone buoy. Nothing was found.
0344h Began ascent.
0513h On the surface, end of Station JC048/28 Isis Dive 168. 54°01.488'N 34°10.675'W.

0529h ROV in board. The vessel departed for the Charlie-Gibbs Fracture Zone DOBO station.

0700h The vessel was making 10.7 knots in reasonable sea conditions. 53°49.8'N 34°18.7'W.
1100h Barometer falling, raining and wind increased to 35 knots from the south. Vessel making 8.7 knots 196°.
1430h Slowed vessel to 6 knots, swell and 30 knots of wind from the south.

1600h Near the DOBO site but conditions still prevent Isis deployment (30 knots southerly, barometer still falling).

1800h Conditions remain the same, however barometer now stabilising.

Monday, 14 June 2010

0100h Wind continuing at 35 knots from the south but the barometer stopped falling. The *RRS James Cook* steamed slowly to and fro near the DOBO station.
0500h Wind decreased to 15 knots, sea conditions improving.
0545h The vessel moved back towards the station in preparation for deployment of Isis.

0622h **Station JC048/029 Isis dive 169 3670m 52°40.86'N 35°04.20'W**
Isis deployed into the water. A power failure occurred and the vehicle was recovered.
0634h Isis out of the water.
0650h The problem was caused by a deck camera on the launch davit blowing a circuit. This failure was quickly diagnosed and the circuit breakers reset.
0650h Vehicle relaunched to a waypoint for start of a benthic survey prior to DOBO recovery.
0655h. Very green surface water with a lot of phytoplankton.
0711h Myctophids observed at 350m.
0748h Stopped to photograph a large brown medusa at 925m.
0815h Photographing ctenophores at 1560m.
0823h An oil leak was observed from the right arm azimuth joint seal. It was decided to continue the dive nevertheless.
0921h 2855m a pelagic planarian worm.
0947h Bottom contact at 400m on the sonar. The oil leak was getting worse. It was decided there would not be time to carry out the biological survey work intended so a direct transect line to the DOBO position at approximately 1000m range was set up.
1013h Start of line transect. Depth of Isis 3599m altitude 1.3m moving down a slope towards DOBO. Reefs and rocks dispersed on the bottom were observed. Clear evidence of strong eastward bottom currents in the CGFZ.
1040h All the oil had leaked out of the accumulator providing oil to the starboard arm.
1050h Observed marks on the sea floor caused by attempts to drag for DOBO in 2008.
1054h 3632m. A slope with small terraces slumping towards the north, Enteropneusts.
1125h End of 500m survey line. Since the oil had run dry in the accumulator it was decided to proceed as fast as possible to DOBO.
1151h Arrived 100m off the DOBO waypoint and Isis slowed down. DOBO had been interrogated and the releases were still working confirming the position. There

proved to be numerous rocks and hummocks on the sea floor that provide false targets for the ROV scanning sonar. A search pattern was started to the west of the DOBO waypoint.

1220h A strong sonar target was acquired.

1230h Visual contact with DOBO.

1318h ROV observations suggested the DOBO yoke had released from one acoustic release but jammed in the jaws of the other release. DOBO was pushed by the Isis but did not release. A cutting knife was then used to attempt to cut the ballast ropes and release the ballast. However, on contact with the ballast ropes the yoke dislodged from the acoustic release jaw and DOBO started to ascend to the surface.

1533h DOBO surfaced (27m/min rise time). Isis was still not on board so recovery of Isis was progressed whilst observation on the DOBO location was maintained.

1558h Isis on deck (Station 29 dive 169, 3670m 52°41.30'N 35°04.82'W).

1600h Started recovery of DOBO.

1636h DOBO on deck after 3 years deployment. Little corrosion evident on first inspection. None of the multibaits had opened however, 3 plastic tubes were broken. Initial inspection indicates that camera was not flooded.

1700h Started steam towards the SW site (estimated 34 h).

Tuesday, 15 June 2010

0400h On passage to the SW site freshening wind from the SSW slowed the speed to 8 knots.

1000h Making 10.2 knots.

1215h Continuing at 10.5 knots towards the SW station course 153°.

1800h Improving weather allows speed increase to 11 knots. Sunny and warm on the aft deck.

Wednesday, 16 June 2010

0300h Continuing to make good progress towards the SW station. Sea fog and poor visibility.

0331h Arrived at the SW station.

0346h **Station JC048/030 CTD +wire test 2531m 48°46.34'N 28°38.43'W**
CTD at the SW station, with the acoustic release from the amphitrap which had been rebatteried.

0440h Stopped at 2520m depth to test release and take water.

0450h Release OK.

0455h Started hauling.

0551h CTD on the surface.

0556h CTD in board and the vessel moved to the SW mooring station. Weather humid and warm.

0650h Mooring released.
0730h Floats sighted on the surface Station JC037/33 48°46.82'N, 28°38.50'W
The visibility was poor in dense fog. The vessel was manoeuvred alongside.
0800h Grappled
0908h Mooring all recovered. The lower sediment trap had failed to rotate properly.

1009h **Station JC048/031 PAL Lander 2500m 48°46.32'N 28°38.44'W**
PAL Lander deployed at the SW station in good weather.

The vessel moved to the amphitrap site 1 mile to the north.
1030h On station.

1042h **Station JC048/032 Amphitrap 2500m 48°47.34'N 28°38.45'W**
Trap deployed.

1124h The vessel arrived at the start of the ROV benthic survey area for the SW station.

1141h **Station JC048/033 Isis Dive 170 2500m 48°43.634'N 28°38.870'W**
Isis in the water for a pelagic dive followed by 12 benthic video survey lines.

1146h Isis started its descent.
1215h At 580m depth moving slowly searching for pelagic organisms of interest.
1435h Isis on the sea floor, end of pelagic work.

1447h Start of photographic survey (line 3, flat).
1600h End of line 3, transit towards line 4. Possible new species of Enteropneusts.
1643h Start line 4 (flat).
1752h End of line 4, transit to line 2. Numbers of medusae visible during transit.
1820h Start line 2 (flat).
1928h End of line 2. With wind at 25 knots, and swell increasing. Photo survey abandoned and ROV started ascending to surface.
2118h ROV on board (Station 33 Isis dive 170 48^{o} 43.965'N 28^{o} 39.352'W, depth 2641m). Swell conditions made it difficult for Isis to lateral shift, however Isis inboard safely. Transit to Megacorer site.

1001h **Station JC048/34 Megacorer 2564m 48^{o} 45.757'N 28^{o} 38.503'W**

2319h Megacorer on sea floor.

Thursday, 17 June 2010

0034h Megacorer in board with 8 successful megacores and one out of two multicore tubes.
The *RRS James Cook* remained on station while the CTD Yoyo experiment was prepared for deployment at the same location.

0132h **Station JC048/035 CTD-ICDeep YoYo 2560m 48°45.764'N 28°38.766'W**

8 downcasts of the ICDeep with splat screen mounted on the CTD frame. The frame was lowered into the water to wait for the onboard programme to start.

0204h Programme started, winch commenced veering.

0326h The barometer was falling and wind speed was 28-30 knots, 160°.

0600h Some evidence that the wind was moderating from 35 knots.

0700h Wind 26 knots as work continued.

0900h Wind clearly increasing, 31 knots, barometer falling and sea state building up.

1134h The final ICDeep cast was finished and the CTD was hauled slowly to the surface.

1230h CTD at 500m, it was decided it was too rough to attempt recovery. The CTD was allowed to hang in the water awaiting moderation of sea conditions.

2024h Yoyo CTD recovered in board. The wire was kinked above the CTD package and will require retermination. Weather conditions decreasing.

Friday, 18 June 2010

0030h The vessel was waiting at the Amphipod trap recovery site but it was decided that it was too risky to recover the lander at night so the *RRS James Cook* moved to the ROV deployment position.

0147h On station for Isis deployment. Sea calming down and a moonlit night.

0209h ROV out board.

0214h **Station JC048/036 Isis Dive 171 2500m 48°43.857'N 28°39.700'W**
Isis in the water for completion of work curtailed by bad weather in Dive 170, Station 33. Deployed on waypoint A11_9_1 at the top of a terrace.

0220h Dive started.

0230h 180m depth. The navigation system had failed to boot up so the descent was delayed until this was resolved.

0245h Descent resumed and pelagic observations were pursued.

0400h 2100 m depth, beginning to see the sea floor on the sonar at 400m range.

0440h Landed on the terrace at 48°43.903'N, 28°39.568'W. Began collecting epibenthic fauna, one small medusa seen in transects, two small enteropneusts and a ctenophore. Potentially 3 new species.

0542h Completed the pelagic and collection phase of the dive and move to the start of the first survey line, A11_9_1.

0557h On station for survey, but the clam (winch) computer needed rebooting.

0609h Start Line 9. Steep cliff faces with black basalt face and white sediment covering wherever possible. Relatively low abundance of fauna.

0723h Line 9 Finished. Move to Line 12.

0750h Start line 12. Continuing on steep cliff faces.

0808h Fish Halosaur on a cliff face.

0905h End Line 12.

1034h Start Line 8, a 10° sloping area on top of the terrace.

1146h End line 8. Start long transit to line 10.

1242h Start line 10, a 30^{o} sloping terrace area.

1400h End line 10, transit to line 11.

1212h Start line 11, a 30^{o} sloping terrace area.

1529h End line 11, prepare Isis for Splat screen ICDEEP and HALO light box HD
1600h Start 200m splat screen with ICDEEP, no lights, then 200m with HD camera and HALO light box. Repeat at different depths. For duration of transit to line 1.
1845h End splat transit.
1859h Start line 1, a flat transect.
2004h End line 1, prepare Isis for Splat screen ICDEEP and HALO light box HD.
2030h Start 200m splat screen with ICDEEP, no lights, then 200m with HD camera and HALO light box. Repeat at different depths. For duration of transit to line 7.
2306h End splat transit.
2317h Start line 7, a 10^{o} sloping terrace area.

Saturday, 19 June 2010

0022h End line 7.
0030h Prepare for splat screen and HALO box run.
0052h Start first of 8 ICDEEP and HALO run 200m long segments.
0341h Completion of bioluminescence studies with ICDEEP and HALO. The ROV arrived close to the first waypoint for Video transect line 5.
0417h Start of video transect Line 5 (10° slopes). Very sparse fauna on undulating terrain with slope down to the left of the north-going ROV track.
0520h End of line 5. Move to Line 6. Sand ripples with pteropod shells conspicuous on the sea floor.
0557h Arrived at the waypoint for Line 6, There was a rocky outcrop near the waypoint, which is conspicuous on the A11 chart with a contour line around it at 48°45.6'N 28°38.6'W.
0606h Start video transect Line 6. 2454m depth.
0611h Smooth substrate with no shells.
0615h Depth 2436m. The ROV was climbing over rough rocky terrain.
0630h A very small enteropneust on a sediment surface.
0651h The ROV crashed into a cliff before moving onto smooth sloping sediment with occasional xenophyophores and swimming medusae.
0714h Ascent to the surface. A brilliant sunny morning with calm weather.
0855h Isis ROV surfaced, end of dive 171, Station JC048/036.

Specimens in the suction sampler were in good condition and were taken into the temperature-controlled lab to be photographed by David Shale.

0937h **Station JC048/037 Megacorer 2520m 48°45.76'N 28°38.50'W**
Megacorer at the established SW coring site with eight tubes plus two conventional multicorer tubes.
1052h Megacorer on the bottom start hauling.

1155h Released the PAL Lander while the megacorer was being hauled.

1218h Megacorer in board with 8 full core tubes plus one successful multicore tube.

Warm calm day as the Isis crew prepared the ROV for pelagic dive. The CTD wire from JC048/035 Yoyo CTD has been reterminated and is awaiting testing once the ROV has been deployed again.

1242h PAL Lander on surface.
1324h With PAL Lander recovery ongoing. The amphitrap was released.
1338h PAL (Station JC048/031) recovered on the port quarter an inboard.

1410h Amphitrap surface.
1440h Amphitrap (Station JC048/032) inboard, again recovered from the port quarter. The ROV was being prepared for pelagic dive using the hydraulically driven Youngbluth D samplers.

1612h **Station JC048/038 Isis Dive 172 2500m 48°43.677'N 28°38.813'W**
Pelagic dive collection using D sampler and suction sampler.

1635h 600m depth start observations.
1800h 900m.
2030h 2000m no catches as yet.
2300h On sea floor. Very difficult task to manoeuvre ROV into position to collect pelagic animals in D samplers. Using suction sampler for medusa collection.
2330h First D sampler collection

Sunday, 20 June 2010

0030h The barometer was falling and wind speed increasing so it was decided to curtail the dive at 0330h. Meanwhile pelagic sampling continued just above the sea floor using the D samplers. All five chambers of the suction sampler were full.
0038h Successful capture of a medusa. The motion of the hydraulically driven D sampler lids was very slow. Often animals escaped before the lids closed.
0100h Descended close to the sea floor for push core sampling aiming for discoid forams.
0200h End of dive begin ascent 48° 43.636'N 28°38.777'W.

0336h Isis on the surface.
0346h Isis out of the water.
0351h ROV Isis on deck end of station JC048/038 in freshening winds.

0405h All material was transferred to the studio for filming and the vessel moved to the megacorer station.

0502h **Station JC048/039 Megacorer 2520m 48°45.79'N 28°38.49'W**
Megacorer deployed with the usual 8 big tubes plus 2 small multicorer tubes.
0627h On the sea floor started hauling.
0738h Megacorer in board with only 4 incomplete cores. Another deployment will have to be conducted.

It was concluded that the rough weather had affected the coring so all work was stood down until conditions were suitable for the next ROV dive.

1115h The vessel steaming slowly in winds of 32-39knots from 145°, science suspended owing to inclement weather.
1630h Weather moderating, wind 20 knots, swell reducing. Vessel is 15nm from work site, turns and steams back on a heading of 350^{o} at 8 knots.

1830h Hold on station until swell moderates.

2255h **Station JC048/40 Isis dive 173, 2619m, 48°44.075'N 28°39.324'W**
Isis dive on SW station to perform two swath dives of terrace, and benthic voucher sample collection.

Monday, 21 June 2010

0028h Isis on sea floor.

0047h Settled on the waypoint for starting a swath transect line. Doppler positioning was reset.
0051h Start of a 500m long swath line 1 at Waypoint A11_15, 48°44.118'N 28°39.335'W at 2623m depth on a flat plain. Isis at 20m altitude at slow speed 0.13m.s^{-1}. There appears to be a current to the north. Lots of ctenophores in the water column.
0115h 171m into the transect the slope upwards begins.
0131h Halfway depth of Isis 2549m
0136h Isis depth 2489m climbing a cliff.
0158h End of line 1 on level ground at waypoint A11_14, 48°44.259'N 28°39.692'W at 2428m with Isis depth 2423m. 48°44.264'N 28°39.691'W.
0200h Doppler reset.
0209h Start of swath line 2, along a reciprocal course 30m offset to the south parallel to Line 1.
0244h Halfway 2552m Isis depth.
0300h On flat plain again at 2600m depth.
0313h End of Swath Line 2 back near the start point.
0315h Doppler reset and recording stopped of data.
0320h Start collection phase of the dive by moving towards the sloping ground.
0625h Collecting on rocky face of buttress at 2504m. Collections were being made of branching corals, sponges.
0900h Collecting continued mainly on rocky faces.
1100h End of dive at 48°44.224'N 28°39.572'W, the Isis began its ascent to the surface. All the biological collecting boxes were full and all except two of the suction sampler chambers. No cores had been taken.
1229h Tether floats on the surface and Isis at 15m, the surface water looked obviously green in the Isis cameras with a phytoplankton bloom in progress.
1247h Isis on board. Station JC048/40 (Isis dive 173, end position depth and position 2600m, 48°44.247'N 28°39.465'W). Start 1.5nm steam to Megacorer site.

1348h **Station JC048/041 Megacorer 2559m 48°45.788'N 28°38.512'W**
Moderate swell, wind speed 20 to 25 knots.
1504h Megacorer on sea floor.
1608h CTD winch warp not spooling correctly, halt haul and readjust warp on reel.
1654h CTD complete (Station JC048/041). Not successful, no cores. Move off to ROV site.
1730h ROV site delayed due to bad weather, 30 knots wind.
1913h Transit to new megacorer site, 150m SW of Station JC048/041 to try to improve Megacorer performance.

2015h **Station JC048/042 Megacorer 2563m 48°45.695'N 28°38.558'W**
2131h Megacorer on sea floor.
2243h Megacorer in board, 3 off 10cm cores. Ben Boorman to investigate performance of megacorer.
2300h Steam to ROV dive site.

Tuesday, 22 June 2010

0030h On station ready to launch the ROV after wind and sea have abated.
0040h ROV lifted off the deck.

0049h **Station JC048/43 Isis dive 174, 2620m, 48°43.873'N 28°39.007'W**
ROV in the water for a voucher specimen collection dive on flat ground at the SW station. Starting 800m away from the steep cliffs the plan was for Isis to work gradually in that direction sampling flat ground initially and concluding with fauna on cliff faces.
0057h Commenced dive after one tether float was lost overboard. Continuous descent.
0218h Bottom detected at 400m range.
0233h Bottom visible.
0240h Start of collection and imaging at Waypoint A11_12_1.
0402h Swimming enteropneust observed and collected.
0600h Steady wind from the west 20 knots. Isis moving at 10m.min^{-1} over sea floor covered with sand waves accentuated by pteropod shells. Bottom current towards the south.
0730h Halfway to the scarp slope.
0900h Isis creeping northwards along the base of the east facing scarp slope.
1000h 2558m climbing up a wall at 48°44.187'N, 28°39.519'W.
1020h Enteropneust on steep rocky ground at 2547m depth.
1133h Trying to lift an branching coral off a rock. It proves to be firmly attached and just fragments are retrieved in the manipulator fingers.
1136h End of Dive, Isis begins the ascent to the surface.
Sunny breezy weather, it is decided to visit the summit of the sea mount on the way to the SE station and ascertain whether the Bergen Lander lost in 2007 is still there.
1317h Isis inboard Station JC048/43 (Isis dive 174, 2600m, 48°44.225'N 28°39.574'W).

1342h Start steaming to Acoustic lander position, located on the seamount between the SW and SE sites.

1602h At acoustic lander position. Interrogated release, listening for responses on both 8kHz and 12kHz. No response. Moved the vessel 250m off site and repeated the interrogation routine, but still with no response. Steam to ROV site.

1715h **Station JC048/44 Isis dive 175, 1111m, 48°44.242'N 28°10.030'W**
Isis dive to photo transect the sea mount, perform sample voucher collections and attempt to locate and recover the acoustic lander.
1730h Ship was 750m off dive waypoint. Adjust location as Isis descent continues.

1836h Start 1000m photo transect. Exciting fauna with great diversity when compared to 2500m terraces previously undertaken.
2040h End photo transect on top of ridge at a horizontal length of 620m. The remaining transect would be down slope, which would be more difficult and time consuming. Started voucher sample collections and outreach imaging.
2253h End of collections, move off towards Acoustic lander waypoint, transiting in mid water.
2320h 250m from acoustic lander waypoint, continue transit art sea floor.
2336h 40m from acoustic lander waypoint. Start box search to the west of the waypoint.

Wednesday, 23 June 2010

0040h Continuing search for the Bergen Acoustic Lander. Two circular wheel hub like stamped steel objects with brass manufacturer plates were found and photographed. 48°44.201'N 28°110.273'W.
0050h Spotted a target on the sonar which subsequently was found to be a large rock.
0102h The Isis was raised to 170m off the bottom and the sonar on 360° scan in and effort to find the acoustic release floats that might be 200m above the sea floor.
0130h Isis descended to the sea floor again and it was noticed that the wrong waypoint had been used for the search. The correct position from cruise JC011 was inserted into the Isis navigation system (48°44.2607'N 28°10.3415'W) and the ROV moved to that position.
0145h The lander was found at 48°44.271'N 28°10.354'W, 15m from the position calculated by triangulation on JC011. It was upside down with most of the plastic floats on the body imploded. The mooring line, monofilament nylon was stretched vertical with presumably buoyancy and release above intact.

The master was notified and following discussions it was decided not to intervene to recover the lander during the hours of darkness. Isis circled round the lander took video and photo stills images for future reference. During departure the lander was viewed in the sonar and it was detectable at 45m.

0246h End of dive Isis began ascent.
0327h 200m depth, ascent delayed owing to need to reset the sonardyne navigation system.
0342h Isis surfaced.
0353h Isis on board, end of Dive 175, Station JC048/044. A small collection of material was offloaded before *RRS James Cook* departed for the SE station.

0650h Arrival at the SE station in benign but overcast weather conditions.

0708h **Station JC048/45 CTD +ICDeep 2531m, 49°02.485'N 27°43.135'W**
CTD in the water with the ICDeep camera for a bioluminescence profile.

0812h On the bottom commenced hauling.
0923h CTD on deck.

0927h Recovery of the SE Mooring Station JC011/008 from 7 August 2009.
First release commands sent.

0934h The mooring was successfully released.
1000h The first floats were on the surface.
1036h Grappled.
1100h The top sediment traps were retrieved with a good set of samples.
1131h Lower sediment trap in board together with releases, end of recovery of JC011/008.
Pilot whales were swimming near the ship during the mooring recovery and as she moved towards the lander deployment sites.

1226h Arrived on the amphitrap site.

1233h **Station JC048/46 Amphitrap 2512m, 49°02.01'N 27°43.44'W**
Flag down as the trap was deployed at the SE station in freshening wind conditions.

1311h **Station JC048/47 PAL Lander 2519m, 49°01.871'N 27°42.094'W**
PAL deployed as wind continued to strengthen (25 knots).

Transit to Isis dive site. ICDEEP camera attached to the Isis, and port arm dismantled to locate ground fault.

1527h **Station JC048/48 Isis dive 176, 2741m, 49°07.468'N 27°49.890'W.**
Isis dive to perform pelagic visual survey and collections and complete a series of 4 flat video transects.
1807h End pelagic survey. Set up for video transects.
1821h Start line 9 video transect (flat).
1928h End line 9.
1956h Start Transit to line 12, with ICDEEP and HALO. Repeated ICDEEP no lights then 200m HALO at different depths for duration of transit.
2227h End ICDEEP run.
2240h Start line 12 video transect (flat).
2346h End line 12.
2350h Transit to line 8. This transit was across an old trawl line, so transit was at slow speed 2m above bottom and record.

Thursday, 24 June
There was no unequivocal evidence of the trawl track.
0046h Arrived at the next waypoint, slight delay while the navigation was reset.
0051h Start Line 1.
Many fine traces on the surface of the sediment, few pteropod shells, fish evident plus some small enteropneusts.
0125h Halfway along the 500m line.
0152h Possible trawl tracks but not very clear.
0156h End of line 1. Start preparing for ICDeep transects.
0216h The splat screen and HALO box were in place and ICDeep start up procedure commenced.
0225h ICDeep on after some delays.
0229h Commence bioluminescence transects at 5,10,20 and 70m above bottom.
0500h End of bioluminescence transects.
0516h Packing away the splat screen and HALO box.

0525h Stop for Doppler reset.
0527h Start final line 3. Bare fine sediment
0547h Patches of pteropod shells.
0600h Halfway along the transect and excavations were observed, a possible trawl door trace?
0630h End of video survey line 3. Pause for Navigation synchronisation.
0644h Start ascent.
0831h ROV surfaces in a freshening stiff breeze.
0844h Isis on deck 49°05.026'N 27°50.406'W.

The Vessel then repositioned itself the short distance to the Megacorer site.

0938h **Station JC048/049 Megacorer 2770m 49°05.399'N 27°50.216'W**
Megacorer deployed at the central SE coring site in the middle of flat trawling ground.
Wind moderating to 12 knots.
1055h On the bottom start hauling.
1230h Megacorer in board. 6 good megacore tubes, but both multicore tubes had failed.

Wind was 20 knots from the west but forecast to increase to 30 knots by 1800h so it was decided not to proceed with the proposed 30h survey dive by Isis but to do two further megacore casts before the sea state made work impossible. These deployments would conclude all work at the SE flat study area.

1304h **Station JC048/050 Megacorer 2770m 49°05.395'N 27°50.227'W**
Second Megacorer deployed at the central SE coring site in the middle of flat trawling ground.

1553h Megacorer on deck (station JC048/050). Seven good cores. With wind from south blowing at 30 knots and swell increasing science was suspended until the weather improves.

Friday, 25 June 2010

0600h Westerly wind 40-48 knots, the vessel was moving steadily westwards at slow speed away from the working stations, riding out the storm.
1630h Winds continue from North West at a constant 40 knot producing a large swell, currently 40nm from station.
2130h Wind moderating at 35knots, and pressure starting to rise. Current position 55nm from SE site.
2300h Vessel turned to head back to the SE station. 49°21'N 29°16'W, 64 nm from the station.

Saturday, 26 June 2010

0200h Wind moderated to 30 knots, the vessel making 8 knots downwind in high seas towards the working area ETA ca. 0630h.

0630h Back on station near the amphitrap waiting for conditions to improve.

0819h It was decided to recover the PAL Lander first.
0837h Talking to the PAL Lander via the dunking transducer.
0839h Release command sent.
0840h Ascent confirmed.

0924h PAL Lander on the surface.
0951h Grappled
1001h Lifted in board, end of Station JC048/47. PAL Lander

In gradually improving weather the vessel reposition for recovery of Amphitrap
49°02.01'N 27°43.44'W Amphitrap
1021h Released.
1115h Surfaced.
1135h Grappled.
1145h Amphitrap out of the water, end of Station JC048/46. An abundant catch of amphipods, mainly small individuals.

1200h In calming conditions and bright sunshine, the vessel positioned for deployment of the Isis ROV for continuing line transects at the SE Station.

1300h **Station JC048/51 Isis dive 177, 2951m, 49°00.821'N 27°40.494'W**
Isis dive to continue video transects on 30° and 10° slopes.
1550h On sea floor after pelagic observations and sampling. Caught 1 medusa.
1658h After repositioning to a different start position at the nominal 2500m depth start line 8, a 30° slope.
1814h End line 8, transit to the start of line 5.
1844h Start line 5, a 30° slope.
1957h End of line 5, start transit to line 3.
2149h Start line 3, a 10° slope.
2302h End of line 3. Extended by 50m due to rock at the start of the transect. Transit to line 4.
2313h Start line 4, a 10° slope.

Sunday, 27 June 2010

0025h Completed Line 2 reposition to Line 4. Raining heavily wind ca, 20 knots.
0126h Arrived at start of Line 2, wait for navigation to settle.
0132h Started Line 2. 10° slope
A few enteropneusts also excavations in the sea floor which is otherwise well covered with pteropod shells.
0159h Colourless enteropneust.
0234h End of Line 2.
0257h Arrived at the start of line 1.
0302h Start line 1 10°slope 2465m depth.
0322h 2459m, the course running parallel to the contours with an across track slope down towards the east. Generally very sparse fauna with some enteropneusts, holothurians and sponges.

0350h Broken bottle.
0358h Large burrows.
0407h End of line 1.
0410h Setting up the ICDEEP camera and splat screen.
0433h Start of bioluminescence runs at 5m, 70m, 20m and 10 m above bottom, using a splat screen and the HALO illumination system alternately for 200m while progressing towards the start of line 7.
0728h During the final line approaching the waypoint for line 7 it was decide it was dangerous to proceed without lights on in the vicinity of steep cliffs. Isis was stopped and the transect was redirected to the east away from the rocky ground.
0739h End of bioluminescence survey. 49°02.202'N 27°44.060'W.
0831h Start of Line 7. 2047m depth, 50m SE of the planned waypoint. A13_7_1. 49°02.226'N 27°44.209'W with course to A13_7_2 of 13.5°.
Vertical, east-facing cliff with very little sign of life. The ROV moved sideways to the right (northwards) with the HD camera facing the cliff horizontally.
0845h Chimaera following the ROV. Occasional sponges, crinoids, soft corals and holothurians on rocks but very sparse.
0950h End of Line 7, 2265m depth, at 550m to allow for loss of contact with the cliff in indented areas.
The ROV moved up hill to line 6.
1016h Start line 6. Steep white cliff solid rock 2129m depth.
1125h Almost solid cliff until this point when ROV moved onto steep sediment slopes with rock outcrops.
1156h Tallus and then pillow lavas.
1210h End of Line 6. 49° 03.0006'N 27°44.542'W.
End of dive the ROV began its ascent to the surface.
1345h Isis surface.
1357h Isis inboard (Station 51, Isis dive 177, 2227m, 49°02.952'N 27°44.472'W). Transit to megacorer site (4.8nm).

1453h **Station JC048/052 Megacorer 2775m 49°05.414'N 27°50.190'W**
Last Megacorer deployed as England are being beaten by Germany 2:1 at half time.

1619h Megacorer on seafloor.
1744h Very successful Megacorer, all tubes full (8 Megacores, 2 Multicores). Steam towards Isis dive location.

1914h **Station JC048/53 Isis dive 178, 2556m 49°01.425'N 27°41.132'W**
Isis dive video bioluminescent coral and conduct voucher specimen sample collections.

2030h On seafloor.
2035h Start bioluminescent imaging of coral. Camera takes four attempts to start.
2120h Too difficult to hover, operate the manipulator all in the dark. Move on to easier target.
2130h Successful imaging of a pen coral, with ICDeep camera.
2220h End ICDeep imaging, and start benthic voucher collections in same location.

Monday, 28 June 2010

0030h Collection of specimens continuing on a cliff face.
0037h Attempted to view bioluminescence of a feathery coral at 2419m depth.
0046h There was no luminescence, the coral was collected for reference.
0250h The starboard arm became disabled, so work continued with the port arm only.
0315h Collected xenophyophore using a push core operated with the port arm.
The suction hose was then also picked up with the port arm.
2378m 49°01.339'N 27°41.350'W.
Soft coral successfully taken by suction in this way so work continued despite the disabled starboard arm.
0344h A full speed transit was started down the slope to where 10° slope video transects had been done previously at WP A13_9 on area 13 line 3.

0408h *En route* a lone rock with a "garden" of sponges, crinoids and corals growing on it was encountered. A 10-min recording was made using the ICDeep camera and no lights on.
0430h End of bioluminescence studies. Material was then collected from the rock at 2381m depth 49°01.355'N 27°41.562'W.
0530h Collections finished moved on to A13_9.
0600h Set down to check the sea floor but then continued down the slope towards the waypoint.
0638h Arrived at the waypoint A13_9.
0651h Box cored anemone.
0707h Suction sampled a holothurian.
0732h Push cored a xenophyophore.
0737h End of dive 178 Station JC048/53 49°01.265'N 27°42.281'W. Ascend to surface.
0912h Isis on the surface.
0925h Isis on deck with full set of samples. Pilot whales around the ship on a calm day. Excellent conditions on the surface.

The ICDeep camera was removed from the ROV, which was geared up for maximum sampling capacity for the next dive.

1209h **Station JC048/54 Isis Dive 179 2760m 49°05.912'N 27°50.325'W**
ROV in the water for a collecting dive at the SE trawl site flat area aimed at WP A12_1_1.
1214h Commenced descent in nice sunny calm conditions.
1347h Isis on seafloor and started collections.
1935h End of dive, all happy with a good collection dive.
1940h Isis leaves sea-floor for surface.
2133h Isis inboard (Station JC048/54 Isis Dive 179 2767m, 49°06.265'N 27°50.200'W.)

2202h **Station JC048/55 Yoyo CTD, 2767m 49°06.262'N 27°50.195'W**
Rapid Yoyo CTD with ICDEEP camera 1000m to 1500m yoyo with different ICDEEP gain settings.

Tuesday, 29 June 2010

0047h Yoyo CTD on deck, curtailed last yoyo to arrive on Isis dive site in time for last dive. Again ICDEEP only recorded for half programmed duration.

Moderate winds and calm seas but heavy rain as the CTD was recovered.

0152h The vessel arrived on the proposed Isis dive location. Work continued on checking the ROV systems and the operation of the D samplers.
0300h ROV checks complete.

0310h **Station JC048/56 Isis Dive 180 2630m 49°01.176'N 27°42.371'W**
Dive aimed at pelagic sampling with some benthic collections at the end on 10° slopes.

Very sparse fauna in the water column, the ROV continued descending.

0611h 300m above the bottom, ROV depth 2340. Continuing descent.

0630h On the bottom searching for epibenthic medusae. Working up slope to the west away from the dive waypoint.
0715h Three medusae captured, two in D samplers and one in the suction sampler.
0830h By this time the ROV was over 600m away from the waypoint designated for benthic studies around lines 3 and 4 of the SE video surveys. The ROV therefore had to be repositioned by heading down the slope again at maximum speed to the dive waypoint.
0910h Arrived at the waypoint, resumed work.
0930h The pelagic section of the dive finished and benthic collection resumed with a view to finding unidentified holothurian species seen in the video transects.
1008h First sample collected.
1022h Remarkable view of pycnogonid attacking a holothurian, videoed and imaged in detail.
1036h Final sample collected.
1100h End of dive. Filmed close-ups of *Plesiopenaeus armatus* deep sea prawn swimming close up to the face plate of the camera.
1104h Departed for the surface.

1247h Isis in board (Station 056, Isis dive 180, 2658m, 49°01.045'N 27°42.472'W).
1254h End of science program! Start steam to Vigo, Spain.

During the afternoon the tether to Isis was cut, the ROV was lifted off the davit platform, packing and dismantling of equipment progressed rapidly.

Wednesday, 30 June 2010
Clocks advanced overnight to GMT +1 (UK summer time)

0900h Made over 11 knots overnight towards Vigo in calm sea but the barometer was falling and wind speeds increased as the anticipated storm caught up with the vessel. All work on deck ceased and the ship slowed to 9 knots.

1200h Wind blowing at 43 knots ship continuing slow steaming in high seas.

1500h Vessel resumed passage at full speed but tacking for optimum angle to wind and swell. Decks continued to be out of bounds.
2000h RPC in the bar.

Thursday, 01 July 2010

0900h On course for Vigo. 46°20'N 18°14'W course 123° 12.2knots. Fine weather with 15knot winds.

Friday, 02 July 2010

1930h Moderate winds and sunny weather in the afternoon, minke whales close to the ship.

2100h Nice sunset with dolphins around the ship. The vessel was making good progress towards Vigo.

Saturday, 03 July 2010

0900h *RRS James Cook a*longside in Vigo at the Transatlantico quay. It was a warm sunny day; a great contrast to the weather during most of the cruise.

DESCRIPTIONS OF WORK

1. ISIS ROV. SUMMARY REPORT ON ROV OPERATIONS

ROV Operations Coordinator:	Simon Dodd	
Sea Systems Cruise Manager:	Mick Myers	
NMFD ROV team:	Pete Mason	James Cooper
	Dave Edge	Robert Keogh
	Will Handley (contractor)	
NMFD Techs:	Steve Whittle	John Wynar

Isis Statistics for Cruise JC048

No. of dives	26 (dives numbered 155 to 180)
Total run time for thrusters	318.94 h
Total time at seabed:	229.53 h
Isis ROV total run time:	2672.89 h
Max Depth:	3685 m
Max Dive Duration and Depth:	32.43 h / 2493 m (dive 167)

Summary of Dives.

Station No	DIVE NO	DIVE (hours)	Max.Depth (m)	Bottom Time (h)
JC048/001	155	1.15	417	0.00
JC048/002	156	0.72	197	0.00
JC048/002	157	3.08	1250	0.00
JC048/003	158	9.16	3488	4.81
JC048/006	159	11.13	2506	7.81
JC048/011*	160*	10.56	2425	6.15
JC048/015	161	26.60	2600	23.30
JC048/016	162	12.30	2493	15.63
JC048/017	163	7.93	2492	4.78
----------	164	1.82	250	0.00
JC048/024	165	15.38	2437	10.75
----------	166	1.57	600	0.00
JC048/026	167	32.43	2493	28.20
JC048/028	168	10.70	2453	6.42
JC048/029	169	9.22	3685	3.33
JC048/033	170	9.63	2681	4.95
JC048/036	171	30.85	2600	26.65
JC048/038	172	11.72	2630	2.85
JC048/040	173	13.97	2606	10.58
JC048/043	174	12.55	2632	9.00
JC048/044	175	10.73	1085	8.28
JC048/048	176	17.35	2802	13.17
JC048/051	177	25.03	2939	21.33
JC048/053	178	14.27	2610	11.12
JC048/054	179	9.42	2759	5.92
JC048/056	180	9.67	2662	4.50
JC048 Totals	**26 Dives**	**318.94 h**		**229.53 h**

Notes: Short dives in which no scientific work was achieved were not necessarily given a discrete station number. * Dead vehicle recovery, successful recovery at night after the dive was curtailed by systems failure.

Data storage

Distributed HDD's:

Isis Data (86GB) + DVR Video (515GB)	PSO Copy ROV / BODC Copy	S/N: WCAV54959514 (600.77 GB on 1TB drive) S/N: WCAV54925047 (600.77 GB on 1TB drive)
BODC Video	None recorded	S/N: N/A

Cruise Data Volume

Isis CTD Data	1.15 GB
DVR Data	515.96 GB
DVLNAV Data	23.03 GB
Eventlog	748 kB (9,545 entries)
Framegrabs	239.70 MB (5,738 files)
Minifilms (2 ch's)	12.64 GB
Scorpio Digital Stills	3.24 GB (3,582 Images)
SM2000 Data	20.00 GB
Sonardyne Data	6.37 GB
Techsas Data	2.80 GB

HDV/DV tapes used:	120 master copies / 120 slave copies
Qty 184min DV Cam tapes:	359 remaining onboard
Qty DVD's:	620 DVD's used ,
MyBook HDD's:	2 used

Mobilisation
St Johns, Newfoundland, Canada: 19th May to 26th May 2010
The mobilisation of the system was very straight forward with no problems reported. The umbilical termination was also done during this period and was pull tested to 7000 kg.

De-Mobilisation
Vigo, Spain : 3rd July 2010
The majority of the system was stripped down during the steam back to Vigo. With good weather we were able to remove the Isis ROV from the LARS enabling us to collapse down the A-Frame and remove all hydraulic connections and power to the system. The major lifts to stow the vehicle, winch and storage drum into containers took place alongside at Vigo, Spain.

NOTES ON Isis EQUIPMENT

Suction Sampler. No problems noted.

Push Cores The push cores worked well for the duration of the cruise.

Tool Sled
Drawer: This device worked well for the duration of the cruise.

Swing Arms: Bio collecting boxes were mounted on swing arms either side of the vehicle. The starboard arm occasionally stuck and failed to swing out. The starboard securing pin was slow to extend resulting in the arm not always being correctly latched in place.

Manipulators

Port Side: Compensation system seals replaced in Azimuth and wrist joints. Wrist pitch and Wrist roll pots inspected and cleaned. Ram leads replaced on shoulder and Elbow. Elbow ram replaced with spare due to comms issue. Oil leak on Shoulder ram to be investigated. The arm still has a ground fault which is yet to be traced.

Starboard Side: Compensation system and hydraulic seals replaced in Azimuth Joint. Both arms fitted with All Oceans comps with springs removed to counter comp level issues.

The starboards wrist occasionally made sporadic movements. It was observed that slowly moving the shoulder through its range this sporadic wrist in/out movement would be more noticeable in different positions. On a few occasions at the end of the cruise this sporadic movement could be stopped by making a subtle adjustment to the shoulder's position.

Pan & Tilt Units

Both ROS PT10 pan and tilt units performed well throughout the cruise. For the future consideration should be given to maybe a 3rd Pan and tilt unit or an integral P&T camera mounted on the vehicle to minimise the conflict between Piloting and Science requirements during dive operations.

Cameras

(a) *Chip Atlas:*

This camera was not used on this cruise so the S-Video output consuming 2 composite video channels was freed for an additional tooling LED minicam whilst the other channel provided communication from the scientific supplied ICDeep camera.

(b) *Pegasus Pilot:*

This camera was positioned centrally on the light bar providing a fixed downward looking view of the tool drawer and performed without problems.

(c) *Pegasus Science:*

This camera was mounted on the starboard side of the science Pan & Tilt unit and performed without problems

(d) *Scorpio digital still with flash unit:*

The Scorpio camera was mounted on the Port side of the science pan & tilt unit with the Strobe fixed centrally on the foam block mount. The Scorpio camera suffered a scratch on the domed glass viewport late in the cruise so was replaced with the older spare which in turn suffered from a small water bead appearing in the viewport. During de-

mob camera s/n: SCP-012 (inv no: 250002222) was opened and approx 10ml of water was removed from the camera prior to shipping the unit.

This camera requires upgrading to a higher resolution with a potentially improved method of downloading images and clear viewfinder, eliminating the requirement of the supporting Science Pegasus camera.

(e)*High Definition Pilot and Fixed camera units*

These two cameras provided excellent high resolution imaging throughout the cruise. The fixed camera was mounted vertically on the tool sledge for video transects on flat ground and horizontally for surveys of cliff faces. The main problems occurred in the early part of the cruise with video signal break up owing to problems with fibre-optic cable connections (see below PRIZM – F/O Comms).

However there were two problems with the controls of these cameras, firstly the zoom setting would tend to drift and secondly it was not possible to control the white balance through the GUI (Graphic User Interface). The white balance is critical for producing high quality footage for broadcast media.

Future modifications/improvements/maintenance:

- Address the Zoom Creep Problem
- Address the White Balance Problem of the HD Pilot Camera. Insite indicates that this may require a return to manufacturer to rectify this problem if the problem is not in the HD GUI setup.
- Both of the HD cameras are factory sealed and would require a return to manufacturer to rectify this problem if the problem is not in the HD GUI set up, cleaning and purging.

(f) *ICDeep Camera* (Aberdeen low light level Camera) / RED Lights Setup

This camera and two red lights were connected as follows:

Camera	Isis SB6	Prizm 21	Control van cable SER 1
Stbd Light	Isis SB2	Prizm 9	Control van cable SER 2
Port Light	Isis SB4	Prizm 11	Control van cable SER 3

All 3 ports utilised power and RS232 communications with the serial lines routed in the control van to the peninsular worktop extension where a scientific laptop could be connected.

NB: Due to the camera's high sensitivity The Isis flashing blue HV light was covered over for the duration of the cruise.

Two 40W RED led lights were attached to the light bar. However these failed and could not be controlled for dimming so an LED minicam supported the operations.

Modifications to this scientific experiment required the LED drawer light to be mounted inside an onboard built slotted box which then had to be positioned by manipulator from the tool drawer storage position to in front of Pilot HD camera. The modifications performed well.

(g) ***Mini Cams:***
Bullet, suction sampler and tool drawer cameras all performed without problems.

(h) ***Mercury (Aft Cam):***
This is an excellent low light monochrome camera providing sharp pictures with minimal lighting and is well suited for vehicle rear view monitoring. No problems were encountered.

Lights

HMI, LED, quartz

The 4 HMI's performed flawlessly throughout the cruise – the 4th unit installed for this cruise to provide additional illumination for the HD cameras was positioned on the tool drawer looking down in support of the fixed HD camera when conducting seabed video transects.

The LED lamps provided excellent illumination as 40W replacements for the 250W halogens.

Lasers

For this cruise 2 laser pairs were essential. Both green and red laser pairs were used throughout the cruise without problems. The green pair was mounted on the port side of the pilot Pan and tilt while the red pair were mounted on the fixed / downward looking HD camera. The green pair significantly outperformed the red lasers for long range visibility / measurements.

Sonars

(a) ***MS2000:*** Worked well for swath bathymetry.

(b) ***MS1000 Imaging (Fwd):***
This unit was positioned on the port side of the light bar however was raised higher during the cruise to reduce the light bar masking. The sonar produced a display with varying gain as it swept back and forth. This showed its self as spokes of bright and dark signal. This sonar was essential to the cruise operations so a spare or alternative be sought.

Digiquartz Pressure Sensor

Sensor s/n: 92887 is currently attached to the Isis vehicle. This unit performed fine for the duration of the cruise. Some problems were experienced when using auto-depth

when the digiquartz was selected. The cause of the vehicle runaways is still unclear and requires further investigation.

CTD

This unit performed without problems.

Altimeter (200kHz, 6000m rated)

The Altimeter fitted to Isis s/n: 0206041 worked well until Dive 170 where serial comms with the instrument was lost. The spare Altimeter was fitted to the vehicle following that dive and worked well for the remainder of the cruise.

PRIZM – F/O Comms

The main tow cable was re-terminated once following the dead vehicle recovery incident. There was no evidence to suggest that cable wraps were the cause of the problem. The OTDR indicated that the fibre failure occurred in the proximity of the potting of the mechanical termination.

During the first few dives, severe video banding was occurring on the Prizm Video feeds. This was eventually tracked down to the short interconnect ST-ST cables joining the vehicle fibre J-Box to the vehicle HV J-Box. Two of these leads had gone hard and shrunk onto the fibre causing high attenuation. Once replaced the Prizm rx levels improved significantly and worked well for the remainder of the cruise. Details on this can be found in the Isis Engineers log book at the back. This fix also appears to have eliminated the long delay that we had been seeing before the Prizm link is established correctly.

Dead Vehicle Recovery Incident (2nd June 2010) Dive 160

During dive 160, Prizm communication with Isis was lost whilst approaching the end of a cliff video transect at 2250h. One HD camera feed was left active and all the Isis lights remained powered on. Initially Isis was hauled in to clear the cliff terrain where it had been working after which an attempt to recover comms. was made. The fault was quickly established to be a problem subsea that could not be remedied and the plans were made to perform a dead vehicle recovery. After discussion with the Master it was decided to make a night recovery and a ship move to starboard was made at 0.1 knot to keep Isis streamed away from the ship whilst hauling in at 30m/min from 2181 metres cable out.

Sonardyne tracking was successfully re-established in tone / simultaneous mode.

The dead vehicle recovery procedure was followed and Isis was recovered and safely back onboard by 0145h on 03/06/10.

The procedure for a “dead vehicle recovery” was re-written after the event and should be fully discussed before moving it from a draft version to the definitive version.

ROV & Dual wire operations

During dive 175, the Bergen Acoustic Lander lost in 2007 during cruise JC011 (sta.018) was located and the question arose as to how viable it would be to examine the lander and recover it using the ROV.

An agreed method of inspecting the lander was established and a draft detailed procedure was written to enable the recovery of the lander using the ROV and the ship's trawl cable.

The inspection of the Lander was successfully completed, which showed serious damage to the lander, possibly during its descent.

The procedure for recovery of the Bergen lander could be developed into a generic procedure for similar recovery operations in future. In the event owing to loss of time during bad weather it was not possible to recover the lander during this cruise.

2. ROV VIDEO TRANSECTS

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Aims

To provide a representative sample of benthic megafaunal assemblage structure, density and diversity at three slope levels at each of the four ECOMAR supersites.

Methods

ROV video transects were designed to assess the benthic environment and biology of the primary four ECOMAR study sites: NW, NE, SW and SE. Within each study site three habitats were identified: flat (0-2° slope), slopes (8-12° slope) and cliffs (30°+ slopes). The area of each habitat was delineated by polygons using ArcGIS (see Appendix). For each habitat in turn, polygons were selected (largest area first) until >0.5km^2 of seabed were covered, all remaining polygons were removed automatically. Within the selected polygons 100 lines were generated starting at random start points, lines were 500m long and 15° heading (following the prominent ridge axis direction). All lines that intersected with polygon boundaries were removed. Four non-overlapping lines were picked at random from the remaining lines. These four lines became the ROV sampling transects. The sampling unit for all analyses was a 500 m long ROV transect, resulting in a total of 48 sampling units (Table 1&2).

Data were collected using the NERC *Isis* ROV (Figure 1&2) which was equipped with two high-definition (HD) colour video cameras (Insite Mini Zeus), a 3-chip colour standard-definition video (Insite Pegasus), digital still camera (Insite Scorpio) and Hydrargyrum medium-arc iodide (HMI) lighting. A set of two parallel lasers (100 mm apart) was mounted on each HD camera for scaling. One HD camera was mounted vertically on the tool tray with a HMI light mounted at an angle to illuminate the field of view (1.5 m separation). The other HD camera was mounted on a pan-and-tilt unit at the front of the ROV. The ROV was equipped with ultra-short baseline navigation (Sonardyne medium frequency USBL) to provide absolute global position (accuracy approximately ± 10 m) and Doppler velocity log navigation (RDI DVL 1200kHz) to provide very accurate relative position (accuracy ± 0.1m).

Flat and 10° slope transects

In every transect the ROV was run in a straight line, on a set bearing, at a constant speed (0.13 ms^{-1}) and set altitude (2 m). The ROV was flown maintaining Doppler lock on the seafloor, enabling very precise control. Transect width (2 m; max variation ± 0.1 m) was maintained over an uneven seafloor by adjusting ROV altitude in 50 mm steps to ensure that parallel laser beams projected onto the seafloor (100 mm apart on the seafloor) were constantly the same distance apart on the screen (5% of screen width). The HD video from the vertical camera was used for all analysis. The pilot HD camera was used to take zoomed-in oblique video to help with species identification.
Over the 500 m long transect, this technique imaged 1000 m^2 of seafloor and 2000 m^3 of overlying suprabenthic water.

30° slope transects

The areas identified as >30° slope based on low-resolution bathymetry data were, in practice, typically near-vertical rocky cliffs. For these areas, the Pilot HD video camera was maintained at a pan and tilt angle that was normal to the prevailing rocky surface. This provided an image of the surface without distortion, and hence equivalent to vertical video from the flat areas. Parallel lasers, mounted to the Pilot HD camera were used for scaling. The ROV was flown sideways, aiming to maintain a constant distance from the cliff. In practise, the error associated with this was approximately ±500mm. Because of this, good quality still frames (with clear picture and consistent distance from the cliff) will be taken from the video along the transect and analysed as photographs. Lighting was provided by three HMI lights mounted on the top bar of the ROV.

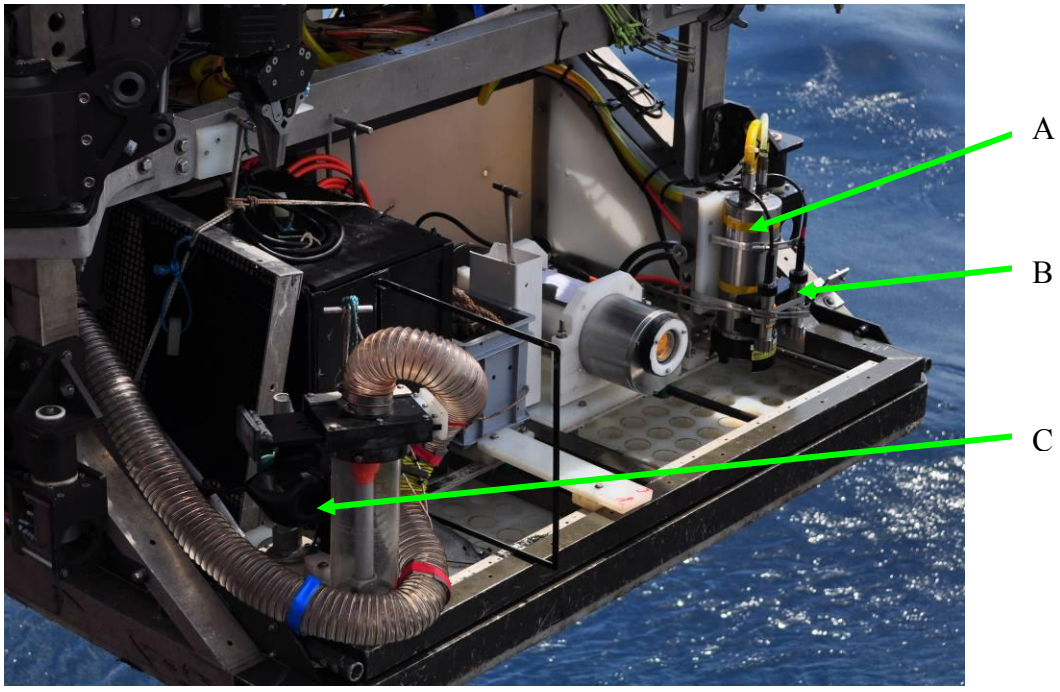


Figure 1 ROV Isis set up for video transects. The HD fixed camera (A) and parallel lasers (B) were mounted on the tool tray. When the transects were flown the tool tray was extended until the camera had a unobstructed view of the seafloor. Behind the suction sampler is an obliquely mounted single HMI light (C), used to illuminate the seafloor. All other lights had to be turned off to eliminate shadows. The pilot HD camera was zoomed in to the seafloor within the pool of light to provide close-up images of fauna to aid in identification. The pilot camera was also equipped with parallel lasers. Image from Pedro Ribeiro.

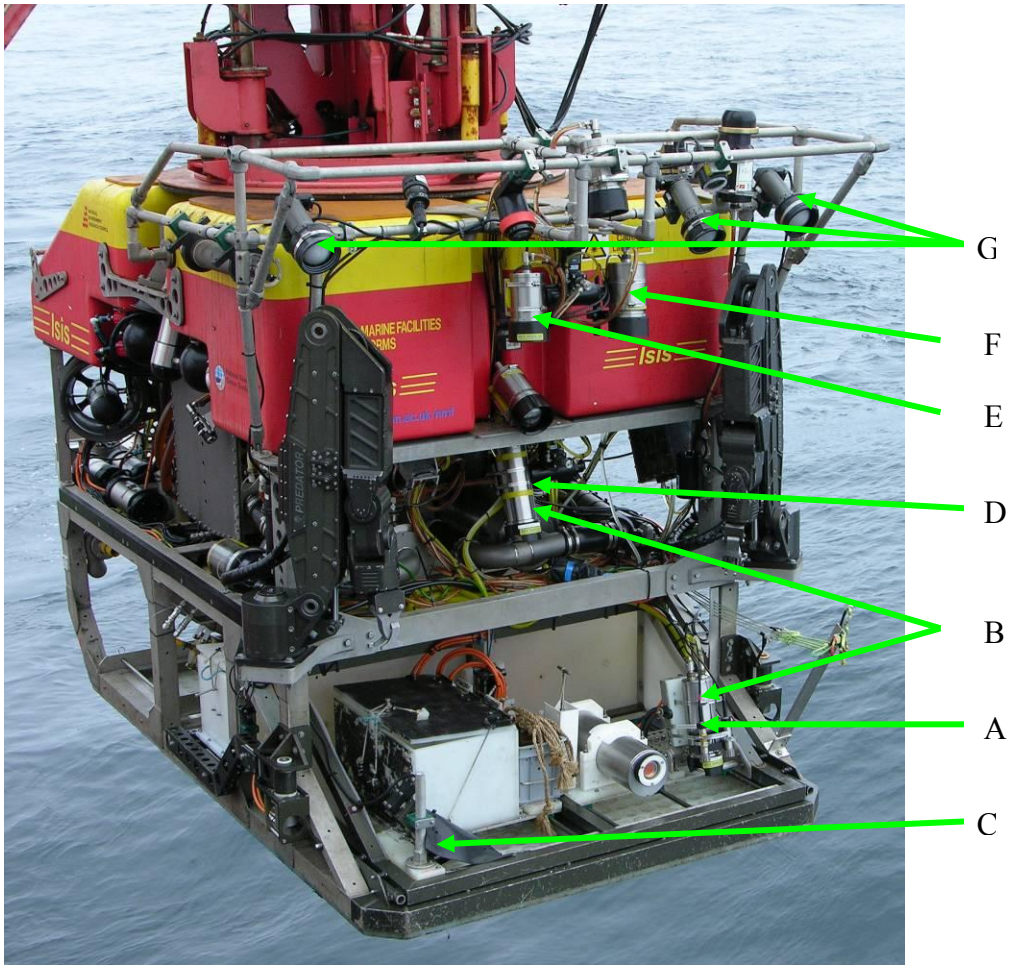


Figure 2 ROV Isis set up for video transects. Showing vertical HD fixed camera (A), parallel lasers (B), oblique HMI lighting on tool tray (C), pilot HD camera (D), Pegasus 3-chip colour video (E), Scorpio stills camera (F), HMI lighting on top bar (G). Photo by Marsh Youngbluth.

Table 1 Planned video transect locations. All positions are in Latitude and Longitude (degrees and decimal minutes). Datum is WGS1984.

Waypoint	Name	Lat_start		Long_start		Lat_end		Long_end	
A02_1	A02_NW_10degslope	53	58.99794	-36	11.15412	53	59.26206	-36	11.052
A02_2	A02_NW_10degslope	53	58.968	-36	10.82406	53	59.23212	-36	10.72794
A02_3	A02_NW_10degslope	53	57.96	-36	12.88812	53	58.22412	-36	12.792
A02_4	A02_NW_10degnew	53	58.56012	-36	10.914	53	58.81806	-36	10.81194
A02_5	A02_NW_30plusdegslope	53	57.85788	-36	12.49194	53	58.122	-36	12.396
A02_6	A02_NW_30plusdegslope	53	57.564	-36	12.40794	53	57.82794	-36	12.30606
A02_7	A02_NW_30plusdegslope	53	56.45394	-36	12.50406	53	56.71806	-36	12.40194
A02_8	A02_NW_30plusdegslope	53	56.74212	-36	12.36006	53	57.006	-36	12.258
A02_9	A02_NW_flat	53	57.624	-36	11.71212	53	57.88194	-36	11.616
A02_10	A02_NW_flat	53	58.25406	-36	11.64	53	58.518	-36	11.53794
A02_11	A02_NW_flat	53	58.07394	-36	11.79612	53	58.33806	-36	11.7
A02_12	A02_NW_flat	53	58.768	-36	11.501	53	59.308	-36	11.422
A05_1	A05_NE_10degslope	53	59.72994	-34	11.54412	53	59.99406	-34	11.43606
A05_2	A05_NE_10degslope	54	0.85806	-34	11.32806	54	1.122	-34	11.21406
A05_3	A05_NE_10degslope	54	0.34788	-34	11.38206	54	0.61206	-34	11.27406
A05_4	A05_NE_10degslope	53	59.97594	-34	11.56794	54	0.23394	-34	11.46012
A05_5	A05_NE_30plusdegslope	54	2.154	-34	8.60388	54	2.41788	-34	8.48994
A05_6	A05_NE_30plusdegslope	54	1.146	-34	9.15	54	1.40394	-34	9.042
A05_7	A05_NE_30plusdegslope	54	0.786	-34	9.39012	54	1.05012	-34	9.28206
A05_8	A05_NE_30plusdegslope	54	0	-34	9.654	54	0.26388	-34	9.54
A05_9	A05_NE_flat	53	59.862	-34	10.716	54	0.12612	-34	10.608
A05_10	A05_NE_flat	54	0.43188	-34	10.212	54	0.696	-34	10.09806
A05_11	A05_NE_flat	54	0.21606	-34	10.464	54	0.474	-34	10.356
A05_12	A05_NE_flat	54	0.54612	-34	9.97812	54	0.80406	-34	9.86388
A11_1	A11_SW_Flat	48	44.44794	-28	39.042	48	44.70588	-28	38.91
A11_2	A11_SW_Flat	48	43.91394	-28	39.19794	48	44.17188	-28	39.07194
A11_3	A11_SW_Flat	48	43.632	-28	38.832	48	43.88994	-28	38.706
A11_4	A11_SW_Flat	48	43.87206	-28	39.024	48	44.12406	-28	38.898
A11_5	A11_SW_10degslope	48	45.38406	-28	36.954	48	45.63606	-28	36.828
A11_6	A11_SW_10degslope	48	45.30006	-28	36.546	48	45.558	-28	36.42
A11_7	A11_SW_10degslope	48	44.694	-28	38.28	48	44.95194	-28	38.154
A11_8	A11_SW_10degslope	48	44.45388	-28	40.188	48	44.71206	-28	40.062
A11_9	A11_SW_30plusdegslope	48	43.82994	-28	39.60606	48	44.08788	-28	39.474
A11_10	A11_SW_30plusdegslope	48	44.98812	-28	39.69006	48	45.24606	-28	39.56406
A11_11	A11_SW_30plusdegslope	48	45.252	-28	39.69006	48	45.50994	-28	39.558
A11_12	A11_SW_30plusdegslope	48	44.13	-28	39.59406	48	44.38794	-28	39.462
A12_1	A12_SE_Flat	49	5.90994	-27	50.32194	49	6.16788	-27	50.19
A12_2	A12_SE_Flat	49	7.22994	-27	49.992	49	7.48194	-27	49.85994
A12_3	A12_SE_Flat	49	5.00406	-27	50.61594	49	5.25606	-27	50.484
A12_4	A12_SE_Flat	49	5.964	-27	50.622	49	6.22194	-27	50.48994
A13_1	A13_SE_10degslope	49	0.98394	-27	43.422	49	1.23594	-27	43.29
A13_2	A13_SE_10degnew	49	0.89994	-27	43.164	49	1.15194	-27	43.03194
A13_3	A13_SE_10degslope	49	1.01394	-27	42.408	49	1.26594	-27	42.27594
A13_4	A13_SE_10degslope	49	0.85188	-27	42.54606	49	1.11006	-27	42.408
A13_5	A13_SE_30plusdegslope	49	1.314	-27	41.07	49	1.57194	-27	40.93806
A13_6	A13_SE_30plusdegslope	49	2.72394	-27	44.55594	49	2.98212	-27	44.424
A13_7	A13_SE_30plusdegslope	49	2.24988	-27	44.244	49	2.50806	-27	44.11206
A13_8	A13_SE_30plusdegslope	49	0.90594	-27	41.112	49	1.15794	-27	40.97394
A12_5	A12_trawltransect	49	5.964	-27	50.622	49	5.90994	-27	50.32194
A0910	A0910_CGFZtransect	52	40.878	-35	4.164	52	41.118	-35	4.363
A14_3	A14_seamount	48	44.084	-28	9.47	48	43.895	-28	10.237

Table 2 Video transect details. Station number is for cruise JC048. Dive number is sequential for all Isis dives.

Waypoint	Name	Start time	End time	Stn No.	Dive No.
A02_1	A02_NW_10degslope	06/06/2010 02:33:30	06/06/2010 03:40:20	15	161
A02_2	A02_NW_10degslope	06/06/2010 04:16:28	06/06/2010 05:22:00	15	161
A02_3	A02_NW_10degslope	05/06/2010 14:13:59	05/06/2010 15:24:30	15	161
A02_4	A02_NW_10degslope	06/06/2010 00:41:02	06/06/2010 01:49:02	15	161
A02_5	A02_NW_30plusdegslope	05/06/2010 10:57:32	05/06/2010 13:00:00	15	161
A02_6	A02_NW_30plusdegslope	02/06/2010 22:04:23	02/06/2010 22:50:59	11	160
A02_7	A02_NW_30plusdegslope	02/06/2010 17:55:10	02/06/2010 18:59:12	11	160
A02_8	A02_NW_30plusdegslope	02/06/2010 19:16:25	02/06/2010 20:29:28	11	160
A02_9	A02_NW_flat	05/06/2010 18:40:17	05/06/2010 19:38:08	15	161
A02_10	A02_NW_flat	05/06/2010 22:42:22	05/06/2010 23:39:20	15	161
A02_11	A02_NW_flat	05/06/2010 21:05:27	05/06/2010 22:14:15	15	161
A02_12	A02_NW_flat	01/06/2010 15:46:42	01/06/2010 17:13:05	6	159
A05_1	A05_NE_10degslope	11/06/2010 19:31:35	11/06/2010 20:39:04	26	167
A05_2	A05_NE_10degslope	11/06/2010 14:51:30	11/06/2010 15:59:25	26	167
A05_3	A05_NE_10degslope	11/06/2010 16:35:40	11/06/2010 17:42:29	26	167
A05_4	A05_NE_10degslope	11/06/2010 18:00:43	11/06/2010 19:09:20	26	167
A05_5	A05_NE_30plusdegslope	10/06/2010 17:32:09	10/06/2010 18:34:29	26	167
A05_6	A05_NE_30plusdegslope	10/06/2010 22:02:45	10/06/2010 23:06:30	26	167
A05_7	A05_NE_30plusdegslope	10/06/2010 23:44:55	11/06/2010 01:55:00	26	167
A05_8	A05_NE_30plusdegslope	11/06/2010 03:06:34	11/06/2010 04:16:11	26	167
A05_9	A05_NE_flat	11/06/2010 06:25:15	11/06/2010 07:27:45	26	167
A05_10	A05_NE_flat	11/06/2010 09:19:45	11/06/2010 10:26:31	26	167
A05_11	A05_NE_flat	11/06/2010 07:56:16	11/06/2010 09:00:02	26	167
A05_12	A05_NE_flat	11/06/2010 11:01:01	11/06/2010 12:06:36	26	167
A11_1	A11_SW_flat	18/06/2010 18:59:04	18/06/2010 20:03:30	36	171
A11_2	A11_SW_flat	16/06/2010 18:21:28	16/06/2010 19:28:00	33	170
A11_3	A11_SW_flat	16/06/2010 14:48:10	16/06/2010 16:01:10	33	170
A11_4	A11_SW_flat	16/06/2010 16:44:20	16/06/2010 17:53:10	33	170
A11_5	A11_SW_10degslope	19/06/2010 04:17:01	19/06/2010 05:20:40	36	171
A11_6	A11_SW_10degslope	19/06/2010 06:06:43	19/06/2010 07:14:09	36	171
A11_7	A11_SW_10degslope	18/06/2010 23:17:00	19/06/2010 00:22:40	36	171
A11_8	A11_SW_10degslope	18/06/2010 10:34:20	18/06/2010 11:45:55	36	171
A11_9	A11_SW_30plusdegslope	18/06/2010 06:09:26	18/06/2010 07:20:20	36	171
A11_10	A11_SW_30plusdegslope	18/06/2010 12:42:25	18/06/2010 14:00:29	36	171
A11_11	A11_SW_30plusdegslope	18/06/2010 14:13:49	18/06/2010 15:29:25	36	171
A11_12	A11_SW_30plusdegslope	18/06/2010 07:50:39	18/06/2010 09:14:40	36	171
A12_1	A12_SE_flat	24/06/2010 00:51:14	24/06/2010 01:56:00	48	176
A12_2	A12_SE_flat	23/06/2010 18:20:55	23/06/2010 19:28:40	48	176
A12_3	A12_SE_flat	24/06/2010 05:27:35	24/06/2010 06:33:00	48	176
A12_4	A12_SE_flat	23/06/2010 22:40:01	23/06/2010 23:46:48	48	176
A13_1	A13_SE_10degslope	27/06/2010 03:02:15	27/06/2010 04:07:20	51	177
A13_2	A13_SE_10degslope	27/06/2010 01:32:20	27/06/2010 02:33:50	51	177
A13_3	A13_SE_10degslope	26/06/2010 21:55:18	26/06/2010 23:02:35	51	177
A13_4	A13_SE_10degslope	26/06/2010 23:17:08	27/06/2010 00:22:21	51	177
A13_5	A13_SE_30plusdegslope	26/06/2010 18:43:50	26/06/2010 19:57:26	51	177
A13_6	A13_SE_30plusdegslope	27/06/2010 10:35:15	27/06/2010 12:10:16	51	177
A13_7	A13_SE_30plusdegslope	27/06/2010 08:31:47	27/06/2010 09:50:00	51	177
A13_8	A13_SE_30plusdegslope	26/06/2010 16:57:45	26/06/2010 18:14:35	51	177
A12_5	A12_trawltransect	23/06/2010 23:51:07	24/06/2010 00:44:45	48	176
A0910	A0910_CGFZtransect	14/06/2010 10:13:25	14/06/2010 11:25:51	29	169
A14_3	A14_seamount	22/06/2010 18:36:00	22/06/2010 20:40:59	44	175

RESULTS

NW area

Flat areas, soft sediment

Dominant species
Urechinus naresianus, *Ophiuroidea* spp. (several species)

Common species
Tromikosoma sp., *Ophiuroidea* spp.,
Holothuroidea *Peniagone longipapillata*, *Benthodytes gosarsi*, *Benthothuria funebris*, *Pseudostichopus* sp., *Paelopatides grisea*,
Enteropneusta (numerous trails, live specimens ca.1 per 100 m)
Glass sponges (Hyalonema type plus 3-4 other main morphotypes), Pheronema
Red shrimp («Acanthephyra» type)
Asteroidea *Freyella*, *Hymenaster*, ?*Bathybiaster*, *Hydrasterias*
Xenophyophorea Syringammina type
?Hydroidea growth on various substrates - light-colour bushes (10-15 cm)

Rocks/cliffs

Dominant species
Glass sponges Hexactinellida 6-8 main morphotypes: Farrea type – several species, Asconema type (tall cups) – several species (fam. Rossellidae) , «Wizards hat»
Demospongiae Geodia type (2 spp. beige and yellow), various encrusting forms (blue, white, yellow etc.)

Common species
Stalked crinoid *Anachalypsicrinus nefertiti*
Anthipatharia *Bathypathes*, *Stauropathes*
Gorgonaria varia (incl. Metallogorgia)
Actiniaria Big purple (Boloceroides type), big red
Asteroidea Brisingidae
Ellipinion sp.; in sediment pockets on the slope Laetmogonidae (two species)
Echinoidea *Echinus*
Xenophyophorea Syringammina type

NE area

Flat areas, soft sediment

Dominant species:
Kolga sp., *Peniagone longipapillata*, *Ellipinion* sp., *Peniagone islandica*

Common species:
Pourtalesia, *Urechinus*, *B. gosarsi*, *Pseudostichopus* sp.
Enteropneusta
Ophiuroidea (several spp.), *Freyella* (2 spp.), *Hymenaster, Tromikosoma*

Xenophyophorea

Rocks/cliffs

Demospongiae – Geodia type (yellow)
Hexactinellida – Hyalonema type very common (not seen at NW), Rossellidae, Farrea type (several spp.), wizards hat
Anachalypsicrinus nefertiti – more often than at NW
Other staked crinoids (5 arms - *Democrinus*?)
Ellipinoin delagei - on the rocks

Gorgonaria, Anemones (not Boloceroides type), Anthomastus
Anthipatharia – rarer than at NW
Brisingidae more rare that at NW

Soft sediment on slope/ terraces)

Holothurians– *Ellipinoin* sp., *E. delagei*, *Peniagone longipapillata*, Laetmogonidae
Xenophyophorea

Slope (weak) «10°»

Urechinus, *Pourtalesiidae* (several spp.), *Tromikosoma*
Peniagone islandica, *Kolga* sp. (no aggregations), *Pseudostichopus*, *Psychropotes depressa*
Hymenaster, *Freyella* spp., *Ophuiroidea* spp.
Enteropneusta
Xenophyophorea

Charlie-Gibbs Fracture Zone

Soft sediment

Benthothuria funebris, *Benthodytes gosarsi*, *Benthodytes lingua*, *Kolga* sp. (abundant), *Synallactes*, ?*Amperima*
Hymenaster
Actiniaria (brown short tentacles), Ceriantharia, Scleractinia (Fungiacyathus type)
Crinoidea Comatulidae (yellow small on rocks very abundant)
Brisingidae (on rocks and on sediment)
Gorgonaria
Enteropneusta
Xenophyophorea

SW area

Flat area/sift sediment

Dominant species:
Elpidiidae *Peniagone*, *Ellipinion*, *Amperima* various spp.

Common species:
Benthodytes lingua, *Pseudostichopus*, *Abyssocucumis abyssorum*
Asteroidea *Hymenaster* , *Hydrasterias*, *Ophiuroidea* several spp., *Tromikosoma*
Enteropneusta (?3 spp.)
Glyphocrangon
Xenophyophorea

Rocks/Steep slope

Hexactinellida (cf. Hyalonema, Rossellidae, cf. Farrea, +++)
Geodia (yellow species)
Gorgonaria (whip forms, Metallogorgia, ++)
Holothuroidea cf. *Synallactes*, *Synallactidae* (light blue), ?*Laetmogonidae*
Actiniaria
Galatheidae, Lithodidae, ?*Munida*
Asteroidea *Hymenaster*, *Brisingida*

South-East area

Soft sediment

1) Pteropod shells absent
Dominant species:
Pourtalesia

Common species:
Enteropneusta, *Hymenaster*, Glyphocrangon, Xenophyophorea

2) Pteropod shells present
Dominant species:
Peniagone sp.n., P. cf. *lugubris*, *Amperima* (2-3 spp.)

Common species:
B. gosarsi, *Benthothuria funebris*, *Abyssocucumis abyssorum*
Bathycrinidae
Pennatularia
Asteroidea Hydrasterias Brisingida *Hymenaster*
Glyphocrangon, Galatheidae, «Acanthephyra»
Pourtalesia
Xenophyophorea

10 ° slope soft sediment

Pteropod shells present

Peniagone.sp.n., P. cf. *lugubris*, *Pseudostichopus*, *B. lingua*
Flabellum, *Anthomastus*
Hexactinellida Rossellidae (small tall goblets)

Enteropneusta
Hymenaster, *Hydrasterias*
Glyphocrangon
Polychaeta large tubes (lying on the sediment) with trails
Xenophyophorea

Steep slope/ rocks

Poor fauna

Hexactinellida cf. Hyalonema (fringes) Rossellidae
Gorgonaria (whips) +red fans
Anthomastus
Synallactes, Synallactidae (blue slug), ?*Mesothuria*
Actiniaria orange & purple (both collected previously)

Concluding comments

1. Preliminary results (based on visual observations) indicate that most abundant (dominant) megafauna species are different in all four ECOMAR study areas:

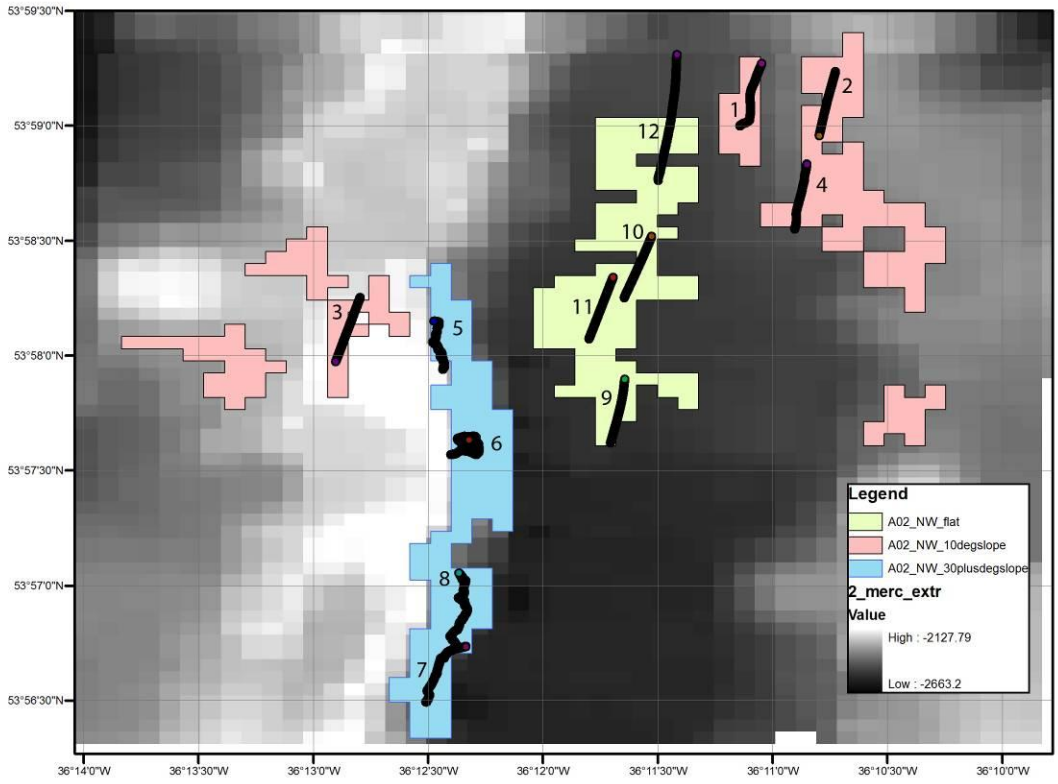
- most pronounced is the difference in composition of dominant species between northern and southern areas
- there is a clear difference in dominant species between two northern areas
- in the south this difference also exists but is less pronounced (several dominant species are shared between the two southern areas).

2. A number of species of holothurians that are among dominant forms apparently are new to science. The holothurian genera are *Ellipinion* sp. and *Peniagone* sp.

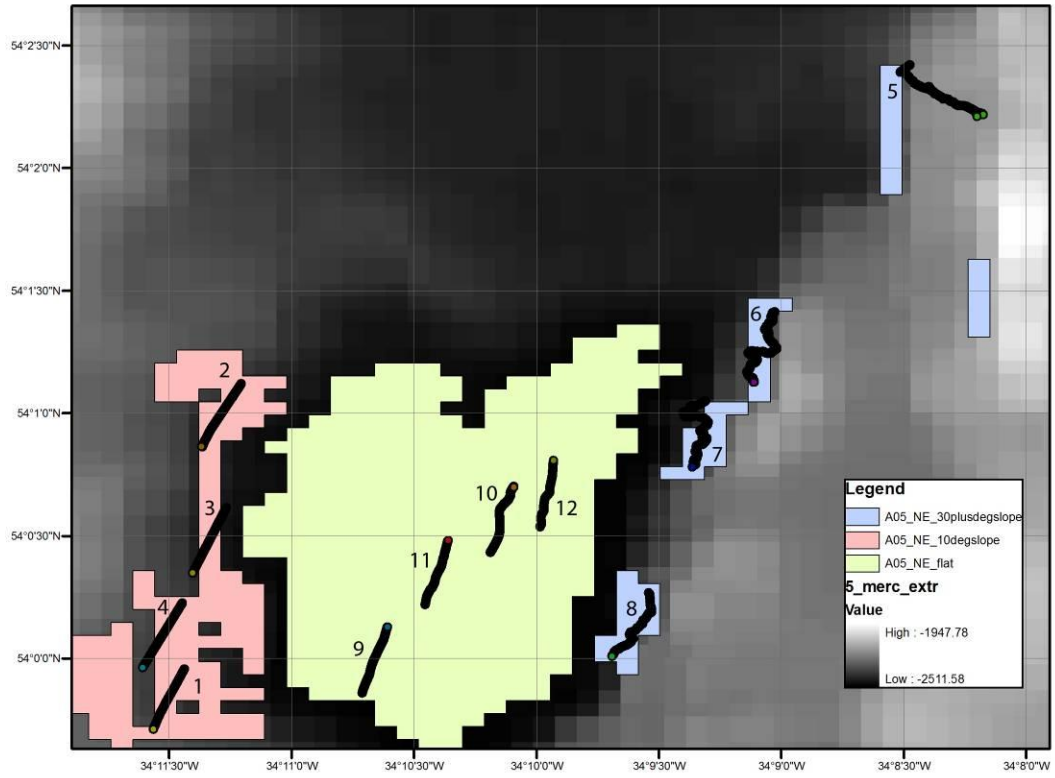
3. The dominant role of several species of elpidiid holothurians, including *Peniagone papillata, P. islandica, P.* cf. *lugubris* and *Amperima* spp., in the ECOMAR areas has not been previously recognised.

Note on Positions of Video Transects.
ROV video transects and study strata polygons for JC048. Blue polygons are cliff sites (>30 degree slope), red polygons are slope sites (8-12 degree slope) and green polygons are flat sites (<2 degree slope). Numbered lines are actual ROV tracks (based on corrected Doppler navigation). Bathymetry and slope information are from ship-board multibeam bathymetry data collected on JC11 (90 x 90m pixel size).

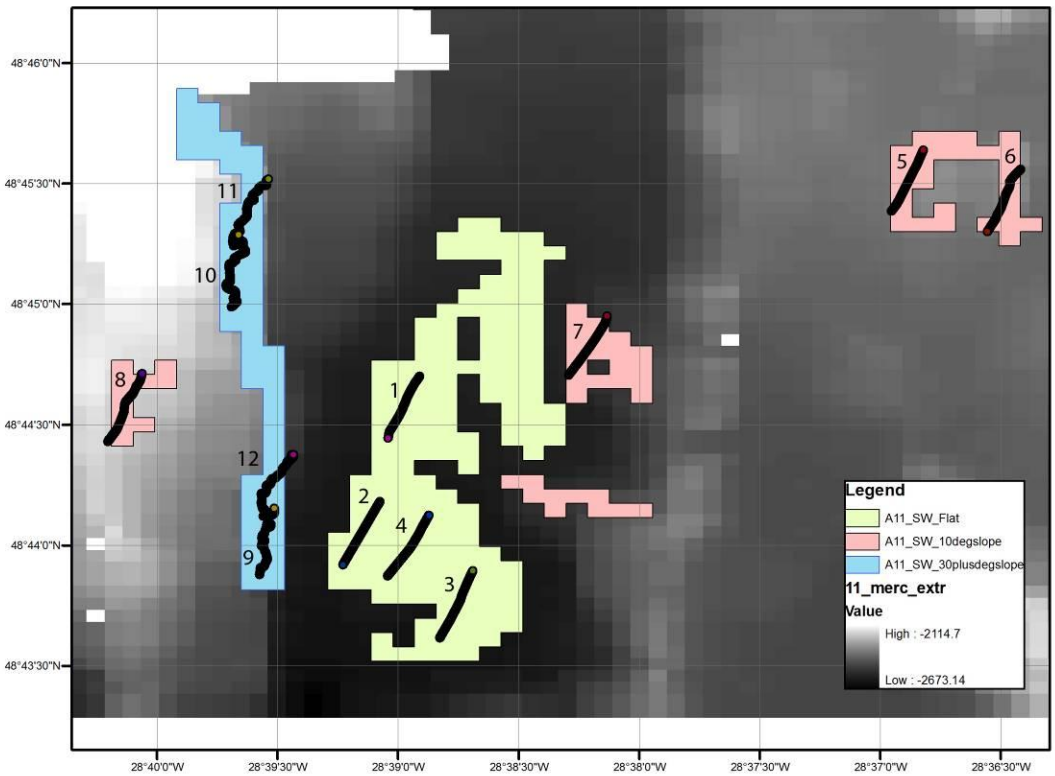
NW Site



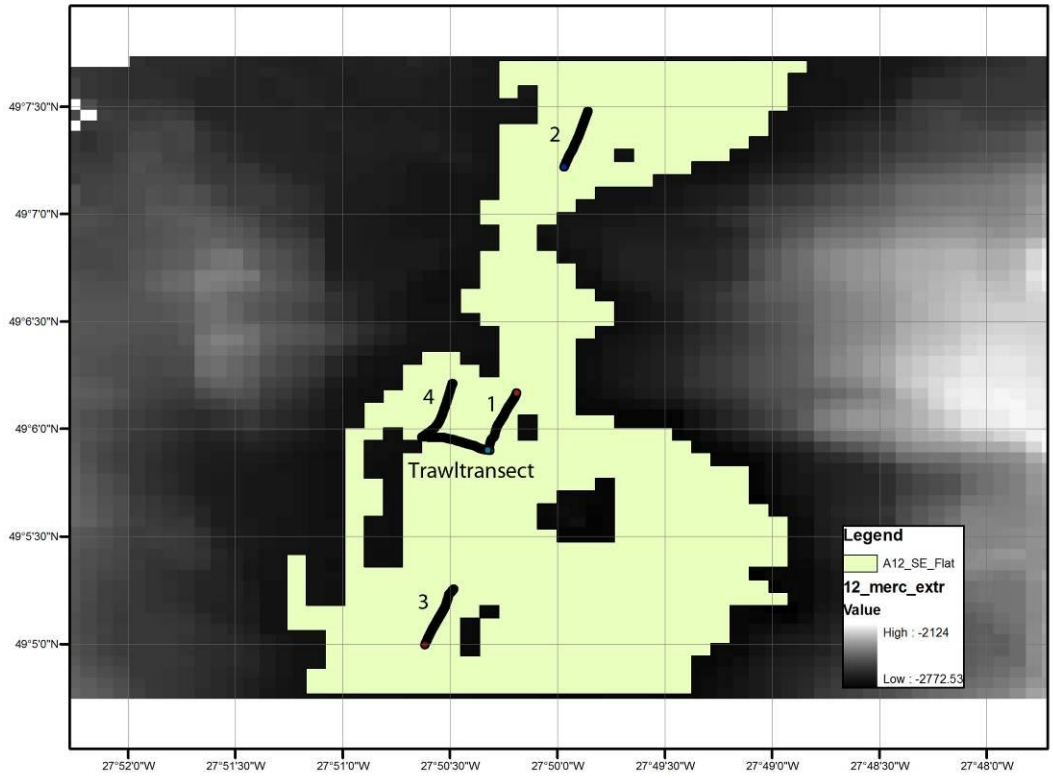
NE Site



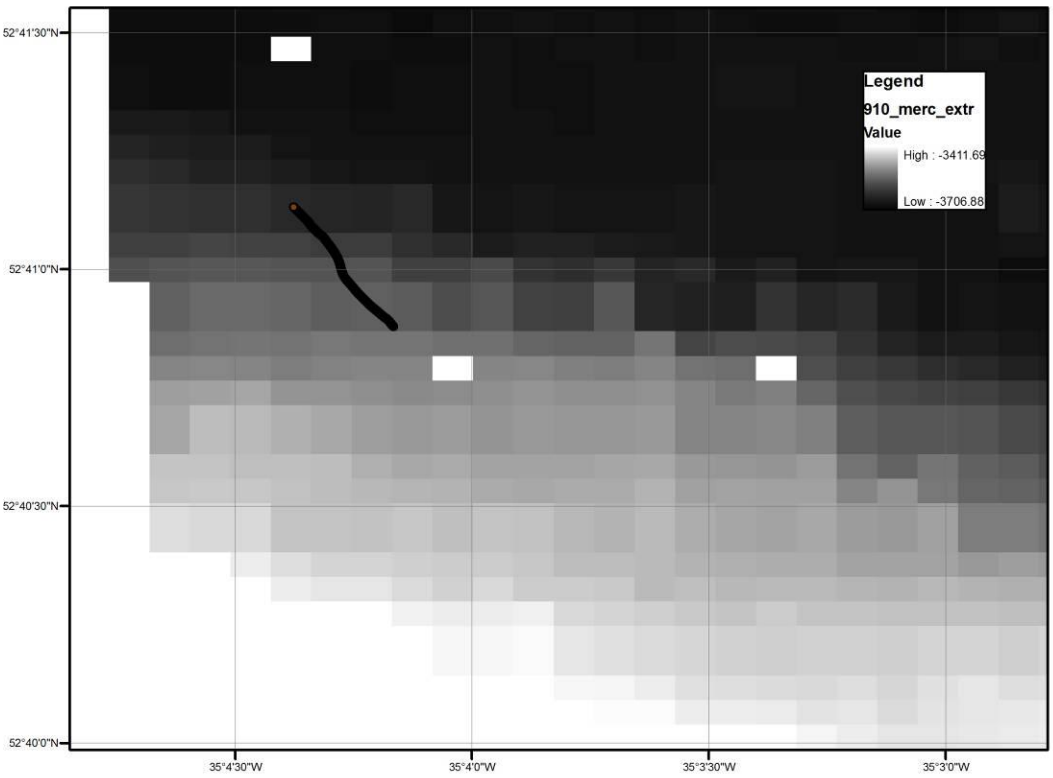
SW site



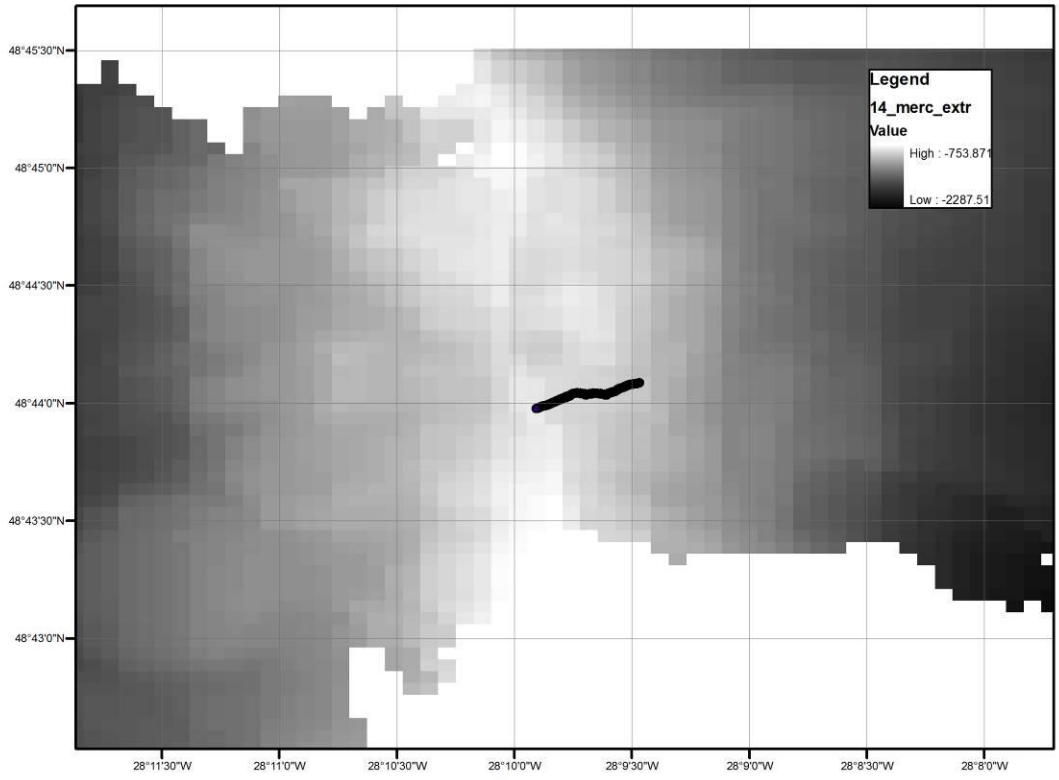
SE site



Charlie-Gibbs Fracture zone transect



Seamount Summit Transect



3. ROV SPECIMEN COLLECTION

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Aims

This work aimed to make extensive collections of megafaunal specimens using the Isis ROV. The specimens were required to identify organisms seen in video, to provide taxonomic specimens of common megafauna, to identify potential new species and for a range of other projects discussed elsewhere.

Methods

The ROV Isis collected specimens using four methods:

1) Suction sampler
2) Push core
3) Box core
4) Direct manipulator collections

Results

Over 200 specimens were obtained over 13 benthic sampling dives during the cruise. Specimens were collected from a range of habitats (rock and sediment) at six sites (4 ECOMAR supersites, Charlie-Gibbs Fracture Zone (CGFZ) and a seamount; table 1). Video and still photographs of faunal collections provided clear *in situ* imagery that will facilitate evaluation of video transects (table 2). Most of the taxa sampled on the seabed were successfully retrieved to the surface and preserved (table 3). A total of 102 specimens were preserved for taxonomic analysis (table 4) and 121 small sub-samples of tissue were preserved for molecular analysis (table 5). The other specimens were used in other studies (discussed in other sections).

Table 1 Specimen collection dive details for JC048.

Dive No	Station No	Station Area	Date	N deg. '	W deg. '	Depth, m
159	6	NW	01/06/2010	53 58,768	36 11,501'	2500
162	16	NW	06/06/2010	53 59,399	36 11,662	2500
163	17	NW	07/06/2010	53 59,399	36 11,662	2500
165	24	NE	9-10/06/10	54 1,081	34 9,455	2500
168	28	NE	12-13/06/10	54 1,471	34 10,632	2500
169	29	CGFZ	14/06/2010	DOBO site		3799
171	36	SW	19/06/2010	48 43,83	28 39,606	2500
172	38	SW	19-20/06/10	48 43,632	28 28,832	2600
173	40	SW	21/06/2010	48 44,118	28 39,335	2623-2428
174	43	SW	22/06/2010	48 43,872	28 39,024	2623-2428
175	44	Seamount	22/06/2010	48 43.972	28 9.921	850
178	53	SE	27/06/2010	49 1,439	27 41,264	2442-2630
179	54	SE	28/06/2010	49 5,91	27 50,332	2700
180	56	SE	29/06/2010	49 1,176	27 42,33	2758

Table 2 Specimen collection details.

Date	Dive	Stn	Specimen no	Time	Specimen description	Collection method
06/06/2010	162	16	1	21:37	Standing up ophiuroid	suction (black chamber)
06/06/2010	162	16	2	21:51	six armed asteroid (Hydrasterias)	suction (black chamber)
06/06/2010	162	16	3	22:00	*Peniagone*	suction (black chamber)
06/06/2010	162	16	4	22:12	Enteropneust	suction (black chamber)
06/06/2010	162	16	5	22:20	*Hymenaster*	suction (black chamber)
06/06/2010	162	16	6	22:29	Laetmogne and branching bryozoan	suction (black chamber)
06/06/2010	162	16	7	22:54	ophiuroid on rock	suction (black chamber)
06/06/2010	162	16	8	22:57	2nd ophiuroid	suction (black chamber)
06/06/2010	162	16	9	22:57	red sponge	suction (black chamber)
06/06/2010	162	16	10	22:59	*Peniagone* on rock	suction (black chamber)
06/06/2010	162	16	11	23:01	Another small holothurian on sediment	suction (black chamber)
06/06/2010	162	16	12	23:17	part of yellow sponge	biobox
06/06/2010	162	16	13	23:18	type D sponge	biobox
06/06/2010	162	16	14	23:33	part of second yellow sponge	biobox
06/06/2010	162	16	15	23:36	2nd type D sponge	biobox
06/06/2010	162	16	16	23:37	3rd yellow sponge complete	biobox
06/06/2010	162	16	17	23:44	red ophiuroid from sponge	suction (green chamber)
06/06/2010	162	16	18	23:49	small holothurian	suction (green chamber)
06/06/2010	162	16	19	23:50	small branching sponge (another one caught earlier but missed off list)	suction (green chamber)
06/06/2010	162	16	20	23:53	3rd type D sponge	biobox
07/06/2010	162	16	21	00:15	red ophiuroid from type D sponge	suction (green chamber)
07/06/2010	162	16	22	00:16	another red ophiuroid from type D sponge	suction (green chamber)
07/06/2010	162	16	23	00:26	small holothurian	suction (green chamber)
07/06/2010	162	16	24	00:31	small red branched sponge	suction (blue chamber)
07/06/2010	162	16	25	00:35	indet white sponge	suction (blue chamber)
07/06/2010	162	16	26	00:36	branched white sponge x2	suction (blue chamber)
07/06/2010	162	16	27	00:42	white echinoid	suction (blue chamber)
07/06/2010	162	16	28	00:47	white asteroid	suction (blue chamber)
07/06/2010	162	16	29	01:18	brown antipatharian	biobox
07/06/2010	162	16	30	01:45	pieces of wizards hat sponge	biobox
07/06/2010	162	16	31	02:00	white gorgonian	biobox
07/06/2010	162	16	32	02:19	brown sponge	biobox
07/06/2010	162	16	33	02:40	*Anachalypticrinus nefititi*	suction (red chamber)
07/06/2010	162	16	34	02:46	*Anthomastus*	biobox
07/06/2010	162	16	35	03:00	*Anachalypticrinus nefititi*	biobox
07/06/2010	162	16	36	03:31	red echinoid - stuck in suction tube	
07/06/2010	162	16	37	04:11	*Freyella* (brisingid)	biobox
07/06/2010	162	16	38	04:43	Xenophyophore	red/white push core
07/06/2010	162	16	39	04:51	Xenophyophore	boxcore
07/06/2010	162	16	40	05:04	Pheronema sponge	biobox
07/06/2010	162	16	41	05:13	*Pseudostichopus*	biobox
07/06/2010	162	16	42	05:14	*Pseudostichopus*	biobox
07/06/2010	162	16	43	05:49	*Discospirina*	yellow push core
07/06/2010	162	16	44	05:55	*Discospirina*	unmarked core
07/06/2010	162	16	45	06:15	*Mesothuria*	biobox

Date	Dive	Stn	Specimen no	Time	Specimen description	Collection method
07/06/2010	162	16	46	06:22	tiny holothurian	biobox
08/06/2010	165	24	1	19:12	*Peniagone longipapills*	suction (pink chamber)
08/06/2010	165	24	2	19:43	*Peniagone* sp.	suction (pink chamber)
08/06/2010	165	24	3	19:48	small holothurian	suction (pink chamber)
08/06/2010	165	24	4	19:57	small holothurian	suction (pink chamber)
08/06/2010	165	24	5	20:12	small holothurian	suction (pink chamber)
08/06/2010	165	24	6	20:14	small holothurian	suction (pink chamber)
08/06/2010	165	24	7	20:16	muddy sausage	suction (red chamber)
08/06/2010	165	24	8	20:27	Enteropneust	suction (green chamber)
08/06/2010	165	24	9	20:59	purple urchin	stb biobox
08/06/2010	165	24	10	21:16	hoovering tiny *Kolga* holothurians	suction (red chamber)
08/06/2010	165	24	11	21:29	purple holothurian	suction (red chamber)
08/06/2010	165	24	12	21:36	burrowing urchin	suction (black chamber)
08/06/2010	165	24	13	21:49	*Pourtalesia* urchin	suction (black chamber)
08/06/2010	165	24	14	21:56	*Peniagone*	suction (blue chamber)
08/06/2010	165	24	15	22:09	Elpididiidae holothurian	suction (blue chamber)
08/06/2010	165	24	16	22:41	*Discospirina*	push core white
08/06/2010	165	24	17	23:09	stalked hexactinellid	stb biobox
08/06/2010	165	24	18	23:45	egg cup sponge	stb biobox
08/06/2010	165	24	19	23:52	yellow sponge	front biobox
09/06/2010	165	24	20	00:09	yellow crinoid (*Anachalypticrinus nefititi*)	front biobox
09/06/2010	165	24	21	00:17	*Peniagone* and sediment	suction (yellow chamber)
09/06/2010	165	24	22	00:21	yellow sponge	front biobox
09/06/2010	165	24	23	00:30	white branched sponge	suction (yellow chamber)
09/06/2010	165	24	24	00:41	white gorgonian	front biobox
09/06/2010	165	24	25	00:46	yellow sponge	front biobox
09/06/2010	165	24	26	00:54	white branched sponge	suction (yellow chamber)
09/06/2010	165	24	27	01:06	stalked egg cup sponge	front biobox
09/06/2010	165	24	28	01:21	part of type D sponge	front biobox
09/06/2010	165	24	29	01:31	complete type D sponge	front biobox
09/06/2010	165	24	30	01:33	type D sponge and ophiuroid	front biobox
09/06/2010	165	24	31	01:47	holothurian	suction (yellow chamber)
09/06/2010	165	24	32	01:52	stalked egg cup sponge	front biobox
09/06/2010	165	24	33	02:03	yellow crinoid (*Anachalypticrinus nefititi*)	front biobox
09/06/2010	165	24	34	02:13	yellow crinoid (*Anachalypticrinus nefititi*)	front biobox
09/06/2010	165	24	35	03:01	*Discospirina*	2nd push core (no markings)
12/06/2010	168	28	1		Enteropneust	suction (green chamber)
12/06/2010	168	28	2		*Pourtalesia* urchin	suction (blue chamber)
12/06/2010	168	28	3		*Pourtalesia* urchin	suction (blue chamber)
12/06/2010	168	28	4		*Hymenaster*	suction (blue chamber)
12/06/2010	168	28	5		*Hymenaster*	suction (blue chamber)
12/06/2010	168	28	6		*Hymenaster*	suction (blue chamber)
12/06/2010	168	28	7		egg cup sponge	suction (blue chamber)
12/06/2010	168	28	8		Enteropneust	suction
12/06/2010	168	28	9		7-armed brisingid seastar	suction
12/06/2010	168	28	10		Xenophyophore	push core (front right)
20/06/2010	172	38	1		*Discospirina*	push core
20/06/2010	172	38	2		*Discospirina*	push core
21/06/2010	173	40	1	03:47	*Glyphocrangon scupia*	suction (red chamber)

Date	Dive	Stn	Specimen no	Time	Specimen description	Collection method
21/06/2010	173	40	2	04:04	*Hymenaster*	suction (red chamber)
21/06/2010	173	40	3	04:30	stalked frilly cup hexactinellid sponge	suction (red chamber)
21/06/2010	173	40	4	04:50	stalked frilly cup hexactinellid sponge	front biobox
21/06/2010	173	40	5	05:10	synallactid holothurian	suction (yellow chamber)
21/06/2010	173	40	6	05:17	tube sponge	front biobox
21/06/2010	173	40	7	05:36	pink holothurian (*synallactus*?)	suction (yellow chamber)
21/06/2010	173	40	8	05:45	small tube sponge	front biobox
21/06/2010	173	40	9	06:10	yellow demosponge	front biobox
21/06/2010	173	40	10	06:42	large metallogorgia gorgonian sea fan	front biobox
21/06/2010	173	40	11	06:56	white bottle brush gorgonian	front biobox
21/06/2010	173	40	12	07:12	yellow bottle brush gorgonian	stb biobox
21/06/2010	173	40	13	07:26	tube sponge	stb biobox
21/06/2010	173	40	14	07:26	folded sponge	stb biobox
21/06/2010	173	40	15	07:38	tube sponge	front biobox
21/06/2010	173	40	16	07:44	antipatharian	front biobox
21/06/2010	173	40	17	07:54	stalked frilly cup hexactinellid sponge	front biobox
21/06/2010	173	40	18	08:16	orange anemone on rock	port biobox
21/06/2010	173	40	19	08:58	yellow demosponge	front biobox
21/06/2010	173	40	20	09:02	white spikey sponge	front biobox
21/06/2010	173	40	21	09:04	large metallogorgia gorgonian sea fan (with ophiuroid)	front biobox
21/06/2010	173	40	22		black anemone	suction (black chamber)
21/06/2010	173	40	23	09:34	small white coral	suction (black chamber)
21/06/2010	173	40	24	09:42	large funnel sponge	front biobox
21/06/2010	173	40	25	10:00	whip gorgonian	stb biobox
21/06/2010	173	40	26	10:22	yellow demosponge	stb biobox
21/06/2010	173	40	27	10:29	white farrea type sponge	stb biobox
21/06/2010	173	40	28	10:40	*Echinus* sp.	front biobox
21/06/2010	173	40	29	10:57	purple holothurian	suction (blue chamber)
22/06/2010	174	43	1	02:55	*Peniagone* sp.	suction (red chamber)
22/06/2010	174	43	2	02:57	*Benthodytes* sp	suction (blue chamber)
22/06/2010	174	43	3	03:04	*Amperima* sp	suction (red chamber)
22/06/2010	174	43	4	03:28	Polychaete tube	suction (yellow chamber)
22/06/2010	174	43	5	03:37	*Amperima* sp	suction (yellow chamber)
22/06/2010	174	43	6	03:44	*Peniagone* sp.	suction (yellow chamber)
22/06/2010	174	43	7	03:50	*Peniagone* sp.	suction (green chamber)
22/06/2010	174	43	8	03:50	smaller *Peniagone* x 2	suction (green chamber)
22/06/2010	174	43	9	04:12	grey enteropneust	suction (black chamber)
22/06/2010	174	43	10	04:17	big head enteropneust	suction (blue chamber)
22/06/2010	174	43	11	04:40	*Discospirina*	front right push core
22/06/2010	174	43	12	04:44	coral	back right push core
22/06/2010	174	43	13	05:08	orange coral (may be flabellum)	front middle push core
22/06/2010	174	43	14	05:19	big head enteropneust	suction (blue chamber)
22/06/2010	174	43	15	05:26	Flabellum	front left push core
22/06/2010	174	43	16	05:32	tube hexactinellid (in sediment)	front biobox
22/06/2010	174	43	17	05:46	Ellipinia type	suction (red chamber)
22/06/2010	174	43	18	05:58	large Benthodytes lingua	front biobox
22/06/2010	174	43	19	06:32	Xenophyophore	back middle push core
22/06/2010	174	43	20	06:43	Xenophyophore	back left push core

Date	Dive	Stn	Specimen no	Time	Specimen description	Collection method
22/06/2010	174	43	21	07:35	*Deima* sp holothurian	suction (red chamber)
22/06/2010	174	43	22	07:55	tube hexactinellid (in sediment)	front biobox
22/06/2010	174	43	23	08:30	Xenophyophore	back left boxcore
22/06/2010	174	43	24	09:42	Purple and blue Synallactid holothurian (on rock)	suction (red chamber)
22/06/2010	174	43	25	09:50	Purple and blue Synallactid holothurian x 2	suction (red chamber)
22/06/2010	174	43	26	10:10	dark anemone	suction (yellow chamber)
22/06/2010	174	43	27	10:28	white asteroid on rock	front biobox
22/06/2010	174	43	28	10:43	yellow spherical sponge on rock	front biobox
22/06/2010	174	43	29	10:44	red frilly vase sponge	front biobox
22/06/2010	174	43	30	11:12	whip gorgonian	front biobox
22/06/2010	174	43	31	11:33	piece of large branching antipatharian	in claw
22/06/2010	175	44	1	21:43	Gorgonocephalus	front biobox
22/06/2010	175	44	2	21:44	Golden gorgonian	front biobox
22/06/2010	175	44	3	21:45	Golden gorgonian	front biobox
22/06/2010	175	44	4	21:47	Golden gorgonian	front biobox
22/06/2010	175	44	5	21:50	venus flytrap anemone	front biobox
22/06/2010	175	44	6	21:51	*Gorgonocephalus*	front biobox
22/06/2010	175	44	7	21:55	*Porania pulvillus*?	front biobox
22/06/2010	175	44	8	21:58	*Gorgonocephalus*	front biobox
22/06/2010	175	44	9	22:06	anemone	front biobox
22/06/2010	175	44	10	22:09	anemone	front biobox
22/06/2010	175	44	11	22:13	anemone	front biobox
22/06/2010	175	44	12	22:29	Pennatulid	front biobox
22/06/2010	175	44	13	22:31	Golden gorgonian (different clone)	front biobox
22/06/2010	175	44	14	22:37	ophiuroid, crinoid etc	suction (yellow chamber)
22/06/2010	175	44	15	22:38	urchin	front biobox
22/06/2010	175	44	16	22:45	coral fragment	front biobox
22/06/2010	175	44	17	22:47	sponge studded with corals	front biobox
27/06/2010	178	53	1	22:00	whip gorgonian	front biobox
27/06/2010	178	53	2	22:03	piece of yellow sponge	front biobox
27/06/2010	178	53	3	22:07	stalked hexactinellid	front biobox
27/06/2010	178	53	4	22:11	whip gorgonian	front biobox
27/06/2010	178	53	5	22:15	whip gorgonian	front biobox
27/06/2010	178	53	6	22:33	stalked hexactinellid	front biobox
27/06/2010	178	53	7	22:36	vase sponge	front biobox
27/06/2010	178	53	8	22:44	vase sponge	front biobox
27/06/2010	178	53	9	22:53	vase sponge	front biobox
27/06/2010	178	53	10	23:03	anemone - white spots on disc	suction (yellow chamber)
27/06/2010	178	53	11	23:06	violet cushion star	suction (black chamber)
27/06/2010	178	53	12	23:13	stalked hexactinellid	front biobox
27/06/2010	178	53	13	23:31	antler horn Faraea sponge	front biobox
27/06/2010	178	53	14	00:12	yellow sponge	front biobox
27/06/2010	178	53	15	00:30	bryozoan	suction (black chamber)
27/06/2010	178	53	16	00:52	antipatharian and ophiuroids	front biobox
27/06/2010	178	53	17	01:05	asteroid	stuck in pipe
27/06/2010	178	53	18	01:21	hand-like sponge	front biobox
27/06/2010	178	53	19	01:21	hand-like sponge	front biobox
27/06/2010	178	53	20	01:23	hand-like sponge	front biobox

Date	Dive	Stn	Specimen no	Time	Specimen description	Collection method
27/06/2010	178	53	21	01:24	hand-like sponge	front biobox
27/06/2010	178	53	22	01:39	stalked crinoid	stb biobox
27/06/2010	178	53	23	01:50	yellow sponge	front biobox
27/06/2010	178	53	24	02:37	small gorgonian	port biobox
27/06/2010	178	53	25	03:07	Xenophyophore	push core (front left)
27/06/2010	178	53	26	03:16	Xenophyophore	push core (back left)
27/06/2010	178	53	27	03:43	*Anthomastus*	suction (pink chamber)
27/06/2010	178	53	28	04:49	*Anachalypticrinus nefititi*	port biobox
27/06/2010	178	53	29	05:08	*Anachalypticrinus nefititi*	port biobox
27/06/2010	178	53	30	05:09	*Anachalypticrinus nefitit*i	port biobox
27/06/2010	178	53	31	05:12	*Echinus* sp.	port biobox
27/06/2010	178	53	32	05:18	solitary coral on rock	suction (blue chamber)
27/06/2010	178	53	33	06:51	large blue anemone	big box core
27/06/2010	178	53	34	07:07	*Peniagone*	suction (yellow chamber)
27/06/2010	178	53	35	07:14	*Peniagone*	suction (yellow chamber)
28/06/2010	179	54	1	14:04	*Pourtalesia*	suction
28/06/2010	179	54	2	14:05	*Pourtalesia*	suction
28/06/2010	179	54	3	14:06	*Pourtalesia*	suction
28/06/2010	179	54	4	14:14	*Hymenaster*	suction
28/06/2010	179	54	5	14:14	*Pourtalesia*	suction
28/06/2010	179	54	6	14:21	medusa	suction
28/06/2010	179	54	7	14:30	*Peniagone*	suction
28/06/2010	179	54	8	15:02	*Anthomastus*	port biobox
28/06/2010	179	54	9	15:38	Enteropneust	suction (red chamber)
28/06/2010	179	54	10	15:49	*Pourtalesia*	suction (blue chamber)
28/06/2010	179	54	11	15:57	Enteropneust	suction (blue chamber)
28/06/2010	179	54	12	16:12	*Peniagone*	suction (red chamber)
28/06/2010	179	54	13	16:36	small holothurian	suction (red chamber)
28/06/2010	179	54	14	16:46	*Discospirina*	front left push core
28/06/2010	179	54	15	17:13	Pennatulid	front biobox
28/06/2010	179	54	16	17:28	Xenophyophore	push core (white band)
28/06/2010	179	54	17	17:39	medusa	suction (green chamber)
28/06/2010	179	54	18	18:05	Xenophyophore	Push core (middle left)
28/06/2010	179	54	19	18:42	Xenophyophore	push core middle right
28/06/2010	179	54	20	19:18	Polychaete tube	suction (black chamber)
28/06/2010	179	54	21	19:33	Polychaete tube	suction (black chamber)
29/06/2010	180	56	1	10:09	Laetmogne holothurian	suction (red chamber)
29/06/2010	180	56	2	10:16	*Peniagone* holothurian	suction (blue chamber)
29/06/2010	180	56	3	10:36	small blue holothurian	suction (blue chamber)

Table 3 Taxa successfully collected during JC048.

Taxon	Dive no.	Station No.	Station Area
Hexactinellida "Farrea" type	159	6	NW
Hexactinellida sp.A	159	6	NW
Hexactinellida sp.C	159	6	NW
Hexactinellida sp.D "Roselliidae" type	159	6	NW
demospongiae "Geodia" type yellow	159	6	NW
Antipatharia *Stauropathes ?punctata*	159	6	NW
Antipatharia *Bathypathes* ?sp.n.	159	6	NW
Crinoidea *Rouxicrinus* sp.	159	6	NW
Anachalypsicrinus nefertiti	159	6	NW
"Pheronema" Hexactinellida	162	16	NW
Hexactinellida 5-6 species	162	16	NW
demospongiae 3 species	162	16	NW
Stauropathes sp.	162	16	NW
Gorgonaria(?*Metallogorgia*)	162	16	NW
Anthomastus sp.	162	16	NW
Polychaeta	162	16	NW
Echinoidea regularia (?Echinus)	162	16	NW
Asteroidea	162	16	NW
Ophiuroidea	162	16	NW
Pseudostichopus	162	16	NW
Laetmogonidae	162	16	NW
Oneirophanta setigera	162	16	NW
Psychropotes depressa	162	16	NW
Peniagone longipapillata	162	16	NW
Ellipinion delagei	162	16	NW
Enteropneusta sp. A	162	16	NW
Enteropneusta sp. A	163	17	NW
Brachiopoda	163	17	NW
Amphipoda	163	17	NW
Bivalvia	163	17	NW
Polychaeta	163	17	NW
Hyalonema	165	24	NE
Hexactinellida	165	24	NE
Demospongiae "Geodia" type yellow	165	24	NE
Gorgonaria	165	24	NE
Polynoidae from sponge	165	24	NE
Tromikosoma ?uranus	165	24	NE
Pourtalesia	165	24	NE
Brisingida	165	24	NE
Hymenaster sp.	165	24	NE
ophiuroid from sponge "Asteronyx"	165	24	NE
Ophiuroidea	165	24	NE
Pseudostichopus ?cf.*peripatus*	165	24	NE

Taxon	Dive no.	Station No.	Station Area
Laetmogonidae	165	24	NE
Ellipinion delagei	165	24	NE
Ellipinion sp.	165	24	NE
Peniagone islandica	165	24	NE
Peniagone longipapillata	165	24	NE
Kolga nana	165	24	NE
Myriotrochus sp.	165	24	NE
Enteropneusta sp. A	165	24	NE
Comatulida	169	29	CGFZ
Enteropneusta sp.B	171	36	SW
Peniagone ?porcella	172	38	SW
Peniagone ?diaphana	172	38	SW
Rosellidae varia	173	40	SW
Hyalonema	173	40	SW
demospongiae"Polymastia"	173	40	SW
Gorgonaria varia	173	40	SW
Actiniaria	173	40	SW
Polychaeta	173	40	SW
Glyphocrangon sp.	173	40	SW
Echinoidea regularia (?Echinus)	173	40	SW
Ophiuroidea	173	40	SW
Hymenaster sp.	173	40	SW
Pseudostichopus sp.	173	40	SW
?*Synallactes* sp.	173	40	SW
Rosellidae	174	43	SW
"Farrea"	174	43	SW
Demospongiae	174	43	SW
Antipatharia *Bathypathes* ?	174	43	SW
Gorgonaria-whip	174	43	SW
Asteroidea	174	43	SW
Synallactidae	174	43	SW
?*Synallactes*	174	43	SW
Benthodytes lingua	174	43	SW
Deima validum	174	43	SW
Ellipinion sp.	174	43	SW
Amperima sp.1	174	43	SW
Amperima sp.2	174	43	SW
Amperima sp.3 "furcata"	174	43	SW
Peniagone cf. *marecoi*	174	43	SW
Peniagone ?porcella	174	43	SW
Peniagone cf.*islandica*	174	43	SW
Enteropneusta sp.B	174	43	SW
Enteropneusta sp.C	174	43	SW

Taxon	Dive no.	Station No.	Station Area
Hyalonema	178	53	SE
"Farrea"	178	53	SE
Scleractinia	178	53	SE
Antipatharia *Bathypathes* ?	178	53	SE
Actiniaria	178	53	SE
Gorgonaria-whip	178	53	SE
Gorgonaria	178	53	SE
Anthomasthus	178	53	SE
Crinoidea ?Bathycrinidae	178	53	SE
Hymenaster sp.	178	53	SE
Asteroidea	178	53	SE
Ophiuroidea	178	53	SE
Echinoidea (?Echinus)	178	53	SE
Peniagone sp.	178	53	SE
Peniagone cf. *marecoi*	178	53	SE
Anthomasthus	179	54	SE
Penatulacea	179	54	SE
Pourtalesia	179	54	SE
Hymenaster sp.	179	54	SE
Ophiuroidea	179	54	SE
Peniagone sp.	179	54	SE
Peniagone ?porcella	179	54	SE
Amperima ?naresi	179	54	SE
Enteropneusta sp.B	179	54	SE
Amperima ?naresi	180	56	SE
Laetmogone sp.	180	56	SE

Table 4 Taxonomic specimens obtained. Fixatives: D=dried, E=ethanol, F= buffered formalin.

Dive No	Station No	Station Area		fixative	No	Storage unit	Comments	Tube No
159	6	NW	Hexactinellida "Farrea" type	D				
159	6	NW	Hexactinellida "Farrea" type	E		small plastic		
159	6	NW	Hexactinellida sp.A	D				
159	6	NW	Hexactinellida sp.A	E		small plastic		
159	6	NW	Hexactinellida sp.C	D				
159	6	NW	Hexactinellida sp.C	E		small plastic		
159	6	NW	Crinoidea *Rouxicrinus* sp.	E	1	1l bucket	det. Mironov	
159	6	NW	*Anachalypsicrinus nefertiti*	E	1	5l bucket		
159	6	NW	Antipatharia *Stauropathes ?punctata*	F	1	5l bucket	det. Molodtsova	
159	6	NW	Antipatharia *Stauropathes ?punctata*	E	fragm	small plastic	det. Molodtsova	
159	6	NW	Demospongia "Geodia" type yellow	D				
159	6	NW	Demospongia "Geodia" type yellow	E		small plastic		
159	6	NW	Antipatharia *Bathypathes* ?sp.n.	F	1	10l bucket	det. Molodtsova	
159	6	NW	Antipatharia *Bathypathes* ?sp.n.	E	fragm	small plastic	det. Molodtsova	
159	6	NW	Hexactinellida sp.D "Roselliidae" type	D				
159	6	NW	Hexactinellida sp.D "Roselliidae" type	E		small plastic		
162	16	NW	*Peniagone longipapillata*	F	1	1l bucket	excellent condition	
162	16	NW	Holothuroidea (Laetmogonidae-2, *Oneirophanta setigera*-1,*Ellipinion delagei*-2,*Pseudostichopus*-2	E	7	1l bucket		
162	16	NW	Polychaeta	F		small plastic		
162	16	NW	*Stauropathes* sp.	F	1	5l bucket	possibly another species than from st.6	
162	16	NW	*Stauropathes* sp.	E	fragm	small plastic	possibly another species than from st.6	
162	16	NW	Enteropneusta	F		small plastic	posteriorly destroyed	
162	16	NW	Enteropneusta	E		tube		
162	16	NW	"pheronema" Hexactinellida	D				
162	16	NW	"pheronema" Hexactinellida	E		small plastic		
162	16	NW	Echinoidea regularia (?Echinus); *Anthomastus*	E	2+1	1l bucket		
162	16	NW	Asteroidea, Ophiuroidea, Gorgonaria(Metallogorgia)	E		5l bucket		
162	16	NW	Hexactinellida	E		1l bucket		
162	16	NW	Hexactinellida 5-6 species; Demospongia 3 species	D	5 fragm	5l bucket		
162	16	NW	Demospongia brown sphaeric	D	1	5l bucket		

Dive No	Station No	Station Area		fixative	No	Storage unit	Comments	Tube No
162	16	NW	Echinoidea regularia (?Echinus)	E		tube	to Kirill Minin	ECH-1
162	16	NW	Echinoidea regularia (?Echinus)	E		tube	to Kirill Minin	ECH-2
163	17	NW	*Psychropotes depressa*	E	1	5l bucket	to the same bucket with nr9; gut lost	
163	17	NW	Enteropneusta	F	1	small plastic	anterior lobe in the good quality	
163	17	NW	Enteropneusta	E		tube		ENT-1
163	17	NW	Brachiopoda	E		small plastic	2 species	
163	17	NW	Amphipoda	E	2	tube		
163	17	NW	Bivalvia	E	1	tube		
163	17	NW	Polychaeta	F	1	tube	from sponge	
165	24	NE	*Kolga nana*	E	5	small plastic	aggregations	
165	24	NE	*Ellipinion* sp.-2; *P.islandica*-1; *P.longipapillata*-1;ophiuroid from sponge "Asteronyx",small ophiuroid	E		1l bucket		
165	24	NE	*Psychropotes depressa*-1; laetmogonidae-1; *Ellipinion delagei*-1	E		small plastic		
165	24	NE	*Pseudostichopus* ?cf.*peripatus*; *Tromikosoma ?uranus*	E	1	1l bucket		
165	24	NE	Enteropneusta	F	1	small plastic	female (eggs inside), anterior end in good condition	
165	24	NE	Enteropneusta	E		tube		ENT-2
165	24	NE	*Kolga nana*; Gorgonaria	E		5l bucket	Kolga-Claudia's samples	
165	24	NE	*Myriotrochus* sp.	E	1	small plastic	anterior end lost	
165	24	NE	Polynoidae from sponge	F	1	small plastic		
165	24	NE	Hexactinellida *Hyalonema*-1: another stalked sp.X -2	D	2			
165	24	NE	Demospongia "Geodia" type yellow	D				
165	24	NE	Hexactinellida *Hyalonema*-1: another stalked sp.X -2	E		2 zip bags	to the 5l bucket see nr47	
165	24	NE	*Pourtalesia*	E	2	small container		
168	28	NE	Enteropneusta	F	1	small plastic	excellent condition	
168	28	NE	Enteropneusta	E		tube		ENT-4
168	28	NE	Brisingida-1; Pterasteridae-2	E	3	1l bucket		
168	28	NE	*Pourtalesia*	E	1	small container		
168	28	NE	*Pourtalesia*	E	1	small container		
168	28	NE	*Hyalonema*	D	1			
168	28	NE	*Hyalonema*	E		small plastic		

Dive No	Station No	Station Area		fixative	No	Storage unit	Comments	Tube No
169	29	CGFZ	Comatulida	E	1	small container	attached to DOBO	
171	36	SW	Enteropneusta sp.B	F	1	small plastic		
171	36	SW	Enteropneusta sp.B	F	1	small plastic		
171	36	SW	Enteropneusta sp.B	E		tube		ENT-5
171	36	SW	Enteropneusta sp.B	E		tube		ENT-6
172	38	SW	*Peniagone* ?*porcella*	E	1	small plastic		
172	38	SW	*Peniagone* ?*diaphana*	F	1	small plastic	no deposits	
173	40	SW	Pseudostichopus sp.	E	1	small plastic		
173	40	SW	?*Synallactes* sp.	E	1	small plastic		
173	40	SW	*Hymenaster* sp.-1, Ophiuroidea-2	E	3	1l bucket		
173	40	SW	Polychaeta	F		small plastic	to Mark Shields	
173	40	SW	Echinoidea regularia (?Echinus)	E	1	1l bucket		ECH-3
173	40	SW	Demospongia "Polymastia"	D				
173	40	SW	Demospongia "Polymastia"	E		small plastic		
173	40	SW	Hexatinellida: Rosellidae varia, "Hyalonema"	D				
173	40	SW	Actiniaria	F	2	small plastic	two different	
173	40	SW	Glyphocrangon sp.	F	1	small plastic		
173	40	SW	Gorgonaria varia	E		5l bucket		
174	43	SW	Enteropneusta sp.B	F	1	small plastic		
174	43	SW	Enteropneusta sp.B	E		tube		ENT-7
174	43	SW	Enteropneusta sp.C	F	1	small plastic		
174	43	SW	Enteropneusta sp.C	E		tube		ENT-8
174	43	SW	Antipatharia Bathypathes ?	F	1	5l bucket		
174	43	SW	Synallactidae	E	1	1l bucket		
174	43	SW	Holothuroidea: ?*Synallactes*; *Benthodytes*; *Deima*	E	3	5l bucket		
174	43	SW	Elpidiidae: *Peniagone* cf.*islandica*-1; *Ellipinion*-1; *Amperima* ssp1-3 - 4	E	6	5l bucket		
174	43	SW	*Peniagone* cf. *marecoi*	E	1	small plastic		
174	43	SW	*Peniagone* ?*porcella*	E	1	small plastic		
174	43	SW	Gorgonaria-whip; Asteroidea-1	E		5l bucket		
174	43	SW	Actiniaria	F	1	small plastic	black	
174	43	SW	Porifera: Rosellidae, Farrea, Demospongia	D				
178	53	SE	*Peniagone* cf. *Marecoi*	E	1	small plastic		

Dive No	Station No	Station Area		fixative	No	Storage unit	Comments	Tube No
178	53	SE	*Hymenaster* sp.-1, Asteroidea-1; Ophiuroidea-2; Echinoidea (?echinus); *Peniagone* sp.	E		5l bucket	Ophiuroidea from Bathypathes	
178	53	SE	Gorgonaria-whip-2; gorgonaria another-1; antomasthus-1; Sclerastinia-1	E		5l bucket		
178	53	SE	Crinoidea ?Bathycrinidae	E	1	plastic jar		
178	53	SE	"Hyalonema","Farrea"	D			plus Hyalonema frozen sample	
178	53	SE	Antipatharia Bathypathes ?; Actiniaria	F		5l bucket		
179	54	SE	Ophiuroidea from sea pen-1; Pennatulacea-1; *Hymenaster*-1; *Peniagone* sp.-1; *Peniagone* ?*porcella*-1; Anthomastus brownish-1	E		5l bucket		
179	54	SE	Enteropneusta sp.B	F	1	plastic container	intact!	
179	54	SE	*Pourtalesia*	E	4	plastic container x4		
179	54	SE	*Amperima* ?*naresi*	E	1	small plastic		
180	56	SE	*Amperima* ?*naresi*	E	2	small plastic		
180	56	SE	*Laetmogone* sp.	E	3	small plastic		

Table 5 Specimen tissue samples for molecular analysis.

Date	Order	Species name	Tissue taken	Dive no.	Sample no.	Pres.	Notes
07.06.10	Porifera	Hexa Z	tissue	161	G18	freeze	
07.06.10	Porifera	Hexa Z	tissue	161	G19	EthoH	
07.06.10	Crinoidea	*Anachalypsicrinus nefertini*	arm	161	G20	freeze	
07.06.10	Crinoidea	*Anachalypsicrinus nefertini*	arm	161	G21	EthoH	
07.06.10	Holothurians	?Laetmigonida sp.	tentacle	161	G22	freeze	
07.06.10	Holothurians	?Laetmigonida sp.	tentacle	161	G23	EthoH	
07.06.10	Holothurians	*Pseudostichopus* sp. A	piece of body wall	161	G24	freeze	
07.06.10	Holothurians	*Pseudostichopus* sp. A	piece of body wall	161	G25	EthoH	
07.06.10	Holothurians	*Pseudostichopus* sp. B	piece of body wall	161	G26	freeze	
07.06.10	Holothurians	*Pseudostichopus* sp. B	piece of body wall	161	G27	EthoH	
07.06.10	Asteroidea	*Hymenaster membranes*	tube feet	161	G28	freeze	
07.06.10	Asteroidea	*Hymenaster membranes*	tube feet	161	G29	EthoH	
07.06.10	Porifera	Hexactinellid sponge D	tissue	161	G30	freeze	
07.06.10	Porifera	Hexactinellid sponge D	tissue	161	G31	EthoH	
07.06.10	Porifera	Hexactinellid sponge S	tissue	161	G32	freeze	
07.06.10	Porifera	Hexactinellid sponge S	tissue	161	G33	EthoH	
07.06.10	Porifera	Demospongia sp. E	tissue	161	G34	freeze	
07.06.10	Porifera	Demospongia sp. E	tissue	161	G35	EthoH	
07.06.10	Porifera	Demospongia sp. K	tissue	161	G36	freeze	
07.06.10	Porifera	Demospongia sp. K	tissue	161	G37	EthoH	
10.06.10	Porifera	Hexactinelid sponge AI	tissue	165	G38	freeze	
10.06.10	Porifera	Hexactinelid sponge AI	tissue	165	G39	EthoH	
10.06.10	Porifera	Hexactinelid sponge AH	tissue	165	G40	freeze	
10.06.10	Porifera	Hexactinelid sponge AH	tissue	165	G41	EthoH	
10.06.10	Holothurians	*Kolga ?nana*	whole specimen	165	G42	freeze	
10.06.10	Holothurians	*Kolga ?nana*	whole specimen	165	G43	EthoH	
13.06.10	Asteroidea	*Hymenaster* sp F	tube feet	168	G44	freeze	
13.06.10	Asteroidea	*Hymenaster* sp F	tube feet	168	G45	EthoH	
13.06.10	Asteroidea	*Hymenster* sp. A	tube feet	168	G46	freeze	
13.06.10	Asteroidea	*Hymenster* sp. A	tube feet	168	G47	EthoH	
13.06.10	Asteroidea	Brisingidae sp	piece of arm	168	G48	freeze	
13.06.10	Asteroidea	Brisingidae sp	piece of arm	168	G49	EthoH	
13.06.10	Porifera	Hexactinellid sp. AI	tissue	168	G50	freeze	
13.06.10	Porifera	Hexactinellid sp. AI	tissue	168	G51	EthoH	
13.06.10		Enteropneust sp A	piece of skin fallen off	168	G52	freeze	
13.06.10		Enteropneust sp A	piece of skin fallen off	168	G53	EthoH	
21.06.10	Porifera	Hexa AX	tissue	173	G54	freeze	
21.06.10	Porifera	Hexa AX	tissue	173	G55	EthoH	
21.06.10	Asteroidea	*Hymenaster* sp A	tube feet	173	G56	freeze	
21.06.10	Asteroidea	*Hymenaster* sp A	tube feet	173	G57	EthoH	
21.06.10	Porifera	Hexa Ay	tissue	173	G58	freeze	
21.06.10	Porifera	Hexa Ay	tissue	173	G59	EthoH	

21.06.10	Porifera	Hexa Aw	tissue	173	G60	freeze	
21.06.10	Porifera	Hexa Aw	tissue	173	G61	EthoH	
21.06.10	Porifera	Hexa AZ	tissue	173	G62	EthoH	
21.06.10	Porifera	Hexa AZ	tissue	173	G63	freeze	
21.06.10	Porifera	Demospongia sp. M	tissue	173	G64	freeze	
21.06.10	Porifera	Demospongia sp. M	tissue	173	G65	EthoH	
21.06.10	Porifera	Demospongia sp. D	tissue	173	G66	freeze	
21.06.10	Porifera	Demospongia sp. D	tissue	173	G67	EthoH	
22.06.10	Holothurians	*Benthodytes lingua*	muscle	174	G68	freeze	
22.06.10	Holothurians	*Benthodytes lingua*	muscle	174	G69	EthoH	
22.06.10		Enteropneust sp. B	tissue	174	G70	freeze	very little tissue and very gelatinous
22.06.10		Enteropneust sp. B	tissue	174	G71	EthoH	
22.06.10	Porifera	*Regadrella phoenix*/Hexa sp. BA	tissue	174	G72	freeze	
21.06.10	Porifera	*Regadrella phoenix*/Hexa sp. BA	tissue	174	G73	EthoH	
21.06.10	Holothurians	*Deima validum*	tentacle	174	G74	freeze	
21.06.10	Holothurians	*Deima validum*	tentacle	174	G75	EthoH	
21.06.10	Porifera	Hexa sp BB	tissue	174	G76	freeze	
21.06.10	Porifera	Hexa sp BB	tissue	174	G77	EthoH	
21.06.10	Holothurians	*Amperima* sp. 1	tentacle	174	G78	freeze	
21.06.10	Holothurians	*Amperima* sp. 1	tentacle	174	G79	EthoH	
21.06.10	Holothurians	*Amperima* sp. 2	tentacle	174	G80	freeze	
21.06.10	Holothurians	*Amperima* sp. 2	tentacle	174	G81	EthoH	
21.06.10	Holothurians	*Ellipinion* sp. A	tentacle	174	H1	freeze	
21.06.10	Holothurians	*Ellipinion* sp. A	tentacle	174	H2	EthoH	
21.06.10	Cnidarian	*Flabellum angulare*	flesh	174	H3	freeze	
21.06.10	Cnidarian	*Flabellum angulare*	flesh	174	H4	EthoH	
21.06.10	Cnidarian	*Flabellum angulare*	flesh	174	H5	freeze	
21.06.10	Cnidarian	*Flabellum angulare*	flesh	174	H6	EthoH	
23.06.10	Cnidarian	Anemone sp. A	tentacle	175	H7	freeze	SEAMOUNT
23.06.10	Cnidarian	Anemone sp. A	tentacle	175	H8	EthoH	SEAMOUNT
23.06.10	Asteroidea	*Porania pulvillus*	tube feet	175	H9	EthoH	SEAMOUNT
23.06.10	Asteroidea	*Porania pulvillus*	tube feet	175	H10	freeze	SEAMOUNT
23.06.10	Porifera	Bioiluminescent sponge Hexa BD	piece, including polyps	175	H11	EthoH	SEAMOUNT
23.06.10	Porifera	Bioiluminescent sponge Hexa BD	piece, including polyps	175	H12	freeze	SEAMOUNT
23.06.10	Cnidaria	Pennatulace sp.	polyps	175	H13	freeze	SEAMOUNT
23.06.10	Cnidaria	Pennatulace sp.	polyps	175	H14	EthoH	SEAMOUNT
23.06.10	Cnidaria	Anemone sp. B	tentacles	175	H15	freeze	SEAMOUNT
23.06.10	Cnidaria	Anemone sp. B	tentacles	175	H16	EthoH	SEAMOUNT we had 3 and Ben took some for isotope samples
23.06.10	Cnidaria	Gorgonia sp. D	branch	175	H17	freeze	
23.06.10	Cnidaria	Gorgonia sp. D	branch	175	H18	EthoH	SEAMOUNT mainly for Pedro, possibly same sp as Gorgonia sp2
23.06.10	Cnidaria	Gorgonia sp. ?D	branch	175	H19	freeze	
23.06.10	Cnidaria	Gorgonia sp. ?D	branch	175	H20	EthoH	SEAMOUNT

23.06.10	Ophiuroid	*Gorgonocephalus sp. (Basket star)*	piece of arm	175	H21	freeze	SEAMOUNT
23.06.10	Ophiuroid	*Gorgonocephalus sp. (Basket star)*	piece of arm	175	H22	EthoH	SEAMOUNT
27.06.10	Asteroidea	*Hymenaster* sp. I	tube feet	178	H23	freeze	very fragile looking one, with fairly translucent skin
27.06.10	Asteroidea	*Hymenaster* sp. I	tube feet	178	H24	EthoH	
27.06.10	Porifera	Hexactillid BC	tissue samples	178	H25	freeze	
27.06.10	Porifera	Hexactillid BC	tissue samples	178	H26	EthoH	
27.06.10	Porifera	Hexactillid I	tissue samples	178	H27	freeze	
27.06.10	Porifera	Hexactillid I	tissue samples	178	H28	EthoH	
27.06.10	Holothurians	*Peniagone* sp. A	tentacle	178	H29	freeze	smaller of the two types collected at that dive
27.06.10	Holothurians	*Peniagone* sp. A	tentacle	178	H30	EthoH	
27.06.10	Cnidarians	Flabellum type	tissue	178	H31	freeze	very little tissue
27.06.10	Cnidarians	Flabellum type	tissue	178	H32	EthoH	very little tissue
27.06.10	Holothurians	*Peniagone* sp. C	tentacle	178	H33	freeze	bigger of the two types collected on that dive
27.06.10	Holothurians	*Peniagone* sp. C	tentacle	178	H34	EthoH	
27.06.10	Porifera	Hexa D	tissue	178	H35	freeze	
27.06.10	Porifera	Hexa D	tissue	178	H36	EthoH	
27.06.10	Polychaete	Polynoidea sp. B	half specimen	178	H37	freeze	
27.06.10	Polychaete	Polynoidea sp. B	other half specimen	178	H38	EthoH	
27.06.10	Cnidaria	Gorgonacea sp. C	piece of stalk with polyps	178	H39	freeze	
27.06.10	Cnidaria	Gorgonacea sp. C	piece of stalk with polyps	178	H40	EthoH	
27.06.10	Cnidaria	Gorgonacea sp. D	polyps	178	H41	freeze	
27.06.10	Cnidaria	Gorgonacea sp. D	polyps	178	H42	EthoH	
27.06.10	Crinoidea	*Anachalypsicrinus nefertiti*	piece of arm	178	H43	freeze	
27.06.10	Crinoidea	*Anachalypsicrinus nefertiti*	piece of arm	178	H44	EthoH	
28.06.10	Cnidaria	Gorgonacea sp. C	polys	179	H45	freeze	
28.06.10	Cnidaria	Gorgonacea sp. C	polyps	179	H46	EthoH	
28.06.10	Asteroidea	*Hymenster* sp. B	tube feet	179	H47	freeze	
28.06.10	Asteroidea	*Hymenster* sp. B	tube feet	179	H48	EthoH	
28.06.10	Holothurians	*Peniagone* sp. C	tentacle	179	H49	freeze	
28.06.10	Holothurians	*Peniagone* sp. C	tentacle	179	H50	EthoH	
28.06.10	Alcyonacea	*Anthomastus* sp.	polyp	179	H51	freeze	
28.06.10	Alcyonacea	*Anthomastus* sp.	polyp	179	H52	EthoH	
28.06.11	Holothurians	*Amperima* sp. 1	tentacle	179	H53	freeze	
28.06.12	Holothurians	*Amperima* sp. 1	tentacle	179	H54	EthoH	
28.06.10	Holothurians	*Laetmogonida sp. ?nov.*	tentacle	180	H57	freeze	only Ethanol sample

4. WHALE BONE RECOVERY AT THE NW AND NE ECOMAR STUDY SITES

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In 2008 during the RRS Discovery cruise D331T, whale bone moorings were deployed at the NW (53º 59.339'N, 36º 11.662'W, depth 2498 m) and NE (54º 01.471'N, 34º10.637'W, depth 2435 m) ECOMAR study sites. The aim of this study was to examine fauna associated with whale bones, with special focus on polychaetes (Helena Wiklund), other macrofauna (Mark Shields) and bioluminescence (Jess Craig). This would be the first study of Atlantic deep-sea whale-fall communities, previous studies on Atlantic whale-fall fauna have only been done in shallow water (30-125 m depth) in Skagerak.

On Isis Dive 159 at the NW ECOMAR study site, the whale bones were found approximately 80 metres from the deposit position. Isis approached the bones using red lights and ICDEEP camera for bioluminescence observations, and finally with white lights for visual observation of associated fauna. Galathean crabs were abundant on the bones and on the ballast weights, with a size sorting of smaller crabs on the ballast and on the sediment, and larger on the bones (Fig. 1). Some urchins were visible on the bones, and there was a dense assemblage of polychaete tubes in the sediment surrounding the bones (Fig. 1). At this point, a decision was made to abandon the bones for that dive, and return with Isis equipped for a more thorough sampling of both the bones and the surrounding fauna. Unfortunately the bones were not found again despite long-lasting searches during Isis Dives 162 and 163. At the NE ECOMAR study site, Isis Dive 168 was dedicated to whale bone search, but the bone mooring was not found.

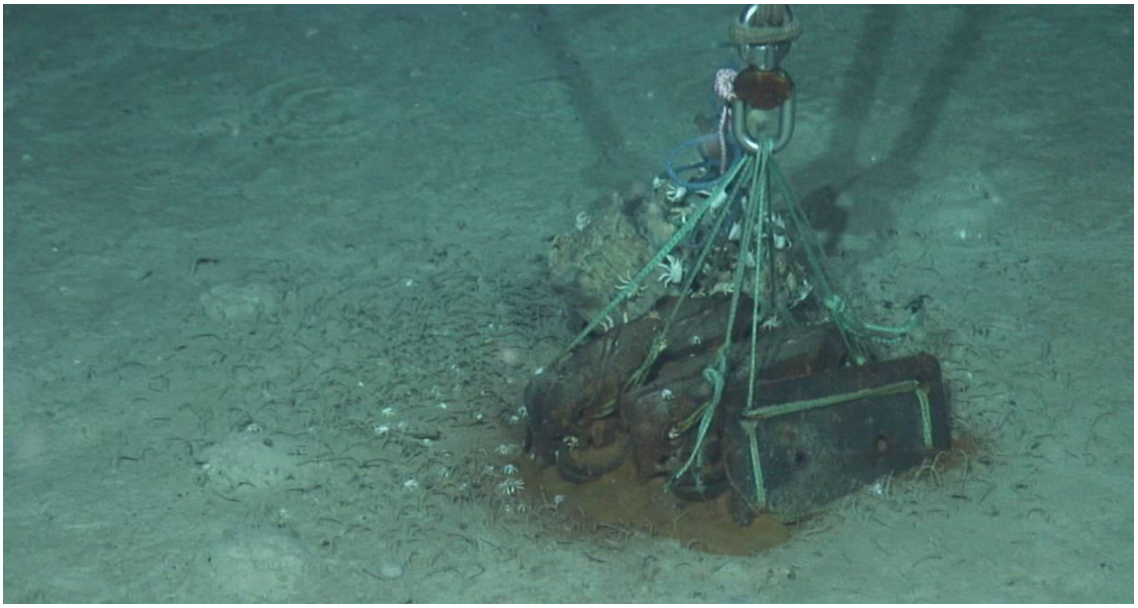

Figure 1 Whale bone mooring at 2498 m depth at the NW ECOMAR study site. Galathean crabs are visible on the bones, and polychaete tubes in the surrounding sediment.

5. FORAMINIFERA

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An effort was made during the cruise to collect large foraminifera visible in Isis videos and still photographs. The species recovered included three species of xenophyophores and *Discospirina tenuissima* (Carpenter 1883), a large miliolid characterised by a very thin, discoidal test, 1-2 cm in diameter,

Table 1 Large foraminifera collected.

Station	Gear	Isis Dive	Xenophyophore	*Discospirina*
048/016	Push core	162	*Syringammina* sp 1. Probably *S. fragillissima*	1 complete; probably dead; attached brachiopod
048/024	Push core	165		2 complete; in situ photos show larger test with partial sediment ring
048/025	Megacore	-		1 complete; found on sieve
048/028	Push core	168	*Homogammina* sp.. Probably a new species	
048/037	Megacore	-		1 complete; found on sieve
048/038	Push cores	172		1 complete, 1 fragment; in situ photos show both tests surrounded by sediment rings
048/042	3 push cores; 1 box core	174	*Syringammina* sp. 1 (2) *Syringammina* sp. 2; 1 specimen of a species found in Whittard Canyon during JC010	1 complete; in situ photos show test surrounded by sediment ring
048/049	Megacore	-		1 complete; found at 2-cm depth in core
048/054	3 push cores	178	*Syringammina* sp. 1 (3)	
048/056	3 push core	179	*Syringammina* sp 1 *Homogammina* sp. (2)	1 complete, with central hole showing signs of regrowth

Discospirina tenuissima

This species was common at all sites. Most reports of *D. tenuissima* are from the Atlantic, where it has been found mainly on the continental margin of western Europe, from the Rockall Trough to the Portuguese margin, as well as from off NW Africa. The ECOMAR material therefore represents the first record from a central oceanic area. A total of eight specimens were collected. Five of them were photographed on the seafloor and then recovered deliberately in push cores, the other 3 were fortuitously recovered in megacores. All are more or less circular or slightly ovate in shape, ranging from 11.3 to 19.3 mm in maximum diameter.

The *in situ* photographs and collected specimens reveal the following interesting features.

1) The outer margin of several of the tests recovered in push cores are interrupted by several angular notches and irregularities (Fig. 1). In both cases, these are also evident in the corresponding seafloor images and therefore did not originate during recovery and subsequent handling of the test. Some sections of the margin of the Dive 165 specimen exhibit smooth concave indentations, rather than angular interruptions. These are associated with evidence of test repair in the form of discontinuities in the development of the annular chambers. Damage to these delicate *Discospirina* tests may occur as a result of the activities of megafaunal animals.

2) Many specimens of *Discospirina* photographed *in situ* at the SW site have what appear to be a large central holes, giving them a ring-like appearance. One of these perforated specimens was collected in a push-core during Dive 179. The hole visible in the photographed was indeed an open space, occupying about a third of the diameter of the test (Fig. 2). Most interestingly, the edges of the central hole showed signs of test repair, similar to those seen on the outer margin of other tests. The origin and function of these central spaces is unclear, but they could serve to increase the food-gathering capabilities of the organism by increasing the length of the test margin.

3) Some tests are surrounded, either partly or completely, by a raised ring of sediment, interpreted as surface material that has been accumulated by pseudopodia deployed from the edge of the test. This feature is clearly visible in many specimens from the SE area (Fig. 3). An abandoned sediment ring, marking the former position of the tests, is also often present, and the remnants of a second abandoned ring are sometimes evident. These observations suggest that the organisms use the surficial sediment that they accumulate around the test as a food source. Once the food content of the accumulated sediment is exhausted, the foraminiferan moves forward by 1-2 test diameter and repeats the sediment-gathering process.

Xenophyophores

These giant foraminifera were common in video transects from all four study areas. However, their distribution was distinctly patchy and they were more of less absent from some transects. For example, rough counts of xenophyophores made during video transects on flat ground or 10º slopes at the SW sites varied from 16 to 102. By far the most common species was *Syringammina* sp. 1 (Fig. 4), probably conspecific with *Syringammina fragillissima,* a species that is widely distributed around the western European continental margin. The dome-shaped tests of this species were observed on steeply sloped topography as well on flat areas. The vast majority of specimens occurred on sedimented surface and usually on fine-grained sediment rather than pteropod ooze. However, a few were noticed on bare rock surfaces.

Two other species were collected in addition to *Syringammina* sp. 1. A specimen from Dive 174 represents another species of *Syringammina* that is morphologically very similar to one obtained in the Whittard Canyon during *James Cook* Cruise 010 (*sis* Dive 63, 3591 m depth). The other is a species of ?*Homogammina,* three specimens of which were collected during Dive 168 (Fig. 5). This species was also seen during video transects, although it was much less common than *Syringammina* sp. 1.

Other foraminifera

A brief survey was made of benthic foraminifera in unstained sediment residues (>150 µm fraction) from the NW (Stn 048/025, Dive 165 push core) and SE (048/037, megacore) sites. Similar species were present in both areas. The most abundant taxa included *Hoeglundina elegans, Cibicidoides wuellerstofi, Pyrgo spp, Quinquiloculina spp.* and *Sigmoilina schlumbergeri.*

Biogeography

There appears to be a close link between the large (megafaunal) foraminifera present at the ECOMAR sites and bathyal, continental margin assemblages around western

Europe. At least two of the three xenophyophore species, and *Discospirina tenuissima,* are present in both areas. Similarly, a quick look at the smaller benthic foraminifera in sediment samples revealed species that are common and widely distributed at bathyal depths in the North Atlantic.

Figure 1 *Discospirina tenuissima*: test with new damage and repaired damage to outer margin (Dive 165).

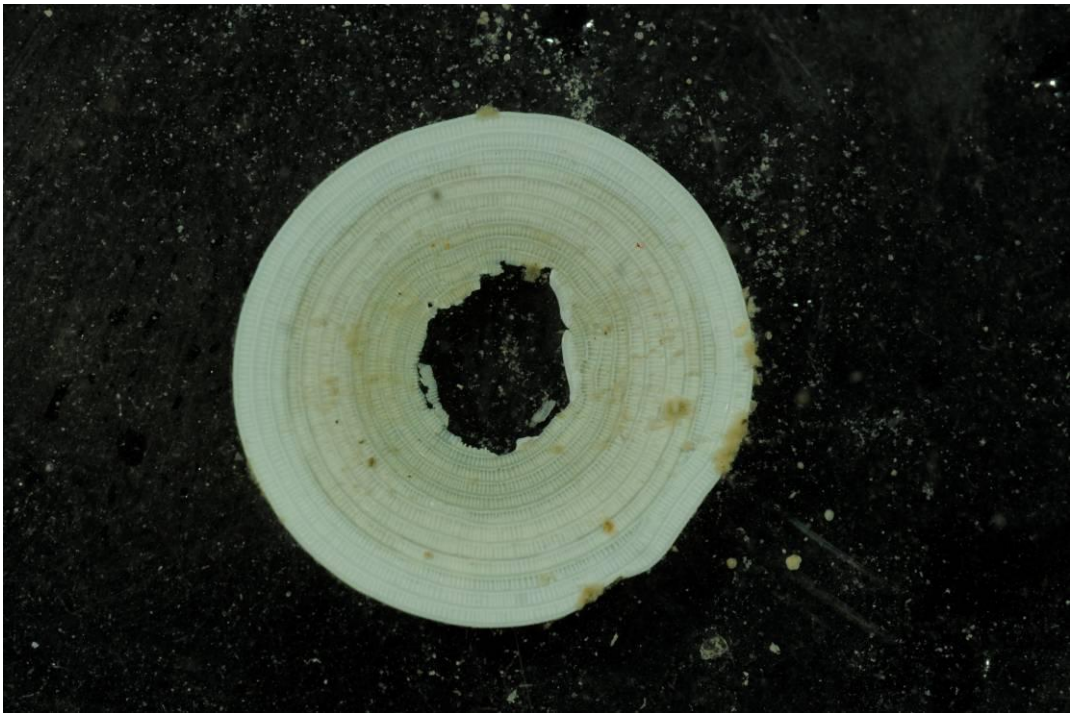

Fig. 2. *Discospirina tenuissima*: test with central hole (Dive 179).

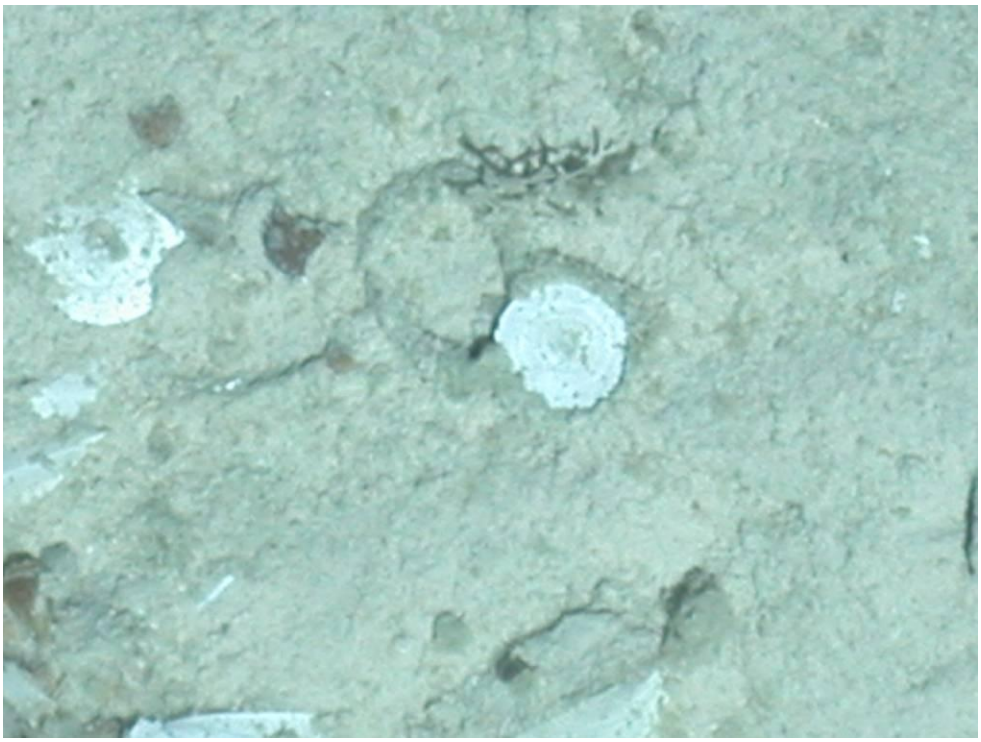

Figure 3 *Discospirina tenuissima*: still photograph of *in situ* specimen with ring of sediment collected around the edge of the test (Dive 172).

Figure 4 *Syringammina fragillissima* from Dive 178

Figure 5 ?*Homogammina* sp. From Dive 179.

6. BENTHIC TROPHODYNAMICS OF THE MID-ATLANTIC RIDGE

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Invertebrate tissue and filtered water samples were collected for stable isotope analysis (carbon, nitrogen and sulphur) (Table 1). This will complement the work conducted on samples collected during JC011 in 2007 and JC037 in 2009. The Isis ROV allows us to sample that component of the benthic megafauna that is inaccessible to trawling, namely the suspension feeding invertebrates colonising the hard-substrate habitats of the Mid-Atlantic Ridge (cliffs, terraces and steep slopes). The aims of this work are to 1) incorporate representative, suspension feeding invertebrates into benthic food webs constructed for north and south of the Charlie-Gibbs Fracture Zone, to see whether different productivity regimes influence trophodynamics and energy flow, and 2) produce a baseline d15N and d13C signature for each locality by analysing filtered water samples from 10m and 1000m above the seabed. Sample collection was relatively successful at all for sites (northwest, northeast, southwest and southeast). We were able to collect approximately half the number of samples anticipated for common, representative species. This was the result of a combination of dive time lost to bad weather and the long time required to sample individuals from steep, topographically complex habitats.

CTD water samples (Stations 4, 19, 30 and 45)
Water was collected using the niskin rosette sampler at each of the four ECOMAR stations.
Bottles were fired at 10m above bottom and 1000m above bottom. Following recovery 40L of water from each depth was removed into 8 off 10L aspirators. Water was then filtered through 3 replicate GF filters (13L per filter) for each depth sample. The pre-weighed filter papers had already been prepared by combustion at 500^{o}C and following filtration they were stored in aluminium foil and frozen at -80^{o}C. The samples from water 10m above the seabed will be used to provide an approximate isotopic signature for the resources exploited by filter feeding invertebrates on the ridge. Samples from 1000m above bottom were taken so that we may try to investigate the contribution of near-bed resuspended material to the isotopic signature of the seawater. These 1000m above seabed samples will also be compared to the isotopic signature of the marine snow collected in the 1000m sediment trap on each of the four moorings.

Mobile macro-consumers: Amphitrap (Stations 8 & 20) and Isis ROV (Stations 6, 16, 24, 28, 40, 43, 44, 51, 53, 54 & 56)
Mobile macro-consumers were collected using the amphitrap and Isis ROV. ROV collections were undertaken at all four ECOMAR sites as well as samples from a shallow (1000-800m) seamount located midway between the southwest and southeast stations. Samples taken by the ROV were selected on the basis of their abundance in previous video transect dives. The aim was to collect replicate (3) individuals from the 8-10 most common species. In reality this proved difficult owing to constraints on dive time and the logistical problems of sampling in rough terrain. Successful samples recovered are shown in Table 1. On recovery 2 - 5g of tissue was removed from each specimen, when large enough, and the whole specimen was taken if it was a small individual. All samples were frozen and stored at -80^{o}C in glass vials.

Table1 Summary of samples collected during JC048 for isotopic analysis.

Species (OTU)	Northwest	Northeast	Southwest	Southeast	Seamount		Cruise list code
"*Phaeronema*" type - brown Island sponge	3						HEXA C
Yellow demospongia	4	3	3	3			DEMO D/E
Small, white branching sponge	3	3					HEXA Z
Brown, funnel/tube sponge	3	3	4	3			HEXA D
Large, white funnel sponge	1						HEXA S
White, stalked 'goblet' sponge		3					HEXA AI
White, stalked multi-lobed sponge "*Hyalonema*" type			3	3			HEXA AH
Sponge with bioluminescent polyps					1		HEXA BD
hand-like' flat, branching sponge				3			HEXA BC
Metallogorgia sp.			2				
Yellow gorgonian					3		Gorgonacea sp. K
Bioluminescent whip coral				3			Gorgonacea sp. D
Flabellum angulare			3				
Large orange anemone					3		Anemone sp. A
Large, red pennatulid					1		Pennatulacea sp.
Trachymedusa - *Voragonema* sp.				3			
Trachymedusa - *Crossota millsae*				2			
Eurythenes gryllus	3	4					
Ostracoda	3						
Anachalypsicrinus nefertiti	2	3		3			
Gorgonacephalus sp.					3		
Kolga nana?		3					
Benthodytes lingua			1				
Pink/red Enteropneust		2					
TOTAL	22	24	16	23	11	**96**	

7. SWATH BATHYMETRY USING THE ISIS ROV

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Technology

The Isis ROV is equipped with a downward facing MS2000 128 beam Multi-beam swath transducer. When combined with the altimeter and Doppler corrected USBL (Ultra Short Base Line) positioning the Isis can be used to generate high resolution swath bathymetry that would not be possible using ship mounted equipment in deep water. Previous ship based work on the ECOMAR study area yielded pixel sizes of 90m however with this method a pixel size of just 1m was possible. Positioning from the ship gives true depth and position with the Isis navigation generating offsets.

Survey lines are run with the ROV at 20m above the seabed. This gives a line width of about 40m on open terrain. Survey speed is about 0.4knts. All data is logged on a TECHSAS data logging system.

Survey lines

Following a short test during dive 158, three swath surveys were run. The first was run as a single line, the other two with an offset line in the return direction (Table1). Since time was limited during the cruise, surveys were of restricted size but focused on areas of complex topography where previous ship based methods has failed to accurately resolve the seabed.

Table 1 Swath survey lines performed by the Isis ROV.

Site	Date	Dive	Offset
Test	29/05/2010	158	
NW	05/06/2010	161	Single line
NE	10/06/2010	165	50m
SW	21/06/2010	173	30m

Results

It was possible to process the swath data onboard using Caraibes processing software (IFREMER). These initial interpretations were very rough representations that allowed us to ensure that data capture was effective and make any modifications required to our acquisition (Fig.1). These images serve to illustrate the complexity of the seabed on and around the ridge. Once thoroughly processed they will no doubt reveal far more information.

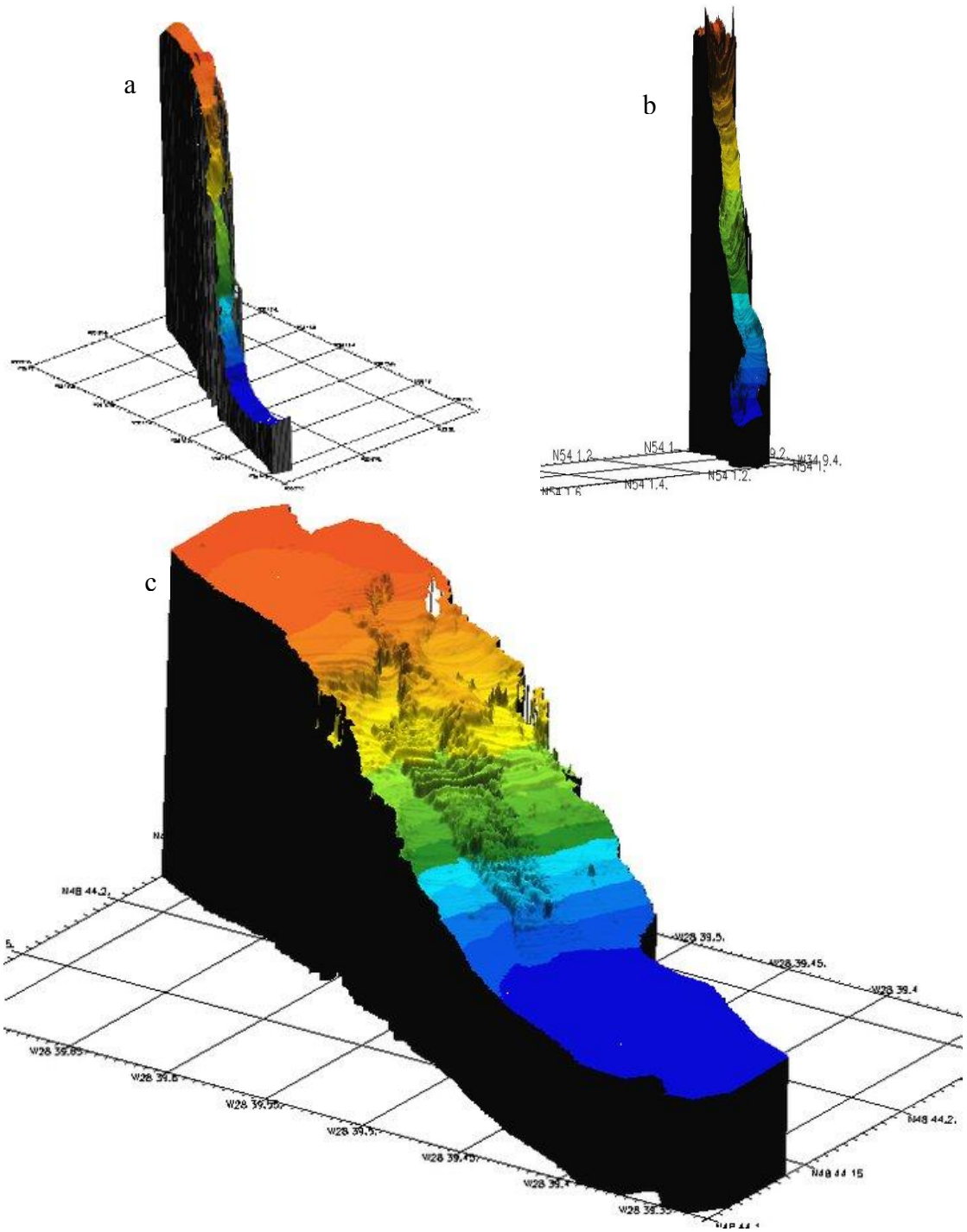

Figure 1 Initial swath line processing a) Dive 161 at the North West site with a five times exaggeration, b) Dive 165 at the North East site with a five times exaggeration, c) combination of both lines during Dive 173 at the South West station shown with no exaggeration.

8. COLLECTION OF TISSUE SAMPLES FOR MOLECULAR STUDIES IN COLD-WATER CORALS

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Voucher specimens of the most common species of cold-water corals found on rocky bottom during the Isis dives were collected at each of the four stations and also at the seamount. A small portion of most specimens was preserved in ethanol or RNA Later to be used in studies of adaptive genetic variation and gene expression that will be conducted at IMAR/DOP.

A total of 19 samples were preserved for molecular work. These included 5 black corals (Order Antipatharia) belonging to at least two different species, and 14 gorgonians (order Alcyonacea), mostly bamboo corals (Isididae), golden corals (*Metallogorgia* sp.) and a few specimens of *Acanthogorgia* sp. collected at the seamount. Depth of collection sites ranged between 844-2506 metres (Table 1).

Table 1 List of cold-water coral samples preserved for molecular studies, sampling location (datum WGS84), depth and preservation method.

Taxon	Isis dive	Station	Location	Date	Latitude	Longitude	Depth (m)	Preservation
Stauropathes sp	159	6	NW	01/06/10	53º 39.320'N	36º 11.633'W	2460	RNA Later
Bathypathes sp.	159	6	NW	01/06/10	53º 39.320'N	36º 11.633'W	2460	RNA Later
Stauropathes sp.	162	16	NW	07/06/10	53º 39.326'N	36º 11.899'W	2400	Ethanol
Metallogorgia sp.	162	16	NW	07/06/10	53º 39.326'N	36º 11.899'W	2400	Ethanol
Isididae	165	24	NE	10/06/10	54º 01.081'N	34º 09.455Ẃ	2447	Ethanol
Isididae	173	40	SW	21/06/10	48º 44.134'N	28º 39.454Ẃ	2506	Ethanol
Isididae	173	40	SW	21/06/10	48º 44.134'N	28º 39.454Ẃ	2506	Ethanol
Isididae	173	40	SW	21/06/10	48º 44.134'N	28º 39.454Ẃ	2506	Ethanol
Metallogorgia sp.	173	40	SW	21/06/10	48º 44.151'N	28º 39.542Ẃ	2504	Ethanol
Alcyonacea	173	40	SW	21/06/10	48º 43.011'N	28º 39.059Ẃ	2496	Ethanol
Alcyonacea	174	43	SW	22/06/10	48º 43.890'N	28º 39.078Ẃ	2493	Ethanol
Bathypathes sp.	174	43	SW	22/06/10	48º 43.890'N	28º 39.078Ẃ	2497	Ethanol
Acanthogorgia sp.	175	44	Seamount	22/06/10	48º 44.000'N	28º 09.902Ẃ	845	Ethanol
Acanthogorgia sp.	175	44	Seamount	22/06/10	48º 44.000'N	28º 09.902Ẃ	845	Ethanol
Acanthogorgia sp.	175	44	Seamount	22/06/10	48º 44.000'N	28º 09.902Ẃ	845	Ethanol
Acanthogorgia sp.	175	44	Seamount	22/06/10	48º 43.999'N	28º 09.908Ẃ	844	Ethanol
Isididae	178	53	SE	27/06/10	49º 01.408'N	27º 41.289Ẃ	2444	RNA Later
Isididae	178	53	SE	27/06/10	49º 01.408'N	27º 41.289Ẃ	2440	Ethanol
Alcyonacea	178	53	SE	27/06/10	49º 01.408'N	27º 41.289Ẃ	2389	RNA Later

9. OBSERVATIONS OF PELAGIC AND EPIBENTHIC GELATINOUS ZOOPLANKTON NEAR THE CHARLIE-GIBBS FRACTURE ZONE

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Background

The pelagic Coelenterates (ctenophores and siphonophores), Cnidarians (scyphozoans/cubozoans/hydrozoans, aka jellyfishes) and Urochordates (appendicularians and salps) constitute a diverse array of pelagic and epibenthic species. The contribution of these soft-bodied fauna to ecological processes in the world's oceans, as herbivores, apex predators and detritivores, can be considerable in the upper 1000 m of the water column. Below this depth, however, there is a relatively meagre amount of information about systematics and evolutionary relationships, life histories and feeding strategies, and distribution and abundance patterns. Deployments of the Isis ROV on this final ECOMAR cruise provided unique and direct opportunities to image rarely observed deep-sea species and to quantify the richness and abundance of epibenthic medusae.

Materials and Methods

Observations of free-swimming zooplankton and nekton were recorded with the Isis remotely operated vehicle (ROV) *in situ* and within a kreisel in a temperature-controlled, shipboard laboratory. Collections of epibenthic medusae and ctenophores were conducted with a rotary, 5-canister suction device and three static d-samplers. ROV dives were either 1-h allotments of pelagic observation or 6-9 h of dedicated work in the water column, nominally 2500 m at all but one of the dive sites. The shorter dives served to indicate the depths where gelatinous fauna were abundant or at least consistently present. The descent of the ROV varied from slow (10 m/min) in an effort to maximize opportunities to observe/video targeted fauna to rapid (30 m/min) so as to expedite transit to the seafloor.

Preliminary Results

Eight reconnaissance and 2 dedicated ROV dives were completed at stations north and south of the Charlie-Gibbs Fracture Zone (Table 1). The vertical distribution of gelatinous zooplankton in the upper 2000 m was generally consistent with ROV surveys conducted over the Mid-Atlantic Ridge during the second leg of the MarEco cruise in 2004 (Hosia et al. 2008; Stemman et al. 2008; Youngbluth et al. 2008). Specifically, the most frequently observed gelatinous fauna in order of overall abundance included medusae, ctenophores, siphonophores, and appendicularians. All of these animals occurred throughout the 2500 m water column. However, their apparent abundances varied with depth and location. Identification to species was limited to easily recognized fauna. Medusae (mainly *Aeginura grimaldii, Periphylla periphylla, Solmissus marshalli*, and *Atolla wyvillei,* in rank order) were the most frequently encountered animals. On a vertical scale their abundance peaked from 550 to 1100 m, but a few

individuals of each species ranged as deep as 2000-2500 m. Ctenophores (mainly *Bathocyroe fosteri*) were scarcer than previously noted and occurred over a broader depth range, from 400 to 1200 m, in contrast to 300-600 m. Several individuals of one, relatively large 10-15 cm long, transparent ctenophore species resembling *Bolinopsis infundibulum* was seen at 1650 m and then again at 2500 m drifting about 10 m above the seafloor during dive 176. Siphonophores (mostly, the physonect *Nanomia cara* and a calycophoran *Chuniphyes sp.)* consistently appeared from 650-750 m and were most numerous north, rather than south, of the Charlie-Gibbs Fracture Zone. Appendicularians (primarily oikopleurids) appeared throughout the entire water column with no obvious prominence in any depth zone. The largest houses (5-10 cm in diameter) appeared to be those of undescribed fritillarids. Houses of both taxa were prevalent in the benthic boundary zone, as deep as 3700 m.

Eight rarely observed species included: the anthomedusae *Pandea rubra* (seen once at 832 m), the scyphomedusa *Poralia rufescens* (seen at 910 m, 941 m and 1205 m), the cydippid ctenophores *Aulacoctena* sp. (800 m and 1680 m), an undescribed horned red cydippid (1605 m), an undescribed benthopelagic cydippid ctenophore (collected at 2510 m), an epibenthic red lobate ctenophore (two individuals collected at 2629 m), a mastigoteuthid squid *Mastigoteuthis* sp. (1500 m), and an unknown squid (1025 m). All of these animals were recorded on HD video sequences *in situ*.

Of particular interest in the epibenthic realm at each station were the small (15-40 mm diameter) trachymedusae that moved slowly or drifted just above the seafloor. The smaller individuals were probably *Veragonema laciniata* and *Benthocodon pedunculata*; the larger species is most likely *Crossota millsae*. These medusae were recorded on HD video *in situ* and in aquaria. All of the smaller species harboured an undescribed commensal amphipod.

Further Analyses

Analyses of zooplankton data will include:

1. Enumerations of epibenthic medusae from 16 transects (four from each station site where video surveys were performed above sandy substrata, Claudia Alt);

2. Determinations of trophic relationships of epibenthic medusae (via stable isotope analyses, Ben Wigham);

3. Identifications of the epibenthic medusae and other species from collections or video recordings by consultation with taxonomic experts (e.g., Claudia Mills, University of Washington; Kevin Raskoff, Monterey Peninsula Community College; Philippe Laval, Station Zoologique, CNRS; Mike Vecchione, Smithsonian Institution; Dhugal Lindsay, Japan Agency for Marine-Earth Science and Technology); and

4. Descriptions of swimming, feeding and resting behaviours of medusae, ctenophores, and squid based on HD video sequences *in situ* and in shipboard laboratories.

Preliminary Conclusions

Observations of several gelatinous zooplankton and two squid from the Isis ROV during pelagic dives revealed range extensions, undescribed species, and poorly understood behaviours. For example, the trachymedusae medusa *Crossota millsae* is known only from the Pacific Ocean (Thuesen 2003) and the western Arctic Ocean (Raskoff et al. 2010). The cydippid ctenophores, *Aulacoctena* sp., and the red-horned species, have been previously seen in Pacific and Atlantic oceans, but have not been described taxonomically. The benthopelagic cydippid ctenophore, which clings precariously to sandy substrata with extended tentacles, presumably to feed, has been observed at 3000 m in the western Arctic Ocean (Raskoff et al. 2010) and at 7000 m in the Pacific Ocean (Lindsay and Miyake 2007).

The abundance, behaviour and trophic relationship of the small, epibenthic trachymedusae have been documented generally (Larson et al. 1990; Larson et al. 1992; Matsumoto et al. 1997; Bouillon et al. 2001; Thuesen 2003). Further analyses of the species collected during this ECOMAR cruise, as noted above, are likely to substantially improve an understanding of their relative abundance and ecological role in deep-sea environments.

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Table 1 Collections of samples and images recorded of pelagic fauna by the Isis ROV.

Date	Station	Latitude	Longitude	ISIS ROV Dive	Depth (m)	Animal	Video *In situ*	Collect	Imaged in lab still/video	Preserved	Isotope Analysis
9-Jun-2010	JC048 /024	54°01.030'N	34°09.445'W	165	832	anthomedusa *Pandea rubra*	xxx				
					910	scyphomedusa *Poralia rufescens*	xxx				
10-Jun-2010	JC048 /026	54°02.414'N	34°08.452'W	166	1605	small red horned *cydippid ctenophore*	xxx				
						scyphomedusa *Atolla wyvillei*	xxx				
12-Jun-2010	JC048 /028	54°01.477'N	34°10.642'W	168	941	scyphomedusa *Poralia rufescens*	xxx				
					1500	red squid *Mastigoteuthis sp.*	xxx				
14-Jun-2010	JC048 /029	52°40.86'N C-Gibbs	35°04.20'W	169	1205	scyphomedusa *Poralia rufesens*	xxx				
					1560	small red horned *cydippid ctenophore*	xxx				
					2855	nemertean worm	xxx				
					3000	appendicularian	xxx				
16-Jun-2010	JC048	48°43.632'N	28°38.832'W	170	800	cydippid *ctenophore Aulacoctena sp.*	xxx				
18-Jun-2010	JC048 /036	48°43.857'N	28°39.700'W	171	1126	physonect siphonophore *Bargmannia sp.*	xxx				
					2030	scyphomedusa *Atolla wyvillei*	xxx				
					2510	trachymedusae *Veragonema*	xxx	xxx	still	xxx	
					2510	bathypelagic *cydippid ctenophore*	xxx	xxx	still/video	xxx	
19-Jun-2010	JC048 /038	48°43.632'N	28°38.832'W	172	250	ribbon fish	xxx				
					799	calycophoran siphonophore	xxx				
					864	scyphomedusa *Halicreas minimum*	xxx				
					883	calycophoran siphonophore	xxx				
					2629	red epibenthic beroid ctenophore		xxx	still/video	xxx (2)	
					2629	trachymedusa *Veragonema* sp.		xxx	still	xxx (2)	
					2629	trachymedusa *Crossota millsae*		xxx	still/video	xxx (2)	

Table 1 (continued)

Date	Station	Latitude	Longitude	ISIS ROV Dive	Depth (m)	Animal	Video *In situ*	Collect	Imaged in lab still/video	Preserved	Isotope Analysis
24-Jun-2010	JC048 /048	49°07.468'N	27°49.890'W	176	1630	lobate ctenophore *Bolinopsis* sp. ?	xxx				
					1680	cydippid ctenophore *Aulacoctena* sp.	xxx				
					1656	red epibenthic beroid ctenophore	xxx				
					2702	trachymedusa *Veragonema* sp.		xxx	still		xxx
26-Jun-2010	JC048 /051	49°00.821'N	27°40.494'W	177	2941	trachymedusa *Veragonema* sp.	xxx				
					2911	trachymedusa *Crossota millsae*	xxx				
					2941	trachymedusa *Veragonema* sp.		xxx	still		xxx
29-Jun-2010	JC048 /056	49°01.176'N	27°42.330'W	180	786	scyphomedusa *Periphylla periphylla*	xxx				
					879	narcomedusa	xxx				
					1452	midwater fish bathylagid (?)	xxx				
					2022	scyphomedusa *Periphylla periphylla*	xxx				
					2077	scyphomedusa *Poralia rufesens*	xxx				
					2160	appendicularian	xxx				
					2557	bathypelagic fish	xxx				
					2617	trachymedusa *Veragonema* sp.		xxx	still	xxx (2)	xxx (1)
						trachymedusa *Crossota millsae*	xxx	xxx	still/video	xxx (2)	xxx(2) tentacles

10. MEGACORER SAMPLING

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Aim

The aim of the megacorer sampling was to collect quantitative replicate samples for macrofauna and foraminifera from each of the four main study locations. For macrofaunal assemblage analysis three replicate drops of the megacorer were required while for foraminifera two replicate cores were collected from separate drops. Variation in macrofaunal and foraminferal assemblage structure would then be investigated on return to the laboratory and comparison drawn between the two distinct biogeochemical regions located within the ECOMAR study area.

Megacorer deployment

The megacorer was deployed on a Kevlar cable and once on the seabed the corer was left for 5 min to allow for adequate core penetration before hauling. The corer was normally deployed with ten coring heads fitted, eight megacores (internal diameter 100 mm) fitted for macrofaunal sampling and two multicores (internal diameter 59mm) fitted for forameniferal sampling (Table 1).

Station	Date	Depth (m)	No. of mega-cores	Mean mega depth (cm)	No. of multi-cores	Mean multi depth (cm)	Notes
007-NW	02.vi.10	2622	3/8	39.3	2/2	27	3 x M; 1 x F
010-NW	02.vi.10	2621	4/8	47.7	2/2	15	3 x M; 1 x NG; 1 x F
012-NW	03.vi.10	2617	0/8	-	-	-	-
014-NW	04.vi.10	2615	0/8	-	-	-	-
022-NE	09.vi.10	2506	8/8	30.5	2/2	20.5	8 x M; 1 x F
025-NE	10.vi.10	2508	9/9	33.7	1/1	32	8 x M; 1 x F; 1 x L
027-NE	12.vi.10	2509	9/10	31.9	-	-	8 x M; 1 x SGA;
034-SW	16.vi.10	2560	8/8	22.4	1/2	22	8 x M; 1 x F
037-SW	19.vi.10	2566	8/8*	28.6	1/2	20.5	7 x M; 1 x F; 1 x PG
039-SW	20.vi.10	2560	4/8	5	0/2	-	4 x PG
041-SW	21.vi.10	2560	0/8	-	-	-	-
042-SW	21.vi.10	2563	3/8	14.2	-	-	3 x M
049-SE	24.vi.10	2770	6/8	18.4	0/2	-	6 x M
050-SE	21.vi.10	2772	7/8	22.6	1/2	27.5	7 x M; 1 x F
052-SE	27.vi.10	2772	8/8	36.4	2/2	38.5	8 x M; 1 x F; 1 x NG

Table 1 (Previous page) M = Macrofaunal samples (Sectioned to 0-2, 2-6, 6-10 cm sediment depth, and fixed in 10% buffered formalin solution, >10 cm dissected for evidence of burrows and larger macrofauna). F = Foramineferal samples (Sectioned to 0-0.5, 0.5-1.0, 1.0-1.5, 1.5-2.0, 2-3, 3-4, 4-5, 5-6, 6=7, 7-8, 8-9, 9-10 cm and fixed in 10% buffered formalin solution. Deeper layers frozen at -80°C for „fossil' foraminifera DNA). PG = Polychaete genetics (Sectioned to 0-5 cm and fixed in ethanol). PSA = Particle Size Analysis (Sectioned every 1 cm until 20 cm sediment depth, frozen at -80°C). NG – Nematode Genetics (Surface sediment layer, frozen at -80°C). L = Lost Sample (Sample lost during processing). * Single megacore tube had no water on arrival at surface and was sieved for polychaete genetics. Station key: NW = North West; NE = North East; SW = South West; SE – South East.

In total the megacorer was deployed fifteen times (Table 1): Four times at the Northwest station (JC048/007, 010, 012 and 014), three times at the Northeast station (JC048/022, 025 and 027), five times at the Southwest station (JC048/34, 37, 39, 41, 42) and three times at the Southeast station (JC048/49, 50, 52). The megacorer unsuccessfully collected samples on three out of the fifteen deployments (JC048/012, 014 and 041).

Initial Observations

Northwest (Figure 1): Only two out of four deployments of the megacorer at the Northwest site provided samples. There was distinct banding through the cores: 0-9 cm the sediment was light brown, 9-13 cm sediment was dark brown, >13 cm sediment was grey. Sediment at this site was extremely soft and was predominately fine mud. Patches of phytodetritus a few mm thick were observed on at the sediment surface. There was no clear evidence of burrowing megafauna and the sediment appeared to have a high pore water content.

Figure 1 Megacores from station 010, located at the Northwest site.

Northeast (Figure 2): There was distinct banding through the cores: 0-10 cm sediment was light brown, 10- 13 cm sediment was dark brown, 13-16 cm sediment was brown, >16 cm sediment was grey. Sediment at this site was extremely soft and was predominately fine mud. Patches of phytodetritus a few mm thick were observed on at the sediment surface. Large numbers of sponge spicules were found in the upper 10 cm. There was evidence of burrowing megafauna, with burrows 1 cm in diameter often observed down to sediment depths of 19 cm. A large sipunculan (>8 cm in length) was recovered from a burrow at a sediment depth >20 cm at station 027.

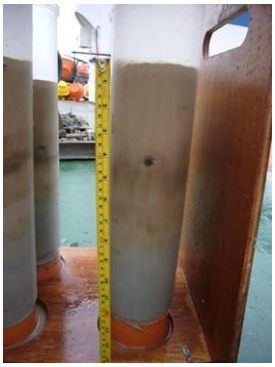

Figure 2 Megacores from station 022, located at the Northeast site.

Southwest (Figure 3): Four out of the five deployments successfully provided samples. All cores from this site had a large number of pteropod tests at the sediment surface. Coverage of the pteropod tests appeared to be patchy and they were absent from the deeper sediment layers. The sediment was uniformly light brown with no distinct sediment layers. Some cores did have some light grey patches of sediment at various sediment depths and on further investigation these deep grey patches of sediment were found to contain large number of pteropod tests. Sediment was generally „grainy' with an increase in sand grains when compared with the two northern sites. Patches of phytodetritus a few mm thick were observed on at the sediment surface. There was some evidence of burrowing megafauna.

Figure 3 Megacores from station 042, located at the Southwest site.

Southeast (Figure 4): All cores from this site had a large number of pteropod tests at the sediment surface, although they were not as dense as the Southwest site. Coverage of the pteropod tests appeared to be patchy and they were absent from the deeper sediment layers. The sediment was uniformly light brown with no distinct sediment layers. Some cores did have some light grey patches of sediment at various sediment depths and on further investigation these deep grey patches of sediment were found to contain large number of pteropod tests. Sediment was generally „grainy' with an increase in sand grains when compared with the two northern sites. Patches of phytodetritus a few mm thick were observed on at the sediment surface. There was some evidence of burrowing megafauna and a large sipunculan was recovered at a sediment depth of about 20 cm at station 049.

Figure 3 Megacores from station 049, located at the Southeast site.

Samples collected

The larger megacores were retained for macrofaunal assemblage analysis. Macrofaunal cores were sliced at 0-2, 2-6 and 6-10 cm intervals and all cores from a megacorer drop were pulled into a single sample. Sediment >10 cm depth was carefully dissected to look for evidence of deep burrowing macrofauna and megafauna. All core slices were washed through a nest of 500 and 300 µm mesh sieves with filtered sea water and sieved sediment was washed into 500 ml nalgene bottles and fixed with 10% buffered formalin solution. On return to the laboratory these samples will be sorted for macrofauna.

When any individual megacores were unsuitable for quantitative analysis of the macrofaunal assemblage they were retained for polychaete genetics. The upper of 5 cms of these cores was washed through a 300 µm and sorted for macrofauna using a stereo microscope (Wild M5). A single core from the Northeast station was sliced and frozen at -80°C for sediment grain size analysis and various geological analysis Sediment and burrows were also retained from >10 cm depth for bacteria studies.

The megacorer was usually fitted with 2 multicorer-sized tubes (internal diameter 59 mm), in addition to the 8 larger core tubes used for macrofauna. These samples were used for a variety of purposes. At each site, two cores from separate deployments were sliced into the following layers: 0-0.5, 0.5-1.0, 1.0-1.5, 1.5-2.0, 2-3, 3-4, 4-5, 5-6, 6=7, 7-8, 8-9, 9-10 cm. Each slice was preserved unsieved in 10% buffered formalin in a 500 ml Nalgene jar. These samples will be used to analyse benthic foraminifera. In addition, deeper sediment layers were frozen at -80°C for a study of „fossil' foraminiferal DNA (Dr Jan Pawlowski, Geneva) and surface sediment was taken from two cores for molecular analyses of nematodes (Dr Holly Bik).

11. COLLECTION AND ISOLATION OF MARINE BACTERIA AND FUNGI FROM SEDIMENT SAMPLES OBTAINED FROM VARIOUS LOCATIONS OF THE MID-ATLANTIC RIDGE AND THE COLLECTION OF VARIOUS SPONGE AND HOLOTHURIANS.

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Objectives

It has been speculated that the number of bacterial and fungal species, which have to date been characterised, is extremely small in comparison to the total number of species present in the marine environment. This study attempts to ascertain the number of bacterial and fungal species found at various sites. These data will then be used to give an indication of the diversity of bacterial species in this area; this information can then be compared with data already existing to give an indication of the different species found in different regions of the marine environment. There is a growing interest in the metabolites that these organisms produce and so these samples will be used in *in-vitro* experiments to determine if they produce potential novel metabolites that have a bioactive effect.

Methods and materials

All samples were obtained using the megacorer (Oceanlab, University of Aberdeen)

30g of sediment was taken from megacorer tubes at depth of 15-18 cm. This material was placed in sterile plastic tubes. 2g samples were taken and serially diluted in sterile Phosphate Buffered solution, Samples of these dilutions were then swabbed onto 3 different types of media, which are selective for bacteria of interest, i.e., ISP-2 media (Actinomycetaeles spp), Malt extract media (Fungi spp) and Bacto-marine for obligate halophillic bacteria. These were then sealed to prevent contamination and allowed to incubate at room temperature, growth was observed and where necessary sub cultures of the bacteria were replated onto new media plates.

All material such as cotton swabs, PBS were sterilised at $121^0C \pm 2^0C$ at pressure for 15 minutes prior to use.

Sterility controls were carried out at the same time as inoculations to determine the possibility of contamination, this was carried out by using control plates which were left in the open air for a 60 min period, every 48 h. Laboratory surfaces were cleaned every day with 70% ethanol to maintain sterility and all work was carried after first gloving up and washing gloves with 70% ethanol. No contamination was recorded in any of the control plates.

Table 1 Location of sediment samples taken.

Station Code	Latitude	Longitude	Depth
007	54°01.00'N	36°08.20'W	2619
010	54°01.00'N	36°08.20'W	2619
22	54°00.65'N	34°10.42'W	2510
25	54°00.65'N	34°10.42'W	2508
27	54°00.67'N	34°10.42'W	2510
34	48°45.76'N	28°38.50'W	2564
37	48°45.76'N	28°38.50'W	2520
42	48°45.70'N	28°38.56'W	2563
52	49°05.41'N	27°50.19'W	2775

Sponge/Holothurian samples

Sponges and holothurians were obtained from various sites during benthic collection dives by Isis Remote Operated Vehicle (ROV). Samples of these were placed into RNAlater for genetic analysis, while samples were also placed onto 3 types of bacterial growth agar to assess any symbiotic bacteria or fungi, which may be present. Samples were then stored at 4^0C in sterile tubes, which had been filled with sterile seawater to remove any oxygen present for further analysis of secondary metabolite production. The samples collected were various species of Hexactinellidae, Demospongia and the holothurian *Benthodytes lingua.*

Preliminary Observations

All sediment show bacterial or fungal growth at various rates, with a number of distinct phenotypes being observed.

Figure 1 Bacteria from Sediment 1

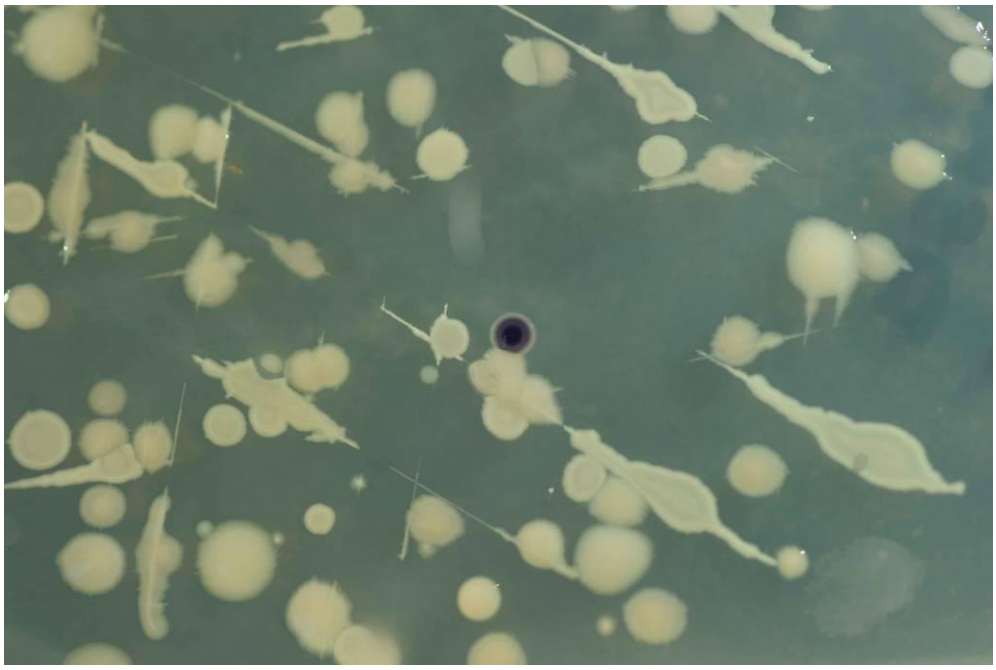

Figure 2 Bacteria from sediment 2.

Figure 3 Mixed fungal species from sediment 3.

Figure 4 Holothurian *Benthodytes lingua*.

Conclusions.

There is a range of phenotypes which were observed throughout samples collected during the cruise. It was observed that there was a difference in the growth rates of the bacteria dependent on the medium on which they were inoculated with bacteria being observed more rapidly when inoculated on Bacto-Marine agar, this would indicate the presence of halophillic bacteria, whilst fungal species grew more rapidly on Malt Extract media.

12. AMPHIPOD TRAP DEPLOYMENTS

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Objective

To sample the scavenging amphipod assemblages of the Mid-Atlantic Ridge, adding to past datasets collected on previous cruises.

Methods

Following damage to the previous Amphitrap during JC037 a new trap was designed and constructed by Ben Boorman for use on this cruise. This trap comprised of four cylindrical traps, two at the bottom and two approximately 1m up, held within a rectangular frame. Each trap can be baited with the bait of choice; in this instance mackerel was used for all deployments. Some minor adjustments were made to the trap during the cruise, which are detailed below. Further modifications are also planned, including a new bracket to hold the acoustic release to prevent slipping, and the addition of a current meter. On the whole the new Amphitrap has been extremely successful in catching large numbers of scavenging amphipods and will no doubt prove its worth on future research cruises.

Three *Eurythenes gryllus* from each catch were given to Ben Wigham (Newcastle University) for stable isotope analysis, sub-samples from each deployment were preserved in ethanol for genetic analysis at the University of Durham. The remaining contents of each cylinder were preserved in formalin for taxonomic analysis. Tammy Horton (NOCS) will be working with the amphipods and Martin Angel (NOCS) will be studying any ostracods caught.

Results

The Amphitrap was deployed once at each of the four main ECOMAR sites:

Site	Station	Deployment Location	Depth (metres)	Deployed	Surfaced	Deployment Time (hh:mm)
NW	JC038/008	53°59.32N 36°08.07W	2628	02/VI/10 0542	06/VI/10 1102	101:20
NE	JC048/020	54°03.95N 34°09.12W	2505	08/VI/2010 1114	09/VI/2010 1123	24:09
SW	JC048/032	48°47.34N 28°38.45W	2448	16/VI/2010 1042	19/VI/2010 1410	75:28
SE	JC048/046	49°02.01N 27°43.44W	2507	23/VI/2010 1232	26/VI/2010 1117	70:45

JC048/008

Initial attempts to recover the trap after 24 h failed as the release did not successfully drop the ballast. The ROV Isis was used for a recovery mission appended to the end of dive 161 (JC048/015 – 06/VI/2010). After approximately two hours of searching near the deployment site, the trap was detected on Isis' forward scanning sonar at 0918 (36°8.1174N, 53°59.3356W). Close inspection of the release showed that it had only partially opened and therefore had not dropped the ballast. After repositioning the ship and ROV to prevent entanglement with the tether, the trap was shaken using Isis'

manipulator arm and successfully released at 0955. The trap surfaced at 1102 and was brought on deck at 1300 following recovery of Isis.

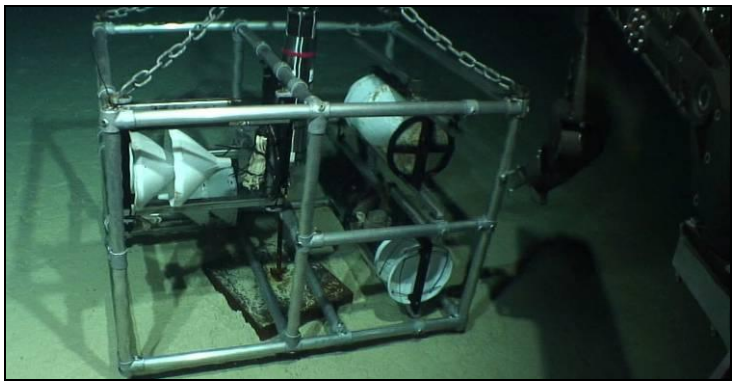

Figure 1 The ROV Isis attempts to release the trap using its mechanical arm.

Large numbers of amphipods were found in each of the four cylinders. Of particular note was a very large catch in one of the top traps, in the past traps elevated above the seabed caught very few individuals. Cannibalism was apparent in all cylinders, though this is of little surprise due to the long deployment time. As in previous years, many scavenging ostracods were found in all cylinders, three of these were given to Ben Wigham (Newcastle University) for stable isotope analysis.

JC048/020

The bar attaching the ballast to the release was adjusted with the addition of a twist in the bar and the acoustic release was rotated through 90° to avoid any future jamming. Large catches were found in both bottom traps and relatively few individuals were found in the top two traps. Initial examination shows the catch to be dominated by *Abyssorchomene* sp., a genus of scavenging amphipods found in abundance during past ECOMAR deployments.

JC048/032

The Amphitrap deployment was extended due to inclement weather and ROV operations. Both bottom traps had large catches containing numerous large *Eurythenes gryllus*, as expected the two top traps contained only low numbers of individuals. Initial examination indicates reduced dominance of *Abyssorchomene sp.* compared to the NE site. Six large *Eurythenes gryllus* were given to Geoff Wigham (University of Plymouth) for use as educational resources.

Figure 2 A selection of the *E. gryllus* found in one of the bottom traps. Photos by Deborah Crockard and Pedro Ribiero

JC048/046

Another large catch characterized by numerous smaller amphipods and relatively few *Eurythenes gryllus*. One bottom trap contained a high number of pteropod shells, most probably as a result on sediment disturbance upon landing.

13. BAITED LANDER STUDIES

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Ichthyofaunal assessment using the Photographic and Acoustic Lander (PAL) at southern and northern stations on the Mid-Atlantic Ridge (MAR)

Technology

The Photographic and Acoustic Lander (PAL) (Fig.1) is a free-fall lander equipped with a digital stills camera (Kongsberg Maritime, OE14-208), flash unit (Kongsberg Maritime, OE11-242), rechargeable Lithium battery pack, custom built digital recording device and hydrophone, and twin acoustic ballast release system (IXSEA 8 and 12Hz).

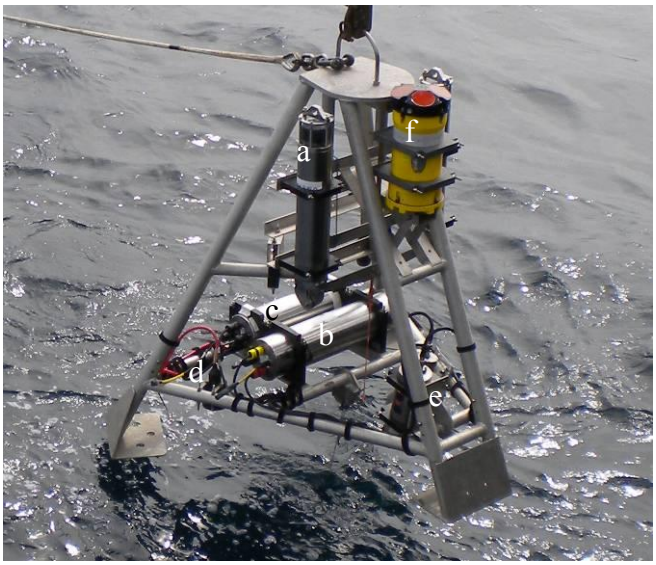

Figure 1 Lander frame. a) IXSEA Acoustic Releases b) Lithium battery pack, c) Acoustic recording unit d) Hydrophone e) Kongsberg Digital Stills Camera and Flash, f) Doppler current profiler – omitted from this cruise.

The camera was programmed to take digital photographs at 60 s intervals, with an average of 2034±751 (mean±SD) seabed photos per deployment.

Deployments

The PAL lander was deployed at 4 stations. Capturing 8,134 seabed images at depths ranging from 2,500-2,542 m UC (Table 1), and 98 hours of digital hydrophone recordings of the scavengers attending the bait.

Table 1 Oceanlab's PAL lander deployment positions.

Deployment	Station	Lat	Long	Depth (m)	Seabed images	Hydrophone recording (min)	Site description
1	JC048/009	53°58.40'N	36°08.22'W	2,542	1,415	1,155	NW
2	JC048/021	54°04.92'N	34°08.69'W	2,506	1,433	Failed	NE
3	JC048/031	48°46.32'N	28°38.44'W	2,500	2,321	2,365	SW
4	JC048/047	49°01.87'N	27°42.09'W	2,519	2,965	2,355	SE

Preliminary results

Dominant species attending the bait at all stations was the blue hake, *Antimora rostrata* (Günther, 1878) (Fig. 2a). This species was the first to arrive at the bait at all stations and within a very short period of time 5±5.7min (mean±SD) (Table 2). They were also the most numerous species, at times as many as 10 individuals per frame. *A.rostrata* and the abyssal grenadier, C*oryphaenoides armatus* (Hector, 1875) (Fig. 2a) were the only species to be seen at all sites. Other abundant species were the pudgy cusk eel (*Spectrunculus.sp,* (Günther, 1877)? (Fig. 2b), and the shortnosed rabbitfish, *Hydrolagus affinis* (de Brito Capello, 1868) (Fig. 2c).

Table 2 Preliminary fish population indicators: species arrival time (minutes after landing).

Deployment	Area	Time of 1st species arrival	1st Species	Time of 2nd species arrival	2nd Species
1	NW	5	blue hake *(Antimora rostrata)*	17	shortnosed rabbitfish (*Hydrolagus affinis*)
2	NE	12	blue hake (*Antimora rostrata*)	21	abyssal grenadier (*Coryphaenoides armatus*)
3	SW	2	blue hake (*Antimora rostrata*)	59	deepwater arrowtooth eel (*Histiobranchus bathybius*)
4	SE	2	blue hake (*Antimora rostrata*)	15	Small dark cuskeel (?*Spectrunculus.sp*)

Figure 2 Images from the PAL lander. (a) the abyssal grenadier, *Coryphaenoides armatus and* the blue hake, *Antimora rostrata*. JC048/009 deployment 1 (b) Large pudgy cusk eel, *Spectrunculus.sp* JC048/031, deployment 3, (c) shortnosed rabbitfish, *Hydrolagus affinis* JC048/031, deployment 3.

Intermittent visitation was seen by other species (Table 3). A large skate species that may be Richardson's ray (?*Bathyraja richardsoni*) (Fig.3a), several species of macrourid and eel were seen. Some species rarely seen at lander deployments, such as the shortbeard grenadier (*Coryphaenoides brevibarbis*), Abyssal halosaur (*Halosauropsis macrochir*) and a slickhead (*Alepocephalus.sp*) (Fig.3c) were also present in at least one image. A large unknown sleeper shark species was seen at the SE site (Fig.3f). Although it appears in three photographs there are no distinguishing features visible other than a large blunt head and small fleshy fins.

Table 3 Preliminary species lists. The order denotes order of each species first arrival. All species identification is speculative at this stage, those marked (?) are best judgements based on the images available.

NW Dep 1 JC048/009	NE Dep 2 JC048/021	SW Dep 3 JC048/031	SE Dep 4 JC048/47
blue hake *Antimora rostrata* **shortnosed rabbitfish** *Hydrolagus affinis* **abyssal grenadier** *Coryphaenoides armatus* **pudgy cusk eel** *Spectrunculus.sp* **shortbeard grenadier** *Coryphaenoides brevibarbis* **small dark cuskeel** *Spectrunculus.sp?* **Richardson's ray** *Bathyraja ?richardsoni*	**blue hake** *Antimora rostrata* **abyssal grenadier** *Coryphaenoides armatus* **Richardson's ray** *Bathyraja ?richardsoni* **deepwater arrowtooth eel** *Histiobranchus bathybius* **shortbeard grenadier** *Coryphaenoides brevibarbis*? **Kaup's arrowtooth eel** *Synaphobranchus kaupii*	**blue hake** *Antimora rostrata* **deepwater arrowtooth eel** Histiobranchus bathybius **shortbeard grenadier** *Coryphaenoides brevibarbis*? **pudgy cusk eel** *Spectrunculus.sp* **Richardson's ray** *Bathyraja ?richardsoni* **shortnosed rabbitfish** *Hydrolagus affinis* **abyssal grenadier** *Coryphaenoides armatus* **small dark cuskeel** *Spectrunculus.sp?* **Kaup's arrowtooth eel** *Synaphobranchus kaupii* **Abyssal halosaur** *Halosauropsis macrochir?*	**blue hake** *Antimora rostrata* **small dark cuskeel** *Spectrunculus.sp* **slickhead species** *Alepocephalus.sp* **abyssal grenadier** *Coryphaenoides armatus* **deepwater arrowtooth eel** *Histiobranchus bathybius* **pudgy cusk eel** *Spectrunculus.sp* **shortnosed rabbitfish** *Hydrolagus affinis* **large unknown shark** ?

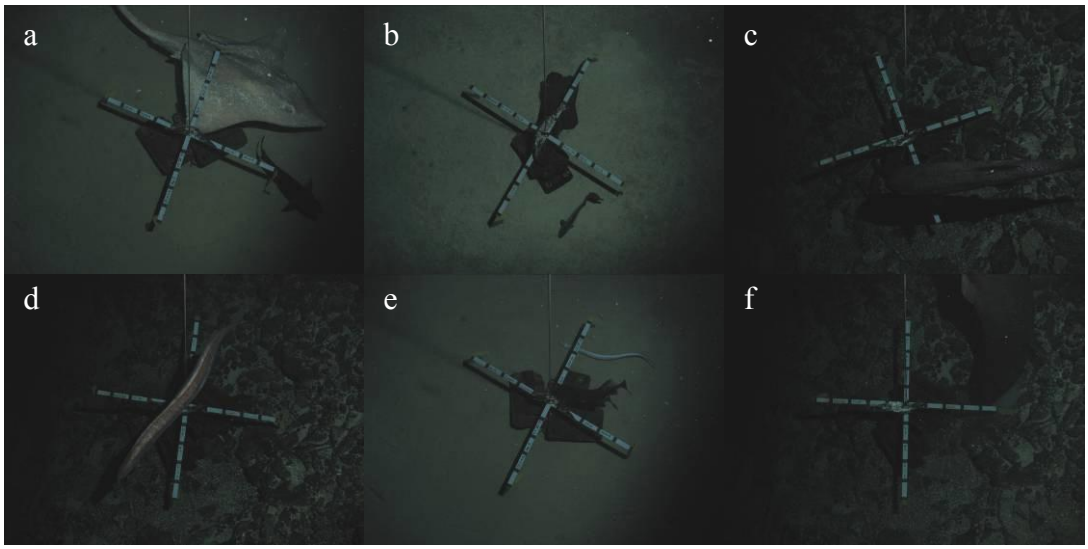

Figure 3 (a) Possibly Richardson's ray, *Bathyraja ?richardsoni* JC048/021 Deployment 2, (b) small dark cuskeel, *Spectrunculus.sp* JC048/031 Deployment 3, (c) slickhead, *Alepocephalus.sp* JC048/047 Deployment 4, (d) deepwater arrowtooth eel, *Histiobranchus bathybius* JC048/047 Deployment 4, (e) Kaup's arrowtooth eel, *Synaphobranchus kaupii* JC048/021 Deployment 2, (f) large unknown shark species JC048/047 Deployment 4.

As was seen on the previous cruise (JC037) some of the abyssal grenadier's at the NE site showed signs of infection (Fig.4). These appear to be bacterial ulcers with a secondary fungal infection of the dead tissue. Possibly as many as one in five of this species is seen to have this sort of infection at the NE site. Damage, scarring and parasitism is commonly seen

at the other sites, however, this distinctive infection is only seen at the NE site. This infection requires some further investigation but this may suggest that the adult *C. armartus* are isolated within this area or that some environmental factor limits the range of the infection.

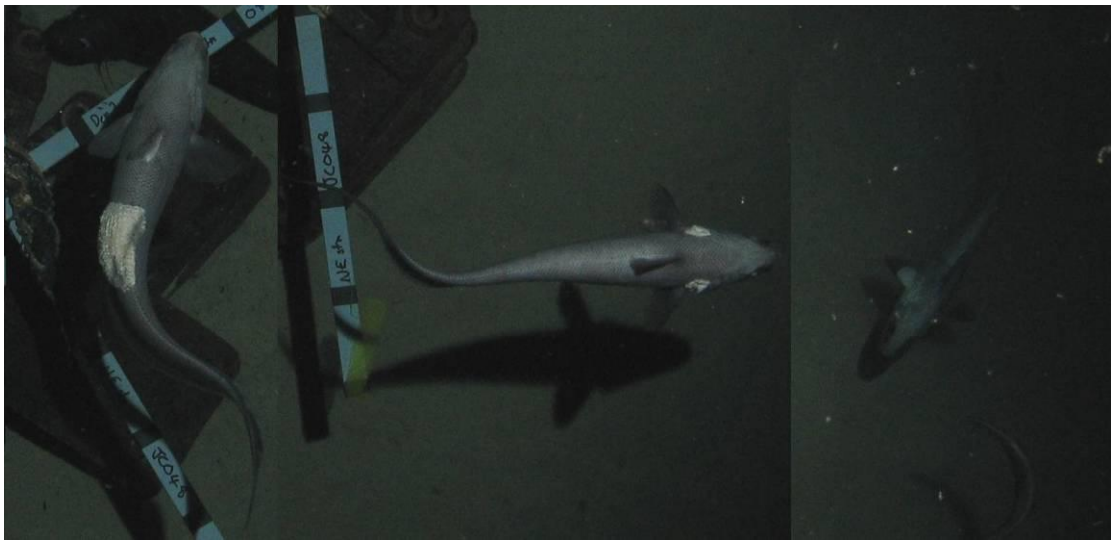

Figure 4 Cropped images of the infection affecting the abyssal grenadier, *Coryphaenoides armatus* at the North Eastern site JC048/021.

Analysis

Analysis of the PAL data will consist of a) image analysis; simple time series counts, length frequency determination, bait visitation by individuals, local abundance estimation calculation for the numerically dominant species, confirmation of species identification, behavioural observations b) the hydrophone recordings from the PAL deployments will be analysed using acoustic interpretation software.

14. DEEP-SEA BIOLUMINESCENCE AT THE MID-ATLANTIC RIDGE

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Background

In the deep sea a large number of organisms have the capacity to emit visible light, bioluminescence. In the deep pelagic zone there are estimates that up to 90% of the organisms are bioluminescent. The Oceanlab ICDeep (I^2CCD (Image Intensified Charge Coupled Device) for Deep-sea research) is an ultra low light camera designed to image the bioluminescence of deep-sea organisms. It integrates I^2CCD (Image Intensified Charge Coupled Device) technology with a custom built computer system for device control and image capture. The ICDeep camera was used in three configurations to investigate a number of aspects of bioluminescence at the Mid-Atlantic ridge:

- Pelagic bioluminescence (400m to seafloor)
  Configuration: ICDeep-CTD yoyo

- Bioluminescence in the benthic boundary layer
  Configuration: ICDeep-ROV with 'splat' screen + Halo quadrat transects

- In-situ benthic bioluminescence observations
  Configuration: ICDeep-ROV

Intensity distribution of pelagic bioluminescence (~400m to seafloor)

Configuration: ICDeep-CTD profiler

Aim: To obtain vertical profiles of the density of bioluminescent animals from ~400m to the seafloor at each station. Also, to measure the frequency distribution of the intensity of bioluminescent emissions of a pelagic community using different gain levels on the ICDeep camera during a CTD yoyo.

Methods

The ICDeep was mounted on the CTD frame focussed downwards on a rectangular mesh (Fig. 1). This was traversed vertically through the water column during the CTD downcast. Bioluminescent animals are stimulated to luminesce as they impact on or pass through the mesh („splat' screen). The stimulated bioluminescence was recorded as time-stamped mpeg digital video.

Results

As a result of technical difficulties, the ICDeep obtained only one cast per deployment (gain 750), except for station 55 where two profiles were obtained (Gains 750 & 600) (Table 1).

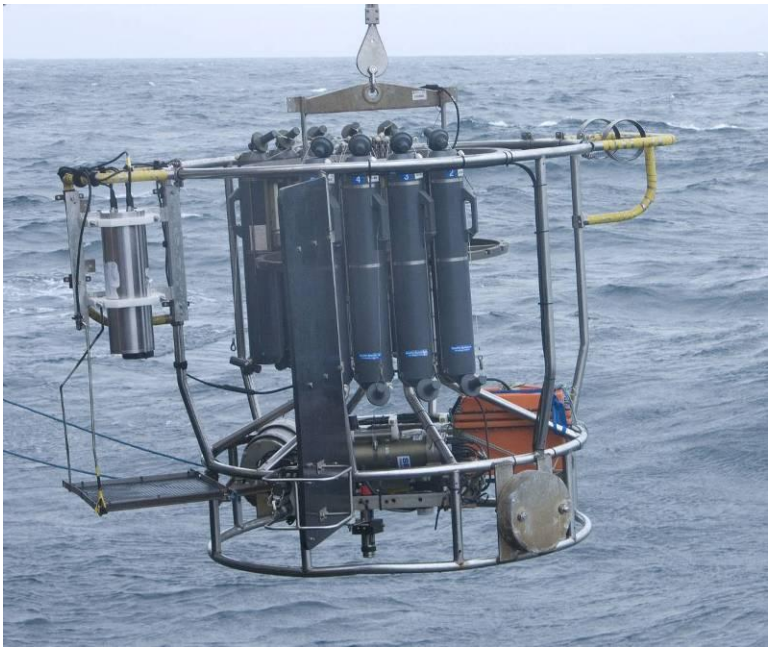

Figure 1 ICDeep-CTD profiler.

Table 1 ICDeep-CTD profiler deployments.

Stn	Date	Depth (m)	Lat (°N)	Lon (°W)	Start (GMT)	Range (m)	No. of casts	Data (cast #)
13	03/06/10	2436	53.983	36.143	15:07:04	400-2400	8	1
23	08/06/10	2496	53.011	34.174	19:38:43	400-2480	8	1
35	17/06/10	2567	48.763	28.642	01:24:52	450-2550	8	1
45	23/06/10	2520	49.042	27.719	07:03:35	400-2500	1	1
55	28/06/10	2763	49.104	27.837	21:56:24	1000-1500	5	1,2

Bioluminescence in the benthic boundary layer
Configuration: ICDeep-ROV with 'splat' screen + Halo quadrat transects

Aim: To assess the presence of a benthic boundary layer and its effect on the abundance of bioluminescent animals.

Methods
The ICDeep was mounted on the tool tray of the Isis ROV (Fig. 2). A „splat' screen (43 x 43 cm) was placed in front of the camera using the manipulator arm. The ROV moved forwards at speeds ranging from 0.2 - 0.5 $m.s^{-1}$. Bioluminescent sources that impacted on or passed through the mesh were stimulated to luminesce. These flashes were recorded as video during 200 m transects. Each bioluminescence transect was followed by a Halo (Highlighted pArticLe Observation) transect of equal length at the same altitude. The Halo consists of a quadrat (43 x 43 cm) whose area is illuminated by a shaft of white light. As the ROV moves forward only the particles travelling through the quadrat are illuminated. This was recorded with HD camera. Halo observations enable the particle load in the water to be quantified, as well as larger particles to be identified to group level (e.g. appendicularians, medusa, siphonophores).

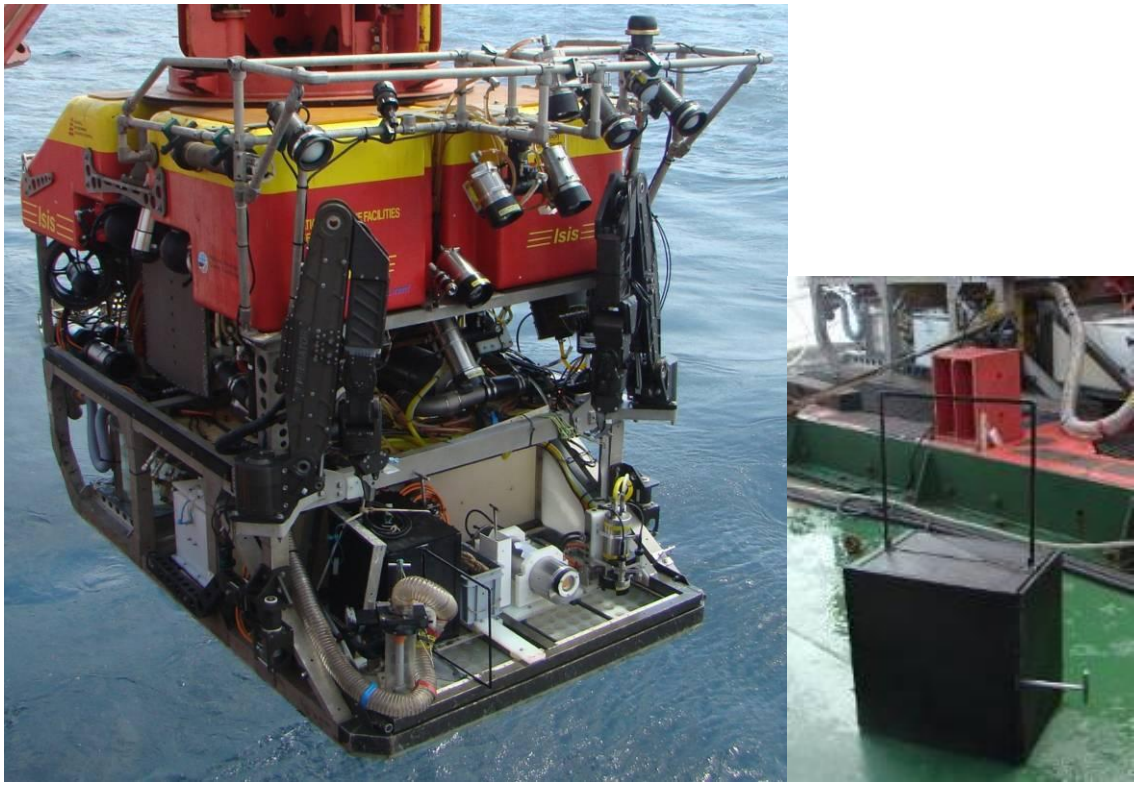

Figure 2 Left: The ICDeep mounted horizontally on the tool tray of the Isis ROV. Right: The Halo quadrat.

Table 2 ICDeep/Halo horizontal 200 m transects.

							No. of ICDeep/Halo transect pairs at each altitude (altitude indicated in metres above bed (mab))				
Stn	**Date**	**Dive**	**SITE**	**Transect**	**Start WP**	**End WP**	**5**	**10**	**20**	**70**	**100**
26	10/06/10	167	NE A05	NE_T1	A05_5_1	A05_6_**2**				2	
				NE_T2	A05_8_1	A05_9_1		1	2		
				NE_T3	A05_12_2	A05_2_2	2	2			
36	18/06/10	171	SW A11	SW_T1	A11_11_2	A11_1_2	1	1	1	1	
				SW_T2	A11_1_1	A11_7_1	1	1	1	1	
				SW_T3	A11_7_2	A11_5_1	1	1	1	1	
48	23/06/10	176	SE A12	SE_T1	A12_2_1	A12_4_2	1	1	1	1	1
				SE_T2	A12_1_2	A12_3_2	1	1	1	1	
51	26/06/10	177	SE A13	SE_T3	A13_1_2	A13_7_1	1	1	1	1	1

Results

Horizontal transects were performed at 5, 10, 20, 70 metres above bed (mab), with the addition of 100 mab at the SE station (Table 2). The Halo quadrat was in development through the course of the cruise and so results between different stations are not comparable.

In-situ benthic bioluminescence observations
Configuration: ICDeep-ROV

Aim: To observe benthic bioluminescence within different environments of the Mid-Atlantic Ridge. During the previous ECOMAR cruise (JC037) observations were made on soft sediments using the ICDeep baited lander. By using the ROV we aimed to access environments not possible with a lander. These included: i/ whale bones placed in the NW and NE stations 2 years previously; ii/ fauna in rocky or steep environments.

Methods
The ICDeep camera was mounted on the tool tray of the Isis ROV. All ICDeep filming took place under very low light or no light conditions.

Results
No ICDeep video was obtained at the whale bone sites.
ICDeep video was obtained in-situ of stimulated bioluminescence of an unidentified whip coral. The whip coral was collected for further imaging on board (Fig. 3). The specimen will be identified by Andrey Gebruk.
ICDeep video was also obtained of unstimulated bioluminescence at a rock outcrop on a sediment covered summit. Ten minutes of video were obtained. During this time ~ 25 bioluminescent events were observed. (Table 3)

Table 3 ICDeep deployments to image benthic bioluminescence in-situ.

Stn	Date	Dive	SITE	Depth (m)	Data obtained
6	01/06/10	159	NW A03	ca. 2500m	No ICDeep video of whale bone, video 30m from whale bone location only
16	06/06/10	162	NW A03	2482	Whale bone not relocated
17	07/06/10	163	NW A03	2482	Whale bone not relocated
28	12/06/10	168	NE	2450	Whale bone not located
53	27/06/10	178	SE A13	ca. 2500m	Imaging of stimulated bioluminescence of an unidentified whip coral Imaging of spontaneous bioluminescence at a rock outcrop

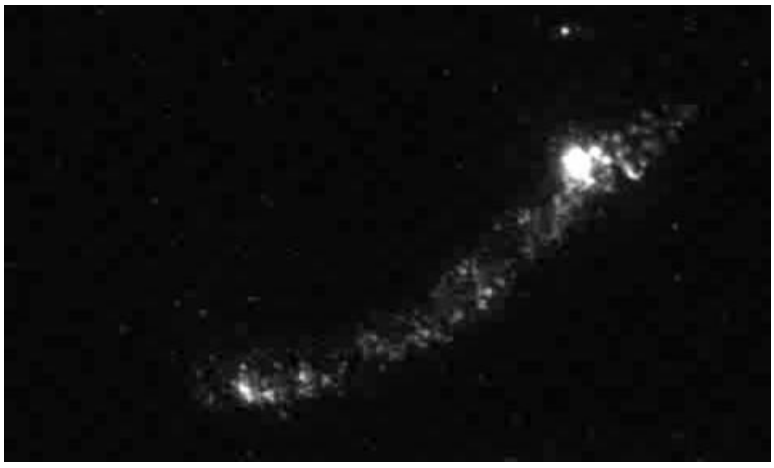

Figure 3 Image of bioluminescent whip coral.

15. IMAGES OF THE DEEP

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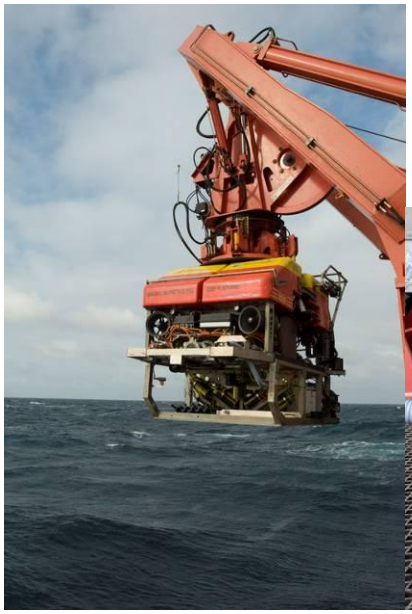
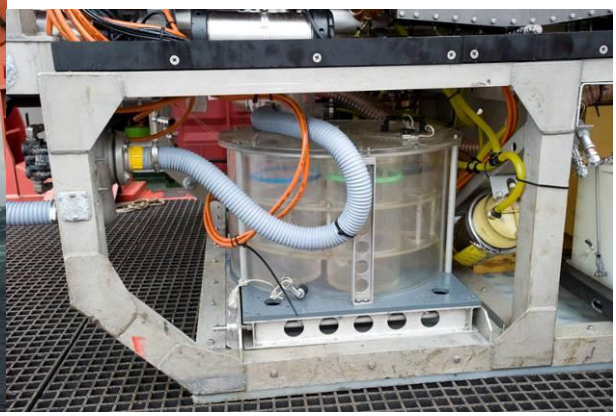
As the final cruise of the ECOMAR/Mar-Eco series of expeditions to the Mid Atlantic Ridge, I was even more aware of the importance of capturing exciting images of the fauna of the deep. My normal source of material has been the trawls and other devices we have employed for sampling the deep. This year we have no sampling gear on board. We were also not sampling the pelagic zone. Our main emphasis therefore was the benthos, the animals of the sea floor. To this end we are employing a 21st century tool, the ROV Isis. This was to take us to areas of the ridge which we had been unable to sample previously, which is actually most of the ridge. We have sampled above and to the sides of the ridge and have trawled on flat areas to the sides. This has always been a challenge and how representative we were about to find out.

Not only were we to record HD video footage of the previously unseen areas of the ridge but we were also able to collect many of the animals too. We had suction samplers, claws, scoops, push corers, box cores and Marsh Youngbluth's D-Samplers.



ROV-Isis



Suction sampler

My expectations were not high as benthic samples taken with a trawl are notoriously difficult to photograph. Most animals are either, damaged and unrecognizable or are completely covered in sediment. Most animals have mucus over their bodies' and this attracts and effectively glues sediment to the outer surface. Many hours have been spent trying to remove this. Consequently benthic animals are my least favourite subject for photography.

I have to keep an open mind and put aside my prejudices. The first specimens were good and continued to get better as scientist's eyes were glued to screens in the ROV control room. Their search patterns improved and the demands placed on the ROV team grew, but so did their ability to respond to requests for less suction to gather less

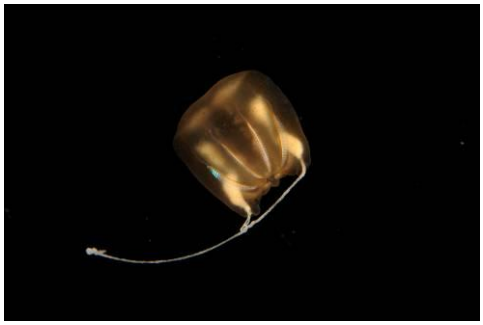
sediment and capture the „pure' animals. Enteropneusts or Acorn worms were one of the major finds.

Enteropneusts from

NW station **NE Station**

These were some of the remarkable finds from the ridge, previously little known and never photographed, yet we found different species on either side of the ridge.

A rarely observed epibenthic ctenophore was sampled and survived the journey to the surface and many hours in the suction sampler vessel on the ROV,



Ctenophore

Then we collected our first holothurians, a specimen of *Peniagone*, a perfect specimen, so clear that the internal organs were visible. Others were equally inspiring and beautiful, perhaps a phrase I should not use for deep sea animals!

Specimens of *Peniagone* (top L and top R and bottom R), *Amperima* (bottom L)

These, however, were not the only animals to be brought to the surface. Many sponges, crinoids, starfish and corals were given space in my aquaria before going to the hands of specialists.

Medusae were a challenge on all fronts, difficult to collect and variable in their condition on arrival at the surface as they had a tendency to autotomize their tentacles. But some survived the 2500m journey to the *RRS James Cook.* One of these, a hydromedusan *Crossota millsae* was a case and when placed in my kreisel produced a spectacular piece of video.

The amount of High Definition video collected is staggering and I have yet to go through it all and copy the best material. It runs into „terabytes' of data and will take me and other scientists many months to evaluate. But it is and will continue to be a valuable archive and resource for many years to come.

16. SEDIMENT TRAPS -RECOVERY OF SEDIMENT TRAPS FROM MOORINGS DEPLOYED DURING JC037

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During the 2009 *RRS James Cook* cruise JC037, moorings were deployed at the four ECOMAR sites (SW, SE, NW, NE). Each mooring included two McLane sediment traps, nominally 100 m and 1000 m above the sea floor respectively in a total water depth of 2500 m. Each trap was paired with an Anderaa current meter. Precise locations, water depth and mooring composition can be found in the JC037 moorings report. In the course of JC048, all of these moorings were successfully recovered. The SE lower sediment trap was recovered upside down.

Serial numbers of the recovered sediment traps and their paired current meters were:

NW mooring	Deployed	26/08/2009	
	Recovered	02/06/2010	
	100m ASF	1 2168-03	21-way 500ml bottles
	1000m ASF	1 11262-08	21-way 500ml bottles
NE mooring	Deployed	01/09/2009	
	Recovered	08/06/2010	
	100m ASF	1 2283-02	21-way 500ml bottles
	1000m ASF	1 1262-10	21-way 500ml bottles
SW mooring	Deployed	20/08/2009	
	Recovered	16/06/2010	
	100m ASF	532	13-way 250ml bottles
	1000m ASF	543	13-way 250ml bottles
SE mooring	Deployed	07/08/2009	
	Recovered	23/06/2010	
	100m ASF	1 1804-02	21-way 500ml bottles
	1000m ASF	1 1804-05	21-way 500ml bottles

On recovery, activity logs were downloaded from each trap. Each trap was allowed to drain then the sample bottles were removed and capped. To each 500 ml sample bottle was added approximately 1 ml of buffered 37% formaldehyde solution (proportionally less for 250 ml bottles). Used sample bottles and the currently-open sample bottle (still active in the trap) were all treated in an identical manner. Bottle caps were sealed with parafilm and the bottles stored at 4°C.

Sample schedules for the SE site followed the previous two cruises. During JC037, after the deployment of the SE mooring, it became known that the current cruise would be earlier than previous years. The schedules on SW, NW, NE were adjusted to make better use of the number of bottles available. Schedules were as follows (the first event represents the beginning of collection in the first bottle and subsequent events represent advance to the next bottle):

SE mooring (both traps)

```
Event 1 of 22 =       08/16/2009 00:00:00
Event 2 of 22 =       09/01/2009 00:00:00
Event 3 of 22 =       10/01/2009 00:00:00
Event 4 of 22 =       11/01/2009 00:00:00
Event 5 of 22 =       12/01/2009 00:00:00
Event 6 of 22 =       01/01/2010 00:00:00
Event 7 of 22 =       02/01/2010 00:00:00
Event 8 of 22 =       03/01/2010 00:00:00
Event 9 of 22 =       03/16/2010 00:00:00
Event 10 of 22 =      04/01/2010 00:00:00
Event 11 of 22 =      04/16/2010 00:00:00
Event 12 of 22 =      05/01/2010 00:00:00
Event 13 of 22 =      05/16/2010 00:00:00
Event 14 of 22 =      06/01/2010 00:00:00
Event 15 of 22 =      06/16/2010 00:00:00
Event 16 of 22 =      07/01/2010 00:00:00
Event 17 of 22 =      07/16/2010 00:00:00
Event 18 of 22 =      08/01/2010 00:00:00
Event 19 of 22 =      08/16/2010 00:00:00
Event 20 of 22 =      09/01/2010 00:00:00
Event 21 of 22 =      09/16/2010 00:00:00
Event 22 of 22 =      10/01/2010 00:00:00
```

SW mooring (both traps)

```
Event 01 of 14 =      09/01/09 00:00:00
Event 02 of 14 =      10/01/09 00:00:00
Event 03 of 14 =      11/01/09 00:00:00
Event 04 of 14 =      12/01/09 00:00:00
Event 05 of 14 =      01/01/10 00:00:00
Event 06 of 14 =      02/01/10 00:00:00
Event 07 of 14 =      03/01/10 00:00:00
Event 08 of 14 =      04/01/10 00:00:00
Event 09 of 14 =      04/16/10 00:00:00
Event 10 of 14 =      05/01/10 00:00:00
Event 11 of 14 =      05/16/10 00:00:00
Event 12 of 14 =      06/01/10 00:00:00
Event 13 of 14 =      06/16/10 00:00:00
Event 14 of 14 =      07/01/10 00:00:00
Event 13 of 14 =      06/16/10 00:00:00
Event 14 of 14 =      07/01/10 00:00:00
```

NW mooring (both traps)

```
Event 1 of 22 =       09/01/2009 00:00:00
Event 2 of 22 =       09/16/2009 00:00:00
Event 3 of 22 =       10/01/2009 00:00:00
Event 4 of 22 =       10/16/2009 00:00:00
Event 5 of 22 =       11/01/2009 00:00:00
Event 6 of 22 =       11/16/2009 00:00:00
Event 7 of 22 =       12/01/2009 00:00:00
Event 8 of 22 =       12/16/2009 00:00:00
Event 9 of 22 =       01/01/2010 00:00:00
Event 10 of 22 =      01/16/2010 00:00:00
Event 11 of 22 =      02/01/2010 00:00:00
Event 12 of 22 =      02/16/2010 00:00:00
Event 13 of 22 =      03/01/2010 00:00:00
Event 14 of 22 =      03/16/2010 00:00:00
Event 15 of 22 =      04/01/2010 00:00:00
Event 16 of 22 =      04/16/2010 00:00:00
Event 17 of 22 =      05/01/2010 00:00:00
Event 18 of 22 =      05/16/2010 00:00:00
Event 19 of 22 =      06/01/2010 00:00:00
Event 20 of 22 =      06/16/2010 00:00:00
Event 21 of 22 =      07/01/2010 00:00:00
Event 22 of 22 =      07/16/2010 00:00:00
```

NE mooring (both traps)

```
Event 1 of 22 =       09/02/2009 00:00:00
```

Then remainder of the schedule is as for the NW mooring.

Line-up photographs (Fig. 1-4) provide an indication of the relative quantity of material collected during each sample period by each trap.

Figure 1 Recovered bottles from the NW mooring (upper and lower).

Bottle No.10 at the NW upper station was lost on recovery. Although missing from the image, bottle No. 13 at the lower station was not missing.

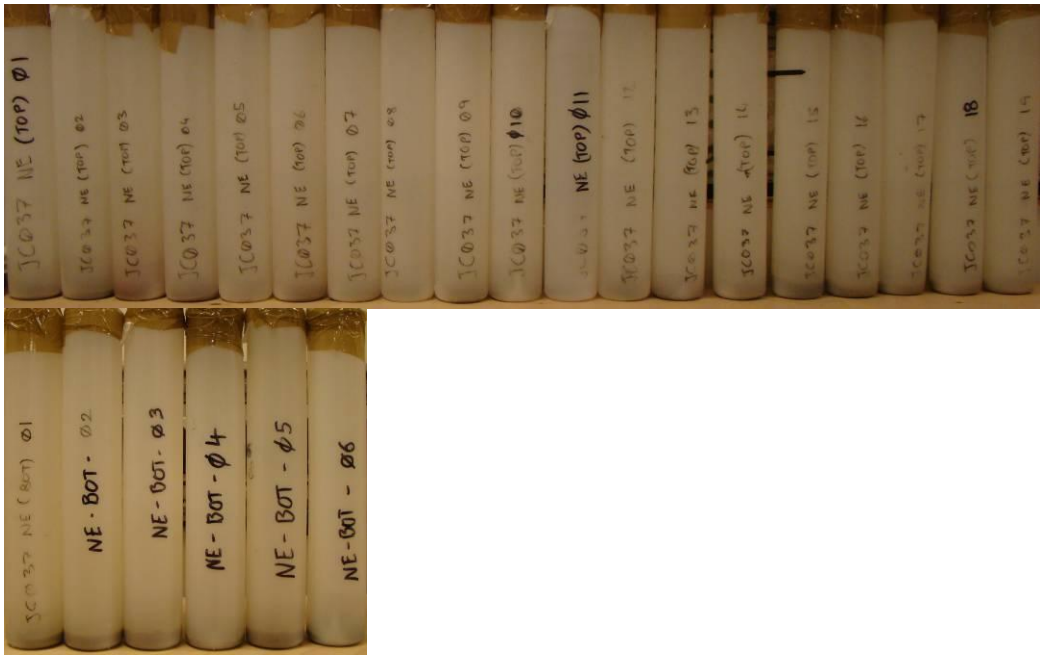

Figure 2. Recovered bottles from the NE mooring (upper and lower).

All bottles were present at the upper NE mooring however it appears the carousel jammed at bottle No.6 in the lower mooring. The trap did not move beyond this bottle.

Figure 3 Recovered bottles from the SW mooring (upper and lower).

The upper SW trap appears a complete sample however the lower may have not rotated properly. Sediment is only visible in the first and last bottles.

Figure 4 Recovered bottles from the SE mooring (upper and lower).

The lower SE mooring was upside down on recovery. A large pelagic fish was captured in bottle No.12 of the lower trap.

APPENDIX I

NMFSS Sensors & Moorings CTD Report

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CTD System Configuration

The initial sensor configuration was as follows:

- Sea-Bird 9*plus* underwater unit, s/n: 09P-0528
- Frequency 0 - Sea-Bird 3 Premium temperature sensor, s/n: 03P-4105
- Frequency 1 - Sea-Bird 4 conductivity sensor, s/n: 04C-3054
- Frequency 2 - Digiquartz temperature compensated pressure sensor, s/n: 73299
- Frequency 3 - Sea-Bird 3 Premium temperature sensor, s/n: 03P-2674
- Frequency 4 - Sea-Bird 4 conductivity sensor, s/n: 04C-2231
- V0 - Sea-Bird 43 dissolved oxygen sensor, s/n: 43-0862
- V2 - Chelsea Aquatracka MKIII fluorometer, s/n: 088-124
- V3 - Benthos PSA-916T 7Hz altimeter, s/n: 41302
- V6 - WETLabs Light Scattering sensor, BBRTD, s/n:182
- V7 - Chelsea Alphatracka MKII transmissometer, s/n: 07-6075-001

Ancillary instruments & components:

- Sea-Bird 11*plus* deck unit, s/n: 11P-34173-0676
- Sea-Bird 24-position Carousel, s/n: 32-19817-0243
- Sonardyne HF Deep Marker Beacon, s/n: 234002-002
- RDI WorkHorse Monitor 300kHz ADCP, s/n:12920 (downward-looking, casts 1-11)
- RDI WorkHorse Monitor 300kHz ADCP, s/n:13399 (downward-looking, casts 12-29)
- NOC/RDI aluminium Workhorse battery pack, s/n: WH002
- 24 x Ocean Test Equipment 10L water samplers, s/n: 01 to 24 inc.

CTD Operations

A total of 29 CTD casts were completed on this cruise numbered sequentially. Casts 3-9, 11-18, 20-27 were yo-yo casts, water samples being taken on the first and last cycles. Each cycle was treated as a separate cast except for cast no. 5 which records two cycles. Cast 29 was also a yo-yo one, but was only cycled between 1000 and 1500m and recorded altogether in one file. A light-sensitive camera was fitted during these yo-yo's necessitating the BBRTD, fluorometer and transmissometer to be blanked off. The pressure sensor was located 30cm below the bottom and approximately 75cm below the centre of the 10L water sampling bottles.

The carousel was fitted with a complete set of 24 water samplers on the first CTD cast and bottles 1 and 2's lower end caps failed to seal properly. There was little demand for water sampling during the cruise, hence subsequent casts operated with fewer samplers fitted. The majority of casts were carried out with samplers in positions 1 – 6, 10 – 15 and 23 -24 inclusive (refer to the log-sheets for exact sampler usage).

Initially, the configuration file used was *0528.con* but this had to be modified twice as both conductivity cells were changed, first to *0528_newC2.con* and then *0528_newC2_C1.con* (see Appendix 1).

Sensor Failures

From the data monitored during a cast it was apparent that one of the conductivity cells (or possibly both) was out of specification, but not immediately obvious which (the salinometer at this time was malfunctioning – see below).That being the case, the secondary conductivity cell was changed first. There was no obvious improvement and hence the primary conductivity cell was changed. This appeared to improve matters considerably although, as there were so few casts (not including yo-yo casts) this remedy was only in time for the last work area (South East).

Data Processing

CTD cast data was post-processed according to guidelines established with BODC as per SOLAS parameters. After examining the data from the first cast, an advance of 5 seconds was chosen for dissolved oxygen alignment.

TRDI LADCP Configuration

The TRDI WHM300 kHz LADCP (s/n:12920) was deployed in a downward-looking orientation on the CTD frame.. Battery voltage could be monitored as the cable was not diode protected. The instrument was configured to ping at intervals of one second, use 16 bins, a blanking distance of 5m and a depth cell size of 10m thus yielding a range of approximately 165m in ideal conditions. The ambiguity velocity was set to 250 cms^{-1} and pings per ensemble to 1.

Deployment Comments

Each deployment BBtalk terminal session was logged to a file (*F3)* of the form: *jc048_XXXm.txt*, where *XXX* is the CTD cast number. Downloaded data files were re-named to be of the form: *jc048_XXXm.000*.

The real-time clock of the LADCP was checked prior to deployment *(TS?)* and re-synchronised with the ship's GPS clock if it was more than a few seconds in error. The actual time was written on the log sheet.

Paper log sheets were used for all casts.

Built-in pre-deployment tests *(PA and PT200)* were run before each cast, and then the following command file sent *(F2)*:

Master command file (WHM_JC048.txt)

```
PS0
CR1
CF11101
EA00000
EB00000
ED00000
ES35
EX00000
EZ0011101
WM15
LW1
LD111100000
LF0500
LN016
LP00001
LS1000
LV250
SM1
SA001
SW05000
TE00:00:01.00
TP00:00.00
CK
CS
```

LADCP Failures

The downloaded data was routinely monitored using WINADCP. When the data from file jc048_011m.000 was checked it was discovered that beam 4 of the unit was weaker than beams 1-3. Although 3 beam solutions are possible this is obviously a less than ideal situation and also possibly the precursor to a catastrophic failure by flooding through one of the transducer faces. Hence from cast 12 the unit was replaced with the similar LADCP WHM 300kHz, s/n: 13399. This unit operated satisfactorily for the remainder of the cruise and was configured using the same command file as previously described.

Salinity measurement

A Guildline Autosal 8400B salinometer, s/n: 65764, was used for salinity measurements. A total of 57 salinity samples were taken during the cruise for CTD analysis. The salinometer was sited in the Chemistry Lab, with the bath temperature set at 24°C, the ambient temperature being between 20 and 22°C. A bespoke program written in Labview called Autosal was used as the data recording program for salinity values, and results were plotted via an Excel spreadsheet.

Only one point in the data set was an obvious outrider (from cast 1, sample bottle no. 695) and was probably due to either a misfire or contamination. This data point was removed.

During the first run of measurements, it was observed that the figures displayed on the salinometer did not match those shown on the computer (the third digit of the BCD output was one bit low) running the Autosal program. The problem was investigated and repaired.

When the first batch of salinity samples were measured (which was delayed due to a fault with the Autosal – see above) and compared with the Seabird 9plus values, it was apparent that there was a problem with one or other of the conductivity sensors. As more samples were plotted it became apparent that there was an offset in the value given by the primary conductivity sensor (see *Sensor Failures* above) and this was replaced.

Configuration Files

Three configuration files were used; for casts 1 – 19 inclusive:

Instrument configuration file:
C:\Program Files\Sea-Bird\SeasaveV7\JC48\0528.CON

Configuration report for SBE 911plus/917plus CTD

Frequency channels suppressed : 0
Voltage words suppressed : 0
Computer interface : RS-232C
Scans to average : 1
NMEA position data added : Yes
NMEA depth data added : No
NMEA time added : No
NMEA device connected to : deck unit
Surface PAR voltage added : No
Scan time added : Yes

1) Frequency 0, Temperature

Serial number : 4105
Calibrated on : 31 March 2010
G : 4.39448536e-003
H : 6.48398568e-004
I : 2.35594191e-005
J : 2.14422651e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

2) Frequency 1, Conductivity

Serial number : 3054
Calibrated on : 26 March 2010
G : -1.01881811e+001
H : 1.40074360e+000
I : 2.86538244e-004
J : 5.06022434e-005
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

3) Frequency 2, Pressure, Digiquartz with TC

Serial number : 73299
Calibrated on : 18 April 2008
C1 : -5.087539e+004
C2 : 2.199664e-002
C3 : 1.589010e-002
D1 : 3.721700e-002
D2 : 0.000000e+000
T1 : 3.011152e+001
T2 : -2.857091e-004
T3 : 4.528990e-006
T4 : -5.484500e-011
T5 : 0.000000e+000
Slope : 0.99983000
Offset : -1.48410
AD590M : 1.282870e-002
AD590B : -9.075590e+000

4) Frequency 3, Temperature, 2

Serial number : 2674
Calibrated on : 25 March 2010
G : 4.35669562e-003
H : 6.42033359e-004
I : 2.33199677e-005
J : 2.26722528e-006
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

5) Frequency 4, Conductivity, 2

Serial number : 2231
Calibrated on : 26 March 2010
G : -1.07743058e+001
H : 1.69638304e+000
I : -3.02862964e-003
J : 3.33507818e-004
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

6) A/D voltage 0, Oxygen, SBE 43

Serial number : 0862
Calibrated on : 10 March 2009
Equation : Sea-Bird
Soc : 4.36200e-001
Offset : -4.99200e-001
A : -1.09340e-003
B : 9.78700e-005
C : -2.32650e-006
E : 3.60000e-002
Tau20 : 1.37000e+000
D1 : 1.92630e-004
D2 : -4.64800e-002
H1 : -3.30000e-002
H2 : 5.00000e+003
H3 : 1.45000e+003

7) A/D voltage 1, Free

8) A/D voltage 2, Fluorometer, Chelsea Aqua 3

Serial number : 088-124
Calibrated on : 2 July 2009
VB : 0.384600
V1 : 2.132300
Vacetone : 0.507800
Scale factor : 1.000000
Slope : 1.000000
Offset : 0.000000

9) A/D voltage 3, Altimeter

Serial number : 41302
Calibrated on : 20 April 2007
Scale factor : 15.000
Offset : 0.000

10) A/D voltage 4, Free

11) A/D voltage 5, Free

12) A/D voltage 6, User Polynomial

Serial number : 182
Calibrated on : 20June 2007
Sensor name : Wetlabs BBRTD
A0 : -0.00035320
A1 : 0.00301900
A2 : 0.00000000
A3 : 0.00000000

13) A/D voltage 7, Transmissometer, Chelsea/Seatech/Wetlab CStar

Serial number : 07-6075-001
Calibrated on : 18 October 2007
M : 23.8781
B : -0.2388
Path length : 0.250

When the secondary conductivity cell was changed, from casts 20 – 27 inclusive the configuration file *0528_newC2.con* was used, as above but with the following modification:

Instrument configuration file:
C:\Program Files\Sea- Bird\SeasaveV7\JC48\0528_newC2.CON

5) Frequency 4, Conductivity, 2

Serial number : 3580
Calibrated on : 5 October 2009
G : -9.67867264e+000
H : 1.16791059e+000
I : -1.15983846e-003
J : 1.27000283e-004
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

When the primary conductivity cell was changed, from cast 28 onwards the configuration file *0528_newC2_C1.con* was used, as above but with the following modification:

Instrument configuration file:
C:\Program Files\Sea-Bird\SeasaveV7\JC48\0528_newC2_C1.CON

2) Frequency 1, Conductivity

Serial number : 2231
Calibrated on : 26 March 2010
G : -1.07743058e+001
H : 1.69638304e+000
I : -3.02862964e-003
J : 3.33507818e-004
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

Appendix 2 Station List - *RRS James Cook* Cruise No. 048 May-June 2010 ECOMAR

Station No.	Date	Time GMT	Latitude	Longitude	Gear	Depth (m)	Remarks
001	27 May	1801 1907	49°26.71'N	48°23.48'W	Isis Dive 155	2257	Test dive, curtailed near the surface owing to technical problems.
002	28 May	1114 1250	50°49.8'N	45°05.3'W	Isis Dive 156/157	4151	Two short test dives but technical problems continued.
003	29 May	0911 1803	52°23.46'N 52°23.24'N	41°03.74'W 41°03.75'W	Isis Dive 158	3500	Successful full depth with bathymetry and visual observations on flat sea floor. Curtailed by deteriorating weather.
004	30May	1820 2134	53°59.36'N	36°07.99'W	CTD Cast 1 + SVP+test	2572	CTD at NW Station with acoustic releases attached for test and sound velocity profiler. 4 out of 5 releases failed.
005	1 Jun	0930 1220	54°00.71'N	36°07.51'W	CTD Cast 2 + test	2608	After a break owing to bad weather a repeat of Sta 4. All releases worked properly
006	1 Jun 2 Jun	1319 0035	53°58.78'N 53°59.41'N	36°11.49'W 36°12.17'W	Isis Dive 159	2538	1km photo transect, whale bone location – survey no/ red/ white light. Photo and collection survey up terrace
007	2 Jun	0131 0427	54°01.00'N	36°08.20'W	Megacorer	2619	3 out 8 successful megacorer tubes and 2 out 2 for multicore tubes. Very liquid sediment
008	2 Jun 6 Jun	0542 0955	53°59.32'N	36°08.07'W	Amphitrap	2628	Trap lander deployed at the NW site. Release jammed but was retrieved by Isis, excellent catch.
009	2 Jun 3 Jun	0626 0924	53°58.40'N	36°08.22'W	PAL Lander	2542	PAL deployed at the NW site
010	2 Jun	0720 1000	54°01.01'N	36°08.36'W	Megacorer	2619	3 out 8 successful megacorer tubes and 1 out 2 for multicore tubes.
JC037 55	26 Aug* 2 Jun	1459 1050	53°59.34'N	36°07.38'W	NW Mooring	2504	Mooring deployed in 2009* recovered.
011	2 Jun 3 Jun	1509 0126	53°56.47'N 53°57.60'N	36°12.38'W 36°12.10'W	Isis Dive 160	2500	Surveys of 11 Line transect at NW station, curtailed near the end of 3rd line by coms. failure on ROV. Spectacular cliffs

012	3 Jun	0243 0530	54°01.00'N	36°08.36'W	Megacorer	2619	Failed to collect any good cores.
013	3 Jun 4 Jun	1545 0225	53°58.96'N	36°08.58'W	CTD YoYo +ICDeep	2436	8 CTD casts with ICDEEP altered gain on each cast. ICDEEP Software fault prevented operation on all but first cast.
014	4 Jun	0323 0557	53°59.55'N	36°08.78'W	Megacorer	2626	Megacorer site displaced to south of the previous site. Zero success.
015	5 Jun 6 Jun	0903 1135	53°57.86'N 53°59.19'N	36°12.49'W 36°08.26'W	Isis Dive 161	2173 2500	8 × 500m long survey lines at the NW station on slopes >30°, 10° and 0°. Amphitrap JC048/008 retrieved.
016	6 Jun 7 Jun	1638 0808	53°59.42'N 53°59.35'N	36°11.67'W 36°12.34'W	Isis Dive 162	2450 2272	Voucher specimen collection and close up images of fauna along a terrace at the NW Station.
017	7 Jun 7 Jun	1204 1950	53°59.44'N 53°59.48'N	36°11.65'W 36°11.58'W	Isis Dive 163	2450 2450	Failed attempt to retrieve the NW whale bone. A small collection including enteropneust in a box core.
018	7 Jun 8 Jun	2055 0334	53°56.77'N 54°02.90'N	36°01.82'W 34°14.53'W	EM120 Swath	2500 1300	Bathymetry survey across the northern transect to fill in areas previously not surveyed.
019	8 Jun	0420 0630	54°01.11'N	34°10.65'W	CTD Cast 3	2497	CTD at the NE station.
JC037 81	1 Sep*	1502 0735	54°00.05'N	34°10.58'W	NE Mooring	2504	Recovery of mooring deployed in 2009*
020	8 Jun 9 Jun	1114 1123	54°03.95'N	34°09.12'W	Amphitrap	2505	Trap at the NE station with release mounts modified to avoid jamming
021	8 Jun 9 Jun	1154 1425	54°04.92'N	34°08.69'W	PAL Lander	2506	PAL at NE station.
22	8 Jun	1607 1845	54°00.65'N	34°10.42'W	Megacorer	2510	10 good cores. One tube was broken
23	8 Jun 9 Jun	1944 0547	54°00.65'N	34°10.43'W	CTD YoYo +ICDeep	2511	Yoyo CTD with ICDEEP camera, 8 casts with altering ICDEEP gain. A modified programme

24	9 Jun 10 Jun	1547 0625	54°01.03'N 54°00.92'N	34°09.46'W 34°08.99'W	Isis Dive 165	2501 2398	Pelagic image mission & voucher specimen collection and close up images of fauna along a terrace at the NE Station.
25	10 Jun	0800 1022	54°00.65'N	34°10.42'W	Megacorer	2508	Successful cast with ten good cores.
26	10 Jun 11 Jun	1411 2030	54°02.41'N 53°59.72'N	34°08.45'W 34°11.51'W	Isis Dive 167	2364 2404	12 benthic transects plus splat screen bioluminescence studies. All successful.
27	11 Jun 12 Jun	2310 0221	54°00.67'N	34°10.42'W	Megacorer	2508	9 out of 10 good cores. A full set of samples for the NE Station.
28	12 Jun 13 Jun	1845 0513	54°01.48'N 54°01.49'N	34°10.64'W 34°10.77'W	Isis Dive 168	2445 2435	Failed to find NE whalebone deployed on *RRS Discovery* 331T Sta. 16440 but good collection including enteropneust.
29	14 Jun	0622 1546	52°40.86'N 52°41.30'N	35°04.20'W 35°04.82'W	Isis Dive 169	3599 3670	Pelagic observation, benthic line transect and recovery of DOBO from the Charlie Gibbs Fracture Zone.
30	16 Jun	0346 0551	48°46.34'N	28°38.43'W	CTD Cast 19	2531	CTD on arrival at the SW station
JC037 33	20 Aug* 16 Jun	1340 0730	48°46.82'N	28°38.50'W	SW Mooring	2500	SW mooring deployed in 2009* recovered. Lower sediment trap failed to rotate completely
31	16 Jun 19 Jun	1009 1242	48°46.32'N	28°38.44'W	PAL Lander	2500	SW site near the CTD station.
32	16 Jun 19 Jun	1042 1410	48°47.34'N	28°38.45'W	Amphitrap	2500	One mile north of PAL. Good catch including large *Eurythenes gryllus.*
33	16 Jun	1141 2118	48°43.63'N 48°43.97'N	28°38.87'W 28°39.35'W	Isis Dive 170	2500 2641	Pelagic survey followed by line transects. Abandoned after 3 flat line transects due to bad weather
34	16 Jun 17 Jun	22:01 0034	48°45.76'N	28°38.50'W	Megacorer	2564	8 Megacores and 1 successful Multicore
35	17 Jun 17 Jun	0132 2024	48°45.76'N	28°38.77'W	CTD YoYo +ICDeep	2560	8 down casts in succession of the CTD with ICDeep camera and a splat screen. Recovery delayed owing to bad weather.
36	18 Jun 19 Jun	0214 0855	48°43.86'N 48°45.33'N	28°39.70'W 28°36.63'W	Isis Dive 171	2600 2480	Pelagic studies, collection of 2 enteropneusts, benthic medusa & ctenophore completion of SW Line transects.

37	19 Jun	0937 1218	48°45.76'N	28°38.50'W	Megacorer	2520	8 Megacores and 1 successful Multicore
38	19 Jun 20 Jun	1612 0336	48°43.68'N 48°43.64'N	28°38.81'W 28°38.78W	Isis Dive 172	To 2630	Pelagic dive with D samplers, captured medusae and swimming holothurians
39	20 Jun	0502 0738	48°45.79'N	28°38.49'W	Megacorer	2520	Not a successful cast, 4 incomplete megacore tubes, disrupted by bad weather.
40	20 Jun 21 Jun	2255 1247	48°44.08'N 48°44.25'N	28°39.32'W 28°39.47'W	Isis Dive 173	2619 2600	Acoustic swath of SE terrace, and benthic voucher sample collection.
41	21 Jun	13:48	48°45.79'N	28°38.51'W	Megacorer	2559	Not a successful cast, no cores
42	21 Jun	20:15	48°45.70'N	28°38.56'W	Megacorer	2563	Repeat megacorer but in a slightly different location, SW of Station 41
43	22 Jun	0049 13:17	48°43.87'N 48°44.23'N	28°39.01'W 28°39.57'W	Isis Dive 174	2620 2547	Very successful collecting and imaging dive with swimming enteropneust and many holothurians. Flat and steep terrain.
44	22 Jun 23 Jun	17:15 0342	48°44.24'N 48°44.27'N	28°10.03'W 28°10.35'W	Isis Dive 175	1111 850	Transect across the summit of a seamount plus location of the Bergen Acoustic Lander JC011/018 lost in 2007.
45	23 Jun	0708 0933	49°02.49'N	27°43.16'W	CTD+ ICDeep	2531	CTD on arrival at the SE station, plus a bioluminescence profile.
JC037 08	7 Aug* 23 Jun	2125 1000	49°02.60'N	27°43.48'W	SE Mooring	2500	Recovery of mooring deployed summer 2009*.
46	23 Jun 26 Jun	1233 1115	49°02.01'N	27°43.44'W	Amphitrap	2519	Good catch of many small amphipods.
47	23 Jun 26 Jun	1311 0924	49°01.87'N	27°42.09'W	PAL Lander	2519	Deployed on the site of previous PAL deployments at the SE site.
48	23 Jun 24 Jun	1527 0831	49°07.47'N 49°05.03'N	27°49.89'W 27°50.41'W	Isis Dive 176	2741	Pelagic video survey, *Varagonema* medusa in suction sampler. 4 × 500m video transects on flat trawl area.
49	24 Jun	0938 1230	49°05.34'N	27°50.22'W	Megacorer	2768	Corer on standard site in the centre of the SE trawl area. 6 good megacores, no multicores.

50	24 Jun	1304 1553	49°05.40'N	27°50.23'W	Megacorer	2770	Corer on standard site in the centre of the SE trawl area. 7 good megacores, no multicores.
51	26 Jun 27 Jun	1300 1357	49°00.82'N 49°02.95'N	27°40.49'W 27°44.47'W	Isis Dive 177	2951 2227	Pelagic survey and collections, plus video survey of terrace.
52	27 Jun	1453 1744	49°05.41'N	27°50.19'W	Megacorer	2775	Full corer, 8 multicores and 2 multicores.
53	27 Jun 28 Jun	1300 0912	49°00.82'N 49°01.27'N	27°40.49'W 27°42.28'W	Isis Dive 178	2442 2630	Collection on rocky area and 10° slopes at the SE station plus ICDeep bioluminescence imaging
54	28 Jun 28 Jun	1209 2133	49°05.91'N 49°06.27'N	27°50.33'W 27°50.20'W	Isis Dive 179	2760 2767	Collection on SE trawl site sedimentary plain. Good collections
55	28 Jun 29 Jun	2202 0049	49°06.26'N	27°50.20'W	CTD YoYo +ICDeep	2767	Yoyo CTD 1000m to 1500m with ICDEEP
56	29 Jun 29 Jun	0310 1247	49°01.18'N 49°01.05'N	27°42.37'W 27°42.47'N	Isis Dive 180	2630 2658	Pelagic collections with D Samplers plus benthic collection on 10° slopes. Medusae and Holothurians collected.

NB: Deployment and recovery positions are given with times gear entered the water and lifted out. For landers times are flag sinking times and surface times.