South Georgia Association Newsletter

Number 24 May 2013

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The Spring Meeting and AGM will be on May 17, 2013

The Government launch Pipit.

The Spring Meeting Lecture will be by Bernard Stonehouse on **Whalers, sealers and king penguins: South Georgia in the 1950s**.

Bernard spent two summers and a winter on South Georgia in 1953-55, studying the ecology and breeding behaviour of king penguins. For most of the time he lived in a small hut close to a penguin colony in Ample Bay. However, he and his companion, Nigel Bonner, became involved also with the whalers and sealers who were then active around the island. In this talk he recalls both his research on a fascinating species of penguin and living on South Georgia in its industrial heyday.

Bernard (far right) and Nigel take leave of visitors at Ample Bay.

Joint lecture with the Friends of SPRI, Cambridge. 7.30, Saturday 21 October.

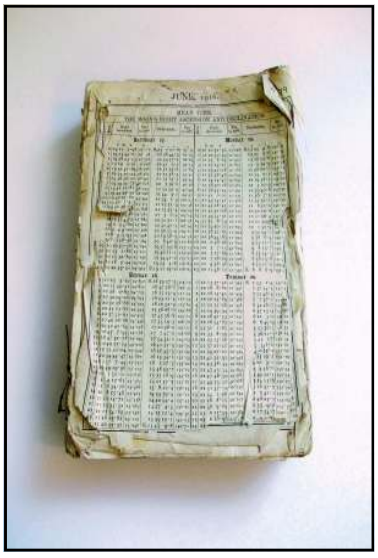
"Introduced Mammals in the Antarctic" by Bob Headland

The lecture will describe the history and environmental effects of terrestrial mammals introduced in all Antarctica regions. Their effects have varied from benign to disastrous, and campaigns to eliminate them from several islands have recently been implemented. Examples of recent eradication programmes of rodents from South Georgia and Macquarie Island will be described.

David Tatham - SGA President

Following Charles Swithinbank stepping down as President at the last AGM, the Committee is very pleased to announce that David Tatham has agreed to be our new President and so continue his longstanding involvement with the SGA. David's initiative launched the SGA thirteen years ago and he served as Chairman until 2009.

Frank Worsley's *James Caird* almanac



The South Georgia Museum has been presented the nautical almanac used by Frank Worsley in 1916 to navigate the *James Caird* from Elephant Island to South Georgia. He had given it to Reginald James, the expedition's physicist, while in Punta Arenas after the successful rescue of the *Endurance* crew. It seems that James and Worsley were good friends, having collaborated in navigational observations during *Endurance*'s drift. The almanac was donated to the museum by the James family.

Worsley famously made landfall at South Georgia after making only four sunshots with his sextant during the 16-day voyage. He was not helped by the almanac falling apart through soaking with sea water. As he wrote later: 'The Nautical Almanac shed its pages so rapidly before the onslaught of the seas that it was a race whether or not the month of May would last to South Georgia. It just did, but April had vanished completely.'

Time-lapse cameras and citizen science

We all know how special South Georgia is: stunning wildlife, beautiful scenery and a total absence of traffic wardens. It is hard to imagine a better place, but recent efforts should mean that we do not have to.

South Georgia is in a period of intense change; many influences such as the SGHT habitat restoration project, the GSGSSI reindeer eradication and the Marine Protected Area (MPA) are extremely positive, but the spectre of negative influences include climate change, which is being recognised as an increasing threat to South Georgia and remaining invasive species. Indeed, even with the MPA in place, management of fisheries and their impact on South Georgia predators remains key to South Georgia.

Traditionally, monitoring around South Georgia means Bird Island, KEP or surveys by Sally Poncet. Therefore, we have excellent data from the two bases and intermittent large-scale surveys. Despite all this effort, there are gaps which, if filled, would greatly increase our understanding and our ability to mitigate threats to wildlife.

Big, diffuse threats such as fisheries and climate change require data on a similarly large-scale to understand them. Taking inspiration from Sally Poncet on South Georgia and Oceanites on the Antarctic Peninsula, I am trying to increase data collection on South Georgia and the South Sandwich Islands using a combination of technology and ships of opportunity.

I have been trialling time-lapse cameras at three sites on South Georgia and 30 sites on the Antarctic Peninsula, and I am now aiming to scale up to monitor two or three colonies of each species of penguin (and possibly albatrosses and shags) in each region. You can see time-lapse from these cameras at www.penguinlifelines.org. The photos are taken once an hour. (You can see the time and date, as well as the air temperature, on the black strip along the top of each photo.)

A camera on a pole overlooks the king penguins on Salisbury Plain.

Photos are a powerful tool for recording change. Time-lapse cameras not only are able to record almost as much as an observer in the field, but they can operate all year round as well. These cameras are particularly good at recording the timing of breeding events. The images on the right show a gentoo penguin colony at Maiviken during incubation, after hatching and the formation of crèches.

Cameras give us the ability to monitor many more sites and also to engage the public directly. Together with computer scientists at Oxford University, I am working on automating the analysis of these photos. We now have volunteers (both adults and children) annotating and counting images via the website, which in turn is teaching a computer how to count penguins.

I am also adding the ability to receive volunteer photos on the website, so that visitors to South Georgia can help with data collection!

Currently, the images are stored on memory sticks, which have to be changed either by me or a volunteer, but I am also trialling wireless-linked and satellite cameras. My dream is to have an automated network of cameras and volunteers that collects data from South Georgia wildlife and feeds it back in near-real time, so allowing us to deal with problems as they arise. The cameras are almost paying for themselves through an adoption scheme and I aim to make the project self-sustaining in terms of finance and volunteer participation within the next couple of years.

This work has been supported by the Darwin Initiative and the South Georgia Government. For more information about this project or to help count penguins, email tom.hart@zoo.ox.ac.uk

Tom Hart

Gentoos nesting at Maiviken early in the season.

Sometimes you can see the chicks hatching!

The transition from brood-guard to crèche . The timing and duration of these stages between years and regions is important .

The Maiviken Sheraton (again)

In SGA NL No. 12 (April 2007) the late Steve Chellingsworth wrote a short article about his experience in early 1970 when he overnighted, with a botanical colleague, at the Maiviken cave, aka 'Maiviken Sheraton'. In the following issue (No. 13, November 2007) the Editor included a note referring to me as that botanist and illustrating said troglodyte with a photograph of me preparing a meal in the cave kitchenette. He has asked me to elaborate on that photo.

The well-appointed interior.

The cave had been a favourite haunt of Grytviken whalers, and probably Government personnel from King Edward Point, as a picnic destination. In those days the rock ledges at the cave entrance were littered with seal bones and flat pebbles inscribed with names. We respected these and left them *in situ*. Inside the cave were numerous rusted utensils (frying or paella pans, saucepans, coffee pots, mugs, cutlery etc.) and a large hearth with the remains of burnt wood and coal and some rusty tins.

My photograph also showed a shiny chrome tea pot. Steve was one of these delightful city dwellers, used to all mod cons and not too used to roughing it. Dining etiquette was important to him and he had insisted that, if we were going to be dining *al fresco*, he couldn't drink tea made in a billycan and had to have a proper tea pot – and a tablecloth. I recall him traipsing down Maidal with this shiny pot, borrowed from the base store, jangling on the outside of his rucksack. There was no room inside due to the inordinate amount of clothing he had for his speleological experience.

Approaching the cave from the sea.

The cave was quite large, extending about 15 m of habitable length, and about 5 m high and 6 m wide at the entrance. It was therefore rather draughty, although that did not deter the local rats. Sleeping bags had to be strategically positioned to avoid the slow but continuous dripping from the faulty ceiling plumbing.

Early in the 1976-77 summer the cave served as store for items waiting to be ferried up to the terrestrial biologists' research sites near Mai Lake (we built the Maiviken hut as an overnighting field laboratory). However, later that season the new generation of bios felt that the cave was unfit for human habitation in its natural state and required modernising. A wooden frame complete with hinged door and heavy duty polythene glazing was constructed across the entrance. A wooden table, an array of cooking and eating utensils, primuses, cans of paraffin, boxes of food rations, and other domestic necessities were installed.

While the cavern was now fairly draught-proof, somehow it had lost its historic atmosphere and, sadly, all the whalers' mementos had gone. In NL No. 12 Pat Lurcock added, with photo, that around 2005 the Sheraton had been further upgraded. But it just isn't the same as in 'the old days'!

I might add that the cave housed several of the rarest mosses on South Georgia, but I doubt if they will have survived being walled-in.

Ron Lewis-Smith

Ferrying biologists and stores round from Grytviken.

Hydra viridis on South Georgia

Occasionally unexpected animals are recorded from South Georgia. These have ranged from monkeys to snails. There is one species with only a single record regardless of searches over many years and various places. The beast in question is a classic hydra which I found in 1978. At the time I did not know it was not recorded and, in any event, I lacked suitable preservatives to collect it (improperly preserved most small coelenterates turn into a messy bit of jelly) and my camera did not have a suitable lens.

I mentioned the discovery on several occasions, and subsequently searched whenever I had time in locations which seemed suitable. The opportunity to examine the original spot never recurred, partly as we had reached that region by a process of getting lost and then had to retrace the route to get to St Andrews Bay without negotiating a steep slope ending in high sea cliffs.

Back in Cambridge I was urged to record the discovery, hence the following note .

British Antarctic Survey
Cambridge Headquarters
24-XI-1980

Note on a South Georgian Coelenterate:

In February 1987 whilst trekking to Royal Bay with the Reindeer Survey Party I found a fresh-water hydra which, I have subsequently been informed, is not recorded from the island. I did not collect it but can provide, as requested, some details.

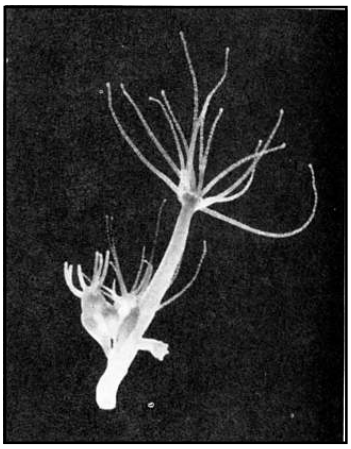
The animal was a classic, green, 'text-book', *Hydra viridis*. Approximately 1 cm long with about eight 5 mm tentacles and about ½ mm across the body when extended. It was in a stream descending from some snow patches and draining through a mossy area on scree. This was to the east of the pass leading into St. Andrews Bay from Hound Bay, near Mount Skittle, roughly 250 m above sea level.

It was secured adventitiously when I paused for refreshment. Whilst in captivity, in a white plastic cup, it disported itself actively, looping around and attaching variously with its foot and oral disc. It was thence returned whence it came.

R. K. Headland

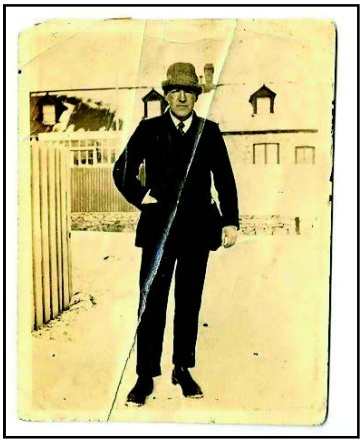
On most of my subsequent visits to South Georgia I have been on 'hydra alert' and have passed details to several colleagues. All have the same result; but Martin Baker, Nigel Lowthrop and I well recall the original specimen. If I had been only slightly less observant the discovery would never have been made; I would have swallowed the hydra with the refreshing cold melt water.

Bob Headland



Hydra, *a textbook animal and a relative of the sea anemones. Well-named after the nine-headed water serpent slain by Hercules.*

Shackleton Centenary Scholarship



Shackleton in Stanley.

The Committee of the Shackleton Scholarship Fund announce that an exceptional or 'flagship' scholarship worth £10,000 will be awarded to mark the centenary of Sir Ernest Shackleton's *Endurance* expedition, which set out in August 1914.

The scholarship will be open to individual scholars or teams of research workers from any country in the world who propose to undertake research at a post-graduate level, in the natural or social sciences of particular relevance to the countries of the South Atlantic in particular the Falkland Islands, South Georgia and the British Antarctic Territories.

Applications should be made using the form provided for Academic Applications on the Fund's website: www.shackletonfund. The word CENTENARY should be entered in the very first box, before inserting the title of the project.

Applications must be received by 15 September 2013. They will be considered by the Fund's committees in London and Stanley during October and the award will be announced in November 2013. The successful applicant will be expected to start work on their project in 2014.

Friends of the Falklands Launch Support for Museum and Archives

The Falklands Islands are clearly looking to the future with confidence and ambition. But a newly-formed group of heritage enthusiasts based in the UK is doing its best to support the people of the Islands in conserving and promoting knowledge of their history.

The Friends of the Falkland Islands Museum and the Jane Cameron National Archives – FIMAFriends for short – was formally established at the end of January. It will work closely with both the Stanley Museum and the Jane Cameron National Archives by building support internationally that will help both institutions to present their collections to the public, and help acquire historical artefacts from around the world that would have a natural home in the Falklands.

The initiative is the brainchild of Swedish philatelist Stefan Heijtz. Noting that the museum was about to move into a new and much more appropriate centre in Stanley's historic dockyard, and that the Archives were becoming an increasingly valuable asset for researchers, Stefan approached like-minded friends, including former Governor David Tatham, to start bringing the initiative to reality.

With the Friends now formally established with a constitution, the Society's Chairman, former Falklands Governor Donald Lamont, said, 'I was delighted to be invited by David Tatham and his committee to take over from him the task of leading this exciting initiative. We have the support of the Falklands Museum and National Trust and can now start promoting the Museum and Archives and putting together the funding to enable us to make a real contribution to the work of both institutions.'

The new museum taking shape in Stanley.

Within the Falklands, the initiative has been greeted warmly. Museum Manager Leona Roberts said: 'The group has the potential to be of enormous importance. A wealth of knowledge and experience exists among our supporters and I believe that FIMA Friends can do much to help us achieve our goal of protecting and promoting the heritage of the Islands.'

Archivist Tansy Bishop pointed out that the day-to-day operating costs of the Archives are covered by the Falkland Islands Government, but FIMA Friends funding will speed up the ability to make items available for viewing. 'Help from the Friends will obviate the need to wait for anything up to two years for funds to purchase the necessary preservation and storage materials,' she said.

The FIMA Friends committee, which was appointed at the first general meeting on 30 January, now faces a number of priority tasks, including promoting the organisation and inviting membership, developing a website and seeking charitable status.

Applications for membership are welcomed. Forms detailing the objectives of the society, the benefits of membership and the various categories – which may cost as little as £15 per year – are available from the Membership Secretary, Dr Stephen Palmer, at email palmers@fintry.plus.com.

Chairman Donald Lamont said, 'There could hardly be a more important time to emphasise the value of conserving and presenting the rich history of the Falkland Islands. The aim of the Friends will be to support the Museum and National Trust and the Jane Cameron National Archives in their vital work. We invite anyone with an interest in Falklands history – whether in the Islands, the UK or elsewhere in the world - to join us.'

Graham Bound

The Ice Cave

By Julian Freeman-Attwood.

You don't need a weather man to know which way the wind blows.

Bob Dylan

Julian enjoys a blizzard.

We all know how windy South Georgia can be, but 1989/90 took the biscuit; at least as seen from where we were dug in on the Ross Pass. Our expedition - The Southern Ocean Mountaineering Expedition 1989 - was perhaps the last from the old era, by which I mean that there was no insurance nonsense or health and safety rubbish in those days. We had luckily got a lift on the old 'Plum', HMS *Endurance* through the good offices of Patrick Fagan and Nick Barker. Nick forwarded us to the last link in the chain, Commander of British Forces Falkland Islands (CBIFFI for short), General Stephenson.

Near to our departure date a bureaucrat at the Ministry of Defence tried to scupper the trip on some health and safety grounds, and we had a note from CBIFFI asking if we were taking radios etc. The great Bill Tilman once said of an expedition: 'If you can't wear it and you can't eat it, then don't take it'. We wrote back to CBIFFI to say we did not know how to work a radio and would take our chances, if he didn't terribly mind. Amazingly, he didn't terribly mind at all. His reply simply said '*on that basis you may go'* and overruled the man at the ministry. You wouldn't get that happening today, with everyone covering their backs.

When we got to Grytviken, a helicopter dropped our food and supplies at Moltke Harbour and the rest of the gear at Sörling Valley. The Moltke drop allowed us to access the Salvesen range where we hoped to do most of our work and climb Mt Carse plus anything else we could.

From the beginning we knew that winds were unlikely to allow a tented base camp for any length of time and that an ice cave would be required. Duncan Carse had intimated as much to us when we went to see him.

The other three in the party were that world-renowned mine of mountaineering information Lindsay Griffin, our secret weapon of technical climbing Brian Davison and Dutch film maker Kees 't'Hooft.

Christmas was spent in the derelict hut at Moltke Harbour and was followed by days load-carrying up to the Ross Pass. One memorable day the winds prevented forward progress at sea level. We should have built our ice cave base camp a mile or so away from the pass. That now sounds like a sensible thing to do but there was such a perfect wind scoop at the base of the north ridge of Mt Vogel, where it intersected with the upper Brøgger Glacier, that we dug some 6 ft into it.

Between us, and with liberal use of an ice saw, we made a main chamber at least large enough for two tents, a Wild Country 'Quasar' for two men and the remains of a 'Himalayan Hotel'. The latter had been proudly brought along by Venables but, without any guy ropes, it lasted only the first night at Moltke, being trashed by a katabatic wind racing down Whale Valley.

By the second day we had made enough room for the 'Himalayan Hotel', and with worsening weather had a second chamber off to the left dug by the following evening for the 'Quasar'.

We headed off that day and made an ascent of Mt Vogel (its second ascent). As we climbed down and abseiled off,

Ice cave architecture.
Left: Lindsay in the niche. Right: The Doric pilaster.

all hell of a wind broke loose and on subsequent days the only way to ascertain what was going on outside of the cave was with Venables' 'blizzing scale'. This was 'scientifically' based on how much you could or could not see of the Vogel buttress 20 yards away. A 90% blizz meant you could see a vague shadow of rock. For the next week we had more or less 100% blizz.

Each morning a hole was made in the 2ft thick cave door with an ice axe and a cylindrical shaft of spindrift would penetrate at least 3ft into the cave. A deep groan from whoever made the hole would mean another day of inactivity, slowly but surely hoovering up our precious food and gas. By the end of a week a Penguin paperback, read by everyone, would become loo paper. Lindsay had a crossword book that kept us occupied up to a point. Venables kept losing his socks and blaming it on a poltergeist.

Joy of joys! On Day 11, it was sufficiently calm to get outside. It was still very overcast but we headed off for a short jaunt down the Brøgger Glacier with good views of Annenkov Island ahead. We managed to ascend two nunataks on the Brøgger which were immediately catalogued by Lindsay as first ascents.

By the time we got back to the cave, all hell was threatening to engulf us again. It is hard to believe now, but we really were unable to do anything during the almost continuous winds that blew from Day 11 to Day 23. We found out later BAS at Grytviken had measured a gust of 140 knots. The noise of the maelstrom outside made us feel very happy to be in our ice house, despite the boredom and frustration. Some of the time was whiled away designing and building bits of architectural interest in the cave. Venables instigated some fine Doric columns and a Doric niche in which Lindsay sat each morning to regally take his breakfast. Shelves for food made an ordered and fitted-looking kitchen. A chimney ventilation shaft went up vertically from the kitchen surface. All that was needed, if

we had brought one, was a Perspex dome through which we could have looked out onto the world.

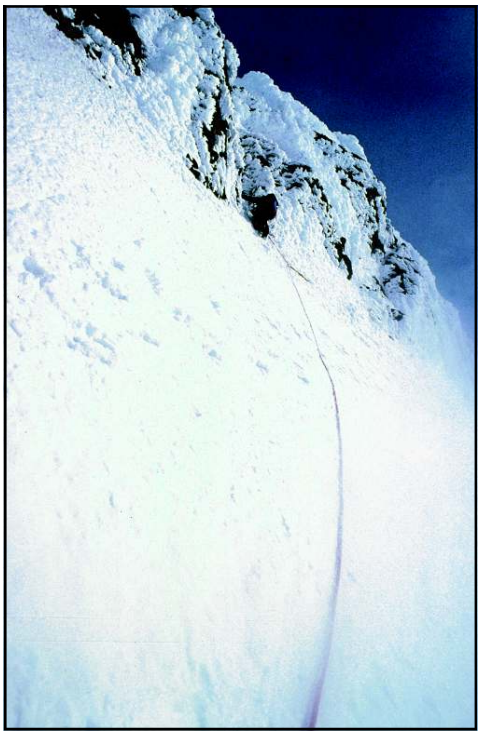
When we thought all was lost and that, with food running low, we should have to head back to Sörling Valley, the weather turned cloudless. Suddenly the magical South Georgia landscape was revealed and there was no time to lose. The best skiers, Venables and Davison, decided to head up the Spenceley Glacier and tackle Mt Carse. Griffin, 't'Hooft and I decided on the closer but more technical Mt Kling. Neither peak had been climbed before.

In the space of 36 hours both these objectives were attained. The Carse party would have been very mindful of how far they were from the ice cave and what the weather was capable of. The Kling party had some hard mixed pitches of Scottish grade 4 near the top of their peak. Both parties had to contend with the return of blizzard conditions en route back to the cave and it was lucky (no GPS in those days) that we had laid out an arc of bamboo wands onto the Brøgger Glacier to guide us back to the wind scoop. Venables, at one point, was on all-fours in a wind sufficiently strong to push him backwards.

The next day all was packed up and, by making some rudimentary sledges out of snow stakes, we managed to get everything down to the coast in one go. It had been an extraordinary month.

Returning through the cacophony of penguin trumpeting in St Andrews Bay was bliss. The rest of the trip was spent on three aborted attempts to climb Mt Roots from Sörling Valley via the Nordenskjöld Glacier, each repelled by repellent weather.

We spent more than 60 days on the island and eventually were picked up by RFA *Diligence*. A fine account of the trip can be found in Venables' book *'Island at the Edge of the World'*. Of course, without the invaluable help from the Navy, none of it would have been possible.



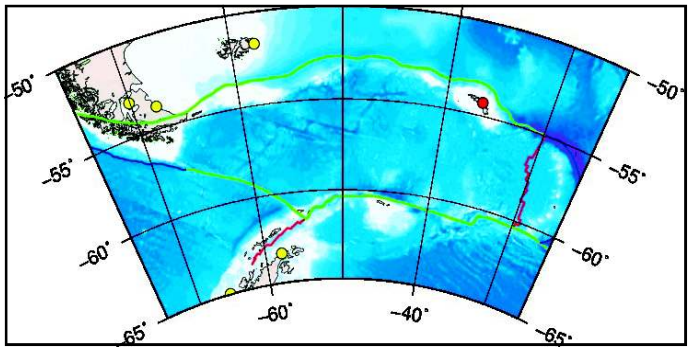
Julian leads to the summit of Mt. Kling.

The view we dream of. Looking over the Spenceley Glacier towards the distant Allardyce Range.

The King Edward Point Geodetic Observatory

During February 2013 a Geodetic Observatory was installed at King Edward Point by the University of Luxembourg in collaboration with the National Oceanography Centre and the British Antarctic Survey. Unavco Inc., a non-profit organisation specialising in providing engineering support for such installations. The Government of South Georgia and the South Sandwich Islands has granted permission to run the observatory for a period of 10 years. Due to the remoteness and position of South Georgia, KEP already hosts instruments for a number of global monitoring networks, including a seismometer to record earthquakes, a magnetometer to observe the state of the Earth's magnetic field and a tide gauge to measure sea level.

The KEP Geodetic Observatory helps fill the sampling gap in geodetic data for the South Atlantic Ocean (see figure below). It will provide valuable information for a number of geophysical applications from local to global scales. The primary objective is use highly accurate Global Navigation Satellite System (GNSS) observations to add millimetre-accurate positioning to existing data sets, especially tidal records. This will allow, for the first time, a quantification of horizontal and vertical land movements of the island. As a by-product, analysis of the GNSS observations will provide additional information on the state of the atmosphere over this region which is relevant both for monitoring space weather and climate change.



Tectonic plates in the South Atlantic Ocean: transforms/fracture zones (green), ridges (red) and trenches (blue); existing continuous GNSS stations (yellow circles) and KEP Geodetic Observatory (red circle).

An autonomous, continuous GNSS station with auxiliary equipment for power, communications and recording weather data forms the heart of the newly-established observatory. It is located on the highest point of Brown Mountain, across the cove from KEP. This site was selected in order to avoid signal obstructions, a difficult task in mountainous South Georgia, and electromagnetic effects. Both could affect the observatory's capability to detect millimetre-level position changes. The closeness of Brown Mountain to KEP allows data to be transferred to the research station by radio and it can also be easily reached for maintenance.

The Government required that the equipment could not easily be seen from King Edward Cove so that the pristine views of South Georgia would not be spoiled. Hence, the GNSS antenna and monument were bolted to a rock outcrop hardly noticeable from KEP and the aluminium pipe frame, which houses the auxiliary equipment and enclosures, was placed approximately 30 m away on a small flat area just out of sight from the cove below.

The observatory also includes a network of survey benchmarks at both Brown Mountain and KEP, which link the GNSS station with the tide gauge and potentially the other monitoring sensors. The tide gauge was upgraded in 2007 and now provides data on sea levels to the Global Sea Level Observing System run by the Joint Technical Commission for Oceanography and Marine Meteorology. As the tide gauge measures sea levels with respect to the land, the mean sea level (MSL) record can be corrected using the observatory's monitoring of local vertical land movements. The corrected MSL record from South Georgia is combined with similar records from all over the world so that better estimates of global sea level rise can be computed.

A number of natural and man-made processes can produce vertical land movements that affect tide gauge measurements. Whereas in many coastal areas around the world human-induced subsidence dominates, land level changes in South Georgia are believed to be primarily of natural origins and they tend to be upward movements. The most likely cause of vertical movements is plate tectonics. South Georgia and its surrounding continental shelf is a small geological block – a microcontinent - between the Scotia and South America plates. As this block is squeezed by the two larger plates, it responses by tilting, i.e. rising in the south-west. Earthquakes in this region have been attributed to this process.

The geodetic observatory on Brown Mountain, out of sight from the Cove. The antenna is on the high point.

During the last glacial maximum, approximately 20,000 years ago, an ice-sheet covered South Georgia and the surrounding shelf, similarly to Scotland. During such glaciations the load of ice pushes the Earth's crust beneath it downwards and forces the material of the Earth's mantle to move sideways. When de-glaciation commences, the load is reduced and mantle material starts to flow back, lifting the crust above. Because the Earth responds so slowly, the land is still continuing to rise. This process, known as glacial isostatic adjustment, still causes Scotland to rise by 1-2 millimetres per year and our observatory may show that this is also happening at South Georgia. Additionally, the present-day shrinking of glaciers causes an immediate response by the earth's crust as the ice load is reduced. For instance, GNSS measurements at stations close to glaciers in Alaska and Greenland often show local uplift of the land. With South Georgia's glaciers retreating, the same process is likely to be occurring here; however,

this is not discernible by a single station. Nevertheless, the GNSS measurements from the KEP Geodetic Observatory provide a first means of testing these theories and, with adequate models for the tectonic and glacial isostatic adjustment processes, it will help to constrain their individual contributions.

Felix Norman Teferle

Reading the wind

South Georgia is famous for wind, so where better to study it? In January/February 2013 four scientists from the National Centre for Atmospheric Science (NCAS) went down to South Georgia to make some 'meteorological observations'. This article explains why we came, what we did and describes our achievements.

NCAS is one of the Natural Environment Research Council's (NERC) six research centres, with responsibility for providing national capability and co-ordinating strategic research on behalf of the atmospheric research community. The four scientists involved in the project were Barbara Brooks (observations and project organiser), Ralph Burton (modeller), Alan Gadian (theoretician and pilot), James Groves (IT support and chief pilot) based at the University of Leeds. Dan Banister, a PhD. student at the British Antarctic Survey completed the team.

Stacks of lenticular clouds are associated with gravity wave flows downstream of the mountains.

Our objective was to study gravity waves. A gravity wave is a vertical wave, with an up and down, rippling motion, and has little to do with gravity. (Think of a pebble thrown into a pond: ripples radiate outwards through the water and gradually die out as the waves are dampened.) Gravity waves are set up as air flows over South Georgia and the familiar stacks of lenticular clouds are formed in the ripples.

Gravity waves can lead to hazardous conditions in the air and at sea. You may have experienced an 'exciting' ride when your flight encounters clear air turbulence, which in the severest cases, can lead to tails, engines and wings being ripped off and the aircraft crashing. This turbulence is due to gravity waves which are also encountered as bouts of severe turbulent winds near the ground – a phenomenon familiar to many visitors to South Georgia (and have nothing to do with katabatic winds). Gravity waves are a significant and large source of error in weather forecasting. Our skill at predicting weather should improve significantly when we learn more about how gravity waves move energy around the atmosphere and the effect this has on the weather.

So research on gravity waves is very important but why did we want to go all the way to South Georgia to study them? It is an isolated island which means that we can pinpoint how its mountains affect the wind. It is an ideal natural laboratory for the study of gravity waves.

To model what we expect to happen as the wind flows around South Georgia and to provide a forecast for King Edward Point we used the Weather Research and Forecasting (WRF) computer program developed in the USA. The big advantage of this program is that it is very well-regarded in the world of meteorology and it provides a large number of people around the world with their daily weather forecast. In addition, WRF is free! In Leeds we had a system that automatically ran a highly detailed, all-bells-and-whistles version of WRF to produce a wide range of output forecast products (such as wind, temperature, cloud cover and precipitation). We also took a powerful computer to South Georgia to run a simplified version of the program that would be able to produce wind forecasts for the island.

A comprehensive data set is required for further research but the problem facing us with the South Atlantic is that there is a dearth of measurements. To do any sort of verification and future research we need to make measurements of the temperature, moisture and wind over as deep a section of the atmosphere as possible: we need to make these measurements from the ground up to around 26 – 35km altitude. There is only one accepted way to do this directly and that is with the use of meteorological balloons carrying sensor packages called radio-sondes. Each sonde was carried aloft by a helium balloon that is about 2m in diameter when released; it expands as it rises until it is about 9m, when it bursts at a height of around 30 – 35km. The instrument package measures temperature, relative humidity and pressure, while the wind speed and direction is determined by comparing Global Positioning System (GPS) measurements of the balloon and the ground station. The package also contains a radio transmitter which sends the data back to the ground station. Over the course of our 17 day visit, we released 29 sondes.

The drawback of using radio-sondes is that they are very expensive and the number of sondes that could be released during the project was limited by how much helium we

could ship to South Georgia. To get round this problem we turned to ground-based remote sensing in the form of a LIDAR (LIght Detection And Ranging) to provide profiles of wind speed and direction.

We were also interested in how the winds and temperature varied vertically and horizontally on a 10cm scale as this gives an indication on how turbulent the atmosphere is. To look at this we used an Unmanned

Aerial System (UAS), much like a model airplane but with an ability to fly itself. It carries a package of sensors that make very fast measurements of pressure, temperature, humidity, wind speed, wind direction and the position and motion of the UAS.

The radio-sondes and LIDAR worked far better than we anticipated. The UAS was not 100% successful but even here we gained valuable experience in understanding how to fly the system in very turbulent conditions.

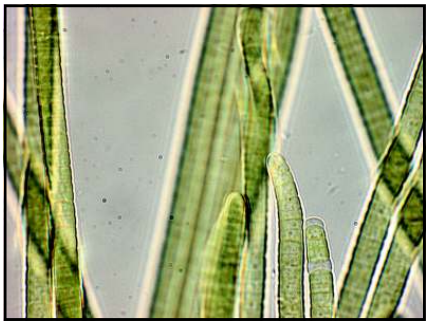
Overall we achieved far more than we expected and have managed to gather a unique and comprehensive data set, access to which was being requested before we got back to the UK. We are currently in the process of checking the data and putting together a product list and web portal that will allow users to access the data. This data set will be publically available after publication of our review paper.

We owe a huge debt of thanks to everybody on South Georgia and in the South Atlantic Environmental Research Institute for making our stay not just successful (from a science point of view) but very, very enjoyable. We are working on plans to get back to South Georgia for a more comprehensive campaign.

Barbara Brooks

The importance of microbes in South Georgia's soils

Given the striking wealth of wildlife on South Georgia – the penguins, the seals, the albatrosses - it might seem surprising at first sight to go there to study its microscopic life. However, microbes play a vital role in the functioning of the terrestrial and marine ecosystems, and one that is often overlooked. For example, ecosystems can be dependent on microbial processes through the oxygen produced by photosynthesis in bacteria and algae, the generation of nutrients by nitrogen-fixing bacteria, and the production of greenhouse gases such as methane by Archaea (very abundant types of microbes similar to bacteria). In addition, soil microbes and marine phytoplankton have a key role determining productivity at the bottom of both terrestrial and marine food webs in that they are responsible for producing the organic matter on which everything else in the food web depends.



Cyanobacteria, or blue-green, algae commonly form films on rocks and the bottom of shallow streams and lakes in polar regions. The filaments are less than 0.01 millimetre across.

Microbial communities thrive in many environments on South Georgia. Our study looked at communities that gain their energy from the minerals and organic matter found upon the extreme environments of very active glaciers and scree slopes. Other communities, in less harsh environments, such as hillsides covered by rich dry grassland, are responsible for the decomposition of dead plants and the fixation of atmospheric nitrogen, among other processes. In many places, coastal soils are heavily influenced by nutrients brought ashore by South Georgia's marine animals. These range from dry sandy soils enriched by penguin guano to saturated methane-rich seal wallows. Since the climate of South Georgia is clearly changing, information is urgently needed to reveal how micro-organisms play a crucial role in the functioning of these terrestrial ecosystems and how the nutrients and organic matter derived from them are transported into the marine environment.

As there is still little known about the microbial biodiversity of South Georgia, our research team from the Natural History Museum (Dr Anne D. Jungblut) and the University of Sheffield (Prof Andrew Hodson and Aga Nowak) recently travelled to South Georgia to survey the diversity and richness of microbes within different soils, sediments and streams. Analysis of our samples back in the UK, in collaboration with David Bass (Natural History Museum) and Dr David Pearce (British Antarctic Survey), will help us map both microbial biodiversity and nutrients in our South Georgia study area. We will use this information to reveal how nutrients released by microbial processes are washed into the sea to sustain the important phytoplankton blooms that, by feeding krill and other planktonic animals, help sustain South Georgia's wildlife and coastal fisheries.

Soil sampling. Nice work - on a nice day!

We were lucky to spend four weeks in South Georgia this January and February. We were based at King Edward Point and used the laboratory facilities there after camping and fieldwork on the Greene, Thatcher and Barff Peninsulas where we collected samples from an extremely diverse range of environments. These environments included glacial tills, seal wallows, tussock grass, penguin colonies, lakes and groundwater seepages. In some cases we were sampling soils less than a decade old, while elsewhere there were mature, organic-rich soils which have not been ice-covered for hundreds of years. We will probably find that these soils will contain many different kinds of bacteria and other micro-organisms, and we will study their DNA to determine their taxonomic richness, abundance and geographic distribution. We hope to find species that are endemic to South Georgia or new to science. We will also be able to identify changes in microbial composition that can be linked to environmental variables such as pH and soil moisture. This will allow us to determine whether a type of plant cover or plant community influences the composition of the microbial communities.

Our census of microbial life will help identify hotspots of microbial biodiversity and processes that are linked to specific geographic locations or soil types. It will provide a baseline ecological framework for pursuing future research on microbial function. Ultimately, the project will help us understand the links between soil and marine ecosystems, which can help in more effective management of South Georgia as the island's life responds to climate change.

Anne D. Jungblut and Andrew J. Hodson

Eradication of reindeer—Part 1

Although overshadowed by the rat-baiting programme, the Government's plan to eliminate reindeer from South Georgia is an intregral part of the broad strategy of eradicating introduced animals and plants and allow the restoration of native species and habitats. Earlier consultation on the reindeer cull showed that their grazing and trampling have had a serious effect on the vegetation, especially tussac, burnet and lichens, and the animal life, including nesting birds. As a result there has been broad support for this cull.

The reindeer and rat problems have to be tackled concurrently because the presence of deer will disrupt poison-baiting for the rats. Deer will accidentally ingest bait pellets, thereby denying them to the rats and also poisoning themselves. Furthermore, both species need to be eliminated before the glaciers retreat further and allow the animals to spread into new parts of the island.

Driving reindeer from Husvik.

January and February saw the first phase of removing South Georgia's estimated 4,000 to 5,000 deer. A group of Norwegian reindeer experts, including expert marksmen and Sami (Lapp) herders, joined Government staff to eliminate the Busen herd that ranged from Stromness Bay to Fortuna Bay. Most were herded into a corrall at the end of Tønsberg Point (on the south side of Stromness Bay) and humanely put down under veterinary supervision. The remainder, in country unsuitable for herding, were shot by experienced marksmen from the Norwegian Nature Inspectorate (SNO). The few survivors were spotted during rat-baiting and shot. A total of over 1,900 deer were killed. The carcasses were removed so they would not provide food for rats and about half were butchered and frozen for human consumption. Their sale will help defray costs.

The Busen work went so well that there was time for the marksmen to visit the Barff herd and start reducing numbers ahead of next year's work.

The effects of removing reindeer will be monitored closely and it is encouraging that there are already signs of vegetation recovering only a few weeks after they had gone.

Corralling reindeer on Pintail Peninsula.

Rat eradication—Phase 2

At the time of writing, the rat-baiting season is in progress so news from the front line is not up-to-date. This year, Team Rat will be working at the western end of the island. The 25-strong party (what a bandwagon to join – if only this writer was younger!) left Stanley aboard RRS *Ernest Shackleton* on February 6. Accompanying them were 420 tonnes of cargo including three helicopters and 12 shipping containers of bait.

The helicopters were unloaded and made operational on arrival at KEP and were then used, with the *Ernest Shackleton,* to establish 14 depots of bait and fuel around the western end of the island. The restored manager's Villa at Husvik became the main base for operations.

Project Leader Tony Martin has written 'Over the next three months 100 million bait pellets will be laid with mathematical precision as three former air ambulance helicopters crisscross the Island discharging their lethal cargo from giant hoppers suspended underneath. The helicopters will fly throughout the hours of daylight in a race against time as the days inexorably shorten and the Antarctic winter approaches. The target is to bait 60% of the remaining area infested by rats in the next few months.'

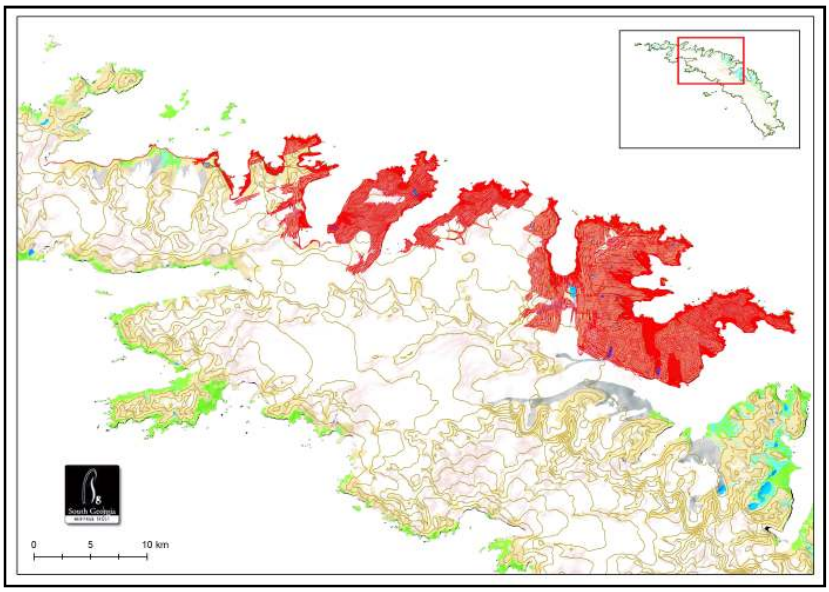
The latest news is that the weather has not been good. The Stromness area has been completed and baiting had reached the Bay of Isles by 4 April. However, recent progress has been slow because the weather has been continuously bad - even by South Georgia standards. Accurate baiting can be carried out only in relatively calm weather.

Tony's newsletters can be downloaded from www.sght.org/newsletters-and-publications and receiving notification of future newsletters can be ensured at www.simplelists.com/subscribe/sght.php

For a simple and rewarding way to make a **donation**, go to: www.sght.org/Sponsor-a-hectare.

Attaching the bait hopper to the helicopter at Husvik.

Snow stops play.



From Cumberland West Bay to the Bay of Isles, the area covered with poison bait by 4 April. An estimated seven good flying days are needed to finish this year's programme.

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