

**Expedition Report:
Subtidal and Intertidal Benthic
Survey of the North Coast of
South Georgia
November 2010**



Prepared by Dr Paul Brewin and Dr Paul Brickle



**SHALLOW
MARINE
SURVEYS
GROUP**

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Logistics

MSV *Pharos* SG
Pharos RIB
Pharos Zodiac
King Edward Point Research Station

Expedition Dates

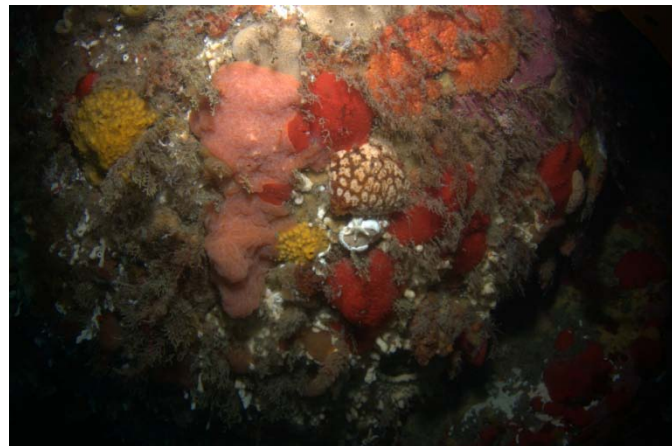
14 Nov – 17 Dec 2010

Expedition Personnel

Dr Paul Brickle	Expedition Leader
Dr Paul Brewin	Science Officer
Dr Judith Brown	Diver Officer
Steve Cartwright	Diver, photographer, tech services
Steve Brown	Diver, photographer, tech services
Dion Poncet	Diver, photographer, regional guide
Dr Claire Goodwin	Scientist, Sponge taxonomist
Dr Emma Wells	Scientist, Seaweed taxonomist
Ali Massey and KEP staff	Volunteer field assistance (intertidal surveys)

Survey Objectives

The marine habitats of South Georgia are potentially of the most interesting in the region, yet at present they are of the most poorly understood. Past studies show that the shelf area of South Georgia has similar or greater species richness in some major groups (eg bryozoans, sponges, nematodes, chelicerates) compared to other regions globally that have much larger shelf areas and that have been more intensively sampled. Furthermore, South Georgia is geologically old and geographically remote, therefore theoretically, it may be high in endemics, and there is some evidence to



support this. Given the increasing fishing and tourism activity on South Georgia, it is important to understand the region's habitat characteristics and biodiversity for impact monitoring purposes. In addition, the region has been shown to be one of the most likely globally to be highly impacted by climate change in terms of shifting or loss of biodiversity and potential for invasive species colonisation.

Our goal is to carry out the first comprehensive subtidal benthic survey of the north coast of South Georgia between 5 and 18 m depth, thus providing valuable and timely baseline data for future studies and monitoring. The only previous study comparable to the present survey was in 1925 during the Discovery expeditions. More recent studies have explored some of these areas, but not in a systematic way, and have tended to centre on Cumberland Sound (King Edward Point Research Station). We also aim to quantify the intertidal benthic habitats around KEP/ Grytviken, as these are potentially areas of particular vulnerability to future commercial and tourist operations.

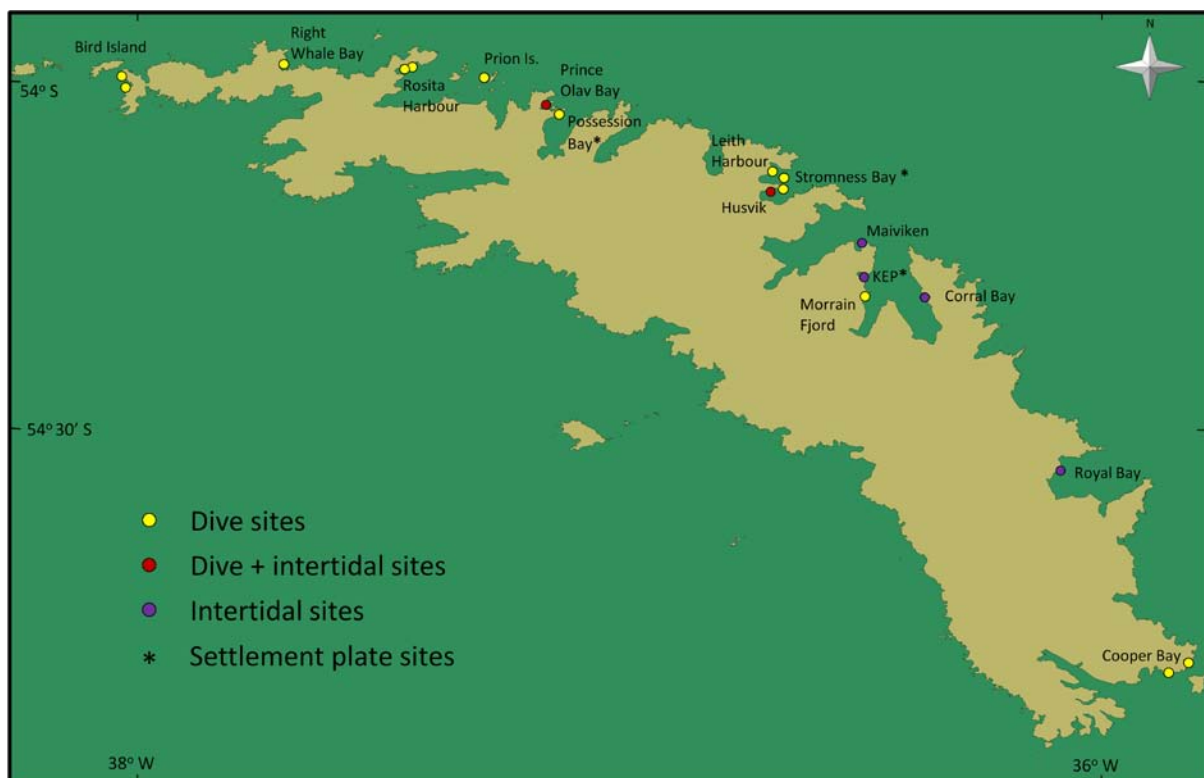
Two visiting scientist from the United Kingdom joined the SMSG team, specialising in species groups that are particularly poorly known from the region; Dr Claire Goodwin of the National Museum of Northern Ireland who is a sponge taxonomist, and Dr Emma Wells of Wells Marine who is a seaweed taxonomist. Ms Ali Massey of the King Edward Point Research Station kindly volunteered to assist with intertidal surveys around KEP and surrounds.

We will;

- Describe South Georgia's northern coast benthos in terms of species composition and distribution.
- Describe South Georgia's northern coast benthic habitats in terms of character and distribution.
- Quantitatively survey 3 depth strata per site (5, 10, 18 meters depth) using photo quadrat methods.
- Make biological collections for museums and genetic studies.
- Target areas that represent gaps in our knowledge or are thought to be sensitive/vulnerable.
- Deploy settlement plates for invasive species detection (3 sites).
- Collect close-up high-quality photographs for a species guide book.
- Describe the intertidal habitat and species characteristics of King Edward Point and surrounds.
- Collect specimens for collaborators at other institutions.

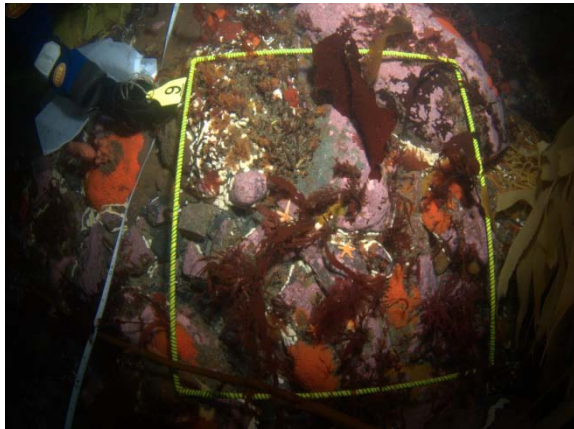
Methodology

A total of 25 sites were sampled throughout the northern coast of South Georgia, extending from Bird Island in the north west to Cooper Bay in the south east. Sites were chosen for their representativeness of the area and diver access (sheltered from wind and wave surge, adequate underwater visibility). At each site, we attempted to carry out 3 transect surveys using SCUBA, although this was not always possible due to poor visibility or weather. We attempted in the least, to make general animal and plant collections, and take high-quality close up photographs (ie macro-photos).



The daily schedule would generally begin at 0800hrs with a meeting on the bridge of the *Pharos* with the captain and key crew to discuss the days diving schedule, or discuss changes/alternatives in plans due to poor weather, etc. The *Pharos* would anchor in a safe and central location, and divers were deployed via RIBs (ridged inflatable boats) to the dive site, remaining in visual contact with the *Pharos* at all times.

Transect surveys consisted of running a tape reel out within a given depth range (18m, 10m or 5m). A 0.25m² quadrat was placed at 1m intervals along the transect and photographed using a digital Nikon D80 or D90 with a wide angle lens. Divers would then collect faunal and floral samples into catch bags that corresponded to the quadrat. This will allow us to directly compare animals collected to those in the photo-quadrat. Divers repeated photo-quadrat/collections for as long as they were able, remaining within allowed diver regulations.



After each dive, samples were identified where possible or assigned “field” names, sorted into jars, and preserved in either buffered formalin or 96% ethanol. JNCC habitat classification forms were filled out after each dive to provide a standard record of substrate type and to allow us to describe the biological environment.

Intertidal surveys were carried out using a similar method to diver surveys. Surveys were done at low tide according to the local maritime almanac. A transect tape was run from high water mark to low water at representative sites, and where fur seal densities were such that a survey could be conducted. Photo quadrat/collections were made at regular intervals along the transect line as determined by time and/or conditions constraints, again maintaining the photo - species collection relationship as in the diver surveys. A complete search within the quadrat was made, including crevasses, and the underside of rocks. We aimed for 3 transects per site, however this was not always achieved.

Diver safety

Considerable preparations were made pre-trip for the safest diving practices possible. Due to the remote nature of South Georgia, diver emergency help (hospitals, decompression chambers, etc) are too far away to be of assistance. Therefore, a rigorous plan of setting dive depth limits (18m maximum), dive time limits (30mins maximum), and compulsory safety stops for dives greater than 10m depth was adhered to. We employed prudent practices for possible seal encounters, in particular leopard seals, keeping



constant watch, and having an underwater signalling device to recall divers if a leopard sea was observed. We used diver to surface signals by way of delayed SMBs (Surface Marker Buoys). All divers carried “pony” bottles for independent back up air supply in case of regulator “free-flow” that can occur in zero degree water.

Settlement plate deployment

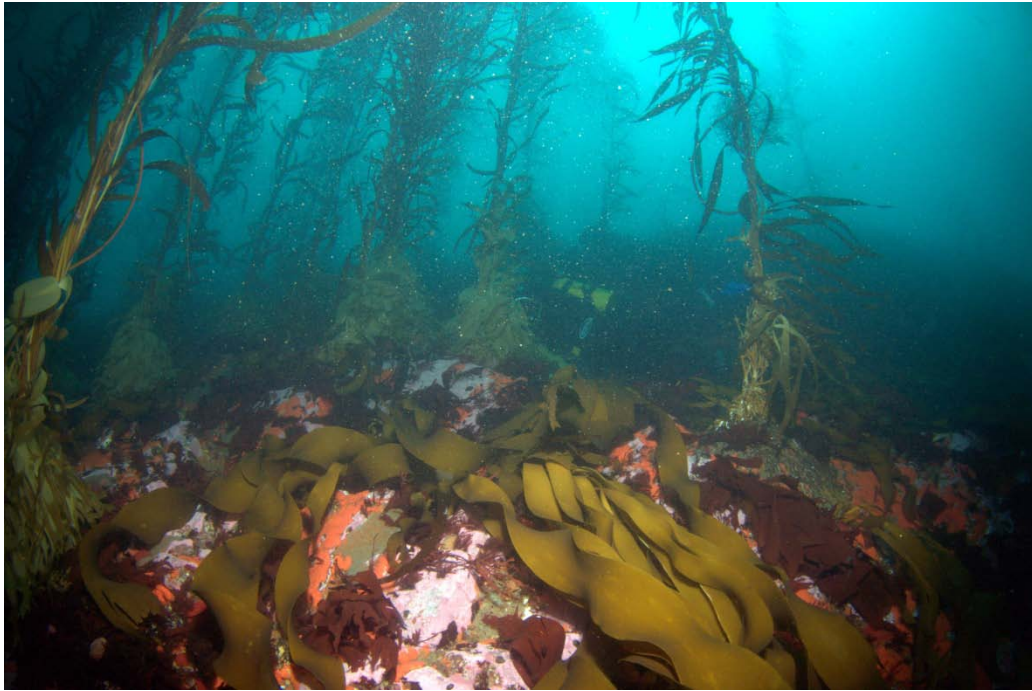
Settlement plates (3 replicate plates per site) were deployed at 3 sites, for detecting invasive species recruitment. These will be collected during a future proposed South Georgia expedition in 1 years time.



Preliminary observations

General observations

Preliminary observations (based on species that were readily identified either from personal knowledge or available keys) indicated that South Georgia’s subtidal assemblage consists of species that are characteristic of South American, Falkland Islands, Antarctic, or circumpolar biogeographic distributions. Generally, we observed multi-storied algal communities throughout the north coast of South Georgia, including stands of *Macrocystis pyrifera*, with sub-canopies of the large brown algae *Himantothallus grandifolius* and complex assemblages of foliose red algal species (Rhodophyta). Common fauna included *Parborlasia corrugatus* (Nemertea), nereid and polynoid polychaets, *Glyptonotus antarcticus* (Amphipoda), *Serolis* sp. (Crustacea), sea spiders (Pycnogonidae), the nudibranchs *Austrodoris kerguelensis* and *Flabellina* sp., the gastropods *Nacella concinna*, *Margarella* sp., *Trophon* sp., the echinoderms *Odontaster validus*, *Diplasterias brucei*, ophiuroids, stalked jellyfish (*Haliclystus antarcticus*), and many varieties of ascidians, sponges, and anemones. Typical of shallow subtidal Antarctic regions, there were no anomurans (eg hermit crabs, *Munida* spp.) or brachyurans (true crabs) observed. There was a distinct lack of sea urchins (Echinoidea - *Sterechinus neumayeri*), which were observed only at one site (Stromness), whereas in both the Falklands and Antarctica sea urchins are of the more conspicuous members of the shallow subtidal benthic assemblage. There was a noticeable paucity of fish species, with only a few species (eg *Harpagifer* sp., *Lepidonotothen nudifrons*, *Parachaenichthys georgianus*, and *Artdidraco mirus*) observed. Many (often greater than 6) fur seals (*Arctocephalus gazelle*) were present throughout all dives.



Initially, intertidal habitats seemed particularly species-poor, with few, if any, encrusting or mobile species evident. However, in crevices, under rocks, and within algal detritus or coarse sands there were often very dense (in the order of hundreds per 10cm²) clusters of bivalves, gastropods, amphipods, turbellarians (flatworms) and oligochaetes. Seaweeds showed the strongest zonation throughout the intertidal, where the most diverse assemblages were at or near low tide areas, consisting of mixed green filamentous species, *Ulva* sp, brown algae (possibly *Adenocystis*), and multiple red algal species (including *Palmaria* sp). Few, if any species of flora or fauna were found at high tide areas, typical of shores where there are extreme physical (ice, cold, fresh water) and biological (seals abrasions and effluent) impacts. When present, green filamentous algae dominated rock pools high on the shore. Occasionally, upper shore rock pools contained dense assemblages of springtails (possibly *Cryptopygus* sp.) and mites (possibly *Alaskozetes* sp.). Fur seals (*A. gazelle*) and elephant seals (*Mirounga leonina*) were present medium to high densities at all sites.



Subtidal habitat description

Bird Sound

At shallow depths bare and coralline encrusts cobble dominated with patchy reds, abundant sponges and asteroids (*Diplasterias brucei*). Fewer mobile fauna were observed at mid depths, with a dramatic increase in *Macrocystis* holdfasts, coralline encrusted cobble, and density of red algae. Deep sites were similar, with patchy red algae on coralline encrusted rocks, some bare rock, and *Macrocystis* drift. There was strong wave action at this site.

Right Whale Bay

At mid depths, coralline encrusted base rock and gravel were exposed between patches of mixed red algae assemblages, *H. grandifolius* and *Macrocystis* drift. At deeper depths, sands/gravels increased and exposed bedrock decreased. Density of red algae decreased. *Macrocystis* drift observed. Burrowing anemones and asteroids (starfish) more evident. Abundant *N. concinna* on coralline cobble and on drift algae.

Rosita Harbour

Shallow depths had very low density of attached seaweeds, where there was mostly drift algae present on clean cobble, gravel and consolidated sand/silt. Abundant living and dead *Nacella* sp. observed. Mid depths increase in attached weed turf, some *H. grandifolius*, mostly detritus. Small gravels to sands and silt with occasional starfish (*D. brucei*, *Solaster* sp.). Sand/silt increased at deep depths, with predominantly decomposing drift weed observed. Deep depths increasing sand and silt, mostly decomposed weed drift, with occasional starfish (*D. brucei*) and cushion stars (*Porania antarctica*).

Prion Island

There were very dense algal assemblages in shallow water, consisting of a mixed assemblage of red and brown alga. At mid-depths, seaweeds were less dense, with patches of exposed clean and coralline encrusted cobble and gravel with little or no sediments. At deeper depths, *Macrocystis* and *H. grandifolius* beds were more evident, mobile epifauna were less evident, and the ascidian *Polyzoa* sp. was frequently observed.

Prince Olav

At mid-depths, the seabed was sandy/muddy, with patchy algae, drift *Macrocystis*, and broken shell. At deeper depths, there were larger cobble on sand/mud, patchy reds, and an increase in *H. grandifolius*, and coralline, spirorbid worm and bryozoan encrusted rocks, and few characteristic mobile epifauna.

Jag Point/Possession Bay

At 8-10m depth at this site there was an overhang/cave; *H. grandifolius* hanging down from the top, with complex assemblage of encrusting and massive sponges within the cave. Particularly notable was a large specimen of a volcano sponge *Rosella/Anoxycalyx* sp. These deepwater sponges have been recorded as shallow as 30m in the Antarctic; this is possibly the shallowest record, where the cave environment is likely to provide a habitat refuge for deeper water species. Below the cave was dense red algal assemblages, *H. grandifolius* and coralline encrusted large cobble and sand patches.

Stromness/Leith Harbour

This was a high current site, with a complex community on steep bedrock walls. *Macrocystis* and *H. grandifolius* beds were abundant, along with dense red algae assemblage, coralline encrusted rock, dense sponges, ascidians, cryptic mobile species, and numerous anemones.

Husvik

At shallow depths there was sandy/silt, cobble bottom with drift *Macrocystis*, dead holdfasts, *H. grandifolius*, red alga patches, *Ulva* sp, cushion stars (*P. antarctica*), starfish (*D. brucei*) and sponge encrusted rock. Sand/silt increased at mid-depths, with little or no rock or cobble and increasing drift algae. The deep site was similar, with an increase in drift algae, muddier, very little epifauna. However, the 2nd deep site had clean gravel, patchy red algae, dead *N. concinna* shell, and little or no coralline encrusting rocks. Large decomposing *H. grandifolius* fronds were abundant.

Cooper Bay

There was very dense red and brown seaweeds, and *Polyzoa* sp. found in at the shallow site here. Mid-depth sites were similar, with increasing abundance of *Polyzoa* sp. Deep sites had very dense seaweeds, lush small and large red algal assemblages, with abundant *H. grandifolius*. Beneath was complex encrusting invertebrate assemblage, and encrusting coralline on bedrock.

Intertidal habitat description

Prince Olav Bay

The entrance of this bay was very exposed, with the intertidal zone consisting of 2-3m tall vertical rock faces. Here, zonation is within a very narrow band, all within the splash zone, and included from high to low tides, yellow lichens, bare rock, green filamentous, red algae, and *Durvillaea antarctica*. Within the bay along sheltered shores, there was a narrow rocky platform with many rock pools. Filamentous greens, small white bivalves in crevasse, green and brown algae dominated.

Husvik

At the first Husvik site there was an exposed steep narrow shore, mostly bedrock, and only a few rock pools. At the edge of the shore within rock pools there was *Ulva* sp, brown algae, and filamentous green algae. At the second Husvik site, there was a wide, shallow sloping cobble beach. Many small rock pools, with green filamentous algae and seaweed detritus. abundant brown algae lower on shore.

Hope Point

Narrow steep sloping, large cobble, mobile beach. Species poor - only amphipods and oligochaets, no attached algae. Thick lines of dense drift algae.

Sooty Bluff

At this site, almost in front of the KEP buildings, there was a long, shallow slope cobble mobile beach. Patches of drift algae throughout. The site was species poor, with only amphipods and oligochaetes found. No attached algae.

Susa Point

On the opposite shore from KEP station, there was a wide, shallow sloping, bedrock/cobble/boulder sheltered beach. Dense clusters/patches of bivalves and littorinids (topshell gastropods) were found lower on the shore. Brown and green algae were found lower on the shore, while green filamentous algae dominated rock pools higher on shore.

Maiviken

At this exposed shore, there was a wide rocky outcrop, steep in places, with many rock pools and deep crevices and channels. At the time, there were numerous small iceberg fragments washing up to the shore. Many fur seals. There were complex assemblages of red, green and brown algae low on shore. Dense patches of amphipods, bivalves, littorinids, and turbellarians (flat worms).

Corral Bay

Long rocky exposed outcrop. Many fur seals. Complex assemblages of red, green and brown algae. Dense patches of amphipods, turbellarians, bivalves, littorinids. Exposed at very low tide were *Haliclystus antarcticus* (stalked jellyfish). There were dense patches (many hundreds per rockpool) of mites (*Alaskozetes* sp.) and springtails (*Cryptopygus* sp.) in pools high on shore.

Royal Bay

Here was a long rocky platform almost uniformly bare rock, dry, and no rock pools or crevasses. Rock pools increased near low tide with green filamentous algae near the water's edge, and some brown algae edge. At this site, the water was very high turbidity due to glacial "flour" runoff from nearby glaciers.

Next stages

All specimens collected will be identified to species, and preserved samples will be sent to various museums and specialists for future study. Species records will also be submitted to various regional and global biogeographic online databases. Photo-quadrats will be quantitatively analysed for community patterns within South Georgia, and combined with global biogeographic data for more complete ecological characterisation of the region. A second return expedition to South Georgia has been proposed in order to revisit sites surveyed in this study, retrieve settlement plates, and survey new sites on South Georgia's south coast.

Acknowledgements

Thanks to the Captain and crew of the MV *Pharos* SG, the Government of South Georgia and South Sandwich Islands, British Antarctic Survey, Darwin Initiative, Joint Nature Conservation Committee, the Falklands Islands Government, the Shackleton Scholarship Fund, Byron Marine Ltd, Neil McKay Ltd, Sullivan Shipping Ltd, Oceanic, and Polar Bears.

Appendix I - Trip log

14-17 Nov 2010

0800 Journey to South Georgia aboard *Pharos*. Clear, smooth sailing throughout. Meetings with the captain throughout, developing work plan, meeting schedules, weather reports and briefings with crew.

17 Nov 2010

1730 Arrive King Edward Point Research Stations.

18 Nov 2010

0830 Meeting on Bridge.

1030 Diving commences. 4 dives completed, buoy and wharf inspection, deploy settlement plates.

1600 Organise deck, dive compressor, scuba gear storage, trip planning meeting, set up laboratory container.

2130 End of day.

2200 Depart KEP - heading to Prion Island.

19 Nov 2010

0430 Arrive at Prion Island. Heavy fog.

0830 Meeting on bridge. Delay start due to fog.

0944 Diving commences. Completed 2 sites, 3 transects each.

2300 End of day. Samples sorted. Remaining at anchor in Prion due to heavy fog.

20 November 2010

0530 Depart Prion.

0800 Arrive at Rosita Harbour.

0900 Diving commences. Site 1 completed (3 transects). Site 2 deep and mid transects only, third dive cancelled due to heavy fog (unable to maintain visual contact between RIB and *Pharos*). Windy and rain increasing.

1930 End of day. Samples sorted. Stooze around until departure.

21 Nov 2010

0430 Depart for Right Whale Bay

0700 Anchor at Right Whale Bay

0830 Commence diving. Site 1 deep and mid transects complete, shallow transect cancelled due to heavy swell (cannot take photos in heavy surge). Collection dive instead.

1600 Site 2 dives cancelled due to heavy fog. Diving cancelled for rest of day. Anchor.

22 Nov 2010

0430 Depart for Elsehul.

0800 Looked into Elsehul, but swell to heavy. Continued on to Bird Island Sound.

0900 Bird Island Sound calm. Commence diving. Site 1 completed. Site 2 deep and middle transects only, plus shallow macro dive due to increasing swell.

2000 Depart for Possession Bay.

23 Nov 2010

0700 Arrive Possession Bay

0830 Diving commences. Dives 1 Macro dives in cave at Jagged Point. Deploy settlement plates. Dive 2 deep transect only. Moved to Prince Olav Bay. Dive 3 deep and mid transects. Intertidal survey. Afternoon becoming stormy.

1800 Departed for Ocean harbour.

24 Nov 2010

0700 Arrive Ocean Harbour. Very windy, large swell. Move on to Royal Bay.

0900 Arrive Royal Bay. Fine day, but zero visibility underwater. Attempt second dive, but zero visibility as well. Carry out 2 intertidal surveys.

1900 Present underwater video+photo montage to crew.

2030 Depart for Larsen Harbour.

25 Nov 2010

0700 Arrive Larsen Harbour - katabatic winds. Head to Cooper Bay. Windy at Cooper Bay, but find shelter south west of Cooper Island.

- 1000 Commence diving in Cooper Bay. Dive 1 Deep transect only as 0.5 meter visibility in shallower water. Dive 2 mid and shallow transects.
- 1600 Cancel further diving as storm building. Depart for Stromness Bay.
- 26 Nov 2010
- 0700 Arrive Stromness (Husvik). Fine day.
- 0830 Commence diving. 2 sites complete + shore survey in Husvik. Remain anchored overnight.
- 27 Nov 2010
- 0500 Move to Leith Harbour. Fine day.
- 0900 Commence diving. Complete 1 site + 3 macro/collection dives + deploy settlement plates. Remain anchored.
- 28 Nov 2010
- 0800 Arrive King Edward Point. Pack up laboratory container. Pack gear container. Drop Paul Brewin off.
- 29 Nov 2010
- 0430 Pharos departs KEP.
- 0830 Brewin has KEP orientation, planning etc. with base commander. Set up lab space.
- 30 Nov 2010
- 0800 2 transects at Hope Point.
- 2000 General collection along Grytviken Rd.
- 01 Dec 2010
- 0900 3 transects at Sooty Bluff.
- 2000 Present video+photo montage to KEP crew.
- 02 Dec 2010
- 0900 Walk to Discovery Point. Cut short as held up negotiating through fur seals. Survey Susa Pt - 2 transects.
- 03 Dec 2010
- 0900 Walk to Maiviken. Beach and rocky points heavily populated with fur seals. Transects impossible. Carry out general collections from 2 sites at high, mid and low intertidal areas.
- 04 Dec 2010 Saturday - base crew day off. Outgoing crew packing.
- 05 Dec 2010 Weekend. Heavy snow. Planning for trip to Corral Bay.
- 06 Dec 2010
- 0900 Depart KEP for Corral Bay (Barff Peninsula) by boat. 3 transects completed. Camp overnight.
- 07 Dec 2010
- 1400 Corral Bay, 3 transects completed. Return to KEP.
- 08 Dec 2010
- 0800 Post-trip gear breakdown and clean. Process previous 2 days collections.
- 09 Dec 2010 Late tide. Conflict with rostered domestic duties on Base.
- 10 Dec 2010 Snowing heavily.
- 11 Dec 2010 Low pressure, low tide is very high. Pack up, ready for possible departure on 12th.
- 12 Dec 2010 Depart KEP for Stanley. Expedition complete.

Appendix 2 - Diver Log

Dive #	Date	Site Name	Transect	DegS	MinS	DegW	MinW	Diver	Vis (m)	Dive Time	Max Depth
1	18.11.10	KEP Buoy	Collection	54	16.916	36	29.818	Brick	1	15	11.9
1	18.11.10	KEP Buoy	Collection	54	16.916	36	29.818	Dion	1	15	11.9
2	18.11.10	Tijuca Jetty Grytviken	Collection	54	16.800	36	30.400	Jude	1	18	7.4
2	18.11.10	Tijuca Jetty Grytviken	Collection	54	16.800	36	30.400	Steve B	1	18	7.4
2	18.11.10	Tijuca Jetty Grytviken	Collection	54	16.800	36	30.400	Emma	1	18	7.4
3	18.11.10	Floating Dock Grytviken	Collection	54	16.937	36	30.475	Stevie C	0	24	6.6
3	18.11.10	Floating Dock Grytviken	Collection	54	16.937	36	30.475	Claire	0	24	6.6
3	18.11.10	Floating Dock Grytviken	Collection	54	16.937	36	30.475	Brewin	0	9	7.0
4	18.11.10	Morraine Fjord	Collection	54	18.800	36	29.600	Jude	3	30	17.0
4	18.11.10	Morraine Fjord	Collection	54	18.800	36	29.600	Claire	3	30	17.0
5	19.11.10	Prion Island	D	54	1.590	37	15.178	Brewin	6	30	17.6
5	19.11.10	Prion Island	D	54	1.590	37	15.178	Dion	6	30	17.6
5	19.11.10	Prion Island	D	54	1.590	37	15.178	Claire	6	30	17.6
6	19.11.10	Prion Island	M	54	1.603	37	15.196	Steve C	6	42	11.6
6	19.11.10	Prion Island	M	54	1.603	37	15.196	Brick	6	42	11.6
7	19.11.10	Prion Island	S	54	1.610	37	15.199	Jude	6	36	6.5
7	19.11.10	Prion Island	S	54	1.610	37	15.199	Steve B	6	36	7.8
7	19.11.10	Prion Island	S	54	1.610	37	15.199	Emma	6	36	8.6
8	19.11.10	Prion Island	D	54	1.862	37	15.032	Brewin	5	38	19.0
8	19.11.10	Prion Island	D	54	1.862	37	15.032	Dion	5	38	18.5
8	19.11.10	Prion Island	D	54	1.862	37	15.032	Claire	5	38	19.8
9	19.11.10	Prion Island	M	54	1.859	37	15.060	Brick	6	34	12.3
9	19.11.10	Prion Island	M	54	1.859	37	15.060	Stevie C	6	34	12.0
9	19.11.10	Prion Island	S	54	1.859	37	15.063	Jude	5	33	9.6
9	19.11.10	Prion Island	S	54	1.859	37	15.063	Steve B	5	33	10.5
9	19.11.10	Prion Island	S	54	1.859	37	15.063	Emma	5	33	10.4
10	20.11.10	Rosita	D	54	0.715	37	26.049	Steve C	8	33	16.7
10	20.11.10	Rosita	D	54	0.715	37	26.049	Brick	8	33	16.7
10	20.11.10	Rosita	D	54	0.715	37	26.049	Claire	8	33	16.7
11	20.11.10	Rosita	M	54	0.691	37	26.087	Jude	10	32	11.0
11	20.11.10	Rosita	M	54	0.691	37	26.087	Steve B	10	32	11.0
11	20.11.10	Rosita	M	54	0.691	37	26.087	Emma	10	32	11.4
12	20.11.10	Rosita	S	54	0.669	37	26.043	Dion	5	33	6.0
12	20.11.10	Rosita	S	54	0.669	37	26.043	Brewin	5	33	6.0
13	20.11.10	Rosita	D	54	0.659	37	25.598	Brick	10	32	14.9
13	20.11.10	Rosita	D	54	0.659	37	25.598	Stevie C	10	32	14.9
14	20.11.10	Rosita	M	54	0.649	37	25.618	Jude	4	34	11.9
14	20.11.10	Rosita	M	54	0.649	37	25.618	Steve B	4	34	11.8
14	20.11.10	Rosita	M	54	0.649	37	25.618	Claire	4	34	11.8
15	21.11.10	Right Whale Bay	D	54	0.173	37	40.856	Jude	2	35	16.4
15	21.11.10	Right Whale Bay	D	54	0.173	37	40.856	Claire	2	35	16.4
15	21.11.10	Right Whale Bay	D	54	0.173	37	40.856	Steve B	2	35	16.4
16	21.11.10	Right Whale Bay	M	54	0.180	37	40.875	Dion	4	34	11.2
16	21.11.10	Right Whale Bay	M	54	0.180	37	40.875	Brewin	4	34	11.0
16	21.11.10	Right Whale Bay	M	54	0.180	37	40.875	Emma	4	34	11.9
17	21.11.10	Right Whale Bay	Macro	54	0.177	37	40.871	Brick	3	36	7.1
17	21.11.10	Right Whale Bay	Macro	54	0.177	37	40.871	Stevie C	3	36	7.4
18	22.11.10	Bird Sound	D	54	2.058	38	0.242	Brick	10	31	18.0
18	22.11.10	Bird Sound	D	54	2.058	38	0.242	Stevie C	10	31	18.1
18	22.11.10	Bird Sound	D	54	2.058	38	0.242	Claire	10	31	18.0
19	22.11.10	Bird Sound	M	54	2.058	38	0.242	Dion	5	34	11.8
19	22.11.10	Bird Sound	M	54	2.058	38	0.242	Brewin	5	34	12.0
19	22.11.10	Bird Sound	M	54	2.058	38	0.242	Emma	5	34	12.1
20	22.11.10	Bird Sound	S	54	2.095	38	0.187	Jude	5	31	8.1
20	22.11.10	Bird Sound	S	54	2.095	38	0.187	Steve B	5	31	8.1
21	22.11.10	Bird Sound	D	54	1.149	38	1.026	Brick	7	33	18.0

Dive #	Date	Site Name	Transect	DegS	MinS	DegW	MinW	Diver	Vis (m)	Dive Time	Max Depth
21	22.11.10	Bird Sound	D	54	1.149	38	1.026	Stevie C	7	33	17.9
21	22.11.10	Bird Sound	D	54	1.149	38	1.026	Claire	7	33	18.0
22	22.11.10	Bird Sound	M	54	1.157	38	1.047	Dion	8	34	15.8
22	22.11.10	Bird Sound	M	54	1.157	38	1.047	Brewin	8	34	15.8
22	22.11.10	Bird Sound	M	54	1.157	38	1.047	Emma	8	34	15.4
23	22.11.10	Bird Sound	Macro	54	2.069	38	0.251	Jude	8	33	11.7
23	22.11.10	Bird Sound	Macro	54	2.069	38	0.251	Steve B	8	33	11.6
24	23.11.10	Possesion Bay/Jagged point	Macro	54	4.514	37	7.188	Claire	6	34	10.5
24	23.11.10	Possesion Bay/Jagged point	Macro	54	4.514	37	7.188	Dion	6	34	10.5
24	23.11.10	Possesion Bay/Jagged point	Macro	54	4.514	37	7.188	Brewin	6	34	10.5
25	23.11.10	Possesion Bay/Jagged point	M	54	4.519	37	7.191	Jude	8	35	12.2
25	23.11.10	Possesion Bay/Jagged point	M	54	4.519	37	7.191	Steve B	8	35	11.8
25	23.11.10	Possesion Bay/Jagged point	M	54	4.519	37	7.191	Emma	8	35	11.6
26	23.11.10	Prince Olav	M	54	3.858	37	8.824	Brick	8	36	11.7
26	23.11.10	Prince Olav	M	54	3.858	37	8.824	Stevie C	8	36	11.3
27	23.11.10	Prince Olav	D	54	3.579	37	8.203	Dion	5	36	18.0
27	23.11.10	Prince Olav	D	54	3.579	37	8.203	Steve B	5	36	18.0
27	23.11.10	Prince Olav	D	54	3.579	37	8.203	Claire	5	36	18.0
28	24.11.10	Royal Bay	D	54	31.814	36	4.775	Steve B	0	3	11.9
28	24.11.10	Royal Bay	D	54	31.814	36	4.775	Jude	0	3	11.9
28	24.11.10	Royal Bay	D	54	31.814	36	4.775	Claire	0	3	11.9
29	24.11.10	Royal Bay 2nd attempt	M	54	31.112	36	2.385	Brewin	0	3	9.1
29	24.11.10	Royal Bay 2nd attempt	M	54	31.112	36	2.385	Dion	0	3	9.1
30	25.11.10	Cooper Bay	D	54	48.000	35	50.561	Steve B	2	34	
30	25.11.10	Cooper Bay	D	54	48.000	35	50.561	Jude	2	34	15.4
30	25.11.10	Cooper Bay	D	54	48.000	35	50.561	Claire	2	34	
31	25.11.10	Cooper Bay	M	54	47.089	35	48.452	Dion	3	34	14.4
31	25.11.10	Cooper Bay	M	54	47.089	35	48.452	Brewin	3	34	14.6
31	25.11.10	Cooper Bay	M	54	47.089	35	48.452	Emma	3	34	14.5
32	25.11.10	Cooper Bay	S	54	47.063	35	48.539	Brick	3	31	11.5
32	25.11.10	Cooper Bay	S	54	47.063	35	48.539	Stevie C	3	31	12.0
33	26.11.10	Husvik	D	54	10.285	36	40.412	Dion	6	39	17.9
33	26.11.10	Husvik	D	54	10.285	36	40.412	Brewin	6	39	17.9
33	26.11.10	Husvik	D	54	10.285	36	40.412	Claire	6	39	18.0
34	26.11.10	Husvik	M	54	10.290	36	40.394	Brick	7	33	11.9
34	26.11.10	Husvik	M	54	10.290	36	40.394	Stevie C	7	33	11.9
35	26.11.10	Husvik	S	54	10.280	36	40.422	Jude	6	32	8.4
35	26.11.10	Husvik	S	54	10.280	36	40.422	Steve B	6	32	8.7
35	26.11.10	Husvik	S	54	10.280	36	40.422	Emma	6	32	8.9
36	26.11.10	Husvik	D	54	10.150	36	39.322	Dion	10	35	17.3
36	26.11.10	Husvik	D	54	10.150	36	39.322	Brewin	10	35	18.0
36	26.11.10	Husvik	D	54	10.150	36	39.322	Claire	10	35	18.0
37	26.11.10	Husvik	M	54	10.143	36	39.302	Brick	10	30	12.1
37	26.11.10	Husvik	M	54	10.143	36	39.302	Stevie C	10	30	12.0
38	26.11.10	Husvik	S	54	10.160	36	39.306	Steve B	10	34	12.2
38	26.11.10	Husvik	S	54	10.160	36	39.306	Jude	10	34	12.2
38	26.11.10	Husvik	S	54	10.160	36	39.306	Emma	10	34	12.2
39	27.11.10	Stromness	D	54	9.448	36	39.752	Brick	10	36	17.5
39	27.11.10	Stromness	D	54	9.448	36	39.752	Stevie C	10	36	17.4
39	27.11.10	Stromness	D	54	9.448	36	39.752	Claire	10	36	17.4
40	27.11.10	Stromness	M	54	9.442	36	39.743	Jude	10	35	14.4
40	27.11.10	Stromness	M	54	9.442	36	39.743	Steve B	10	35	14.7
40	27.11.10	Stromness	M	54	9.442	36	39.743	Emma	10	35	13.8
41	27.11.10	Stromness	S	54	9.425	36	39.739	Dion	10	35	12.0
41	27.11.10	Stromness	S	54	9.425	36	39.739	Brewin	10	35	12.0
42	27.11.10	Leith	D	54	8.811	36	40.888	Brick	10	33	15.0
42	27.11.10	Leith	D	54	8.811	36	40.888	Stevie C	10	33	15.0

Dive #	Date	Site Name	Transect	DegS	MinS	DegW	MinW	Diver	Vis (m)	Dive Time	Max Depth
42	27.11.10	Leith	D	54	8.811	36	40.888	Claire	10	33	15.1
43	27.11.10	Leith	M	54	9.352	36	40.130	Jude	5	33	15.7
43	27.11.10	Leith	M	54	9.352	36	40.130	Steve B	5	33	15.4
43	27.11.10	Leith	M	54	9.352	36	40.130	Emma	5	33	15.4
44	27.11.10	Leith	M	54	9.757	36	40.182	Dion	5	30	16.0
44	27.11.10	Leith	M	54	9.757	36	40.182	Brewin	5	30	16.0
45	28.11.10	Stromness	D	54	9.381	36	39.852	Jude	8	36	18.0
45	28.11.10	Stromness	D	54	9.381	36	39.852	steve b	8	36	18.4
45	28.11.10	Stromness	D	54	9.381	36	39.852	Claire	8	36	18.0
46	28.11.10	Stromness	Macro	54	9.445	36	39.752	Brick	5	36	12.5
46	28.11.10	Stromness	Macro	54	9.445	36	39.752	Stevie C	5	36	12.5
46	28.11.10	Stromness	Macro	54	9.445	36	39.752	Dion	5	36	12.5
46	28.11.10	Stromness	Macro	54	9.445	36	39.752	Emma	5	36	12.5