RRS Discovery 100 survey report: Marine Biodiversity of Tristan da Cunha and St Helena

Blue Belt Programme: RRS Discovery DY100 survey report CR155

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Cefas


Foreign &
Commonwealth
Office


Marine
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Organisation


British
Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL


St Helena
GOVERNMENT


RSPB


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1.0 Introduction

1.1 Blue Belt Programme

The Blue Belt Programme supports the delivery of the UK Government's commitment to enhance marine protection of over 4,000,000 km^2 of marine environment across UK Overseas Territories (UKOTs). The programme currently includes the Pitcairn Islands, British Antarctic Territory, South Georgia and the South Sandwich Islands, Tristan da Cunha, St Helena, Ascension Island and the British Indian Ocean Territory (Figure 1). The main aim of the programme is to assist and support UKOTs to manage human activities, while sustainably developing their local economies and protecting vulnerable ecosystems (Blue Belt Programme Annual Update, 2018).

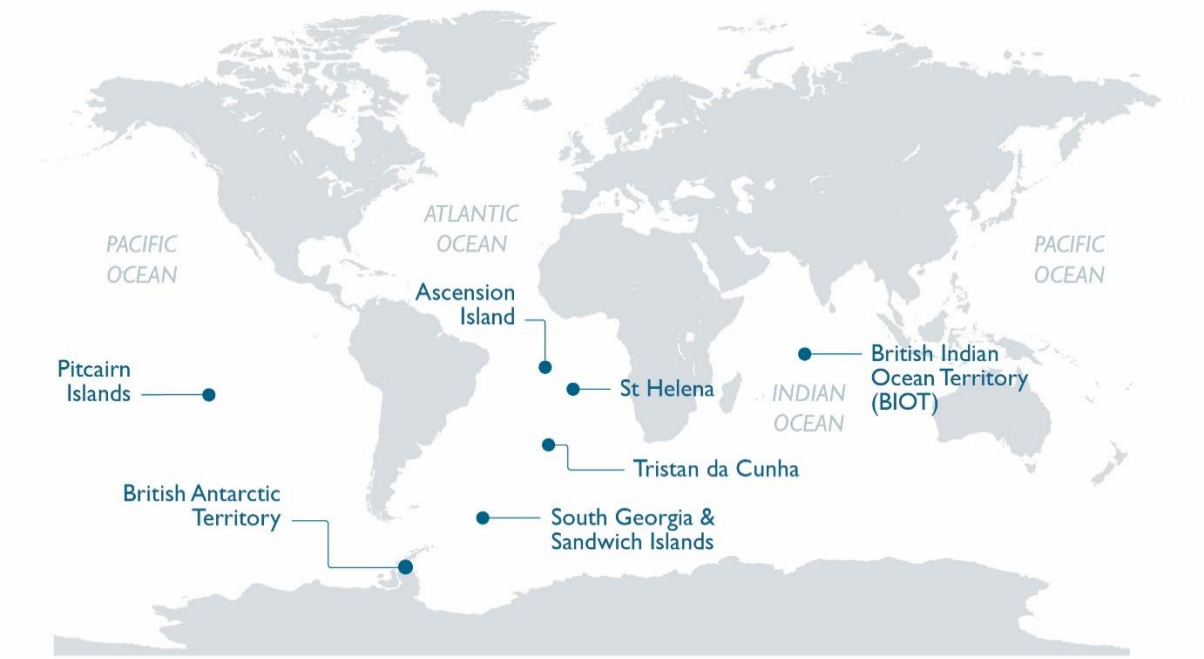


Figure 1 Location of the UK Overseas Territories currently within the Blue Belt Programme

1.2 British Antarctic Survey Official Development Assistance Programme

British Antarctic Survey's (BAS) core funding has been allocated to supporting development needs in Tristan da Cunha and St Helena. BAS Official Development Assistance programme (ODA) research was underpinned by access to the National Environmental Research Council (NERC) research vessels, large scale National UK Capability that could be utilised to support Island Blue Belt priorities. The collaboration between the BAS ODA programme and the Cefas/MMO implementation of the Blue Belt program hugely increased the benefit of this UK funding to the Island Territories.

1.3 Discovery 100 Marine Survey

In partnership with the Foreign and Commonwealth Office, several of the UK Overseas Territories have committed to developing marine protection strategies for their maritime zones by 2020. In support of this objective, the Centre for Environment, Fisheries and Aquaculture Science (Cefas) led, in partnership with BAS, the Natural History Museum (NHM), Royal

Society for the Protection of Birds (RSPB), The Government of Tristan da Cunha and the Government of St Helena, a multidisciplinary marine survey designed to fill some of the most pressing gaps in understanding of their marine environments. The survey onboard RRS *Discovery* cruise is one in a series to visits to Tristan da Cunha and St Helena. Previous surveys have included the 2013 *RRS James Clark Ross,* Nat Geo Pristine Seas 2017, and the 2018 ODA/BB RRS *James Clark Ross* survey. Key aims are to collect data to increase our understanding of seamount topography and communities; pelagic food webs and water quality.

1.4 Tristan da Cunha

Figure 2 Tristan da Cunha

The biodiversity of the Tristan da Cunha seamounts is almost totally unknown, excepting data collected during JR17-004 and a small number of historic research expeditions. Historic catch data provides very little information, if any, on the composition of non-target species in catches. Consequently, there is a serious risk that demersal fisheries will not be managed effectively in the context of an ecosystem approach to fisheries. The Blue Belt/ BAS Overseas Development Assistance (ODA) programme represents a timely opportunity to address these data deficiencies and support the Tristan da Cunha Government in creating a robust, evidence-based marine management plan.

There is also serious concern that bottom trawling could have a significant impact on benthic communities. Collecting data on the known and inferred distribution of already identified vulnerable marine ecosystems (VMEs) will provide vital evidence to support the Tristan da Cunha Government in the development of any future marine protection strategy.

1.5 St Helena

Figure 3 St Helena

Pelagic fisheries for yellowfin, skipjack, bigeye and albacore tuna are one of the main sources of income for St Helena, either through sport fishing or commercial landings. Preliminary tagging data suggest a high residency of yellowfin tuna around St Helena (programme ongoing). This has significant management implications and differs from assumptions

currently accepted i.e. that yellowfin tuna stocks are highly migratory. This intensifies the need for understanding of tuna life history around St Helena and necessitates other wide-ranging considerations, such as the fishing pressure upon key tuna prey species like scad.

An increase in our knowledge of the how seabed features such as seamounts influence pelagic foodwebs and are utilised by large pelagic species will help establish the links between environmental conditions and tuna distribution. Therefore, increasing the evidence on which future habitat protection and fisheries management scenarios can be developed.

1.6 Survey Crew

Table 1 Survey crew, affiliation and role onboard.

Name	Institute	Role
Martin Collins	Cefas	Principal Scientific Officer & Cefas Principle Investigator
Paul Whomersley	Cefas	Cefas Scientist in Charge
Simon Morley	BAS	BAS Principal Investigator
James Bell	Cefas	Benthic ecology; habitat mapping; fisheries
Vladimir Laptikhovsky	Cefas	Benthic & pelagic biodiversity; fisheries
Tammy Stamford	Cefas	Marine advisor (St Helena Leg only)
Fabio Campanella	Cefas	Pelagic biodiversity and acoustics
Dave Barnes	BAS	Benthic ecologist
Gabi Stowasser	BAS	Food web ecologist
Alison Pettafor	Cefas	Bathymetric data acquisition processing
Bjorg Appland	BAS	Scientific deck operations
Gareth Flint	BAS	Scientific deck operations
Kerry Howell	UP	Benthic ecologist
Gemma Kiff	Cefas	Data management & communications
Andy Schofield	RSPB	Seabird/ mammal observer
Stephanie Martin	TDCG	Seabird/ mammal observer
Jon Ablett	NHM	Pelagic ecology and taxonomy
James Maclaine	NHM	Pelagic ecology and taxonomy
Kirsty Lloyd	NHM	Bio-archiving
Warren Glass	TDCG	Tristan da Cunha Fisheries
Adrian Swain	TDCG	Tristan da Cunha Fisheries
Julian Repetto	TDCG	Tristan da Cunha Conservation
Alison Small	SHG	Oceanography
Leeann Henry	SHG	Pelagic & benthic ecology
Jamie Ellick	SHG	Deck operations
Elizabeth Clingham	SHG	Blue Belt Co-ordinator / Marine Ecologist

Name	Institute	Role
Rhys Hobbs	SHG	ST Helena Government
Philip Leat	BAS	Bathymetric data processing
John Wynar	NOC	CTD Technical supervisor
Dan Comben	NOC	Operations manager
Nathan Truelove	Stanford Uni	eDNA collection
Jennifer Ward-Neale	NOC	IT Support
Martin Bridger	NOC	IT Support

2.0 DY100 Survey Objectives and Outcomes

Table 2 Survey objectives and outcomes.

Number	Survey Objective	Survey outcome
1	Collection of Multibeam Bathymetric data from prioritised seamount habitats	• To increase our understanding of the complexity and location of these seabed structures • To correlate seabed features with known fishing activity • To acoustically map seamount habitats found within the EEZs of Tristan da Cunha and St Helena
2	The collection of benthic epifaunal species using an Agassiz trawl	• To identify the occurrence of key benthic invertebrate species • Validate an existing benthic terrain model • Groundtruth underwater still imagery
3	The collection of underwater still images using the BAS SUCS	• To validate an existing benthic terrain model and bathymetric multibeam data • Increase our understanding of benthic species diversity • Increase or understanding of species and habitat distribution • To assess the impact of trawl fishing on seamount habitats and species
4	The collection of pelagic specimens using the RMT 25	• To increase our understanding of pelagic species diversity • Increase our understanding of species distribution within pelagic environments

Number	Survey Objective	Survey outcome
		• To increase our understanding of the effects of seamount habitats on species diversity and ocean productivity • Groundtruth targets identified during fisheries acoustic surveys
5	The collection of oceanographic data and water samples.	• To increase our understanding of oceanographic conditions around Tristan da Cunha, St Helena and associated seamount habitats. • To use the information collected to validate an existing ocean circulation model • To investigate the application of eDNA to assess marine biodiversity • To increase our understanding of pelagic foodwebs • To increase our understanding of oceanographic parameters from different pelagic habitats and environments • To assess water quality around St Helena
6	The collection of fisheries acoustic data.	• To identify the presence and location within the water column of key pelagic species, including prey species for large pelagic predators • To investigate causes of differences in marine mammal and bird feeding distributions between years.
7	Increase the marine habitats and species evidence base for Tristan da Cunha and St Helena	• To support evidence-based decision making in relation to the management and protection of marine habitats, species and fisheries resources

3.0 Survey Equipment and Methodologies

3.1 Multibeam Bathymetry

Bathymetric data was collected using 2 hull-mounted Kongsberg echosounders (Figure 4 and Table 3)

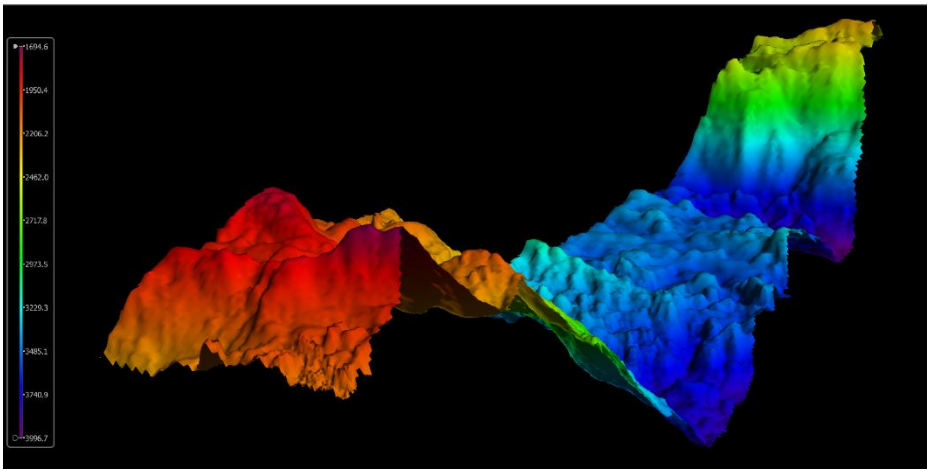


Figure 4 An example of multibeam bathymetric data collected during the transit between Falklands Island and Tristan da Cunha as RRS Discovery transited over the Mid Atlantic ridge.

Table 3 Echosounder and depth bands

Echosounder	Depth Band
1º x 1º EM122	50-7000m
2 º x 2 º EM710	5-800m

The echosounders were operated using Kongsberg Seafloor Information System (SIS) and Helmsman software. Acquisition settings and filters were adjusted as required as dictated by weather conditions, sea state, and ocean depth. Changes to acquisition parameters, sea-state conditions, sound velocity profiles and salinity values were logged using the RRS *Discovery's* digital event logging system and paper survey line logs.

To ensure that the Multibean Echosounder MBES system was fully calibrated a Sound Velocity Profile (SVP) was conducted before the start of each MBES survey. Multibeam Echosounder data was also collected during all transits. Live sound velocity data was also acquired through the SSVtoSIS application.

3.2 Shelf Underwater Camera System

The Shelf Underwater Camera System (SUCS) (Figure 5) comprises of three units:

1. UIC unit comprising (i) PC & monitors, (ii) deck box and (iii) aux hard drive.

2. Deck unit consisting of the (i) winch, (ii) UW cable, (iii) deck monitor and (iv) cable pulleys on ships gantry.

3. UW unit consisting of a tripod holding the (i) UW housing including camera, booster & power distribution board, (ii) UW lights and (iii) USBL beacon.

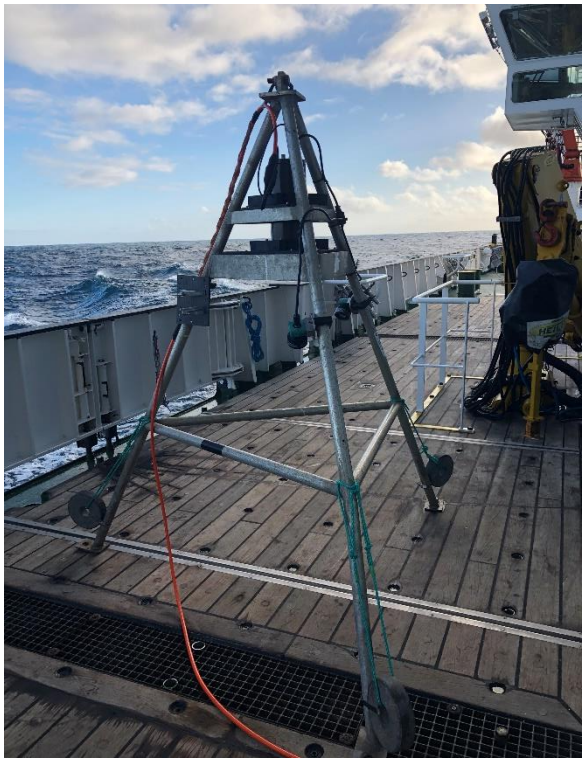


Figure 5 British Antarctic Survey Shelf Underwater Camera System.

The BAS SUCS can make seafloor observations down to 1000 m. The Shelf Underwater Camera System deployment sites were selected based on bathymetric seabed data and benthic habitat model predictions. The SUCS was deployed to the seabed once settled on the seabed a still image was captured,10-20 habitat and species targeted still images were captured during in each deployment. The images collected will be used to undertake a robust assessment of the biodiversity of the major fishing grounds at Tristan da Cunha and the shelf and seamount habitats associated with St Helena. Key information derived from the still images includes habitat type (substratum nature, particle size and rugosity), estimates of faunal density and taxon composition of the benthos.

3.3 Agassiz Benthic Trawl

The mini Agassiz trawl (AGT) (Figure 6) has a mesh size of 1 cm and a mouth width of 1.25 m. Trawl stations were slightly offset from the deployment of the SUCS and chosen by examining features shown on multibeam sonar (swath) imagery. This was done to ensure safe deployment and so the samples of benthic organisms could be used to validate and aid in the identification of morphospecies identified during SUCs deployments. Infaunal specimens which cannot be surveyed by videogrammetric methods were also collected using the Agassiz Trawl. Additional information including biometric measurements were also taken.

Figure 6 Agassiz trawl, deployed to collect epibenthic and infaunal benthic samples.

The deployment protocol of the mini AGT from the RRS *Discovery* deviated slightly from previous cruises. While the AGT was lowered, the ship was stationary until the AGT reached the seabed. The ship then moved at 0.5 knot as 500m of cable was laid on the sea floor. The ship then held position as the net was hauled using the winch only. The reduced size of the trawl and reduced trawling speed results in a slightly smaller catch, damages substantially less seafloor, but the quality of the catch is much higher.

Samples were sorted to class and where possible to morphotype. Most specimens were preserved in 99.8% ethanol (total vial volume at least 80% ethanol) and stored in the -20°C freezer, specimens too large for ethanol containers were directly frozen at -20°C, and a selection of specimens were frozen at -80°C for stable isotope analyses.

3.4 Rectangular Midwater Trawl

Pelagic trawl nets (25 m^2 aperture) or RMT 25 (Figure 7) were primarily deployed between dusk and dawn when meso-pelagic organisms (e.g. tunicates cnidarians, crustaceans fish species and cephalopods) were concentrated in surface layers. The RMT 25 (25m^2 opening) was rigged with 2 nets and deployments depth stratified (1000-700 m; 700-400m; 400-200m; 200m to surface). Hauls targeting specific acoustic signals were also conducted over and around the seamounts (Section 6.3). Opening and closing of the nets was controlled through the Down Wire Net Monitor system which also recorded depth, water flow through, temperature, salinity and Photosynthetically Active Radiation (PAR).

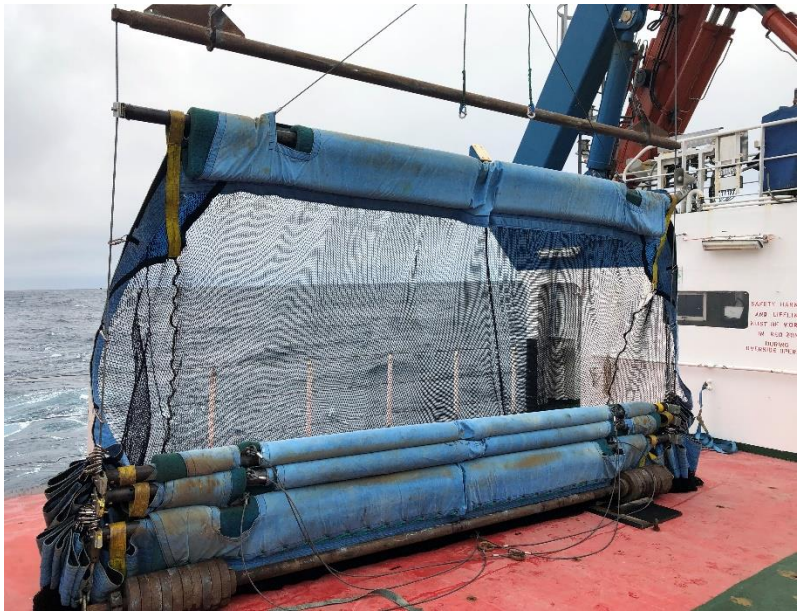


Figure 7.25m^2 Rectangular Midwater Trawl (RMT25) on the deck of RRS Discovery. The image shows the top net open.

Tows were selected to represent oceanic, shelf and seamount environments. Several tows were also selected to target acoustic signals identified using onboard fisheries acoustics. These tows were undertaken to groundtruth acoustics signals i.e. begin to identify the presence of pelagic species based on their acoustic echo.

Samples from the cod end were collected in separate buckets to ensure catches from the different depth bands remained separate. The catches were then weighed and photographed. Specimens were then identified to the highest taxonomic level possible, enumerated, weighed and photographed before being persevered. Where required a subsample of each species was preserved for isotope and genetic analysis.

3.5 Fisheries Acoustics

The focus of the acoustic sampling was to investigate the distribution patterns and density of fish and micronekton at the different seamounts in Tristan da Cunha and St Helena. The fisheries acoustic sampling was conducted using a SIMRAD EK60 hull-mounted echosounder at 6 frequencies (18, 38, 70, 120, 200, 333 kHz). The maximum logged depth was 1500 m and the ping rate used was between 2 and 4 seconds based on the depth of the study area. The slower ping rate was used at higher depths to avoid false bottom echo return. The survey was carried out primarily at night (~ 19:00 - 07:00) but additional data were also collected during the day when the EK60 was not interfering with the multibeam systems. A detailed list of the settings and parameters used during the survey is shown in Section 6.3.

3.6 Bongo Nets

To sample small mesozooplankton that was not sampled with the RMT 25 motion compensated Bongo nets (60 cm mouth opening, 2x 200µm mesh size cod ends) were deployed over two of the seamounts in each region (Figure 8). The Bongo nets were deployed to a depth of 200m. All samples were filtered through a 200µm mesh and the whole sample stored in seawater at -80°C until further analysis was carried out.

Figure 8 Motion compensated Bongo nets (60 cm mouth opening, 2x 200µm mesh size cod ends).

3.7 CTD Oceanographic Measurements

The availability of in situ oceanographic measurements is limited around both Tristan da Cunha and St Helena. Measurements of temperature and salinity and physical water samples were taken from several areas of each survey region to provide empirical validation of ocean circulation models under development at BAS.

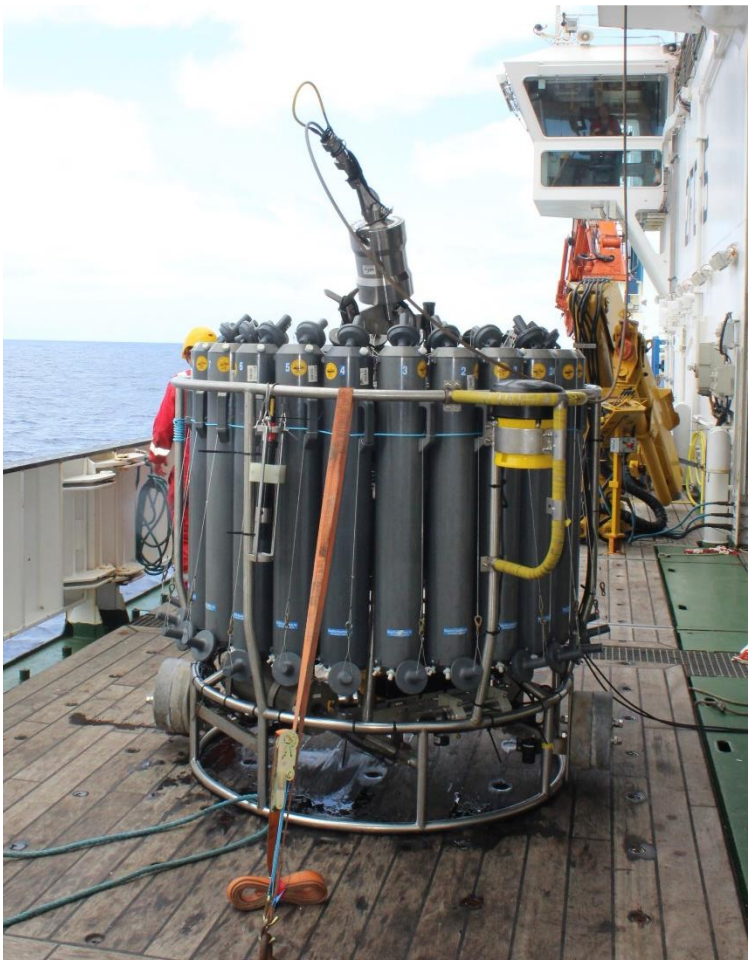


Figure 9 CTD unit with primed Niskin bottles.

In order to establish an isotopic baseline for the depth horizons where zooplankton samples originated from, corresponding particulate organic matter (POM) was collected. CTD deployments were carried out in deep water off the shelf and shallower water over the plateau of each of the seamounts (Figure 9). POM samples were obtained through filtering waters collected by Niskin bottles. Water was taken from various depths at each station. All water samples collected from Niskin bottles were processed on-board and filtered onto 47mm GF/F filters and frozen at -80°C.

eDNA samples were also extracted from water samples collected using the CTD. The samples were collected to assess the presence of sharks within the survey area. These samples were also filtered and frozen at -80°C.

3.8 Seabird and Marine Mammal Observations

During the transits between overseas territories and survey areas two observers were positioned on the bridge wings scanning for wildlife from 08:00-11:30 and 12:30-17:00 in Sea State 6 or less conditions. All observations were logged using GPS and identified to the highest taxonomic level.

3.9 CryoArcs Bio-Bank Project

3.9.1 CryArcs aims

CryoArks is a collaboration between Cardiff University, the University of Nottingham, the University of Edinburgh (Roslin Institute), the NHM, National Museums Scotland (NMS) and the Royal Zoological Society of Scotland (RZSS). As species and populations are disappearing from the wild, there is a clear and increasingly evident need to responsibly curate and make available samples from existing and future frozen collections. The CryoArks project was developed to address this need, to provide a sustainable resource of samples for genetics and genomics research on animal species.

The main aims of the project are to collate molecular samples, collections and data from UK universities, zoos, museums and institutes, with the intention to facilitate, centralise and increase access. This will involve leveraging the vast range of samples that have been collected in the past and sampling as many new species and populations from ex-situ collections over the coming years. Bringing these collections together, both physically and informatically, to provide a resource that will be responsibly managed but with the rights and responsibilities of scientists in mind.

The project will create the first conjoined UK national zoological biobank that crosses multiple institutions and that links their collections via a common database. Making rare and valuable samples, that would otherwise remain inaccessible, available to the research community. This will facilitate the responsible and sustainable use of these collections for a wide range of applications that will enhance fundamental research and species conservation.

3.9.2 CryArcs sample collection

Samples were collected from RMT 25 and Agassiz trawl deployments. The identification numbers of all voucher specimens sub-sampled were recorded so as each can be matched with its originator. Where the organism was too small for a viable subsample to be taken the whole organism was collected. Representative samples of all major taxa were collected, and most species were sampled.

All specimens were photographed before subsampling and the taxonomists were consulted before any dissection took place to ensure preservation of features that are important in

identification. Where possible multiple tissue samples were taken and stored dry, in ethanol and in RNA Later. Where possible, 3 representatives per morphotype per trawl were sampled. Specimens from both the pelagic and benthic trawls were sampled although only 3 benthic trawls were conducted therefore benthic taxa make up a smaller proportion of the total. The aim was to collect up to 1 cm^3 of tissue however due to the size range of the organisms collected this was rarely possible without compromising the specimen. Enough tissue to enable multiple extractions was collected and cut into segments so as thawing of the whole sample would not be necessary when fulfilling loan requests.

All data was collected digitally (and backed up) in the field and all barcodes scanned for unique identification of each sample and to enable easier accessioning and faster data upload onto the relevant databases. Preanalytical variables including the time the tissue sample was taken, time any ethanol changes took place and time the samples were placed in the Freezer were recorded. All samples were transported on dry ice to the NHM maintaining the cold chain and are stored at –80°C in the Molecular Collections Facility.

3.10 Isotope Analysis

Whole specimens of benthic invertebrate species were collected from the AGT and pelagic species from the RMT 25 and Bongo nets. Due to the deployment failure of the AGT net on RSA seamount only benthic specimens from McNish seamount were collected for the Tristan da Cunha region. In the St. Helena region benthic samples were collected from two Agassiz trawls carried out on Cardno seamount. A selection of pelagic species was collected from several of the RMT 25 hauls carried out in both the Tristan da Cunha and St Helena regions. All samples collected were stored at -80°C.

4.0 Survey Narrative

4.1 Tristan da Cunha

RRS *Discovery* sailed from Falkland Islands on 12/03/19 at 18:00 to begin the transit to Tristan da Cunha. During the transit underway swathe bathymetry, weather, oceanographic and seabird and marine mammal observations data were collected. Survey gear which included the RMT 25, Bongo nets, and the SUCS were assembled and tested. Survey planning and preparation meetings were held to agree survey aims and approaches. Laboratories were prepared and procedures for sample processing finalised.

A test deployment of the RMT 25 net was conducted (16:00, 20/03/19) the initial deployment failed due to an issue with the firing mechanism. Following adjustments, the gear was deployed successfully resulting in a catch from both nets. After recovery of the gear RRS Discovery continued transiting to Tristan da Cunha. On arrival at Tristan da Cunha the weather was not suitable for planned boat transfers of Cefas, MMO, the Tristan da Cunha Government representative and observers from Tristan da Cunha. To avoid weather downtime the EM122 Multibeam Echosounder was calibrated and test trial deployments of the SUCS conducted. A further RMT 25 deployment was carried out west of Tristan da Cunha before RRS *Discovery* transited to Tristan to transfer passengers (09:30, 22/03/19). Before transiting to McNish seamount a sonar mooring which had been monitoring cetacean calls to the North of Tristan was recovered.

On arrival at McNish Seamount a CDT deployment was carried out before starting the planned Multibeam acquisition survey in survey box McNish East (16:00, 23/03/19). On completion of this survey an EK60 pelagic acoustic survey was undertaken across McNish Seamount. On

completion of this survey (00:30, 24/03/19), the RMT 25 was deployed to groundtruth targets identified during the EK60 pelagic acoustic acquisition survey. The catches from the RMT 25 nets were then processed. While the catches from the RMT 25 deployments acquisition of EK60 pelagic acoustic data continued.

Following the completion of the EK60 acoustic survey line (07:30, 24/03/19) a MBES survey of survey box McNish West was conducted which was followed by 4 deployments of the SUCS. Sites for deployment of the SUCS were identified from the MBES data. Following the completion of the SUCS survey of survey box McNish West further EK60 pelagic acoustic data was collected over McNish seamount. On completion of the planned EK60 transects the RMT 25 was again deployed to groundtruth observed acoustic targets (22:00, 24/03/19). Before a further RMT 25 deployment was undertaken over McNish Seamount the Bongo nets were deployed to collect samples for foodweb and isotope analysis. Following the deployment of the RMT25 over McNish Seamount acquisition of MBES data over McNish Seamount resumed. On completion of the MBES survey over McNish seamount an Agassiz benthic trawl was conducted in survey box McNish East. On completion of this trawl RSS *Discovery* began transiting to RSA Seamount.

On arrival at RSA Seamount (21:00, 25/03/19) EK60 pelagic acoustic data was collected from across RSA Seamount before deployment of the RMT25. On recovery of the RMT25 the CTD was deployed before a MBES survey of survey box RSA west. On completion of this MBES survey further RMT 25 trawls and a Bongo net deployment were carried out over survey box RSA West (19:00, 26/03/19). RSS Discovery remained at RSA Seamount where further RMT 25 deployments were undertaken in addition to Agassiz trawl and SUCS deployments before transiting to Unknown Seamount (07:00, 28/03/19).

On arrival at Unknown Seamount a MBES survey over the seamount was carried out, followed by the deployment of the CDT. On completion of the CTD deployment RSS *Discovery* began transiting back to Tristan da Cunha (19:00, 28/03/19). During the transit to Tristan da Cunha a live broadcast to the Natural History Museum from RSS Discovery was conducted (15:00, 29/03/19). On arrival at Tristan da Cunha a CTD deployment was undertaken as part of the EK60 calibration process. While the calibration of the EK60 was conducted boat transfers of personnel and goods occurred before beginning the transit to St Helena (20:00, 30/03/19). St Helena.

4.2 St Helena

On arrival at St Helena (08:30, 05/04/19) a crew change was conducted before deploying a CTD and undertaking a MBES survey to begin infilling existing data that had previously been collected from around the island (19:50, 05/04/19). Following the completion of the MBES infill survey lines a CTD deployment was undertaken at Speery Ledge to the south of St Helena. After retrieval of the CTD a fisheries EK60 acoustic survey transiting the west coast of ST Helena to George Island was completed before a further CTD deployment at Shovel was undertaken (08:25, 06/04/19). Further MBES infill lines were then completed which were followed by a further CTD deployment and a SUCs survey at Lighter on the east coast of St Helena (18:47, 06/04/19). Additional fishery acoustic survey lines were then run to identify acoustic targets which were then fished using the RMT 25. On retrieval of the net it became apparent that only one of the nets had opened successfully. While the RMT 25 was being maintained the Bongo nets were deployed. Once the RMT 25 had been fixed it was again deployed to target observed acoustic signatures identified using the EK60 at Shovel (04:59 07/04/19). An acoustic mooring was then deployed at Dawsons before RSS *Discovery* transited south to Barn Ledge where a CTD deployment was carried out. Following the recovery of the CTD a further acoustic mooring was deployed off George Island (10:35

07/04/19). During all transits between stations routes were plotted to ensure any gaps in the existing MBES data from around the Island were infilled. While off George Island a CTD deployment and a SUCS survey was undertaken before the RMT 25 was deployed twice to replicate tows that were conducted in 2018 while onboard RSS *James Clark Ross* (04:15, 08/04/19). Further fisheries acoustic survey lines were then completed before RSS Discovery transited south to Speery Ledge where another acoustic mooring was deployed followed by a SUCS survey (11:46, 08/04/19). On completion of these deployments RSS *Discovery* transited back to James Bay to undertake a partial crew change. While in James Bay a further CTD deployment was undertaken which was followed by the calibration of the EK60. On completion of the calibration RSS Discovery transited to Bonaparte Seamount (05:50, 09/04/19).

On arrival at Bonaparte Seamount a CTD deployment was undertaken followed by a SUCs survey (10:50, 09/04/19). A further CTD deployment was carried out in the open ocean before RSS Discovery transited to Cardno Seamount. On arrival (15:17, 10/04/19) a CTD was deployed which was followed by the acquisition of MBES data from around the seamount. The seamount was then fished using the RMT 25 (03:05, 11/09/19). On recovery of the RMT 25 a fisheries acoustic survey was carried out using the EK60. To complete the planned survey of Cardno Seamount two further CTD deployments, a SUCs survey, 2 deployments of the Agassiz trawl and two further deployments of the RMT 25 were completed. In addition, two acoustic moorings were deployed.

On completion of this survey RSS *Discovery* transited to Southern Cross Seamount (21:30, 12/04/19) where a similar survey was undertaken of the seamount habitat. Throughout these surveys substantial MBES data was acquired from over and around all three seamounts (Cardno, Southern Cross and Unnamed). On completion of these seamount surveys RSS *Discovery* transited back to James Bay. On arrival in James Bay a small boat seawater contaminants survey was conducted before crew disembarked at the end of the survey (08:00, 15/04/19).

5.0 Preliminary Findings and Outcomes

5.1 Bathymetric Survey Data

5.1.1 Tristan da Cunha

Multibeam Echo-Sounder surveys were completed in two areas, firstly, on seamounts in the EEZ around Tristan da Cunha and secondly around the island of St Helena and on seamounts in the EEZ around St Helena. Data were collected using both the EM710 and EM122 systems and the merged data were cleaned in CARIS HIPS and SIPS (Table 4).

Table 4 Summary of EM170 and EM122 data collected During DY100.

Survey Name	Start Date	End Date	Description	files (.all)	Processed (Caris Hips & Sips v10.4.)	Comment
DY100	22:36 12/03/2019	11:31 21/03/2019	Transit Falkland Islands – Tristan Da Cunha	396	396	
DY100_MBES_CAL	11:37 21/03/2019	18:05 21/03/2019	Calibration	17	17	Near Tristan da Cunha
DY100_Tristan	23:07 21/03/2019	14:30 31/03/2019	Tristan Da Cunha Seamount Survey	375	375	
DY100_Trans_TDCtoSTH	14:33 31/03/2019	06:33 05/04/2019	Transit Tristan Da Cunha – St Helena	225	225	
DY100_StHelena	08:37 05/04/2019	18:13 14/04/2019	St Helena and Seamounts	336	322	

Tristan da Cunha island was visited twice during the survey. As there is considerable existing MBES coverage around the island, no new surveys were undertaken. New data was primarily collected over McNish, RSA and the Unknown Seamounts (Figure 10).

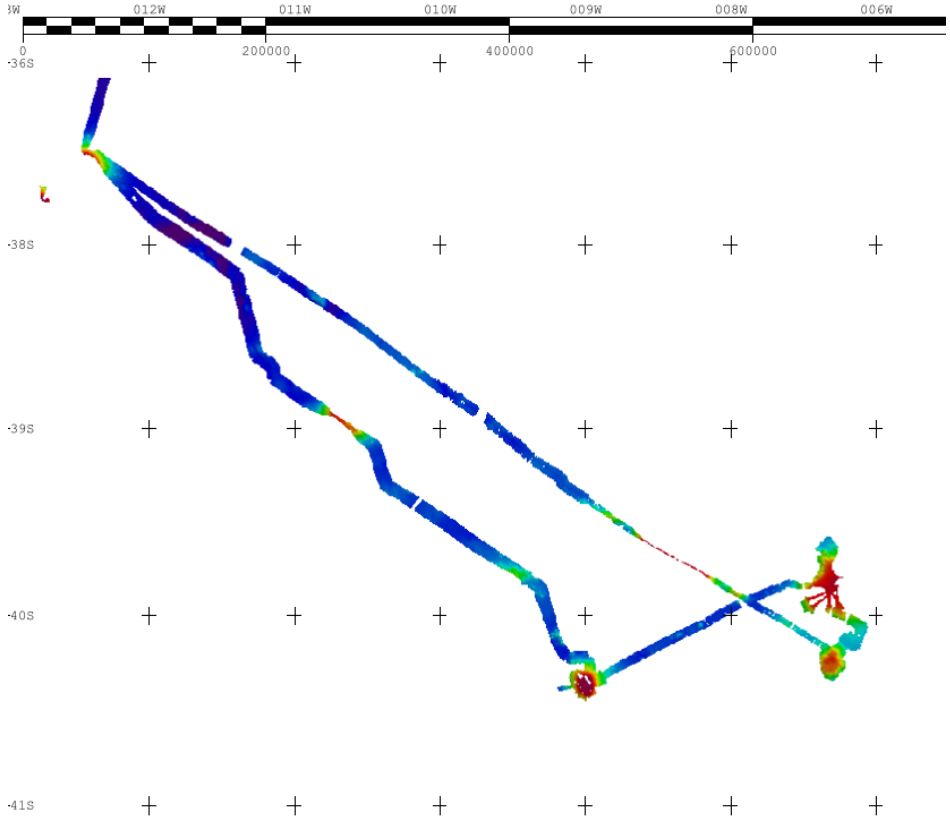


Figure 10 Multibeam survey track around Tristan da Cunha.

5.1.2 McNish Seamount

McNish Seamount is a prominent seamount, situated south of Tristan da Cunha and east of Gough Island and centred at 40.11°S; 8.60°W. There were no previous MBES data for the seamount. The seamount rises from a base depth of 2600 m and has an extensive shallow plateau. The survey work during DY100 covered most of the plateau and most of the upper flanks of the seamount (Figure 11).

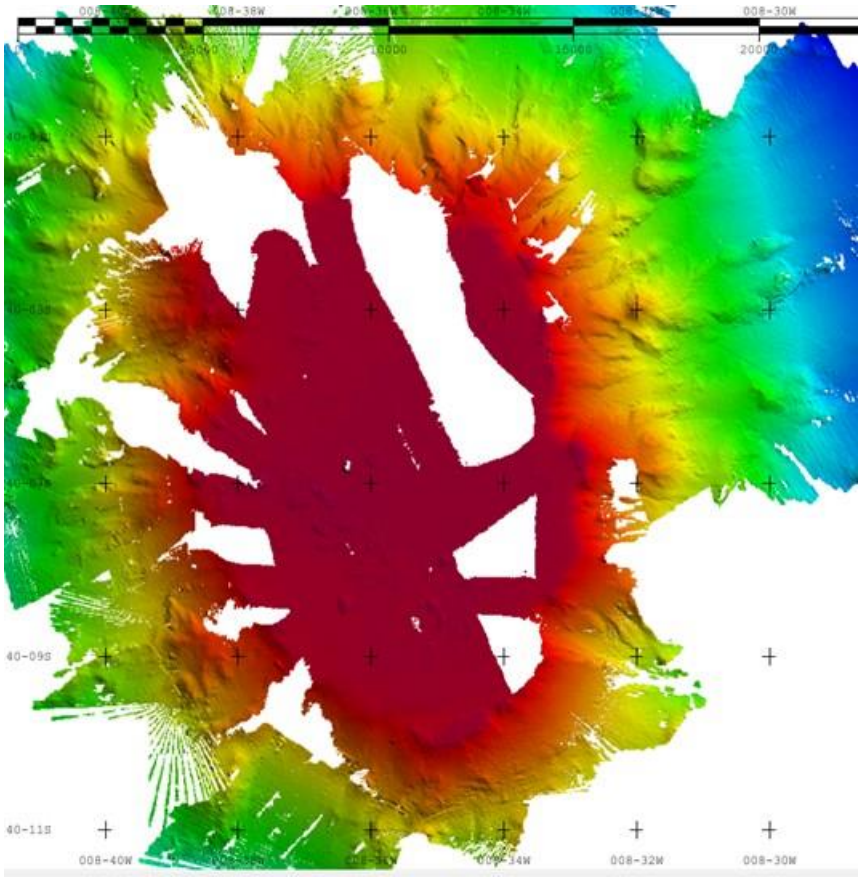


Figure 11 Multibeam echosounder map of McNish Seamount displayed in CARIS.

The plateau is 15 km across in a North-South direction, and 12 km across east-west. The plateau generally has a depth of 162-200 m. A number of bathymetric highs within the plateau form small ridges around 500 m long and typically have depths in the range 135-149 m. They are aligned along a northwest-southeast-trending zone approximately parallel with the long axis of the seamount. Over the shallowest point encountered at 40.11°S; 8.60°W, a depth of 96 m was recorded. However, the bathymetric high was at the edges of two multibeam swaths, and an accurate measurement of this feature was not obtained. Most of the upper flanks of the seamount are concave-up, and slopes are steepest along the east-facing flank.

5.1.3 RSA Seamount

RSA Seamount is a large seamount with some previous multibeam collected along the margins of the plateau of the seamount. A complete mapping of this seamount was not possible during the time available due to its large size. Survey data were acquired on the northwestern part of the shallow plateau on the western part of the seamount, with the survey area centred at 39.52°S; 06.8°W (Figure 12). The part of shallow shelf surveyed has depths generally in the range 300-500 m. The slope to the northwest is relatively gentle. The

shallowest point encountered had a depth of 292 m. The plateau is generally flat, with no significant bathymetric highs or lows.

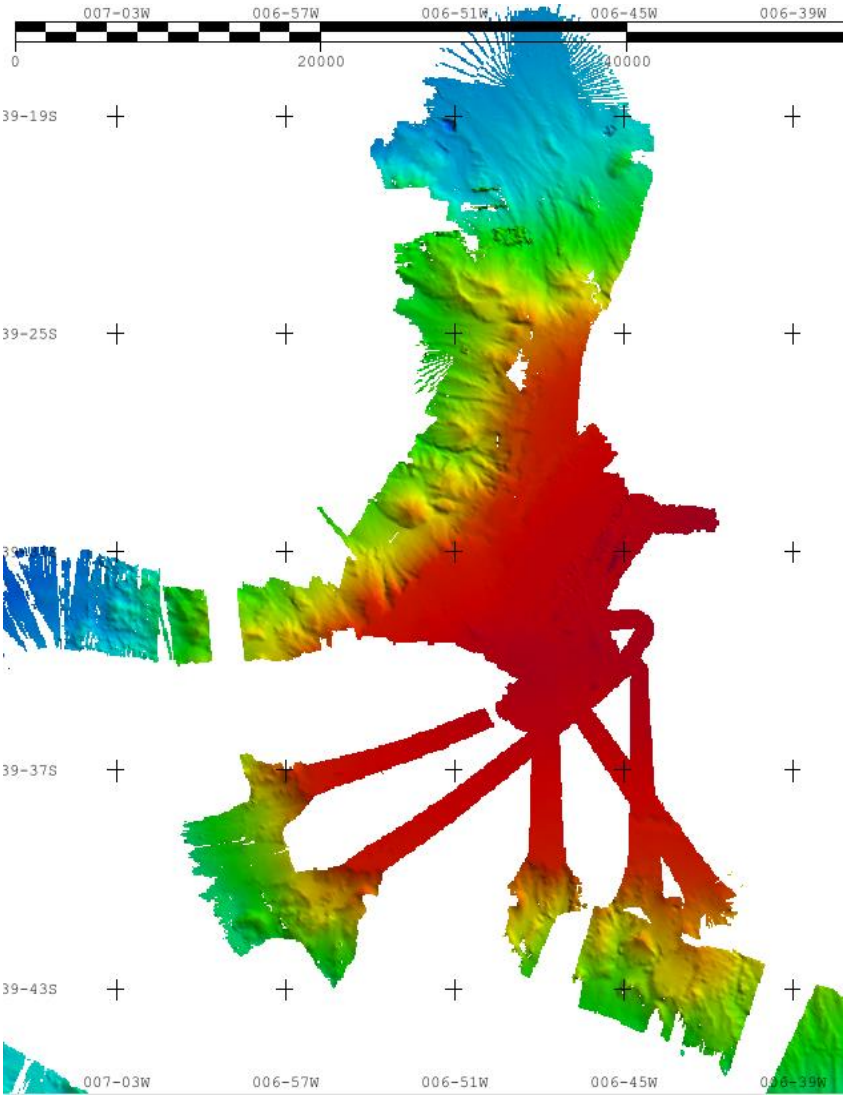


Figure 12 Map of the multibeam coverage of the western part of RSA Seamount displayed in CARIS.

5.1.4 Unknown Seamount

This seamount is centred on 40.0°S; 06.78°W and had no pre-existing multibeam data. The coverage was started with a north-south track over the centre of the seamount. Poor sea conditions required a change to east-west tracks for a while during which the eastern part of the summit was covered. A wide track around the southern part of the seamount and north-south tracks along the western part of the seamount completed the coverage. The surrounding seafloor has depths of approximately 2800 m. The seamount has what could be described as a circular flat plateau 11 km in diameter that is around 720-880 m deep in the central and southern part of the seamount (Figure 13). The northern part of the plateau is formed by several bathymetric highs generally rising to 616-560 m deep. The shallowest of these rises to 530 m depth. There is a prominent ridge extending north from the plateau. The other flanks of the seamount are typically formed by radiating small ridges and slopes that are concave upwards, producing a sharp change in slope at the edge of the plateau. The southeast facing flank is notably steep. The pattern of radiating ridges and troughs may be the result of multiple

minor landslides. The depth of the plateau is significantly greater than those of RSA and McNish Seamounts, suggesting a greater age for the time of planation, assuming depth of planation surfaces is corelated with subsidence related to cooling of the underlying plate.

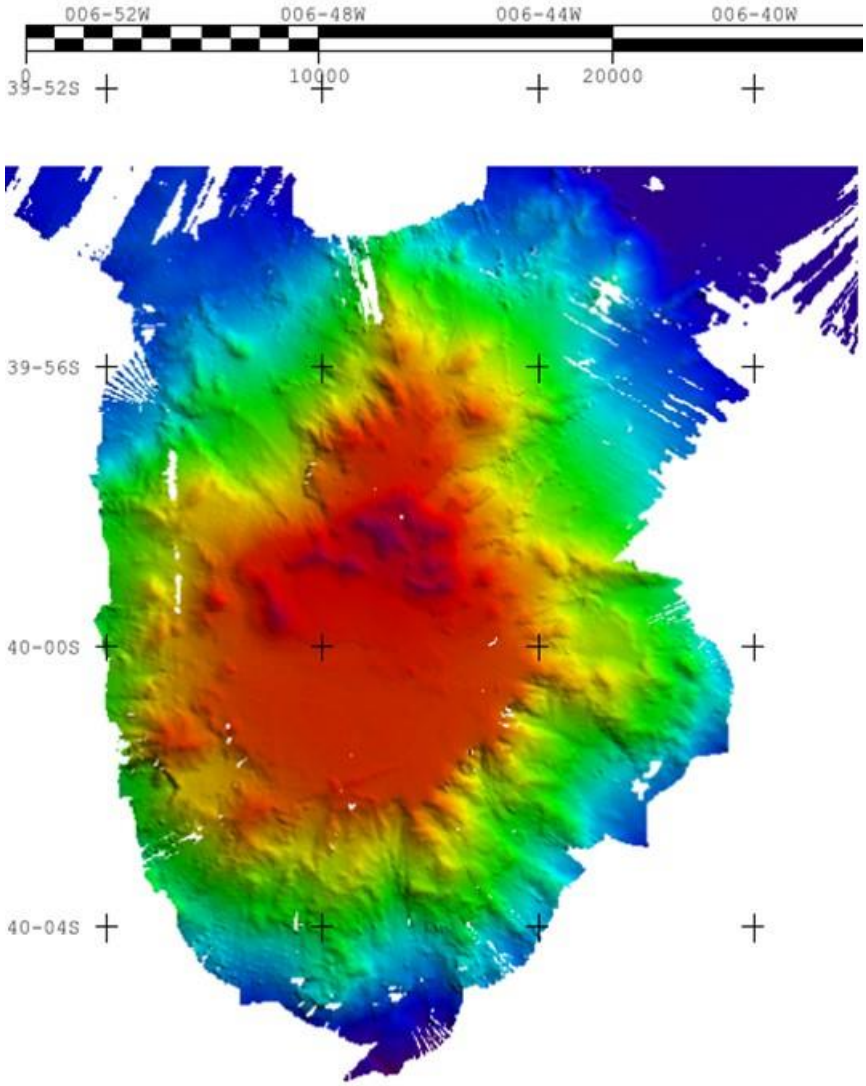


Figure 13 Map of the multibeam coverage of the Unknown Seamount displayed in CARIS.

5.1.5 St Helena

Previous multibeam data had been collected from around the island during cruise JR17004 on RRS *James Clark Ross* and by the Hydrographic Office using a towed instrument with an inshore vessel. The main objective of the current survey was to fill gaps in coverage between the inshore and the existing survey data.

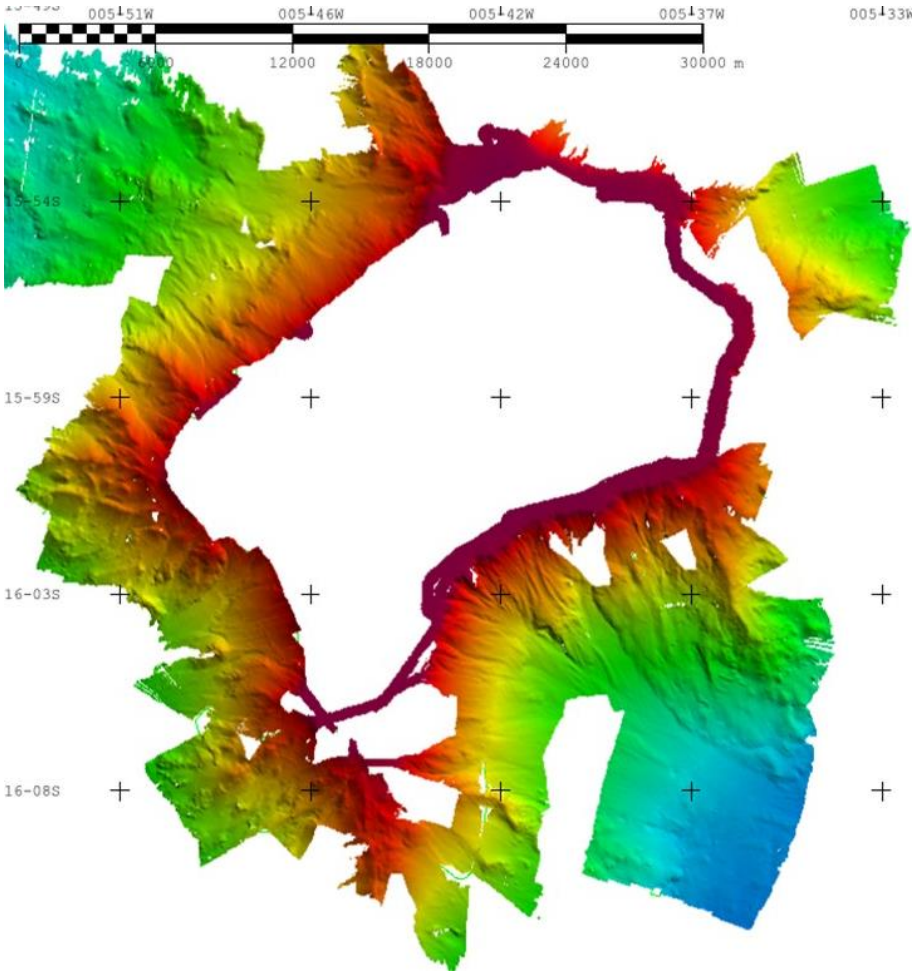


Figure 14 Map of the multibeam coverage from around St Helena displayed in CARIS.

Most of the new MBES data were collected from the outer part of the shallow shelf, with depths typically in the range 70-110 m. Multibeam Echosounder data were collected throughout the survey that was conducted around St Helena with all transits between survey sites being plotted to ensure maximum MBES data coverage was acquired (Figure 14).

5.2 Cardno Seamount Complex

Cardno Seamount is the westernmost of a group of seamounts aligned approximately east-west at the northern limit of the St Helena EEZ. There were no previous MBES data for these seamounts. The multibeam surveys revealed significant differences in the size and shapes of the seamounts compared to the those suggested by the Admiralty Chart and Genco Marine Company (GEBCO) data, the differences are demonstrated in Figure 16. Figure 15 shows the new MBES data collected on the three seamounts which are, from west to east, Cardno Seamount, Southern Cross Seamount (unofficial name) and an unnamed seamount.

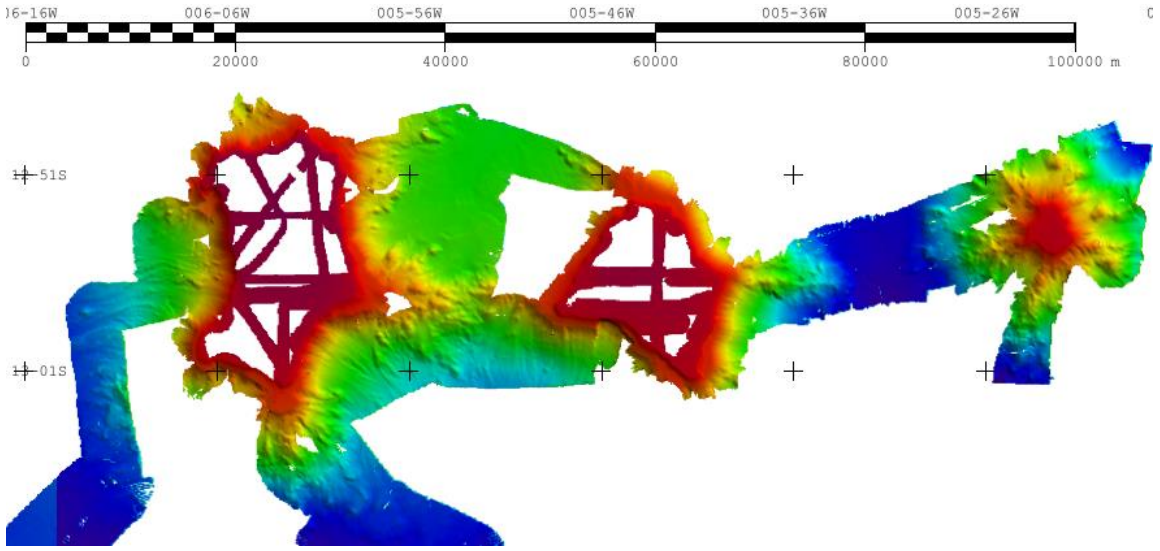


Figure 15 Map of the multibeam coverage from the Cardno Seamount complex displayed in CARIS.

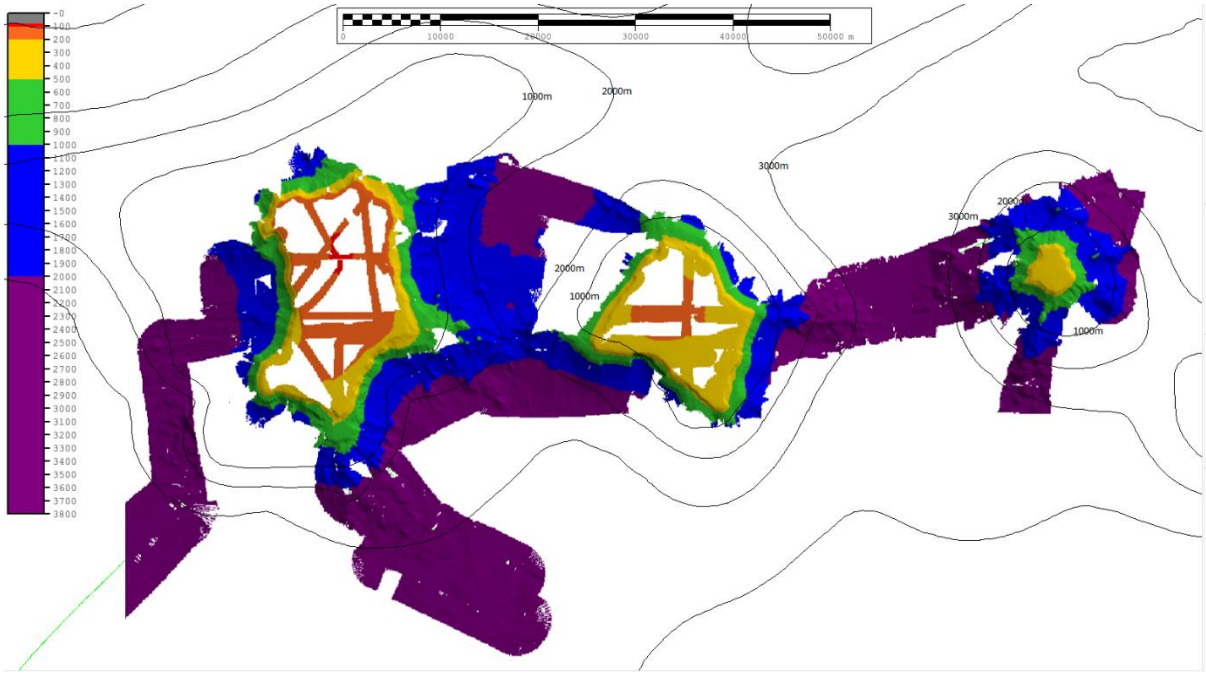


Figure 16 The image shows the GEBCO contours and the scale bar demonstrates where the actual contours are. The most noticeable differences are the 1000m contour around the Cardno Seamount, with some differences being more than 13km away from the GEBCO contours and a section on the 1000m contour on the Southern Cross Seamount actually being at a depth of 300m.

5.2.1 Cardno Seamount

Cardno Seamount is situated 330 km north of St Helena centred at approximately 12.92°S; 06.04°W. There were no previous MBES data from the seamount. During the survey (Figure 17) the edges of the shallow plateau and several tracks across the plateau were undertaken to determine its depth variations.

The base level of the seamount is 3100 m deep to the west, and 2050 m to the east. There is a saddle with a deepest point of 1400 m deep joining Cardno Seamount with Southern Cross Seamount to the east. The Cardno Seamount plateau is large, measuring 23 km across in a

north-south direction and 13 km across in an east-west direction. The plateau mostly has a depth of 90-150 m, with the shallowest point encountered being 86 m deep. No prominent shoals or bathymetric lows were encountered within the plateau. The edge of the plateau is everywhere defined by a steep drop-off and a generally concave-up slope.

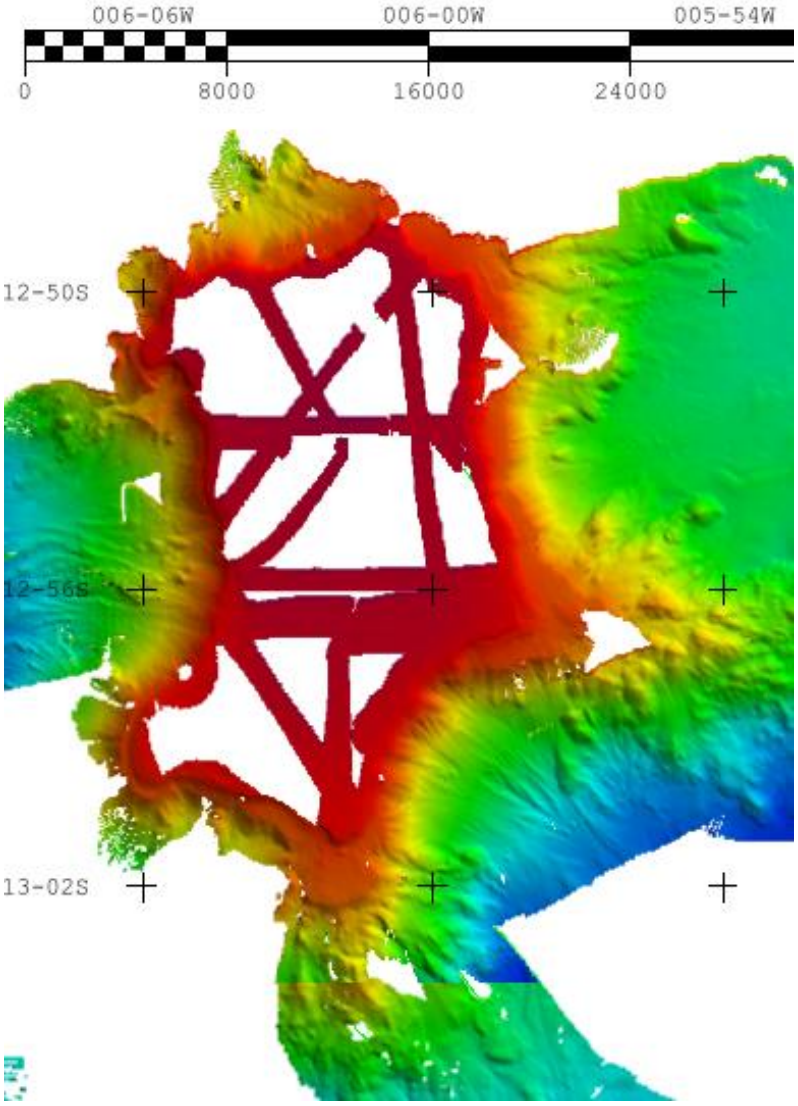


Figure 17 Map of multibeam coverage of Cardno Seamount displayed in CARIS.

5.2.2 Southern Cross Seamount

Southern Cross Seamount (unofficial name) is situated east of Cardno Seamount. There were no previous MBES data from the seamount. the edges of the shallow plateau were fully mapped during the survey. Most of the seafloor between Cardno and Southern Cross seamounts was found to be at about 2050 m. In contrast, the depth between Southern Cross and the unknown seamount is much deeper, at 3500 m deep. The 16 by 16 km plateau of Southern Cross Seamount is generally flat and typically 160-230 m deep (Figure 18). The shallowest point encountered was 154 m deep. No significant shoals or troughs were encountered within the plateau. The slopes away from the plateau are relatively gentle in the north, and steeper in the south. There is a prominent 4 km wide landslide scar on the South-facing flank.

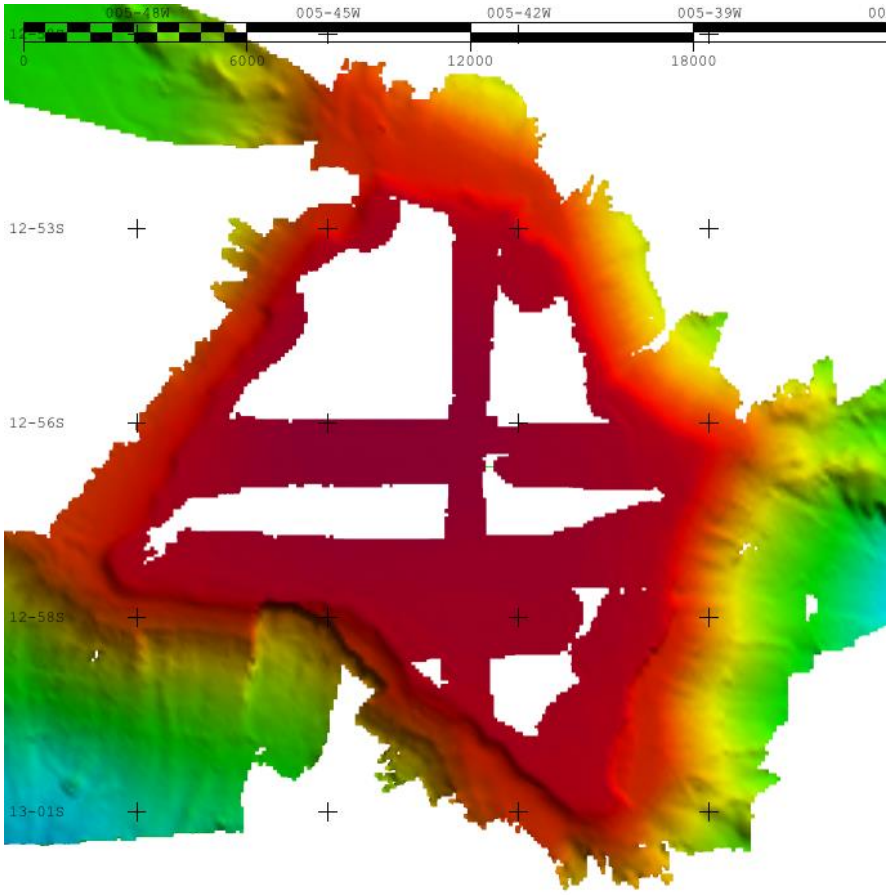


Figure 18 Map of multibeam coverage of Southern Cross Seamount displayed in CARIS

5.2.3 Unknown Seamount

This seamount is centred on 19.89°S; 05.37°W, some 28 km to the east of Southern Cross Seamount. It has a shallow plateau 4.6 km wide in a north-south direction and 4.4 km across east-west (Figure 19). The depth of the plateau is generally in the depth range 290-2660 m. The shallowest point is at about 273 m depth.

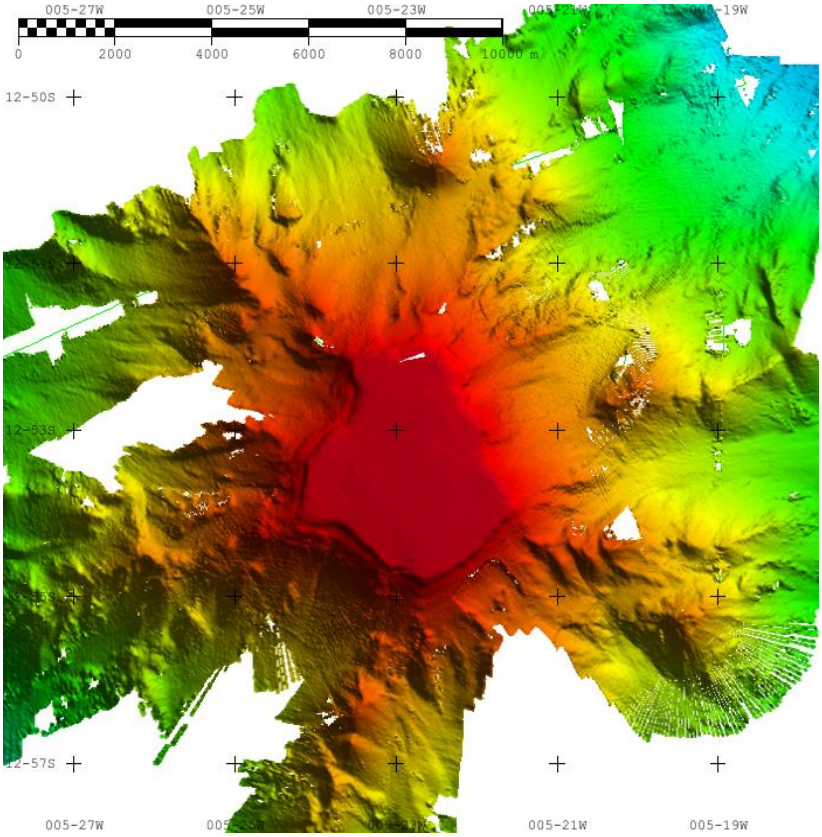


Figure 19 Map of multibeam coverage of Southern Cross Seamount displayed in CARIS

5.3 Benthic Community Data

5.3.1 Shelf Underwater Camera System -Tristan da Cunha

The Shelf Underwater Camera System was deployed at 3 locations, during which 195 high resolution still images were taken across10 separate deployments. The deployment plan targeted two boxes on McNish Seamount (east and west) and the west side of RSA Seamount, both south of the main Tristan da Cunha archipelago (Figure 20).

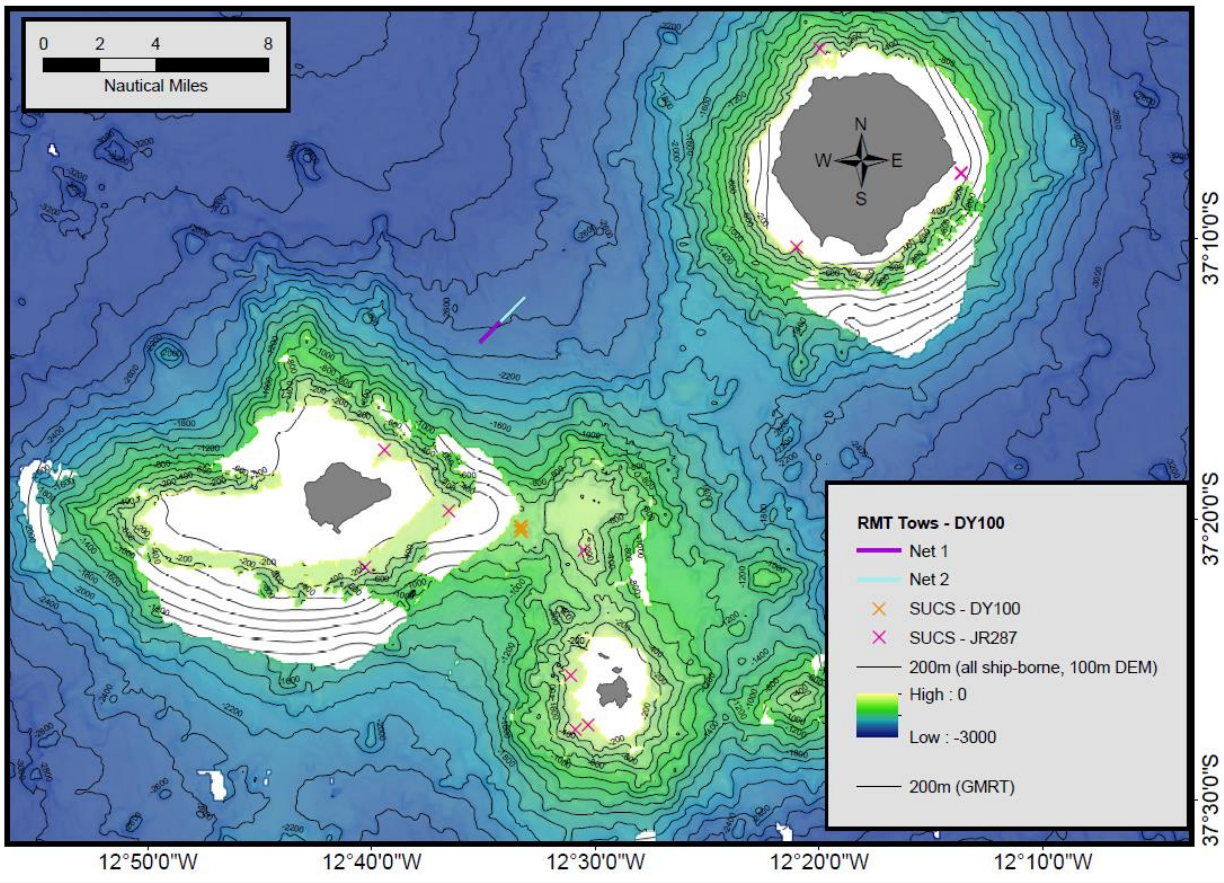


Figure 20 Deployments of SUCS around the Tristan archipelago (including deployments from JR287).

An initial trial deployment was made between Inaccessible and Nightingale islands, to test the new operating procedure, given the difficulties experienced during this trial deployment. Site selection at McNish Seamount was primarily based on recent bottom fishing intensity and seabed topography from (EM122 and EM710 multibeam) seabed mapping data. Sites were generally focussed on flat areas, between 170-600 m depth, with the addition of one deeper deployment on RSA. The bottom types were broadly bedrock, cobble & pebble matrix, broken coral and coarse sand – mostly typically a mixture of these (Figures 21 - 23).

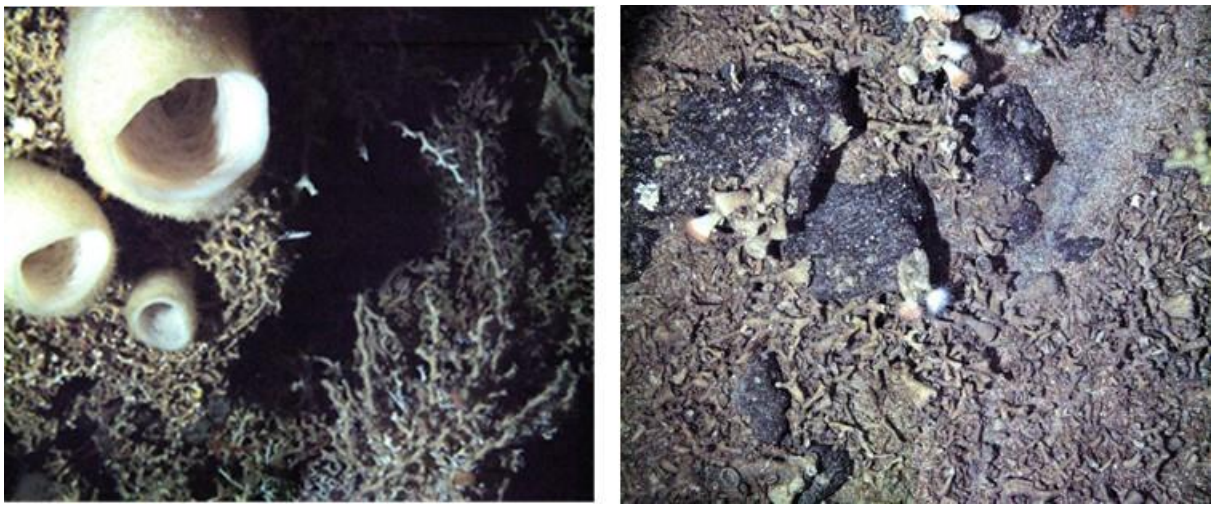


Figure 21 Habitats between Inaccessible and Nightingale islands.

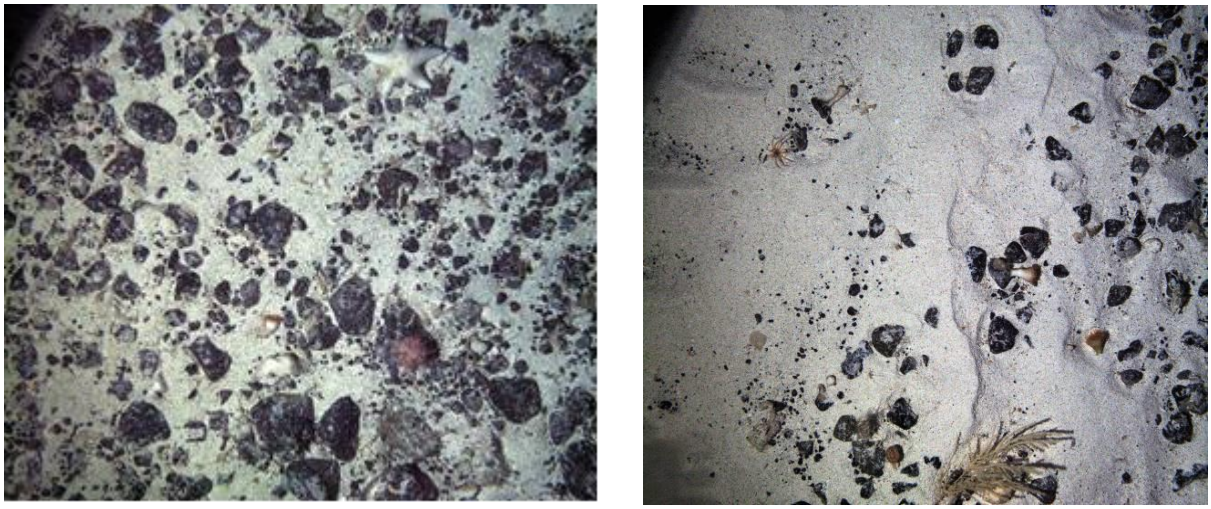


Figure 22 Trawled habitats of McNish Seamount.

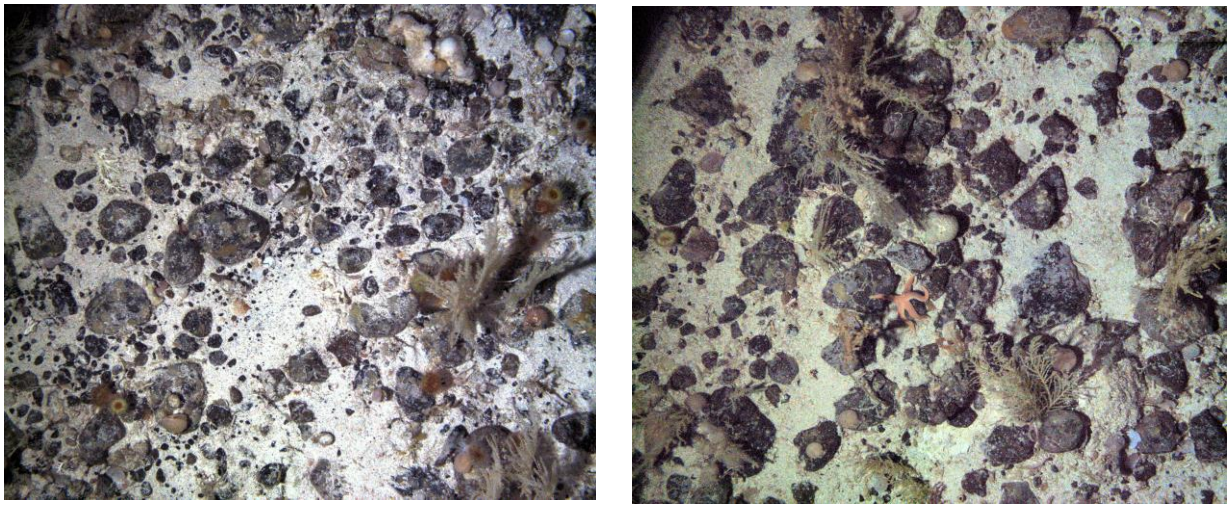


Figure 23 Untrawled habitats of McNish Seamount.

Biological assemblages were imaged across a 175-704 m depth range across the two seamounts and off Inaccessible Island. Representatives of 10 phyla were seen but detailed image analysis over the next year is likely to reveal more. Representatives of 16 classes of fauna were seen and at least 35 morphotypes. Some of the species are characteristic of Vulnerable Marine Environments (VMEs). These included branching corals e.g. *Lophelia*, cup corals e.g. *Caryophyllia*, black fan corals e.g. *Antipatharia* and erect sponges, all of which are likely to be important in bioconstruction, seabed carbon accumulation and indicators of anthropogenic pressure (such as fishing intensity).

The most ubiquitous morphotypes were an unidentified (brittlestar, Echinodermata), *Caryophyllia* (cup coral, Anthozoa) and certain bivalve molluscs (Figures 24 and 25). Abundance levels exceeded 100 ind.m^2 in places but were zero in some images. Key contributors to biomass, 3-dimensional habitat (bioconstruction) and benthic carbon accumulation were patchy outcrops of corals.

Figure 24 habitats of RSA seamount plateau. Brittlestars (left) were common and a large basketstar was seen (right).

Figure 25 life is patchily abundant in rock and sand habitats of deeper water on RSA seamount's slope.

The SUCS still images will be worked up by a combined team from Plymouth University, BAS and Cefas. Completion of image analysis, together with those of previous expeditions (JR287, JR864, JR16-NG and JR17004) will enable robust characterisation of regional seamount communities in the south Atlantic UKOTs. It should also facilitate testing of impacts and recovery rates from bottom fishing intensity, cold coral occurrence and abundance hypotheses, and blue carbon accumulation importance. In the Tristan EEZ the 100-1000m region of four islands and four seamounts have now been explored using SUCS since 2013. Work analysing this data has already lead to testing of a predictive model for VME and coral habitat and should soon lead to both reports on impact of regional bottom trawling and peer reviewed scientific papers.

Preliminary observations suggest that although there is a particular suite of biodiversity associated with Atlantic seamounts, there are strong differences between each territory. As elsewhere, habitat and substratum profile (e.g. slopes vs flat plateau) seem to influence the density and nature of biodiversity on seamounts in the Tristan EEZ. It is against this background of natural variability that we try to determine what the influences are of direct and indirect impacts of human activity, particularly fishing activity

5.3.2 Agassiz Trawl – Tristan da Cunha

The first AGT deployment (at McNish seamount) yielded a small catch but a wide variety that was seemingly reflective of what had been observed in SUCS imagery from the same location. Intact erect corals and regular echinoids were testament to how gentle the trawling method onboard RSS Discovery was (Figure 26). Representatives of all morphotypes were preserved in ethanol (for BAS and NHM) and frozen (for isotopic analysis by Dr G. Stowasser). The second deployment, which was at RSA, was required to be on more challenging terrain. None of the SUCS deployments on RSA had shown ideal seabed for trawling as it was found to fluctuate in depth and be punctuated by hard bedrock outcrops. The tension trace on the trawl wire indicated that the trawl had left the seabed at several points during the tow and on return to the surface it was apparent it had failed – the inner net had inverted and wrapped around the trawl mouth. No trawl samples were successfully collected from RSA Seamount however, samples do exist from three of the four seamounts and similar depths from both main island clusters, across JR287, JR17004 and the present survey.

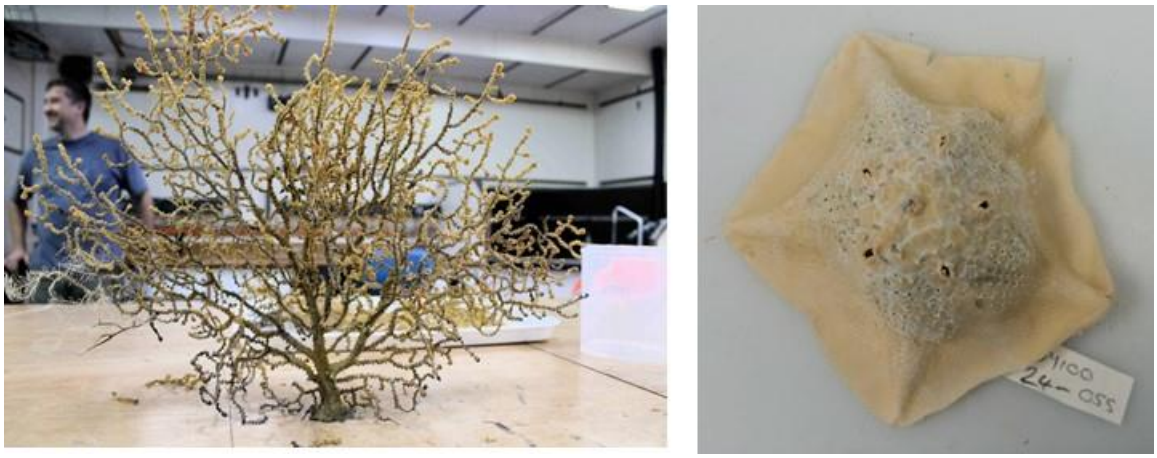


Figure 26 Megabenthos from the Agassiz trawl at McNish Seamount.

5.3.3 Shelf Underwater Camera System - St Helena

Deployments started with three regions around the main island of St Helena; Lighter, George Island and Speery Ledge, Bonoparte and Cardno Seamount complex (Figures 27 - 29). Representatives of nine phyla (Annelida, Brachiopoda, Bryozoa, Chordata, Cnidaria, Crustacea, Echinodermata, Mollusca and Porifera) and 16 classes were seen in SUCS images across St Helena, Bonaparte and the Cardno Seamount complex. Most of these were seen around St Helena's coast alone, but different morphotypes (species) and densities were seen across all habitats and seamounts (Figures 30 and 31).

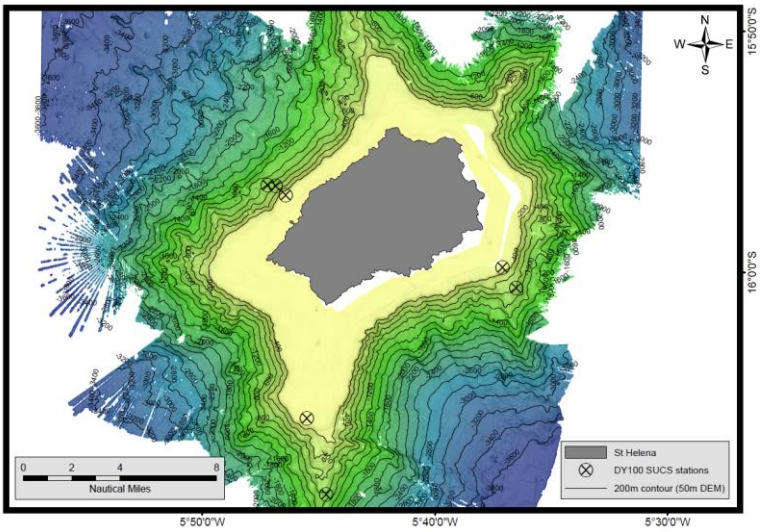


Figure 27 Benthic deployments around St Helena.

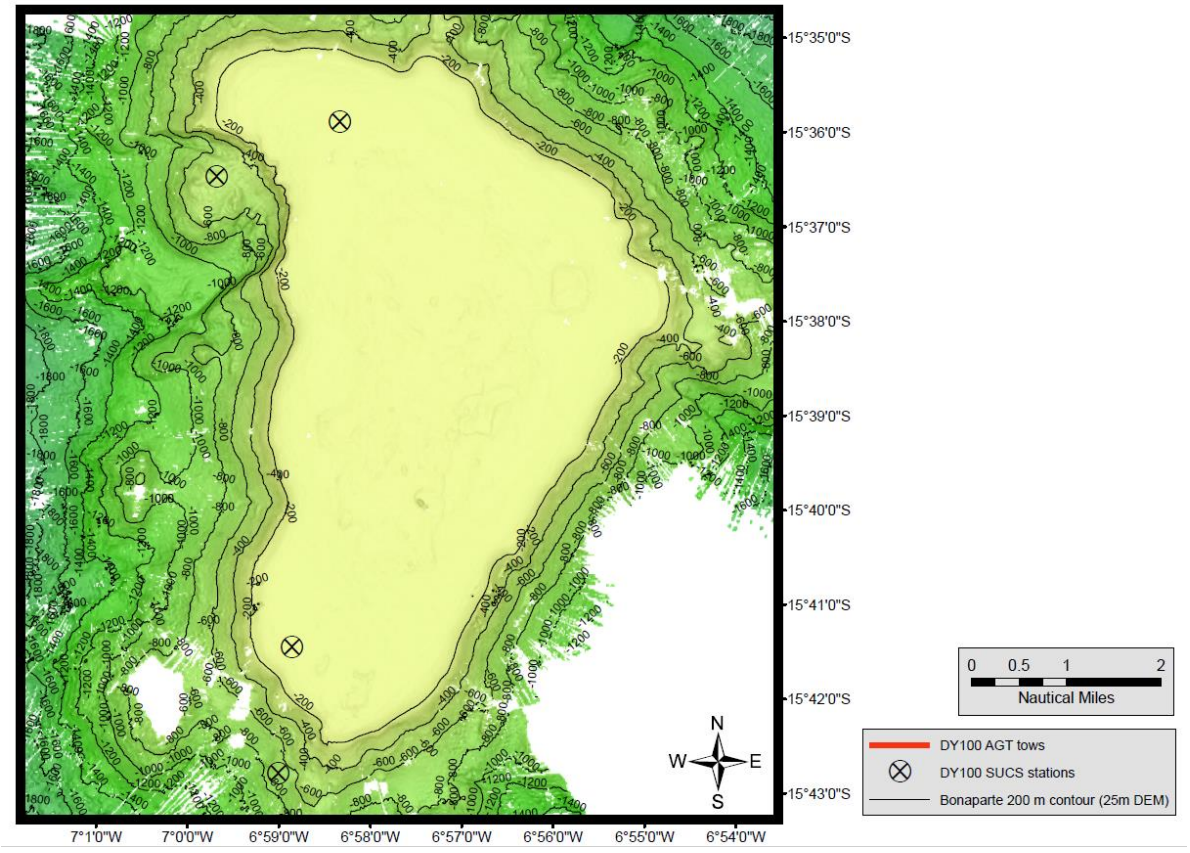


Figure 28 Benthic deployments around Bonaparte Seamount.

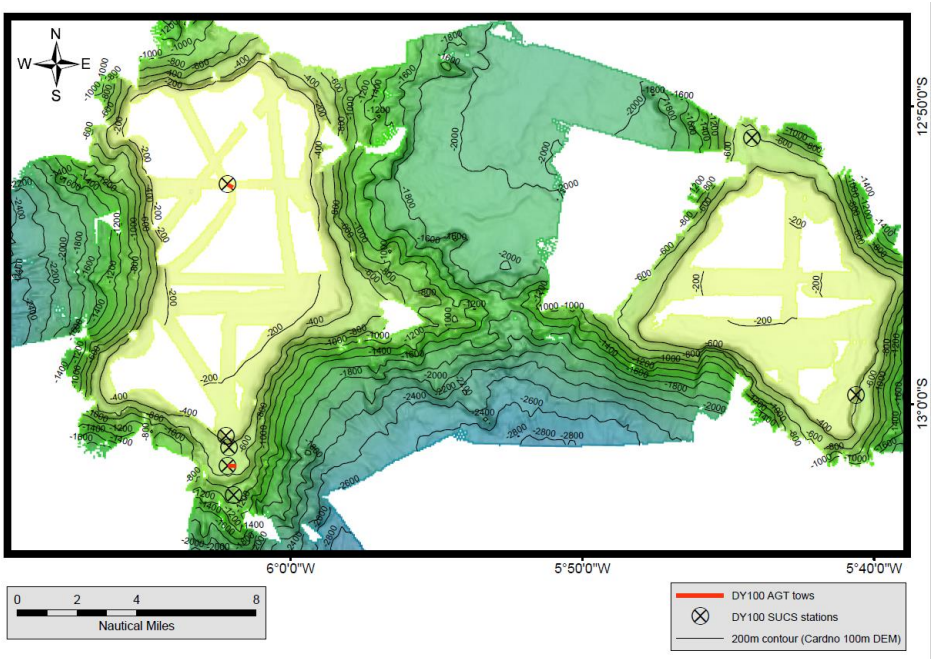


Figure 29 Benthic deployments at Cardno and Southern Cross Seamounts.

It was clear that seamounts not only differed in their faunal composition to St Helena's coast but also differed from each other. Most striking were the changes from sandy flat plateau tops to the fauna on their rocky steep sides.

Figure 30 Environments around St Helena from the shallows (top left through to sands and muds (top right) to deeper coral covered bedrock (bottom)

Detailed work on identification of the species in the images will begin in May 2019, primarily at the University of Plymouth. The camera deployment site selection was in part informed by a draft model of two cold water corals (CWC) *Lophelia pertusa* and *Solenosmilia variabilis*. This is part of work ongoing at the University of Plymouth designed to test the extent to which pre-existing models of CWC distribution can be used to predict abundance in previously unstudied areas (PhD project of Amelia Bridges). In several deployments, predictions of CWC reef were confirmed, but the initial model is still quite coarse (200m grid cell size) and will be refined in future versions.

Figure 31 Examples of CWC reef-forming species observed in the St Helenian EEZ

The seabed imaging equipment (SUCS) was used in 20 deployments / sites around St Helena and its seamounts, to gain insights into characteristics and variability of biodiversity. Methodology for camera deployments followed that for similar methods further south around Tristan da Cunha during the same survey Image analysis did not take place during the research cruise but a spreadsheet of information concerning each image was constructed. This included latitude, longitude, depth (from USBL) and temperature, oxygen, fluorescence (chlorophyll proxy) and salinity from the nearest CTD conducted. SUCS locations were chosen following multibeam swath seabed mapping to encompass as many different habitat types as possible.

5.3.4 Agassiz Trawl – ST Helena

Two Agassiz tows were completed during the St Helena leg, both at the Cardno Seamount. The first was targeted at one of the shallowest areas of the seamount (85 m depth) where a previous SUCS deployment indicated high abundances of primary producing taxa. Consequently, the length of the tow was reduced from 500m to 300m to reduce the chance of over-filling the net. Even so, the catch was very large and most of the volume of material was returned after sorting. The shallow tow included a large volume of red algal morphotypes (spheroidal rhodoliths and maerl), together with a low diversity of other invertebrates, principally decapods and polychaetes (cf. *Hermodice* sp.). The second tow was targeted in deeper water on a plateau along the southern margin of the seamount (ca. 565 m). This haul

yielded small quantities of specimens, again representative of that seen in the adjacent SUCS deployment and included several echinoid and anthozoan morphotypes.

5.4 Pelagic Communities

5.4.1 Fisheries acoustics (EK 60)

The acoustic data were analysed using the software Echoview v9.0.3. The first step in the analysis was to edit the bottom line, which is not always correctly detected by the bottom detection algorithm of the EK60 software and remove noise and unwanted targets. The area immediately below the transducers (~10m below the transducer) was excluded from the analysis because it was impacted by the near-field effect and surface noise (e.g. surface bubbles). Background noise, pulse noise and attenuated signals were removed using a series of tools integrated in the Echoview software. This noise can be caused by different sources (e.g. boat propeller, hydraulic winches, bad weather, cross talking from other electronic instruments) and could potentially affect the quality of the data during further analysis. Other sources of noise that could not be identified automatically (e.g. false bottom interference) were eliminated by visual inspection of the echogram and manual editing of the acoustic data. In order to reduce the stochastic variability of the data, the data were resampled to a lower resolution (20m x 2m cell) before further steps.

The Nautical Area Backscattering Coefficient (NASC) was exported from the “clean” echograms. The distance interval used to export the integrated NASC was 500 m. The data were exported for the entire depth range (600m) and stratified by depth layers (every 100 m). The NASC was exported at 70 kHz using a minimum threshold value of -70 dB. The threshold was used to exclude the weak scatterers such as some plankton organisms (e.g. copepods, euphasiids). The NASC exported was mainly associated to fish but it could also include gas-filled organisms such as siphonofores. NASC can be considered as a proxy for biomass.

In order to discriminate different classes of acoustic target, a combination of thresholding and DB differencing was also used (results not shown in this report). This analysis was limited to the first 200 m of the water column due to the depth range limit of the 120 KHz. The analysis consisted of 2 steps:

Thresholding - Mean Volume Backscattering Strength (MVBS) at 70 and 120 kHz was summed and the resulting echogram was thresholded in order to separate 2 broad classes of targets (fish vs plankton). The difference in variability between fish and zooplankton was used to enhance the contrast between both types of organisms. The use of this approach is helpful when there is a high density of gas-bearing plankton that can easily be mistaken for fish if only dB-differencing is used. The threshold value used for the data collected during the day was empirically chosen at-140 dB. Values above the threshold were classified as fish and values below threshold were identified as plankton. A Boolean mask was then created to assign the backscatter to fish and plankton. Fish schools, when present, were detected and assigned to the fish class without going through the thresholding procedure.

DB differencing – The fish and plankton categories were further separated into 4 additional classes (fish with swimbladder, fish without swimbladder, fluid-like plankton, gas-bearing plankton). Identification of these classes was based on the differences of MVBS measured at 120 and 70 kHz ($\Delta MVBS_{120-70}$) (Table 5).

NASC was exported from the final classes obtained by the discrimination algorithm.

Table 5. dB-differencing values used to species/groups discrimination.

Categories	Classes	ΔMVBS120–70	Example
Fish	Fish with swimbladder	< 2	
	Fish without swimbladder	> 2	
Plankton	Fluid-like plankton	> 2	euphausiids, copepods, salps, etc..
	Gas-bearing plankton	< 2	gelatinous and gas-bearing siphonofores, fish larvae, etc..

Examples of the Sv (volume backscatter) echograms for each seamount are shown in Figures 32 and 33.

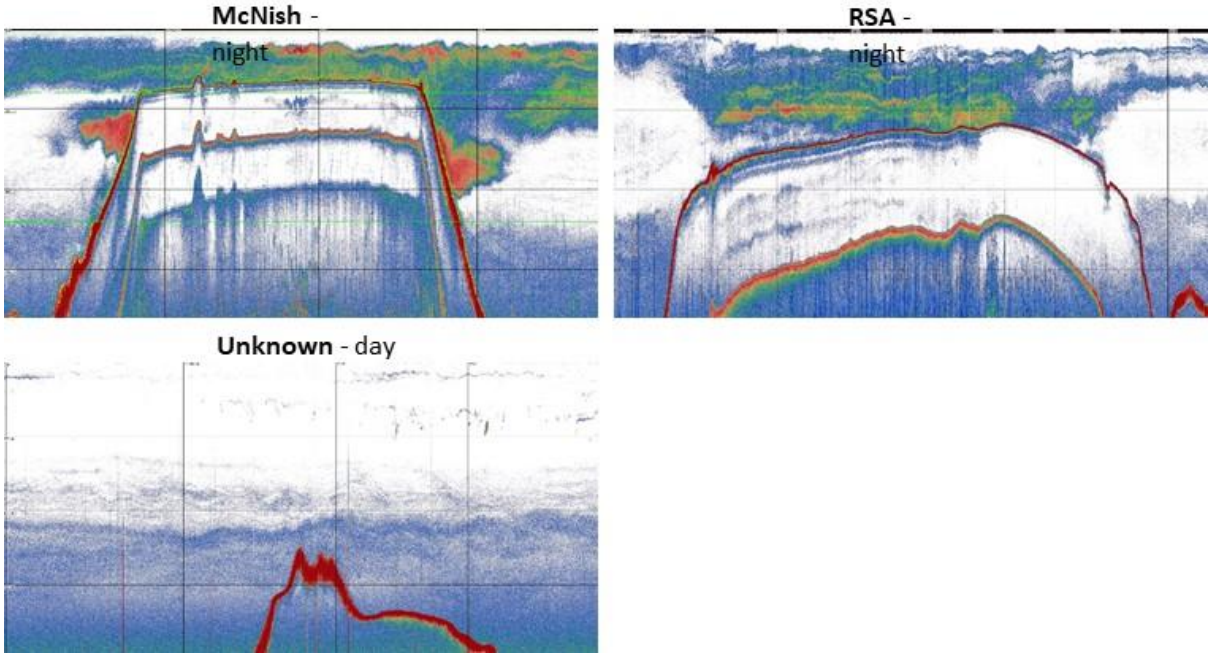


Figure 32 Sv (Volume backscatter) echograms at 70 kHz of the seamounts surveyed around Tristan da Cunha. The cell grids are 2.5 nmi long and 250 m deep. The minimum Sv threshold was set to -75 dB.

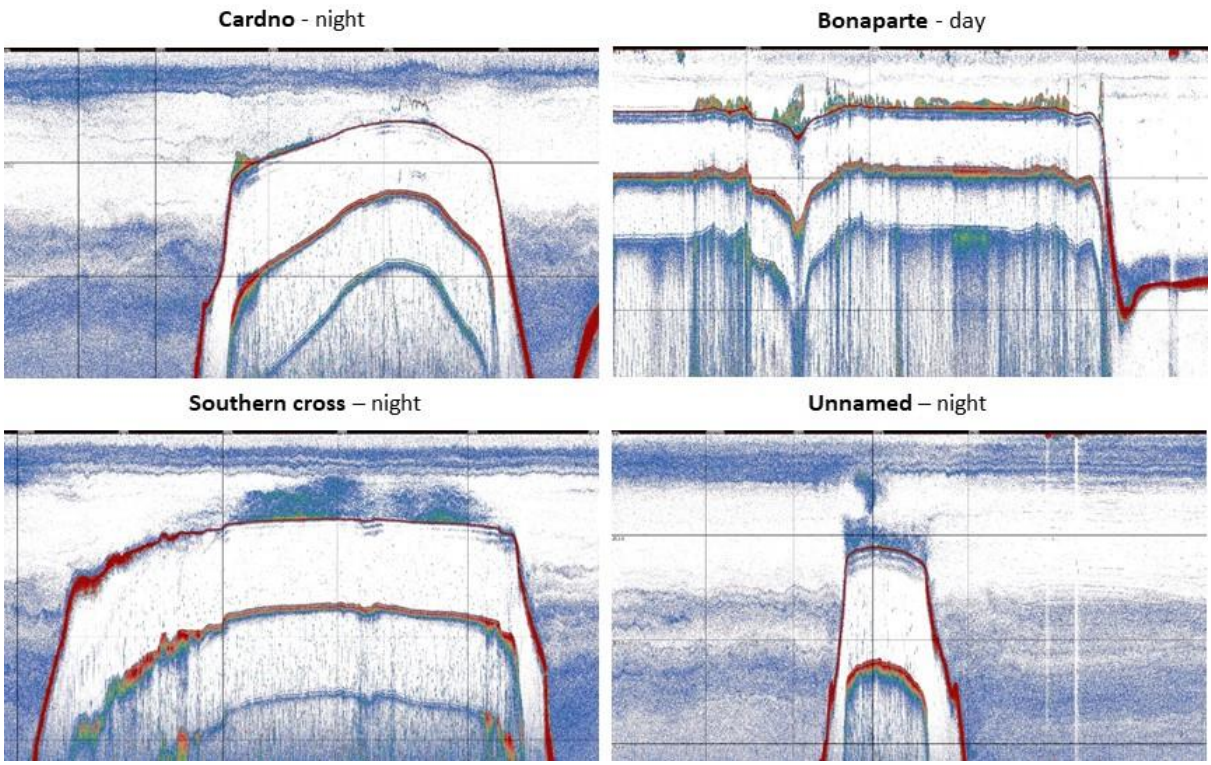


Figure 33 Sv (Volume backscatter) echograms at 70 kHz of the seamounts surveyed around St. Helena. The cell grids are 2.5 nmi long and 250 m deep. The minimum Sv threshold was set to -75 dB.

The spatial distribution of total NASC for all the surveyed seamounts overlaid to the multibeam bathymetry layers is shown in Figures 34 and 35. The total acoustic density largely differed between the 2 study areas and between seamounts within the same area. The seamounts in Tristan da Cunha, in particular McNish and RSA were the areas with the highest density.

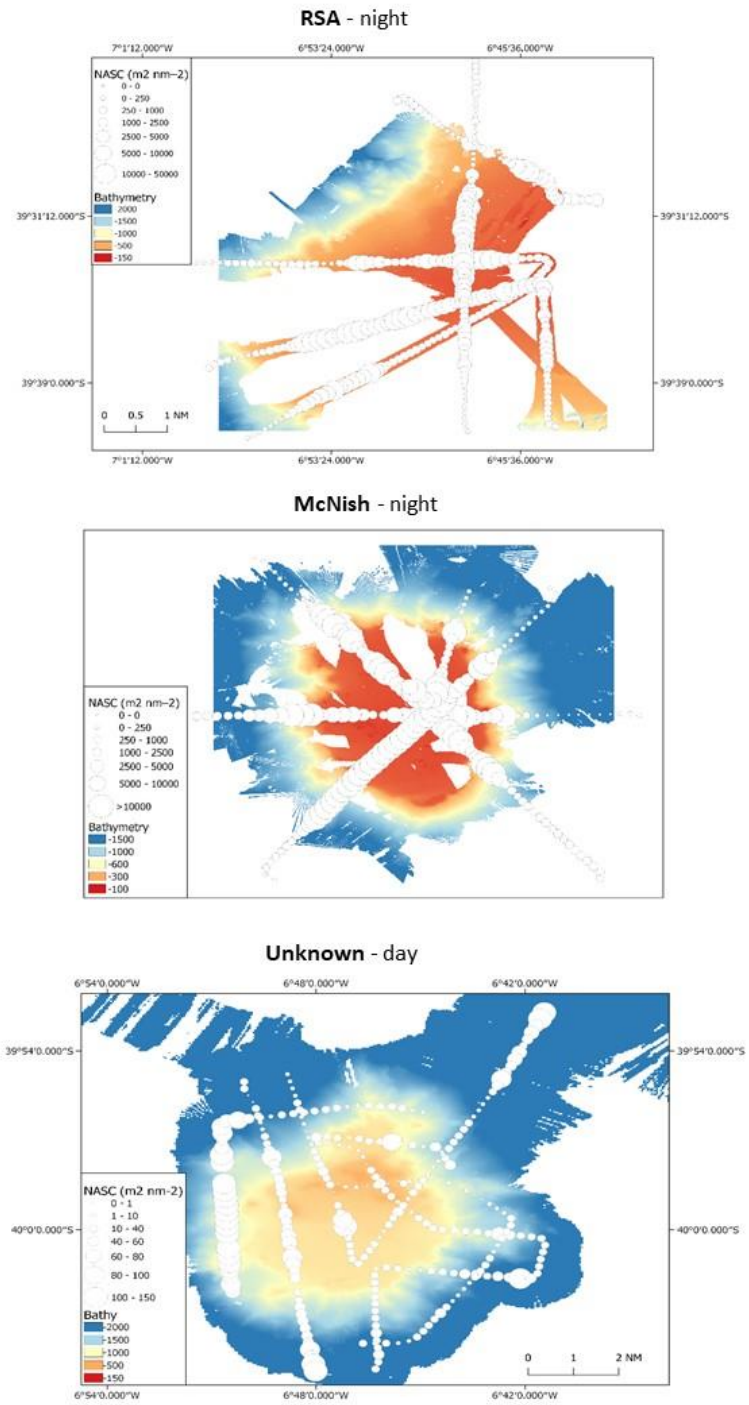


Figure 34 Maps of total NASC (Nautical Area Backscattering Coefficient) for the Tristan da Cunha seamounts.

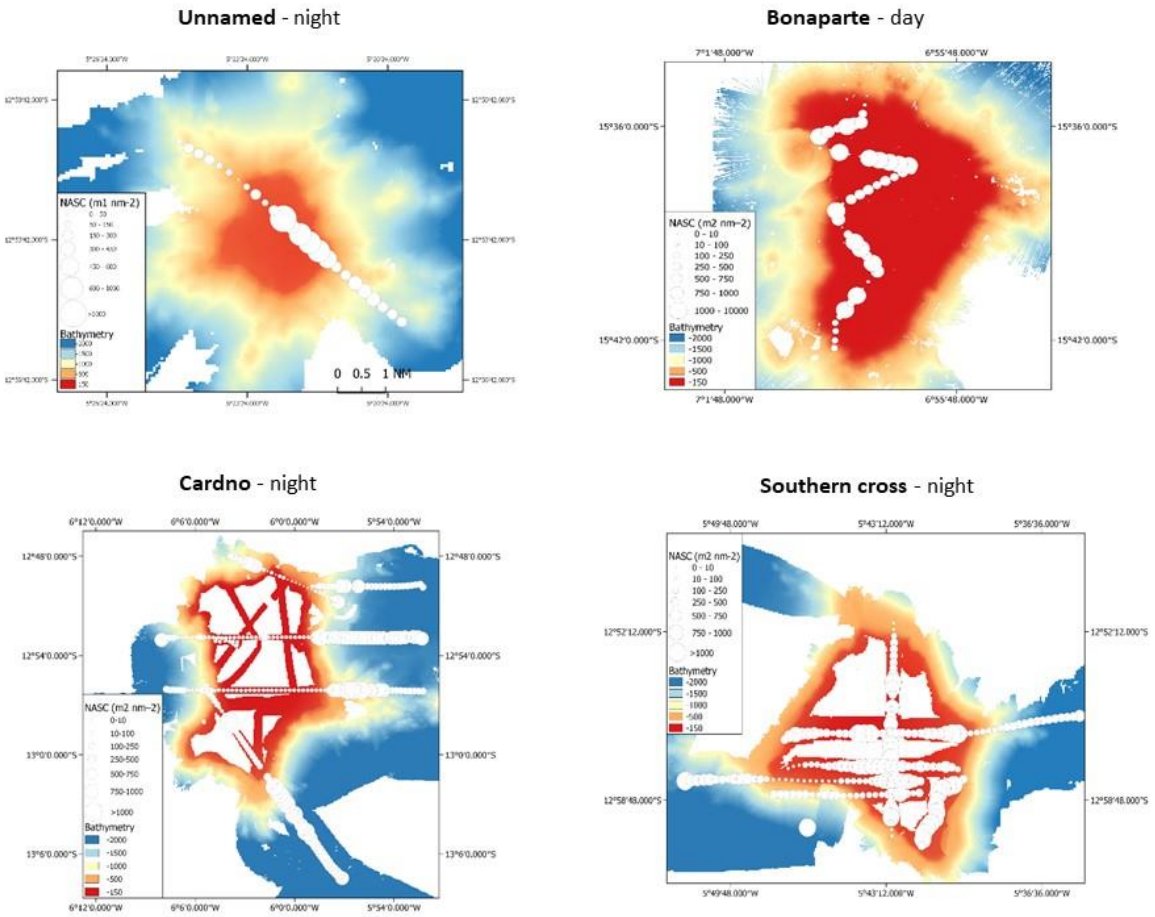


Figure 35. Maps of total NASC (Nautical Area Backscattering Coefficient) for the St. Helena seamounts.

Based on the catches of the RMT 25 sampling performed at these seamounts, most of the backscatter was associated with pearlside (*Maurolicus inventionis).* Pearlside formed high density layers on top of the seamount distributed up in the water column at night. During the day, these layers became denser and moved close to the sea floor. A comparison of the overall acoustic density between the seamounts is shown in Figure 36.

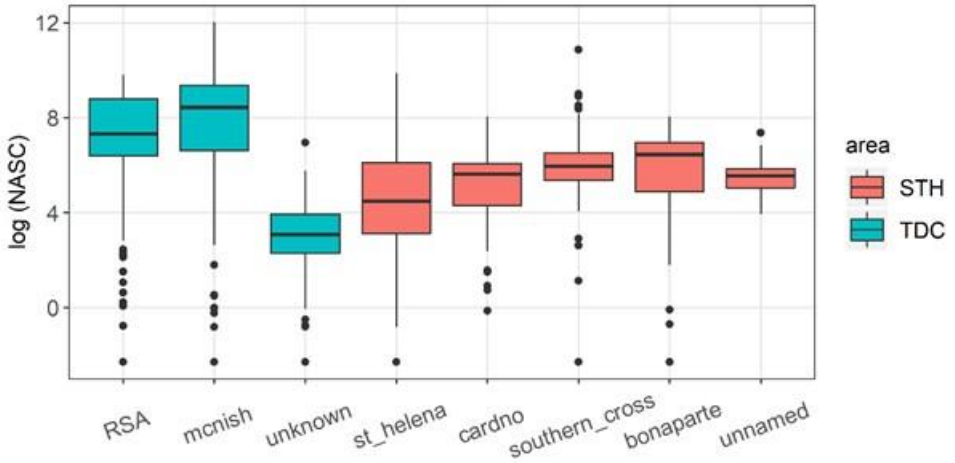


Figure 36 Boxplots of the total NASC (log-transformed) for all the surveyed areas.

5.4.2 Rectangular midwater trawl

The RMT 25 nets were deployed for the purpose of assessing pelagic species from a depth of 1000m-surface. The nets were deployed to assess species composition across different regions and to directly target acoustic signatures identified using fishing acoustics (EK60) live data.

5.4.3 Tristan da Cunha

During the deployments of the RMT 25 within the seamount complexes associated with Tristan da Cunha several issues arose with the net which prevented it operating successfully. These included problems with the down-wire connection and water ingress into the motorised trigger mechanism. These issues were all rectified while onboard. However, due to these issues several of the recorded catches must only be considered as a qualitative representation of the pelagic species present.

RMT 25 deployments were undertaken to the west of Tristan da Cunha, at McNish Seamount and RSA Seamount. Initial observations revealed differences in communities from the different depth bands (Figure 37) A wide range of organisms were observed which included, many species of deep-sea fish, molluscs, crustacea, and cnidarians.

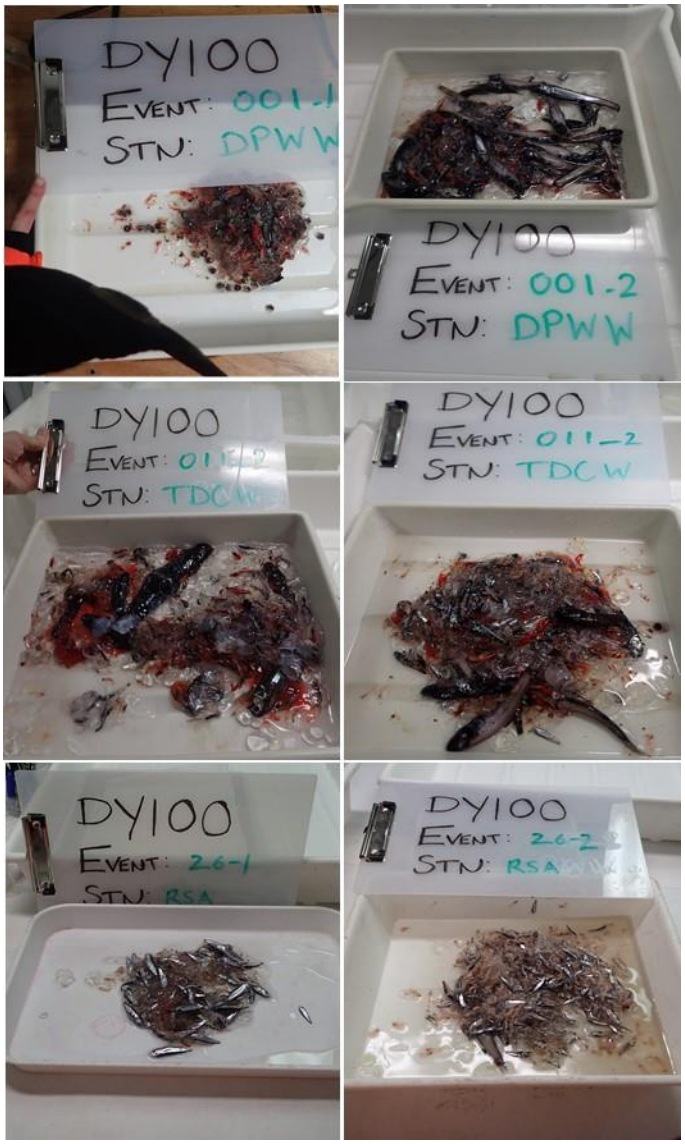


Figure 37 Representative catches from west of Tristan da Cunha (001), McNish Seamount (011) and RSA Seamount (026).

Targeted fishing also revealed discrete species acoustic signals. This was particularly highlighted by *Maurolicus inventionis* (Figure 38*).* Interestingly, the Tristan lobster larvae (*Jasus paulensis*) was observed in several catches taken from the shallowest fished net (Figure 39).

Figure 38 An example of an RMT 25 targeted catch (Maurolicus inventionis) that was conducted over McNish Seamount. Acoustic image shows targeted acoustic signals

Figure 39 An example of a Tristan lobster larvae (Jasus paulensis) caught in the RMT 25 surface net.

5.4.4 St Helena

As with the RMT 25 deployments carried out at Tristan da Cunha both targeted and stratified hauls from different locations (leeward and windward sides of St Helena) and habitat types (open ocean and seamount) were carried out.

Clear differences were observed when catches from the leeward and windward sides of St Helena were compared. The main difference observed was the dominance of the fish species *Ectosebastes imus* and the crustacean *Sergia* sp on the windward side of the island when compared with a catch from the leeward side of the Island (Figure 40).

Figure 40 Representative catches from the leeward (Ev 64; Shovel) and the windward (Ev77-1; George Island) sides of St Helena

Catches from RMT 25 nets that were deployed between the seamounts of Cardno, Southern Cross and Unnamed also revealed subtle differences in the catches (Figure 41). Number of species certainly appeared to be higher at the seamount complexes off St Helena when compared with values attained from Tristan da Cunha, though the malfunctioning of the RMT 25 net while fishing the seamounts around Tristan da Cunha could have also contributed to the lower number of species observed.

Figure 41 Images of RMT 25 catches from Open Ocean (OO), Cardno Seamount (CAR) and Southern Cross Seamount (SC)

It is likely that new species will be identified from the catches and certainly new records of species will be documented as demonstrated catching two inflated rat tails (*Macrouroides inflaticeps*) off the Southern Cross Seamount (Figure 41) All the samples collected during DY100 have been given to the Natural History Museum where they will be fully curated and kept in perpetuity.

A full species inventory and photographic library of all species caught during the RMT 25 surveys around Tristan da Cunha and St Helena was compiled and will be available once it has undergone a thorough Quality Assurance process.

Figure 42 Inflated rat tails (Macrouroides inflaticeps) caught off the Southern Cross seamount. Thought to be a new species record for the Atlantic

5.5 Marine Mammal Sightings

Observations were carried out on all days from the Bridge and Bridge wings, a summary table of daily observation start and end positions and the recorded average sea state conditions is included below:

5.5.1 Falkland Islands transit and Tristan da Cunha

Table 6 Daily observation schedule.

Date	Observation Start position	Observation end position	Average sea state
14/03 – DAY 1	48’50’’23’’’ 47’64’’60’’’	48’08’’88’’’ 45’36’’82’’’	4
15/03 – DAY 2	47’07’’06’’’ 42’14’’87’’’	46’28’’52’’’ 40’12’’39’’’	2 - 5
16/03- DAY 3	45’17’’96’’’ 36’27’’67’’’	44’45’’02’’’ 34’46’’94’’’	4-6
17/03 – DAY 4	43’33’’94’’’ 31’07’’94’’’	42’53’’08’’’ 29’03’’42’’’	5-6
18/03 – DAY 5	41’44’’04’’’ 25’39’’31’’’	41’12’’21’’’ 24’06’’22’’’	5-6
19/03 – DAY 6	40’00’’48’’’ 20’38’’57’’’	39’30’’68’’’ 18’59’’45’’’	3-6

Table 7 Sightings table.

Date	Time	Species	Abundance Estimate	Notes
13-Mar	12:16	Fin Whale	1	
14-Mar	9:45	UNID Baleen Whale	1	
14-Mar	10:38	Sei Whale	1	
14-Mar	11:22	Southern Bottlenosed Whale	2	Travelling together
15-Mar	7:45	Pilot Whale	~10-15	
15-Mar	8:10	Southern Right Whale Dolphin	~20-40	Travelling with pilot whales & common dolphins
15-Mar	8:10	Pilot Whale	~50-60	Travelling with southern right whale dolphins & common dolphins
15-Mar	8:10	Common Dolphin	~30-40	Travelling with pilot whales & southern right whale dolphins
15-Mar	11:20	Fur Seal	1	
15-Mar	15:25	UNID Large Whale	1	
16-Mar	10:45	Sei Whale	1	
18-Mar	10:06	Sei Whale	1	
19-Mar	8:40	Pilot Whale	~30-50	
13-Mar	12:16	Fin Whale	1	

5.5.2 Transit from Tristan da Cunha to St. Helena and on St. Helena Sea Mounts

Table 8 Daily observation schedule.

Date	Observation Start position	Observation end position	Average sea state
2/04 –	27’51’’87’’’ 09’19’86’’’	26’18’’17’’’ 08’51’’54’’’	2-3
3/04 –	23’40’’79’’’ 08’03’’37’’’	46’28’’52’’’ 40’12’’39’’’	2 - 5
4/04-	19’52’’07’’’ 06’55’’85’’	44’45’’02’’’ 34’46’’94’’’	5-6

Date	Observation Start position	Observation end position	Average sea state
5/04 – 08:00-10:40	16'07"31"' 05'48"06"'	15'55"00"' 05'45"98"'	4-5
6/04 – 08:00-12:30	15'58"42"' 05'50"11"'	15'56"84"' 05'46"93"'	2-3
7/04 –	15'58"42"' 05'50"11"'	15'56"84"' 05'46"93"'	3-6
8/04 –08:00-9:20, 12:15-13:15	16'03"70" 05'42"21"'	15'55"57"' 05'45"77"'	5-2
9/04 –08:00-11:30 13:50-16:00	15'42"86" 06'58"95"'	15'04"39"' 06'47"98"'	5
10/04–08:00-10:40 12:00-15:00	13'41"30" 06'22"10"'	12'57"23"' 06'07"28"'	5
11/04 –08:20-11:00	12'50"41" 05'59"33"'	12'51"18"' 06'01"97"'	5
12/04 –On Station's All Day			
13/04 –08:00-11:45 14:00-15:45	12'57"66"' 05'39"97"'	12'59"74"' 05'40"72"'	2-5
14/04-08:00-11:30 12:00-17:30	12'53"72' 05'24"19"'	13'50"06"' 05'29".66"'	4-5

Table 9 Sightings table.

Date	Time	Species	Abundance Estimate	Notes
7-Apr	10:00	Whale Shark	1	100 yards to port
7-Apr	10:40	Rough Toothed Dolphin	20-30	Residents near St. Helena?
7-Apr	11:45	Pan-Tropical Spotted Dolphin	50-100	Residents near St. Helena?
8-Apr	12:30	Bottlenose Dolphin	15-20	Residents near St. Helena?
8-Apr	12:52	Pan-Tropical Spotted Dolphin	50-100	Residents near St. Helena? Same group as 7-Apr?
9-Apr	10:17	Whale Shark	1	100 yrds to port
12-Apr	7:20	UnID Dolphin	6	100-200 near ship

Date	Time	Species	Abundance Estimate	Notes
13-Apr	13:56	Bottlenose Dolphin	8	
14-Apr	15:41	Humpback Whale	3	Breaching on the horizon

5.6 Bird observations

Bird observations are currently being QA'd and are available through request to Andy Schofield at the RSPB – andy.schofield@rspb.org.uk

5.7 CryArcs Project

The tissue sample collection from Discovery 100 is a significant and valuable resource that will be housed at the Natural History Museum Molecular Collections Facility and be made available to the research community through the CryoArks project. During Discovery 100 930 tissue samples from species collected during the trawls around Tristan Da Cunha and 1143 samples from species collected at the St Helena sea mounts. Cumulatively 2073 tissue samples were collected whilst at sea.

5.8 Investigating Trophic Pathways Through Stable Isotope Analysis

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 main objective of this study was to identify the trophic position of the dominant pelagic and benthic species on the Tristan da Cunha and St. Helena seamounts and investigate the key links between the pelagic and the underlying benthos. We expect to get a better understanding of the energy transfer between the benthos and the pelagic and the importance of both pelagic and benthic prey species in the diet of Bluenose warehou in the Tristan da Cunha and St. Helena food webs respectively. The samples collected on DY100 will furthermore be used in comparison to a similar study on bentho-pelagic coupling in the Tristan and St. Helena regions on different seamounts carried out in 2018 (cruise JR17004 on James Clark Ross). Analysis is currently on-going, and a full report made available once completed.

6.0 Appendices

6.1 Events table

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
20/03/2019 16:55	1	DPWW	RMT25	Deployed	9	3446.46	-38.15353	-14.227089
20/03/2019 17:01	1	DPWW	RMT25	Veering		3861.77	-38.154176	-14.22243
20/03/2019 17:52	1	DPWW	RMT25	Net 2 Fired	350	4857.98	-38.1592	-14.185728
20/03/2019 18:23	1	DPWW	RMT25	Net 2 Closed	200	3453.53	-38.162272	-14.163275
20/03/2019 18:24	1	DPWW	RMT25	Net 1 Open	200	4982.69	-38.16232	-14.162866
20/03/2019 19:09	1	DPWW	RMT25	Net 1 Closed	20	7006.60	-38.166744	-14.129792
20/03/2019 19:30	1	DPWW	RMT25	Recovered		3435.00	-38.167232	-14.120158
21/03/2019 12:46	2	EM122 CAL	SVP	Deployed		2328.02	-37.071562	-12.449925
21/03/2019 14:36	3	EM122 CAL	MBES	SOL		2364.94	-37.07244	-12.448665
21/03/2019 16:30	3	EM122 CAL	MBES	EOL		2464.00	-37.080642	-12.455887
21/03/2019 18:00	4	EM710 CAL	MBES	SOL		238.64	-37.324883	-12.51442
21/03/2019 19:54	4	EM710 CAL	MBES	EOL		586.00	-37.332927	-12.53609
21/03/2019 20:25	5	TDCW	SUCS	Deployed		568.60	-37.325486	-12.547623
21/03/2019 21:03	5	TDCW	SUCS	Image taken		567.62	-37.325486	-12.547608
21/03/2019 21:04	5	TDCW	SUCS	Image taken		567.71	-37.325483	-12.547621
21/03/2019 21:05	5	TDCW	SUCS	Image taken		569.68	-37.325481	-12.547616
21/03/2019 21:06	5	TDCW	SUCS	Image taken		568.58	-37.32548	-12.547614
21/03/2019 21:07	5	TDCW	SUCS	Image taken		569.37	-37.325491	-12.547612
21/03/2019 21:17	5	TDCW	SUCS	Image taken		569.39	-37.325481	-12.547611
21/03/2019 22:18	5	TDCW	SUCS	Image taken		570.11	-37.325865	-12.548108
21/03/2019 22:19	5	TDCW	SUCS	Image taken		568.20	-37.32587	-12.548142
21/03/2019 22:20	5	TDCW	SUCS	Image taken		569.92	-37.325864	-12.5482
21/03/2019 22:20	5	TDCW	SUCS	Image taken		567.94	-37.32585	-12.548167
21/03/2019 22:22	5	TDCW	SUCS	Image taken		568.76	-37.325871	-12.548271
21/03/2019 22:22	5	TDCW	SUCS	Image taken		567.60	-37.325864	-12.548215
21/03/2019 22:23	5	TDCW	SUCS	Image taken		567.26	-37.325883	-12.548295
21/03/2019 22:24	5	TDCW	SUCS	Image taken		567.68	-37.325906	-12.548285
21/03/2019 22:24	5	TDCW	SUCS	Image taken		569.62	-37.325897	-12.548296
21/03/2019 22:25	5	TDCW	SUCS	Image taken		568.60	-37.32591	-12.548299
21/03/2019 22:32	5	TDCW	SUCS	Image taken		567.61	-37.325947	-12.548454
21/03/2019 22:58	5	TDCW	SUCS	Recovered		554.34	-37.324889	-12.547536
22/03/2019 00:38	6	TDCW	RMT25	Deployed	0	2026.00	-37.236451	-12.600418
22/03/2019 00:57	6	TDCW	RMT25	Veering	80	2167.00	-37.229154	-12.591292
22/03/2019 01:03	6	TDCW	RMT25	Veering 0.5	129	2245.00	-37.226728	-12.588247
22/03/2019 01:09	6	TDCW	RMT25	Veering 0.5	175	2307.00	-37.2246	-12.585545
22/03/2019 01:26	6	TDCW	RMT25	Veering 0.5	315	2447.00	-37.217805	-12.576914
22/03/2019 01:36	6	TDCW	RMT25	Net 1 Open	390	2502.00	-37.213971	-12.571934
22/03/2019 01:39	6	TDCW	RMT25	Hauling 0.3	384	2500.00	-37.213101	-12.570764
22/03/2019 01:52	6	TDCW	RMT25	Hauling 0.3	288	2572.00	-37.208379	-12.564525

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
22/03/2019 02:10	6	TDCW	RMT25	Net 2 Open	205	2629.00	-37.201914	-12.555968
22/03/2019 02:10	6	TDCW	RMT25	Net 1 Closed	202	2625.00	-37.202114	-12.556246
22/03/2019 02:13	6	TDCW	RMT25	Hauling 0.3	198	2630.00	-37.201028	-12.554806
22/03/2019 02:36	6	TDCW	RMT25	Hauling 0.4	102	2652.00	-37.193432	-12.544619
22/03/2019 02:54	6	TDCW	RMT25	Net 2 Closed	18	2704.00	-37.187952	-12.537156
22/03/2019 03:20	6	TDCW	RMT25	Recovered		2705.00	-37.185517	-12.5333
22/03/2019 10:01	7	TDC	Mooring	Released		158.00	-37.047345	-12.303401
22/03/2019 10:21	7	TDC	Mooring	Recovered		158.00	-37.045184	-12.301478
23/03/2019 14:07	8	MCNE	CTD	In water		1881.79	-40.026538	-8.554853
23/03/2019 14:37	8	MCNE	CTD	MAX Depth	1000	1810.00	-40.026524	-8.554817
23/03/2019 14:45	8	MCNE	CTD	Bottle fired	750	1813.00	-40.026547	-8.554841
23/03/2019 14:53	8	MCNE	CTD	Bottle fired	450	1773.00	-40.026543	-8.554841
23/03/2019 15:00	8	MCNE	CTD	Bottle fired	200	1752.00	-40.026538	-8.554828
23/03/2019 15:04	8	MCNE	CTD	Bottle fired	125	1871.00	-40.026545	-8.554823
23/03/2019 15:08	8	MCNE	CTD	Bottle fired	75	1841.00	-40.026545	-8.554813
23/03/2019 15:10	8	MCNE	CTD	Bottle fired	50	1800.00	-40.02655	-8.554835
23/03/2019 15:13	8	MCNE	CTD	Bottle fired	25	1830.00	-40.026566	-8.554822
23/03/2019 15:16	8	MCNE	CTD	Bottle fired	5	1776.00	-40.026537	-8.55482
23/03/2019 15:20	8	MCNE	CTD	Deployed	0	1773.00	-40.026555	-8.554823
23/03/2019 15:59	9	MCNE	EM122	SOL		1736.62	-40.034952	-8.558262
23/03/2019 19:09	9	MCNE	EM122	EOL		1318.80	-40.123852	-8.508854
23/03/2019 20:08	10	MCNE	EK60	SOL		2498.00	-40.117131	-8.468091
24/03/2019 00:28	10	MCNE	EK60	EOL			-40.232785	-8.530276
24/03/2019 01:02	11	MCN	RMT25	Deployed			-40.195207	-8.503287
24/03/2019 01:14	11	MCN	RMT25	Veering 0.6	60	2302.00	-40.199975	-8.507986
24/03/2019 01:19	11	MCN	RMT25	Veering 0.6	138		-40.201866	-8.510018
24/03/2019 01:24	11	MCN	RMT25	Veering 0.6	187	2500.00	-40.20305	-8.512059
24/03/2019 01:35	11	MCN	RMT25	Veering 0.6	290	2242.00	-40.206445	-8.517683
24/03/2019 01:55	11	MCN	RMT25	Net 1 Open	395	3498.00	-40.213707	-8.527663
24/03/2019 02:01	11	MCN	RMT25	Hauling 0.2	385	2200.00	-40.215036	-8.529813
24/03/2019 02:08	11	MCN	RMT25	Hauling 0.3	364	2132.00	-40.217041	-8.532981
24/03/2019 02:31	11	MCN	RMT25	Hauling 0.3	215		-40.226144	-8.545642
24/03/2019 02:36	11	MCN	RMT25	Net 1 Closed	202	2382.00	-40.228017	-8.548317
24/03/2019 02:38	11	MCN	RMT25	Net 2 Open	202	2348.00	-40.228817	-8.549353
24/03/2019 02:40	11	MCN	RMT25	Hauling 0.3		2340.00	-40.229532	-8.550315
24/03/2019 02:57	11	MCN	RMT25	Hauling 0.4	140	2420.00	-40.236749	-8.560064
24/03/2019 03:23	11	MCN	RMT25	Net 2 Closed	15	2972.00	-40.247241	-8.573126
24/03/2019 04:41	12	MCN	EK60	SOL		2018.00	-40.199596	-8.661035
24/03/2019 07:05	12	MCN	EK60	EOL		156.76	-40.109787	-8.579692
24/03/2019 07:26	13	MCNW	MBES	SOL		172.13	-40.079979	-8.610052
24/03/2019 13:05	14	MCNW	SUCS	Deployed		238.46	-40.160155	-8.603649
24/03/2019 14:03	14	MCNW	SUCS	Image taken		241.01	-40.160191	-8.603744
24/03/2019 14:05	14	MCNW	SUCS	Image taken		239.72	-40.160159	-8.603672

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
24/03/2019 14:07	14	MCNW	SUCS	Image taken		238.54	-40.160144	-8.603625
24/03/2019 14:09	14	MCNW	SUCS	Image taken		228.33	-40.160113	-8.603533
24/03/2019 14:09	14	MCNW	SUCS	Image taken		232.28	-40.160117	-8.603551
24/03/2019 14:10	14	MCNW	SUCS	Image taken		225.34	-40.160089	-8.603495
24/03/2019 14:10	14	MCNW	SUCS	Image taken		228.73	-40.160109	-8.603535
24/03/2019 14:11	14	MCNW	SUCS	Image taken		225.57	-40.160094	-8.603501
24/03/2019 14:13	14	MCNW	SUCS	Image taken		225.18	-40.160064	-8.60342
24/03/2019 14:14	14	MCNW	SUCS	Image taken		224.49	-40.160047	-8.603375
24/03/2019 14:14	14	MCNW	SUCS	Image taken		226.32	-40.160052	-8.603397
24/03/2019 14:14	14	MCNW	SUCS	Image taken		230.30	-40.160055	-8.6034
24/03/2019 14:15	14	MCNW	SUCS	Image taken		230.02	-40.160037	-8.603355
24/03/2019 14:15	14	MCNW	SUCS	Image taken		225.77	-40.160037	-8.603366
24/03/2019 14:16	14	MCNW	SUCS	Image taken		226.26	-40.160012	-8.603306
24/03/2019 14:16	14	MCNW	SUCS	Image taken		223.05	-40.160013	-8.603312
24/03/2019 14:16	14	MCNW	SUCS	Image taken		224.23	-40.160033	-8.603345
24/03/2019 14:17	14	MCNW	SUCS	Image taken		219.95	-40.160004	-8.603284
24/03/2019 14:17	14	MCNW	SUCS	Image taken		225.14	-40.160017	-8.6033
24/03/2019 14:18	14	MCNW	SUCS	Image taken		223.98	-40.159998	-8.603257
24/03/2019 14:28	14	MCNW	SUCS	Recovered		230.32	-40.160002	-8.603212
24/03/2019 15:02	15	MCNW	SUCS	Deployed		182.16	-40.158083	-8.585376
24/03/2019 15:14	15	MCNW	SUCS	Image taken		180.57	-40.158074	-8.585367
24/03/2019 15:16	15	MCNW	SUCS	Image taken		179.74	-40.158081	-8.585372
24/03/2019 15:17	15	MCNW	SUCS	Image taken		181.80	-40.15808	-8.585374
24/03/2019 15:18	15	MCNW	SUCS	Image taken		179.02	-40.158077	-8.585379
24/03/2019 15:19	15	MCNW	SUCS	Image taken		181.24	-40.158082	-8.585383
24/03/2019 15:20	15	MCNW	SUCS	Image taken		178.97	-40.158083	-8.585369
24/03/2019 15:21	15	MCNW	SUCS	Image taken		180.59	-40.158073	-8.58537
24/03/2019 15:22	15	MCNW	SUCS	Image taken		180.38	-40.15808	-8.585375
24/03/2019 15:23	15	MCNW	SUCS	Image taken		179.59	-40.158076	-8.585373
24/03/2019 15:24	15	MCNW	SUCS	Image taken		179.84	-40.158079	-8.585381
24/03/2019 15:25	15	MCNW	SUCS	Image taken		179.41	-40.158076	-8.585374
24/03/2019 15:26	15	MCNW	SUCS	Image taken		180.31	-40.158078	-8.585391
24/03/2019 15:27	15	MCNW	SUCS	Image taken		178.81	-40.158079	-8.58539
24/03/2019 15:28	15	MCNW	SUCS	Image taken		179.09	-40.158074	-8.58538
24/03/2019 15:29	15	MCNW	SUCS	Image taken		178.79	-40.158077	-8.585373
24/03/2019 15:29	15	MCNW	SUCS	Image taken		179.16	-40.158081	-8.585375
24/03/2019 15:30	15	MCNW	SUCS	Image taken		180.76	-40.158076	-8.585375
24/03/2019 15:31	15	MCNW	SUCS	Image taken		178.63	-40.158079	-8.585386
24/03/2019 15:32	15	MCNW	SUCS	Image taken		180.12	-40.158071	-8.585385
24/03/2019 15:33	15	MCNW	SUCS	Image taken		181.03	-40.158069	-8.585374
24/03/2019 15:39	15	MCNW	SUCS	Recovered		180.21	-40.158067	-8.585383
24/03/2019 15:41	15	MCNW	SUCS	Recovered	0	177.98	-40.158061	-8.585369
24/03/2019 17:03	13	MCNW	MBES	EOL		175.60	-40.081891	-8.563321

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
24/03/2019 17:13	16	MCNE	SUCS	Deployed		174.99	-40.083356	-8.562421
24/03/2019 17:29	16	MCNE	SUCS	Image taken		175.36	-40.083535	-8.562133
24/03/2019 17:57	16	MCNE	SUCS	Image taken		185.79	-40.083509	-8.561505
24/03/2019 17:58	16	MCNE	SUCS	Image taken		185.76	-40.083471	-8.561559
24/03/2019 17:58	16	MCNE	SUCS	Image taken		187.78	-40.08348	-8.561531
24/03/2019 17:59	16	MCNE	SUCS	Image taken		185.12	-40.083453	-8.561595
24/03/2019 17:59	16	MCNE	SUCS	Image taken		187.69	-40.083454	-8.561564
24/03/2019 18:00	16	MCNE	SUCS	Image taken		186.32	-40.083409	-8.561645
24/03/2019 18:00	16	MCNE	SUCS	Image taken		185.01	-40.08343	-8.561634
24/03/2019 18:01	16	MCNE	SUCS	Image taken		185.52	-40.08338	-8.561716
24/03/2019 18:01	16	MCNE	SUCS	Image taken		184.30	-40.083397	-8.561689
24/03/2019 18:02	16	MCNE	SUCS	Image taken		184.22	-40.083342	-8.561766
24/03/2019 18:02	16	MCNE	SUCS	Image taken		185.34	-40.083359	-8.561751
24/03/2019 18:03	16	MCNE	SUCS	Image taken		184.30	-40.083291	-8.561845
24/03/2019 18:03	16	MCNE	SUCS	Image taken		184.45	-40.083311	-8.561822
24/03/2019 18:03	16	MCNE	SUCS	Image taken		183.57	-40.083324	-8.561791
24/03/2019 18:04	16	MCNE	SUCS	Image taken		183.32	-40.083266	-8.561864
24/03/2019 18:04	16	MCNE	SUCS	Image taken		184.04	-40.083272	-8.56185
24/03/2019 18:05	16	MCNE	SUCS	Image taken		181.92	-40.083232	-8.561927
24/03/2019 18:05	16	MCNE	SUCS	Image taken		184.90	-40.083249	-8.561884
24/03/2019 18:06	16	MCNE	SUCS	Image taken		184.49	-40.083209	-8.561968
24/03/2019 18:12	16	MCNE	SUCS	Recovered		182.88	-40.083135	-8.562084
24/03/2019 18:13	16	MCNE	SUCS	Recovered		184.05	-40.083265	-8.562153
24/03/2019 18:34	17	MCNE	SUCS	Deployed		250.79	-40.071849	-8.570027
24/03/2019 18:44	17	MCNE	SUCS	Image taken		253.65	-40.071838	-8.570033
24/03/2019 18:46	17	MCNE	SUCS	Image taken		253.66	-40.071836	-8.570033
24/03/2019 18:46	17	MCNE	SUCS	Image taken		254.42	-40.071848	-8.570021
24/03/2019 18:46	17	MCNE	SUCS	Image taken		253.32	-40.071843	-8.570024
24/03/2019 18:46	17	MCNE	SUCS	Image taken		251.50	-40.071843	-8.570026
24/03/2019 18:47	17	MCNE	SUCS	Image taken		252.15	-40.07184	-8.570023
24/03/2019 18:47	17	MCNE	SUCS	Image taken		253.45	-40.07183	-8.570015
24/03/2019 18:48	17	MCNE	SUCS	Image taken		247.11	-40.071841	-8.570024
24/03/2019 18:49	17	MCNE	SUCS	Image taken		254.33	-40.071838	-8.57002
24/03/2019 18:51	17	MCNE	SUCS	Image taken		251.90	-40.071899	-8.570095
24/03/2019 18:52	17	MCNE	SUCS	Image taken		246.57	-40.071937	-8.570151
24/03/2019 18:52	17	MCNE	SUCS	Image taken		249.44	-40.071922	-8.570135
24/03/2019 18:53	17	MCNE	SUCS	Image taken		246.16	-40.071979	-8.5702
24/03/2019 18:53	17	MCNE	SUCS	Image taken		249.86	-40.071953	-8.570168
24/03/2019 18:54	17	MCNE	SUCS	Image taken		250.22	-40.072002	-8.570262
24/03/2019 18:54	17	MCNE	SUCS	Image taken		249.02	-40.07199	-8.570231
24/03/2019 18:55	17	MCNE	SUCS	Image taken		244.49	-40.072062	-8.570329
24/03/2019 18:55	17	MCNE	SUCS	Image taken		245.48	-40.072027	-8.570297
24/03/2019 18:55	17	MCNE	SUCS	Image taken		248.47	-40.072017	-8.570278

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
24/03/2019 18:56	17	MCNE	SUCS	Image taken		246.64	-40.072081	-8.570352
24/03/2019 19:05	17	MCNE	SUCS	Recovered		268.45	-40.071366	-8.569389
24/03/2019 20:41	18	MCN	EK60	SOL		963.27	-40.162953	-8.641599
24/03/2019 21:34	18	MCN	EK60	EOL		1520.43	-40.095242	-8.514831
24/03/2019 21:58	19	MCN	RMT25	In water		1387.11	-40.095825	-8.520188
24/03/2019 22:08	19	MCN	RMT25	Issue with net readings	90	1245.97	-40.098652	-8.523899
24/03/2019 22:21	19	MCN	RMT25	Haul cable up 20m		1011.41	-40.102293	-8.529699
24/03/2019 22:23	19	MCN	RMT25	End of 20m haul cable		994.46	-40.10274	-8.53056
24/03/2019 22:24	19	MCN	RMT25	Veering to 150m		972.80	-40.103047	-8.531154
24/03/2019 22:26	19	MCN	RMT25	End of veering to 150m		952.59	-40.103462	-8.53198
24/03/2019 22:29	19	MCN	RMT25	Haul cable to 120m		913.65	-40.104147	-8.533292
24/03/2019 22:32	19	MCN	RMT25	End of haul cable to 120m	92	880.67	-40.104842	-8.534429
24/03/2019 22:40	19	MCN	RMT25	Net 1 open	94	718.17	-40.106937	-8.538171
24/03/2019 22:42	19	MCN	RMT25	Haul cable to 100m	78	684.71	-40.107354	-8.538949
24/03/2019 22:44	19	MCN	RMT25	End of haul cable to 100m		641.93	-40.107825	-8.539842
24/03/2019 23:10	19	MCN	RMT25	Net 1 closed	74	169.98	-40.114713	-8.552461
24/03/2019 23:14	19	MCN	RMT25	Net 2 open	72	168.72	-40.115928	-8.55455
24/03/2019 23:17	19	MCN	RMT25	Gear depth change	58	163.23	-40.117123	-8.556468
24/03/2019 23:24	19	MCN	RMT25	Veering to 115m	58	160.71	-40.11986	-8.561388
24/03/2019 23:26	19	MCN	RMT25	End of veering to 115m	55	154.82	-40.120677	-8.562841
24/03/2019 23:38	19	MCN	RMT25	Haul to 100m		152.98	-40.125527	-8.571968
24/03/2019 23:40	19	MCN	RMT25	Net 2 closed	52	154.04	-40.126184	-8.573167
24/03/2019 23:58	19	MCN	RMT25	On deck		156.73	-40.128647	-8.577673
25/03/2019 00:30	20	MCN	Bongo	Deployed		161.26	-40.129281	-8.580549
25/03/2019 01:00	20	MCN	Bongo	Recovered	0-100	154.82	-40.12543	-8.584079
25/03/2019 02:35	21	MCN	RMT25	In water		1064.74	-40.057589	-8.655683
25/03/2019 02:43	21	MCN	RMT25	Veering 0.6	57	1004.53	-40.060311	-8.661829
25/03/2019 02:45	21	MCN	RMT25	Veering 0.6	66	1062.77	-40.061296	-8.664061
25/03/2019 02:45	21	MCN	RMT25	Veering 0.6	66	1062.77	-40.061296	-8.664061
25/03/2019 03:29	21	MCN	RMT25	Net 1 Open	1000	1962.46	-40.077423	-8.700374
25/03/2019 04:13	21	MCN	RMT25	Net 1 Closed	700		-40.093034	-8.735519
25/03/2019 04:14	21	MCN	RMT25	Net 2 Open	700	1187.44	-40.093277	-8.736053
25/03/2019 05:05	21	MCN	RMT25	Net 2 Closed	400	3000.00	-40.114157	-8.783158
25/03/2019 07:10	22	MCNW	MBES	SOL		620.71	-40.1233	-8.652037
25/03/2019 07:27	22	MCNW	MBES	EOL		164.47	-40.126109	-8.619002
25/03/2019 08:02	23	MCNW	CTD	In water		161.14	-40.125114	-8.618523
25/03/2019 08:11	23	MCNW	CTD	MAX depth	160	162.03	-40.125117	-8.618524
25/03/2019 08:24	23	MCNW	CTD	Upcast		161.77	-40.125107	-8.618526
25/03/2019 08:34	23	MCNW	CTD	Recovered		161.27	-40.125114	-8.618528
25/03/2019 09:39	24	MCNE	AGT	Deployed		162.50	-40.119511	-8.56084

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
25/03/2019 09:53	24	MCNE	AGT	On bottom	167	162.50	-40.119513	-8.560842
25/03/2019 10:15	24	MCNE	AGT	Hauling	167	164.05	-40.117955	-8.55794
25/03/2019 10:33	24	MCNE	AGT	Off bottom		162.09	-40.117928	-8.557952
25/03/2019 10:45	24	MCNE	AGT	Recovered		162.62	-40.117928	-8.557945
25/03/2019 21:01	25	RSAW	EK60	SOL		1947.51	-39.555747	-7.005281
25/03/2019 21:51	28	RSAW	MBES	SOL		387.62	-39.556155	-6.867569
26/03/2019 03:01	25	RSAW	EK60	EOL		942.16	-39.683887	-6.736176
26/03/2019 04:30	26	RSAW	RMT25	Deployed	0	756.45	-39.679067	-6.702231
26/03/2019 04:41	26	RSAW	RMT25	Veering 0.5	135	647.99	-39.67413	-6.706607
26/03/2019 05:00	26	RSAW	RMT25	Stopped Veering	248	543.04	-39.664122	-6.715456
26/03/2019 05:05	26	RSAW	RMT25	Veering 0.5 to 450	254	527.01	-39.661369	-6.7179
26/03/2019 05:10	26	RSAW	RMT25	Veering 0.5 to 500	268	516.11	-39.658825	-6.720155
26/03/2019 05:13	26	RSAW	RMT25	Veering 0.5 to 550	282	505.19	-39.657023	-6.721745
26/03/2019 05:28	26	RSAW	RMT25	Net 1 Open	328	492.52	-39.647369	-6.730286
26/03/2019 05:47	26	RSAW	RMT25	Ship slowed	325	405.07	-39.636437	-6.739977
26/03/2019 05:49	26	RSAW	RMT25	Hauling 0.2	320	402.88	-39.635647	-6.7407
26/03/2019 06:03	26	RSAW	RMT25	Net 1 Closed	205	378.34	-39.625542	-6.749867
26/03/2019 06:04	26	RSAW	RMT25	Net 2 Open	205	380.06	-39.624911	-6.750437
26/03/2019 06:29	26	RSAW	RMT25	Net 2 Closed	100	349.56	-39.607354	-6.766514
26/03/2019 07:00	26	RSAW	RMT25	Recovered	0	329.15	-39.591765	-6.77905
26/03/2019 08:43	27	RSAW	CTD	Deployed	0	1229.87	-39.542021	-6.920191
26/03/2019 08:45	27	RSAW	CTD	In water		1193.37	-39.542037	-6.920191
26/03/2019 09:13	27	RSAW	CTD	MAX depth	1000M	1191.34	-39.542027	-6.920192
26/03/2019 09:21	27	RSAW	CTD	Bottle fired	750	1189.20	-39.542032	-6.920181
26/03/2019 09:21	27	RSAW	CTD	Bottle fired	750	1192.90	-39.542031	-6.920185
26/03/2019 09:29	27	RSAW	CTD	Bottle fired	450	1195.27	-39.542038	-6.920185
26/03/2019 09:29	27	RSAW	CTD	Bottle fired	450	1193.93	-39.542038	-6.920181
26/03/2019 09:36	27	RSAW	CTD	Bottle fired	200	1180.80	-39.542022	-6.920197
26/03/2019 09:36	27	RSAW	CTD	Bottle fired	200	1194.24	-39.542025	-6.920197
26/03/2019 09:40	27	RSAW	CTD	Bottle fired	125	1198.45	-39.542037	-6.920183
26/03/2019 09:40	27	RSAW	CTD	Bottle fired	125	1194.53	-39.542033	-6.920178
26/03/2019 09:44	27	RSAW	CTD	Bottle fired	75	1191.08	-39.542029	-6.920198
26/03/2019 09:48	27	RSAW	CTD	Bottle fired	25	1200.63	-39.542042	-6.920197
26/03/2019 09:49	27	RSAW	CTD	Bottle fired	20	1221.25	-39.542042	-6.920221
26/03/2019 09:51	27	RSAW	CTD	Bottle fired	5	1231.19	-39.542051	-6.920221
26/03/2019 09:55	27	RSAW	CTD	Recovered	0	1216.76	-39.542061	-6.920208
26/03/2019 10:18	28	RSAW	MBES	SOL		1229.35	-39.530427	-6.90554
26/03/2019 18:46	28	RSAW	MBES	EOL		547.43	-39.482344	-6.806667
26/03/2019 20:10	29	RSAW	RMT25	Deployed	0	376.63	-39.496907	-6.786717
26/03/2019 20:36	29	RSAW	RMT25	Net 1 Open	310	352.76	-39.500805	-6.768154
26/03/2019 21:07	29	RSAW	RMT25	Net 1 Closed	200	320.85	-39.504678	-6.746312
26/03/2019 21:08	29	RSAW	RMT25	Net 2 Open	200	321.11	-39.50478	-6.745766
26/03/2019 21:45	29	RSAW	RMT25	Net 2 Closed	25	261.11	-39.507562	-6.714199

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
26/03/2019 22:05	29	RSAW	RMT25	Recovered	0	252.87	-39.507371	-6.70704
26/03/2019 22:48	30	RSAW	Bongo	Deployed	200	301.99	-39.50667	-6.735784
27/03/2019 01:10	31	RSAW	RMT25	In Water	0	1800.58	-39.426407	-6.843857
27/03/2019 01:18	31	RSAW	RMT25	Veering 0.5	90	1768.70	-39.422857	-6.843079
27/03/2019 01:36	31	RSAW	RMT25	Veering 0.6	506	1615.51	-39.414127	-6.841212
27/03/2019 01:47	31	RSAW	RMT25	Stopped 1000 out	697	1527.05	-39.408381	-6.840037
27/03/2019 01:49	31	RSAW	RMT25	Veering 0.5	695	1555.56	-39.407536	-6.839904
27/03/2019 02:07	31	RSAW	RMT25	Net 1 Open	998	1550.59	-39.398611	-6.838908
27/03/2019 03:05	31	RSAW	RMT25	Net 1 Closed	698	2651.00	-39.363549	-6.836208
27/03/2019 03:06	31	RSAW	RMT25	Net 2 Open	698		-39.363028	-6.836162
27/03/2019 03:57	31	RSAW	RMT25	Net 2 Closed	387	2879.37	-39.332928	-6.829442
27/03/2019 05:08	32	RSAW	EK60	SOL		2838.03	-39.326872	-6.796546
27/03/2019 07:00	32	RSAW	EK60	EOL		291.32	-39.572945	-6.76385
27/03/2019 07:57	33	RSAW	SUCS	Deployed		367.22	-39.501956	-6.788733
27/03/2019 08:13	33	RSAW	SUCS	Image taken		366.58	-39.502399	-6.789758
27/03/2019 08:14	33	RSAW	SUCS	Image taken		365.82	-39.502439	-6.789843
27/03/2019 08:15	33	RSAW	SUCS	Image taken		365.76	-39.502522	-6.790042
27/03/2019 08:15	33	RSAW	SUCS	Image taken		366.79	-39.502483	-6.789914
27/03/2019 08:16	33	RSAW	SUCS	Image taken		365.69	-39.502576	-6.790096
27/03/2019 08:17	33	RSAW	SUCS	Image taken		364.97	-39.502633	-6.790254
27/03/2019 08:17	33	RSAW	SUCS	Image taken		363.89	-39.502608	-6.790178
27/03/2019 08:18	33	RSAW	SUCS	Image taken		363.87	-39.502695	-6.790384
27/03/2019 08:19	33	RSAW	SUCS	Image taken		362.51	-39.502776	-6.790589
27/03/2019 08:20	33	RSAW	SUCS	Image taken		362.21	-39.502847	-6.790727
27/03/2019 08:21	33	RSAW	SUCS	Image taken		363.26	-39.502892	-6.790796
27/03/2019 08:22	33	RSAW	SUCS	Image taken		363.99	-39.502948	-6.79099
27/03/2019 08:22	33	RSAW	SUCS	Image taken		362.79	-39.502922	-6.79092
27/03/2019 08:23	33	RSAW	SUCS	Image taken		366.51	-39.503034	-6.791129
27/03/2019 08:23	33	RSAW	SUCS	Image taken		364.28	-39.502989	-6.791054
27/03/2019 08:24	33	RSAW	SUCS	Image taken		367.05	-39.503053	-6.791207
27/03/2019 08:25	33	RSAW	SUCS	Image taken		361.93	-39.503144	-6.791411
27/03/2019 08:25	33	RSAW	SUCS	Image taken		366.63	-39.503097	-6.791306
27/03/2019 08:26	33	RSAW	SUCS	Image taken		365.96	-39.503179	-6.791532
27/03/2019 08:26	33	RSAW	SUCS	Image taken		364.43	-39.503161	-6.791486
27/03/2019 08:42	33	RSAW	SUCS	Recovered		367.55	-39.503795	-6.7929
27/03/2019 09:22	34	RSAW	SUCS	Deployed		407.78	-39.488012	-6.791371
27/03/2019 09:41	34	RSAW	SUCS	Image taken		406.08	-39.487985	-6.791353
27/03/2019 09:41	34	RSAW	SUCS	Image taken		409.99	-39.487973	-6.791345
27/03/2019 09:42	34	RSAW	SUCS	Image taken		405.99	-39.48798	-6.791358
27/03/2019 09:43	34	RSAW	SUCS	Image taken		405.72	-39.487972	-6.791365
27/03/2019 09:44	34	RSAW	SUCS	Image taken		404.67	-39.487978	-6.791349
27/03/2019 09:45	34	RSAW	SUCS	Image taken		407.34	-39.487974	-6.791366
27/03/2019 09:46	34	RSAW	SUCS	Image taken		408.19	-39.487977	-6.791352

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
27/03/2019 09:46	34	RSAW	SUCS	Image taken		405.02	-39.487968	-6.791364
27/03/2019 09:47	34	RSAW	SUCS	Image taken		406.31	-39.487988	-6.791351
27/03/2019 09:48	34	RSAW	SUCS	Image taken		407.49	-39.487963	-6.791355
27/03/2019 09:55	34	RSAW	SUCS	Image taken		406.77	-39.487748	-6.791042
27/03/2019 09:56	34	RSAW	SUCS	Image taken		407.05	-39.487692	-6.790993
27/03/2019 09:57	34	RSAW	SUCS	Image taken		404.70	-39.487712	-6.791
27/03/2019 09:57	34	RSAW	SUCS	Image taken		406.09	-39.487695	-6.790999
27/03/2019 09:58	34	RSAW	SUCS	Image taken		405.79	-39.487695	-6.790997
27/03/2019 09:59	34	RSAW	SUCS	Image taken		408.48	-39.487693	-6.791009
27/03/2019 09:59	34	RSAW	SUCS	Image taken		405.37	-39.4877	-6.791007
27/03/2019 10:00	34	RSAW	SUCS	Image taken		405.29	-39.487711	-6.790992
27/03/2019 10:00	34	RSAW	SUCS	Image taken		406.51	-39.487705	-6.791001
27/03/2019 10:01	34	RSAW	SUCS	Image taken		407.10	-39.487704	-6.790992
27/03/2019 10:18	34	RSAW	SUCS	Recovered		405.87	-39.48771	-6.790994
27/03/2019 10:57	35	RSAW	SUCS	Deployment		510.53	-39.476139	-6.801134
27/03/2019 11:15	35	RSAW	SUCS	Image taken		512.25	-39.476131	-6.801149
27/03/2019 11:16	35	RSAW	SUCS	Image taken		510.41	-39.476126	-6.801154
27/03/2019 11:18	35	RSAW	SUCS	Image taken		511.13	-39.476104	-6.801121
27/03/2019 11:23	35	RSAW	SUCS	Image taken		514.36	-39.476013	-6.800997
27/03/2019 11:25	35	RSAW	SUCS	Image taken		509.46	-39.475978	-6.800954
27/03/2019 11:26	35	RSAW	SUCS	Image taken		511.81	-39.475975	-6.800921
27/03/2019 11:27	35	RSAW	SUCS	Image taken		510.93	-39.475971	-6.800902
27/03/2019 11:28	35	RSAW	SUCS	Image taken		512.40	-39.475911	-6.800873
27/03/2019 11:29	35	RSAW	SUCS	Image taken		514.58	-39.475896	-6.800847
27/03/2019 11:30	35	RSAW	SUCS	Image taken		515.21	-39.475878	-6.800796
27/03/2019 11:30	35	RSAW	SUCS	Image taken		514.04	-39.475891	-6.800836
27/03/2019 11:31	35	RSAW	SUCS	Image taken		512.80	-39.475858	-6.800792
27/03/2019 11:32	35	RSAW	SUCS	Image taken		511.88	-39.475848	-6.80075
27/03/2019 11:32	35	RSAW	SUCS	Image taken		512.36	-39.475852	-6.800783
27/03/2019 11:34	35	RSAW	SUCS	Image taken		511.45	-39.475785	-6.800718
27/03/2019 11:35	35	RSAW	SUCS	Image taken		510.94	-39.475768	-6.800693
27/03/2019 11:37	35	RSAW	SUCS	Image taken		511.31	-39.475733	-6.800629
27/03/2019 11:37	35	RSAW	SUCS	Image taken		510.61	-39.475752	-6.800652
27/03/2019 11:38	35	RSAW	SUCS	Image taken		510.27	-39.475724	-6.800633
27/03/2019 11:39	35	RSAW	SUCS	Image taken		510.60	-39.475707	-6.800585
27/03/2019 11:54	35	RSAW	SUCS	Recovered		512.68	-39.475703	-6.800568
27/03/2019 12:32	36	RSAW	SUCS	Deployment		691.73	-39.468276	-6.81238
27/03/2019 13:00	36	RSAW	SUCS	Image taken		693.88	-39.469268	-6.813229
27/03/2019 13:01	36	RSAW	SUCS	Image taken		691.00	-39.469264	-6.813242
27/03/2019 13:02	36	RSAW	SUCS	Image taken		690.16	-39.469279	-6.813228
27/03/2019 13:02	36	RSAW	SUCS	Image taken		689.91	-39.469274	-6.813231
27/03/2019 13:03	36	RSAW	SUCS	Image taken		693.87	-39.469268	-6.813234
27/03/2019 13:04	36	RSAW	SUCS	Image taken		692.05	-39.46927	-6.813237

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
27/03/2019 13:05	36	RSAW	SUCS	Image taken		693.80	-39.469258	-6.813238
27/03/2019 13:07	36	RSAW	SUCS	Image taken		691.60	-39.469275	-6.81324
27/03/2019 13:07	36	RSAW	SUCS	Image taken		693.85	-39.469265	-6.813233
27/03/2019 13:08	36	RSAW	SUCS	Image taken		693.50	-39.469262	-6.813249
27/03/2019 13:09	36	RSAW	SUCS	Image taken		691.60	-39.469257	-6.813242
27/03/2019 13:10	36	RSAW	SUCS	Image taken		694.12	-39.469275	-6.813253
27/03/2019 13:11	36	RSAW	SUCS	Image taken		685.22	-39.469327	-6.813291
27/03/2019 13:12	36	RSAW	SUCS	Image taken		692.51	-39.469364	-6.813316
27/03/2019 13:13	36	RSAW	SUCS	Image taken		690.44	-39.469495	-6.813387
27/03/2019 13:14	36	RSAW	SUCS	Image taken		691.19	-39.469562	-6.813452
27/03/2019 13:15	36	RSAW	SUCS	Image taken		693.74	-39.469633	-6.813528
27/03/2019 13:15	36	RSAW	SUCS	Image taken		691.45	-39.469609	-6.813505
27/03/2019 13:16	36	RSAW	SUCS	Image taken		693.11	-39.469726	-6.813583
27/03/2019 13:17	36	RSAW	SUCS	Image taken		682.37	-39.469764	-6.81359
27/03/2019 13:41	36	RSAW	SUCS	Recovered		699.84	-39.471818	-6.815172
27/03/2019 14:17	37	RSAW	SUCS	Deployed		1039.91	-39.490702	-6.805642
27/03/2019 14:36	37	RSAW	SUCS	Image taken		532.20	-39.490698	-6.805665
27/03/2019 14:39	37	RSAW	SUCS	Image taken		532.20	-39.49071	-6.805638
27/03/2019 14:42	37	RSAW	SUCS	Image taken		532.20	-39.490698	-6.805698
27/03/2019 14:49	37	RSAW	SUCS	Image taken		529.20	-39.490794	-6.805793
27/03/2019 14:50	37	RSAW	SUCS	Image taken		529.20	-39.490799	-6.805788
27/03/2019 14:51	37	RSAW	SUCS	Image taken		529.20	-39.490748	-6.805805
27/03/2019 14:53	37	RSAW	SUCS	Image taken		529.20	-39.490665	-6.805938
27/03/2019 14:54	37	RSAW	SUCS	Image taken		529.20	-39.490628	-6.805983
27/03/2019 14:55	37	RSAW	SUCS	Image taken		529.20	-39.490559	-6.806041
27/03/2019 14:56	37	RSAW	SUCS	Image taken		529.20	-39.490504	-6.806091
27/03/2019 14:57	37	RSAW	SUCS	Image taken		532.60	-39.490462	-6.806141
27/03/2019 14:58	37	RSAW	SUCS	Image taken		532.60	-39.490412	-6.806176
27/03/2019 14:59	37	RSAW	SUCS	Image taken		532.60	-39.490381	-6.806191
27/03/2019 15:00	37	RSAW	SUCS	Image taken		532.60	-39.490324	-6.806252
27/03/2019 15:01	37	RSAW	SUCS	Image taken		532.60	-39.490303	-6.806276
27/03/2019 15:02	37	RSAW	SUCS	Image taken		532.60	-39.490262	-6.80633
27/03/2019 15:02	37	RSAW	SUCS	Image taken		532.60	-39.490279	-6.806314
27/03/2019 15:03	37	RSAW	SUCS	Image taken		532.60	-39.490226	-6.806337
27/03/2019 15:04	37	RSAW	SUCS	Image taken		532.90	-39.490152	-6.806417
27/03/2019 15:04	37	RSAW	SUCS	Image taken		532.90	-39.490189	-6.806376
27/03/2019 15:20	37	RSAW	SUCS	Recovered		1027.82	-39.489441	-6.80565
27/03/2019 16:12	38	RSAW	AGT	Deployed		499.38	-39.493278	-6.804875
27/03/2019 16:43	38	RSAW	AGT	On bottom		501.80	-39.493194	-6.805209
27/03/2019 17:11	38	RSAW	AGT	Hauling		507.05	-39.491896	-6.810339
27/03/2019 17:50	38	RSAW	AGT	Off bottom		510.21	-39.49188	-6.81043
27/03/2019 18:10	38	RSAW	AGT	Recovered		515.02	-39.491889	-6.810429
27/03/2019 18:57	39	RSAW	CTD	Deployed	0	367.22	-39.501512	-6.78877

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
27/03/2019 19:12	39	RSAW	CTD	At 350m depth	350	367.65	-39.501362	-6.789043
27/03/2019 19:14	39	RSAW	CTD	MAX depth	365	366.76	-39.501368	-6.789052
27/03/2019 19:15	39	RSAW	CTD	Bottle fired	365	369.08	-39.50136	-6.789059
27/03/2019 19:20	39	RSAW	CTD	Bottle fired	200	1136.89	-39.971275	-6.740682
27/03/2019 19:24	39	RSAW	CTD	Bottle fired	125	370.00	-39.501368	-6.78905
27/03/2019 19:26	39	RSAW	CTD	Bottle fired	75	366.69	-39.501382	-6.789052
27/03/2019 19:29	39	RSAW	CTD	Bottle fired	30	366.19	-39.501387	-6.789072
27/03/2019 19:32	39	RSAW	CTD	Bottle fired	25	368.62	-39.501362	-6.789054
27/03/2019 19:34	39	RSAW	CTD	Bottle fired	5	366.41	-39.501329	-6.789157
27/03/2019 19:37	39	RSAW	CTD	On deck	0	366.71	-39.501199	-6.789386
27/03/2019 20:27	40	RSAW	EK60	SOL		349.92	-39.522032	-6.798942
27/03/2019 21:47	40	RSAW	EK60	EOL		1501.95	-39.688031	-6.795429
27/03/2019 22:09	41	RSAW	RMT25	Deplyed	0	1391.89	-39.691173	-6.786699
27/03/2019 23:27	41	RSAW	RMT25	Net 1 Open	1000	1269.62	-39.711412	-6.724048
27/03/2019 23:31	41	RSAW	RMT25	Veering 50m		1278.50	-39.712229	-6.721072
27/03/2019 23:57	41	RSAW	RMT25	Hauling 0.2		1385.76	-39.719199	-6.700356
28/03/2019 00:07	41	RSAW	RMT25	Slowed hauling to 0.1		1637.91	-39.721806	-6.692848
28/03/2019 00:09	41	RSAW	RMT25	Stopped hauling		1692.67	-39.722595	-6.690932
28/03/2019 00:16	41	RSAW	RMT25	Hauling 0.1		1740.20	-39.724638	-6.685679
28/03/2019 00:29	41	RSAW	RMT25	Net 1 Closed		1695.20	-39.72891	-6.674867
28/03/2019 00:30	41	RSAW	RMT25	Net 2 open		1711.45	-39.729314	-6.673889
28/03/2019 00:32	41	RSAW	RMT25	Hauling 0.2		1706.97	-39.730017	-6.672272
28/03/2019 00:37	41	RSAW	RMT25	Hauling 0.3		1808.40	-39.731767	-6.668051
28/03/2019 00:48	41	RSAW	RMT25	Reduced hauling to 0.2		1977.32	-39.736662	-6.658067
28/03/2019 00:53	41	RSAW	RMT25	Reduced hauling to 0.1		2084.60	-39.739002	-6.653568
28/03/2019 01:28	41	RSAW	RMT25	Increased hauling to 0.2		2359.49	-39.756649	-6.621385
28/03/2019 01:38	41	RSAW	RMT25	Closed net 2		2416.82	-39.761959	-6.611759
28/03/2019 02:22	41	RSAW	RMT25	Recovered		2685.37	-39.784118	-6.57132
28/03/2019 03:49	42	RSAW	RMT25	Deployed net		3734.84	-39.888224	-6.626162
28/03/2019 03:54	42	RSAW	RMT25	Paying out 0.2		3951.39	-39.886128	-6.628505
28/03/2019 03:57	42	RSAW	RMT25	Veering 0.5	50	2863.70	-39.884792	-6.629976
28/03/2019 04:12	42	RSAW	RMT25	Veering 0.5	342	2846.62	-39.877827	-6.637655
28/03/2019 04:15	42	RSAW	RMT25	Veering 0.5	406	2845.03	-39.876352	-6.639285
28/03/2019 04:17	42	RSAW	RMT25	All stopped	421	2847.27	-39.875723	-6.639964
28/03/2019 04:23	42	RSAW	RMT25	Net 1 open	441	2835.82	-39.872679	-6.643335
28/03/2019 04:27	42	RSAW	RMT25	Hauling 0.2	443	2834.48	-39.871262	-6.644903
28/03/2019 04:33	42	RSAW	RMT25	Hauling 0.3	390	2837.97	-39.86875	-6.647594
28/03/2019 04:42	42	RSAW	RMT25	Hauling 0.3	294	2838.64	-39.865299	-6.6513
28/03/2019 04:50	42	RSAW	RMT25	Net 1 Closed	215	2844.30	-39.861807	-6.655071
28/03/2019 04:51	42	RSAW	RMT25	Net 2 Open	217	2844.39	-39.8615	-6.655395
28/03/2019 04:53	42	RSAW	RMT25	Hauling 0.2	214	2840.19	-39.860611	-6.656336
28/03/2019 05:05	42	RSAW	RMT25	Hauling 0.1	105	2838.46	-39.855424	-6.661888

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
28/03/2019 05:19	42	RSAW	RMT25	Hauling 0.2	74	2826.19	-39.849688	-6.668108
28/03/2019 05:26	42	RSAW	RMT25	Net 2 Closed	20.5	2831.21	-39.847392	-6.67069
28/03/2019 05:46	42	RSAW	RMT25	Recovered		2826.79	-39.844589	-6.670184
28/03/2019 05:59	43	UNK	EK60	SOL		2850.62	-39.855654	-6.678157
28/03/2019 07:12	43	UNK	EK60	EOL		830.13	-40.017896	-6.782581
28/03/2019 07:13	44	UNK	EM122	SOL		824.01	-40.015268	-6.782903
28/03/2019 13:35	45	UNK	CTD	Deployed		627.59	-39.975399	-6.766997
28/03/2019 14:01	45	UNK	CTD	MAX depth	625	630.05	-39.975375	-6.766954
28/03/2019 14:02	45	UNK	CTD	Bottle fired	625	629.07	-39.975381	-6.766954
28/03/2019 14:15	45	UNK	CTD	Bottle fired	200	1237.62	-39.975372	-6.766866
28/03/2019 14:22	45	UNK	CTD	Bottle fired	55	623.57	-39.975376	-6.766888
28/03/2019 14:25	45	UNK	CTD	Recovered	0	627.39	-39.975364	-6.766904
28/03/2019 14:30	45	UNK	CTD	Recovered		629.47	-39.975382	-6.766918
28/03/2019 19:10	44	UNK	EM122	EOL		2121.67	-39.914233	-6.799062
29/03/2019 14:54	46	NHM	CTD	Deployed		3433.17	-38.405621	-9.684454
29/03/2019 15:00	46	NHM	CTD	MAX depth	100	3431.60	-38.405626	-9.684463
29/03/2019 15:17	46	NHM	CTD	Recovered	0	3429.93	-38.405618	-9.684458
30/03/2019 08:09	47	TDC	CTD	Deployed		34.00	-37.057563	-12.309138
30/03/2019 08:14	47	TDC	CTD	MAX depth	28	34.00	-37.057562	-12.309151
30/03/2019 08:15	47	TDC	CTD	Bottle fired	28	34.00	-37.057561	-12.309149
30/03/2019 08:25	47	TDC	CTD	Recovered		34.00	-37.05767	-12.309152
30/03/2019 08:30	48	TDC	EK60	EK60 calibration			-37.057915	-12.309038
30/03/2019 10:00	49	TDC	N/A				-37.057992	-12.309089
30/03/2019 12:00	50	TDC	N/A				-37.057985	-12.309085
05/04/2019 06:51	51	STHSL	SVP	Deplyed	1000	1322.94	-16.121938	-5.804435
05/04/2019 07:44	51	STHSL	SVP	at 1000m			-16.121926	-5.804441
05/04/2019 08:08	51	STHSL	SVP	Recovered		1336.35	-16.12194	-5.804432
05/04/2019 08:08	51	STHSL	SVP	Recovered		1336.35	-16.12194	-5.804432
05/04/2019 08:51	52	STH	MBES	SOL		1072.98	-16.072367	-5.794478
05/04/2019 11:00	52	STH	MBES	EOL		78.90	-15.9058	-5.723337
05/04/2019 15:19	53	STHDS	CTD	Deployed	1000	1017.30	-15.850084	-5.745284
05/04/2019 15:19	53	STHDS	CTD	Deployed	1000	1017.30	-15.850084	-5.745284
05/04/2019 15:51	53	STHDS	CTD	MAX Depth - Bottle fired	980	1018.50	-15.850089	-5.745293
05/04/2019 15:58	53	STHDS	CTD	Bottle fired	750	1015.56	-15.850086	-5.745291
05/04/2019 16:05	53	STHDS	CTD	Bottle fired	450	1019.70	-15.850091	-5.745292
05/04/2019 16:12	53	STHDS	CTD	Bottle fired	127	1018.86	-15.850089	-5.74529
05/04/2019 16:16	53	STHDS	CTD	Bottle fired	98	1020.21	-15.85009	-5.745294
05/04/2019 16:16	53	STHDS	CTD	Bottle fired	97	1019.16	-15.85009	-5.745294
05/04/2019 16:21	53	STHDS	CTD	Bottle fired	43	1021.22	-15.850091	-5.745298
05/04/2019 16:23	53	STHDS	CTD	Bottle fired	23	1019.63	-15.850093	-5.745294
05/04/2019 16:25	53	STHDS	CTD	Bottle fired	8	1019.13	-15.850091	-5.745294
05/04/2019 16:27	53	STHDS	CTD	Recovered	0	1018.92	-15.850089	-5.745292
05/04/2019 16:50	54	STHSL	MBES	SOL		1023.87	-15.850412	-5.744865

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
05/04/2019 16:53	54	STH	MBES	SOL		1033.38	-15.855292	-5.741537
05/04/2019 19:50	54	STHSL	MBES	EOL		131.17	-16.059089	-5.723269
05/04/2019 20:38	55	STHSL	CTD	Deployed		1016.75	-16.105028	-5.79572
05/04/2019 21:04	55	STHSL	CTD	Bottle fired	838	1016.25	-16.105036	-5.795713
05/04/2019 21:08	55	STHSL	CTD	Bottle fired	659	1011.99	-16.105033	-5.795721
05/04/2019 21:14	55	STHSL	CTD	Bottle fired	423	1017.24	-16.10503	-5.795719
05/04/2019 21:19	55	STHSL	CTD	Bottle fired	175	1018.27	-16.105027	-5.795726
05/04/2019 21:22	55	STHSL	CTD	Bottle fired	126	1017.32	-16.105023	-5.795724
05/04/2019 21:25	55	STHSL	CTD	Bottle fired	62	1017.95	-16.105029	-5.795711
05/04/2019 21:28	55	STHSL	CTD	Bottle fired	6	1010.04	-16.105022	-5.795718
05/04/2019 21:33	55	STHSL	CTD	Recovered		1019.96	-16.105021	-5.795738
06/04/2019 01:40	56	STHGI	EK60	SOL		1979.97	-16.051544	-5.600635
06/04/2019 06:40	56	STHSV	EK60	EOL		1191.72	-15.95103	-5.814423
06/04/2019 07:17	57	STHSV	CTD	Deployed		1014.39	-15.973597	-5.835401
06/04/2019 07:45	57	STHSV	CTD	Bottle fired	999	1016.36	-15.973593	-5.835405
06/04/2019 07:51	57	STHSV	CTD	Bottle fired	750	1017.44	-15.973596	-5.835403
06/04/2019 07:58	57	STHSV	CTD	Bottle fired	450	1010.49	-15.973596	-5.835402
06/04/2019 08:02	57	STHSV	CTD	Bottle fired	320	1014.79	-15.973604	-5.835398
06/04/2019 08:05	57	STHSV	CTD	Bottle fired	201	1013.19	-15.973593	-5.835395
06/04/2019 08:08	57	STHSV	CTD	Bottle fired	127	1014.61	-15.973601	-5.835408
06/04/2019 08:12	57	STHSV	CTD	Bottle fired	83	1015.03	-15.97359	-5.835401
06/04/2019 08:14	57	STHSV	CTD	Bottle fired	78	1013.54	-15.973592	-5.835398
06/04/2019 08:17	57	STHSV	CTD	Bottle fired	28	1013.75	-15.973596	-5.835399
06/04/2019 08:19	57	STHSV	CTD	Bottle fired	8	1016.41	-15.9736	-5.835404
06/04/2019 08:20	57	STHSV	CTD	Bottle fired	8	989.64	-15.973604	-5.835413
06/04/2019 08:20	57	STHSV	CTD	Bottle fired	7	1015.62	-15.973598	-5.835402
06/04/2019 08:25	57	STHSV	CTD	Recovered		1016.33	-15.973591	-5.835407
06/04/2019 09:15	58	STH	MBES	SOL		1651.06	-15.899459	-5.781267
06/04/2019 11:59	58	STH	MBES	EOL		366.13	-15.90009	-5.73186
06/04/2019 12:50	59	STHLT	CTD	Deployed		392.87	-15.947608	-5.782877
06/04/2019 13:09	59	STHLT	CTD	Bottle fired	380	392.99	-15.947601	-5.782875
06/04/2019 13:15	59	STHLT	CTD	Bottle fired	200	392.46	-15.947603	-5.782871
06/04/2019 13:19	59	STHLT	CTD	Bottle fired	125	392.76	-15.947605	-5.782882
06/04/2019 13:24	59	STHLT	CTD	Bottle fired	80	392.75	-15.947601	-5.782872
06/04/2019 13:28	59	STHLT	CTD	Bottle fired	60	393.20	-15.947605	-5.782871
06/04/2019 13:33	59	STHLT	CTD	Bottle fired	5	393.07	-15.947604	-5.78287
06/04/2019 13:36	59	STHLT	CTD	Recovered		391.13	-15.9476	-5.78287
06/04/2019 14:05	60	STHLT	SUCS	Deployed		81.85	-15.95163	-5.777419
06/04/2019 14:15	60	STHLT	SUCS	Image taken		81.32	-15.951626	-5.777399
06/04/2019 14:17	60	STHLT	SUCS	Image taken		82.08	-15.95163	-5.77741
06/04/2019 14:18	60	STHLT	SUCS	Image taken		81.62	-15.951629	-5.777411
06/04/2019 14:20	60	STHLT	SUCS	Image taken		80.42	-15.951626	-5.777414
06/04/2019 14:22	60	STHLT	SUCS	Image taken		79.46	-15.951602	-5.777376

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
06/04/2019 14:23	60	STHLT	SUCS	Image taken		80.38	-15.951569	-5.777354
06/04/2019 14:24	60	STHLT	SUCS	Image taken		80.51	-15.951537	-5.777323
06/04/2019 14:25	60	STHLT	SUCS	Image taken		80.50	-15.951479	-5.777261
06/04/2019 14:25	60	STHLT	SUCS	Image taken		81.68	-15.951512	-5.777292
06/04/2019 14:26	60	STHLT	SUCS	Image taken		81.29	-15.951453	-5.777232
06/04/2019 14:27	60	STHLT	SUCS	Image taken		80.91	-15.951419	-5.777198
06/04/2019 14:28	60	STHLT	SUCS	Image taken		80.70	-15.951377	-5.777159
06/04/2019 14:29	60	STHLT	SUCS	Image taken		80.17	-15.951352	-5.777125
06/04/2019 14:30	60	STHLT	SUCS	Image taken		82.02	-15.951305	-5.777082
06/04/2019 14:31	60	STHLT	SUCS	Image taken		81.05	-15.951266	-5.777048
06/04/2019 14:32	60	STHLT	SUCS	Image taken		81.56	-15.951226	-5.777003
06/04/2019 14:33	60	STHLT	SUCS	Image taken		81.62	-15.951189	-5.776959
06/04/2019 14:34	60	STHLT	SUCS	Image taken		81.79	-15.951144	-5.776915
06/04/2019 14:35	60	STHLT	SUCS	Image taken		81.15	-15.951098	-5.776867
06/04/2019 14:36	60	STHLT	SUCS	Image taken		81.82	-15.951044	-5.776803
06/04/2019 14:41	60	STHLT	SUCS	Recovered		82.49	-15.951026	-5.776794
06/04/2019 15:23	61	STHLT	SUCS	Deployed		539.08	-15.945208	-5.784527
06/04/2019 15:46	61	STHLT	SUCS	Image taken		574.84	-15.945073	-5.784308
06/04/2019 15:48	61	STHLT	SUCS	Image taken		574.46	-15.94508	-5.784304
06/04/2019 15:52	61	STHLT	SUCS	Image taken		575.22	-15.945082	-5.784299
06/04/2019 15:53	61	STHLT	SUCS	Image taken		572.74	-15.94508	-5.7843
06/04/2019 15:54	61	STHLT	SUCS	Image taken		573.70	-15.945078	-5.784303
06/04/2019 15:55	61	STHLT	SUCS	Image taken		571.81	-15.945077	-5.784301
06/04/2019 15:56	61	STHLT	SUCS	Image taken		573.21	-15.945084	-5.784307
06/04/2019 15:58	61	STHLT	SUCS	Image taken		572.41	-15.945082	-5.784304
06/04/2019 15:59	61	STHLT	SUCS	Image taken		573.27	-15.945081	-5.784303
06/04/2019 16:00	61	STHLT	SUCS	Image taken		573.93	-15.945081	-5.784301
06/04/2019 16:02	61	STHLT	SUCS	Image taken		573.75	-15.94508	-5.784299
06/04/2019 16:10	61	STHLT	SUCS	Image taken		573.89	-15.945082	-5.784302
06/04/2019 16:20	61	STHLT	SUCS	Image taken			-15.944841	-5.784041
06/04/2019 16:36	61	STHLT	SUCS	Image taken			-15.944363	-5.783329
06/04/2019 16:38	61	STHLT	SUCS	Image taken			-15.944345	-5.783192
06/04/2019 16:39	61	STHLT	SUCS	Image taken			-15.944338	-5.783157
06/04/2019 16:40	61	STHLT	SUCS	Image taken			-15.944327	-5.783091
06/04/2019 16:40	61	STHLT	SUCS	Image taken			-15.944329	-5.783116
06/04/2019 16:41	61	STHLT	SUCS	Image taken			-15.944316	-5.783028
06/04/2019 16:44	61	STHLT	SUCS	Image taken			-15.944287	-5.782893
06/04/2019 16:46	61	STHLT	SUCS	Image taken			-15.944266	-5.782771
06/04/2019 16:52	61	STHLT	SUCS	Image taken			-15.944288	-5.782864
06/04/2019 17:07	61	STHLT	SUCS	Recovered			-15.944282	-5.782878
06/04/2019 17:38	62	STHLT	SUCS	Deployed			-15.945007	-5.78998
06/04/2019 18:02	62	STHLT	SUCS	Image taken		725.00	-15.945045	-5.790059
06/04/2019 18:03	62	STHLT	SUCS	Image taken			-15.945078	-5.790148

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
06/04/2019 18:05	62	STHLT	SUCS	Image taken			-15.945099	-5.790228
06/04/2019 18:08	62	STHLT	SUCS	Image taken			-15.945154	-5.790424
06/04/2019 18:09	62	STHLT	SUCS	Image taken			-15.945181	-5.790474
06/04/2019 18:10	62	STHLT	SUCS	Image taken			-15.94519	-5.790518
06/04/2019 18:11	62	STHLT	SUCS	Image taken			-15.945199	-5.790563
06/04/2019 18:12	62	STHLT	SUCS	Image taken			-15.945219	-5.790609
06/04/2019 18:14	62	STHLT	SUCS	Image taken			-15.94527	-5.790741
06/04/2019 18:15	62	STHLT	SUCS	Image taken			-15.945282	-5.790772
06/04/2019 18:16	62	STHLT	SUCS	Image taken			-15.945305	-5.790851
06/04/2019 18:16	62	STHLT	SUCS	Image taken			-15.945293	-5.790815
06/04/2019 18:18	62	STHLT	SUCS	Image taken			-15.945339	-5.790956
06/04/2019 18:23	62	STHLT	SUCS	Image taken			-15.945437	-5.791222
06/04/2019 18:23	62	STHLT	SUCS	Image taken			-15.945427	-5.791189
06/04/2019 18:24	62	STHLT	SUCS	Image taken			-15.945448	-5.791268
06/04/2019 18:25	62	STHLT	SUCS	Image taken			-15.945476	-5.791339
06/04/2019 18:25	62	STHLT	SUCS	Image taken			-15.945459	-5.791297
06/04/2019 18:26	62	STHLT	SUCS	Image taken		739.00	-15.945501	-5.791406
06/04/2019 18:26	62	STHLT	SUCS	Image taken			-15.945486	-5.791367
06/04/2019 18:47	62	STHLT	SUCS	Recovered			-15.945761	-5.792141
06/04/2019 19:17	63	STHLT	EK60	SOL			-15.946175	-5.773193
06/04/2019 20:29	63	STHLT	EK60	EOL			-15.872566	-5.751337
06/04/2019 21:02	64	STHSV	RMT25	Deployed			-15.869632	-5.772574
06/04/2019 21:05	64	STHSV	RMT25	Veering 0.5	59		-15.870906	-5.774137
06/04/2019 21:27	64	STHSV	RMT25	Veering 0.5	458		-15.880495	-5.786152
06/04/2019 21:39	64	STHSV	RMT25	Veering 0.5	633		-15.885553	-5.792647
06/04/2019 22:07	64	STHSV	RMT25	All stopped			-15.897166	-5.807624
06/04/2019 22:09	64	STHSV	RMT25	Veering to 1900			-15.898026	-5.808713
06/04/2019 22:15	64	STHSV	RMT25	Open net 1	1056		-15.900266	-5.811499
06/04/2019 22:23	64	STHSV	RMT25	Hauling 0.2			-15.903736	-5.815878
06/04/2019 22:33	64	STHSV	RMT25	Hauling 0.1			-15.907682	-5.820841
06/04/2019 23:15	64	STHSV	RMT25	Closed net 1	743		-15.925991	-5.843482
06/04/2019 23:17	64	STHSV	RMT25	Open net 2	745		-15.926536	-5.844156
06/04/2019 23:25	64	STHSV	RMT25	Hauling 0.3	699		-15.930148	-5.848669
06/04/2019 23:49	64	STHSV	RMT25	Hauling 0.3	518	2291.00	-15.938885	-5.859793
06/04/2019 23:51	64	STHSV	RMT25	Hauling 0.2	505	2313.00	-15.939558	-5.860634
07/04/2019 00:16	64	STHSV	RMT25	Closed net 2	422	2082.00	-15.948104	-5.871142
07/04/2019 01:05	64	STHSV	RMT25	Gear on surface	0	2234.00	-15.958806	-5.884169
07/04/2019 01:23	65	STHSV	Bongo	Deployed	200	2272.00	-15.958798	-5.88417
07/04/2019 03:02	66	STHSV	RMT25	Deployed	8.6	1458.00	-15.996432	-5.875909
07/04/2019 03:05	66	STHSV	RMT25	Veering 0.5	31.7	1438.00	-15.995074	-5.873979
07/04/2019 03:30	66	STHSV	RMT25	All stopped	435	1053.00	-15.982643	-5.85668
07/04/2019 03:33	66	STHSV	RMT25	Net 1 Open	420	961.00	-15.981551	-5.855098
07/04/2019 03:57	66	STHSV	RMT25	Hauling 0.2	319	1212.00	-15.970397	-5.837845

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
07/04/2019 04:14	66	STHSV	RMT25	Closed net 1	223	1022.00	-15.961003	-5.825839
07/04/2019 04:16	66	STHSV	RMT25	Open net 2	225	1118.00	-15.959642	-5.8244
07/04/2019 04:44	66	STHSV	RMT25	Closed net 2	39.5	970.00	-15.939839	-5.795443
07/04/2019 04:59	66	STHSV	RMT25	Recovered	0	972.00	-15.939582	-5.795072
07/04/2019 06:30	67	STHDS	Mooring	Deployed		86.78	-15.873791	-5.704247
07/04/2019 06:54	68	STH	MBES	SOL		110.29	-15.892254	-5.663372
07/04/2019 07:35	69	STHBL	CTD	Off deck		4208.16	-15.910537	-5.611803
07/04/2019 08:02	69	STHBL	CTD	Bottle fired	1000	1029.94	-15.910539	-5.6118
07/04/2019 08:08	69	STHBL	CTD	Bottle fired	750m	1028.07	-15.910538	-5.611795
07/04/2019 08:15	69	STHBL	CTD	Bottle fired	450m	1029.21	-15.910543	-5.611808
07/04/2019 08:23	69	STHBL	CTD	Bottle fired	125m	1030.54	-15.91054	-5.611801
07/04/2019 08:26	69	STHBL	CTD	Bottle fired	70m	1027.43	-15.910544	-5.611802
07/04/2019 08:29	69	STHBL	CTD	Bottle fired	8m	1030.12	-15.910536	-5.611801
07/04/2019 08:44	69	STHBL	CTD	Recovered	0	1017.06	-15.907858	-5.61476
07/04/2019 10:42	70	STHGI	Mooring	Mooring released		82.19	-15.98453	-5.620806
07/04/2019 13:12	71	STHSBB	Mooring	Mooring released		77.74	-16.020932	-5.694028
07/04/2019 13:59	68	STH	MBES	EOL		830.34	-16.002835	-5.603605
07/04/2019 14:23	72	STHGI	CTD	Deployed		1026.10	-16.004139	-5.599489
07/04/2019 14:59	72	STHGI	CTD	Bottle fired	750	1027.91	-16.004127	-5.599488
07/04/2019 15:03	72	STHGI	CTD	Bottle fired	680	1025.79	-16.004119	-5.599498
07/04/2019 15:08	72	STHGI	CTD	Bottle fired	530	1027.62	-16.004129	-5.599497
07/04/2019 15:11	72	STHGI	CTD	Bottle fired	450	1026.72	-16.004114	-5.599513
07/04/2019 15:18	72	STHGI	CTD	Bottle fired	201	1027.85	-16.004116	-5.599507
07/04/2019 15:21	72	STHGI	CTD	Bottle fired	127	1027.38	-16.004127	-5.59949
07/04/2019 15:25	72	STHGI	CTD	Bottle fired	79	1027.84	-16.004123	-5.599488
07/04/2019 15:26	72	STHGI	CTD	Bottle fired	73	1029.13	-16.004104	-5.599508
07/04/2019 15:30	72	STHGI	CTD	Bottle fired	29	1025.32	-16.004129	-5.599489
07/04/2019 15:32	72	STHGI	CTD	Bottle fired	8	1028.99	-16.004127	-5.599491
07/04/2019 15:34	72	STHGI	CTD	Bottle fired	5	1026.11	-16.004123	-5.599493
07/04/2019 15:37	72	STHGI	CTD	Recovered		1027.36	-16.004129	-5.599492
07/04/2019 16:43	73	STHGI	SUCS	Deployed		127.79	-15.999294	-5.621551
07/04/2019 16:52	73	STHGI	SUCS	Image taken		126.71	-15.999305	-5.621572
07/04/2019 16:54	73	STHGI	SUCS	Image taken		125.38	-15.999244	-5.62156
07/04/2019 16:55	73	STHGI	SUCS	Image taken		126.25	-15.999211	-5.621558
07/04/2019 16:56	73	STHGI	SUCS	Image taken		124.38	-15.999169	-5.621518
07/04/2019 16:56	73	STHGI	SUCS	Image taken		125.38	-15.999192	-5.621525
07/04/2019 16:57	73	STHGI	SUCS	Image taken		123.00	-15.999109	-5.621487
07/04/2019 16:57	73	STHGI	SUCS	Image taken		123.35	-15.999141	-5.621511
07/04/2019 16:58	73	STHGI	SUCS	Image taken		123.29	-15.999044	-5.62148
07/04/2019 16:59	73	STHGI	SUCS	Image taken		122.45	-15.998994	-5.621459
07/04/2019 16:59	73	STHGI	SUCS	Image taken		123.34	-15.999024	-5.621473
07/04/2019 17:00	73	STHGI	SUCS	Image taken		124.07	-15.998973	-5.62144
07/04/2019 17:01	73	STHGI	SUCS	Image taken		123.28	-15.998914	-5.621429

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
07/04/2019 17:01	73	STHGI	SUCS	Image taken		122.93	-15.998936	-5.621433
07/04/2019 17:02	73	STHGI	SUCS	Image taken		123.53	-15.99883	-5.621401
07/04/2019 17:02	73	STHGI	SUCS	Image taken		122.86	-15.998864	-5.621405
07/04/2019 17:02	73	STHGI	SUCS	Image taken		122.95	-15.998887	-5.621414
07/04/2019 17:03	73	STHGI	SUCS	Image taken		123.89	-15.9988	-5.621384
07/04/2019 17:04	73	STHGI	SUCS	Image taken		122.04	-15.998756	-5.621358
07/04/2019 17:04	73	STHGI	SUCS	Image taken		122.93	-15.998783	-5.621369
07/04/2019 17:05	73	STHGI	SUCS	Image taken		122.91	-15.998724	-5.621361
07/04/2019 17:11	73	STHGI	SUCS	Recovered		121.13	-15.998411	-5.621243
07/04/2019 17:38	74	STHGI	SUCS	Deployed		593.04	-16.01287	-5.611284
07/04/2019 17:59	74	STHGI	SUCS	Image taken		590.85	-16.01287	-5.611277
07/04/2019 18:03	74	STHGI	SUCS	Image taken		593.20	-16.012728	-5.611218
07/04/2019 18:04	74	STHGI	SUCS	Image taken		591.54	-16.012683	-5.611194
07/04/2019 18:05	74	STHGI	SUCS	Image taken		593.60	-16.012625	-5.61119
07/04/2019 18:06	74	STHGI	SUCS	Image taken		595.66	-16.012542	-5.611148
07/04/2019 18:06	74	STHGI	SUCS	Image taken		593.35	-16.01259	-5.611157
07/04/2019 18:07	74	STHGI	SUCS	Image taken		593.85	-16.012514	-5.61113
07/04/2019 18:08	74	STHGI	SUCS	Image taken		595.27	-16.012471	-5.611121
07/04/2019 18:09	74	STHGI	SUCS	Image taken		599.63	-16.012397	-5.611084
07/04/2019 18:09	74	STHGI	SUCS	Image taken		596.52	-16.012419	-5.611109
07/04/2019 18:10	74	STHGI	SUCS	Image taken		596.43	-16.012354	-5.611081
07/04/2019 18:11	74	STHGI	SUCS	Image taken		595.18	-16.012291	-5.611044
07/04/2019 18:11	74	STHGI	SUCS	Image taken		598.41	-16.012317	-5.611069
07/04/2019 18:12	74	STHGI	SUCS	Image taken		598.24	-16.012249	-5.611049
07/04/2019 18:13	74	STHGI	SUCS	Image taken		600.35	-16.012197	-5.611022
07/04/2019 18:14	74	STHGI	SUCS	Image taken		602.29	-16.012116	-5.610983
07/04/2019 18:15	74	STHGI	SUCS	Image taken		602.90	-16.012084	-5.61097
07/04/2019 18:16	74	STHGI	SUCS	Image taken		602.34	-16.012053	-5.61096
07/04/2019 18:17	74	STHGI	SUCS	Image taken		603.97	-16.011954	-5.610939
07/04/2019 18:17	74	STHGI	SUCS	Image taken		603.05	-16.012012	-5.610948
07/04/2019 18:21	74	STHGI	SUCS	Recovered		609.61	-16.0118	-5.610867
07/04/2019 18:40	75	STHGI	SUCS	Deployed		594.82	-16.012877	-5.610876
07/04/2019 18:43	75	STHGI	SUCS	Image taken		595.29	-16.012879	-5.610858
07/04/2019 18:44	75	STHGI	SUCS	Image taken		595.88	-16.012913	-5.610871
07/04/2019 18:44	75	STHGI	SUCS	Image taken		595.59	-16.012895	-5.610861
07/04/2019 18:45	75	STHGI	SUCS	Image taken		594.64	-16.01295	-5.610872
07/04/2019 18:46	75	STHGI	SUCS	Image taken		595.72	-16.013036	-5.610861
07/04/2019 18:47	75	STHGI	SUCS	Image taken		596.38	-16.013091	-5.610859
07/04/2019 18:48	75	STHSL	SUCS	Image taken		595.83	-16.013133	-5.610865
07/04/2019 18:49	75	STHGI	SUCS	Image taken		594.53	-16.013169	-5.610876
07/04/2019 18:50	75	STHGI	SUCS	Image taken		597.80	-16.01321	-5.610872
07/04/2019 18:51	75	STHGI	SUCS	Image taken		594.10	-16.013321	-5.610858
07/04/2019 18:52	75	STHGI	SUCS	Image taken		593.54	-16.013352	-5.610863

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
07/04/2019 18:53	75	STHGI	SUCS	Image taken		595.40	-16.013409	-5.610861
07/04/2019 18:53	75	STHGI	SUCS	Image taken		595.89	-16.013383	-5.61086
07/04/2019 18:55	75	STHGI	SUCS	Image taken		597.43	-16.013517	-5.610856
07/04/2019 18:56	75	STHGI	SUCS	Image taken		598.92	-16.013593	-5.610855
07/04/2019 18:57	75	STHGI	SUCS	Image taken		599.01	-16.013622	-5.610859
07/04/2019 18:58	75	STHGI	SUCS	Image taken		602.29	-16.013668	-5.610865
07/04/2019 19:00	75	STHGI	SUCS	Image taken		600.42	-16.013776	-5.610866
07/04/2019 19:01	75	STHGI	SUCS	Image taken		603.12	-16.013853	-5.610856
07/04/2019 19:02	75	STHGI	SUCS	Image taken		602.82	-16.013884	-5.610858
07/04/2019 19:19	75	STHGI	SUCS	Recovered		605.13	-16.014103	-5.611068
07/04/2019 20:44	76	STHGI	RMT25	Deployed	35	2983.71	-15.979204	-5.516256
07/04/2019 20:47	76	STHGI	RMT25	Veering 0.5	57	2964.35	-15.976704	-5.517424
07/04/2019 21:01	76	STHGI	RMT25	Veering 0.5	277	2846.99	-15.966717	-5.521934
07/04/2019 21:40	76	STHGI	RMT25	Veering 0.5	756	2470.57	-15.939583	-5.534238
07/04/2019 22:08	76	STHGI	RMT25	Open net 1	1000	2630.34	-15.91881	-5.54151
07/04/2019 22:31	76	STHGI	RMT25	Hauling 0.1	902	2842.43	-15.901754	-5.547731
07/04/2019 22:55	76	STHGI	RMT25	Hauling 0.3	796	2724.53	-15.883734	-5.554251
07/04/2019 23:06	76	STHGI	RMT25	Closed net 1	704	2656.77	-15.874585	-5.557195
07/04/2019 23:08	76	STHGI	RMT25	Open net 2	708	2652.32	-15.872751	-5.55774
08/04/2019 00:00	76	STHGI	RMT25	Closed net 2	399	2218.51	-15.835747	-5.571825
08/04/2019 02:23	77	STHGI	RMT25	Net deployed	8.1	1222.48	-15.863224	-5.595783
08/04/2019 02:36	77	STHGI	RMT25	Veering 0.5	218	1366.37	-15.871392	-5.593131
08/04/2019 02:54	77	STHGI	RMT25	Open net 1	406	1829.12	-15.883717	-5.589613
08/04/2019 03:09	77	STHGI	RMT25	Hauling 0.2	340	2057.68	-15.893639	-5.586832
08/04/2019 03:35	77	STHGI	RMT25	Closed net 1	212	1984.28	-15.911069	-5.581995
08/04/2019 03:37	77	STHGI	RMT25	Open net 2	214	1944.24	-15.912628	-5.581577
08/04/2019 04:14	77	STHGI	RMT25	Closed net 2	40	1407.10	-15.93757	-5.574708
08/04/2019 04:33	77	STHGI	RMT25	Recovered	0	1498.74	-15.943456	-5.573759
08/04/2019 05:04	78	STHGI	EK60	SOL		2068.54	-15.90554	-5.579553
08/04/2019 07:24	78	STHGI	EK60	EOL		96.15	-16.000148	-5.635717
08/04/2019 08:43	79	STHSL	Mooring	Deployed		853.96	-16.157469	-5.74541
08/04/2019 09:39	80	STHSL	SUCS	Deployed		844.58	-16.15757	-5.745459
08/04/2019 10:00	80	STHSL	SUCS	Image taken		853.33	-16.157568	-5.745444
08/04/2019 10:01	80	STHSL	SUCS	Image taken		847.14	-16.157569	-5.745439
08/04/2019 10:02	80	STHSL	SUCS	Image taken		846.98	-16.157563	-5.745442
08/04/2019 10:03	80	STHSL	SUCS	Image taken		847.23	-16.157569	-5.745443
08/04/2019 10:04	80	STHSL	SUCS	Image taken		854.65	-16.157576	-5.745438
08/04/2019 10:06	80	STHSL	SUCS	Image taken		852.84	-16.15757	-5.745439
08/04/2019 10:08	80	STHSL	SUCS	Image taken		851.83	-16.157538	-5.745301
08/04/2019 10:10	80	STHSL	SUCS	Image taken		852.69	-16.157527	-5.745225
08/04/2019 10:11	80	STHSL	SUCS	Image taken		851.02	-16.157514	-5.745119
08/04/2019 10:11	80	STHSL	SUCS	Image taken		852.84	-16.157526	-5.745157
08/04/2019 10:12	80	STHSL	SUCS	Image taken		851.98	-16.157507	-5.74509

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
08/04/2019 10:13	80	STHSL	SUCS	Image taken		850.94	-16.157491	-5.74502
08/04/2019 10:14	80	STHSL	SUCS	Image taken		851.69	-16.157483	-5.744982
08/04/2019 10:15	80	STHSL	SUCS	Image taken		854.47	-16.15748	-5.744912
08/04/2019 10:21	80	STHSL	SUCS	Image taken		867.16	-16.157416	-5.74456
08/04/2019 10:22	80	STHSL	SUCS	Image taken		871.93	-16.157407	-5.74449
08/04/2019 10:28	80	STHSL	SUCS	Image taken		870.66	-16.157395	-5.744425
08/04/2019 10:29	80	STHSL	SUCS	Image taken		870.60	-16.157389	-5.744423
08/04/2019 10:29	80	STHSL	SUCS	Image taken		872.42	-16.157391	-5.744431
08/04/2019 10:30	80	STHSL	SUCS	Image taken		877.48	-16.157392	-5.744432
08/04/2019 10:52	80	STHSL	SUCS	Recovered		875.10	-16.157409	-5.744425
08/04/2019 11:31	81	STHSL	SUCS	Deployed		87.07	-16.10633	-5.759365
08/04/2019 11:35	81	STHSL	SUCS	Image taken		86.81	-16.106313	-5.759366
08/04/2019 11:36	81	STHSL	SUCS	Image taken		86.41	-16.106328	-5.759364
08/04/2019 11:37	81	STHSL	SUCS	Image taken		85.53	-16.106346	-5.759389
08/04/2019 11:38	81	STHSL	SUCS	Image taken		85.87	-16.106377	-5.75941
08/04/2019 11:39	81	STHSL	SUCS	Image taken		85.49	-16.106455	-5.759423
08/04/2019 11:39	81	STHSL	SUCS	Image taken		84.33	-16.106422	-5.75941
08/04/2019 11:40	81	STHSL	SUCS	Image taken		87.45	-16.106511	-5.759448
08/04/2019 11:40	81	STHSL	SUCS	Image taken		86.41	-16.106492	-5.759428
08/04/2019 11:41	81	STHSL	SUCS	Image taken		87.86	-16.106562	-5.759464
08/04/2019 11:41	81	STHSL	SUCS	Image taken		87.36	-16.10653	-5.759458
08/04/2019 11:42	81	STHSL	SUCS	Image taken		88.13	-16.106621	-5.759479
08/04/2019 11:42	81	STHSL	SUCS	Image taken		88.34	-16.106582	-5.759471
08/04/2019 11:43	81	STHSL	SUCS	Image taken		86.83	-16.106671	-5.759505
08/04/2019 11:43	81	STHSL	SUCS	Image taken		87.56	-16.106652	-5.759492
08/04/2019 11:44	81	STHSL	SUCS	Image taken		87.35	-16.10669	-5.759508
08/04/2019 11:46	81	STHSL	SUCS	Recovered		89.01	-16.106712	-5.759517
08/04/2019 14:25	82	STHJB	CTD	Deployed		42.44	-15.914283	-5.721375
08/04/2019 14:31	82	STHJB	CTD	on bottom	40	42.89	-15.914279	-5.721373
08/04/2019 14:36	82	STHJB	CTD	Bottle fired	4	41.36	-15.914284	-5.721376
08/04/2019 14:49	82	STHJB	CTD	Recovered		39.85	-15.908495	-5.727555
08/04/2019 15:08	83	STHJB	CTD	Deployed		211.75	-15.908243	-5.728602
08/04/2019 15:20	83	STHJB	CTD	Bottle fired	105	211.49	-15.908239	-5.728594
08/04/2019 15:25	83	STHJB	CTD	Bottle fired	59	212.20	-15.90824	-5.728598
08/04/2019 15:29	83	STHJB	CTD	Bottle fired	4	211.82	-15.908241	-5.728599
08/04/2019 15:38	83	STHJB	CTD	Recovered		115.92	-15.907582	-5.729572
08/04/2019 16:04	84	STHJB	CTD	Deployed		527.28	-15.903382	-5.735442
08/04/2019 16:27	84	STHJB	CTD	Bottle fired	449	519.11	-15.903358	-5.735436
08/04/2019 16:31	84	STHJB	CTD	Bottle fired	325	523.38	-15.903354	-5.735438
08/04/2019 16:35	84	STHJB	CTD	Bottle fired	200	525.35	-15.903354	-5.735438
08/04/2019 16:38	84	STHJB	CTD	Bottle fired	126	526.83	-15.903351	-5.735436
08/04/2019 16:41	84	STHJB	CTD	Bottle fired	92	527.03	-15.903358	-5.735437
08/04/2019 16:48	84	STHJB	CTD	Bottle fired	4	525.71	-15.903356	-5.735439

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
08/04/2019 16:50	84	STHJB	CTD	Recovered		522.75	-15.903356	-5.73544
08/04/2019 18:42	85	STHJB	EK60	EK60 calibration		1199.00	-15.92129	-5.778368
09/04/2019 05:48	86	BON	CTD	Deployed		1090.43	-15.722304	-6.992005
09/04/2019 06:19	86	BON	CTD	Bottle fired	750	1088.80	-15.722338	-6.99202
09/04/2019 06:25	86	BON	CTD	Bottle fired	499	1089.82	-15.72234	-6.992019
09/04/2019 06:27	86	BON	CTD	Bottle fired	449	1090.88	-15.722342	-6.992022
09/04/2019 06:33	86	BON	CTD	Bottle fired	201	1092.59	-15.722324	-6.992015
09/04/2019 06:37	86	BON	CTD	Bottle fired	121	1089.53	-15.72232	-6.992014
09/04/2019 06:43	86	BON	CTD	Bottle fired	8	1089.86	-15.722324	-6.992017
09/04/2019 06:45	86	BON	CTD	Recovered		1093.50	-15.72232	-6.992017
09/04/2019 07:12	87	BON	SUCS	Deployed		687.86	-15.713838	-6.983768
09/04/2019 07:43	87	BON	SUCS	Image taken		687.82	-15.713874	-6.983787
09/04/2019 07:44	87	BON	SUCS	Image taken		687.68	-15.713876	-6.983786
09/04/2019 07:45	87	BON	SUCS	Image taken		686.88	-15.713893	-6.983758
09/04/2019 07:46	87	BON	SUCS	Image taken		688.84	-15.713941	-6.983693
09/04/2019 07:47	87	BON	SUCS	Image taken		686.64	-15.713959	-6.983676
09/04/2019 07:48	87	BON	SUCS	Image taken		686.54	-15.71402	-6.983598
09/04/2019 07:48	87	BON	SUCS	Image taken		685.27	-15.713999	-6.983627
09/04/2019 07:49	87	BON	SUCS	Image taken		686.21	-15.714051	-6.983564
09/04/2019 07:50	87	BON	SUCS	Image taken		684.41	-15.714103	-6.983499
09/04/2019 07:51	87	BON	SUCS	Image taken		685.02	-15.714123	-6.983465
09/04/2019 07:52	87	BON	SUCS	Image taken		682.97	-15.71416	-6.98342
09/04/2019 07:53	87	BON	SUCS	Image taken		683.17	-15.714184	-6.983391
09/04/2019 07:54	87	BON	SUCS	Image taken		683.72	-15.714227	-6.983337
09/04/2019 07:54	87	BON	SUCS	Image taken		682.60	-15.714203	-6.983362
09/04/2019 07:55	87	BON	SUCS	Image taken		683.38	-15.714251	-6.983301
09/04/2019 07:56	87	BON	SUCS	Image taken		681.51	-15.714284	-6.983261
09/04/2019 07:58	87	BON	SUCS	Image taken		672.15	-15.714396	-6.983218
09/04/2019 07:58	87	BON	SUCS	Image taken		673.18	-15.714373	-6.983193
09/04/2019 07:59	87	BON	SUCS	Image taken		673.97	-15.714401	-6.983214
09/04/2019 08:00	87	BON	SUCS	Image taken		660.12	-15.71441	-6.983212
09/04/2019 08:18	87	BON	SUCS	Recovered		680.57	-15.714371	-6.983192
09/04/2019 08:57	88	BON	SUCS	Deployed		147.59	-15.691974	-6.98194
09/04/2019 09:06	88	BON	SUCS	Image taken		146.94	-15.691966	-6.981941
09/04/2019 09:09	88	BON	SUCS	Image taken		146.10	-15.691846	-6.981935
09/04/2019 09:09	88	BON	SUCS	Image taken		146.19	-15.691882	-6.981931
09/04/2019 09:10	88	BON	SUCS	Image taken		145.87	-15.691805	-6.981934
09/04/2019 09:11	88	BON	SUCS	Image taken		144.99	-15.691749	-6.981934
09/04/2019 09:12	88	BON	SUCS	Image taken		145.43	-15.691681	-6.98194
09/04/2019 09:12	88	BON	SUCS	Image taken		144.51	-15.691719	-6.981936
09/04/2019 09:13	88	BON	SUCS	Image taken		145.52	-15.691618	-6.981936
09/04/2019 09:13	88	BON	SUCS	Image taken		144.74	-15.691652	-6.98194
09/04/2019 09:14	88	BON	SUCS	Image taken		145.18	-15.691564	-6.981935

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
09/04/2019 09:14	88	BON	SUCS	Image taken		144.47	-15.691597	-6.981937
09/04/2019 09:15	88	BON	SUCS	Image taken		145.11	-15.691513	-6.981943
09/04/2019 09:16	88	BON	SUCS	Image taken		144.83	-15.69148	-6.981941
09/04/2019 09:17	88	BON	SUCS	Image taken		145.48	-15.691413	-6.981936
09/04/2019 09:17	88	BON	SUCS	Image taken		145.44	-15.691445	-6.981938
09/04/2019 09:18	88	BON	SUCS	Image taken		144.82	-15.691365	-6.981969
09/04/2019 09:19	88	BON	SUCS	Image taken		143.94	-15.691296	-6.981944
09/04/2019 09:19	88	BON	SUCS	Image taken		144.39	-15.691324	-6.981948
09/04/2019 09:20	88	BON	SUCS	Image taken		145.36	-15.691264	-6.981941
09/04/2019 09:21	88	BON	SUCS	Image taken		145.40	-15.691213	-6.98193
09/04/2019 09:27	88	BON	SUCS	Recovered		145.87	-15.691169	-6.981936
09/04/2019 10:02	89	BON01	Mooring	Deployed	122	118.33	-15.667996	-6.964378
09/04/2019 10:52	90	BON02	Mooring	Deployed		115.53	-15.619191	-6.948608
09/04/2019 11:31	91	BON	SUCS	Deployed		434.61	-15.608961	-6.996022
09/04/2019 11:40	91	BON	SUCS	Image taken		434.23	-15.608964	-6.996013
09/04/2019 11:40	91	BON	SUCS	Image taken		433.94	-15.608966	-6.996022
09/04/2019 11:41	91	BON	SUCS	Image taken		434.40	-15.608963	-6.996015
09/04/2019 11:41	91	BON	SUCS	Image taken		436.13	-15.608963	-6.996016
09/04/2019 11:42	91	BON	SUCS	Image taken		434.73	-15.60896	-6.99601
09/04/2019 11:43	91	BON	SUCS	Image taken		433.95	-15.608962	-6.996017
09/04/2019 11:43	91	BON	SUCS	Image taken		434.49	-15.608961	-6.996013
09/04/2019 11:44	91	BON	SUCS	Image taken		434.06	-15.608962	-6.996016
09/04/2019 11:45	91	BON	SUCS	Image taken		434.21	-15.608959	-6.996025
09/04/2019 11:45	91	BON	SUCS	Image taken		433.07	-15.608964	-6.99602
09/04/2019 11:48	91	BON	SUCS	Image taken		432.88	-15.608935	-6.996066
09/04/2019 11:49	91	BON	SUCS	Image taken		434.12	-15.608902	-6.996097
09/04/2019 11:51	91	BON	SUCS	Image taken		433.95	-15.608832	-6.996176
09/04/2019 11:52	91	BON	SUCS	Image taken		430.87	-15.608792	-6.996221
09/04/2019 11:53	91	BON	SUCS	Image taken		430.85	-15.608747	-6.996278
09/04/2019 11:54	91	BON	SUCS	Image taken		430.14	-15.608719	-6.996318
09/04/2019 11:55	91	BON	SUCS	Image taken		427.35	-15.608678	-6.996359
09/04/2019 11:56	91	BON	SUCS	Image taken		427.10	-15.608631	-6.996419
09/04/2019 11:57	91	BON	SUCS	Image taken		425.17	-15.608592	-6.996471
09/04/2019 11:59	91	BON	SUCS	Image taken		426.57	-15.60855	-6.99653
09/04/2019 12:26	91	BON	SUCS	Image taken		438.57	-15.60914	-6.9966
09/04/2019 12:47	91	BON	SUCS	Recovered		434.37	-15.608825	-6.996653
09/04/2019 13:25	92	BON	SUCS	Deployed		134.70	-15.598886	-6.974049
09/04/2019 13:30	92	BON	SUCS	Image taken		133.97	-15.598894	-6.974043
09/04/2019 13:31	92	BON	SUCS	Image taken		134.60	-15.598895	-6.974043
09/04/2019 13:32	92	BON	SUCS	Image taken		133.32	-15.598888	-6.97405
09/04/2019 13:33	92	BON	SUCS	Image taken		134.10	-15.598874	-6.973984
09/04/2019 13:33	92	BON	SUCS	Image taken		134.15	-15.59888	-6.974018
09/04/2019 13:34	92	BON	SUCS	Image taken		133.75	-15.598856	-6.973929

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
09/04/2019 13:34	92	BON	SUCS	Image taken		134.20	-15.598864	-6.973962
09/04/2019 13:35	92	BON	SUCS	Image taken		135.03	-15.598835	-6.973867
09/04/2019 13:35	92	BON	SUCS	Image taken		133.31	-15.598847	-6.973891
09/04/2019 13:35	92	BON	SUCS	Image taken		134.57	-15.598852	-6.973909
09/04/2019 13:36	92	BON	SUCS	Image taken		136.26	-15.598832	-6.973836
09/04/2019 13:37	92	BON	SUCS	Image taken		134.41	-15.598814	-6.973757
09/04/2019 13:37	92	BON	SUCS	Image taken		134.64	-15.598821	-6.973791
09/04/2019 13:37	92	BON	SUCS	Image taken		134.53	-15.598826	-6.973807
09/04/2019 13:38	92	BON	SUCS	Image taken		134.80	-15.5988	-6.9737
09/04/2019 13:38	92	BON	SUCS	Image taken		134.66	-15.598811	-6.973735
09/04/2019 13:39	92	BON	SUCS	Image taken		134.76	-15.598794	-6.973655
09/04/2019 13:39	92	BON	SUCS	Image taken		134.45	-15.598797	-6.973681
09/04/2019 13:40	92	BON	SUCS	Image taken		135.95	-15.598777	-6.973614
09/04/2019 13:40	92	BON	SUCS	Image taken		134.18	-15.598781	-6.973638
09/04/2019 13:48	92	BON	SUCS	Recovered		134.82	-15.598771	-6.973585
09/04/2019 19:20	93	STHOO	RMT25	Deployed		4556.31	-14.803813	-6.693196
09/04/2019 19:27	93	STHOO	RMT25	Veering 0.5	71.5	4550.01	-14.800695	-6.689772
09/04/2019 20:00	93	STHOO	RMT25	Veering 0.5	627	4556.34	-14.786176	-6.673922
09/04/2019 20:28	93	STHOO	RMT25	Open net 1	1003	4987.70	-14.773794	-6.660232
09/04/2019 21:19	93	STHOO	RMT25	Closed net 1	700	4680.86	-14.75158	-6.635378
09/04/2019 21:20	93	STHOO	RMT25	Open net 2	702	4659.21	-14.751096	-6.634818
09/04/2019 22:20	93	STHOO	RMT25	Closed net 2	407	4321.38	-14.725186	-6.60478
09/04/2019 23:09	93	STHOO	RMT25	Recovered		4095.39	-14.659806	-6.600571
09/04/2019 23:51	94	STHOO	RMT25	Deployed		4579.49	-14.645369	-6.594662
09/04/2019 23:55	94	STHOO	RMT25	Veering to 400m	25	4131.12	-14.645295	-6.594356
10/04/2019 00:29	94	STHOO	RMT25	Hauling to 200m	400	4223.26	-14.640572	-6.57322
10/04/2019 00:29	94	STHOO	RMT25	Open net 1	400	4216.25	-14.640632	-6.573479
10/04/2019 01:09	94	STHOO	RMT25	Closed net 1	200	3897.90	-14.634938	-6.54804
10/04/2019 01:18	94	STHOO	RMT25	Open net 2	201	4559.07	-14.633752	-6.54276
10/04/2019 01:19	94	STHOO	RMT25	Heaving to 40m	190	5083.74	-14.633555	-6.541894
10/04/2019 01:57	94	STHOO	RMT25	Closed net 2	40	4880.55	-14.628273	-6.517917
10/04/2019 02:13	94	STHOO	RMT25	Recovered		4070.64	-14.627905	-6.516136
10/04/2019 10:52	95	STHOO	CTD	Deployed		3775.85	-13.26423	-6.339637
10/04/2019 11:19	95	STHOO	CTD	Bottle fired	749	3757.88	-13.264217	-6.339621
10/04/2019 11:23	95	STHOO	CTD	Bottle fired	598	3752.06	-13.264219	-6.339621
10/04/2019 11:27	95	STHOO	CTD	Bottle fired	449	3779.64	-13.264219	-6.339626
10/04/2019 11:30	95	STHOO	CTD	Bottle fired	349	3779.60	-13.264216	-6.339636
10/04/2019 11:36	95	STHOO	CTD	Bottle fired	126	3780.53	-13.264222	-6.339631
10/04/2019 11:38	95	STHOO	CTD	Bottle fired	82	3781.86	-13.264221	-6.33963
10/04/2019 11:41	95	STHOO	CTD	Bottle fired	7	3777.81	-13.264219	-6.339637
10/04/2019 11:44	95	STHOO	CTD	Recovered		3753.01	-13.264218	-6.339624
10/04/2019 15:18	96	CAR	CTD	Deployed		1733.13	-12.954071	-6.118282
10/04/2019 15:47	96	CAR	CTD	Bottle fired	749	1726.68	-12.954097	-6.118282

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
10/04/2019 15:52	96	CAR	CTD	Bottle fired	599	1732.97	-12.954091	-6.118288
10/04/2019 15:56	96	CAR	CTD	Bottle fired	498	1717.70	-12.954092	-6.118285
10/04/2019 15:58	96	CAR	CTD	Bottle fired	448	1732.46	-12.954092	-6.118285
10/04/2019 16:03	96	CAR	CTD	Bottle fired	349	1726.63	-12.954087	-6.118294
10/04/2019 16:08	96	CAR	CTD	Bottle fired	126	1730.95	-12.954087	-6.118296
10/04/2019 16:11	96	CAR	CTD	Bottle fired	101	1725.05	-12.954087	-6.118291
10/04/2019 16:15	96	CAR	CTD	Bottle fired	6	1726.35	-12.954081	-6.118295
10/04/2019 16:17	96	CAR	CTD	On deck		1722.26	-12.954089	-6.118292
10/04/2019 16:27	97	CAR	MBES	SOL		1600.59	-12.953708	-6.117668
10/04/2019 18:17	97	CAR	MBES	EOL		148.47	-12.957109	-6.032674
10/04/2019 20:51	98	CAR	RMT25	Deployed		3457.34	-13.179161	-5.888857
10/04/2019 20:52	98	CAR	RMT25	Paying out to 400m	8	3459.06	-13.178751	-5.889771
10/04/2019 21:30	98	CAR	RMT25	Net 1 opened	400	3381.21	-13.166307	-5.918399
10/04/2019 21:34	98	CAR	RMT25	Heaving to 200m	360	3392.31	-13.164782	-5.92198
10/04/2019 22:11	98	CAR	RMT25	Net 1 closed	200	4353.33	-13.152874	-5.949751
10/04/2019 22:12	98	CAR	RMT25	Net 2 opened	203	3387.45	-13.152676	-5.950228
10/04/2019 22:20	98	CAR	RMT25	Aborted tow	181	3313.01	-13.149793	-5.957184
10/04/2019 23:48	99	CAR	RMT25	Deployed	15	3529.14	-13.159786	-5.991044
11/04/2019 00:49	99	CAR	RMT25	Net 1 opened	1000	3477.49	-13.175841	-5.957062
11/04/2019 01:43	99	CAR	RMT25	Net 1 closed	700	3497.23	-13.190789	-5.92526
11/04/2019 01:44	99	CAR	RMT25	Net 2 opened	706	3736.51	-13.191089	-5.924644
11/04/2019 02:34	99	CAR	RMT25	Net 2 closed	400	3553.75	-13.205125	-5.894329
11/04/2019 03:05	99	CAR	RMT25	Recovered		3624.78	-13.213636	-5.875926
11/04/2019 03:38	100	CAR	EK60	SOL		3560.29	-13.20597	-5.869465
11/04/2019 06:01	101	CAR	CTD	Recovered		143.48	-12.945184	-6.051498
11/04/2019 06:09	100	CAR	EK60	EOL		142.03	-12.945421	-6.033495
11/04/2019 06:19	101	CAR	CTD	Deployed		142.50	-12.945341	-6.033437
11/04/2019 06:29	101	CAR	CTD	Bottle fired	132	142.23	-12.94534	-6.033433
11/04/2019 06:31	101	CAR	CTD	Bottle fired	127	143.01	-12.94533	-6.033427
11/04/2019 06:32	101	CAR	CTD	Bottle fired	127	141.54	-12.945327	-6.033437
11/04/2019 06:34	101	CAR	CTD	Bottle fired	102	142.17	-12.945334	-6.033431
11/04/2019 06:37	101	CAR	CTD	Bottle fired	78	142.17	-12.945331	-6.033431
11/04/2019 06:39	101	CAR	CTD	Bottle fired	72	142.47	-12.945338	-6.033433
11/04/2019 06:42	101	CAR	CTD	Bottle fired	53	141.92	-12.945332	-6.033441
11/04/2019 06:45	101	CAR	CTD	Bottle fired	28	142.76	-12.94533	-6.033436
11/04/2019 06:48	101	CAR	CTD	Bottle fired	8	143.01	-12.945329	-6.033436
11/04/2019 07:05	102	CAR	Mooring	Mooring released		143.61	-12.945438	-6.033264
11/04/2019 07:08	103	CAR	MBES	SOL		142.95	-12.946459	-6.031786
11/04/2019 11:14	104	CAR02	Mooring	Mooring released	116	111.92	-12.848772	-6.03046
11/04/2019 14:25	103	CAR	MBES	EOL		450.25	-13.02776	-6.035933
11/04/2019 14:40	105	CAR	SUCS	Deployed		434.90	-13.029144	-6.036487
11/04/2019 14:53	105	CAR	SUCS	Image taken		435.78	-13.029146	-6.036507
11/04/2019 14:53	105	CAR	SUCS	Image taken		435.37	-13.029151	-6.036505

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
11/04/2019 14:54	105	CAR	SUCS	Image taken		435.80	-13.029148	-6.036499
11/04/2019 14:54	105	CAR	SUCS	Image taken		435.44	-13.029156	-6.0365
11/04/2019 14:54	105	CAR	SUCS	Image taken		435.49	-13.029155	-6.036504
11/04/2019 14:55	105	CAR	SUCS	Image taken		435.66	-13.029155	-6.036504
11/04/2019 14:55	105	CAR	SUCS	Image taken		435.13	-13.029153	-6.036505
11/04/2019 14:56	105	CAR	SUCS	Image taken		435.49	-13.02915	-6.036472
11/04/2019 14:57	105	CAR	SUCS	Image taken		435.18	-13.02915	-6.036411
11/04/2019 14:57	105	CAR	SUCS	Image taken		435.09	-13.029148	-6.036444
11/04/2019 14:58	105	CAR	SUCS	Image taken		432.84	-13.029155	-6.036352
11/04/2019 14:58	105	CAR	SUCS	Image taken		433.27	-13.029149	-6.036385
11/04/2019 14:59	105	CAR	SUCS	Image taken		433.48	-13.029153	-6.036322
11/04/2019 15:00	105	CAR	SUCS	Image taken		434.43	-13.029148	-6.036283
11/04/2019 15:01	105	CAR	SUCS	Image taken		441.80	-13.029131	-6.036226
11/04/2019 15:03	105	CAR	SUCS	Image taken		447.03	-13.029114	-6.036081
11/04/2019 15:03	105	CAR	SUCS	Image taken		446.41	-13.029122	-6.036119
11/04/2019 15:04	105	CAR	SUCS	Image taken		447.34	-13.029117	-6.036043
11/04/2019 15:05	105	CAR	SUCS	Image taken		451.27	-13.029098	-6.035953
11/04/2019 15:05	105	CAR	SUCS	Image taken		452.23	-13.02911	-6.035998
11/04/2019 15:17	105	CAR	SUCS	Recovered		463.30	-13.028292	-6.035573
11/04/2019 15:43	106	CAR	SUCS	Deployed		266.30	-13.02267	-6.037904
11/04/2019 15:52	106	CAR	SUCS	Image taken		266.09	-13.022672	-6.037914
11/04/2019 15:55	106	CAR	SUCS	Image taken		265.48	-13.022708	-6.037836
11/04/2019 15:56	106	CAR	SUCS	Image taken		266.44	-13.022743	-6.037754
11/04/2019 15:56	106	CAR	SUCS	Image taken		265.72	-13.022724	-6.037795
11/04/2019 15:57	106	CAR	SUCS	Image taken		266.27	-13.022769	-6.037689
11/04/2019 15:57	106	CAR	SUCS	Image taken		265.84	-13.02276	-6.037726
11/04/2019 15:58	106	CAR	SUCS	Image taken		266.73	-13.022789	-6.037655
11/04/2019 15:59	106	CAR	SUCS	Image taken		266.75	-13.022796	-6.037632
11/04/2019 16:00	106	CAR	SUCS	Image taken		266.92	-13.022839	-6.03755
11/04/2019 16:00	106	CAR	SUCS	Image taken		268.28	-13.022818	-6.037585
11/04/2019 16:01	106	CAR	SUCS	Image taken		267.64	-13.022862	-6.037492
11/04/2019 16:02	106	CAR	SUCS	Image taken		267.17	-13.022877	-6.03747
11/04/2019 16:03	106	CAR	SUCS	Image taken		267.56	-13.022907	-6.037397
11/04/2019 16:03	106	CAR	SUCS	Image taken		265.79	-13.022896	-6.037435
11/04/2019 16:04	106	CAR	SUCS	Image taken		267.00	-13.022927	-6.037352
11/04/2019 16:05	106	CAR	SUCS	Image taken		266.93	-13.022948	-6.037301
11/04/2019 16:05	106	CAR	SUCS	Image taken		266.99	-13.02294	-6.037321
11/04/2019 16:06	106	CAR	SUCS	Image taken		266.01	-13.022979	-6.037238
11/04/2019 16:06	106	CAR	SUCS	Image taken		267.06	-13.022966	-6.037274
11/04/2019 16:07	106	CAR	SUCS	Image taken		279.84	-13.023	-6.03719
11/04/2019 16:14	106	CAR	SUCS	Recovered		267.25	-13.023017	-6.03715
11/04/2019 17:44	107	CAR	CTD	Deployed		1680.86	-12.953414	-5.876774
11/04/2019 18:12	107	CAR	CTD	Bottle fired	749	1679.87	-12.953428	-5.876786

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
11/04/2019 18:15	107	CAR	CTD	Bottle fired	649	1680.60	-12.953433	-5.876784
11/04/2019 18:20	107	CAR	CTD	Bottle fired	449	1682.08	-12.953425	-5.876795
11/04/2019 18:24	107	CAR	CTD	Bottle fired	370	1681.88	-12.953417	-5.876797
11/04/2019 18:31	107	CAR	CTD	Bottle fired	126	1680.17	-12.953433	-5.876785
11/04/2019 18:36	107	CAR	CTD	Bottle fired	72	1681.49	-12.953423	-5.876787
11/04/2019 18:40	107	CAR	CTD	Bottle fired	7	1681.08	-12.953432	-5.876793
11/04/2019 18:44	107	CAR	CTD	Recovered		1681.97	-12.953429	-5.876786
11/04/2019 19:00	108	CAR	EK60	SOL		1693.93	-12.935921	-5.871117
11/04/2019 21:03	108	CAR	EK60	Paused		131.02	-12.881879	-6.075782
11/04/2019 21:24	109	CAR03	Mooring	Mooring released		116.34	-12.890473	-6.059196
11/04/2019 21:30	110	CAR	Bongo	Deployed		115.80	-12.890902	-6.059033
11/04/2019 22:14	111	CAR	EK60	SOL		138.43	-12.882421	-6.07822
11/04/2019 23:38	111	CAR	EK60	EOL		1943.73	-12.905871	-5.872506
12/04/2019 00:46	112	CAR	RMT25	Deployed	2.2	263.70	-12.881091	-6.006338
12/04/2019 01:05	112	CAR	RMT25	Veering 0.2	83	142.96	-12.88352	-5.995009
12/04/2019 01:17	112	CAR	RMT25	Open net 1	102	326.52	-12.885135	-5.986442
12/04/2019 01:48	112	CAR	RMT25	Closed net 1	52	1157.17	-12.88864	-5.967886
12/04/2019 01:49	112	CAR	RMT25	Open net 2	57	1174.99	-12.888719	-5.967439
12/04/2019 02:20	112	CAR	RMT25	Closed net 2	5	1606.35	-12.892562	-5.946921
12/04/2019 02:30	112	CAR	RMT25	Recovered	0	1688.18	-12.893271	-5.943185
12/04/2019 03:26	113	CAR	EK60	SOL		2083.38	-12.828774	-5.872477
12/04/2019 04:08	113	CAR	EK60	EOL		217.87	-12.830385	-5.991157
12/04/2019 04:25	114	CAR	RMT25	Deployed	5	300.74	-12.832554	-5.999372
12/04/2019 04:32	114	CAR	RMT25	Open net 1	76	161.59	-12.834186	-5.994991
12/04/2019 05:03	114	CAR	RMT25	Closed net 1	34	587.79	-12.840122	-5.976564
12/04/2019 05:04	114	CAR	RMT25	Open net 2	41	596.13	-12.840268	-5.976065
12/04/2019 05:34	114	CAR	RMT25	Closed net 2	3	1202.74	-12.845846	-5.957746
12/04/2019 05:45	114	CAR	RMT25	Recovered		1211.84	-12.84623	-5.955743
12/04/2019 06:55	115	CAR	CTD	Deployed		1063.09	-12.800083	-6.062728
12/04/2019 07:25	115	CAR	CTD	Bottle fired	749	1060.99	-12.800065	-6.062724
12/04/2019 07:26	115	CAR	CTD	Bottle fired	750	1066.36	-12.80007	-6.06273
12/04/2019 07:32	115	CAR	CTD	Bottle fired	500	1072.95	-12.800072	-6.062721
12/04/2019 07:35	115	CAR	CTD	Bottle fired	450	1059.57	-12.800078	-6.062719
12/04/2019 07:42	115	CAR	CTD	Bottle fired	200	1065.38	-12.800062	-6.062719
12/04/2019 07:45	115	CAR	CTD	Bottle fired	128	1073.06	-12.800055	-6.062703
12/04/2019 07:45	115	CAR	CTD	Bottle fired	126	1061.11	-12.800056	-6.062702
12/04/2019 07:48	115	CAR	CTD	Bottle fired	93	1062.46	-12.80008	-6.062728
12/04/2019 07:50	115	CAR	CTD	Bottle fired	82	1062.33	-12.800076	-6.062726
12/04/2019 07:53	115	CAR	CTD	Bottle fired	77	1064.87	-12.800091	-6.062734
12/04/2019 07:56	115	CAR	CTD	Bottle fired	27	1065.81	-12.800085	-6.062727
12/04/2019 07:58	115	CAR	CTD	Bottle fired	7 and 8	1061.00	-12.80008	-6.062726
12/04/2019 08:01	115	CAR	CTD	Recovered		1060.46	-12.800082	-6.062728
12/04/2019 09:25	116	CAR	SUCS	Deployed		73.77	-12.881397	-6.038746

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
12/04/2019 09:31	116	CAR	SUCS	Image taken		75.11	-12.881401	-6.038741
12/04/2019 09:32	116	CAR	SUCS	Image taken		76.31	-12.881397	-6.038754
12/04/2019 09:32	116	CAR	SUCS	Image taken		74.50	-12.8814	-6.03875
12/04/2019 09:33	116	CAR	SUCS	Image taken		75.09	-12.881424	-6.038709
12/04/2019 09:34	116	CAR	SUCS	Image taken		74.57	-12.881441	-6.038645
12/04/2019 09:34	116	CAR	SUCS	Image taken		74.83	-12.881427	-6.038672
12/04/2019 09:35	116	CAR	SUCS	Image taken		75.31	-12.881484	-6.038578
12/04/2019 09:35	116	CAR	SUCS	Image taken		75.70	-12.88146	-6.038612
12/04/2019 09:36	116	CAR	SUCS	Image taken		75.69	-12.881511	-6.038525
12/04/2019 09:36	116	CAR	SUCS	Image taken		76.33	-12.881492	-6.038548
12/04/2019 09:37	116	CAR	SUCS	Image taken		75.83	-12.88152	-6.038502
12/04/2019 09:38	116	CAR	SUCS	Image taken		75.10	-12.881555	-6.038426
12/04/2019 09:38	116	CAR	SUCS	Image taken		75.43	-12.881538	-6.038458
12/04/2019 09:39	116	CAR	SUCS	Image taken		75.89	-12.881583	-6.038391
12/04/2019 09:39	116	CAR	SUCS	Image taken		76.65	-12.881573	-6.038403
12/04/2019 09:40	116	CAR	SUCS	Image taken		75.01	-12.881604	-6.038346
12/04/2019 09:40	116	CAR	SUCS	Image taken		75.15	-12.881591	-6.038368
12/04/2019 09:41	116	CAR	SUCS	Image taken		75.14	-12.881635	-6.038289
12/04/2019 09:41	116	CAR	SUCS	Image taken		75.47	-12.881617	-6.038314
12/04/2019 09:42	116	CAR	SUCS	Image taken		74.44	-12.881649	-6.03826
12/04/2019 09:47	116	CAR	SUCS	Recovered		74.54	-12.881659	-6.038238
12/04/2019 11:00	117	CAR	AGT	Deployed		74.01	-12.881755	-6.03845
12/04/2019 11:03	117	CAR	AGT	On bottom		73.94	-12.881841	-6.038285
12/04/2019 11:11	117	CAR	AGT	Towing		74.59	-12.882391	-6.037221
12/04/2019 11:35	117	CAR	AGT	Off bottom		76.59	-12.883298	-6.03547
12/04/2019 11:35	117	CAR	AGT	Off bottom		76.59	-12.883298	-6.03547
12/04/2019 11:41	117	CAR	AGT	Recovered		76.41	-12.883294	-6.035468
12/04/2019 13:54	118	CAR	SUCS	Deployed		549.20	-13.038867	-6.036513
12/04/2019 14:11	118	CAR	SUCS	Image taken		553.69	-13.039375	-6.037012
12/04/2019 14:13	118	CAR	SUCS	Image taken		552.17	-13.039403	-6.036977
12/04/2019 14:13	118	CAR	SUCS	Image taken		553.21	-13.039379	-6.036987
12/04/2019 14:15	118	CAR	SUCS	Image taken		554.86	-13.039425	-6.036948
12/04/2019 14:16	118	CAR	SUCS	Image taken		554.24	-13.039435	-6.036923
12/04/2019 14:17	118	CAR	SUCS	Image taken		553.23	-13.039459	-6.036896
12/04/2019 14:18	118	CAR	SUCS	Image taken		552.85	-13.039473	-6.036878
12/04/2019 14:19	118	CAR	SUCS	Image taken		552.17	-13.039511	-6.036812
12/04/2019 14:20	118	CAR	SUCS	Image taken		552.18	-13.039546	-6.036791
12/04/2019 14:21	118	CAR	SUCS	Image taken		552.30	-13.03957	-6.036759
12/04/2019 14:22	118	CAR	SUCS	Image taken		552.74	-13.03961	-6.036692
12/04/2019 14:23	118	CAR	SUCS	Image taken		552.82	-13.039642	-6.036661
12/04/2019 14:24	118	CAR	SUCS	Image taken		553.24	-13.039703	-6.036588
12/04/2019 14:24	118	CAR	SUCS	Image taken		554.50	-13.039666	-6.036618
12/04/2019 14:26	118	CAR	SUCS	Image taken		554.03	-13.039757	-6.036504

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
12/04/2019 14:26	118	CAR	SUCS	Image taken		553.09	-13.039738	-6.036538
12/04/2019 14:27	118	CAR	SUCS	Image taken		553.67	-13.039779	-6.036472
12/04/2019 14:28	118	CAR	SUCS	Image taken		553.17	-13.03981	-6.036416
12/04/2019 14:28	118	CAR	SUCS	Image taken		552.62	-13.039794	-6.036446
12/04/2019 14:29	118	CAR	SUCS	Image taken		553.21	-13.039824	-6.036383
12/04/2019 14:42	118	CAR	SUCS	Recovered		553.38	-13.039447	-6.036287
12/04/2019 14:55	119	CAR	AGT	Deployed		552.35	-13.039411	-6.036276
12/04/2019 15:15	119	CAR	AGT	On bottom		551.94	-13.039394	-6.036274
12/04/2019 15:59	119	CAR	AGT	Off bottom		559.28	-13.039478	-6.03167
12/04/2019 16:21	119	CAR	AGT	Recovered		559.75	-13.03948	-6.031663
12/04/2019 17:03	120	CAR	SUCS	Deployed		924.45	-13.056105	-6.033872
12/04/2019 17:33	120	CAR	SUCS	Image taken		919.67	-13.056164	-6.033829
12/04/2019 17:34	120	CAR	SUCS	Image taken		920.76	-13.056156	-6.033836
12/04/2019 17:34	120	CAR	SUCS	Image taken		922.99	-13.056162	-6.033835
12/04/2019 17:37	120	CAR	SUCS	Image taken		910.61	-13.056011	-6.033702
12/04/2019 17:38	120	CAR	SUCS	Image taken		903.95	-13.055988	-6.033679
12/04/2019 17:40	120	CAR	SUCS	Image taken		908.40	-13.055945	-6.033648
12/04/2019 17:41	120	CAR	SUCS	Image taken		906.15	-13.055927	-6.033617
12/04/2019 17:42	120	CAR	SUCS	Image taken		906.37	-13.055881	-6.033601
12/04/2019 17:43	120	CAR	SUCS	Image taken		903.54	-13.055881	-6.033586
12/04/2019 17:44	120	CAR	SUCS	Image taken		902.17	-13.055867	-6.033571
12/04/2019 17:45	120	CAR	SUCS	Image taken		903.94	-13.055845	-6.033556
12/04/2019 17:46	120	CAR	SUCS	Image taken		899.88	-13.055809	-6.033524
12/04/2019 17:46	120	CAR	SUCS	Image taken		902.41	-13.055836	-6.033545
12/04/2019 17:47	120	CAR	SUCS	Image taken		900.88	-13.055794	-6.033514
12/04/2019 17:48	120	CAR	SUCS	Image taken		900.57	-13.055772	-6.033495
12/04/2019 17:49	120	CAR	SUCS	Image taken		901.99	-13.055754	-6.033481
12/04/2019 17:50	120	CAR	SUCS	Image taken		895.92	-13.055737	-6.033467
12/04/2019 17:50	120	CAR	SUCS	Image taken		894.16	-13.055746	-6.033481
12/04/2019 17:51	120	CAR	SUCS	Image taken		894.33	-13.055715	-6.033449
12/04/2019 17:52	120	CAR	SUCS	Image taken		892.75	-13.055702	-6.033438
12/04/2019 18:14	120	CAR	SUCS	Recovered		892.90	-13.05569	-6.033425
12/04/2019 21:55	121	STHSC	RMT25	Deployed		1984.40	-13.001968	-5.771978
12/04/2019 22:32	121	STHSC	RMT25	Net 1 opened	400	2264.42	-13.002	-5.802795
12/04/2019 23:22	121	STHSC	RMT25	Net 2 opened	202	2464.91	-13.001986	-5.844443
12/04/2019 23:22	121	STHSC	RMT25	Net 1 closed	200	2454.34	-13.001988	-5.844241
13/04/2019 00:12	121	STHSC	RMT25	Net 2 closed	3	2318.41	-13.002121	-5.894202
13/04/2019 00:24	121	STHSC	RMT25	Recovered	0	2272.40	-13.001439	-5.896192
13/04/2019 01:20	122	STHSC	RMT25	Deployed	3.5	1129.85	-12.934401	-5.92586
13/04/2019 02:25	122	STHSC	RMT25	Net 1 opened	1000	1932.80	-12.8969	-5.90609
13/04/2019 03:16	122	STHSC	RMT25	Net 2 opened	700	2010.01	-12.866957	-5.890234
13/04/2019 03:16	122	STHSC	RMT25	Net 1 closed	700	2007.19	-12.867158	-5.890345
13/04/2019 04:05	122	STHSC	RMT25	Net 2 closed	400	2075.16	-12.839346	-5.875674

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
13/04/2019 04:45	122	STHSC	RMT25	Recovered		2093.51	-12.82069	-5.865865
13/04/2019 06:04	123	STHSC	EK60	SOL		524.73	-12.859424	-5.728427
13/04/2019 06:39	124	STHSC	Mooring	Deployed		170.00	-12.919736	-5.716726
13/04/2019 07:13	123	STHSC	EK60	EOL		424.87	-12.998095	-5.716259
13/04/2019 07:19	125	STHSC	MBES	SOL		441.54	-13.007483	-5.708113
13/04/2019 09:04	126	STHSC	CTD	Deployed		157.18	-12.928778	-5.71639
13/04/2019 09:15	126	STHSC	CTD	Bottle fired	145	157.17	-12.928774	-5.716386
13/04/2019 09:18	126	STHSC	CTD	Bottle fired	126	157.01	-12.928783	-5.716386
13/04/2019 09:20	126	STHSC	CTD	Bottle fired	106	158.81	-12.928783	-5.716385
13/04/2019 09:22	126	STHSC	CTD	Bottle fired	91	157.85	-12.928779	-5.716389
13/04/2019 09:23	126	STHSC	CTD	Bottle fired	92	156.86	-12.928775	-5.716385
13/04/2019 09:25	126	STHSC	CTD	Bottle fired	77	157.17	-12.928778	-5.716382
13/04/2019 09:28	126	STHSC	CTD	Bottle fired	27	157.44	-12.928779	-5.716386
13/04/2019 09:30	126	STHSC	CTD	Bottle fired	7	159.79	-12.928782	-5.71639
13/04/2019 09:31	126	STHSC	CTD	Bottle fired	7	157.59	-12.928776	-5.71638
13/04/2019 09:34	126	STHSC	CTD	Recovered		156.63	-12.928777	-5.716383
13/04/2019 10:18	127	STHSC	Mooring	Deployed		183.04	-12.929436	-5.766062
13/04/2019 11:53	128	STHSC	SUCS	Deployed		517.77	-12.851815	-5.739299
13/04/2019 12:08	128	STHSC	SUCS	Image taken		519.71	-12.851815	-5.739291
13/04/2019 12:11	128	STHSC	SUCS	Image taken		518.03	-12.851965	-5.739244
13/04/2019 12:13	128	STHSC	SUCS	Image taken		520.36	-12.852037	-5.739217
13/04/2019 12:14	128	STHSC	SUCS	Image taken		516.98	-12.852123	-5.73919
13/04/2019 12:14	128	STHSC	SUCS	Image taken		518.07	-12.852088	-5.739199
13/04/2019 12:16	128	STHSC	SUCS	Image taken		517.45	-12.852237	-5.739153
13/04/2019 12:16	128	STHSC	SUCS	Image taken		520.44	-12.852184	-5.739172
13/04/2019 12:17	128	STHSC	SUCS	Image taken		518.32	-12.852234	-5.739114
13/04/2019 12:18	128	STHSC	SUCS	Image taken		518.98	-12.852235	-5.739083
13/04/2019 12:19	128	STHSC	SUCS	Image taken		519.13	-12.852234	-5.739057
13/04/2019 12:20	128	STHSC	SUCS	Image taken		521.53	-12.852224	-5.738985
13/04/2019 12:21	128	STHSC	SUCS	Image taken		519.36	-12.852229	-5.738902
13/04/2019 12:21	128	STHSC	SUCS	Image taken		522.28	-12.852244	-5.738954
13/04/2019 12:22	128	STHSC	SUCS	Image taken		525.78	-12.852234	-5.738848
13/04/2019 12:24	128	STHSC	SUCS	Image taken		528.16	-12.852233	-5.73878
13/04/2019 12:27	128	STHSC	SUCS	Image taken		523.10	-12.852221	-5.738562
13/04/2019 12:28	128	STHSC	SUCS	Image taken		534.37	-12.852235	-5.738512
13/04/2019 12:29	128	STHSC	SUCS	Image taken		534.81	-12.852237	-5.738468
13/04/2019 12:30	128	STHSC	SUCS	Image taken		537.22	-12.852224	-5.73842
13/04/2019 12:32	128	STHSC	SUCS	Image taken		526.28	-12.852241	-5.738326
13/04/2019 12:52	129	STHSC	SUCS	Image taken		559.66	-12.852222	-5.737193
13/04/2019 12:52	129	STHSC	SUCS	Image taken		561.40	-12.852221	-5.737234
13/04/2019 12:53	129	STHSC	SUCS	Image taken		561.35	-12.85223	-5.73714
13/04/2019 12:53	129	STHSC	SUCS	Image taken		561.95	-12.85223	-5.737169
13/04/2019 12:54	129	STHSC	SUCS	Image taken		560.29	-12.852224	-5.737108

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
13/04/2019 12:55	129	STHSC	SUCS	Image taken		562.14	-12.852217	-5.737059
13/04/2019 12:56	129	STHSC	SUCS	Image taken		566.86	-12.852223	-5.737008
13/04/2019 12:57	129	STHSC	SUCS	Image taken		567.75	-12.852222	-5.736959
13/04/2019 12:58	129	STHSC	SUCS	Image taken		572.51	-12.852258	-5.736935
13/04/2019 12:58	129	STHSC	SUCS	Image taken		564.80	-12.852238	-5.736935
13/04/2019 12:59	129	STHSC	SUCS	Image taken		569.47	-12.852313	-5.736909
13/04/2019 13:00	129	STHSC	SUCS	Image taken		573.72	-12.852388	-5.736887
13/04/2019 13:00	129	STHSC	SUCS	Image taken		573.31	-12.852338	-5.736901
13/04/2019 13:01	129	STHSC	SUCS	Image taken		573.93	-12.852422	-5.736871
13/04/2019 13:02	129	STHSC	SUCS	Image taken		574.75	-12.852481	-5.736854
13/04/2019 13:02	129	STHSC	SUCS	Image taken		572.00	-12.852453	-5.736858
13/04/2019 13:03	129	STHSC	SUCS	Image taken		574.21	-12.852522	-5.736841
13/04/2019 13:04	129	STHSC	SUCS	Image taken		569.98	-12.852568	-5.73682
13/04/2019 13:05	129	STHSC	SUCS	Image taken		576.67	-12.852622	-5.736799
13/04/2019 13:06	129	STHSC	SUCS	Image taken		576.09	-12.852656	-5.73679
13/04/2019 13:19	129	STHSC	SUCS	Recovered		576.91	-12.852675	-5.736779
13/04/2019 15:38	130	STHSC	SUCS	Deployed		266.93	-12.995793	-5.678998
13/04/2019 15:48	130	STHSC	SUCS	Image taken		265.68	-12.995789	-5.679014
13/04/2019 15:51	130	STHSC	SUCS	Image taken		266.46	-12.99572	-5.678892
13/04/2019 15:52	130	STHSC	SUCS	Image taken		266.68	-12.995688	-5.678812
13/04/2019 15:52	130	STHSC	SUCS	Image taken		264.86	-12.995705	-5.678843
13/04/2019 15:53	130	STHSC	SUCS	Image taken		265.56	-12.99568	-5.678772
13/04/2019 15:54	130	STHSC	SUCS	Image taken		265.52	-12.995648	-5.678695
13/04/2019 15:54	130	STHSC	SUCS	Image taken		265.80	-12.995663	-5.678738
13/04/2019 15:55	130	STHSC	SUCS	Image taken		266.88	-12.995635	-5.678673
13/04/2019 15:56	130	STHSC	SUCS	Image taken		266.44	-12.995605	-5.678583
13/04/2019 15:56	130	STHSC	SUCS	Image taken		265.76	-12.995631	-5.678627
13/04/2019 15:58	130	STHSC	SUCS	Image taken		266.32	-12.995579	-5.678499
13/04/2019 15:58	130	STHSC	SUCS	Image taken		266.89	-12.995582	-5.678527
13/04/2019 15:59	130	STHSC	SUCS	Image taken		265.72	-12.995557	-5.678428
13/04/2019 15:59	130	STHSC	SUCS	Image taken		265.78	-12.995574	-5.678467
13/04/2019 16:00	130	STHSC	SUCS	Image taken		266.60	-12.995539	-5.678378
13/04/2019 16:01	130	STHSC	SUCS	Image taken		265.67	-12.99552	-5.678318
13/04/2019 16:01	130	STHSC	SUCS	Image taken		265.26	-12.995535	-5.678348
13/04/2019 16:02	130	STHSC	SUCS	Image taken		265.24	-12.995511	-5.678286
13/04/2019 16:03	130	STHSC	SUCS	Image taken		265.47	-12.995494	-5.67826
13/04/2019 16:04	130	STHSC	SUCS	Image taken		264.91	-12.995458	-5.678185
13/04/2019 16:04	130	STHSC	SUCS	Image taken		266.64	-12.995486	-5.678228
13/04/2019 16:05	130	STHSC	SUCS	Image taken		265.29	-12.995458	-5.678154
13/04/2019 16:06	130	STHSC	SUCS	Image taken		266.50	-12.995437	-5.678101
13/04/2019 16:06	130	STHSC	SUCS	Image taken		266.17	-12.995441	-5.67812
13/04/2019 16:07	130	STHSC	SUCS	Image taken		267.60	-12.995403	-5.678046
13/04/2019 16:07	130	STHSC	SUCS	Image taken		266.65	-12.995427	-5.678076

Date/Time	Event	StnCode	GearCode	Action	Gear depth	Water depth	Lat	Long
13/04/2019 16:08	130	STHSC	SUCS	Image taken		266.84	-12.995389	-5.678012
13/04/2019 16:09	130	STHSC	SUCS	Image taken		267.36	-12.995376	-5.677949
13/04/2019 16:09	130	STHSC	SUCS	Image taken		267.40	-12.995375	-5.677978
13/04/2019 16:10	130	STHSC	SUCS	Image taken		267.77	-12.995357	-5.677905
13/04/2019 16:21	130	STHSC	SUCS	Image taken		285.25	-12.995333	-5.677822
13/04/2019 16:28	130	STHSC	SUCS	Recovered		289.16	-12.995316	-5.677822
13/04/2019 20:58	131	UNK	RMT25	Deployed		1729.92	-12.865119	-5.428944
13/04/2019 21:58	131	UNK	RMT25	Net 1 opened	1000	2519.49	-12.880946	-5.466658
13/04/2019 22:50	131	UNK	RMT25	Net 1 closed	700	3347.96	-12.894587	-5.496676
13/04/2019 22:51	131	UNK	RMT25	Net 2 opened	701	3356.12	-12.894913	-5.497387
13/04/2019 23:41	131	UNK	RMT25	Net 2 closed	400	3469.76	-12.908551	-5.526903
14/04/2019 00:25	131	UNK	RMT25	Recovered		3426.90	-12.917132	-5.551413
14/04/2019 01:12	132	STHSC	MBES	SOL		262.96	-12.936628	-5.662517
14/04/2019 04:30	132	STHSC	MBES	EOL		253.79	-12.949149	-5.668064
14/04/2019 05:38	133	UNK	CTD	Deployed		3510.39	-12.921565	-5.527326
14/04/2019 06:04	133	UNK	CTD	Bottle fired	1000	3505.10	-12.921548	-5.527332
14/04/2019 06:11	133	UNK	CTD	Bottle fired	749	3489.51	-12.921561	-5.527333
14/04/2019 06:18	133	UNK	CTD	Bottle fired	449	3502.28	-12.921564	-5.527337
14/04/2019 06:18	133	UNK	CTD	Bottle fired	449	3504.28	-12.921565	-5.527337
14/04/2019 06:23	133	UNK	CTD	Bottle fired	250	3503.57	-12.921567	-5.527334
14/04/2019 06:27	133	UNK	CTD	Bottle fired	127	3505.56	-12.921563	-5.527347
14/04/2019 06:30	133	UNK	CTD	Bottle fired	87	3506.72	-12.921562	-5.527332
14/04/2019 06:30	133	UNK	CTD	Bottle fired	87	3503.74	-12.921571	-5.527334
14/04/2019 06:32	133	UNK	CTD	Bottle fired	62	3504.19	-12.921563	-5.527339
14/04/2019 06:35	133	UNK	CTD	Bottle fired	8	3504.33	-12.921568	-5.527332
14/04/2019 06:35	133	UNK	CTD	Bottle fired	7	3505.50	-12.921563	-5.52733
14/04/2019 06:37	133	UNK	CTD	Recovered		3503.63	-12.921572	-5.527341
14/04/2019 09:06	134	UNK	CTD	Deployed		264.06	-12.891295	-5.375699
14/04/2019 09:19	134	UNK	CTD	Bottle fired	260	264.05	-12.891309	-5.375736
14/04/2019 09:21	134	UNK	CTD	Bottle fired	255	266.21	-12.891306	-5.375742
14/04/2019 09:22	134	UNK	CTD	Bottle fired	250	265.94	-12.891304	-5.375741
14/04/2019 09:26	134	UNK	CTD	Bottle fired	125	265.52	-12.891314	-5.375758
14/04/2019 09:29	134	UNK	CTD	Bottle fired	82	264.06	-12.891319	-5.375751
14/04/2019 09:30	134	UNK	CTD	Bottle fired	72	264.63	-12.89132	-5.375761
14/04/2019 09:34	134	UNK	CTD	Recovered		265.03	-12.89132	-5.37577
14/04/2019 09:34	134	UNK	CTD	Bottle fired	7	266.04	-12.891302	-5.375765
14/04/2019 09:48	135	UNK	Mooring	Deployed		265.58	-12.891639	-5.37534
14/04/2019 10:37	136	UNK	Mooring	Deployed		277.16	-12.895693	-5.389803

6.2 Benthic species list – Tristan da Cunha

Survey ID	OT	Event Number	Station Code	Date	Depth	Count	Provisional ID	Phylum
DY100	TDC	7	TDCN	22/03/2019	158	7	Hydrozoa	Cnidaria
DY100	TDC	7	TDCN	22/03/2019	158	7	Hydrozoa	Cnidaria
DY100	TDC	7	TDCN	22/03/2019	158	1	Hydrozoa	Cnidaria
DY100	TDC	7	TDCN	22/03/2019	158	1	Hydrozoa	Cnidaria
DY100	TDC	7	TDCN	22/03/2019	158	5	Amphipod	Amphipod
DY100	TDC	7	TDCN	22/03/2019	158	1	Polychaete	Polychaete
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	5	Mollusca	Mollusca
DY100	TDC	24	MCNE	25/03/2019	160	5	Mollusca	Mollusca
DY100	TDC	24	MCNE	25/03/2019	160	5	Mollusca	Mollusca
DY100	TDC	24	MCNE	25/03/2019	160	1	Mollusca	Mollusca
DY100	TDC	24	MCNE	25/03/2019	160	1	Mollusca	Mollusca
DY100	TDC	24	MCNE	25/03/2019	160	1	Mollusca (subsample)	Mollusca
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	2	Crustacea	Crustacea
DY100	TDC	24	MCNE	25/03/2019	160	2	Crustacea	Crustacea
DY100	TDC	24	MCNE	25/03/2019	160	1	Crustacea	Crustacea
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	4	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	4	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	4	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	4	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	4	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	1	Bryozoa	Bryozoa
DY100	TDC	24	MCNE	25/03/2019	160	1	Bryozoa	Bryozoa
DY100	TDC	24	MCNE	25/03/2019	160	4	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	4	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	4	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	4	Cnidaria (subsample)	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	4	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	1	Crustacea	Crustacea
DY100	TDC	24	MCNE	25/03/2019	160	4	Crustacea	Crustacea
DY100	TDC	24	MCNE	25/03/2019	160	4	Crustacea	Crustacea
DY100	TDC	24	MCNE	25/03/2019	160	1	Crustacea	Crustacea
DY100	TDC	24	MCNE	25/03/2019	160	1	Crustacea (subsample)	Crustacea
DY100	TDC	24	MCNE	25/03/2019	160	3	Crustacea	Crustacea
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Mollusca	Mollusca

Survey ID	OT	Event Number	Station Code	Date	Depth	Count	Provisional ID	Phylum
DY100	TDC	24	MCNE	25/03/2019	160	1	Mollusca	Mollusca
DY100	TDC	24	MCNE	25/03/2019	160	1	Mollusca	Mollusca
DY100	TDC	24	MCNE	25/03/2019	160	1	Crustacea	Crustacea
DY100	TDC	24	MCNE	25/03/2019	160	10	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	10	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	10	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata (subsample)	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata (subsample)	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata (subsample)	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	2	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	2	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	2	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	1	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	1	Cnidaria (subsample)	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	1	Porifera	Porifera
DY100	TDC	24	MCNE	25/03/2019	160	1	Porifera	Porifera
DY100	TDC	24	MCNE	25/03/2019	160	1	Porifera	Porifera
DY100	TDC	24	MCNE	25/03/2019	160	1	Porifera	Porifera
DY100	TDC	24	MCNE	25/03/2019	160	1	Porifera (subsample)	Porifera
DY100	TDC	24	MCNE	25/03/2019	160	1	Annelida	Annelida
DY100	TDC	24	MCNE	25/03/2019	160	1	Annelida	Annelida
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Cnidaria	Cnidaria+epifauna
DY100	TDC	24	MCNE	25/03/2019	160	3	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	5	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	1	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata (subsample)	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	1	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	1	Porifera	Porifera
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	5	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	5	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	1	Porifera	Porifera
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	4	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Cnidaria	Cnidaria

Survey ID	OT	Event Number	Station Code	Date	Depth	Count	Provisional ID	Phylum
DY100	TDC	24	MCNE	25/03/2019	160	25	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	3	Crustacea	Crustacea
DY100	TDC	24	MCNE	25/03/2019	160	8	Mollusca	Mollusca
DY100	TDC	24	MCNE	25/03/2019	160	1	Annelida	Annelida
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	25	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	19	Bryozoa	Bryozoa
DY100	TDC	24	MCNE	25/03/2019	160	11	Cnidaria	Cnidaria

6.3 Benthic species list - St Helena

Survey ID	OT	Event Number	Station Code	Date	Depth	Count	Provisional ID	Phylum
DY100	TDC	7	TDCN	22/03/2019	158	7	Hydrozoa	Cnidaria
DY100	TDC	7	TDCN	22/03/2019	158	7	Hydrozoa	Cnidaria
DY100	TDC	7	TDCN	22/03/2019	158	1	Hydrozoa	Cnidaria
DY100	TDC	7	TDCN	22/03/2019	158	1	Hydrozoa	Cnidaria
DY100	TDC	7	TDCN	22/03/2019	158	5	Amphipod	Amphipod
DY100	TDC	7	TDCN	22/03/2019	158	1	Polychaete	Polychaete
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	5	Mollusca	Mollusca
DY100	TDC	24	MCNE	25/03/2019	160	5	Mollusca	Mollusca
DY100	TDC	24	MCNE	25/03/2019	160	5	Mollusca	Mollusca
DY100	TDC	24	MCNE	25/03/2019	160	1	Mollusca	Mollusca
DY100	TDC	24	MCNE	25/03/2019	160	1	Mollusca	Mollusca
DY100	TDC	24	MCNE	25/03/2019	160	1	Mollusca (subsample)	Mollusca
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	2	Crustacea	Crustacea
DY100	TDC	24	MCNE	25/03/2019	160	2	Crustacea	Crustacea
DY100	TDC	24	MCNE	25/03/2019	160	1	Crustacea	Crustacea
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	4	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	4	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	4	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	4	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	4	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	1	Bryozoa	Bryozoa
DY100	TDC	24	MCNE	25/03/2019	160	1	Bryozoa	Bryozoa
DY100	TDC	24	MCNE	25/03/2019	160	4	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	4	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	4	Cnidaria	Cnidaria

Survey ID	OT	Event Number	Station Code	Date	Depth	Count	Provisional ID	Phylum
DY100	TDC	24	MCNE	25/03/2019	160	4	Cnidaria (subsample)	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	4	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	1	Crustacea	Crustacea
DY100	TDC	24	MCNE	25/03/2019	160	4	Crustacea	Crustacea
DY100	TDC	24	MCNE	25/03/2019	160	4	Crustacea	Crustacea
DY100	TDC	24	MCNE	25/03/2019	160	1	Crustacea	Crustacea
DY100	TDC	24	MCNE	25/03/2019	160	1	Crustacea (subsample)	Crustacea
DY100	TDC	24	MCNE	25/03/2019	160	3	Crustacea	Crustacea
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Mollusca	Mollusca
DY100	TDC	24	MCNE	25/03/2019	160	1	Mollusca	Mollusca
DY100	TDC	24	MCNE	25/03/2019	160	1	Mollusca	Mollusca
DY100	TDC	24	MCNE	25/03/2019	160	1	Crustacea	Crustacea
DY100	TDC	24	MCNE	25/03/2019	160	10	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	10	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	10	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata (subsample)	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata (subsample)	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata (subsample)	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	2	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	2	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	2	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	1	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	1	Cnidaria (subsample)	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	1	Porifera	Porifera
DY100	TDC	24	MCNE	25/03/2019	160	1	Porifera	Porifera
DY100	TDC	24	MCNE	25/03/2019	160	1	Porifera	Porifera
DY100	TDC	24	MCNE	25/03/2019	160	1	Porifera	Porifera
DY100	TDC	24	MCNE	25/03/2019	160	1	Porifera (subsample)	Porifera
DY100	TDC	24	MCNE	25/03/2019	160	1	Annelida	Annelida
DY100	TDC	24	MCNE	25/03/2019	160	1	Annelida	Annelida
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Cnidaria	Cnidaria+epifauna
DY100	TDC	24	MCNE	25/03/2019	160	3	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	5	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	1	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata (subsample)	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Cnidaria	Cnidaria

Survey ID	OT	Event Number	Station Code	Date	Depth	Count	Provisional ID	Phylum
DY100	TDC	24	MCNE	25/03/2019	160	1	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	1	Porifera	Porifera
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	5	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	5	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	1	Porifera	Porifera
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	4	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	1	Cnidaria	Cnidaria
DY100	TDC	24	MCNE	25/03/2019	160	25	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	3	Crustacea	Crustacea
DY100	TDC	24	MCNE	25/03/2019	160	8	Mollusca	Mollusca
DY100	TDC	24	MCNE	25/03/2019	160	1	Annelida	Annelida
DY100	TDC	24	MCNE	25/03/2019	160	1	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	25	Echinodermata	Echinodermata
DY100	TDC	24	MCNE	25/03/2019	160	19	Bryozoa	Bryozoa
DY100	TDC	24	MCNE	25/03/2019	160	11	Cnidaria	Cnidaria
DY100	STH	117	CAR	12/04/2019	79	5	Hermadice	Polychaete
DY100	STH	117	CAR	12/04/2019	79	5	Hermadice	Polychaete
DY100	STH	117	CAR	12/04/2019	79	1	Hermadice	Polychaete
DY100	STH	117	CAR	12/04/2019	79	1	Eel	Pisces
DY100	STH	117	CAR	12/04/2019	79	20		Ophiuroidea
DY100	STH	117	CAR	12/04/2019	79	20		Ophiuroidea
DY100	STH	117	CAR	12/04/2019	79	20		Ophiuroidea
DY100	STH	117	CAR	12/04/2019	79	1		Pisces
DY100	STH	117	CAR	12/04/2019	79	1	Cowrie	Gastropoda
DY100	STH	117	CAR	12/04/2019	79	1		Ophiuroidea
DY100	STH	117	CAR	12/04/2019	79	1	Hermit crab	Malacostraca
DY100	STH	117	CAR	12/04/2019	79	1	Brachiura	Malacostraca
DY100	STH	117	CAR	12/04/2019	79	1	Brachiura 2	Malacostraca
DY100	STH	117	CAR	12/04/2019	79	1	Brachiura 3	Malacostraca
DY100	STH	117	CAR	12/04/2019	79	1	Brachiura 4	Malacostraca
DY100	STH	117	CAR	12/04/2019	79	2	Brachiura 5	Malacostraca
DY100	STH	117	CAR	12/04/2019	79	2	Brachiura 5	Malacostraca
DY100	STH	117	CAR	12/04/2019	79	1	Brachiura 5	Malacostraca
DY100	STH	117	CAR	12/04/2019	79	1	Cowrie	Gastropoda
DY100	STH	117	CAR	12/04/2019	79	1	Megalopa	Malacostraca
DY100	STH	117	CAR	12/04/2019	79	1	Megalopa	Malacostraca
DY100	STH	117	CAR	12/04/2019	79	1	Demospongia	Porifera
DY100	STH	117	CAR	12/04/2019	79	3	Brachiura	Malacostraca
DY100	STH	117	CAR	12/04/2019	79	1	Demospongia	Porifera
DY100	STH	117	CAR	12/04/2019	79	1	Demospongia	Porifera

Survey ID	OT	Event Number	Station Code	Date	Depth	Count	Provisional ID	Phylum
DY100	STH	117	CAR	12/04/2019	79	1	Cowrie	Gastropoda
DY100	STH	117	CAR	12/04/2019	79	1	Gastropoda	Mollusca
DY100	STH	117	CAR	12/04/2019	79	3	Hermodice	Polychaete
DY100	STH	117	CAR	12/04/2019	79	4	Brachiura 1	Malacostraca
DY100	STH	117	CAR	12/04/2019	79	1	Brachiura 2	Malacostraca
DY100	STH	117	CAR	12/04/2019	79	5		Bryozoa
DY100	STH	117	CAR	12/04/2019	79	5		Bryozoa
DY100	STH	117	CAR	12/04/2019	79	2	Cowrie	Gastropoda
DY100	STH	117	CAR	12/04/2019	79	3		Bryozoa
DY100	STH	117	CAR	12/04/2019	79	5		Bryozoa
DY100	STH	117	CAR	12/04/2019	79	1	Eel	Pisces
DY100	STH	117	CAR	12/04/2019	79	5	Algae	Chlorophyta
DY100	STH	117	CAR	12/04/2019	79	2	Ophiuroidea	Ophiuroidea
DY100	STH	117	CAR	12/04/2019	79	1	Ophiuroidea	Ophiuroidea
DY100	STH	117	CAR	12/04/2019	79	4	Hydrozoa	Hydrozoa
DY100	STH	117	CAR	12/04/2019	79	20	Ophiuroidea	Ophiuroidea
DY100	STH	117	CAR	12/04/2019	79	1	Euphausid	Malacostraca
DY100	STH	117	CAR	12/04/2019	79	1	Brachiura 5	Malacostraca
DY100	STH	117	CAR	12/04/2019	79	5		Rhodophyta
DY100	STH	117	CAR	12/04/2019	79	10	Maerl	Rhodophyta
DY100	STH	117	CAR	12/04/2019	79	2	Maerl	Rhodophyta
DY100	STH	117	CAR	12/04/2019	79	7	Maerl	Rhodophyta
DY100	STH	117	CAR	12/04/2019	79	5	Maerl	Rhodophyta
DY100	STH	119	CAR	12/04/2019	552	1	Decapoda	Malacostraca
DY100	STH	119	CAR	12/04/2019	552	1	Antipatharia	Anthozoa
DY100	STH	119	CAR	12/04/2019	552	1	Cup corals	Anthozoa
DY100	STH	119	CAR	12/04/2019	552	1	Cup corals	Anthozoa
DY100	STH	119	CAR	12/04/2019	552	1	Cup corals	Anthozoa
DY100	STH	119	CAR	12/04/2019	552	1	Cideroidea	Echinoidea
DY100	STH	119	CAR	12/04/2019	552	1	Cideroidea	Echinoidea
DY100	STH	119	CAR	12/04/2019	552	1	Cideroidea	Echinoidea
DY100	STH	119	CAR	12/04/2019	552	1	Cideroidea	Echinoidea
DY100	STH	119	CAR	12/04/2019	552	1	Decapoda	Malacostraca
DY100	STH	119	CAR	12/04/2019	552	4	Decapoda	Malacostraca
DY100	STH	119	CAR	12/04/2019	552	2	Decapoda	Malacostraca
DY100	STH	119	CAR	12/04/2019	552	5	Decapoda	Malacostraca
DY100	STH	119	CAR	12/04/2019	552	5	Decapoda	Malacostraca
DY100	STH	119	CAR	12/04/2019	552	5	Decapoda	Malacostraca
DY100	STH	119	CAR	12/04/2019	552	2	Decapoda	Malacostraca
DY100	STH	119	CAR	12/04/2019	552	2	Decapoda	Malacostraca
DY100	STH	119	CAR	12/04/2019	552	2	Decapoda	Malacostraca

6.4 Pelagic species lists

The species list developed from catches from the RMT25 is currently being QA's by experts at the Natural History Museum. A copy of the draft species list can be accessed by contacting the BB data manager (see section 6.5).

6.5 Data

All data is stored on Cefas servers and is currently undergoing thorough data quality checks. It is stored in the following file structure. All data queries should be directed to Ken May (Blue Belt data coordinator and manager).

Ken.May@cefas.co.uk

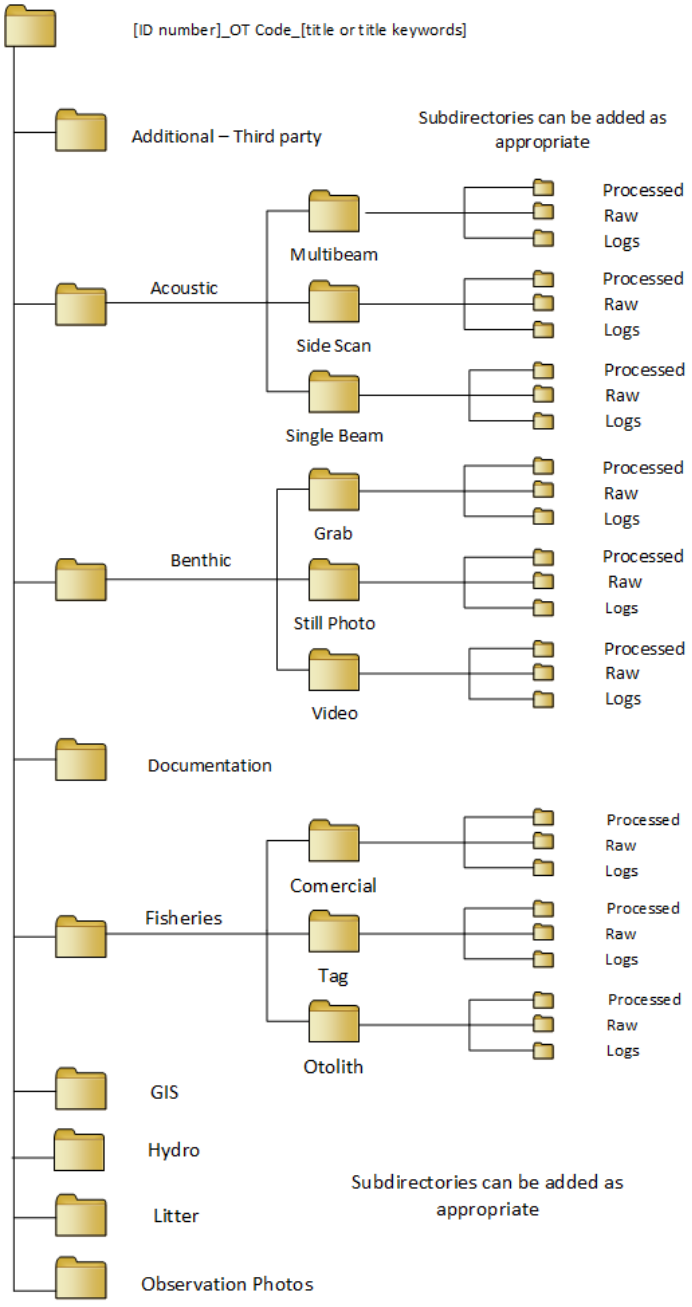


Figure 43 Data storage structure

6.6 Engineering Report

6.2.1 Setup RMT

All metal parts show considerable corrosion, and consideration should be given towards renewal of all metal parts. It is also suggested to build or re-design the frame in which the cross rests in to make it easier to work with.

One of the wooden bases in which the RMT weights rest is missing and should be replaced.

6.2.2 Tristan da Cunha

Deployed 10 times, 1 system failure

It failed on its final deployment, as detailed in the next section.

The fibre optic connection had to be re-terminated after its fourth deployment as the system showed poor optic link performance. It was discovered that the wires going through the gland can very easily be twisted if care is not taken in handling the downside fibre box to prevent twisting out or bending the connectors. It is suggested to come up with a slightly more rugged system should we return to the Discovery again.

The side wire swivels might be the wrong size and should be investigated.

6.2.3Flooding

The release motor housing flooded due to mechanical failure of the connection shown in *Figure* .

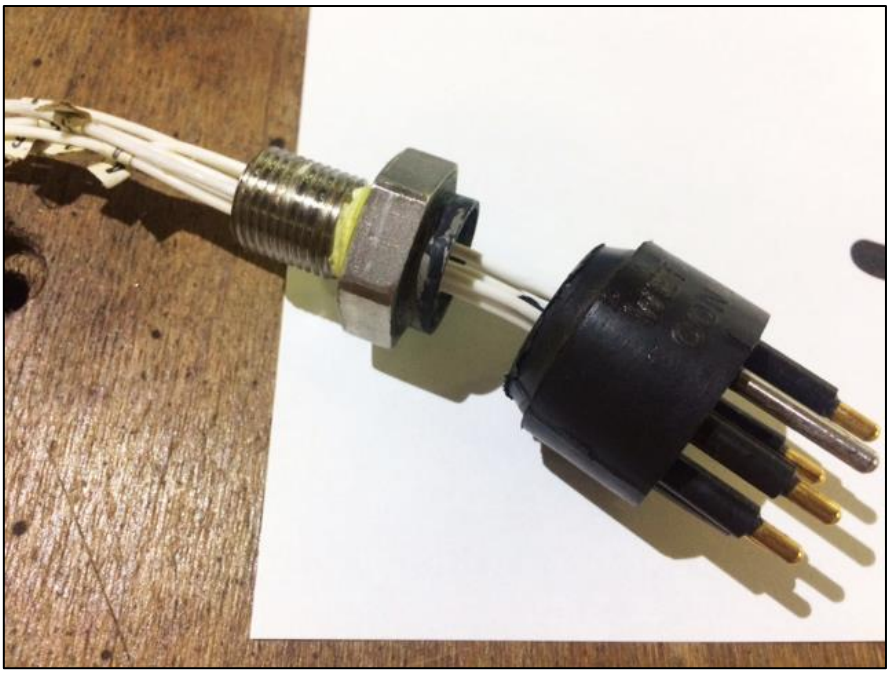


Figure 44 Failed connector point (photographed fully separated but only partially separated when found).

Although the motor initially seized slightly due to corrosion, it was cleaned and lubricated externally and survived several functional tests. It wasn't replaced as the spares are not easily interchangeable: they have an offset drive shaft of a different diameter.

The optical switch was damaged and replaced. The spares weren't like-for-like so the wiring had to be changed accordingly.

Original part: Fairchild H21B1

Replacement part: RS 304-560

6.2.4 St Helena

10 deployments, 2.5 system failures

The release unit was tested prior to first deployment and failed to operate.

On investigation, the motor was found to be inoperative and could not be revived. It was replaced with the alternative part. This required the following modifications:

- Additional holes drilled in the coupling housing to accommodate the square flange on the new motor.
- The replacement of the input Oldham coupling with a spare output coupling to accommodate the different in motor shaft diameters, although it was not an exact fit (1/4" compared with 6mm, i.e. 0.35mm difference).
- The removal of the acrylic spacer, foam spacer and PVC tube from the unit.

The protective capacitor and diode on the original motor were transferred to the new motor, it should be noted that we didn't have spares for these.

Original motor: Faulhaber MINIMOTOR SA 38/1, 415:1 gearbox

Replacement motor: RS 341-660, 100:1 gearbox

The unit was reassembled and functionally tested.

The unit only fired once on each of the next two deployments. Large voltage drops were seen on the failed firing attempts (*Figure*)*Figure 45 Failed firing voltage drops (white bands)*. The unit fired repeatedly on deck and in shallow water without fault, indicating a pressure-induced cause.

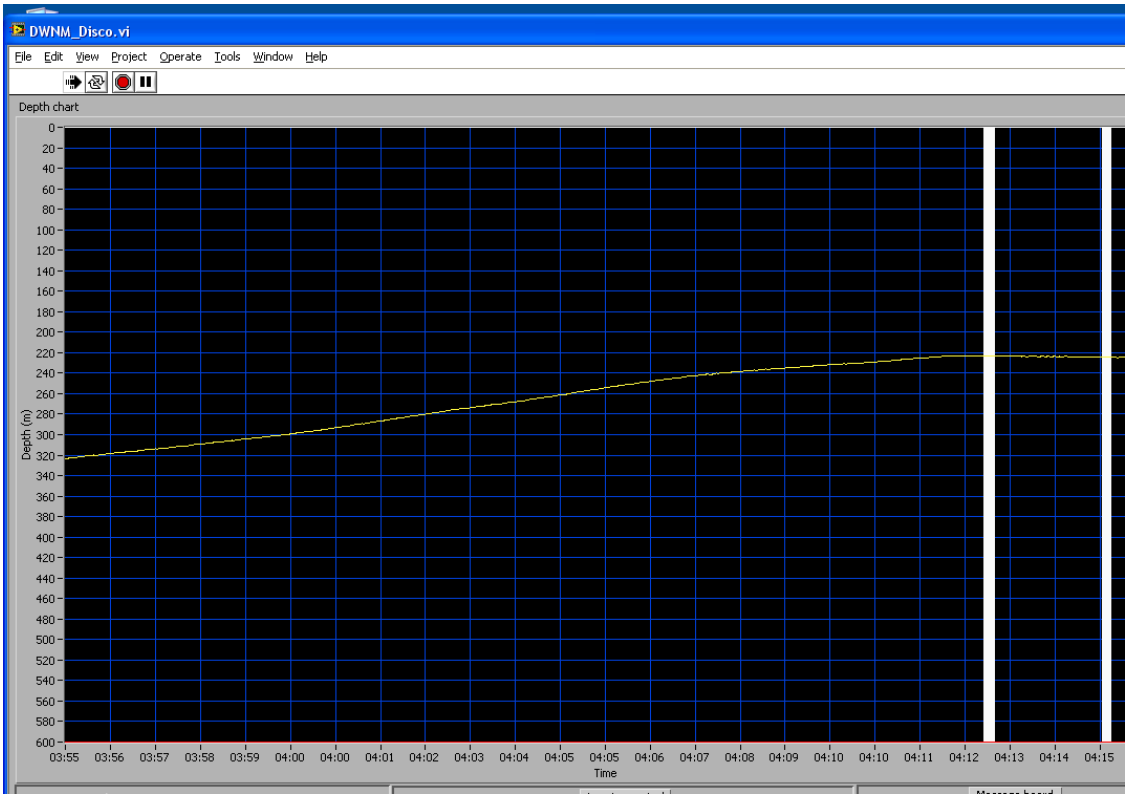


Figure 45 Failed firing voltage drops (white bands).

The likely cause seems to be a combination of two factors:

1. The slight mismatch between the output shaft and Oldham coupling allowing it to slip under high load.
2. The comparatively low torque of the replacement motor meaning that even if the coupling doesn't slip, the motor is struggling to drive the gears.

To rectify the first issue a grub screw was fitted to the coupling to pin the shaft.

The second issue cannot be rectified as the are no alternative spares and the original gearbox is not compatible with the new motor

The RMT was successfully deployed twice the following night, only one detectable voltage drop occurred, on the second firing at 700m depth. Due to this and the previous problems with the second firing, the unit was re-sequenced to fire #2 last, which provides two advantages:

- Ensures that Net 1 should open and close
- Reduces the depth of firing and therefore the mechanical loads on the apparently 'sensitive' #2 quadrant

Net 2 failed to open on one subsequent deployment although no voltage drop was apparent, indicating that release unit was not at fault. The suspected cause was the bar getting hung up on the side wires. The unit had been fired repeatedly by the time it was recovered to the surface and both nets were closed, so it wasn't possible to confirm this.

The net worked successfully on the remaining five deployments.

6.2.5 Post-Cruise Tasks

Spares:

- Motors. The gearbox on the replacement RS motor is poor, it's a cheap 100:1 pinion compared with the 415:1 planetary gearbox in the original. It is essential to buy spares comparable with the original and to replace the one currently fitted.
- Optical switches. Both the original and the spares are now discontinued: 4-pin replacements should be ordered to match the current wiring diagrams and the new 5-pin one replaced.
- Capacitors
- Diodes
- Oldham couplings (3-piece: 7.5 mm, 1/4", acetal torque disks)
- 6-pin bulkhead connector
- Terminal blocks
- Carabiners (several had to be replaced during the cruise and we have no spares left). Snap hooks will probably be more reliable.

Other:

- Wiring diagram updated to be readable by idiots
- Assess corrosion extent on bars

- Purchase oil pump and pressure connections for quick filling of oil filled junction box. CEFAS used a '*Gloria 405T*'.
- Investigate why firing command acknowledgements aren't working on DWNM
- The top net needs repairing due to several tears. Some repairs have been made but they should only be considered temporary as they are placing strain on the net
- Replace missing weight rest

6.2.6 DWNM

The DWNM system was used throughout the cruise in conjunction with the RMT25.

The DWNM wires needs a review, there are a lot of missing bits and bobs, and lack of system. There is also a lack of spare parts at this point.

The pitch gauge in LabVIEW is very erratic and needs improving to provide a logical orientation and increments.

Both RMT8 & 25 flowmeters need maintenance: the impellers are damaged, and the nose cones are mismatched. Two 5mm spanners are needed to set the top nuts on the shaft, it's quite difficult to do it without and critical to correct operation.

The altimeter doesn't work on the Discovery without the EA600 input. It would be helpful to have a direct altimeter feed in LabVIEW.

6.2.7 SUCS setup

The SUCS hadn't been used since a complete cable failure the previous season and the replacement cable exceeded the manufacturer's quoted lead time, leaving no time for testing prior to the cruise.

The first task whilst alongside at FIPASS was to spool the new SUCS cable onto the winch. After this the full system was set up.

On first power-up, the system was not functioning ('Camera Not Found' error in LabVIEW), although the camera could be successfully pinged through command prompt.

Fault diagnosis carried out as follows:

- All fibre optic connections were cleaned.
- 70V power was confirmed with a multimeter.
- VFL (Visual Fault Locator) laser used along all fibre optic sections.
- Fibre and power were taken straight from the deck box to the camera to prove functionality of the PC and camera.
- Noticeable VFL attenuation across one of the connections on the slip ring/FORJ (Fibre Optic Rotary Joint).
- The FORJ manufacturer (Princetel) were contacted. They suggested that the connections themselves were more susceptible to damage than the FORJ itself and advised that the connectors were removed and the fibres behind them tested. This was done but the attenuation remained, indicating that the fault was within the FORJ itself.
- Princetel advised that the FORJ was not field-repairable and should be returned for repair. There was some possibility that this could be completed in time for the unit to be flown out to meet the Discovery in St Helena.

With no slip ring, the camera could not be live whilst the winch was used. A method statement was developed to enable use of SUCS with this limitation, a short summary of which is here:

1. Set up the SUCS cable to run through a sheave suspended from the bullhorn winch.

2. Using swath, determine a target depth to deploy the SUCS to which leaves it approximately 5m clear of the sea floor.
3. Deploy the SUCS 'blind', i.e. camera disconnected, to this target depth, using depth data from a USBL beacon mounted on the SUCS tripod.
4. Connect up SUCS and power up.
5. Use the bullhorn winch to control the camera depth in the final few metres.
6. The SUCS winch is isolated if it is connected to prevent inadvertent rotation and damage to the connections.

Further to the FORJ fault, the Y-cable for the LED lamps couldn't be found. One was made onboard but new ones should be prepared for the next cruise.

One lamp was dimmer than the other and was replaced with a spare. The spare will need to be tested/repaired/replaced back in the UK.

A stainless-steel cable grip was initially fitted to the tripod and SUCS cable, but it was quite sharp and there were concerns that it would eventually damage the cable, so it was replaced with a cord grip.

The following items/equipment were used in the setup/fault-diagnosis and should be considered essential for future cruises:

- Fluke Optfiber 2
- Fluke fibre optic cleaning kit
- VFL laser
- Multimeter
- Additional multimode fibre
- Fusion splicer

Additional recommended items for future cruises:

- Launch cables and necessary connectors to take advantage of the Optifiber's 'SmartLoop' facility for simultaneous two-fibre testing
- Spare SubOptica connectors, male and female
- 20m of spare multimode fibre
- Spare power connectors, male and female, 2-pin and 3-pin.

6.2.8 Test Location

The SUCS deployment method described above was carried out at a test location in waters around Tristan da Cunha. The deployment was with the ship holding position on DP and the camera moving with the current.

After around an hour in the water, the signal began to deteriorate until the camera became unusable. The camera was raised 50m whilst all FO connections were cleaned, and the ship was repositioned to tow the camera at 0.1 Kts to exert some control over its heading.

The camera was lowered to the sea floor again and some satisfactory images were obtained. With the limited range of the bullhorn winch, it was quite difficult to get the tripod steady as

any slack given by the winch was soon taken up by movement of the ship and the current. Paying out slightly faster on the bullhorn helped somewhat.

It was proposed that rather than the ship towing the camera, the ship could follow the camera to keep the cable closer to vertical and allow more time to capture images. Either method is heavily dependent on the strength of the current and altitude changes on the sea floor.

The USBL proved accurate and the deployment in general went smoothly, no major changes required ahead of the first ‘proper’ site.

6.2.9 Tristan Da Cunha

10 successful deployments, using the method described above.

6.2.10 St Helena

The FORJ was received at St Helena but did not appear to work.

The system was returned to its prior setup.

The winch remote control was tested at this point and worked fine, although it wasn’t necessary with the setup on the Discovery.

6.2.11 Post-Cruise Tasks

- Make/order new lamp cable
- Test/service/replace spare lamp
- Get new PC fully operational
- Add a fin to limit rotation of the tripod during deployments
- Spiral wrap to protect the cable where it can rub against the tripod
- Increased resolution camera upgrade
- Investigate if single-fibre mode operation can be implemented with existing hardware/software.
- Ensure FORJ scheduled maintenance intervals are observed and recorded
- Computer peripheral for light adjustment and camera trigger

6.2.12 AGT setup

The AGT damaged during last years cruise at St Helena was used for this cruise to prevent damaging the ‘good’ AGT on the unfavourable terrain. One rubber mat was replaced during setup and the AGT was straightened out slightly.

6.2.13 Tristan Da Cunha

2 deployments, 1 unsuccessful.

On the second deployment, the AGT was recovered with the inner net wrapped around the mouth of the trawl and nothing inside.

6.2.14 Post-Cruise Tasks

- The ‘good’ AGT needs some minor net repairs.
- The ‘bad’ AGT might need replacing due to the extent of the damage to it.
- The rubber mats are prone to failure due to bending and tearing, it’s worth a quick investigation to see if any improvements can be made.

6.2.15 Neuston Sledge setup

Due to time limitations, the sledge wasn’t used on this cruise, although it was set up in case an opportunity arose.

The setup was fine, the manual was updated with slightly amended sequences and photos.

A configuration for the blue net with flowmeter is required as the existing brackets only work with NEM.

The manual needs updating to include NEMO configuration.

6.2.16 SonoVault Mooring – Tristan da Cunha

The mooring outside Tristan da Cunha carrying a SonoVault was retrieved on 23.03.2019 after being deployed approx. around the same time in 2018. The mooring released on first ping and was recovered using the starboard side gantry.

The mooring setup shows severe crevice corrosion on most of its stainless-steel parts: one of the jubilee clips had failed due to this and some of the shackle pins had lost a significant amount of their material thickness. It might be more beneficial using galvanised steel in the future for shallow mooring deployments.

The rope was recovered in good condition.

Figure 46 Failed Jubilee clip

Figure 47 Shackle pin crevice corrosion

Data retrieval from the memory cards showed that there was only data on two of the SD-Cards. The following card in the sequence showed “corrupted” data. The same pattern

appeared on the WCB Mooring, were a SonoVault was deployed as well. It is suggested to investigate the SonoVault configuration file for mistakes.

6.2.17 Additional Observations/Comments

RRS Discovery

Wire weights

Fibre optic

EA600

Electronics limited equipment

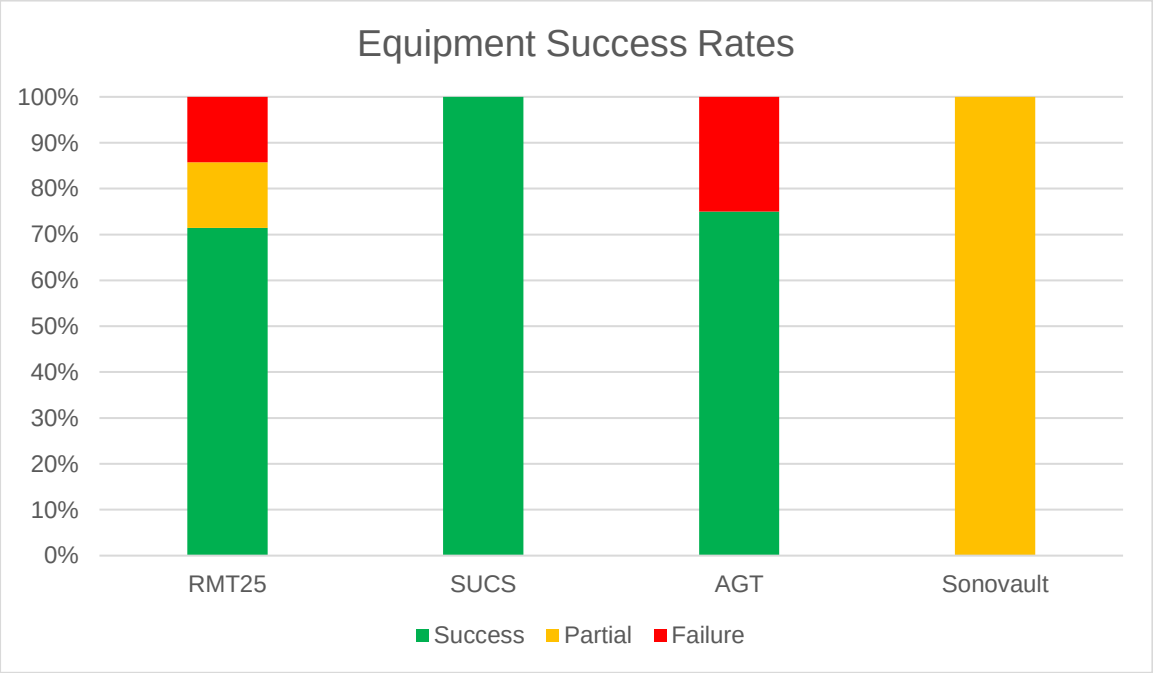
Touchscreen monitors for equipment stations?

Working out of boxes!

Tools and Equipment

Multimeter

6.2.18 Summary



6.7 Fisheries Acoustic Settings and Calibration Data

Two separate acoustic calibrations were performed to take into account the different water masses of the two study areas. The first calibration was carried out in Tristan da Cunha on 30/03/2019 and the second one in St Helena on 09/04/2019. The calibrations were done following the standard sphere method. A 38.1 mm diameter sphere made from tungsten carbide with 6 % cobalt binder material (WC) is used as a reference target. It was positioned between 15 to 25 m from the transducers and moved systematically throughout the acoustic beams to measure and adjust the on-axis system gains.

6.3.1 Calibration in Tristan

Calibration in Tristan took place about 500 m off the north side of the island at 25 m depth. A CTD cast was performed before the start of the calibration. Temperature and salinity were averaged from the surface to 25 m and were 18.65 °C and 35.08 PSU. These values were used to estimate local values of sound speed and absorption coefficient. The conditions during the calibration were not ideal. A strong current was present making difficult to position and move the sphere in the acoustic beam. In addition, many unwanted fish targets, swimming close to the calibration sphere, were erroneously recorded during the calibration. The final calibration parameters were estimated in post-processing using the replay mode in the EK80 software. A list of the calibration parameters is shown in Table 10.

6.3.2 Calibration in St. Helena

Calibration in St. Helena was carried out 1.5 nmi off the north-west coast of the island at 1100 m depth. A CTD cast was performed before the start of the calibration. Temperature and salinity were averaged from the surface to 25 m and were 25 °C and 36.5 PSU. The absence of current allowed us to easily move the sphere within the beam. After completing the first frequency (38 kHz), the ER60 software started to have some issues. The sphere was well centred in the beam and clearly visible in the 38 kHz single target view and on the other frequencies Sv echograms, but it was not showing up in the single target view for the remaining frequencies. We continued to log data for the rest of the frequencies moving the sphere in the beam and taking the 38 kHz single target view as reference. The calibration was run in post-processing using the EK80 software. A list of the calibration parameters is shown in Table 11.

Table 10 Calibration settings parameters used for the survey in Tristan da Cunha.

Variable	18 kHz	38 kHz	70 kHz	120 kHz	200 kHz	333 kHz
Transducer type	ES18-11	ES38B	ES70-7C	ES120-7C	ES200-7C	ES333-7C
Transducer Serial No.	2111	31185	258	890	533	125
Transducer depth (m)	6.6 (9.9)*	6.6 (9.9)*	6.6 (9.9)*	6.6 (9.9)*	6.6 (9.9)*	6.6 (9.9)*
Transceiver Serial No.	00907206dc83	00907206d08e	00907206b831	00907206ebdf	00907206b82f	00907206d0a4
Transducer power (W)	1400	1000	750	250	150	50
Pulse length (us)	1024	1024	1024	1024	1024	1024
2-way beam angle (dB)	-17.1	-20.7	-20.5	-20.4	-20.3	-20.3
Transducer gain (dB)	23.10	23.39	27.03	26.94	27.03	25.10
Sa correction (dB)	-0.67	-0.046	0.013	0.062	-0.39	-0.64
3dB beam along (°)	10.93	6.92	6.82	6.55	6.53	6.71
3dB beam athwart (°)	10.89	6.95	6.73	6.59	6.31	6.76
Along offset (°)	-0.09	-0.10	0.01	-0.05	-0.29	0.03
Athwart offset (°)	-0.17	-0.05	0	-0.01	0.19	-0.11
RMS (Root Mean Square error)	-	0.10	0.047	0.066	0.15	-
Comments	Unable to calibrate – The settings used are from the previous calibration (DY980.	Only on-axis calibration. The angle settings are from the previous calibration (DY98).				Unable to calibrate. The settings used are from the previous calibration (DY980).

*Drop-keel down

Table 11 Calibration settings parameters used for the survey in St. Helena.

Variable	18 kHz	38 kHz	70 kHz	120 kHz	200 kHz	333 kHz
Transducer type	ES18-11	ES38B	ES70-7C	ES120-7C	ES200-7C	ES333-7C
Transducer Serial No.	2111	31185	258	890	533	125
Transducer depth (m)	6.6 (9.9)*	6.6 (9.9)*	6.6 (9.9)*	6.6 (9.9)*	6.6 (9.9)*	6.6 (9.9)*
Transceiver Serial No.	00907206dc83	00907206d08e	00907206b831	00907206ebdf	00907206b82f	00907206d0a4
Transducer power (W)	1400	1000	750	250	150	50
Pulse length (us)	1024	1024	1024	1024	1024	1024
2-way beam angle (dB)	-17.1	-20.7	-20.5	-20.4	-20.3	-20.3
Transducer gain (dB)	23.10	23.04	26.84	26.82	26.55	25.10
Sa correction (dB)	-0.67	-0.046	-0.09	0.092	-0.14	-0.64
3dB beam along (°)	10.93	6.92	6.75	6.46	6.19	6.71
3dB beam athwart (°)	10.89	6.95	6.74	6.53	6.01	6.76
Along offset (°)	-0.09	-0.10	-0.08	-0.11	-0.08	0.03
Athwart offset (°)	-0.17	-0.05	-0.08	-0.1	0.14	-0.11
RMS (Root Mean Square error)	-	0.372	0.17	0.16	0.34	-
Comments	Unable to calibrate – The settings used are from the previous calibration (DY980.	Only on-axis calibration. The angle settings are from the previous				Unable to calibrate. The settings used are from the previous calibration (DY980).

Variable	18 kHz	38 kHz	70 kHz	120 kHz	200 kHz	333 kHz
		calibration (DY98).				

*Drop-keel down

6.3.3 Issues

The calibration highlighted some problems on the 18 and 38 kHz. In both frequencies, the single target view showed a pattern in the distribution of the targets within the beam (Figure 48). The 18 kHz targets were only detected in a limited area of the right sector of the beam and in the 38 kHz there was a lack of targets in the top-right and bottom-left sector of the beam. In addition, the estimated gain values obtained after the calibration (for the 18 kHz this refers to the calibration conducted on DY98) differed by several dB compared to the previous calibration. This indicates a malfunctioning of either the transducers or the transceivers. For this reason, the data collected at 18 kHz and 38 kHz have not been used and processed. This has limited the depth range of the analysis to 600 m which is the maximum depth at the lower frequency available (70 kHz) where the data is not affected by background noise.

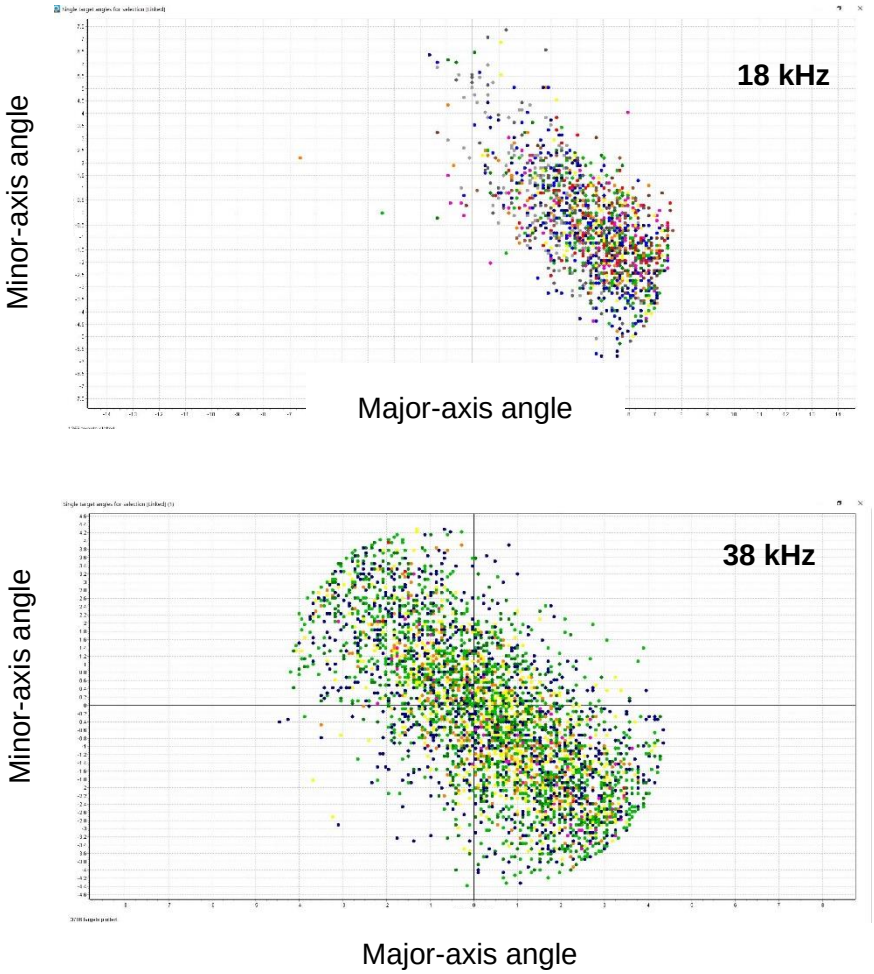


Figure 48 Plot of the minor-axis (alongship) angle vs major-axis (athwartship) angle for the single targets detected in the 18 and 38 kHz acoustic beams.

6.8 Multibean Echo-Sounder Settings

Table 12 Summary of EM122 data collected on DY100.

Survey Name	Start Date	End Date	Description	Number of files (.all)	Processed (Caris Hips & Sips v9.)	Comment
DY100	22:36 12/03/2019	11:31 21/03/2019	Transit Falkland Islands – Tristan Da Cunha	396	396	
DY100_MBES_CAL	11:37 21/03/2019	18:05 21/03/2019	Calibration	17	17	Near Tristan da Cuhna
DY100_Tristan	23:07 21/03/2019	14:30 31/03/2019	Tristan Da Cunha Seamount Survey	375	375	
DY100_Trans_TDCtoSTH	14:33 31/03/2019	06:33 05/04/2019	Transit Tristan Da Cunha – St Helena	225	225	
DY100_StHelena	08:37 05/04/2019	18:13 14/04/2019	St Helena and seamounts	336	322	

Table 13 Summary of EM122 sounder and filter settings that were predominately used during DY100.

Sounder Main Settings		Filter and Gain Settings	
Max Angle	72	Spike Filter Strength	MEDIUM
Max Coverage	8000	Range Gate	NORMAL
Max/Min Coverage	Variable depending on water	Phase Ramp	LONG

Sounder Main Settings		Filter and Gain Settings	
	depths expected		
Coverage mode	Auto	Penetration Filter Strength	MEDIUM
Ping Mode	Auto/Very deep when deeper than 3500m		
Beam Spacing	HD Equidistant		

Table 14 Summary of EM710 data collected on DY100.

Survey Name	Start Date	End Date	Description	Number of files (.all)	Processed (Caris Hips & Sips v9.)	Comment
DY100	21:55 12/03/2019	09:11 13/03/2019	Transit Falkland Islands – Tristan Da Cunha	24	24	Falklands Plateau
DY100_MBES_CAL	18:00 21/03/2019	19:54 21/03/2019	Calibration	11	11	
DY100_Tristan	18:31 23/03/2019	21:28 27/03/2019	Tristan Da Cunha Seamount Survey	83	83	
DY100_StHelena	10:53 05/04/2019	04:37 14/04/2019	St Helena Survey	122	122	

Table 15 Summary of EM710 sounder and filter settings that were predominately used during DY100.

Sounder Main Settings		Filter and Gain Settings	
Max Angle	72	Spike Filter Strength	MEDIUM
Max Coverage	2000	Range Gate	NORMAL
Max/Min Coverage	Variable depending on water depths expected	Phase Ramp	NORMAL
Coverage mode	AUTO	Penetration Filter Strength	STRONG
Ping Mode	Variable depending on depth		
Beam Spacing	HD Equidistant		

During DY100 the EM122 and EM710 were run simultaneously with the EK60 18/38/70/120/200 kHz singlebeam echosounder, at the start of the survey, the vessel mounted acoustic Doppler profiler (VMADCP), EA640, EK60 and both multibeam echosounders (MBES) were being externally triggered and calculated by the Kongsberg Synchronisation Unit (K-Sync). A few tests were trialled after the first few days as the ping rate was significantly reduced using the K-Sync device, both MBESs and EK60 were run together without interference without using the K-Sync. The other sounders were switched off when not required.

SSVtoSIS was also run during multibeam acquisition to feed live sound velocity streams into the EM122 and EM710 SIS PC through the network. Feeding live surface sound velocity measurements from the SSVtoSIS, rather than taking the keel value from the last sound velocity profile applied increases the quality of the beam forming process and the quality of data collected. The operator selects SENSOR as the Sound Speed at Transducer in the Sound Speed Tab of SIS's Runtime Parameter window. It is crucial for the operator to note if the feed isn't coming into SIS as this will affect the overall quality of the data.

Sound velocity profiles generated by a sound velocity profiler (SVP) were used to correct EM122 and EM710 data within SIS during acquisition around Tristan da Cuhna and St Helena (Table 11) The SVP was either deployed alone or attached to the CTD. The profiler measures

pressure, temperature and sound velocity. Comparisons of salinity derived from the SVP corelated very well with CTD measurements. During transits from the Falkland Islands to Tristan da Cuhna and from Tristan da Cuhna to St Helena, data were collected using the EM122. During these transits, water velocities were corrected using modelled water velocity profiles generated by DORIS using the NOAA Oceanographic database WOA13.

Table 16 Summary of the sound velocity profiles used on DY100 to calibrate the EM122 and EM710 bathymetry data.

Date-Time Applied (UTC)	SVP Source	File
21/03/2019 14:12:36	SVP	20190321_FINAL_PRIMARY_DY100.asvp
23/03/2019 15:44:43	CTD	20190323_McNISH_FINAL.asvp
26/03/2019 10:16:10	CTD	20190326_RSA_W_FIAL.asvp
05/04/2019 08:26:24	SVP	20190405_STH_FINAL.asvp
06/04/2019 08:47:47	CTD	20190406_Shovel_Final.asvp
07/04/2019 15:54:48	CTD	20190407_George_FINAL.asvp
10/04/2019 16:51:14	CTD	20190410_car_FINAL.asvp
14/04/2019 06:47:57	CTD	20190414_SC_FINAL.asvp

Surveying around the different seamounts was challenging at times as limited hydrographic or scientific mapping had been conducted at some of the seamounts. The master preferred at times to contour around from deep to shallow always remaining within the previous pass' multibeam coverage to ensure the safety of the vessel. While this method ensured overlap of the outer beams it also meant that there was frequent turning, which in areas had occasional adverse impact on data quality and bottom detection, resulting in small holes in the final coverage. Data quality was also adversely impacted by the sea state and swell direction. Where possible, multibeam data was acquired with 20-30% overlap of outer beams, this was to reduce gaps, increase data density and ensure enough data where the system struggled with bottom detection.

Issues in the data acquisition

There were several errors that were noticed throughout the survey, these have been noted and detailed below.

Nadir false return

Figure 49 shows the false return in the nadir, this was occurring at sporadic intervals and during calm weather, this suggests a possible issue with transducer elements in the EM122, this was not noticed with the EM710. These were all removed during data processing and has resulted in several gaps in the data.

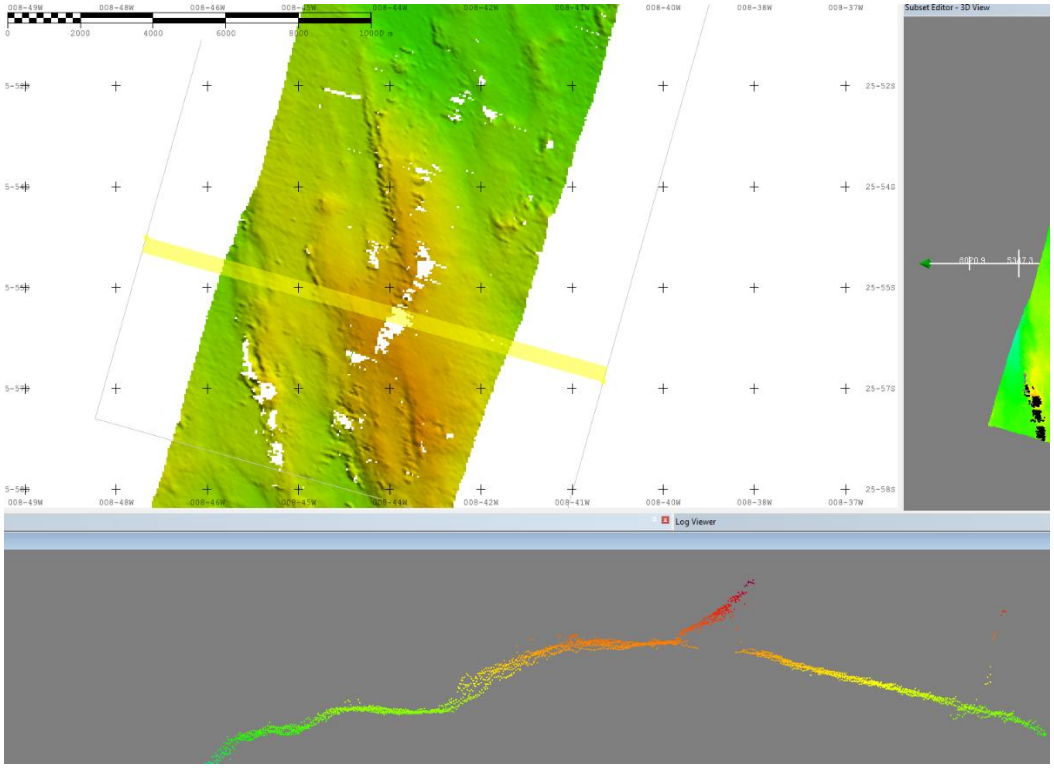


Figure 49 Example of the EM122 producing a false return in the nadir viewed in subset editor of CARIS HIPS and SIPS. In the plan view, false returns have been edited out to produce a strip with no data along the central right axis of the swath. The pings in the bottom panel are from the yellow strip and show false returns (in red) rising on the right of the bathymetric high.

6.4.1 Failure in bottom detection

There was an issue with the EM122 with losing bottom tracking, investigations were made into the issue and it was determined that the issue was occurring between 2500-3500m. The system mode was typically operated in Auto, however when the depth was greater than 2500m, the system defaulted to 'VERY DEEP'. This caused the EM122 to lose bottom tracking, when the mode was changed to 'DEEP', the EM122 returned to worked normally. This suggests that the default 'VERY DEEP' mode is set to switch too shallow. The system typically operated successfully in 'VERY DEEP' mode when the seabed was deeper than 3500m (Figure 50).

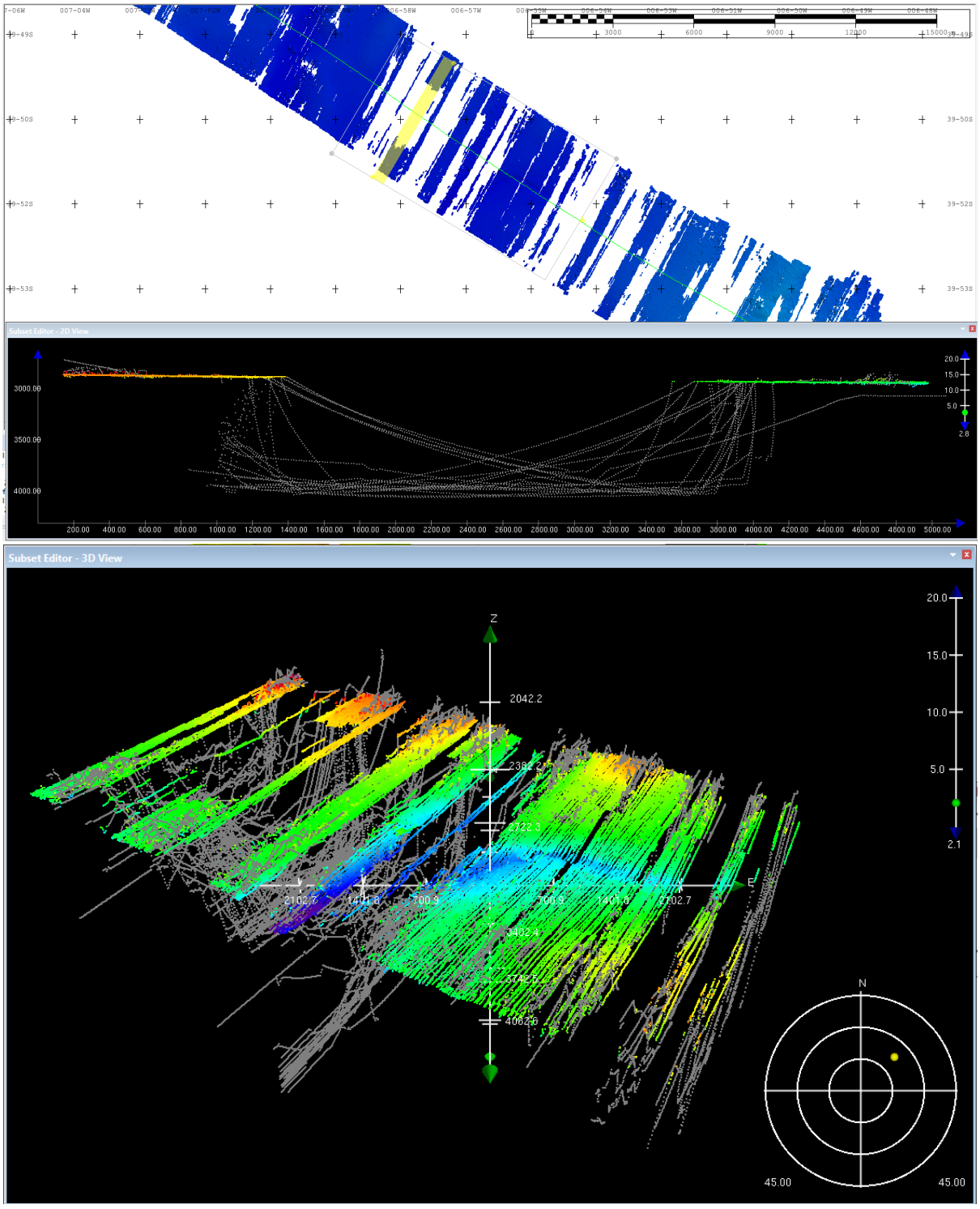


Figure 50 Example of the EM122 producing a false bottom, the grey sections have been removed in the data, where the system has dropped off and can't determine the seabed correctly. The images from top to bottom show the gaps in the data, a profile view showing where the signal has dropped off (profile from yellow strip in top image) and the 3D view showing how extensive the issue is when operated in the wrong mode. Images produced in Caris HIPS and SIPS in geographic view in subset editor.

6.4.2 False ridge

This error occurred during the survey of RSA seamount, a ridge was detected in the outer half of the starboard beam at first glance, it was difficult to determine if the ridge was real or an artefact (see Figure 51).

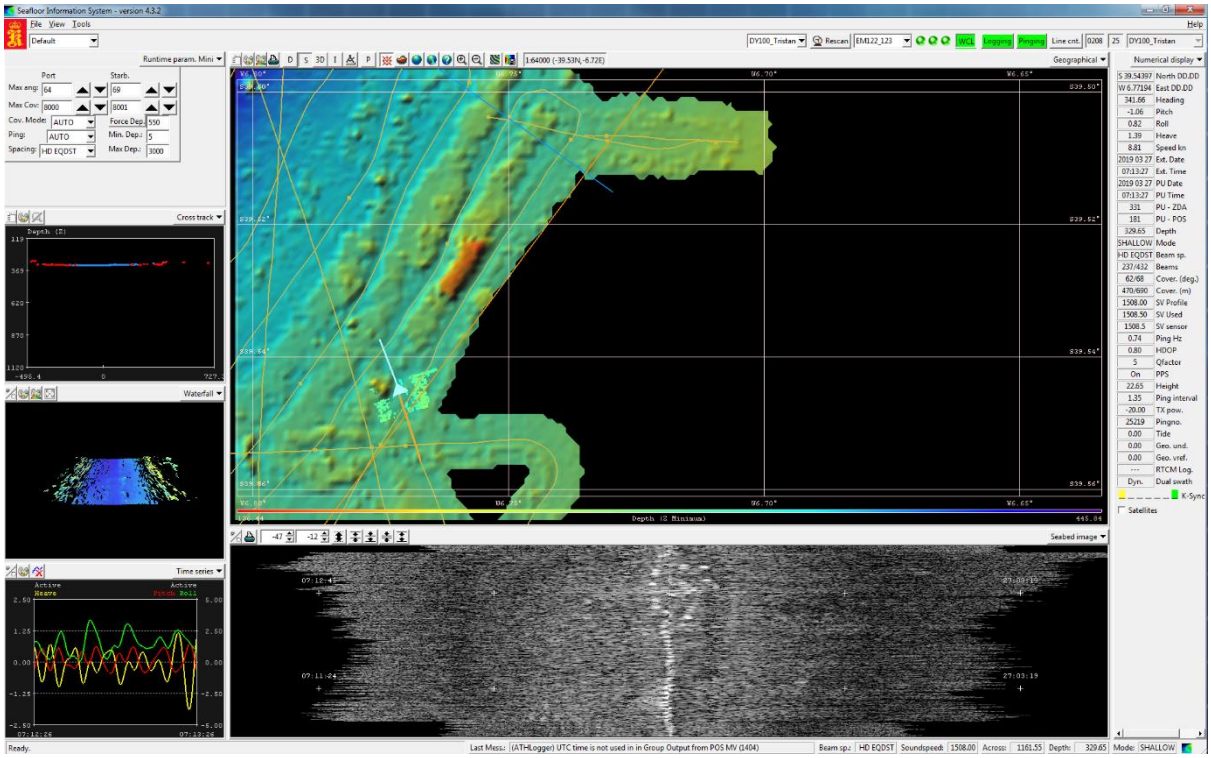


Figure 50 The image shows the features showing in the Kongsberg SIS acquisition screen, the waterfall display shows the changes in the edge of the swath, however the seabed image shows no obvious change in the texture.

Changes were made to settings and several attempts were made to force the depth to try to understand if the data was real. The next survey line was planned for the other side of the 'ridge' as further investigation, this was picked up again on the same side and also on the opposite side as well, covering half of each side of the beam, the same as before. This outcome caused more confusion, picking up the exact same height ridge in two opposite running lines suggested that the feature could be real, however, conveniently running exactly parallel to 2 separate features suggested that something else could be going on. The run lines crossed a previous line that had been run in a different direction, this matched up with one of the features, giving more weight to the feature. A third line was run, this showed the same as the second line, a flat nadir, with the outer beams on both sides showing a feature. The decision was made to run a line at 90 degrees across the three run lines. During this time, the watercolumn data was logged and the EK60 data was logged to identify if it was picking up the same feature. This line showed the feature appearing again in the outer beams, confirming that the feature couldn't be real, as it was showing in a different location to the previous lines. The EK60 and watercolumn data were reviewed as well and they showed that there was a layer of fish sitting just above the sea floor and they were so dense, that the outer beams of the multibeam were picking them up as a feature. The decision was made to remove all of the erroneous soundings and there are large gaps in the data in these areas.

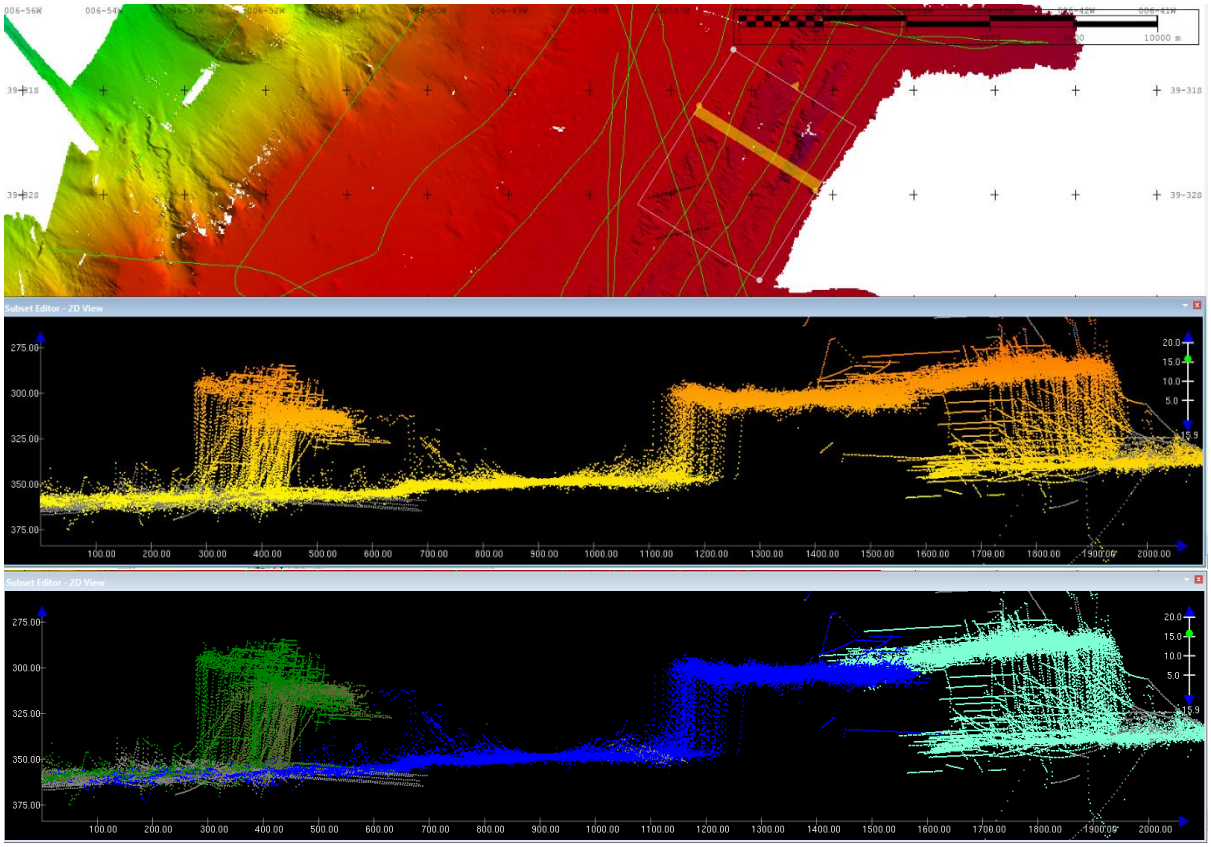


Figure 51 Images generated in Caris HIPS and SIPS, top image: This image shows the error showing in the swath angle surface during the data processing. Middle image: A profile of the dataset (some of the yellow strip from top image), coloured by depth. Bottom image: The same profile as the middle image, but the data is coloured by line, showing 2 separate lines picking up the same features.

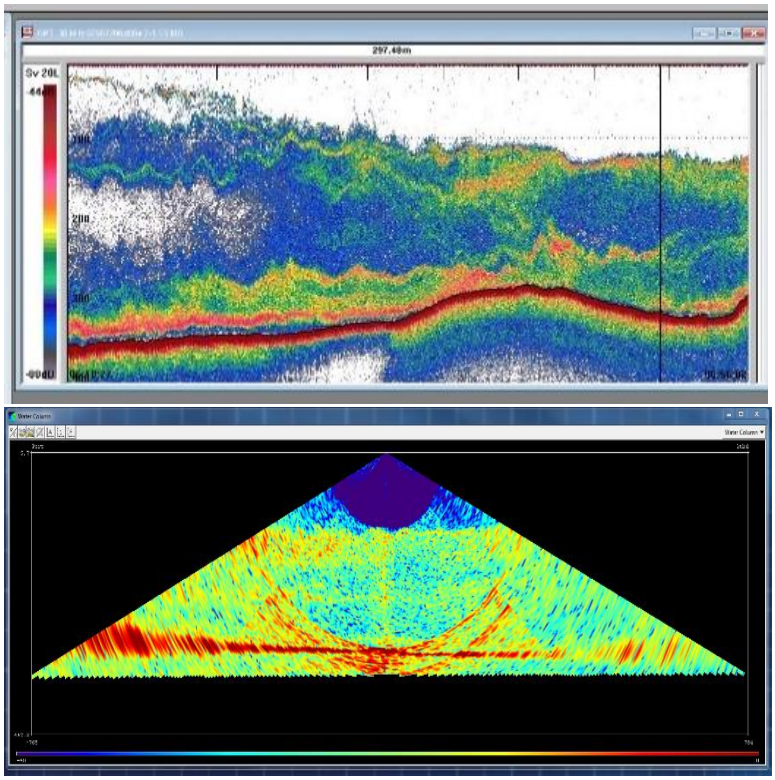


Figure 52 Image shows the dense layer of fish showing in the EK60 data, they are noticeably closer to the sea floor.

Figure 53 Image shows large quantity of fish and several false signatures that have been picked up instead of real sea floor.

6.9 EM122 Calibration

The multibeam system was calibrated for pitch, roll, heading and latency by conducting a patch test during the DY100 survey when the vessel reached Tristan Da Cunha. Given the proximity of the two sites and no errors showing in the data, the offset values obtained have been used for both Tristan Da Cunha and St Helena.

The calibration involved running survey lines over a large feature at position 37.078°S, 12.43°W; to look at the slope, errors were checked in both the along track and cross track. The calibrations are shown below, where the lines match in each case, shows the accuracy in the calibration, any shift would need to be accounted for. The system had been calibrated well previously and minimal changes were required.

Prior to carrying out the test, a deep CTD (20190321_FINAL_PRIMARY_DY100.asvp) was taken near the calibration site to ensure an accurate sound velocity profile.

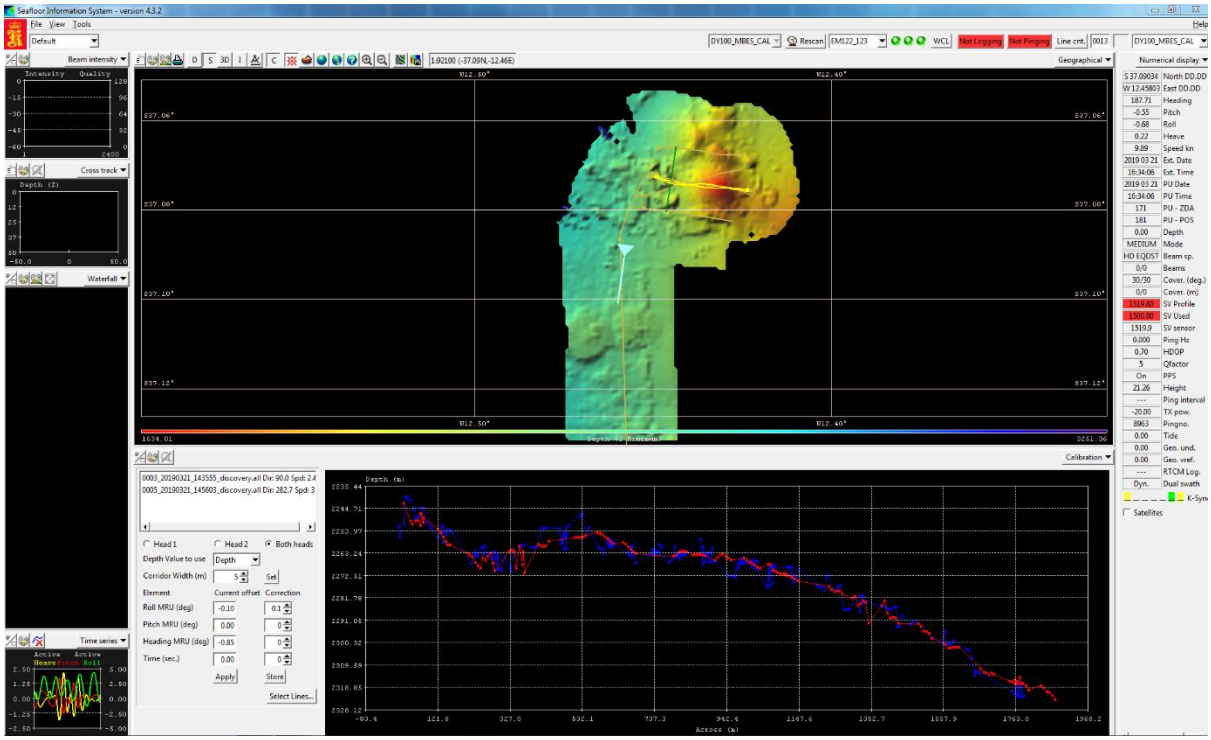


Figure 54 The image shows the roll calibration in Kongsberg SIS, two lines were run over each other in opposite directions, at a similar speed and the green line displays a section of the cross-track in the bottom window. The current roll value and correction is shown next to this cross-section.

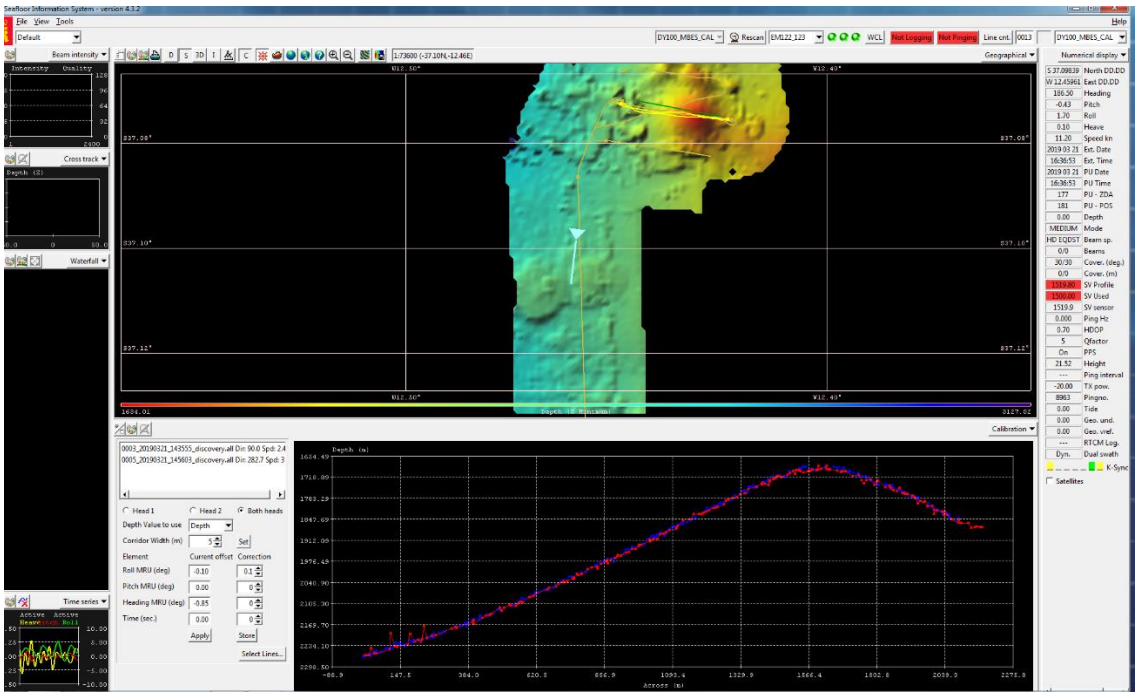


Figure 55 The image shows the pitch calibration in Kongsberg SIS, two lines were run over each other in opposite directions, at a similar speed and the green line displays a section of the along-track in the bottom window. The current pitch value and correction is shown next to this cross-section.

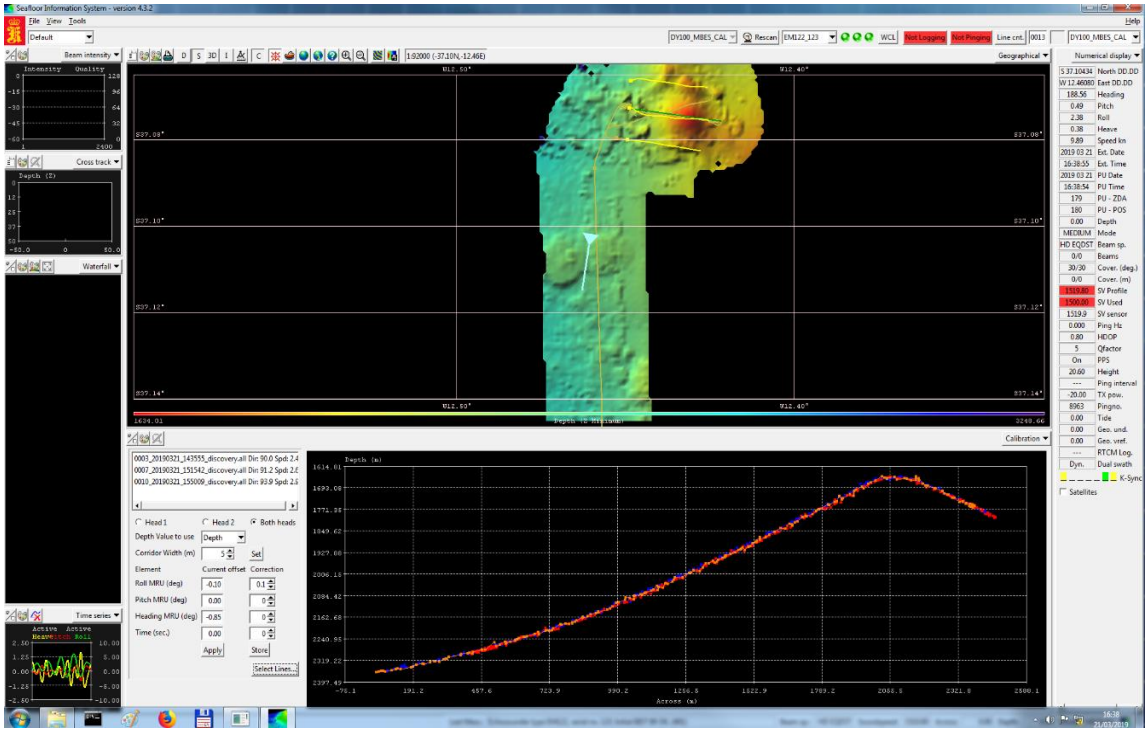


Figure 56 The image shows the heading calibration in Kongsberg SIS, three lines were run in the same direction, one centre line with 2 wing lines that ensured the outer beams covered the nadir of the centre line. The lines were run at a similar speed and the green line displays a section of the along-track in the bottom window. The current heading value and correction is shown next to this cross-section.

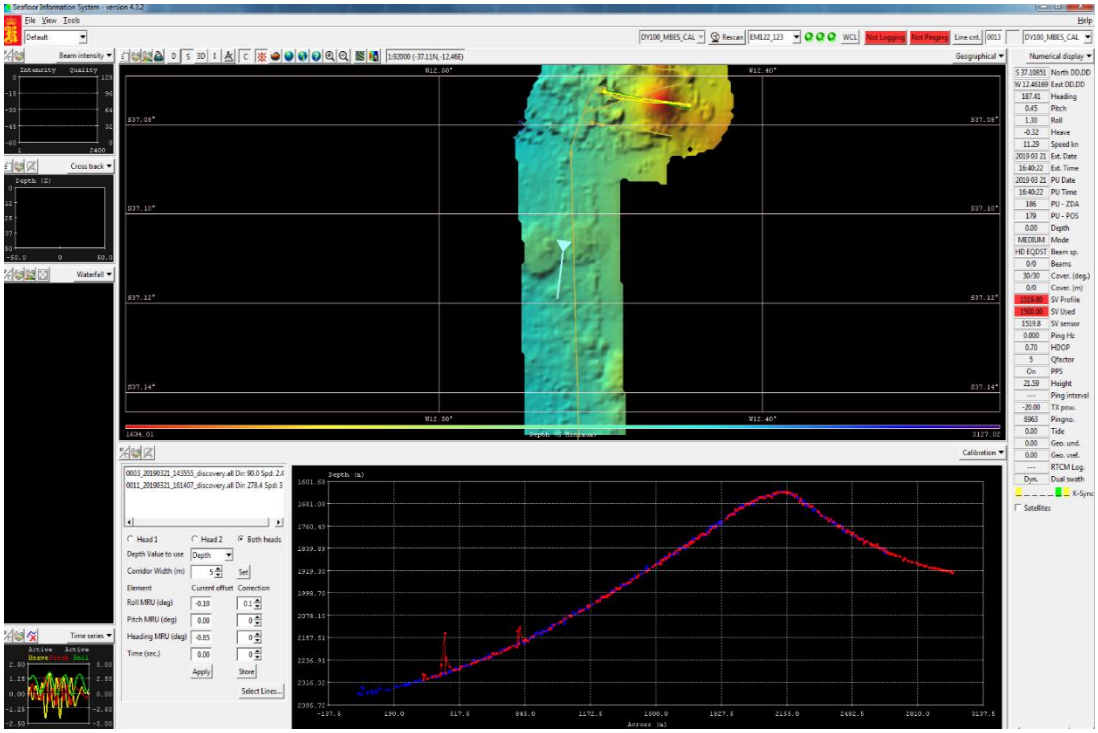


Figure 57 The image shows the latency calibration in Kongsberg SIS, two lines were run in the same direction, one was run at 4.5kts and one and 6.5knts. The green line displays a section of the along-track in the bottom window. The current latency value and correction is shown next to this cross-section.

6.10 EM710 Calibration

The multibeam system was calibrated for pitch, roll, heading and latency by conducting a patch test during the DY100 survey when the vessel reached Tristan da Cunha. Given the proximity of the two sites and no errors showing in the data, the offset values obtained have been used for both Tristan da Cunha and St Helena.

The calibration involved running survey lines over a slope around Tristan da Cunha, a different site was required to calibrate the EM710 in shallower waters. The slope was positioned at 37.327°S, 12.525°W; to look at the slope, errors were checked in both the along track and cross track. The calibrations are shown below, where the lines match in each case, shows the accuracy in the calibration, any shift would need to be accounted for. The system had been calibrated well previously and minimal changes were required.

Prior to carrying out the test, a deep CTD (20190321_FINAL_PRIMARY_DY100.asvp) was taken near the calibration site to ensure an accurate sound velocity profile (the same was used for both calibrations due to how close the sites were).

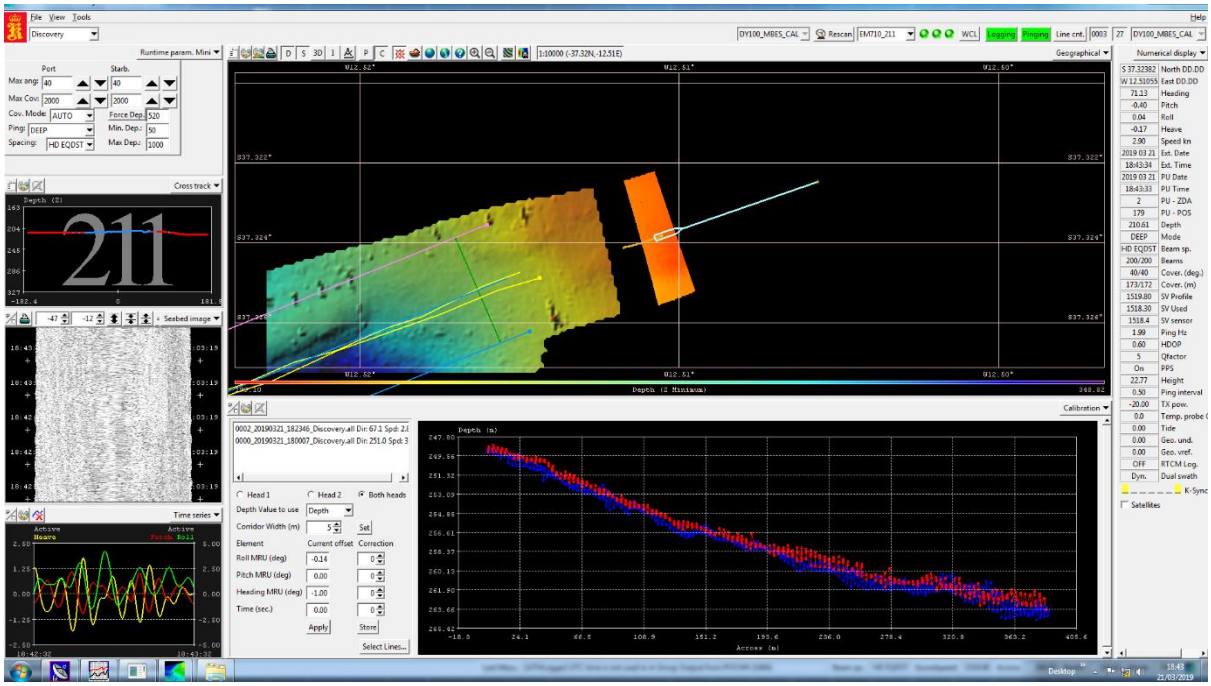


Figure 58 The image shows the roll calibration in Kongsberg SIS, two lines were run over each other in opposite directions, at a similar speed and the green line displays a section of the cross-track in the bottom window. The current roll value and correction is shown next to this cross-section.

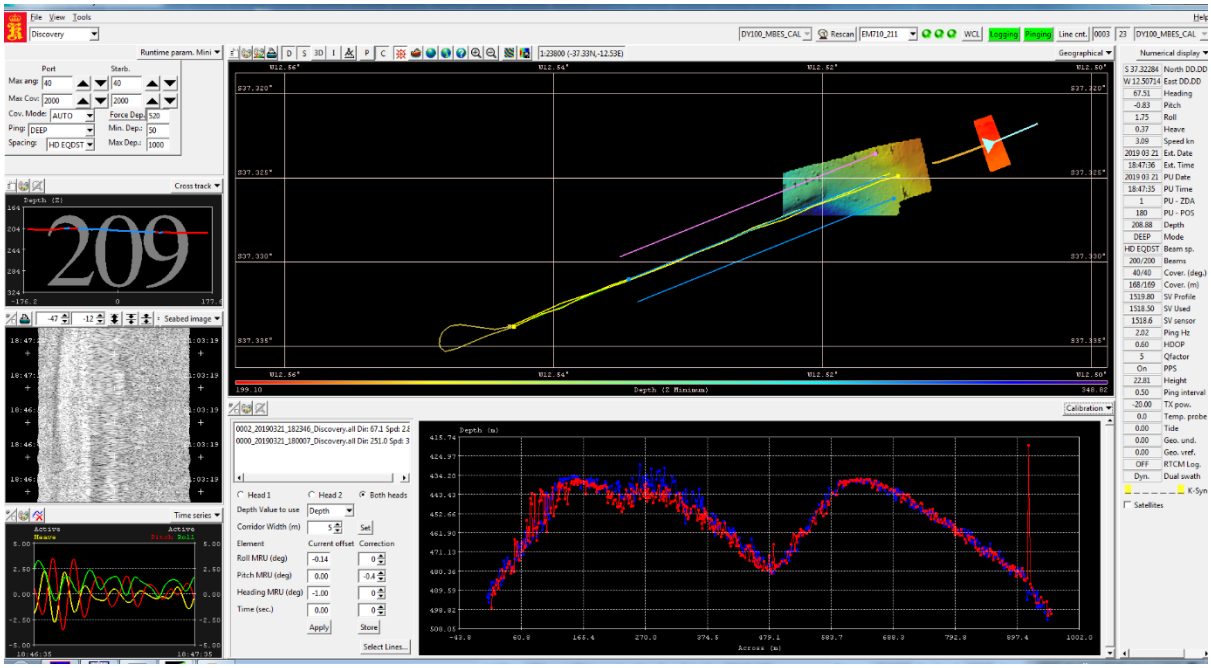


Figure 59 The image shows the pitch calibration in Kongsberg SIS, two lines were run over each other in opposite directions, at a similar speed and the green line displays a section of the along-track in the bottom window. The current pitch value and correction is shown next to this cross-section.

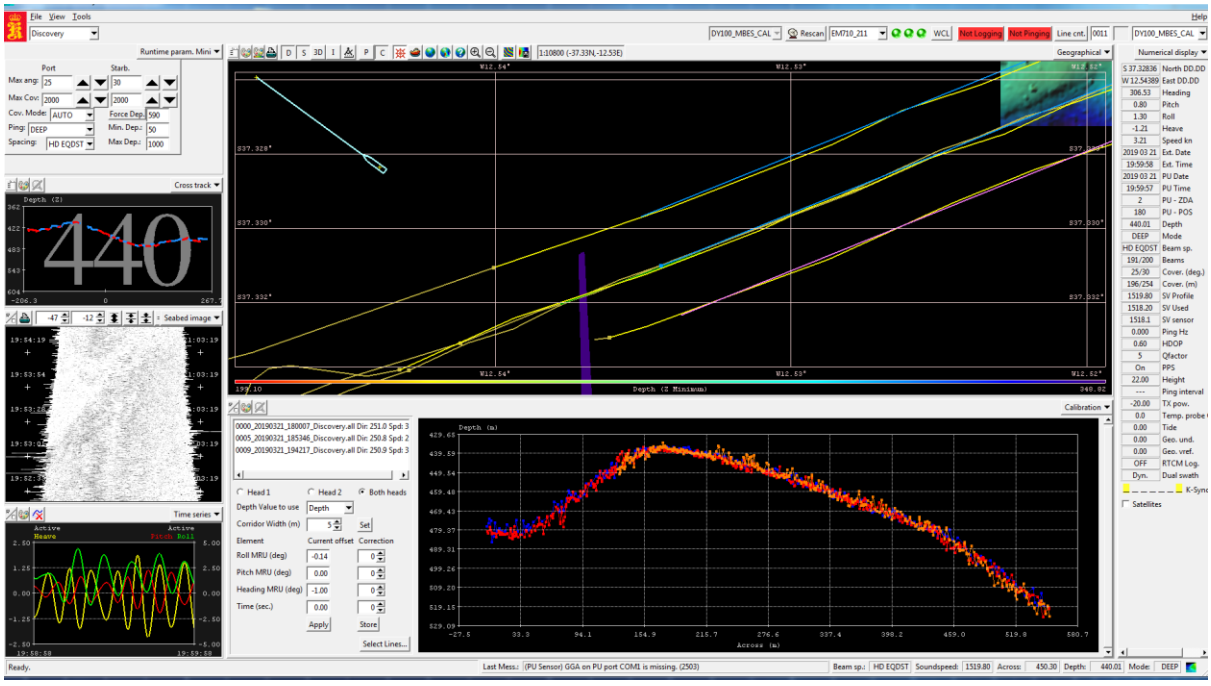


Figure 60 The image shows the heading calibration in Kongsberg SIS, three lines were run in the same direction, one centre line with 2 wing lines that ensured the outer beams covered the nadir of the centre line. The lines were run at a similar speed and the green line displays a section of the along-track in the bottom window. The current heading value and correction is shown next to this cross-section.

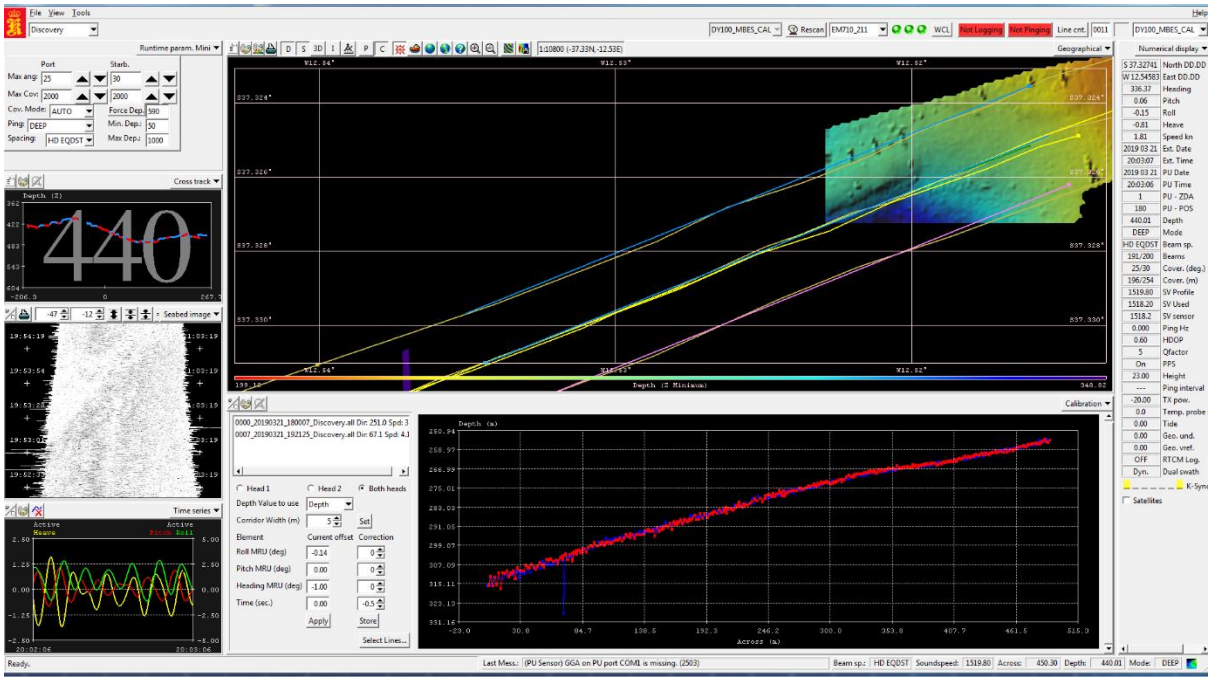


Figure 60 The image shows the latency calibration in Kongsberg SIS, two lines were run in the same direction, one was run at 6kts and one and 8knts. The green line displays a section of the along-track in the bottom window. The current latency value and correction is shown next to this cross-section.

6.11 Caris Hips & Sips v10.4 Data Processing

Processing was carried out on Caris HIPS and SIPS v10.4, with projects created in the WGS84 World Mercator projected coordinate system. Separate projects were created for each survey area, with raw files imported and converted into the Caris HDCS (Hydrographic Data Cleaning System) data structure. The navigation data was reviewed and spikes in some of the turns were removed in the dataset. All sound velocity corrections were applied to the data during acquisition in SIS so no further corrections were applied in Caris. The Caris vessel file, required prior to importing the data, was created during the previous cruise, but was checked before use. The ADMIRALTY TotalTide software shows only a small tidal range at Tristan Da Cunha and St Helena tide gauges (<=1m), so no tidal corrections were applied to the depths.

At each survey location, a Swath Angle (SA) ‘csar’ surface was created once the data was imported. The surface is generated using the weighting scheme based on a beam's intersection angle with the seafloor. The SA surface was viewed to aid the manual cleaning, subset editor was used to clean the dataset due to the steep slopes. Geotiffs were exported from the SA ‘csar’ surfaces, once the preliminary cleaning was complete, and used to aid the identification of sites suitable for the shallow underwater camera system.

6.12 NMF Scientific Ship System Survey Report

1 Scientific Computer Systems

1.1 Acquisition

Network drives were set up on the on-board file server; firstly, a read-only drive of the ship's instruments data ('current_cruise') and a second drive ('Public') for the scientific party. Both drives were combined and copied to disks for CEFAS, BAS and St Helena.

Data was logged by the Techsas 5.11 data acquisition system. The system creates NetCDF and ASCII output data files located in the below 'TechSAS' directory. The format of the data files is given per instrument in the "Data Description" directory:

Cruise Disk Location:
'DY100/Cruise_Documentation/Data_Description_Documents/'

'DY100\Ship_Fitted_Scientific_Systems/TechSAS'

The Ship-fitted instruments that were logged are listed in the below file (includes BODC/Level-C notes):

'DY100_BODC_ship_fitted_information_sheet_DY.docx'

Cruise Disk Location: ***'DY100/Cruise_Documentation/'***

The NMF 'RVDAS' raw data logger also records raw data streams as a backup/QC option to the primary Techsas logger. These raw ASCII files are located in the below cruise directory:

Cruise Disk Location: ***'DY100\Ship_Fitted_Scientific_Systems/RVDAS'***

Data was additionally logged into the legacy RVS Level-C format.

There are ASCII dumps of all the Level-C streams included on the data disk in the directory:

Cruise Disk Location: ***'DY100\Ship_Fitted_Scientific_Systems \Level-C/Enterprise-pro_data\ascii/'***

1.1.1 Main Acquisition Period

Techsas logging for 'DY100' commenced **14:35:16 on 11/03/2019 (J070)** whilst alongside in Stanley, Falkland Islands. RVDAS logging commenced 23:43:09 on 12/03/2019 (J071). Legacy 'Level-C' logging was started on 15/03/2019 (J074).

All logging was concluded **18:00:00 J104 (14/04/2019)** during final transit to Jamestown, St Helena.

1.1.2 Events/Data Losses

RVDAS (the secondary acquisition system) stopped recording temporarily between 2019-04-04 10:11 and 2019-04-04 13:38. Data was still logged by Techsas during this time.

Underway sampling acquisition gaps (from cleaning, etc.) are tabulated in the Surfmet section of this document and may also be found in the event log sheets in the Surfmet directory.

1.2 Communications

1.2.1 Internet provision

Satellite Communications were provided with both the Vsat and Fleet Broadband (FBB) systems. The Vsat had a guaranteed speed of 1.5 Mbps, bursts greater than this when there is space on the satellite, and unlimited data. The FBB had a maximum un-guaranteed speed of 256 kbps with a fair use policy that equates to 15 GB of data a month. There was solid service throughout, interrupted with a few mast blockages.

The Vsat connection enabled live video streams from the ship to the Natural History Museum to take place on 29 Mar 19 and 12 April 19 over Skype.

1.2.2 Email provision

Email communications were provided primarily through user email clients and web-browser clients. The AMS system was available as a backup if primary communications were lost.

2 Instrumentation

2.1 Coordinate reference Datum

The common coordinate reference was defined by the Parker Maritime survey (2013) as:

1. The reference plane is parallel with the main deck abeam (transversely) and with the baseline (keel) fore- and aft-ways (longitudinally).
2. Datum (X = 0, Y = 0, Z = 0) used in all systems is that of the coordinate reference system 2 with CRP at CG.

2.1.1 Multibeam

The Kongsberg axes reference conventions are (see Figure) as follows:

1. X positive forward,
2. Y positive starboard,
3. Z positive downward.

The roll reference is set to follow the convention of Applanix PosMV.

The translations and rotations provided by the Applanix PosMV Primary scientific position and attitude system have the following convention:

1. Roll positive port up,
2. Pitch positive bow up,
3. Heading true,
4. Heave positive up.

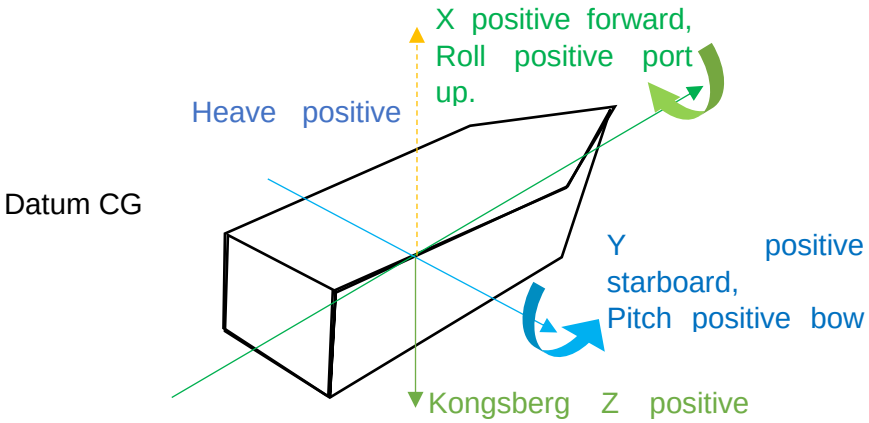


Figure 1 Conventions used for position and attitude.

2.2 Position and Attitude

GPS and attitude measurement systems were run throughout the cruise.

2.2.2 Applanix POSMV

The ***Applanix POSMV*** system is the vessel's primary scientific GPS system, outputting the position of the ship's common reference point in the gravity meter room (Refer to Parker Report, 2013 – Enclosure 3/Coordinate System 2). The POSMV is available to be sent to all scientific systems and is repeated around the vessel. The position fixes, attitude and gyro data are logged to the Techsas system.

The POSMV was the position and attitude source used by the EM122/EM710 as appropriate during this cruise.

2.2.3 Kongsberg Seapath 330

The ***Kongsberg Seapath 300*** system is the vessel's secondary GPS system. It provides an input to the Gravity meter due to the POSMV not having vessel course available in its RMC NMEA message. Position fixes and attitude data is logged to the Techsas system.

Due to faults with the Seapath developed on the previous cruise resulting in occasional large HDOP values, data from this system should be treated with caution.

2.2.4 C-NAV 3050

The ***CNav 3050*** GPS system is a differential correction service. It provides the Applanix POSMV system with RTCM DGPS corrections (greater than 1m accuracy). The position fixes data are logged to the Techsas system.

2.2.5 Fugro Seastar 9205

The **Fugro Seastar 9205** GPS system is a differential correction service. It provides the Seapath system with RTCM DGPS corrections. Fugro NMEA output messages are logged to the Techsas system.

2.3 Meteorology and sea surface monitoring package

The NMF Surfmet system was run throughout the cruise, excepting times for cleaning, entering and leaving port, around St Helena, and whilst alongside. Please see the separate information sheet for details of the sensors used and whether calibrations values have been applied:

'DY100_Surfmet_sensor_information_sheet.docx'

Cruise Disk Location: ***'DY100/Ship_Fitted_Scientific_Systems/Surfmet/'***

The Surfmet system is comprised of:

1. Hull water inlet temperature probe (SBE38).
2. Sampling board conductivity, temperature salinity sensor (SBE45).
3. Sampling board transmissometer (CST).
4. Sampling board fluorometer (WS3S)
5. Met platform temperature and humidity probe (HMP45).
6. Met platform port and starboard ambient light sensors (PAR, TIR).
7. Met platform atmospheric pressure sensor (PTB110).
8. Met platform anemometer (Windsonic).

Instrument calibration sheets are included in the directory:

Cruise Disk Location:
'DY100/ Ship_Fitted_Scientific_Systems/Surfmet/SurfMet_Calibration_sheets/'

2.3.1 Underway TSG Data

Events, including cleaning, sampling and any observed issues/flow adjustments were recorded and scans of these log sheets are included on the disk in the above 'Surfmet' directory. A summary of the main events excluding sampling is tabulated below.

Date:	Julian Day:	Start time	Event	Notes	End time
2019-03-13	072	12:43	Start	Flow stabilised at 12:52 at ~1.55-1.65 L/min	
2019-03-24	083	12:41	Cleaning		13:23
2019-04-01	091	12:01	Cleaning		12:18
2019-04-04	094	15:34	Stopped	Non-toxic turned off whilst close to St Helena	
2019-04-08	098	09:23	Cleaning		09:44

2019-04-08	098	09:44	Start	Non-toxic turned on again	
2019-04-09	099	04:10	Stopped	Stopped due to a leak	09:47
2019-04-09	099	09:47	Leak fixed		09:50
2019-04-11	101	19:46:15	Debubbled	Flow rate increased to remove bubbles	19:48:40
2019-04-14	104	11:21	Stopped	Stopped for end of cruise	

The collected water samples were measured for salinity using a Guildline Autosal 8400B salinometer. These results and a comparison with SBE45 TSG salinity values (averaged over 10 seconds before sample and 10 seconds after sample) are in the directory below:

Cruise Disk Location:
'DY100/Ship_Fitted_Scientific_Systems/Surfmet/tsg_salinities'

2.4 Drop Keel Sound Velocity Sensor

The surface Sound Velocity (SV) sensor (AML SmartSV) mounted on the drop keel was used throughout providing SV data to the EM122/EM710. The port drop keel remained flush with the hull for the duration of the cruise.

2.5 Kongsberg EA640 10 & 12 kHz Single-beam

The EA640 single-beam echo-sounder was run throughout the cruise. The 10kHz was primarily used. Pulse parameters were altered during the cruise in response to changing depth. This depth was used as the input for the CLAM (Cable Logging and Measurement) during deployment activities.

The system used a constant sound velocity of 1500 ms^{-1} throughout the water column to allow it to be corrected for sound velocity in post processing if required. Salinity (35 PSU) and Temperature (10degreeC) and Conditions (salt water) were also left as constant values for the cruise duration.

Kongsberg *.raw files (~100MB file size) and *.xyz files are logged and depths were logged to Techsas, Level-C and RVDAS.

2.6 ADCP OS75KHz (RDI Teledyne).

The RDI Teledyne Ocean Surveyor 75KHz ADCP was configured as per dy098. It was not run continuously as data collection from the multibeam systems and EK60 was prioritised.

Cruise	Disk	Location:
'DY100/Ship_Fitted_Scientific_Systems/Acoustics/OS75kHz		

2.6.1 Data Feeds

- GGA (Ship Position) and VTG (Ship Speed) was provided by the Applanix POS-MV.
- Heading and Tilt was provided by the iXSea PHINS MRU (PRDID NMEA message).

2.7 ADCP OS150KHz (RDI Teledyne).

The RDI Teledyne Ocean Surveyor 150KHz ADCP was configured as per dy098. It was not run continuously as data collection from the multibeam systems and EK60 was prioritised.

Cruise	Disk	Location:
'DY100/Ship_Fitted_Scientific_Systems/Acoustics/OS150kHz		

2.7.1 Data Feeds

- GGA (Ship Position) and VTG (Ship Speed) was provided by the Applanix POS-MV.
- Heading and Tilt was provided by the iXSea PHINS MRU (PRDID NMEA message).

2.8 Simrad EK60 scientific echo sounder.

The EK60 scientific echo-sounder was configured by the scientific party and ran with or without K-sync depending on the survey requirements. Acoustic surveying was mostly undertaken during the night.

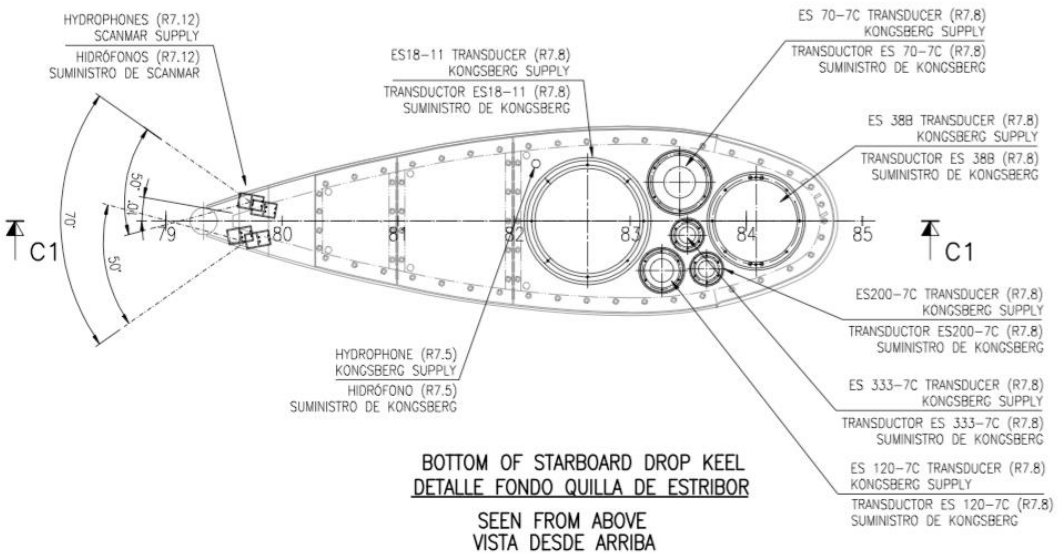
Cruise Disk Location: ***'DY100/Ship_Fitted_Scientific_Systems/Acoustics/EK60***

2.8.1Data Feeds

- Vessel position and attitude data was provided by the Applanix POS-MV.

2.8.2 Transducer Location

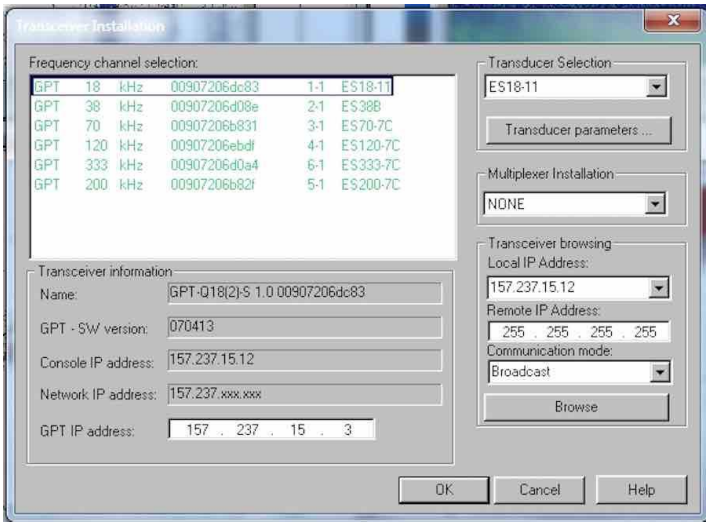
The suite of EK60 transducers are mounted on the vessel's starboard drop keel. This was deployed flush to the vessel's baseline for the majority of the cruise, therefore with the EK60 software transducer configuration ('Normal Operation' menu) 'Depth[m]' set to 6.60m. This value is the depth of the transducer face relative to the water surface (**ref. 164692/D Simrad EK60 Manual**).



2.8.3 Transducer Information

Manufacturer information sheets for the below fitted EK60 transducers are on the cruise disk.

Type	Transducer Serial No.
18kHz	2111
38kHz	31185
70kHz	258
120kHz	890
200kHz	533
333kHz	135



2.8.4Tristan Calibration

A calibration of the EK60 was undertaken on 30th March 2019 outside Tristan in water depth of approximately 33m. The 333kHz transducer calibration was not attempted – this was due to it being a lower priority frequency. Calibration requires a different size sphere to be deployed, so increases the operation time significantly. Calibration of the remaining frequencies (18kHz, 38kHz, 70kHz, 120kHz) were attempted with the 38.1mm tungsten carbide sphere positioned at a depth of 15-20m below the ship. It was known beforehand that there was an issue with the 18kHz transducer (further details below) so calibration was started with the 38kHz.

The main outcomes are below:

- The 38kHz transducer showed similar symptoms as the 18kHz had shown on a previous cruise (DY098): difficulty in obtaining soundings in all quadrants, and returns >2dB lower than the expected level (further details below). The presence of fish resulted in false detections.

- The 18kHz, as expected, could not receive echoes in all quadrants.
- The 70kHz and 120kHz functioned fine, however tidal currents made positioning the sphere difficult and the sphere was lost in the echogram before calibration could be completed. Calibration was completed by replaying data collected from the 38kHz calibration.

2.8.5 St Helena Calibration

A second calibration was planned at St Helena. This took place on 8th April 2019 at a depth of ~140m. The current beneath the ship was much more favourable and in addition the ship drifted with the current. This made it much easier to position the sphere, which was positioned at a depth of 15-20m below the ship. A problem (possibly with the software- see below for further details) meant the 70kHz and 120kHz single targets were not detected, so these frequencies were calibrated using data collected for the 38kHz.

2.8.6 18KHz Transducer Fault

During DY098, it was discovered that the 18KHz transducer (ES18-11 Serial No. 2111) could not be calibrated successfully. It was not possible to obtain soundings in all four quadrants. The returns were also several dB different to the expected level. This points to there being an issue with the transducer. An investigation of the fault prior to DY100 sailing, using the test procedure from Simrad/Kongsberg, found a short circuit between the 18kHz transducer cable screen and ground, and open circuit readings on channels 1 and 4 of the transducer. This indicated a problem with either the transducer or cable and was not a problem that could be fixed whilst at sea.

The last time the 18kHz was successfully calibrated was in June 2018.

From Simrad EK60 reference manual:

'The data evaluation should start using the Plot view and the polynomial model to check the shape of the polar plot. A circular transducer should have a circular beam and an elliptic transducer an ellipse, both with only insignificant offset angles. If a circular transducer in the Plot view shows an ellipse with approximately 45 or 135 degrees axis, the reason may be one missing quadrant in the transducer or one missing quadrant in the receiver. This symptom should also give approximately 2 dB lower TS, i.e. 1dB lower transducer gain to compensate.' (p.47 EK60 Reference Manual).

The data logged by the 18KHz transducer during the cruise is therefore to be treated with caution.

2.8.7 38KHz Transducer Fault

During the calibration at Tristan, it became apparent that the 38kHz transducer (ES38B Serial No. 31185) was behaving in a similar way to the 18kHz. An investigation after the calibration attempt, again following Simrad/Kongsberg's testing procedure, found an open circuit reading on channel 1 of the transducer, pointing to a fault with the transducer or cable.

The 38kHz was last successfully calibrated on 15/01/2019. An analysis by the scientific party found that the fault began on 27/01/2019 and therefore since the start of DY100.

The data logged by the 38KHz transducer during the cruise is therefore to be treated with caution.

2.8.8 Software issues with 70KHz and 120KHz

During the calibration at St Helena, the following issue was observed whilst calibrating the 70KHz and 120kHz transducers: no targets (or very few) were picked up and shown on the polar plot, despite the echograms showing a clear return for the sphere. Occasionally when a target was plotted, it would freeze on the plot for several seconds. There were also no targets plotted even when the lower db threshold was set very low. The software and transducers were rebooted but the problem persisted. Both the 70KHz and 120KHz were therefore calibrated using the data collected from the 38kHz, and good coverage was achieved across all quadrants.

2.9 Kongsberg EM122 Multibeam Echo Sounder

The EM122 multibeam echo sounder was run throughout the cruise. The position and attitude data was supplied from the Applanix PosMV and True Heave *.ath file are logged to allow for inclusion during reprocessing.

GeoTIFFs for previous surveys around Tristan and St Helena were imported into SIS as background images in order to fill in data gaps.

During passage, sound velocity profiles were derived from a statistical model using SHOM & Ifremer's DORIS programme. Before swath surveys, sound velocity profiles were collected using the Valeport Sound Velocity Profiler (see section Sound Velocity Profiles below).

The following figures show the system installation configuration. The values are from the ships Parker survey report, which is included on the data disk.

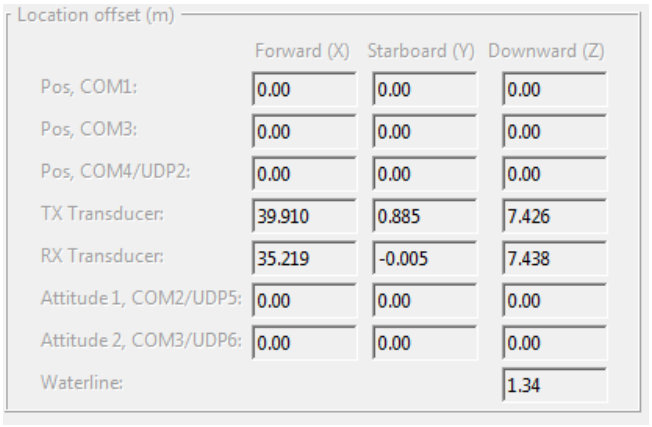


Figure 2 – EM122 transducer locations

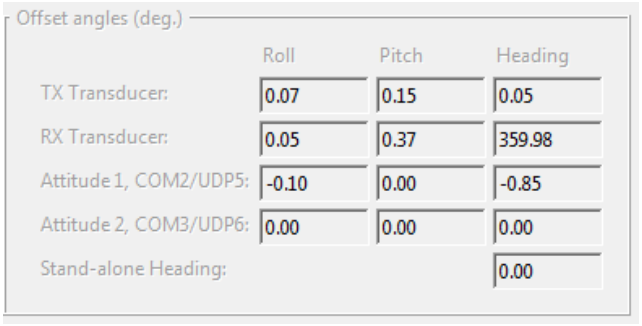


Figure 3 – EM122 transducer offsets

Cruise Disk Location: ***'DY100\Ship_Fitted_Scientific_Systems\Acoustics \EM122\'***

2.10 Kongsberg EM710 Multibeam Echo Sounder

The EM710 multibeam echo sounder was during shallow water surveys of the seamounts. The position and attitude data were supplied from the Applanix PosMV and True Heave *.ath file are logged to allow for inclusion during reprocessing.

During passage, sound velocity profiles were derived from a statistical model using SHOM & Ifremer's DORIS programme. Before swath surveys, sound velocity profiles were collected using the Valeport Sound Velocity Profiler (see section Sound Velocity Profiles below).

The following figures show the system installation configuration. The values are from the ships Parker survey report, which is included on the data disk.

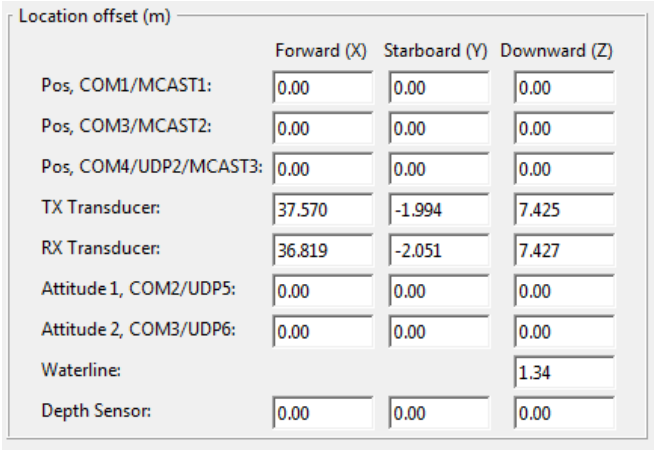


Figure 4 – EM710 transducer locations

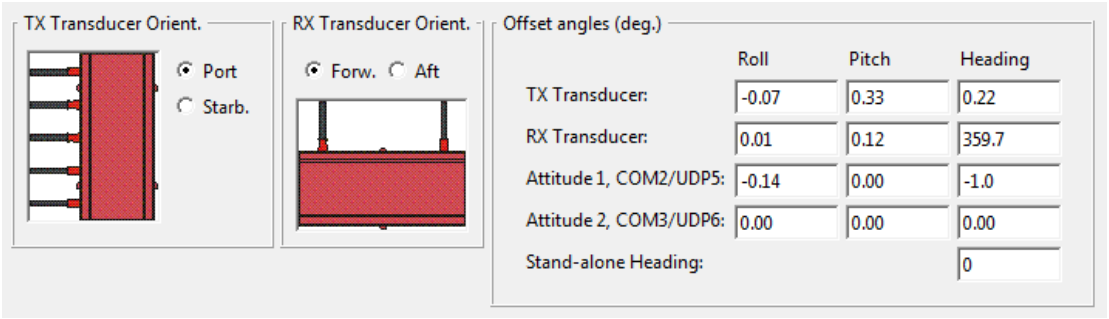


Figure 5 – EM710 transducer offsets

Cruise Disk Location:
'DY100\Ship_Fitted_Scientific_Systems\Acoustics \EM710\'

2.11 Multibeam CARIS Processing

Processing using CARIS HIPS&SIPS was undertaken by the scientific party.

Cruise Disk Location:
'DY100\Ship_Fitted_Scientific_Systems \Acoustics\CARIS_Processed_Multibeam\'

2.12 Sound velocity profiles

DORIS Programme

During passage, modelled sound velocity profiles to a depth of 12,000m were derived from SHOM & Ifremer's DORIS programme using the WOA13 database. The sound velocity profiles were input to the EM122, EM710 and USBL when required.

Cruise Disk Location:
'DY100/Ship_Fitted_Scientific_Systems/Acoustics/Sound_Velocity_Profiles/DORIS'

A summary of the modelled profiles is given in the table below:

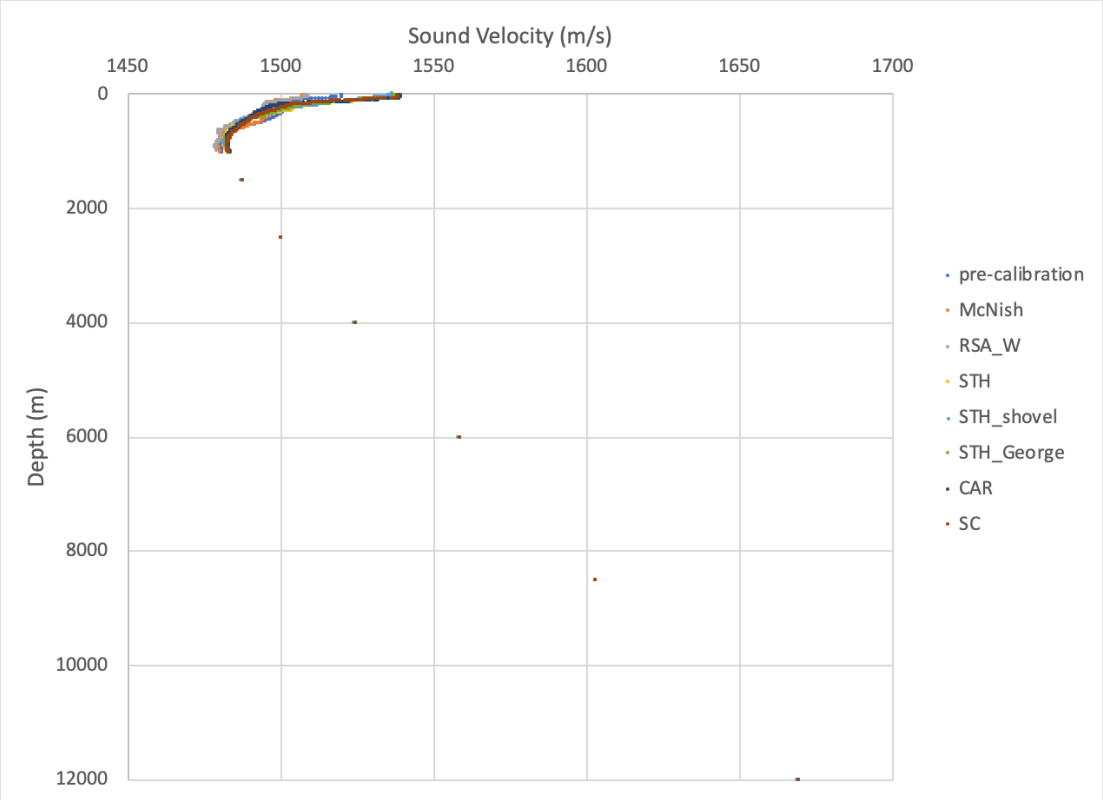
Date	Time	Latitude	Longitude	Profile file name
2019/03/13	14:00	50.447°S	53.456°W	Woa13.asvp
2019/03/14	10:57	48.85°S	47.97°W	Woa13_20190314110000ext.asvp
2019/03/14	16:35	48.4°S	46.46°W	Woa13_20190314163000.asvp
2019/03/14	22:43	47.95°S	44.96°W	Woa13_20190314224500.asvp
2019/03/17	11:05	43.4°S	30.65°W	Woa13_20190317110500.asvp
2019/03/18	09:28	41.7°S	25.58°W	Woa13_20190318093000.asvp
2019/03/20	08:00	38.546°S	15.612°W	Woa13_20190320075900.asvp
2019/03/21	10:51	37.259°S	12.515°W	Woa13_20190321105100.asvp
2019/03/22	19:58	38.1716°S	11.037°W	Woa13_20190322195800.asvp
2019/03/31	13:13	34.319°S	11.396°W	Woa13_20190331131300.asvp
2019/04/02	09:38	27.595°S	9.254°W	Woa13_20190402093800asvp.asvp
2019/04/02	18:05	26.118°S	8.804°W	Woa13_20190402180500asvp.asvp
2019/04/03	08:56	23.588°S	8.027°W	Woa13_20190403085500asvp.asvp

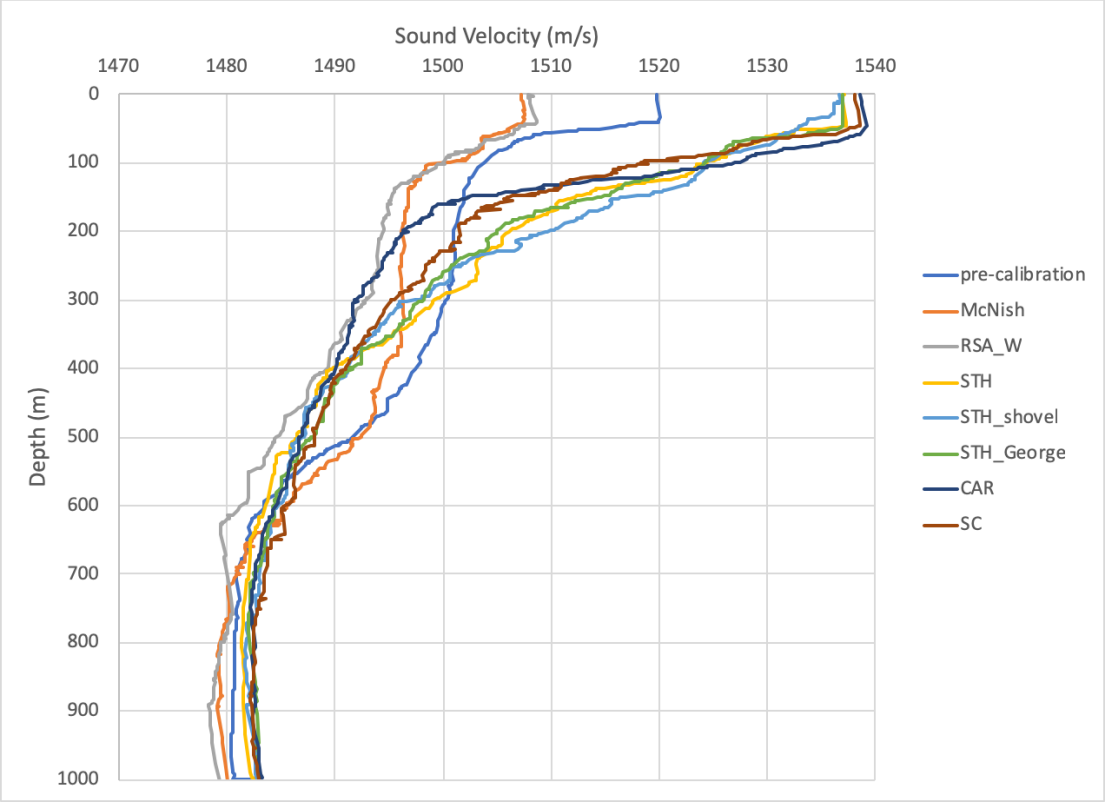
2.12.1 MIDAS Valeport SVP

The MIDAS Valeport SVP (SN:41603) was deployed either on a wire or attached to the CTD frame prior to swath surveys. Each deployment went to a depth of approximately 1,000m. Profiles were extended to 12,000m and thinned before being input to the EM122, EM710 and USBL when required.

A summary of the SVP profiles is tabulated and plotted below:

Date	Time (start of recording)	Site	Latitude	Longitude	Processed profile file name*
21/03/2019	12:42	Pre swath calibration	37.072°S	12.450°W	FINAL_PRIMARY_DY100.asvp
23/03/2019	13:52	McNish	40.027°S	8.556°W	20190323_McNish_FINAL.asvp
26/03/2019	08:37	RSA_W	39.542°S	6.920°W	20190326_RSA_W_FINAL.asvp
05/04/2019	06:49	STH	16.122°S	5.804°W	20190405_STH_FINAL.asvp
06/04/2019	07:12	STH_Shovel	15.974°S	5.835°W	20190406_shovel_FINAL.asvp
07/04/2019	14:17	STH_George	16.004°S	5.600°W	20190407_George_FINAL.asvp
10/04/2019	15:12	CAR	12.954°S	6.118°W	20190410_car_FINAL.asvp
*processing includes removing zeros, extending to 12000m and thinning					





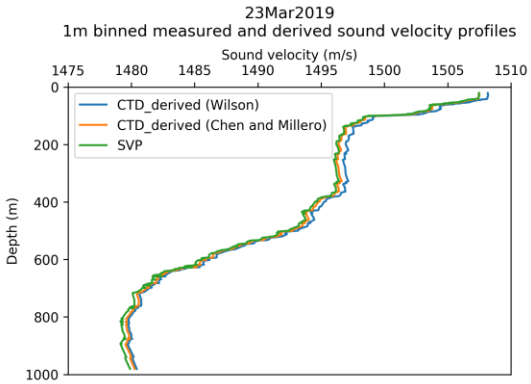
The raw and processed files, an excel spreadsheet used to produce the plots above, and a scanned logsheet of the deployments are contained in the data directory below:

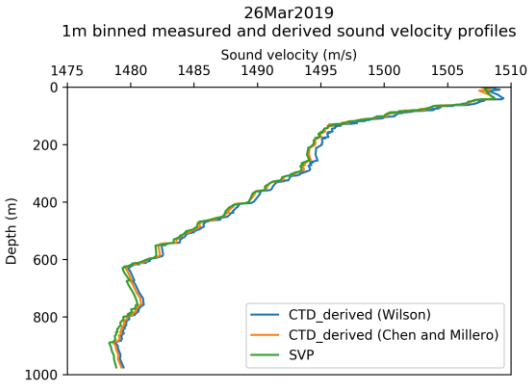
Cruise Disk Location:
***'DY100/Ship_Fitted_Scientific_Systems/Acoustics/*Sound_Velocity_Profiles/SVP_Probe'**

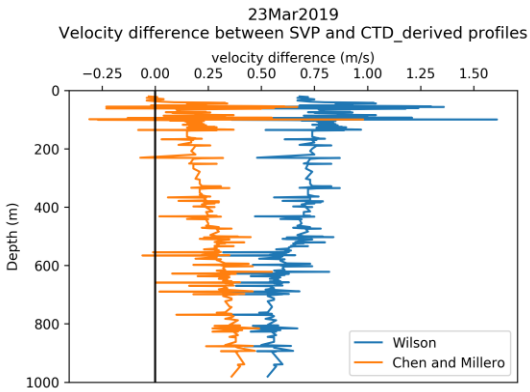
2.12.2 Comparison between SVP and CTD sound velocities

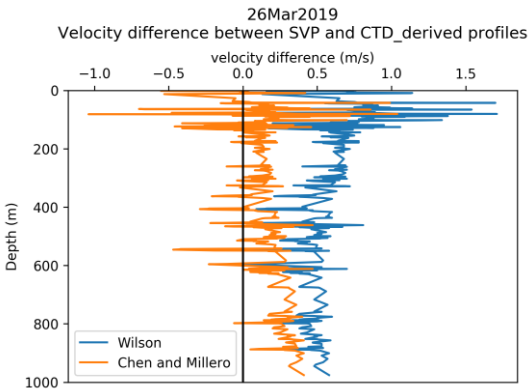
Sound velocity profiles can be derived from the temperature and salinity measurements obtained by the CTD. On two of the occasions where the SVP was attached to the CTD frame (23/03/2019 and 26/03/2019), CTD-derived sound velocities were compared with the sound velocities measured by the SVP.

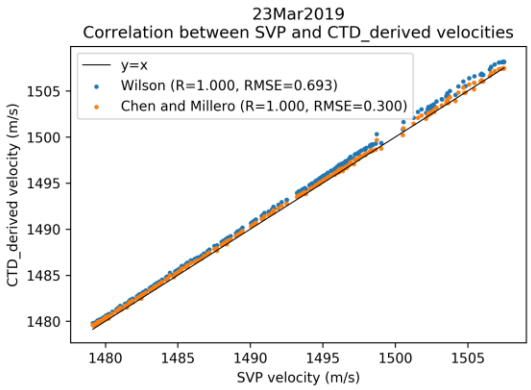
Two different algorithms were used to derive velocities from the CTD data: Chen and Millero, and Wilson. Both the CTD-derived velocities and the SVP velocities were resampled onto a 1m depth spacing prior to comparison.

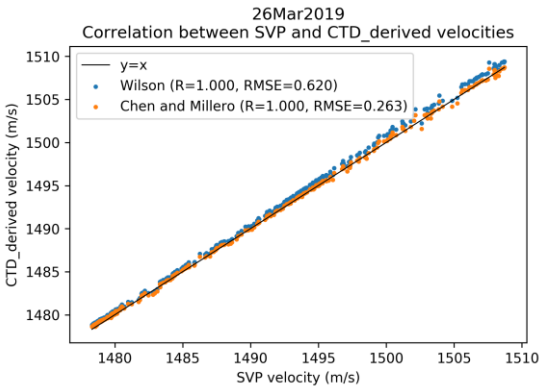

23Mar2019
1m binned measured and derived sound velocity profiles
Sound velocity (m/s)
Depth (m)
CTD_derived (Wilson)
CTD_derived (Chen and Millero)
SVP

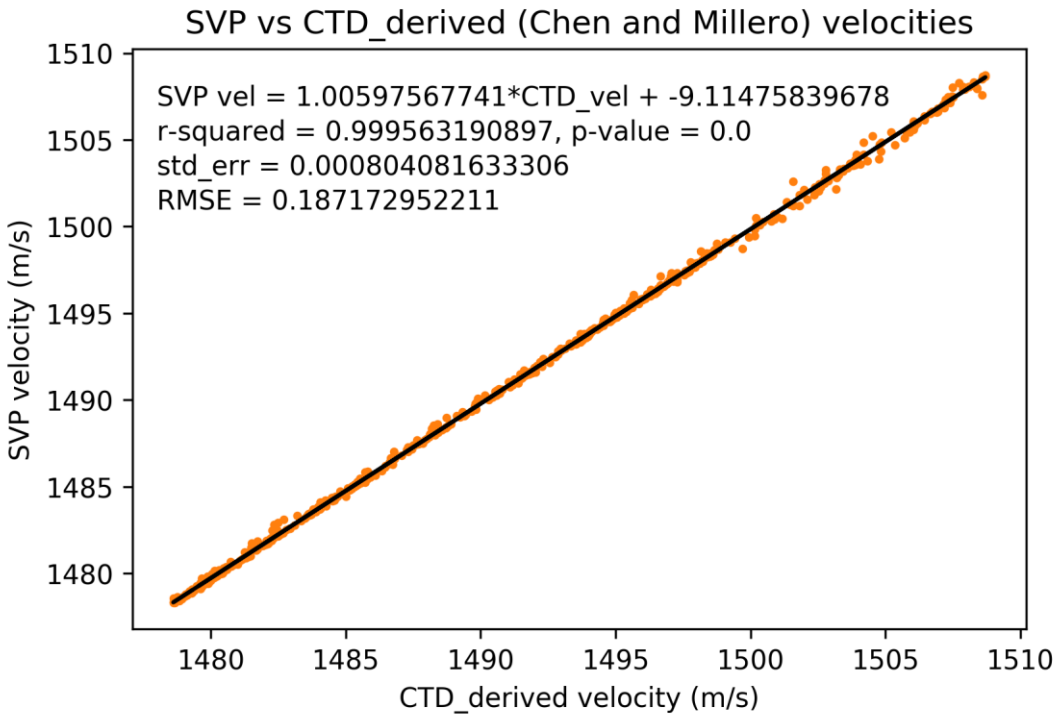

26Mar2019
1m binned measured and derived sound velocity profiles
Sound velocity (m/s)
Depth (m)
CTD_derived (Wilson)
CTD_derived (Chen and Millero)
SVP


23Mar2019
Velocity difference between SVP and CTD_derived profiles
velocity difference (m/s)
Depth (m)
Wilson
Chen and Millero


26Mar2019
Velocity difference between SVP and CTD_derived profiles
velocity difference (m/s)
Depth (m)
Wilson
Chen and Millero


23Mar2019
Correlation between SVP and CTD_derived velocities
y=x
Wilson (R=1.000, RMSE=0.693)
Chen and Millero (R=1.000, RMSE=0.300)
CTD_derived velocity (m/s)
SVP velocity (m/s)


26Mar2019
Correlation between SVP and CTD_derived velocities
y=x
Wilson (R=1.000, RMSE=0.620)
Chen and Millero (R=1.000, RMSE=0.263)
CTD_derived velocity (m/s)
SVP velocity (m/s)


SVP vs CTD_derived (Chen and Millero) velocities
SVP vel = 1.00597567741*CTD_vel + -9.11475839678
r-squared = 0.999563190897, p-value = 0.0
std_err = 0.000804081633306
RMSE = 0.187172952211
SVP velocity (m/s)
CTD_derived velocity (m/s)
1480
1485
1490
1495
1500
1505
1510