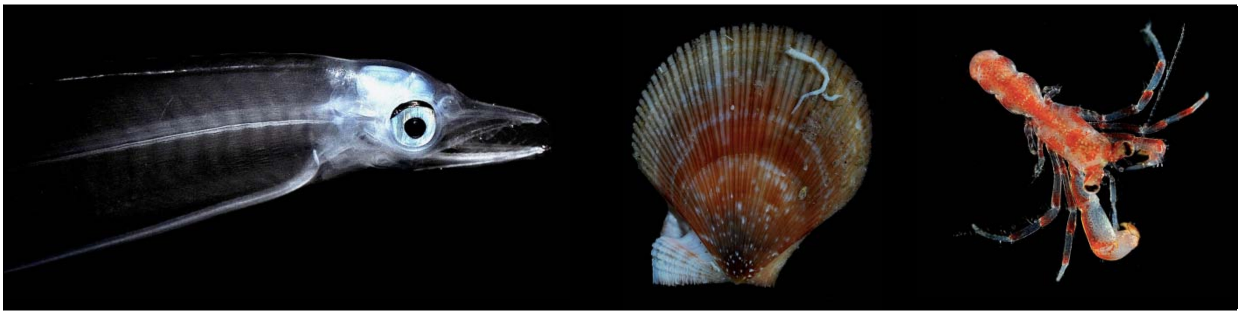

South Atlantic wilderness; assessment of Tristan da Cunha’s seabed biodiversity

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1. Summary

There are just two temperate, mid-oceanic island archipelagos in the Southern Hemisphere; little is known of seabed biodiversity below 40m at either. One of these is the UK overseas territory of Tristan da Cunha (TdC) in the Atlantic. With no airport and low human impact, the perceived importance of its biodiversity is underlined by its World Heritage Site status. A previous Darwin-funded project (DI post-project EIDP023) investigated its shallow depths, but the state of most of its marine environment and native species (below diving depths) is virtually unknown. A three day science cruise, JR287, was funded by a successful Darwin Initiative joint application by the British Antarctic Survey, Conservation Department of the Tristan da Cunha Government and the Shallow Marine Surveys Group based in the Falkland Islands. Additional funding, lengthening the science time to 7 days total, was later provided by The Pew Charitable Trusts. The research planned, involving marine, intertidal and terrestrial sampling, necessitated a diverse team of 10 specialists (from UK, Falkland Islands, France and Germany) with expertise in bentho-pelagic coupling, biogeography, ecology and population genetics. The previously successful protocol from the first polar Darwin project (18-019) was planned and used to survey the Tristan da Cunha region. Prior to the cruise the past literature was searched, collated and checked to establish a new database on Tristan da Cunha marine biodiversity. However most deep sea records of species occurrence were restricted to historic expeditions such as the Norwegian and Challenger voyages in the first half of the Twentieth Century. The establishment of the database and the JR287 cruise work was designed to build a platform that will strongly facilitate establishment of a meaningful system of protection for key areas of the seabed in this region. Further, part of the reason for BAS involvement and interest is to investigate whether Tristan da Cunha's deep shelf and other biodiversity retains a signal of sub-Antarctic and Antarctic species from periods when the Polar Front migrated northwards during glacial cycles. This is important because the archipelago's biodiversity may shed light on how biodiversity further south will react to predicted warming.

On completion of its Antarctic work in the austral summer of 2012/2013, the oceanographic research ship RRS *James Clark Ross* diverted from its usual path to reach Gough Island on 18th May. At each of Tristan da Cunha, Gough, Nightingale and Inaccessible Islands we attempted to characterise the 'island shelf' and the biota present using the following suite of apparatus: multibeam sonar swath was used to produce the first detailed bathymetric map of the surrounding seafloor (for Gough Island). A snapshot of water column physico-chemistry was gained using CTD, the benthos was imaged (video and stills) using a camera lander, multiple Agassiz trawls were carried out to sample megabenthos and finally pelagos and bentho-pelagic coupling were examined using a towed RMT8 net system. Specimens collected were photographed, fixed and then preserved in 96% ethanol for later genetic analyses and additional specimens of similar morphotypes were frozen for later fatty acid and/or isotopic work. We also lowered the camera lander onto the top of the recently discovered seamount Esk Guyot, half way between Gough Island and the main Tristan da Cunha archipelago. Landings were made on three islands to collect terrestrial flora and microfauna as well as intertidal biota, again to shed light on linkages with regions further south, and to provide baseline biodiversity data for some less charismatic groups (mosses, micro-arthropods) that nevertheless form a major component of these islands' biodiversity and importance.

2. List of personnel

2.1. Scientific and technical

DKA Barnes	BAS	PSO
P Convey	BAS	Terrestrial ecologist
J Dömel	RUB	Molecular ecologist
J Edmonston	BAS	Computing support
P Enderlein	BAS	Moorings biologist
W Goodall-Copestake	BAS	Geneticist
E Hancox	SMSG	Intertidal biologist
O Hogg	BAS	Biogeographer
J Klepacki	BAS AME	Electronic engineer
C Moreau	BAS	Marine biologist
S Scott	PT	Marine biologist
G Stowasser	BAS	Trophic biologist
I Brooks JR254F	NOC	Oceanographer
R Pascal JR254F	NOC	Oceanographer
S Peppe JR254F	NOC	Oceanographer
M Yelland JR254F	NOC	Oceanographer
O Bonner	TR	Assistance
R Stilwell	TR	Assistance
S Burrell	TR	Assistance

BAS = British Antarctic Survey, RUB = Ruhr University Bochum, AME = Antarctic and marine engineering section, SMSG = Shallow Marine Surveys Group, Falkland Islands, PT = Pew Charitable Trusts, NOC = National Oceanography Centre. JR254F = NOC WAGES oceanographic cruise personnel, TR = transit staff from South Georgia rat eradication programme, provided manpower assistance.

2.2. Ship's complement

RGP Chapman	Master
S Evans	Ch Off
P Alvarez-Munoz	2nd Off
G Delph	3rd Off
CA Waddicor	ETO (Coms)
D Cutting	Ch Eng
G Collard	2nd Eng
AJW Hardy	3rd Eng
SJ Eadie	4th Eng
SA Wright	Deck Eng

NJ Dunbar	ETO (Eng)
JS Gibson	Purser
GM Stewart	Bosun SciOps
DG Jenkins	Bosun
D Triggs	SG1
C Mullaney	SG1
CJ Leggett	SG1
JP O'Duffy	Bosun’s mate
N MacDonald	SG1
C Steele	SG1
MA Robinshaw	MG1
I Herbert	MG1
K Walker	Cook
P Molloy	2^{nd} cook
K Weston	Sr Stwd
J Newall	Stwd
D Lee	Stwd
T Patterson	Stwd

3. Timetable of events

28 April	Departure RAF Brize Norton
30th April – 1st May	Mobilisation
1st May	Leave Stanley to refuel
2nd May	Leave Mare Harbour; emergency drills
5th May	Mooring buoy, P3
6th May	King Edward Point, South Georgia, shore party
7th May	Drygalski Fjord sampling
8-9th May	South Georgia shelf sampling
10th May	Stromness harbour and KEP, retrieve shore party
11-17th May	Transit north, WAGES work
18-20th May	Sampling at Gough Island (3 sites)
21st May	Transit north, sampling Esk Guyot, ashore Tristan da Cunha
22nd May	Sampling Tristan da Cunha (3 sites)
22-23rd May	Sampling Nightingale Island (3 sites)
24th May	Sampling and ashore Inaccessible Island (3 sites)
25th May	Sampling Tristan da Cunha (1 site)
26th May	Ashore Tristan da Cunha, WAGES work
27th May – 6th June	Transit north and WAGES work
6th June	Arrive Ascension Island
7th June	Disembark on Ascension Island, airbridge to UK

4. Introduction

The UK overseas territory of Tristan da Cunha (TdC) in the Atlantic is one of just two temperate, mid-ocean islands archipelagos in the Southern Hemisphere, the other being St. Paul and Amsterdam in the Indian Ocean. Little is known of seabed biodiversity below 40 m depth at either, but the marine environment is very important to TdC, as the local lobster (*Jasus tristani*) fishery is key to its economy. The archipelago includes four main islands – the main group of Tristan da Cunha, Inaccessible Island and Nightingale Island (known as the 'top islands') and the southern outlier of Gough Island (see Figure 1). There is no airport on any of the TdC islands and, with a population of less than 300 and lying at least 1500 km from the nearest continent, anthropogenic impact is probably very low, at least in the marine environment. The perceived importance of the archipelago's biodiversity is underlined by both its World Heritage Site status and several government and NGO staff dedicated to biodiversity and marine resources. Previously a Darwin-funded project (DI post-project EIDP023) investigated both the shore and shallows (using SCUBA) of the top islands, but the state of most of the marine environment and native species (below diving depths) has been little studied (the last major expedition to the archipelago was about 80 years ago). The South African National Antarctic Programme maintains an active meteorological station, along with year-round staff who undertake ecological work, at Gough Island.

The British Antarctic Survey, Conservation Department of the Tristan da Cunha Government and the Shallow Marine Surveys Group of the Falkland Islands successfully applied for funding to the Darwin Initiative (DEFRA) in 2012. This funded a researcher to search the literature, collate biodiversity information on TdC and check the records obtained, to establish a new database on TdC marine biodiversity. This grant also funded a diversion to the transit of RRS *James Clark Ross* north at the end of Antarctic work following the 2012-2013 austral summer. The diversion provided a three day research science cruise to the TdC region, which was later lengthened to seven days by additional funding from The Pew Charitable Trusts. The research planned in the cruise was to sample at each of the four main islands – Gough, Tristan da Cunha, Inaccessible and Nightingale – as well as the recently discovered seamount of Esk Guyot. To generate the greatest scientific gain from the visit, a team of 10 biologists was assembled spanning marine (benthic and pelagic), intertidal and terrestrial disciplines. This team of specialists, from UK, Falkland Islands and German institutions, provided expertise in bentho-pelagic coupling, biogeography, ecology and population genetics. One of the team (SS) had run previous Darwin Initiative funded diving surveys around the top islands, and advised the Tristan da Cunha Government on marine impacts. Many of the team had been involved in a previous successful Darwin Initiative project (18-019) to map the marine biodiversity around another UK Overseas Territory (OT), South Georgia.

For the current TdC expedition (JR287) the protocol was adapted from the South Georgia project in order to attempt to survey the much narrower, shallower and steeper 'shelf' or erosion platform (between *c*. 150 m and 300 m depth) of the islands of the archipelago. Prior to the cruise, available literature was searched for bathymetric information and past multibeam data. The Alfred Wegner Institut, Bremerhaven, Germany, kindly provided recent data collected around both the main archipelago and the seamounts further south. With a database established and many of the species records verified, the next priority was to contact a network of taxonomic authorities who would be prepared to take specimens once collected and attempt to identify these using morphological characters. A stock of 96% ethanol was organised for RRS *James Clark Ross* so that the geneticists could fix and preserve material, allowing for complementary analyses to the morphological work.

Contributing to the BAS core scientific programmes 'Ecosystems' and 'Environmental Change and Evolution', the cruise JR287 aimed to investigate whether TdC's deep shelf and other biodiversity retains a signal of sub-Antarctic and Antarctic diversity from periods when the Polar Front migrated northwards during glaciations. This is important to establish, as understanding TdC's biodiversity may help answer how biodiversity further south may cope with predicted warming. For the Conservation Department, TdC government, the major outcome of the cruise will be to aid understanding of the wider marine environment which, in turn, should lead to better modelling and sustainability of the lobster fishery. The other project partner, the Shallow Marine Surveys Group, benefits from JR287 by both widening the geographic scope of its 'South Atlantic shores' project and also building links with other UK OTs. Finally the Pew Charitable Trusts' Global Ocean Legacy has built an understanding with the TdC government to work towards establishment of marine protected area(s) in the region, and therefore the cruise represents an opportunity to provide objective scientific underpinning for this.

With funding, team, apparatus and itinerary established the voyage was planned for a late April departure from the Falkland Islands, and to be carried out in combination with two other scientific cruises; one to replace a mooring buoy off the north-west shelf of South

Georgia (a BAS tasking), and the other o investigate air-ocean interactions across a latitudinal transect (WAGES), involving National Oceanography Centre oceanographers. After arrival of cruise participants in the Falkland Islands, a fourth work package was added, involving science and fishery related work around South Georgia through a five day charter by the Government of South Georgia and the South Sandwich Islands. This extended the itineraries of the staff involved in the cruise by several days at very late notice.

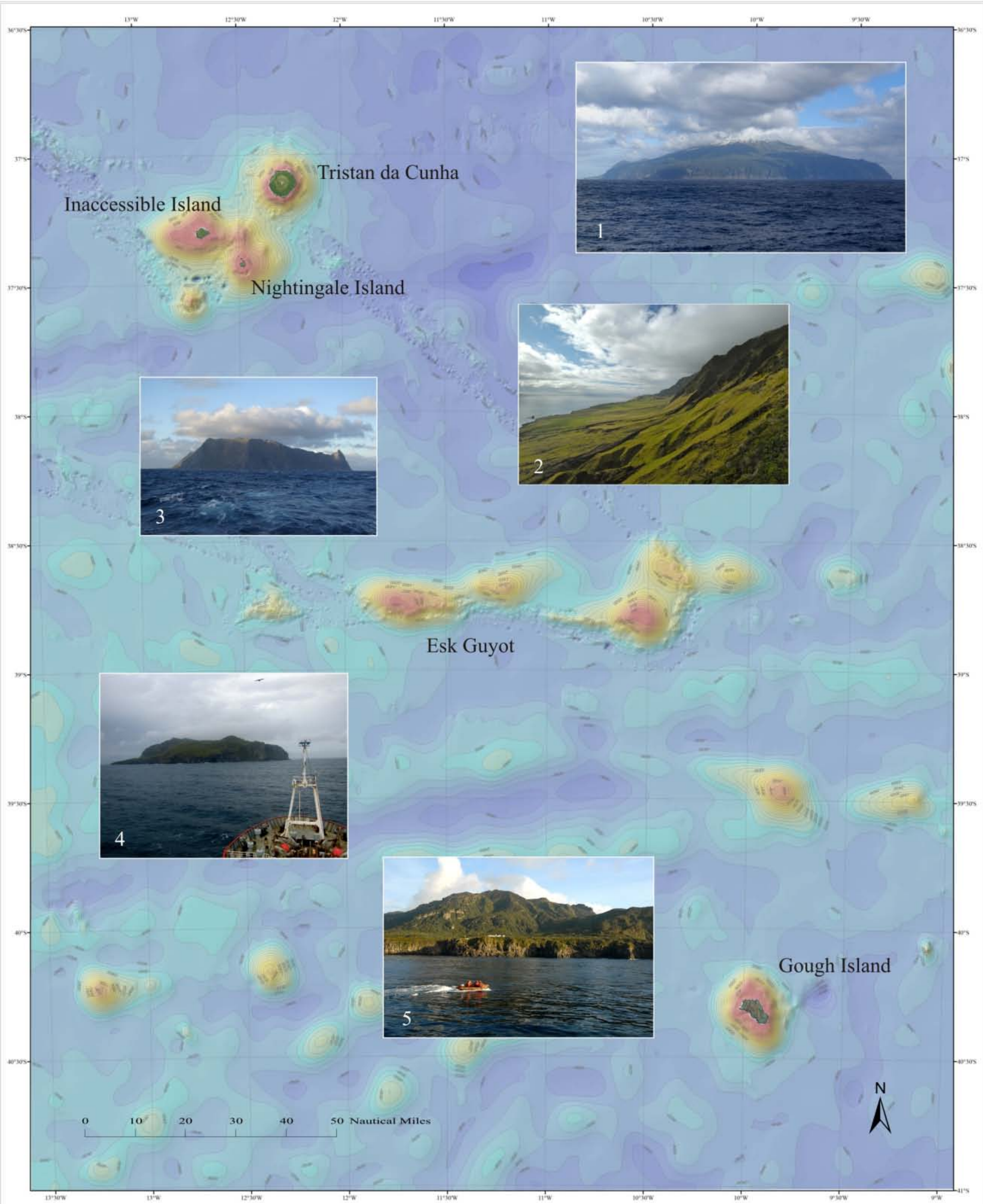

Figure 1: TdC archipelago. Inset photos: Tristan da Cunha: view from offshore (1) and from the 'base' (2); Inaccessible Island (3); Nightingale Island (4); Gough Island (5).

5. Potential and realised sample regime

The number of planned sampling sites was determined on the basis of the seven days science time available divided by the expected time taken for each deployment of each gear, taking into account the expectation of landing for work at terrestrial and intertidal sites on each island. By using multiple apparatus we intended to investigate organisms across benthic and pelagic realms, but focussing on macro- and mega-fauna. Realised sample regimes often omit sites, add others and use different suites of equipment due to limitations imposed by weather, equipment malfunction and changes to scheduling of other activities planned for the ship. The plan was to sample as follows around each island, between 150 m and 350 m depth:

- Agassiz trawl (AGT): 3 stations at each of 3 sites (where practicable, given steep and abrasive topography)
- Shallow Underwater Camera System (SUCS): 10-20 photos of 0.5 m^2 per site
- Rectangular Midwater Trawl (RMT8): 1 tow per site at each of multiple depths
- Conductivity Temperature Depth (CTD): 1 at each major sample area (island/seamount)

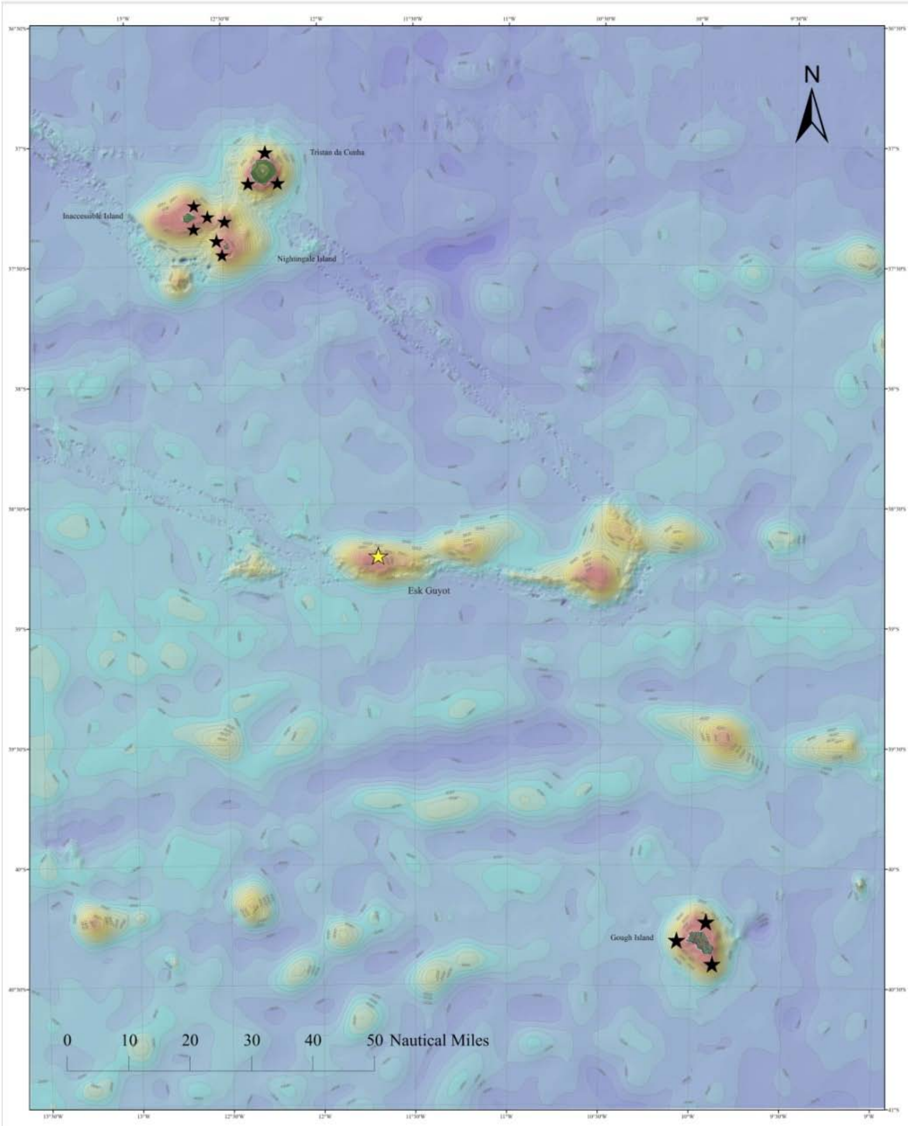

Figure 2: Planned sample regime at TdC (black = AGT, RMT8 and SUCS; yellow = SUCS alone)

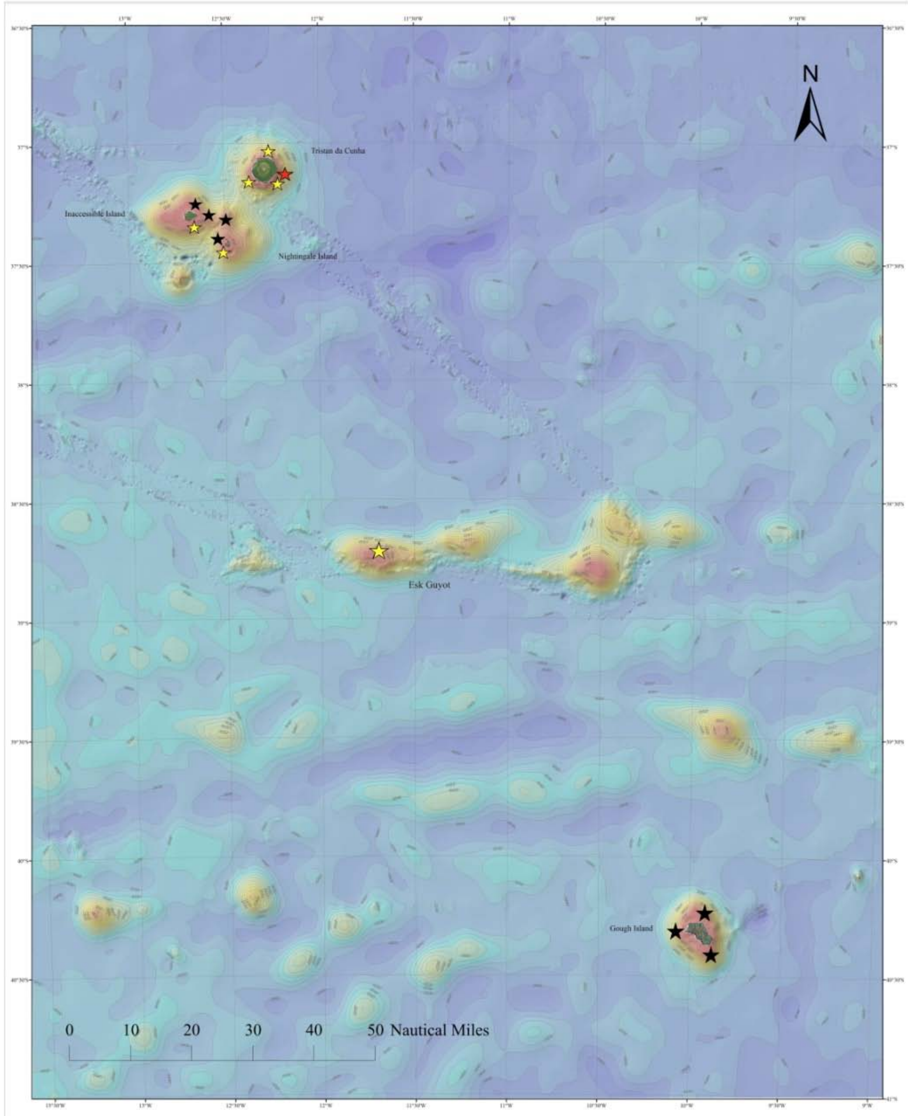

Figure 3: Achieved sample regime at TdC (black = AGT, RMT8, SUCS; yellow = SUCS alone, red = AGT, SUCS)

6. ICT (Information Communication Technology)

ICT are responsible for all ship-side and scientific computing. This includes data acquisition, logging and storage, ship and scientific network and network services. Working with AME (Section 7) who are responsible for the instruments themselves, ICT looks after the computer systems connected to them and the data that comes out of them.

6.1. SCS

Login started: 1711, 30 April 2013 (UTC) ACQ
No problems with the SCS in itself, however acquisition was interrupted as explained later.

6.2. Netware

No problems with netware during the cruise.

6.3. UNIX/LINUX

JRLB, responsible for SAMBA, and SCS stream processing hung. Acquisition was interrupted for a period of approximately 3 h while on station doing wave buoys. Sequence of events was as follows:

1300	SAMBA on jrlb unresponsive, waited to see if it would recover – did not
1313	acq stopped
1320	jrlb restart
1320	jrlb on reboot forcing a file system check
1632	SCS logging locally
1830	jrlbrebooting
1847	scs local acq stopped - files on U updated
1900	raw2compress restarted, scs acq restarted, normal operations resumed

The problem was caused by deleting a large file, approx 440 Gb on the datavol. This caused SAMBA to stop, and downward trend in performance, necessitating a reboot. However, the machine wouldn't unmount datavol cleanly, which led to a forced restart, which then forced a file system check which found errors in the filesystem, namely the large file. Once the file system was checked and cleaned, the machine and all dependant processes functioned correctly. All other UNIX / LINUX systems functioned normally.

6.4. EM122

Performed as expected, once or twice the SIS had to be restarted when it stopped rendering old swath data, ping display etc not updating. The machine was pinging and data coming back, just not updating the workstation.

6.5. EK60

All good.

6.6. ADCP

All good.

6.7. AMS

Also good.

7. AME (Antarctic Marine Engineering)

7.1.LAB Instruments

Instrument	S/N Used	Comments
AutoSal		
Scintillation counter		
Magnetometer STCM1	Y	
XBT		

7.2.Acoustic

Instrument	S/N Used	Comments
ADCP	Y	
Hydrophone		
EM120	Y	
TOPAS		
EK60		
SSU	Y	hung up once, restart all ok
USBL	Y	considered poor tracking, see notes
10kHz IOS pinger		
Benthos 12kHz pinger S/N 1316 + bracket		
Benthos 12kHz pinger S/N 1317 + bracket		
MORS 10kHz transponder		

7.3.Oceanlogger

Instrument	S/N Used	Comments
Barometer1(UIC)	#V145002	
Barometer1(UIC)	#V145003	
Foremast Sensors		
Air humidity & temp1	#60599556	Dropped out, moisture ingress?
Air humidity & temp2	#60599558	
TIR1 sensor (pyranometer)	#112993	
TIR2 sensor (pyranometer)	#112992	
PAR1 sensor	#110127	
PAR2 sensor	#110126	

Instrument	S/N Used	Comments
Prep Lab		
Thermosalinograph SBE45	#4524698-0018	
Transmissometer C-STAR	CST-396DR	
Fluorometer	Y	
Flow meter	#11950	
Uncontaminated seawater temp	Y	

7.4. CTD (all kept in cage/ sci hold when not in use)

Instrument	S/N Used	Comments
CTD PC	Y	see notes
Deck unit 2 SBE11plus	#11P20391-0502	
Underwater unit SBE9plus	#09P30856-0707	
Temp1 sensor SBE3plus	#03P5623	
Temp2 sensor SBE3plus	#03P2307	
Cond1 sensor SBE 4C	#041913	
Cond2 sensor SBE 4C	#044087	
Pump1 SBE5T	#54458	
Pump 2 SBE5T	#51807	
Standards Thermometer SBE35	#3515759-0056	
Transmissometer C-Star	CST-846DR	
Fluorometer Aquatraka Mk3	#12_8513_03	
Oxygen sensor SBE43	#2290	
PAR sensor	#70441	
Altimeter PA200	#24470	
CTD swivel+ linkage	#196111	
Carousel + 24 Bottle Pylon	#0636	
Notes on any other part of CTD eg faulty cables, wire drum slip ring, bottles, swivel, frame, tubing etc		

7.5.AME Unsupported instruments but logged

Instrument	Working?	Comments
EA600	Y	
Anemometer	Y	
Gyro	Y	
DopplerLog	Y	
EMLog	Y	

7.6. Additional notes and recommendations for change / future work

7.6.1. CTD PC

The CTD PC appeared to lose time quickly, up to seconds-per-hour. K9 wouldn't run on the machine, maybe the OS was too new. Changed to time-server, JRLA, but updates weekly by default. Changed update in registry (SpecialPollInterval) to every minute but it seemed to make no difference. Updates still weekly? Installed Tardis, but PC time still drifted. Also, on each cast had an RS232 Timeout error at least once, never occurred before. On previous cruise (JR281) 128+ CTDs never once came up with this. Believe it to be related to installing Tardis (only thing that changed with PC). Stopped Tardis in the 'processes'couple of CTDs. NO RS232 Timeout error. Need to get K9 working on the CTD PC.

7.6.2. Fusion/USBL

Fusion/USBL used to track the Shallow Under Water Camera Systems (SUCS). Tracking performed quite poorly. Various solutions tried - changing filter, power, receiver settings, beacon configs, beacons etc., but failed to get quality tracking. It tracked, i.e. the tracked item was not jumping around all over the place. It just didn't track say 60+% of the time, i.e. RED icon, no position output. SUCS deployments were shallow ~150 m, slowly deployed then stationary on the sea-floor for some minutes obtaining imagery. Dynamic-filter slowed right down to reflect this, but also tried in various combinations, etc., with no significant difference achieved. All combinations of receiver gains and transmitter power on transceiver and beacon alike tried in case problem related to signal saturations, noise levels, etc., again with no significant difference achieved. Wideband channels would always return excellent signal strength: Constant magnitude, all 8-pulses at 50 . But still no update on position, and icon stayed red.

Changed beacon channel, in case it was this, to a previously used channel from when it was all good and stable; HPR, Add 3812, Rply B23, TaT 60ms info was taken from a previous job file. This somewhat reduced signal quality (Figure 4), and the effect was often seen. Changed back to previous wideband channels for beacon config; Wideband, Add 4703, Rply MF9 (B2 quick setup). Tracking remained poor, but returned signal excellent

Last combo was transceiver on high power, medium receiver gain, default beacon sample count (6/8), dynamics mid-slow range, Beacon on Sonardyne Wideband channel transmit power low, receiver gain high. This appeared to give a higher rate of tracking, but a significant number of dropouts continued. Wide-angle 'normal-head' is more susceptible to noise than narrow 'big-head', which may underlie this.

It feels that, before the failed head saga, you could track a CTD or corer and count on one hand the times it would dropout on a 3Km round trip deployment. Now you count on one hand the times it tracks on a 150 m dip. In mitigation, on the previous cruise JR281, the USBL was used to track VMPs with what was considered great success. Maybe the requirements on the current cruise were just too shallow. Advice required from Sonardyne.

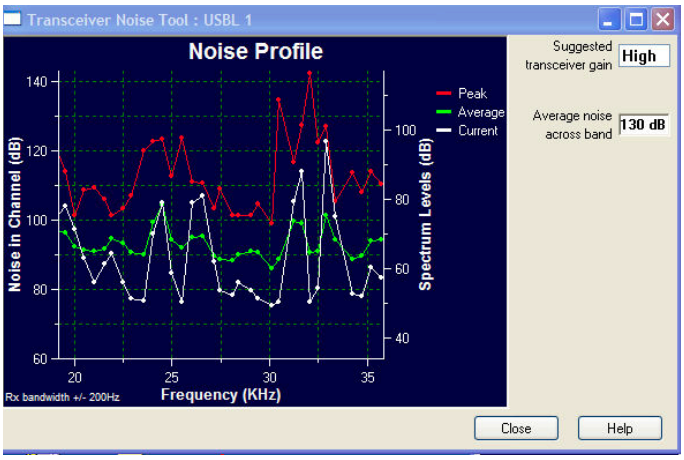

Figure 4: Noise on station, possibly caused by DP/Thrusters.

With WSM set to Sonardyne Wide-band channel signal quality is constant at 50 for all 8 samples (Figure 5). Phase and envelopes all good, as expected.

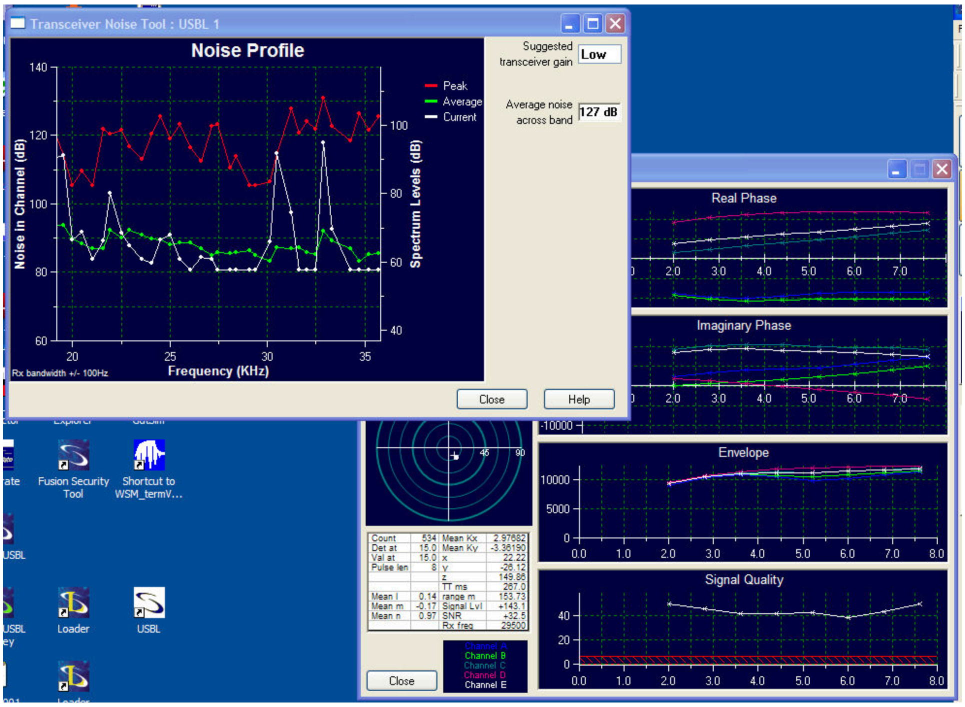

Figure 5: Fusion USBL screen shot; Poor Tracking WSM, Add 3812, B23, TaT 60ms.

8. Swath EM122

8.1. Introduction

The EM122 swath system was run continually through JR287 to collect information on the seabed in order to create acoustic habitat characterisations (seabed map or visualisation) for Gough Island, Esk Guyot, Tristan da Cunha, Nightingale and Inaccessible Islands.

8.2. System setups

The sound synchronisation unit (SSU) was used to interface all acoustic instruments together during shelf work. To run the EM122 and EA600 together the EM & EA group was chosen. The EM120 was set to: Trigger "on" and Trigger Mode to "Calculated", the EA600 was set to: Trigger "on" and Trigger Mode to "Tx pulse". This synchronised the instruments with the EM122 in master mode and the EA600 in slave mode, triggered by the EM122.

The EM122 12 kHz multibeam was operated using SIS Seafloor Information System version 38. BIST tests were run prior to operating the EM122 and all tests were passed satisfactorily. All data where saved in the folder JR287.

Sounder settings: Max angle port and starboard was set to 55° and max width was set to 20000 m. Angular coverage mode was set to manual and beam spacing to high density equidistant HIDENS EQDIST). Dual swath mode was set to dynamic, ping mode varied depending on survey and the FM was disabled. Pitch stabilisation was on and auto tilt off, with along direction set to 0. Yaw stabilisation mode was off and heading filter was medium. The spike filter strength was set to medium, range gate to normal and slope and sector tracking was turned on. The angle from Nadir was 6° and the absorption coefficient source was salinity with a default 35 ppt. Mammal protection Tx power level was max and the soft startup ramp time was 0 mins.

As the islands all had steep slopes, and as a result the EM122 was not always able to follow the rapid changes in water depth and lost the bottom. By manually forcing the depth to the correct depth, the system often returned to logging, reducing data loss. To get the system back, sometimes the angle was brought in to a minimum of 40°, then once stable, brought back out again to 55°.

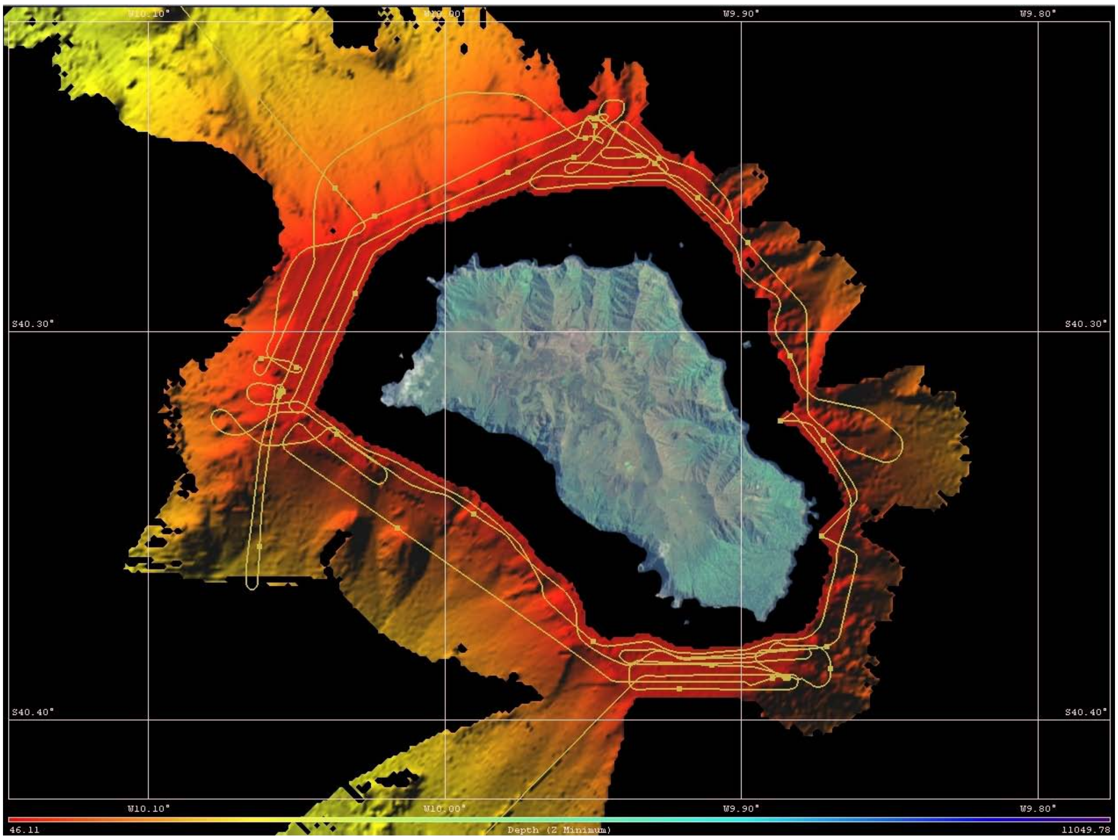

Figure 6: Swath around Gough Island, also showing ship's track.

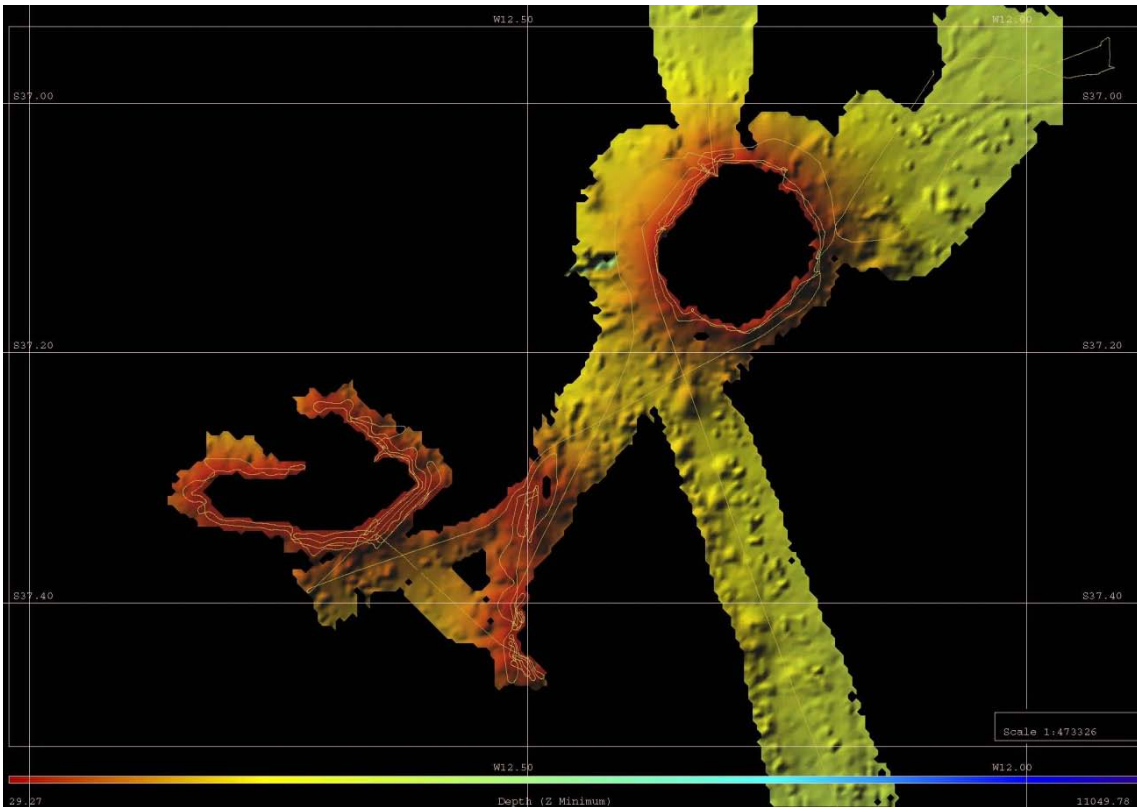

Figure 7: Swath and ship's track (white line) for TdC.

9. Sampling

9.1.Agassiz Trawl

The Agassiz Trawl (AGT) used during the cruise was the same as has been used since JR144 (2006). It shows signs of use on the frame, but still works perfectly well. It was usually deployed with a ship speed of 0.3 kn, then increased to 0.5 kn, veering the cable with max of 40 m/min up to 15 times the water depth. The trawling time was 1 to 5 min depending on the amount of catch wanted in the net. After the trawling the AGT was recovered at 30 m/min until the AGT had cleared the seabed. Hauling speed was then increased to 40 m/min. It was used in this cruise in winds up to 40 kn without any problems.

Figure 8: Agassiz trawl deployment

On this cruise the AGT was deployed 20 times. During some deployments the AGT net suffered some damage, but was quickly repaired by the ship's AB. At one point the rubber mat became ripped and was replaced. As TdC has a very steep slope, and the SUCS showed very rough terrain, it was decided to trawl this as the last site, as the risk of major damage was significant. The deployment and trawling procedures were also adapted in order to be able to react quickly if the trawl became caught on the seabed. The maximum ship speed during these deployments was 0.5 kn and the maximum haul speed was 10 m/min. The AGT was deployed 3 times at TdC. The first deployment went smoothly, with a maximum tension of 2 t. During the second deployment the AGT became caught once, resulting in a 6 t tension spike. The trawl showed only minor tear and the net was slightly ripped. During the third deployment the AGT became caught twice with a maximum tension of 8 t, at the equipment's limits. On recovery the towing eyes were bent and stretched and the outer net was ripped for nearly its whole length. But, as the inner net was only slightly ripped, a sample could still be retrieved. The AGT proved again to be a very reliable sampling device.

The benthos taxa caught in the 20 Agassiz trawls completed is shown by site in 1. . At the time of report preparation only the echinoderms had been examined in any detail and these included the following morphotypes: asteroids (9), crinoids (1), echinoids (3), holothuroids (1), ophiuroids (5). This was greater richness than expected in so few, brief trawls on very small, isolated shelf areas.

9.2. Rectangular Midwater Trawl (RMT8) on the Down Wire Net Monitor (DWNM)

The RMT8 DWNM was used on the 'Biological Wire'. As a new termination was made in November, it was re-used and worked very reliably.

The DWNM system was set up on the RMT8 and cross with the various sensors. These all worked well except for the altimeter initially. The initial sensor did not work and therefore, with the help of Julian Klepaki, the altimeter test tube was rigged outside the UIC, accessible from the boat deck. A cable was made up that was long enough to reach from the test tube to a point adjacent to the DWNM station inside the UIC. Then all three DWNM altimeters were tested and this confirmed that the altimeter on the unit was faulty. The other two units worked well and the RMT25 unit was put on the cross. This worked fine during the following deployments, and we towed the RMT at one point only 11 m over the seabed when a seamount was crossed during the deployment. The faulty unit will go back to the manufacturer for repairs and also to change the connector to a standard Subcon bulkhead instead of the specialised Tritech Connector.

9.2.1. RMT8 net

The RMT8 was deployed successfully eight times for oblique hauls, and worked very well. There were a few occasions when the cod ends had been pulled, indicated by the clips fastening it together becoming undone, however never to the extent that the cod ends came completely unattached. It is thought that this happens if they get caught on the net whilst pulling them back onto the ship. On a couple of hauls, there were a few small rips in the older net and these have been fixed. The new net used on the top is still in excellent condition.

9.3. Benthopelagic coupling

9.3.1. Background

The use of stable isotopes as dietary tracers is based on the principle that isotopic concentrations of consumer diets can be related to those of consumer tissues in a predictable fashion. It has been extensively applied in the investigation of trophic relationships in various marine ecosystems, and has been used to determine feeding migrations in numerous species. The stepwise enrichment of both carbon and nitrogen in a predator relative to its prey suggests that the predator will reflect the isotopic composition in the prey and isotope values can be used to identify the trophic position of species in the food web investigated. Additionally, $\delta^{13}C$ values can successfully be used to identify carbon pathways and sources of primary productivity.

The objective here was to identify the trophic position of the dominant benthic species around the TdC islands, and to investigate the key links between the pelagos and the underlying benthos. We expect to gain a better understanding of the energy transfer between the benthic and pelagic realms, and of the importance of the benthos in the diet of pelagic species in this region. The samples collected on JR287 will furthermore be used in comparison to a similar study on bentho-pelagic coupling in the East Bellingshausen Sea and the Scotia Sea, with samples collected during JR230 and JR262 respectively.

9.3.2. Sampling

Whole specimens of benthic invertebrate and fish species were collected from the AGTs during both day and night hauls. Pelagic invertebrates and fish were sampled from catches with the RMT net at night. The RMT8 (8 m^2 opening) was rigged with two nets for depth-stratified hauls (100-50 m; 50 m-surface), and was deployed at the majority of AGT stations (8 hauls) (see Table 3), with each net open for 20 min. Opening and closing of the nets was controlled through the DWNM system, which additionally recorded depth, flow, temperature, salinity and PAR.

Table 1: Pelagic groups collected for stable isotope analysis during cruise JR287.

Groups sampled	Island Sites		
	Gough	Nightingale	Inaccessible
Hydromedusae		X	X
Siphonophorae	X	X	X
Polychaeta		X	
Pteropoda	X	X	X
Gastropoda		X	X
Teuthida	X	X	X
Copepoda			X
Amphipoda	X	X	X
Mysidacea	X		
Euphausiacea	X	X	X
Decapoda	X	X	X
Chaetognatha	X	X	X
Pyrosomatida		X	X
Salpida	X	X	X
Pisces	X	X	X

9.3.3. Catch sorting and processing

For all hauls of the RMT8 the total catch was sorted and quantified. Numbers caught and total weight (when > 1 g) was recorded for each species. For the majority of animal groups specific identification was not possible and identification will be verified through re-examination in the laboratory in either Cambridge or by consulting taxon specialists outside BAS. All specimens in relatively good condition were collected for stable isotope analysis. Both pelagic and benthic animals were bagged, labelled and frozen at -80°C (sample catalogue, see Table 3 and Table 5). All samples were frozen whole and tissue samples will be taken at BAS after sample return to Cambridge. All biochemical analysis will be carried

Table 2: Benthic groups collected for stable isotope analysis during cruise JR287.

Groups sampled	Island Sites			
	Gough	Nightingale	Inaccessible	Tristan
Florideophyceae		X	X	
Demospongiae	X	X	X	
Anthozoa	X	X	X	X
Hydrozoa	X			
Bivalvia	X			
Gastropoda			X	
Malacostraca	X		X	
Stellasteroidea	X			
Echinoidea	X	X		
Gymnolaemata				X
Pisces	X	X	X	X

out at BAS, Cambridge and the NERC mass spectrometry facility in East Kilbride. Subsamples of several salp species were preserved separately for genetic studies in 96% ethanol. All data were recorded in an Excel database.

9.3.4. Using the RMT 8 net to sample for salps (genetics)

Salps are planktonic animals with the ability to rapidly bloom and ecologically dominate the pelagos; however, they have yet to be studied using population genetic methods. Recent work at BAS Cambridge using salp collections from the 'Geneflow Cruise' JR26 has revealed that the mitochondrial DNA diversity of *Salpa thompsoni* is low at the DNA sequence level compared to many other animals, but the structural organisation of the mitochondrial genome is incredibly complicated. The ecological importance of salps and their apparently unique mitochondrial DNA profile makes this group of animals a promising subject for further molecular-genetic studies. Therefore, salp material was obtained from the present cruise on an opportunistic basis when spare animals were available. A sample of a *Salpa* sp. was taken from RMT8 hauls near Gough Island and used for a time-sampling experiment to assess the temporal viability of fresh-collected salp DNA. This will provide useful information to guide future field sampling efforts. Additionally, samples of *Thalia* sp. were taken from the shelf of Nightingale and Inaccessible Islands. These will be used to assess the diversity of *Thalia* mitochondrial DNA for comparison with existing data from *S. thompsoni*. The *Thalia* samples provide an excellent comparative resource because *Thalia* species are among the fastest reproducing (blooming) salps known.

9.4. Shallow Underwater Camera System (SUCS)

9.4.1. The SUCS set up

The SUCS system was designed to undertake benthic surveys to depths of up to 500 m by using low resolution video footage and high resolution (5 megapixel) still photos. The system comprises three units:

1. The UIC unit consisting of a) the PC with monitor, b) the cable status indicator and c) the deck box.
2. The deck unit with a) the winch consisting of the UW-cable, b) the deck monitor and c) the metering sheave on the mid-ships gantry.
3. The UW-unit of the tripod consisting of a) the UW-housing including the camera, booster and power distribution board, b) the UW-light and c) the USBL pinger.

The UIC units worked without any problems. The PC had to be rebooted frequently, but this was not inherently a problem with the PC itself, rather resulting from the system being unstable (see below). The cable status indicator worked well throughout and the deck box worked reliably.

A new winch was bought for the SUCS system this year and it worked very well and reliably. This made the winch operation for the winch driver very easy, and helped to keep the system as stable as possible during operation. During the cruise a “suspension” system of bungee cords was rigged onto the deck sheave, to buffer as many sudden changes of tension on the cable as possible. This helped to increase the reliability of the link. As the cable was shortened during the previous cruise, the maximum deployment depth of the system was limited to about 330 m. The deck monitor was attached on to the winch using two brackets fixed by jubilee clips. This worked well and the monitor remained attached for the whole cruise, without the need to repeatedly remove and re-attach it. During daytime, and especially periods of sunshine, the monitor required shading to allow the operator to see it effectively, especially at the point of landing the tripod. Short term use of cardboard boxes to achieve this helped, but a longer term solution would be to construct something analogous to a photographer’s hood, which could be attached to the monitor and provide the operator with a shaded space in which to view the screen.

Three RMT8 weights were attached to the UW-tripod, using short strops and cable ties. This worked very well as it made the UW unit heavy enough to react quickly to the winch operations and to be stable in the water, but it was still light enough to be moved on deck by three people. The camera housing worked very well as well as did the LED lights. These are now dimmable, which helped to achieve appropriate exposures on each photograph. The USBL, fitted onto a purpose-built bracket, worked well initially, but over time proved to be not very reliable.

In general the system operation was most stable in calm waters, but was used during the cruise in rough seas and up to 35 kn wind speed. Fifteen photographic surveys were undertaken and, where weather, time and conditions allowed, a target total of 20 pictures was obtained. Sudden changes in the tension of the cable, for example during landing or retrieving from the seabed or if the ship rolled heavily, could cause the link between the UW camera and the deck unit to crash. This is a known issue but with the upgrade to fibre optics underway, this problem should be eliminated and the video quality will additionally be increased to full colour HD video.

9.4.2. Using SUCS during cruise

The SUCS can be used to estimate faunal density, biomass and species abundance of the benthos, which is otherwise difficult to achieve because of the selectivity of capture by the AGT. In addition it gives an overview of the conditions of the underwater landscape. Hence SUCS was also performed to investigate the unknown topography of the benthos around the TdC archipelago ahead of every series of Agassiz trawls. The SUCS and Agassiz gears, when both deployed at the same site, increase the value of the data obtained, as the specimens trawled in the latter and identified by detailed morphological inspection or using molecular methods then improve the likelihood and confidence of correct identifications of individuals seen in the SUCS images.

During JR287 more than 220 stills were taken within a depth range of *c*. 100 - 300 m (Figure 9). In total 15 different sites around the TdC archipelago were examined (Table 3). Several lower resolution videos were also taken, revealing a moderate fish density and diversity of > 4 species. Based on the photographs taken, a number of initial identifications of fish have been suggested, including *Lepidoperca coatsii* and *Helicolenus mouchesii* (orange mottled, commonest in SUCS pics), these two also being the commonest in trawls. A single flatfish was trawled and its identity has not yet been confirmed, but the only flatfish previously recorded from TdC, and then only rarely, is *Arnoglossus capensis*. Several specimens of the dragonet (*Synchiropus valdiviae*) were also trawled/seen and, if confirmed, this will be a new record for the archipelago. Long, thin, transparent fish caught by the RMT are thought to be larval conger eels.

Table 3: Summary of SUCS deployments.

Location	Number of SUCS sites
Gough Island	3
Esk Guyot Seamount	1
Tristan da Cunha	4
Inaccessible Island	3
Nightingale Island	4

In general, the seafloor surrounding of all these volcanic islands was rocky, with some areas of sand, especially off north-east Inaccessible Island. Often bright deposits (e.g. sand or

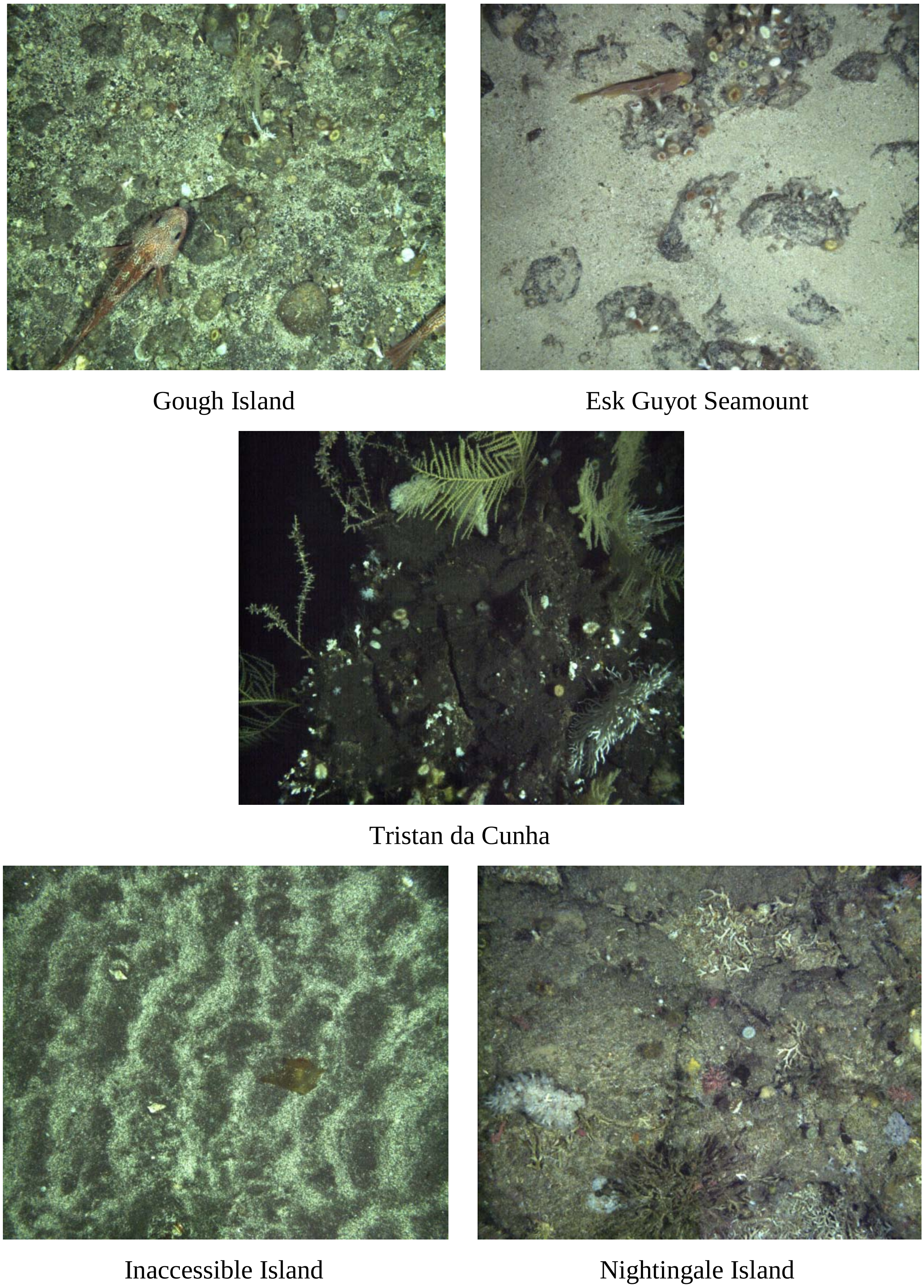

Figure 9: Examples of SUCS images from each surveyed location.

broken corals and dead shells) were highlighted against a black lava background. Fishes that are recorded as common around Tristan da Cunha and cup corals were encountered at every SUCS site. At many sites, such as around Gough Island and Inaccessible Island, echinoderms (e.g. brittle stars, sea stars and sea urchins) and arthropods (e.g. hermit crabs) were well represented. Larger boulders offer a good growing surface for bryozoans, corals, hydroids and sponges, in particular on the slopes surrounding Tristan da Cunha itself. Through creating new habitats, they offer food and hiding places for representatives of higher trophic levels such as echinoderms, arthropods, worms and fishes.

Some of the SUCS sites were unsuitable for trawling (Tristan da Cunha (3), Inaccessible Island (1), Nightingale Island (1)). Photographic data obtained from these sites nevertheless gives an important new insight into the less-studied deeper shelf habitats of the TdC archipelago. Additionally, two further sites were observed only using SUCS, these being the seamount Esk Guyot and a wreck location on the shelf of Nightingale Island.

Esk Guyot is a seamount situated about half way between Gough Island and Tristan da Cunha which was only mapped recently. Its top consists of a small plateau at *c*. 300 m depth. Such a site provides a good example of where non-invasive techniques such as SUCS are best used. The pictures of the untouched and never investigated sea floor illustrate black rocks and bright sand. A few cup corals grow on the rocks and the seamount provided a habitat for fish.

The cargo ship *Oliva*, loaded with 65000 t of soya beans, was wrecked and sank in March 2011 on the shelf of Nightingale Island, releasing much of its cargo. Subsequent observations reported a negative impact on the benthic flora and fauna. A reduction in the local lobster catch rate was linked with oxidation of the soya beans, leading to a period of fishery closure. Detailed SUCS investigation of one site previously linked with soya bean contamination, close to the location of the shipwreck location, did not show any remaining visible evidence of pollution.

9.5.The location of sites

Sites were chosen so as to be as far apart as possible within the constraint of being suitable for the use of our apparatus (Figure 10-13).

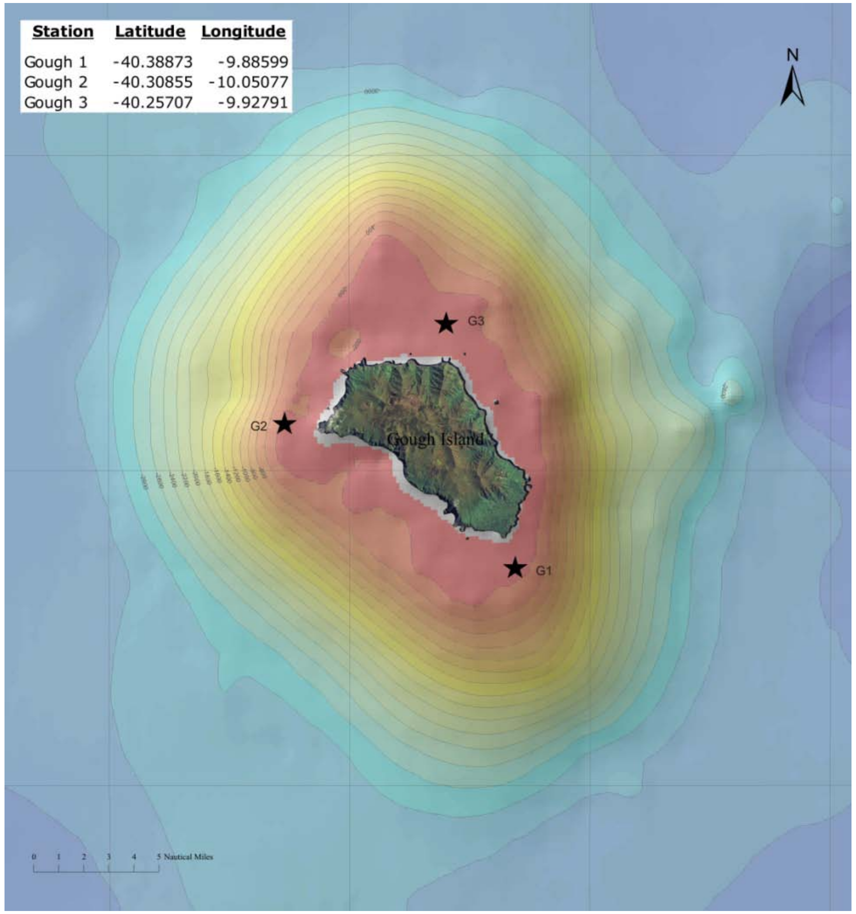

Figure 10: At Gough Island SUCS, AGT and RMT8 were used at all three sampling sites (black star).

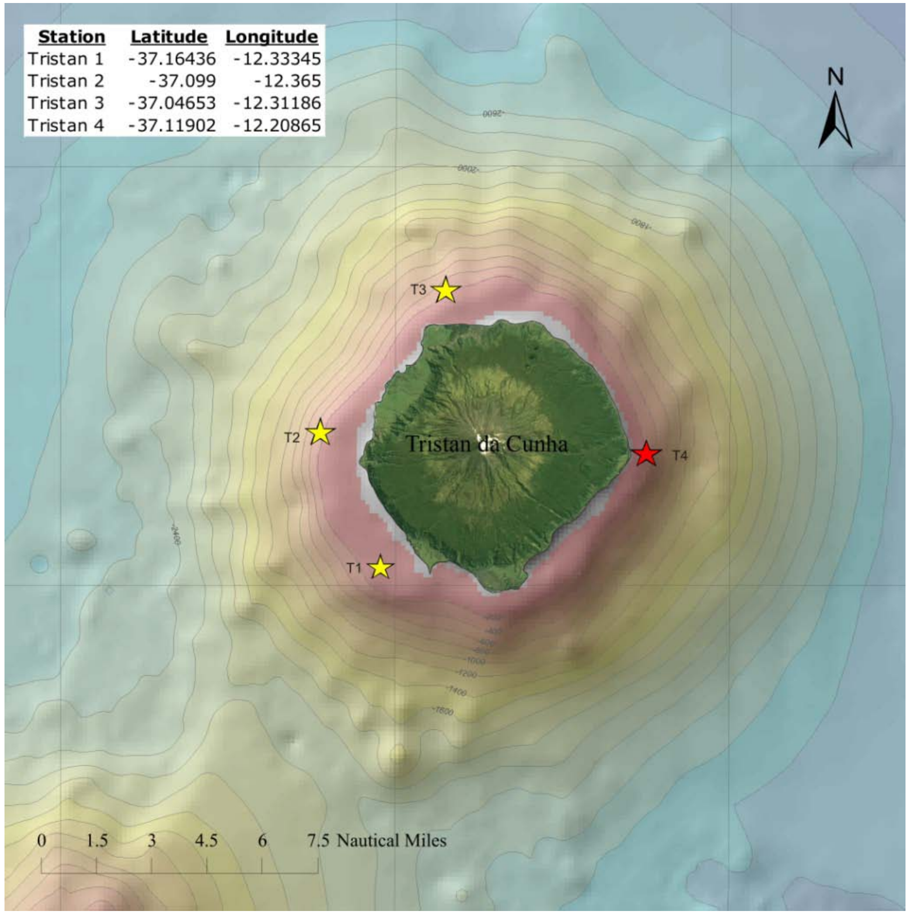

Figure 11: At Tristan da Cunha we deployed SUCS at three sites (yellow star) and SUCS and AGT at one site (red star).

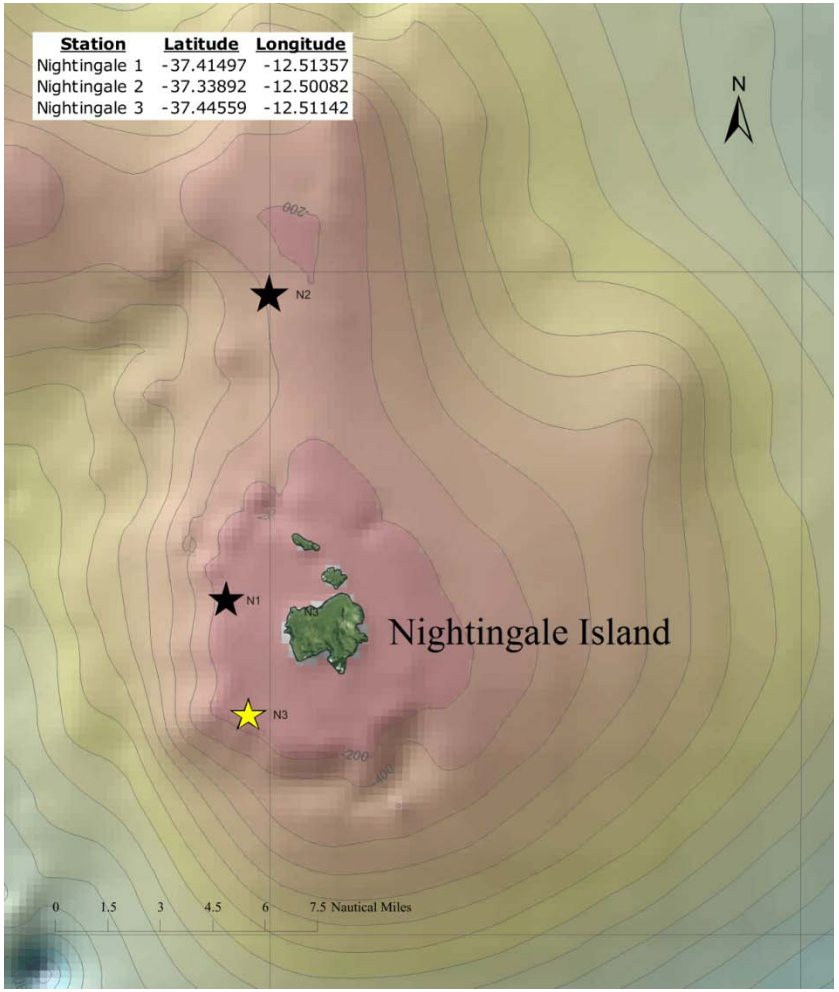

Figure 12: At Nightingale Island SUCS, AGT and RMT8 were deployed at two sites (black star) and SUCS alone (yellow star) at one site.

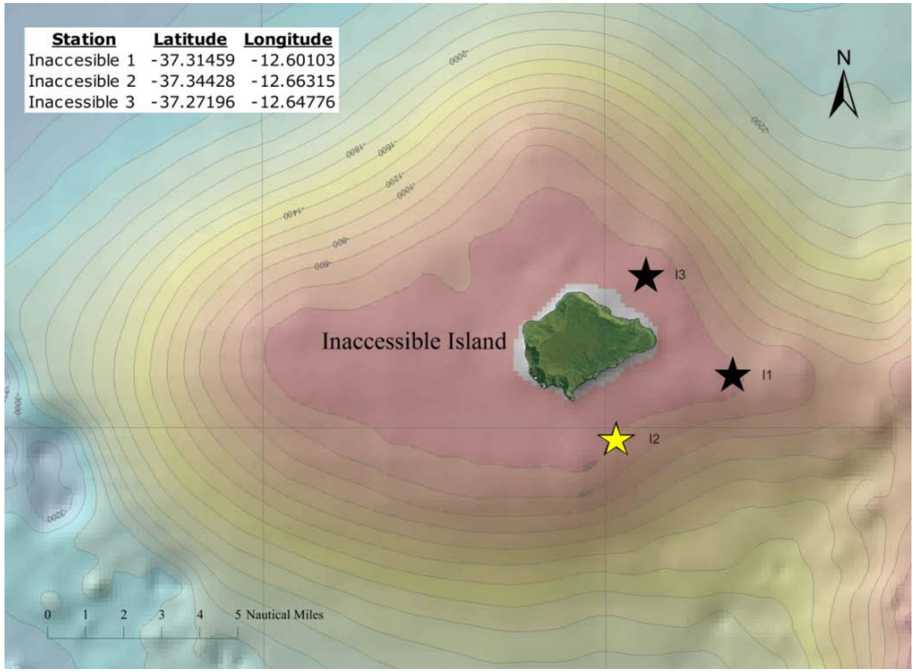

Figure 13: At Inaccessible Island SUCS, AGT and RMT8 were deployed at two sites (black star) and SUCS alone (yellow star) at one site.

9.6. Intertidal sampling

The intertidal zone is an exciting transitional environment, with a diverse range of conditions. This creates a challenging habitat as the species that inhabit this zone are exposed to regular, drastic changes in temperature, salinity and moisture and have developed specific characteristics to survive and adapt. The plants and animals of the intertidal of the top islands were recorded in some detail by the Norwegian Expedition in the 1930s. The intertidal of Gough Island is less well known. Opportunistic collections of animals and algae were made in the 1950s, but community structure is less well documented. As elsewhere, smaller and cryptic species may be undersampled at all locations. During JR287, there were several opportunities to work onshore, and intertidal sampling was undertaken as part of the collaboration with SMSG.

Landings and collections were made at each of the following locations (Figs. 14-18):

- Gough Island (19/05/13): Seal Beach, Old Glen Beach
- Tristan da Cunha (21/05/13): Puma Beach
- Inaccessible Island (24/05/13): Salt Beach

Figure 14: Seal Beach, Gough Island, with steep cliffs of bedrock and boulders with tussac vegetation backing rugged rocky shores.

The planned methodology was to conduct line transects from the water line at low tide to the high tide line. However, the challenges presented by the very small effective tidal range (0.4 m at Gough Island), and wave surge greater than the tidal range at the top islands, together with limited time ashore, meant that this sampling strategy was modified. At each site, general photographs were taken of the intertidal zone, followed by quadrat photographs for size reference and for later comparison of the community structure. Each of the sampled sites consisted of volcanic bedrock and cobbles/boulders, with minimal foliose algae present on the upper shore. Algal turfs on the lower shore were inaccessible because of poor tides and wave action, and collection of animals, and quadrat photography, were not possible below mid-shore level. Cobble shores were scoured by movement in the constant wave action, and carried only ephemeral algae. Samples of invertebrate species were collected from each site with the aim of establishing a better baseline survey than currently available and providing a comprehensive species inventory. These samples were stored in 96% ethanol for identification by SMSG. The sampling strategy included identifying and collecting cryptic (i.e. hidden) species, for example from the underside of boulders, in crevices and from decomposing drift algae. The TdC upper intertidal and supralittoral zones at first sight appear species-poor, yet the prevalence of cryptic species may offer much greater

Figure 15: Intertidal seaweeds at Seal Beach, Gough Island, with bull kelp *Durvillaea antarctica* (which does not occur at the top islands), and turfs of pink coralline and darker red algae.

biodiversity than originally appreciated. The animals collected and photographs taken will complement previous work conducted in this habitat and will add to the biological knowledge of the area. All taxa will be examined in detail, compared with older records and combined with the photo-quadrat images to provide further information on the intertidal communities of the archipelago.

There are significant differences between the intertidal flora and fauna of Gough Islands and those of the top islands, because they lie on either side of the Subtropical Convergence, resulting in the temperature of the seawater around Gough Island being 3-4 degrees colder than at the other islands. Collections of intertidal macroalgae were made from Gough and Inaccessible Islands, by accessing the mid and lower intertidal zones through use of a drysuit. Specimens were preserved by drying, so that genetic barcoding can be used to compare with algae already collected and barcoded at the top islands by recent Darwin Initiative projects. Around a third of seaweed species from the top islands were thought to be endemic when described in the 1930s, but this was at a time when the floras of both South Africa and South America (probable source areas for TdC species) were little known. By contributing genetic material into a global database, it is hoped that the affinities of TdC taxa may be revealed through comparison with those of the adjacent continental shelves. Specimens of *Porphyra* species were also collected for a specialist working on this group in the BMNH.

Figure 16: Puma Beach, Tristan da Cunha: volcanic bedrock upper shore with tide pools and typical high energy waves.

Figure 17: Steep topography and cobble shore at Salt Beach, Inaccessible Island. Drift algae and debris visible at the high tide line.

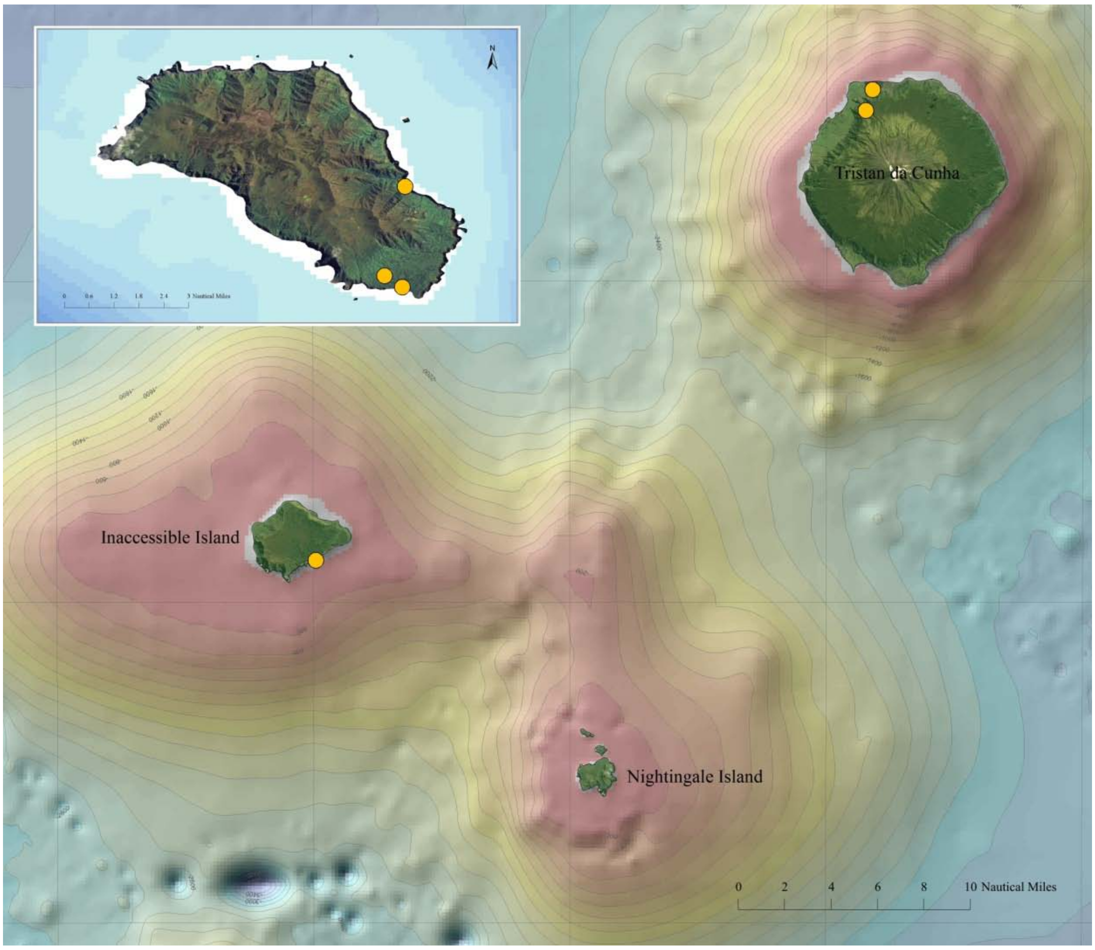

Figure 18: Landing sites at Tristan da Cunha, Inaccessible Island and (inset) Gough Island.

10. Terrestrial sampling

10.1. Introduction

Terrestrial sampling provided an opportunity to enhance the work that could be achieved under the umbrella of JR287. From the outset, it was appreciated that the form and number of landings would at best be extremely limited, and at worst there was a very realistic possibility that none might be achieved. The work planned was therefore intentionally opportunistic, aimed at obtaining material that would be suitable for use in enhancing a number of existing projects within the BAS Ecosystems and ECE programmes, and those of collaborators and students directly linked with PC. Collecting targets were kept simple, both to facilitate speed and practicability of collection on the ground, and to take maximum advantage of the generous assistance of the marine team as a 'terrestrial collecting posse' whenever shore landings were possible.

As a summary, the following 'wish list' of collection targets was made at the outset:

i. *Polytrichum* peat monoliths, surface water and rainfall samples, mosses for testate amoebae (BAS-Exeter-Cambridge AFI, PC BAS PI, J Royles BAS postdoc, M Amesbury Exeter postdoc)

ii. General moss specimen collection for deposition in BAS Antarctic herbarium (few if any recent studies of moss diversity exist for the TdC archipelago, though Gough Island has been better covered by the South African programme)

iii. Targetted moss genus collections: *Schistidium*, *Chorisodontium*, *Polytrichum*, *Bryum*, *Syntrichia*, *Hennediella*, *Ceratodon* (for E Biersma, ECE PhD studies)

iv. Sediment and moss samples for diatom culturing (D Hodgson, BAS, and E Verleyen, Ghent, collaboration)

v. Record collections of microarthropods through Tullgren extraction of moss specimen subsamples. Again, limited diversity data exist other than for Gough Island

vi. Soil samples, contributing to two University of Malaya PhD studentships for which PC is external supervisor (soil fungal diversity and function, A Krishnan; microbial remediation of pollutants, L Salwoom)

vii. Terrestrial snails, targeting the two resident genera (R Preece, University of Cambridge)

viii. Beetles – diving beetles (Dytiscidae) and a specific family of southern terrestrial beetles (Perimylopidae) (BAS Ecosystems programme phylogeography studies, with Italian collaborators)

ix. *Deschampsia antarctica* and *Colobanthus quitensis*, to contribute to a SCAR fellowship working in Cambridge in summer 2013 (M Tsujimoto, Tokyo)

10.2. Season Summary

The terrestrial landings were remarkably successful, given the very realistic possibility at the outset of not having suitable landing conditions for any of the cruise target locations. Although not part of the cruise plan *per se*, the opportunity to collect specific samples on the Falklands and South Georgia provided a very valuable addition to the work completed. All cruise landings were relatively short duration – giving 3-4 hours ashore on Gough Island and Tristan da Cunha (twice on the latter) and 1.5 hours on Inaccessible Island. Conditions were unsuitable to permit any attempt at landing on Nightingale Island.

In general, landings permitted wide ranging collections of mosses, which were then subdivided on ship to give material for the various different project uses outlined above. Peat suitable for monolith collection was only encountered on the Falkland Islands and South Georgia, nevertheless giving a very valuable extension of the regional transect of samples available within the AFI project. Some relatively deep moss samples (10-15 cm, multi-decadal age) were also collected from Gough Island and Tristan da Cunha. Soil, water and sediment samples were also collected from most landing sites. Invertebrate collections were less successful overall, although in most cases were known to be more speculative from the outset. The short periods spent ashore, combined with the very late timing in the season at South Georgia, precluded time-consuming detailed exploration for these species. The targeted snails were possibly only obtained at two locations, and the targeted beetles were not encountered even on South Georgia. A number of opportunistic collections were made of non-native invertebrates, mostly centipedes and millipedes. A range of moss samples were subjected to Tullgren extraction to provide a record collection of terrestrial micro-arthropods.

10.3. Falkland Islands

Peat cores collected 30 April from Johnson's Harbour (Figure 19), following advice from James Fenton (ex BAS botanist, now Director of Falklands Conservation) that a bank of *Polytrichum strictum* was present at this location, with a similar growth form to that seen in the Antarctic. Two deeper (30-50 cm) peat monoliths were collected. Two further shallow monoliths were collected covering the top *c*. 20 cm, with the intention of using these for regrowth and genetic studies. J Fenton also provided a number of samples previously requested of the grass *Deschampsia antarctica* and the pearlwort *Colobanthus quitensis*.

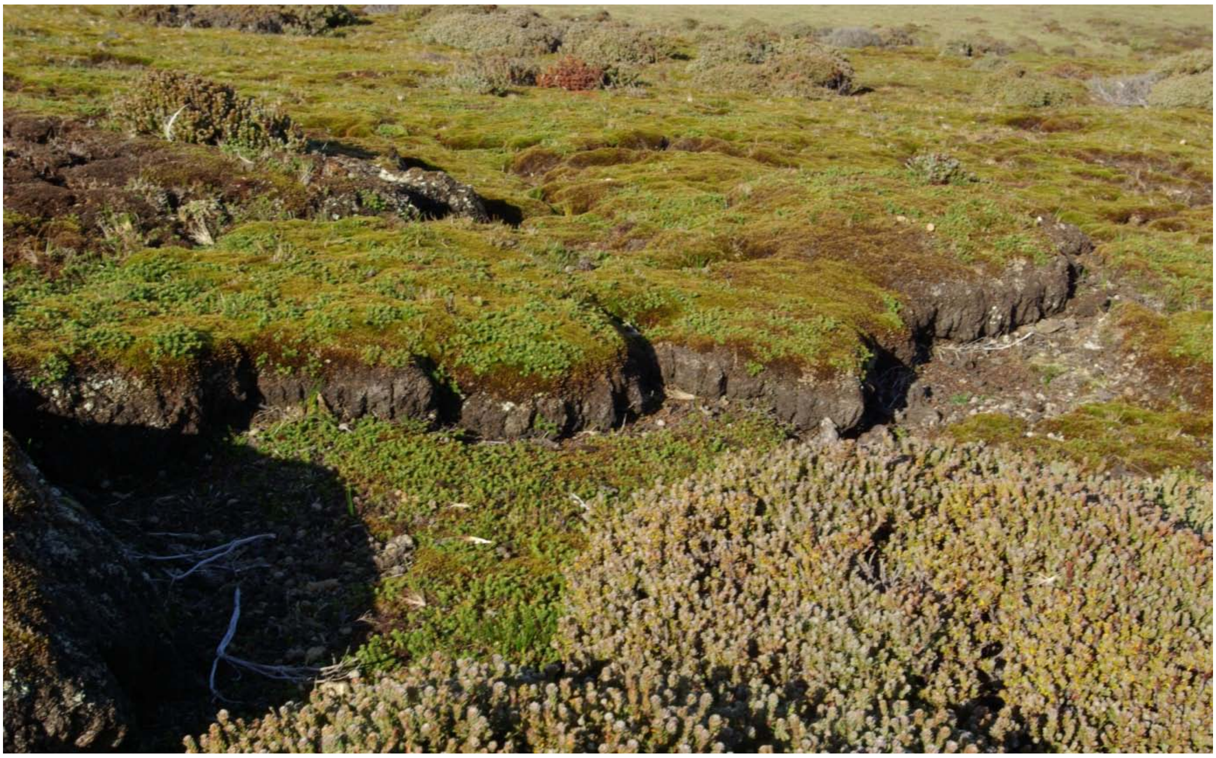

Figure 19: Moss bank dominated by *Polytrichum strictum* at Johnson's Harbour, East Falkland.

10.4. South Georgia

A visit or landings on South Georgia were not part of the original cruise plan, but the cruise period was extended on our arrival in the Falklands through JCR being chartered for specific work by the Government of South Georgia and the South Sandwich Islands. At the suggestion of the Chief Executive of GSGSSI (Dr Martin Collins), PC spent four nights ashore at the BAS King Edward Point station, permitting a range of collections enhancing ongoing BAS Ecosystems and ECE work, and other collaborative projects. These included further peat monoliths, moss samples, *Colobanthus* plants, soil and water samples. These were collected around KEP and Grytviken, Maiviken (Figure 20) and along the coast to Susa Point/Penguin River.

Figure 20: Two moss banks dominated by *Polytrichum strictum*, below Maiviken Hut, South Georgia.

10.5. Gough Island

Ashore near the SANAP station 19 May, in very good weather conditions (Figure 21). Collected moss, lichen, soil, water and a small number of invertebrate samples (including a single *Balaea* snail) along two tracks from the station inland of the helipad, and towards 'the glen'. A few further samples obtained later in the day from a second small shore party in a short visit to the beach at Quest Bay.

10.6. Tristan da Cunha

Ashore near the settlement, 21 May. Part of the party (PC, WG-C, GS, PE) sampled around the edge of the settlement, in particular around the volcanic source stream for the village water supply, and the base of the 1961 eruption lava (Figure 22). The remainder (DKAB, JD, CM, OH) climbed up to 'the base'. A range of moss, water and soil samples were collected.

Second visit ashore at the settlement on 26 May. Party members (PC, DKAB, JD, CM, OH, WG-C) targeted moss and soil collections near the top of the 1961 eruption volcano.

Figure 21: Native vegetation with *Phylica* trees and native ferns (e.g. *Blechnum*), Gough Island.

Figure 22: The 1961 eruption volcano above Edinburgh village on Tristan da Cunha, a moss-rich habitat.

10.7. Inaccessible Island

A brief landing at Salt Beach was achieved on the afternoon of 24 May. The beach is in two sections, separated by a small headland covered in head high dense tussock grass (Figure 23). The northern section was unproductive for mosses, although soil samples were collected. The southern section includes a waterfall descending from the cliffs above, with a drop pool at its base. Slabs and small gullies around this waterfall have reasonably rich if low diversity moss growth, from which collections were made along with soil and water samples. Further moss growth was collected from the substantial remaining walls of the old sealer refuge behind the beach. Overturning some large supralittoral boulders resulted in finding large concentrations of snails possibly of the target genus *Balaea*, the only location where this was noted.

Figure 23: Shoreline sampling under the steep cliffs of Salt Beach, Inaccessible Island.

10.8. Summary of terrestrial activities, collection dates and locations

Table 4: Work diary for terrestrial science activities.

Date	Information
Apr 28	Departure BZN-MPA
Apr 29	Arrive MPA, transfer to Waterfront Hotel, Stanley
Apr 30	Field collections of peat cores at Johnson's Harbour with James Fenton, Director of Falklands Conservation; join JCR
May 1	Stanley to Mare Harbour for bunkering, delayed; cruise mobilisation (marine gear)
May 2	Bunkering completed mid afternoon, departure from Falklands 24 h later than planned
May 3	At sea; work on SCAR Development Council report, BAS promotion case, Mizan Foundation (Malaysia) funding application, NIOO (Netherlands) grant panel assessments
May 4	At sea; South Georgia collection permitting, NIOO (Netherlands) grant panel assessments
May 5	At sea; buoy deployment; NIOO grant panel assessments; ms review for *Annual Reviews of Ecology, Evolution and Systematics*
May 6	Arrive and disembark King Edward Point; moss monolith and other moss collections, Hope Point
May 7	Day to Maiviken; *Polytichum* monolith, other moss, soil, water and sediment collections
May 8	At KEP; rainwater samples; kelp samples; samples of polluted soils within Grytviken whaling station
May 9	At KEP; half day to Penguin River; *Colobanthus*, moss and soil samples collected on the way to Susa Point
May 10	JCR pickup from KEP late morning; edited Mizan Foundation research proposal 1 & 2 (Malaysia collaborators, microbiology – enzymes, microbial biodiversity)
May 11	At sea; editing mss for submission to *Journal of Insect Physiology* and *Current Biology*; review of NZARI proposal
May 12	At sea; ms review for *Plant Genetic Resources*
May 13	At sea; ms review for *Plant Genetic Resources*; edited Mizan Foundation research proposal 3 (Malaysia collaborators, microbiology - antibiotics); preparation of field collection guidance notes
May 14	At sea; SCAR Fellowship proposal (Casanovas, citizen science); SCAR EBA programme final report for Delegates; advice on JNCC proposal (for O Hogg and D Barnes)
May 15	At sea; SCAR EBA programme final report for Delegates; final revision of *Ecological Monographs* ms
May 16	At sea; Springer Antarctic Invasions chapter

Table 4: continued.

Date	Information
May 17	At sea (storm delay to retrieval of NOC oceanography buoys); Springer Antarctic Invasions chapter; MISA abstract (Krishnan PhD)
May 18	At sea; evening arrival at Gough Island; SUCS and AGT
May 19	Half day landing at Gough SANAP station, local area collections; short landing by team members in Quest Bay, small number of additional collections; SUCS
May 20	At sea off Gough Island; completion of RMT's and AGT's, specimen sorting
May 21	Overnight swath and SUCS on seamount; transit to Tristan da Cunha; afternoon landing and multiple terrestrial collections; sample Tullgren extractions commenced
May 22	Overnight swath and SUCS around Tristan da Cunha; transit to Nightingale Island; swath, SUCS and trawl work; SCAR EBA programme final report for Delegates; communications on BAS-MARP institutional MoU development
May 23	At sea off Nightingale Island; swath, SUCS and trawl work; transit to Inaccessible Island;
May 24	At sea off Inaccessible Island; swath, SUCS and trawl work; 15 hr landing on Salt Water Beach, Inaccessible Island, moss soil and water collections made; Tullgren extractions; transit to Tristan da Cunha
May 25	At sea off Tristan da Cunha; swath, SUCS and trawl work; marine sampling completed by lunchtime
May 26	Afternoon landing Tristan da Cunha; moss and soil collections; Tullgren extractions
May 27	SCAR Fellowship application (Casanovas); cruise report;
May 28	Work on two Chilean collaborative funding applications (Molina-Montenegro, Cuba Diaz); PhD student viva preparation (Seydametova); work on new *Journal of Insect Physiology* ms (Everatt, Birmingham); new set of Tullgren extractions commenced
May 29	Cruise and field reports; gear sorting/packing;
May 30	Cruise report; Chilean funding application (Cuba Diaz); new set of Tullgren extractions commenced
May 30	BOLs; cruise report; cruise *Polar* Research ms planning; SCAR Ant-Eco report draft; Malaysian programme field planning
Jun 1	BOLs; specimen packing; cruise report

11. Photographic support

Depending on their size, the available time and their particular interest, incoming samples during the expedition JR287 were documented using a digital camera system consisting of a Nikon D3x fitted with a Micro Nikkor 60 mm f/28 VR and two externally powered and manually operated Metz flashguns connected to the camera by a split sync cable (Y type) (Figure 24). Aperture was set from F5-12 for the more transparent specimens and from F22-36 for the remaining material.

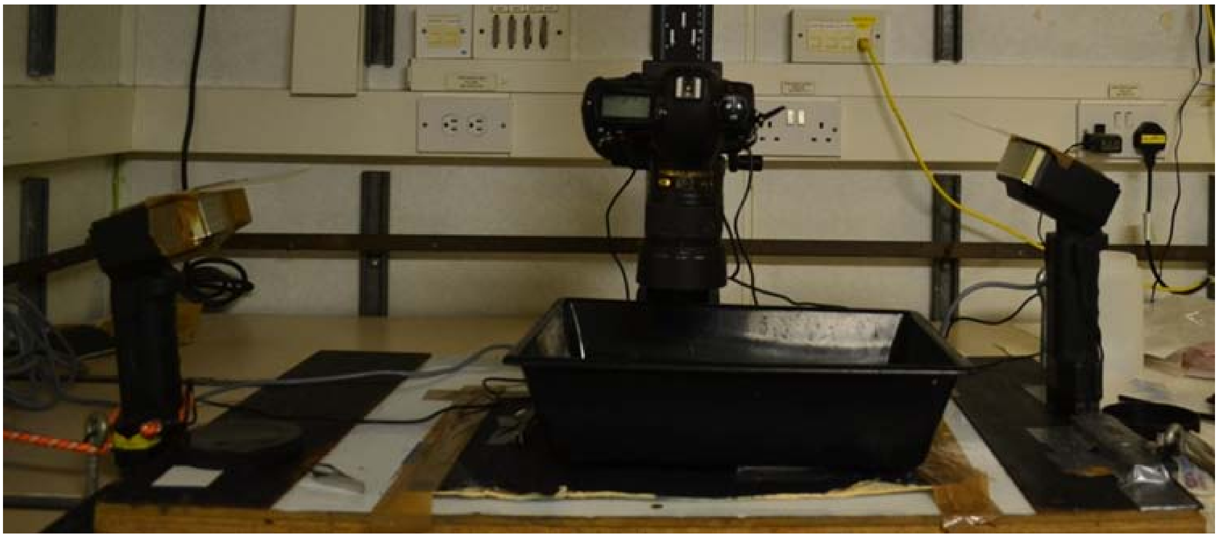

Figure 24: Photographic setup.

A total of 500 pictures of live animals were taken during the expedition (Figure 25), stored as JPEG files and catalogued immediately in a common folder. Pictures derived from the same individual were named after the unique vial number corresponding to that specimen. All the pictures were then stored into different folders containing information about the ship event, the station number and the type of gear used. The event number is a unique number which refers to the deployments of gear during JR287 and is kept in the ship's event log (see Appendix 0-5). The vial number is a unique number assigned to each specimen or jar of specimens during sorting. Photographed specimens were kept separate for unambiguous identification. On the basis of the collection number alone, it is possible to locate the vial containing the specimen or specimens in the collection and also all associated metadata (station, date, etc.). The inclusion of some of these metadata as keywords assigned to each individual photograph also provides a straightforward means of addressing frequently encountered queries (e.g. pictures from station X, all pictures of ophiuroids) directly from the collection of pictures without having to query a database first. Keywords containing taxonomic information have been added for some taxa and will continue to be added as feedback is obtained from international specialists. The pictures will eventually be made available to the scientific community through the SCAR-MarBin database.

Figure 25: Examples of photographed spécimens. Upper left: Cup coral *Caryophillia* sp; upper right: Tritoniid, nudibranch (ventral/dorsal); lower left. Pteropod; lower right: Octopus.

12. Prinicipal partner report

12.1. Shallow Marine Surveys Group

Participation in JR287 has been the second collaborative research trip between BAS and SMSG, following on from JR262. The opportunity to draw from the experience and knowledge between these organisations has fostered a strong working relationship, to the benefit of South Atlantic science and research.

The RRS *James Clark Ross* provides a valuable research platform, allowing an overarching view of the biological systems in place around the Tristan archipelago by linking data collected from benthic and pelagic trawls with the sub tidal, littoral and terrestrial zones. The mutual advantages of working with other British OTs such as Tristan da Cunha are evident, and the Conservation officer form Tristan will be visiting the Falkland Islands later this year to continue sharing the resources of the OT's.

The SMSG representative during this period was focused on collecting samples from the littoral zone, and this objective was enhanced by the level of expertise available from other scientists on the team.

12.2. Pew Charitable Trusts

Global Ocean Legacy (GOL), a project of The Pew Trusts and its partners, works with citizens, local and national governments and locally based conservation organisations to help build support for the establishment of very large, fully protected no-take marine reserves. Since 2006, GOL has worked with governments and formally partnered with more than 20 institutions and organisations to provide information and research for decision makers and to educate the public. Pew is currently involved with planning for marine reserves around several UKOTs, including South Georgia and the South Sandwich Islands, and is consulting with the Tristan government over possible ways of setting up marine reserves around the Tristan archipelago. Recognising that information on species, habitats and biodiversity is essential underpinning for planning marine reserves, and that this is lacking from deeper waters around the islands, Pew contributed funding which enabled the work of this survey to be expanded considerably, to include 2 days at Gough, and an extra two days at the top Tristan islands.

Part of the contract between The Pew Charitable Trusts and BAS for JR287 was to provide a space on the cruise for a biologist who would communicate progress of the survey to GOL, mainly through a blog on Pew's website. Sue Scott, a marine biologist with extensive experience of surveys and impact assessment in the shallow waters around Tristan since 2004, mainly funded by the Darwin Initiative and Tristan Government, took on this role. Seeing the seabed in water deeper than diving depths has greatly enhanced her knowledge and appreciation of the marine life of the Tristan archipelago, and complements detailed surveys done in shallow water at all the top islands from 2004-2008. Intertidal work on Gough during this cruise was a useful precursor for Darwin Initiative-funded shore and diving surveys to take place there later in 2013.

Within the limitations of survey equipment and seabed terrain, the aims of the surveys have been fully achieved, and the cruise has expanded our knowledge of the marine life around the islands of the Tristan archipelago to include depths of 150-300m. Ship-based work continued uninterrupted despite adverse weather conditions at times, and all credit to Master, crew and scientists for expert round-the-clock handling of the ship, sampling equipment and specimen processing, enabling a large amount of information to be gained in a very short time. Post-cruise working up of specimens and data promises to provide further insights into biodiversity and trophic relationships of the biota of the depths and habitats sampled. Team members also managed to land at 3 of the four Tristan islands, a remarkable achievement considering the time of year and extreme exposure of the landing sites.

13. Mooring buoy deployment

13.1. 3700 m sediment trap mooring at P3

In general: During JR287 the P3 deep sediment trap mooring was successfully redeployed. Because of weather conditions (a large swell at the time) and the lack of cruise time it could not be redeployed during JR280 as originally planned.

13.2. Redeployment

The mooring was redeployed on 5 May 2013 with the former P2 equipment. The deployment started at 11:57 GMT with the buoy first again. After the deployment of all the equipment the weight was finally released at 14:01 at a depth of 3788 m at location 52° 4637 S 40° 0956 W. The mooring was pinged after the deployment to determine its position by triangulation (Figure 26; Table 5). The ship moved from its position approx 1 nm first N and then again 1 nm E. This gave the following triangulation, with a relative position of 52° 46.6278 S and 40° 09.7293 W at a calculated water depth of 3738 m where we believe the 3700 m mooring is sitting.

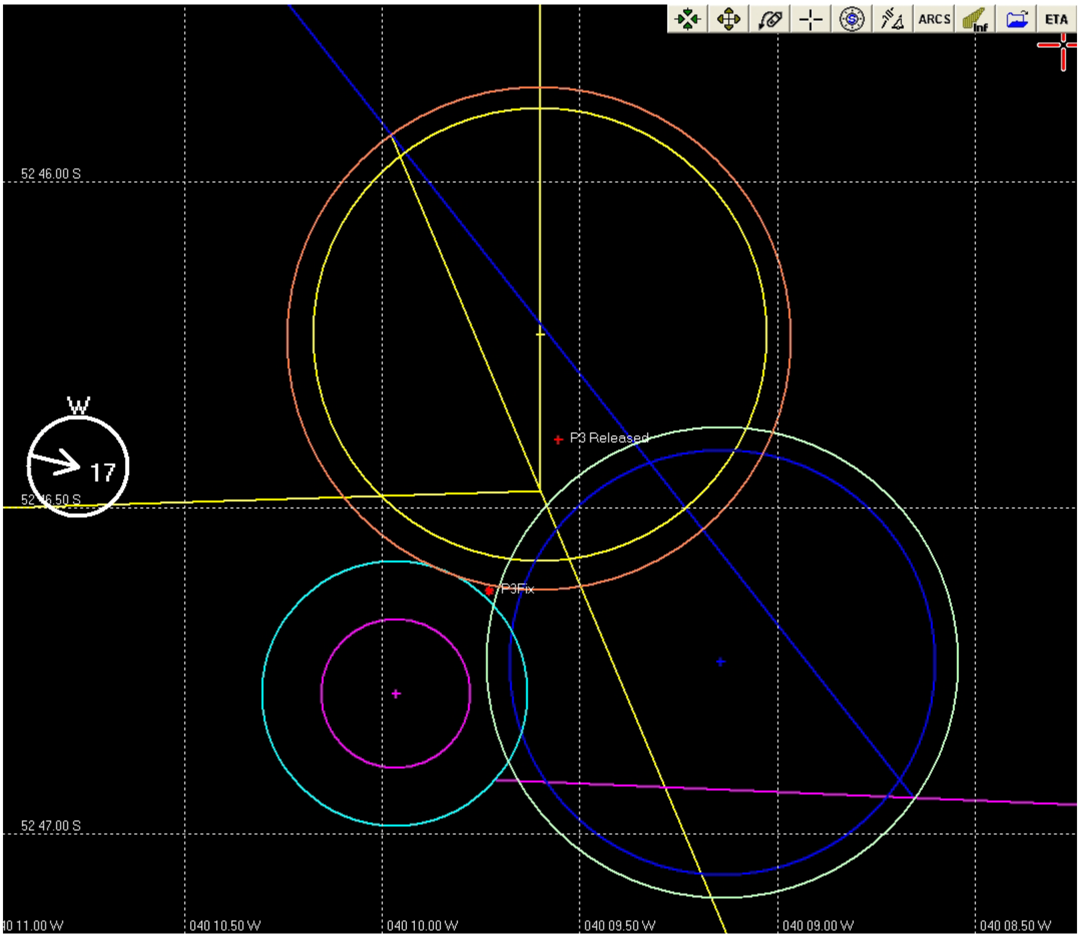

Figure 26: Microplot screenshot of mooring triangulation.

Table 5: Details of mooring triangulation.

Position	Time	Triangulation		Latitude	Longitude
P1	16:00:00	Depth (m)	3802		
		Ping distance	3835	52° 46.24 S	40° 09.60 W
P2	15:33:00	Depth (m)	3802		
		Ping distance	3828	52° 46.74 S	40° 09.14 W
P3	15:18:00	Depth (m)	3802	52° 46.79 S	40° 09.97 W
		Ping distance	3786		

13.3. Work carried out

NOVATEC beacon: R09, Ch B, 15948 MHz

Acoustic Releases:

- Codes: Release No: 93 release code: **0484 + 0455**
  Release No: 573 release code: **15E1 + 1555**

Acoustic releases: 93 + 573

- new batteries
- tested

Irmasat beacon: 13901110

- back from repairs
- tested

NOVATEC Combo beacon: R09-020

- new batteries
- tested

CTD 37 SMP 29579: 2462 on main buoy

- new batteries
- set-up instrument for re-deployment
  - set real time clock to PC clock (p 28)
  - check instruments are ok and clock is set properly by using “DS”command (p 27)
  - set-up instrument for “Autonomous Sampling” following the instructions on page 24
  - samplenum=0 automatically makes entire memory available for recording
  - sample interval: 900 sec
  - starttime=05052013

ADCP WHS300: 15548

- new batteries
- set-up instrument for re-deployment
  - erase data (p16 WinSC)
  - start WinSC for set up instrument

- set-up instrument
    - Number of bins: 30 (1-128)
    - Bin size (m): 8. (02-16)
    - Pings per Ensemble: 10
    - Interval (min): 15
    - Duration (days): 550 days
    - Transducer depth (m): 200
- save deployment settings in prepared folder
- set up ADCP real time clock to PC clock
- do not verify the compass (needless on a ship)
- run pre-deployment tests to check instrument
- start date: 05052013 at 18:00

Sediment trap: Parflux No: ML11966-02

- new batteries (14x C – Cells + 1x 9V Block battery)
    - Do not remove both batteries at the same time!
- **Always disconnect the cable on the sediment trap first, before unplugging the computer end!**

PS3 Sediment Trap Deployment

- Schedule Verification:

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

Current meter: Aquadopp No A2L - 1792

- new batteries

Deployment:	P3JR287
Start at:	05/05/2013 18:00:00
Comment:	3700m mooring at P3, deployed 050513
Measurement interval (s):	900
Average interval (s):	60
Blanking distance (m):	037
Diagnostics interval (min):	N/A
Diagnostics samples:	N/A
Measurement load (%):	4
Power level:	HIGH
Compass upd rate (s):	900
Coordinate System:	ENU
Speed of sound (m/s):	MEASURED
Salinity (ppt):	34
File wrapping:	OFF
Assumed duration (days):	5500
Battery utilization (%):	2430
Battery level (V):	105
Recorder size (MB):	89
Recorder free space (MB):	89000
Memory required (MB):	21
Vertical vel prec (cm/s):	14
Horizon vel prec (cm/s):	09

Aquadopp Version 128

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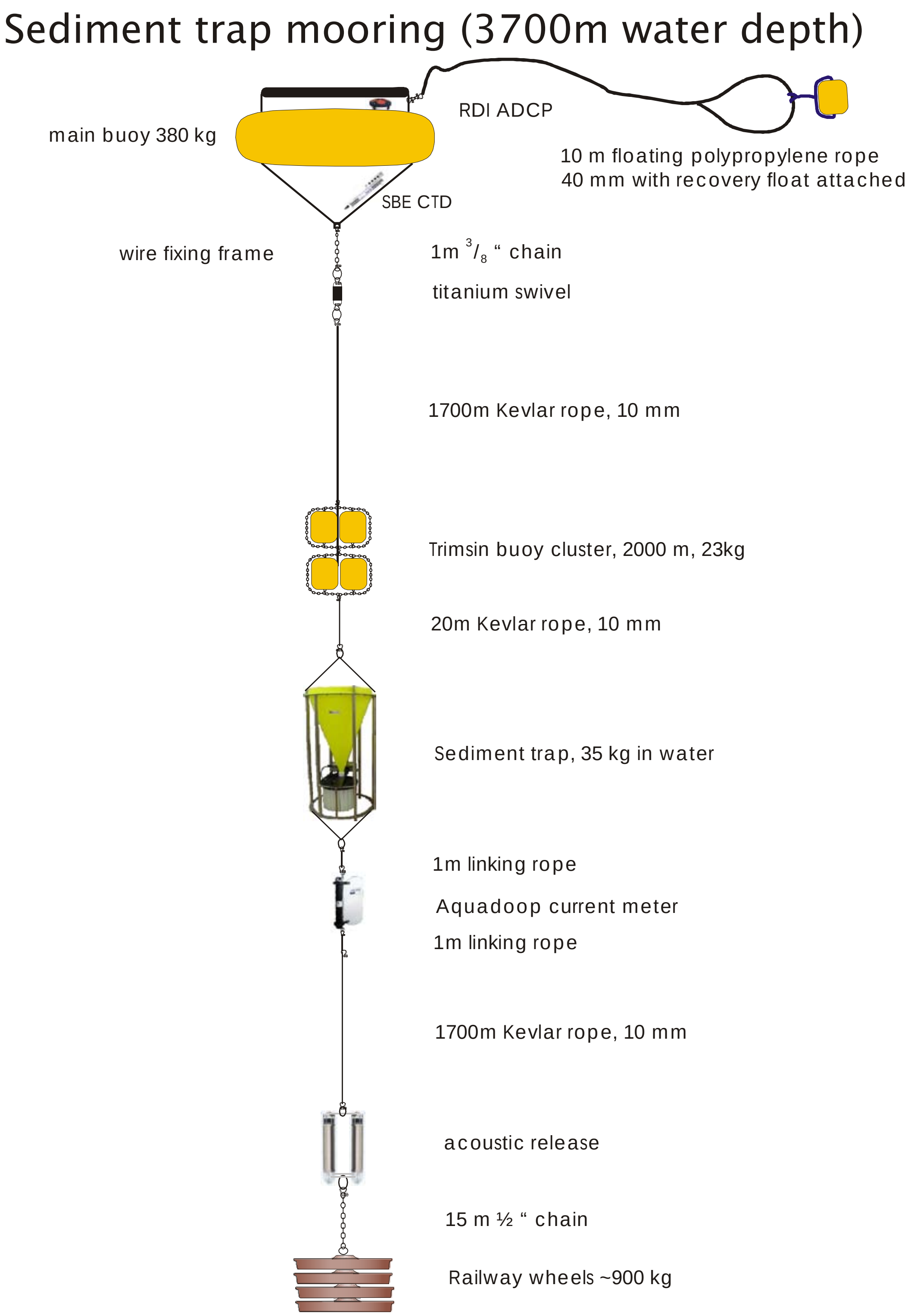

Figure 27: Schematic illustration of the mooring sediment trap.

14. Preliminary results and conclusions

14.1. Sampling

The sampling was designed to be as representative and comparable to other areas surveyed by BAS as possible, given the tight time-scale, likely weather and the nature of the substrata. Thus box core and epibenthic sledge, and associated personnel, were not included in the cruise plans as it was felt that the terrain would be rarely appropriate. This decision was borne out by the observations during SUCS and AGT operations. We planned to use each of our principal apparatus on the shelves of each main island and just the swath and SUCS at Esk Guyot – and this was all achieved. At each of Nightingale and Inaccessible Islands work was completed at two sites and partially completed at a third. We intended to resurvey for impacts of the *Oliva* wreck at Nightingale Island, particularly looking for evidence of the released cargo of soya persisting in the local environment. No presence or impacts were noted from the SUCS photographs, but evidence may emerge from subsequent data trend visualisation techniques such as ordination, once the fauna has been identified to lower taxonomic levels. Shore visits were planned for four islands and achieved for three, in each of which terrestrial and intertidal collections were made. Overall the level of sampling success was higher than expected.

14.2. Marine fauna

The depauperate shelf fauna of Gough Island and the main islands of the TdC archipelago clearly reflect the relative youth, isolation and small size of the islands, as is the shallow-water fauna. The relative ages of the different islands were reflected to some extent in the degree of development of the shelf/erosion platform around each, with the youngest island (Tristan da Cunha) being particularly striking in the almost complete absence of a developed shelf/platform. Space occupation of the habitats surveyed was typically low, patchy and, as is a general feature on shelves, highly dependent on the nature and profile of substratum (for example anthozoans and hydrozoans were common on steep rock surfaces, which were poorly sampled). Few groups were rich in morphotypes, though some were locally abundant – the cup coral *Caryophyllia* (cf. *profunda*) was widespread. Future detailed sorting of specimen morphotypes along with genetic analyses will enable better description of the species richness and affinities of this fauna,but notable features already apparent include:

- Octocorals, cup corals, hydroids and desmosponges patchily common

- Desmosponges and cheilostome bryozoans well represented
- First possible report of holothuroid echinoderms from TdC
- The brachiopod species present were very large (>8 cm^3 estimated)
- One suspected new salp species (*Thalia* sp.)
- Polychaetes, molluscs and percarid crustaceans surprisingly impoverished
- No nemerteans or pycnogonids
- No Antarctic (e.g. South Georgia or Bouvetøya) marine species apparent
- Phylogenetic and geographic affinities not obvious from morphotypes
- Secondary space (organism externa; Figure 28) was an important source of biodiversity

Figure 28: Hermit crab with associated biodiversity.

At higher taxonomic levels the fauna was fairly rich – only six days' sampling work yielded 1/3 of extant animal phyla - Annelida, Brachiopoda, Bryozoa, Chaetognatha, Chordata, Cnidaria, Ctenophora, Crustacea, Echinodermata, Mollusca, Porifera, Priapula and Sipuncula, also noting that the apparatus used was inappropriate to assess small taxa such as Nematoda, Platyhelminthes and meiofauna.

Acknowledgements

We are very grateful for the funding which allowed this cruise to take place, which was provided by the Darwin Initiative, BAS (matched funding) and The Pew Charitable Trusts. The Conservation Department, Tristan da Cunha, were not only our grant co-applicant but also were pivotal in providing boats and advice in getting ashore at each of the islands, for which we particularly thank Trevor Glass. We also thank Roger Stillwell for his help deploying and recovering apparatus as well as Oliver Bonner and Sam Burrell for aid with terrestrial and intertidal collections. James Fenton and Falklands Conservation very kindly supported the field sampling at Johnson's Harbour, and collected further plant samples. Thanks to Dr Martin Collins for suggesting and making possible the collecting opportunities on South Georgia, and to BAS staff at King Edward Point (especially Rod Strachan, Sue Gregory and Hazel Woodward) for their kind hospitality and assistance in the field. Staff at the SANAP Gough Island station are thanked for their very kind hospitality and enthusiastic assistance with our short visit and field collections, especially Chris Bell and Mara Nydegger. We thank Tim Andrew (West Indian Ocean Marine Science Association) and Peter Wirtz (Madeira) for provisional fish identifications from photographs provided. We thank Magda Biszczuk and Louise Ireland for pre-cruise mapping support and advice. Most of all we thank the master, officers and crew of RRS *James Clark Ross* for the skill, effort and kindness in making both a productive and enjoyable science cruise.

Appendices

1. Summary of major taxa

Phyla

Tristan	Nightingale	Inaccessible	Gough	South Georgia (for interest)
Annelida	Annelida	Annelida	Annelida	Annelida
Bryozoa	Bryozoa	Bryozoa	Brachiopoda	Brachiopoda
Chordata	Chordata	Chordata	Bryozoa	Bryozoa
Cnidaria	Cnidaria	Cnidaria	Chordata	Chelicerata
Crustacea	Crustacea	Crustacea	Cnidaria	Chordata
Echinodermata	Echinodermata	Echinodermata	Crustacea	Cnidaria
Mollusca	Mollusca	Mollusca	Echinodermata	Crustacea
Porifera	Porifera	Porifera	Mollusca	Echinodermata
Sipuncula			Porifera	Mollusca
			Sipuncula	Platyhelminthes
				Porifera
				Priapula
				Sipuncula
9	8	8	10	13

Class

Tristan	Nightingale	Inaccessible	Gough	South Georgia (for interest)
Anthozoa	Anthozoa	Anthozoa	Anthozoa	Anthozoa
Demospongiae	Ascidiacea	Asteroidea	Articulata	Articulata
Gastropoda	Asteroidea	Bivalvia	Bivalvia	Ascidiacea
Bivalvia	Bivalvia	Demospongiae	Crinoidea	Bivalvia
Gymnolaemata	Crinoidea	Echinoidea	Demospongiae	Cephalopoda
Hydrozoa	Crustacea	Gastropoda	Echinoidea	Crinoidea

Tristan	Nightingale	Inaccessible	Gough	South Georgia (for interest)
Malacostraca	Demospongiae	Gymnolaemata	Gastropoda	Demospongiae
Pisces	Echinoidea	Hydrozoa	Gymnolaemata	Echinoidea
Polychaeta	Gastropoda	Malacostraca	Holothuroidea	Gastropoda
Sipunculida	Gymnolaemata	Pisces	Hydrozoa	Gymnolaemata
Stellasteroidea	Holothuroidea	Polychaeta	Malacostraca	Holothuroidea
	Hydrozoa	Scaphopod	Maxillopoda	Hydrozoa
	Malacostraca	Stellasteroidea	Pisces	Malacostraca
	Pisces	Thaliacia	Polychaeta	Pisces
	Polychaeta		Sipunculida	Polychaeta
	Polyplacophora		Stellasteroidea	Priapulida
	Stellasteroidea		Thaliacia	Pycnogonida
	Thaliacia			Sipunculida
				Stellasteroidea
				Turbellaria
11	18	13	17	20

2. SUCS

Time	Time	Latitude	Longitude	Station	Event	Water depth	Action
25/05/2013 09:25	92524.77	-37.1238	-12.2105	Tristan_4	92	110.96	SUCS recovered
25/05/2013 06:59	65955.97	-37.1233	-12.2103	Tristan_4	92	119.81	SUCS deployed
24/05/2013 18:33	183310.4	-37.2756	-12.6457	Inaccessible_3	85	124.14	SUCS recovered
24/05/2013 16:52	165200.8	-37.2755	-12.6446	Inaccessible_3	85	125.48	SUCS deployed
24/05/2013 11:43	114324.2	-37.3443	-12.6635	Inaccessible_2	84	164.99	SUCS recovered
24/05/2013 10:40	104029	-37.3443	-12.6632	Inaccessible_2	84	164.24	SUCS deployed
24/05/2013 04:00	40003.77	-37.3136	-12.6002	Inaccessible_1	78		SUCS recovered

Time	Time	Latitude	Longitude	Station	Event	Water depth	Action
24/05/2013 02:03	20351.17	-37.3128	-12.5997	Inaccessible_1	78	155.81	SUCS deployed
23/05/2013 14:58	145807.4	-37.443	-12.502	Nightingale_3	77	121	SUCS recovered
23/05/2013 12:53	125327.8	-37.4433	-12.5009	Nightingale_3	77	114.83	SUCS deployed
23/05/2013 10:13	101311	-37.4456	-12.5116	Nightingale_3	75	148.14	SUCS recovered
23/05/2013 09:33	93340.37	-37.4456	-12.5114	Nightingale_3	75	149	SUCS deployed
23/05/2013 03:24	32400.77	-37.3396	-12.5004	Nightingale_2	71	178.35	SUCS recovered
23/05/2013 01:41	14141.57	-37.3401	-12.5	Nightingale_2	71	169.75	SUCS deployed
22/05/2013 17:17	171712.8	-37.4132	-12.5136	Nightingale_1	65	147	SUCS recovered
22/05/2013 15:54	155436.2	-37.4141	-12.5136	Nightingale_1	65	142.83	SUCS deployed
22/05/2013 11:30	113033.8	-37.0465	-12.3119	Tristan_3	64	0	SUCS recovered
22/05/2013 09:43	94318.77	-37.0471	-12.3121	Tristan_3	64	211.62	SUCS deployed
22/05/2013 06:56	65648.77	-37.0994	-12.3651	Tristan_2	62	173.46	SUCS recovered
22/05/2013 05:29	114830.2	-37.1235	-12.2106	Tristan_2	62	206	SUCS deployed
22/05/2013 02:27	22715.17	-37.1644	-12.3335	Tristan_1	61	146.3	SUCS recovered
22/05/2013 00:31	3127.77	-37.164	-12.3344	Tristan_1	61	130	SUCS deployed
21/05/2013 03:11	31115.77	-38.7362	-11.7124	Esk Guyot	59	295	SUCS recovered
21/05/2013 01:43	14304.37	-38.7359	-11.7127	Esk Guyot	59	295.22	SUCS deployed
19/05/2013 23:35	233557.2	-40.2449	-9.94863	Gough_3	51	187	SUCS deployed
19/05/2013 20:36	204609.2	-40.3151	-10.0547	Gough_2	50	171	SUCS deployed
19/05/2013 20:36	220857.8	-40.3154	-10.0543	Gough_2	50	170	SUCS recovered
19/05/2013 01:17	11758.37	-40.389	-9.8842	Gough_1	43	214	SUCS recovered
18/05/2013 23:18	231823.6	-40.389	-9.88522	Gough_1	43	180	SUCS deployed

3. AGT

Time	Time	Latitude	Longitude	Station	Event	Depth	Speed	Wire out	Action
25/05/2013 11:48	114830.2	-37.1235	-12.2106	Tristan 4_3	95	90	0.9	-18	AGT on deck
25/05/2013 11:42	114205	-37.1235	-12.2106	Tristan 4_3	95	90	0.8	112	AGT off bed
25/05/2013 11:30	113053	-37.1234	-12.2106	Tristan 4_3	95	90	1.33	161	AGT stop trawl
25/05/2013 11:27	112743.4	-37.123	-12.2104	Tristan 4_3	95	90	0.93	161	AGT start trawl
25/05/2013 11:25	112526.6	-37.1227	-12.2103	Tristan 4_3	95	90	1.42	100	AGT on bottom
25/05/2013 11:21	110645.8	-37.1222	-12.2101	Tristan 4_3	95	90	0.52	-18	AGT deployed
25/05/2013 11:06	110633.8	-37.1222	-12.21	Tristan 4_2	94	90	0.61	-18	AGT on deck
25/05/2013 11:00	110053	-37.1222	-12.2101	Tristan 4_2	94	90	0.34	108	AGT off bed
25/05/2013 10:51	105149.4	-37.1219	-12.2099	Tristan 4_2	94	90	0.66	160	AGT stop trawl
25/05/2013 10:51	105103.8	-37.1218	-12.2099	Tristan 4_2	94	90	0.9	160	AGT start trawl
25/05/2013 10:48	191748.2	-36.9639	-12.0477	Tristan 4_2	94	95	0.5		AGT start trawl
25/05/2013 10:46	104651.8	-37.1213	-12.2096	Tristan 4_2	94	95	0.64	101	AGT on bottom
25/05/2013 10:42	104227.8	-37.1209	-12.2095	Tristan 4_2	94	95	0.83	-12	AGT deployed
25/05/2013 10:26	191438.6	-36.9637	-12.0487	Tristan 4	93	85	-0.62		AGT on deck
25/05/2013 10:21	102115.8	-37.119	-12.2087	Tristan 4	93	90	0.73	74	AGT off bed
25/05/2013 10:12	101236.2	-37.1185	-12.2084	Tristan 4	93	100	1.07	150	AGT stop trawl
25/05/2013 10:09	102121.8	-37.119	-12.2087	Tristan 4	93	100	0.82	73	AGT start trawl
25/05/2013 10:08	100812.2	-37.1179	-12.2081	Tristan 4	93	100	0.63	133	AGT on bottom
25/05/2013 10:03	100312.2	-37.1175	-12.2078	Tristan 4	93	100	0.58	-11	AGT deployed
24/05/2013 20:39	203926.6	-37.272	-12.6506	Inaccessible 3_3	89	130		-6	AGT on deck
24/05/2013 20:35	203551.8	-37.272	-12.6502	Inaccessible 3_3	89	130	0.81	128	AGT off bed
24/05/2013 20:33	203323	-37.272	-12.65	Inaccessible 3_3	89	130	0.67	200	AGT stop trawl
24/05/2013 20:26	202621.8	-37.272	-12.6478	Inaccessible 3_3	89	135	1.22	200	AGT start trawl
24/05/2013 20:24	202426.6	-37.272	-12.6474	Inaccessible 3_3	89	135	0.72	139	AGT on bottom
24/05/2013 20:20	202028.4	-37.272	-12.647	Inaccessible 3_3	89	130	0.71	2	AGT deployed

Time	Time	Latitude	Longitude	Station	Event	Depth	Speed	Wire out	Action
24/05/2013 20:08	200848.2	-37.2738	-12.6466	Inaccessible 3_2	88	131	0.9	-6	AGT on deck
24/05/2013 20:05	200524.2	-37.2738	-12.6463	Inaccessible 3_2	88	131	0.62	120	AGT off bed
24/05/2013 20:02	200239.8	-37.2738	-12.646	Inaccessible 3_2	88	131	0.72	200	AGT stop trawl
24/05/2013 19:56	195617	-37.2738	-12.6439	Inaccessible 3_2	88	131	0.77	200	AGT start trawl
24/05/2013 19:54	195436.2	-37.2738	-12.6436	Inaccessible 3_2	88	131	0.55	141	AGT on bottom
24/05/2013 19:49	194912.8	-37.2738	-12.6431	Inaccessible 3_2	88	131	0.28	-17	AGT deployed
24/05/2013 19:36	193633.2	-37.2756	-12.6428	Inaccessible 3_1	87	125	0.78	-8	AGT on deck
24/05/2013 19:33	193305.6	-37.2756	-12.6424	Inaccessible 3_1	87	132	0.75	118	AGT off bed
24/05/2013 19:30	193010.4	-37.2756	-12.6421	Inaccessible 3_1	87	132	0.64	200	AGT stop trawl
24/05/2013 19:24	192414	-37.2756	-12.6402	Inaccessible 3_1	87	132	1.01	200	AGT start trawl
24/05/2013 19:22	192239.2	-37.2756	-12.6399	Inaccessible 3_1	87	132	0.75	155	AGT on bottom
24/05/2013 19:16	191648.8	-37.2756	-12.6393	Inaccessible 3_1	87	132	0.74	-16	AGT deployed
24/05/2013 19:08	190846.4	-37.2756	-12.6392	Inaccessible 3_1	86		0.35	-4	AGT washed
24/05/2013 06:50	65034.97	-37.3216	-12.6075	Inaccessible_1_3	82	160	0.87	-5	AGT on deck
24/05/2013 06:46	64627.77	-37.3213	-12.6072	Inaccessible_1_3	82	160	0.96	151	AGT off bed
24/05/2013 06:42	64213.37	-37.3211	-12.6069	Inaccessible_1_3	82	160	1.4	240	AGT stop trawl
24/05/2013 06:38	63852.97	-37.3204	-12.6061	Inaccessible_1_3	82	160	1.18	240	AGT start trawl
24/05/2013 06:35	63548.17	-37.3201	-12.6057	Inaccessible_1_3	82	160	0.64	168	AGT on bottom
24/05/2013 06:30	63054.17	-37.3198	-12.6053	Inaccessible_1_3	82	160	0.5	7	AGT deployed
24/05/2013 05:35	53502.57	-37.3191	-12.6044	Inaccessible_1_2	80	160	0.42	-12	AGT on deck
24/05/2013 05:29	52952.97	-37.3187	-12.6041	Inaccessible_1_2	80	160	0.42	171	AGT off bed
24/05/2013 05:26	52618.17	-37.3183	-12.6038	Inaccessible_1_2	80	160	1.07	240	AGT stop trawl
24/05/2013 05:20	52058.97	-37.3171	-12.6029	Inaccessible_1_2	80	160		240	AGT start trawl
24/05/2013 05:17	51745.77	-37.3166	-12.6026	Inaccessible_1_2	80	160	0.53	175	AGT on bottom
24/05/2013 05:10	51054.17	-37.3161	-12.6022	Inaccessible_1_2	80	160	0.39	-6	AGT deployed
24/05/2013 04:42	44252.97	-37.3158	-12.602	Inaccessible_1	79	160	0.45	-10	AGT on deck
24/05/2013 04:37	43750.57	-37.3154	-12.6017	Inaccessible_1	79	160	0.36	168	AGT off bed
24/05/2013 04:34	43401.37	-37.3151	-12.6015	Inaccessible_1	79	160	1.09	240	AGT stop trawl

Time	Time	Latitude	Longitude	Station	Event	Depth	Speed	Wire out	Action
24/05/2013 04:31	43150.57	-37.3146	-12.601	Inaccessible_1	79	160	0.98	240	AGT start trawl
24/05/2013 04:28	42838.57	-37.3142	-12.6007	Inaccessible_1	79	160	0.15	169	AGT on bottom
24/05/2013 04:21	42133.77	-37.3137	-12.6003	Inaccessible_1	79	160	0.27	-8	AGT deployed
23/05/2013 06:13	61341.57	-37.3082	-12.491	Nightingale 2_3	74	200	0.39	-14	AGT on deck
23/05/2013 06:07	60758.37	-37.3087	-12.4908	Nightingale 2_3	74	200	0.63	188	AGT off bed
23/05/2013 06:02	60212.77	-37.3092	-12.4906	Nightingale 2_3	74	200	1.22	300	AGT stop trawl
23/05/2013 05:56	55642.77	-37.3107	-12.4902	Nightingale 2_3	74	200	1.27	300	AGT start trawl
23/05/2013 05:53	55301.97	-37.3113	-12.49	Nightingale 2_3	74	200		212	AGT on bottom
23/05/2013 05:43	54330.77	-37.312	-12.4897	Nightingale 2_3	74	200	0.21	-14	AGT deployed
23/05/2013 05:19	51925.97	-37.3183	-12.5019	Nightingale 2_2	73	200	0.34	-6	AGT on deck
23/05/2013 05:13	51333.17	-37.3188	-12.5017	Nightingale 2_2	73	200	0.92	208	AGT off bed
23/05/2013 05:09	50936.77	-37.3191	-12.5015	Nightingale 2_2	73	200	0.5	300	AGT stop trawl
23/05/2013 05:06	50643.97	-37.3198	-12.501	Nightingale 2_2	73	200	1 kt	300	AGT start trawl
23/05/2013 05:03	50324.77	-37.3202	-12.5007	Nightingale 2_2	73	202		220	AGT on bottom
23/05/2013 04:52	45218.77	-37.321	-12.5001	Nightingale 2_2	73	202	1.1	-19	AGT deployed
23/05/2013 04:20	45133.17	-37.321	-12.5	Nightingale 2_1	72	180	0.42	-19	AGT on deck
23/05/2013 04:09	40930.77	-37.3378	-12.5016	Nightingale 2_1	72	180		169	AGT off bed
23/05/2013 04:05	40519.97	-37.3381	-12.5014	Nightingale 2_1	72	180	0.96	270	AGT stop trawl
23/05/2013 04:01	40146.37	-37.3389	-12.5008	Nightingale 2_1	72	180	0.81	270	AGT start trawl
23/05/2013 03:58	35828.37	-37.3393	-12.5006	Nightingale 2_1	72	180	0.71	183	AGT on bottom
23/05/2013 03:49	34928.37	-37.3396	-12.5004	Nightingale 2_1	72	180	0.48	-18	AGT deployed
22/05/2013 20:20	202006.2	-37.407	-12.5101	Nightingale 1_3	68	134	-0.11	-15	AGT on deck
22/05/2013 20:15	201514.6	-37.4074	-12.5101	Nightingale 1_3	68	134	-0.14	128	AGT off bed
22/05/2013 20:10	201047	-37.4078	-12.5101	Nightingale 1_3	68	134		201	AGT stop trawl
22/05/2013 20:08	200843.4	-37.4084	-12.5101	Nightingale 1_3	68	134	0.59	201	AGT start trawl
22/05/2013 20:05	172611.6	-37.4144	-12.5136	Nightingale 1_3	68	134	-0.92	140	AGT on bottom
22/05/2013 19:56	195651.2	-37.4097	-12.51	Nightingale 1_3	68	134	-0.6	-20	AGT deployed

Time	Time	Latitude	Longitude	Station	Event	Depth	Speed	Wire out	Action
22/05/2013 19:21	192150	-37.4146	-12.5059	Nightingale 1_2	67	100	-0.18	-13	AGT on deck
22/05/2013 19:18	191810.4	-37.4149	-12.5059	Nightingale 1_2	67	100	-0.01	102	AGT off bed
22/05/2013 19:14	191452.4	-37.4152	-12.5059	Nightingale 1_2	67	101	0.55	153	AGT stop trawl
22/05/2013 19:12	191203.2	-37.416	-12.5059	Nightingale 1_2	67	101	0.11	153	AGT start trawl
22/05/2013 19:09	190929.6	-37.4163	-12.5059	Nightingale 1_2	67	101	-0.12	105	AGT on bottom
22/05/2013 19:02	190224.8	-37.4169	-12.5059	Nightingale 1_2	67	101	-0.23	-21	AGT deployed
22/05/2013 17:55	175545.2	-37.4136	-12.5136	Nightingale 1_1	66	140	0.25	-10	AGT on deck
22/05/2013 17:51	175156	-37.4139	-12.5136	Nightingale 1_1	66	140	0.46	128	AGT off bed
22/05/2013 17:48	174818.8	-37.4144	-12.5136	Nightingale 1_1	66	120	0.89	180	AGT stop trawl
22/05/2013 17:46	174600.8	-37.415	-12.5136	Nightingale 1_1	66	120	1.22	180	AGT start trawl
22/05/2013 17:42	174250	-37.4155	-12.5136	Nightingale 1_1	66	120	0.34	138	AGT on bottom
22/05/2013 17:37	173741.6	-37.4159	-12.5136	Nightingale 1_1	66	120		-5	AGT deployed
20/05/2013 13:59	135900.8	-40.3094	-10.0495	Gough 2_1	58	166	0.78	-14	AGT on deck
20/05/2013 13:54	135414	-40.3091	-10.0498	Gough 2_1	58	166	0.49	146	AGT off bed
20/05/2013 13:49	134906.8	-40.3089	-10.0503	Gough 2_1	58	166	1.1	250	AGT stop trawl
20/05/2013 13:46	134717.6	-40.3086	-10.0508	Gough 2_1	58	166	1.18	250	AGT start trawl
20/05/2013 13:42	134232	-40.3081	-10.0514	Gough 2_1	58	166	0.6	170	AGT on bottom
20/05/2013 13:36	133655.4	-40.3079	-10.0519	Gough 2_1	58	166	0.34	-13	AGT deployed
20/05/2013 11:40	131053.6	-40.3078	-10.052	Gough_3_3	56	148		-1	AGT on deck
20/05/2013 11:35	113515.8	-40.2509	-9.94747	Gough_3_3	56	148	0.53	152	AGT off bed
20/05/2013 11:30	113001.4	-40.2506	-9.94827	Gough_3_3	56	148	1.18	225	AGT stop trawl
20/05/2013 11:27	112709.8	-40.2503	-9.94902	Gough_3_3	56	149	0.62	218	AGT start trawl
20/05/2013 11:24	112411.6	-40.2502	-9.9493	Gough_3_3	56	149	0.68	139	AGT on bottom
20/05/2013 11:19	130554.8	-40.3078	-10.052	Gough_3_3	56	151	-0.16		AGT deployed
20/05/2013 10:53	105327.8	-40.2468	-9.94918	Gough_3_2	55	165	0.59	-19	AGT on deck
20/05/2013 10:47	104721.8	-40.2465	-9.94968	Gough_3_2	55	167	0.45	164	AGT off bed
20/05/2013 10:39	103903.8	-40.246	-9.95044	Gough_3_2	55	163	1.03	260	AGT stop trawl

Time	Time	Latitude	Longitude	Station	Event	Depth	Speed	Wire out	Action
20/05/2013 10:37	103757.8	-40.2458	-9.95075	Gough_3_2	55	169	1.01	260	AGT start trawl
20/05/2013 10:33	103327.8	-40.2454	-9.95126	Gough_3_2	55	177	0.24	185	AGT on bottom
20/05/2013 10:25	102527.8	-40.245	-9.95197	Gough_3_2	55	175	0.22	-18	AGT deployed
20/05/2013 09:42	94242.77	-40.2584	-9.92548	Gough_3	54	115		-18	AGT on deck
20/05/2013 09:38	93837.97	-40.2582	-9.92585	Gough_3	54	112	0.31	103	AGT off bed
20/05/2013 09:30	93029.57	-40.2578	-9.92656	Gough_3	54	120		201	AGT stop trawl
20/05/2013 09:25	92513.97	-40.2571	-9.92791	Gough_3	54	120	0.41	201	AGT start trawl
20/05/2013 09:21	92107.97	-40.2567	-9.92851	Gough_3	54	120	0.32	142	AGT on bottom
20/05/2013 09:10	91052.37	-40.2564	-9.92915	Gough_3	54	119	-0.04	-18	AGT deployed
20/05/2013 09:06	90634.37	-40.2564	-9.92916	Gough_3	53	120	-0.01	-2	AGT on deck
20/05/2013 09:01	90152.37	-40.2564	-9.92917	Gough_3	53	119	-0.09	118	AGT off bed
20/05/2013 08:35	83558.97	-40.2563	-9.92936	Gough_3	53	120	0.03	175	AGT on bottom
20/05/2013 08:30	83020.57	-40.256	-9.92987	Gough_3	53	119	0.06	-2	AGT deployed
19/05/2013 02:02	20239.17	-40.3887	-9.88769	Gough_1	44	170	0.64	6	AGT Recovered
19/05/2013 01:57	15728.37	-40.3888	-9.88712	Gough_1	44	170	0.87	182	AGT off bed
19/05/2013 01:53	15329.57	-40.3887	-9.88666	Gough_1	44	170	1.61		AGT stop trawl
19/05/2013 01:51	15143.97	-40.3887	-9.88599	Gough_1	44	170	1.36	260	AGT start trawl
19/05/2013 01:49	14945.17	-40.3887	-9.88558	Gough_1	44	170	0.69	217	AGT on bottom
19/05/2013 01:44	14419.97	-40.3888	-9.88499	Gough 1	44	175	0.82	33	AGT deployed

4. RMT8

Time	Time	Latitude	Longitude	Station	Event	Action
25/05/2013 00:15	1500.77	-37.3716	-12.69271	Inaccessible 2	91	RMT8 recovered
24/05/2013 23:36	233600.8	-37.3486	-12.66955		91	RMT8 deployed Net 1 opened 23:44 at 100m Net 1 closed 00:04 at 52m Net 2 not opened due to weather conditions
24/05/2013 22:18	221800.8	-37.2523	-12.6719	Inaccessible 3	90	RMT8 recovered
24/05/2013 21:26	212600.8	-37.2579	-12.62917		90	RMT8 deployed Net 1 opened 21:32 at 100m Net 1 closed 21:52 at 50m Net 2 opened 21:53 at 53m Net 2 closed 22:13 at 9m
24/05/2013 08:23	82300.17	-37.3399	-12.63196	Inaccessible 1	83	RMT8 recovered
24/05/2013 07:33	73300.17	-37.3147	-12.60163		83	RMT8 deployed Net 1 opened 7:38 at 99m Net 1 closed 7:58 at 61m Net 2 opened 7:58 at 62m Net 2 closed 8:18 at 20m
23/05/2013 00:10	1000.77	-37.3107	-12.47141	Nightingale 2	70	RMT8 recovered
22/05/2013 23:19	231900.8	-37.3407	-12.49277		70	RMT8 deployed Net 1 opened 23:24 at 100m
Time	Time	Latitude	Longitude	Station	Event	Action

						Net 1 closed 23:44 at 51m Net 2 opened 23:44 at 55m Net 2 closed 00:04 at 10m
22/05/2013 21:45	214500.8	-37.3783	-12.51034	Nightingale 1	69	RMT8 recovered
22/05/2013 20:55	205500.2	-37.4114	-12.51255		69	RMT8 deployed Net 1 opened 20:59 at 102m
20/05/2013 07:00	70000.77	-40.2692	-9.90876	Gough 3	52	RMT8 recovered
20/05/2013 06:11	61100.77	-40.2454	-9.94558		52	RMT8 deployed Net1 opened 6:15 at 100m Net1 closed 6:35 at 50m Net2 opened 6:36 at 55m Net2 closed 6:55 at 10m
19/05/2013 20:00	200000.8	-40.3616	-10.0628	Gough 2	49	RMT8 recovered
19/05/2013 19:05	190500.2	-40.3209	-10.05662		49	RMT8 deployed Net1 opened 19:14 at 200m Net1 closed 19:35 at 100m Net2 opened 19:36 at 107m Net2 closed 19:56 at 10m
19/05/2013 07:12	71200.77	-40.3856	-9.92967	Gough 1	46	RMT8 recovered
19/05/2013 06:26	62600.77	-40.3885	-9.88525		46	RMT8 deployed Net 1 opened 6:31 at 100m Net 1 closed 6:51 at 50m Net 2 opened 6:52 at 56m Net 2 closed 7:12 at 10m

5. CTD

Time	Time	Latitude	Longitude	Station	Event	Depth	Comment	Comment
23/05/2013 10:33	103323	-37.4456	-12.5116	Nightingale_3	76	150	CTD for Nightingable	CTD in marginal conditions
20/05/2013 13:12	131208	-40.3078	-10.052	Gough_2	57	165	CTD for Gough	
07/05/2013 08:14	222020.6	-54.5621	-35.5836	Drygalski _SG37	14	307	CTD for Drygalski	CTD went to 253