Environmental Inspection, Gough Island Wildlife Reserve, September 2001

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Summary: ACTIONS REQUIRED

1. Follow-up of control measures for *Sagina* are essential, especially given the disturbance caused by the untimely replacement of the crane. The area around the new crane should be re-treated with boiling water, and the entire logistic zone searched carefully to ensure that plants have not established beyond the zone of known infestation. **Action: Gough 47 team**
   If necessary, experienced personnel from Tristan need to be sent during 2001/02 or another dedicated person sent during the 2002 relief. **Action: GIWRAC**
2. The use of dedicated Gough Island containers needs to be adhered to strictly by DEAT, and should be extended to include NDPW. With increasing use of reusable, plastic bins for food packing within containers, there needs to be consideration of also making these items island-specific. **Action: DEAT, NDPW**
3. A plant pathologist should visit the island to assess the threat to *Phylica arborea* trees. **Action: GIRWAC, DEAT**
4. There remains a need for improved incineration and waste food treatment systems at the base. **Action: DEAT**
5. A visitors' guide, similar to that produced for Marion Island, is needed for Gough Island. **Action: DEAT, GIWRAC**
6. The presence of environmental scientists on the island for the past two years has been of great assistance in managing the island effectively. Serious consideration should be given to appointing a dedicated environmental officer for the island each year (or at least each summer); such a post could be justified by the *Sagina* work alone. **Action: GIRWAC, DEAT**

PROGRESS MADE

1. The helipad lights and other external lights have been disconnected to prevent them being turned on accidentally.
2. Communication between the inspector and personnel running the relief continues to improve. Capt. Jon Klopper of the *SA Agulhas* was responsive as ever to suggestions regarding conservation-related issues, and the Department of Environmental Affairs and Tourism (DEAT) officer in charge, Alma Beukes, responded swiftly when issues were brought to her attention.

PROBLEM AREAS

No new environmental issues were identified during the current relief, but several recurrent problems still require attention.

1. Despite considerable improvement in the screening of cargo to the island, the arrival of live, mega-invertebrates (cockroaches and carabid beetles) during the past year indicates that there is still considerable room for improvement.
2. The decision to replace the crane at this crucial stage of the *Sagina* control programme suggests that the severity of the threat posed by this plant is still not being taken seriously enough by DEAT.

Permission for the replacement should have required Tristan's approval under section 5.4.1 of the Gough Island Management Plan.

3. An improved incinerator system and a macerator for food wastes has been requested for several years.

Background and relief schedule

I accompanied the 2001 annual relief voyage to Gough Island to conduct the 11th environmental inspection in terms of the Gough Island Wildlife Reserve Management Plan (Cooper & Ryan 1994). I was also on Gough as a co-project leader (with Steven Chown and Kevin Gaston) of the SANAP biological research programme which concluded its field work in 2001, and was team leader for the scientists on the island. Every attempt was made to avoid possible conflicts of interest between these two roles. Much of the scientific co-ordination was delegated to Alex Jones, a researcher on the programme.

The departure of the *S.A. Agulhas* from Cape Town was scheduled for 14h00 on 5 September 2001, but this was delayed due to high winds which closed the harbour. The ship eventually sailed at 23h00, and after a rather slow and stormy trip arrived at Tristan da Cunha on 12 September. With the seas in the harbour too large to work cargo, the *Agulhas* departed for Gough the same day, after flying Tristan passengers and their cabin luggage ashore. She arrived off Gough at 11h00 on 13 September. Personnel and luggage were flown ashore, and some cargo slinging took place, continuing on 14 September. Diesel pumping took place on 15 September, and the ship remained at the island until 17 September to facilitate the replacement of the crane.

After the buoy-laying cruise, the *Agulhas* went to Tristan to offload cargo, then returned to Gough on 26 September. Back-loading of cargo took place on 27 September, and relief personnel left the island on the morning of 28 September, when the *Agulhas* sailed for Tristan to collect passengers bound for Cape Town. She sailed for Cape Town on 29 September, arriving there one day ahead of schedule on 4 October.

Activities prior to departure

As environmental inspector, I was invited to attend the voyage planning meeting held in Cape Town on 1 August. Team leaders from all groups were present, and potential environmental concerns were identified and solutions sought. I also gave a briefing to the new team and interested people from DEAT on the conservation management concerns at Gough Island during an informal seminar on the morning of 3 September. A similar talk was given aboard the *Agulhas* on 7 September, and the message was further driven home by another talk by Alex Jones.

Impromptu inspections of the DEAT and NDPW stores were made on 27 August. Mr Eric Buenk (DEAT) was very co-operative and showed me around the DEAT stores in Paarden Eiland. The facility was in a much neater condition than in previous years. Bait stations for rodents were deployed throughout, and had fresh bait. A rodent free certificate dated 21 August 2001 is attached. There was no evidence of birds roosting in the roof. Rodent bait stations had been checked recently, and Eric reported no problems with rodents during the past year. Some containers had already been packed, and others were ready for packing. All were clearly marked with a large black G (on sides and lid) to denote their use only at Gough Island. Random containers were inspected for cleanliness, and all were clean other than a layer of dust on some surfaces. I was assured that the containers would be given a final cleaning before being transported to the ship.

A spot check of boots ready for re-issue in the clothing store found most were well cleaned,

although a few pairs had a little 'dirt' adhering to their leg sections. One *Aceana* seed and a few other pieces of vegetation were found stuck in the velcro strip on a waterproof jacket. This problem was pointed out to the newly-appointed store manager, Ms Nonkolo Mosehle, who undertook to inspect all such clothing issued. I took the opportunity to explain to Nonkolo the importance of ensuring that boots and clothes are free of seeds and other propagules. In terms of the new clothing agreement, it is the responsibility of the person being issued their clothes to ensure that they are clean. This step is welcomed, but it should not be seen as a way for the Department to abrogate its overall responsibility in this regard, especially as there is likely to be a range of vigilance expressed by takeover personnel.

At the National Department of Public Works (NDPW) stores in Wingfield I was escorted by Mr Mike Murphy, leader of the NDPW team going to Gough. Freshly baited rodent traps were deployed throughout the store, and a rodent-free certificate (dated 10 August 2001) is attached. All containers had been cleaned and were outside drying. After the recent rains, some had acquired some fresh mud on their sides, but I was assured that this would be removed when the containers were being loaded for transport to the ship. Mr Murphy raised the issue of the weeds, saying that they had scraped the cement forecourt a few weeks ago. There was some regrowth, but the area was less heavily affected than adjacent areas. This is the last year that Wingfield will be used for this purpose. Operations are scheduled to move to Customs House on the Cape Town foreshore before the end of 2001.

On 28 August I visited two facilities where cargo for Tristan was being packed and stored prior to loading onto the *Agulhas*. At the Table Bay Marine store in Ndabeni I was shown around by Achmat Osman, who was extremely helpful, and pointed out how all items were sealed and stacked away from the walls to allow easy inspection. Freshly-baited rodent stations were situated behind the cargo. Lihou Agencies store their cargo at Freight Co-ordination Services in Montague Gardens. Some cargo is packed in sealed plastic containers, but other items are on wooden pallets, which were stacked against the wall. Only one rodent bait station was seen, well away from the cargo. Also in the same area was a large pile of used fishing nets. Stricter measures could be taken to isolate Tristan cargo at this site. Rodent free certificates were obtained from Table Bay Marine (dated 28 August) and Lihou Agencies (28 August).

The *SA Agulhas* was berthed at her new permanent mooring at Quay 500 until she sailed. This area is distant from any warehouses and is unlikely to attract a significant rodent problem. A rodent free certificate for the ship dated 4 September is attached. The holds were inspected on 28 August before cargo was loaded, and on 5 September once the cargo was loaded. No sign of rodent droppings or other problems was found during these inspections, but an old, half-eaten packet of dates with a growth of fungus was found high up in the forward hold on 5 September. This site was not accessible when the hold was empty. It was removed and disposed of ashore before the ship sailed.

Rat guards were in place on all hawsers when the ship was visited on 28 August and 3 September, as well as on 5 September, when the ship was scheduled to sail. All the guards were the new design that clamp around the hawser. Capt. Klopper is to be commended for persevering in finding a solution to this long-standing problem. Despite the gale force winds on 5 September, the guards remained in place and appeared to be effective barriers to rodents. Four hawsers broke during the gale, and some new lines did not have rat guards, but this was for a limited period immediately prior to sailing.

Activities at Gough Island

Takeover personnel

In addition to the old (9, including three biologists) and new teams (6), personnel from the

following departments remained on the island for the duration of takeover: DEAT (3 administrators), Department of Foreign Affairs (1 communications expert), SA Weather Services (2; although 1 left to go on the buoy-laying cruise), NDPW (8), Tristan government (1 environmental inspector), SA National Defence Force (1 chef), Universities of Pretoria and Sheffield (1 scientist) and a chaplain. During the initial visit of the *SA Agulhas*, the airforce ground crew and selected ship's personnel visited the base on 16 September.

Arrival, helicopter operations and other logistics

The first flight ashore took place at 13h00 on 13 September, and comprised an inspection team made up of the OIC and other DEAT personnel, the NDPW leader, the SA Weather Services representative, new team leader and myself. The helicopter shut down until the inspection was complete (approximately two hours). The remaining personnel and luggage were then flown ashore, and some cargo slinging took place, including recovering one field depot from Gonydale, and back-loading several containers of accumulated wastes. Cargo off-loading by helicopter continued on 14 September, when the second field depot, at Waterfall Camp was recovered. On this flight, we visited the site where the fishing dingy from the Edinburgh was washed ashore in Battle Bay on the NW coast of Gough. There was no sign of the inflatable boat used by the first abortive rescue attempt; only a life ring and a few unidentified items remained visible. I considered it unnecessary to risk a winch landing of personnel to recover this litter; most of it will doubtless be removed in the next few years' storms.

Prior to flying cargo or personnel, I briefed the SAAF crew, asking them to avoid flying over Seal Beach as well as other large penguin and seal colonies. Special notice was made of the Long Beach/Capsize Sands area where the small relict population of Southern Elephant Seals *Mirounga leonina* breed. I also requested that the helicopter head straight out to sea when carrying pieces of the old crane that could potentially be contaminated with *Sagina* seeds (see below). Within the constraints of the prevailing weather conditions, this request was adhered to.

On 16 September, Richard Cuthbert, Erica Sommer and I swam ashore from the ship's rescue boat at the Glen and Sophora Glen to recover containers with emergency rations deployed in 1999/2000 by invertebrate field biologists. The containers were returned to the ship, and then flown ashore for unpacking and disposal of their contents as appropriate. Such depots should not be allowed in future without approval from GIWRAC.

Cargo transfer

Three areas were identified for landing cargo: the helipad, crane platform and designated areas behind the kitchen adjacent to the water tanks. Use of the crane area was limited, however, because of the need for space to demolish the old crane and erect its replacement. Most containers were landed on the old helipad that forms the periphery for the new pad. During the inspection of the station I approved the landing of containers and materials on the vegetation behind the kitchen adjacent to the water tanks (dominated by *Holcus lanatus*), and on a patch of largely alien vegetation (dominated by *Plantago major* and *Rumex obtusifolius*) up-slope from the disused store (i.e. opposite the NDPW brown store). This causes some localised damage and trampling of the vegetation, especially immediately around the water tanks.

No fresh fruit and vegetables other than washed potatoes were offloaded. Several boxes of fresh eggs were brought ashore, but these had been irradiated. One member of the ship's crew brought a fresh banana ashore on 16 September, which was eaten, but the peel was returned to the ship for

disposal. Of the 27 orange DEAT containers flown ashore, five were not marked G for dedicated Gough use. Two of these were old containers for back-loading caustic soda wastes. In addition, nine NDPW containers were used that were not dedicated for use at Gough Island. Although these were inspected prior to loading in Cape Town, it would be better if dedicated containers were available. If necessary, DEAT should make available dedicated containers for use by the NDPW.

General base condition

At the initial inspection, the base was in good condition, with no litter outside the buildings and the catwalks had been cleared of vegetation. The annual mouse tally on base was at least 375 killed, with several more killed during takeover. Black-out blinds were fitted to all windows, although some were in need of repair (weighted bottom poles tearing out, etc.). The new helipad has sunk slightly in the middle, but is otherwise fine. The old structure is still intact; it remains the best site for landing and storing containers. The old helipad surface is becoming overgrown with alien grasses (mostly *Poa annua* with some *Agrostis stolonifera*), which the old team elected to leave this vegetation in place, as it facilitates walking on the otherwise very slippery surface. However, team members leaving base should avoid walking over the alien-infested area to avoid spreading seeds on their boots. The catwalks were in reasonably good condition, but some of the wooden support beams are rotten and need replacing.

New construction

The main external construction during the relief was the replacement of the old crane with a new, hydraulic crane. This was unfortunate timing, because it meant a great deal of activity and disturbance in the area that has been heavily infested by *Sagina procumbens*. The NDPW team members were briefed thoroughly about trying to minimise walking off the cement platform, and the need to wash their boots each time they left the crane area. In the event, it was impossible to demolish the crane without causing major disturbance to the adjacent soil. Many of the large pieces of crane fell into the affected area and then were hauled up onto the crane platform. I asked that all items be washed before slinging back to the ship, and that wherever possible, flights be direct from the crane out over the sea. As noted above, this request was largely adhered to. However, GIWRAC and Niek Gremmen should have been consulted by DEAT before the decision was made to replace the old crane, given the sensitive nature of the crane area. Section 5.4.1 of the Gough Island Management Plan which requires *inter alia* permission from the Tristan Administrator for all construction and extensions should be read to include replacement of existing infrastructure in the logistic zone.

In addition to routine maintenance, it was planned to modify an old store room in the main base behind the upper-air building to provide accommodation for two additional personnel. This was to include the provision of a new toilet and shower, with grey water and sewage routed into the existing waste-water system within the footprint of the existing base. Plans for the conversion were pre-approved by GIWRAC. In the event, this did not go ahead because of a dispute between DEAT and NDPW regarding the conditions of use for the planned accommodation.

Removal of redundant structures

The emergency radio shack, which for the last few years has housed only a German GPS facility, was removed (the GPS equipment was relocated in the main base). The walkway lights leading to this hut also were removed, but the catwalk was left *in situ* pending replacement of catwalks in 2002. Gough 47 has agreed to stack this old catwalk behind the kitchen to allow the vegetation to recover (and

prevent the old catwalk being overgrown).

The walkway lights leading to the helipad also should be removed because they are no longer connected to the power supply, but this was not acceded to "in case of emergencies". Other items requiring removal include the end of the old walkway to the crane operating point (now dangerously unstable) and ropes, wooden steps and other infrastructure on the stack that formerly was the Archway. During 2000/01 the wooden box on top of South Peak was blown apart and the log book lost. We returned the debris from this box to the base for disposal. No new box should be erected, as it contravenes the management plan.

Fuel pumping

Approximately 99 100 litres of polar diesel were pumped ashore on 15 September. There were some initial problems leading the hose from the ship to the shore station, with the pipe not being sufficiently inflated, and so a section sank and became snagged on the sea floor. The line was eventually freed and led ashore, despite a strong drift to the south-west. The integrity of the system tested by pumping air through the system at 7 bar. Diesel pumping commenced at 13h30 and was completed by 18h30, where-after more air was pumped down the line to prevent residual spilling when the line was returned to the ship. The transfer went off reasonably smoothly. A small leak occurred on the transfer line near the ship, creating a slick that drifted away to the south-west past Cavern Head. However, once the ship's captain was alerted, the work boat was sent out and the leak sealed. Examination of penguins at Seal Beach found no birds with any evidence of oiling.

Wastes

In general, solid waste management on the island is conducted in a sensible manner, with plastics, glass, tins and poultry wastes (stored frozen) returned to South Africa for recycling/disposal, paper and wood being incinerated, and food wastes being disposed of into the sea via Skivvygat. The old incinerator continues to be used, despite plans for a new, more efficient, cleaner-burning diesel incinerator since 1997. Base personnel were responsible about manning fire-hoses at the incinerator.

Disposal of food wastes and base sewage into skivvygat is acceptable during most of the year, but a macerator would be a great improvement during takeover when the volumes of waste are much greater. Sewage and grey water also goes into the sea via Skivvygat, except for the waste-water pipe leading from e-base, which leads direct over the cliff in front of the base. This pipe has broken about 5 m from the edge of the cliff in an area of dense tussock. However, it was decided not to repair this pipe immediately, because the area is in the *Sagina* infestation area, and it was decided that the risk of disturbance was greater than leaving the grey water to flow into the tussock grassland. However, personnel stationed in e-base were asked to preferentially use the toilets in the main base. As usual, team members and especially relief personnel were warned not to dispose of oils and toxic chemicals in the waste water system.

Lights and night-strikes

In general, people were conscientious about closing blinds at night and not turning on outside lights. Some blinds let light in at the sides, especially if they are not closed to lie flush with the window. Velcro was brought down during the relief to be fitted to the blinds; this should be undertaken by Gough 47 during the coming year. There were no significant bird strikes during the relief, and Gough 46 reported few incidents during the past year. Most outside lights, including the helipad lights, have been

disconnected from the power supply so that they cannot be turned on inadvertently; only the lights down to the NDPW store remain connected. Lights no longer in use should be removed (see above).

Alien plants

Effective treatment of areas infested with *Sagina* remains the top environmental priority at Gough base. The Gough 46 team are to be congratulated for their vigilance in this regard during the year. A fairly careful search on 24 September found only relatively few, small patches of *Sagina*, all in areas previously known to have been infected (adjacent to the crane platform, on the cliffs between the diesel pump station and the crane, and at the end of the walkway to the old crane operating point); some of these sites had been left deliberately to show to the new team. Plants and infected soil removed during 2000/01 were removed from the island and dumped at sea mid-way between Tristan and Cape Town.

As stated above, the replacement of the crane has potentially exacerbated the situation, despite the best efforts of all concerned to minimise the levels of disturbance, and good compliance with boot-cleaning regulations by people working in the crane area. Pieces of the old crane were washed down before flying, and the airforce were requested to fly pieces of the crane directly out over the sea, but this was not always possible. I recommend that the entire crane platform area be re-treated with boiling water, following the erection of the new crane; Gough 47 have agreed to undertake this task. There will be need for extra vigilance over the next year, and the entire logistic zone should be searched carefully to ensure that plants have not established beyond the zone of known infestation. It is unfortunate that there will be no field biologists on the island to check for new infestations of the plant. This reinforces calls for at least a part-time conservation officer for the island. Repeated monitoring and follow up treatment is required for the next several years, if this potentially serious weed is to be eradicated.

No new alien plants were observed during the relief, or during the preceding year. There was no sign of the novel plants introduced when the upper magnetometer hut was constructed, nor of Potatoes *Solanum tuberosum*, which have occurred at the base in recent years. The two containers at Gonydale and Waterfall Camp, used to support field research during the last two years, had little impact on the spread of alien vegetation: no alien plants were found at the site of the Waterfall Camp container (despite *Holcus* occurring at the main camp site), and only two small clumps of *Poa annua* were found at the Goneydale container (and none at the adjacent tent site). *Poa annua* is a common weed along the stream in Gonydale, but the plants at the container site were removed.

The new team was shown the more common alien plants (*Rumex obtusifolius, Holcus lanatus, Agrostis stolonifera, Poa annua, Plantago major* and *Sonchus* spp.), and asked to remove these where feasible in the immediate vicinity of the base, but not to devote undue effort to this task, as all are widespread on the island. *Sonchus* in particular has been weeded over the past few years, and is now much less common around the base.

Other introductions

A recent arrival, the German cockroach *Blattella germanica*, apparently was eradicated during the year, but a new species of cockroach (cf. *Deropeltis* sp.) was found in a bag of camera film newly arrived from Cape Town. This bag included one dead male and a live, unwinged female; both were collected, and the female killed. Weevils and flour moths were found in pasta and other dried foodstuffs (see Appendix for a full list of pantry commensal invertebrates in 2000). Contaminated food stores were frozen pending return to South Africa.

During the past year, the invertebrate biologists collected one new species for the island: a carabid

beetle was found in the base pantry in March 2001, presumably having lived there since its introduction from South Africa. This family of predatory beetles is absent from Gough, and could wreak havoc among the native weevils and other insects should it become established. It further emphasises the need for vigilance in checking all imported cargo for stow-aways.

The apparent fungal infection on island trees *Phylica arborea* which causes the foliage to turn yellow, wither and die, remains widespread around the base area. Although there does not appear to have been a major die-back since the problem was first noted two years ago, a visit by a plant pathologist is warranted to identify the fungus and its source, and assess its possible impacts on the tree population.

Paths, erosion and peat slips

With four biologists on the island, there was considerable use of paths during the 2000/01 year (Table 1). The paths leading to Seal Beach/Swemgat and up towards Golden Highway are deeply incised, making walking difficult. Ribbon paths are developing in some areas. The main development was the reopening of a direct path to Gonydale, which greatly reduced the impact on routes leading to South Peak. Alex Jones, one of the island-based biologists in 1999/2000, reported that the Tafelkop route is less severely eroded than it was last year, when the biologists used this route as the main access to the interior of the island. However, the path remains fairly heavily eroded in places. If possible, the direct route to Gonydale should be reduce pressure on the routes to South Peak. Two short ladders were added to help descents to the river crossing above swemgat (*en route* to Goneydale via the direct route).

I assessed the two main routes to South Peak: the eastern ridge of Ruin Ridge and Tafelkop via the 'Golden Highway'. I also came down the direct route from 1760' past Pummel Crag. The main Ruin Ridge route remains fairly eroded on the upper, wet heath sections, but the lower section through fern bush has largely overgrown to the point where the trail was hard to follow. We removed an aluminium ladder and rope at the bottom small cliff face of this route, because they were no longer safe. For the coming year, I suggest that the classic ascent of Tafelkop is the best route, but that the direct route to Gonydale should be maintained if at all possible for people wanting to walk beyond South Peak. We showed members of the new team the route up Tafelkop and across to South Peak. The new team was instructed to remain on paths wherever feasible, and to avoid cutting across slopes, especially at higher elevations. If there are future island-based field personnel, it is suggested that they consider using walking sticks to help reduce foot-slip erosion on the island's uplands.

During the year the scientists replaced the rope at Waterfall Point. The rope ladder at Admirals is still in good shape, but the one to Swemgat still has a broken rung (dating back to at least 1999) that requires repairing or replacing the entire structure. The extension ladder used for *Sagina* clearance is buckled and no longer safe to use. A ladder and floodlight damaged by storms at the diesel pump station were removed.

Table 1. Numbers of trips made to various destinations during 2000/01. Units are number of people walking each route; each trip is counted only once.

Destination	2000 relief	2000/01 year		2001 relief
		Base personnel	Scientists	
Admiral/Snoekgat		13	45	9
Seal Beach/Yellow-nosed colony		12	88	31
Swemgat		10	6	2
Prion cave		4	48	7
Tumbledown (seal colony)		9	41	2
Richmond Hill/South Point		0	14	0
River/dam		8	16	8
Tafelkop/South Peak		2	25	8
Gonydale		4	74	4
Rowetts and beyond		2	22	3
960/Waterfall Point		0	20	1
The Glen		0	2	0*

* a boat-assisted landing was made at the Glen and Sophora Glen on 16 September to recover two boxes of emergency supplies and equipment left by the invertebrate biologists in 1999/2000.

There were no major peat-slip events during 2000/01. The slump resulting from the collapse of the Archway in 1992 has not changed visibly since 1999, but there has been considerable erosion of the peat slopes at the top of the cliffs under the crane due to the control measures against *Sagina*. This has exposed considerable debris (cement blocks, plastic bags, etc.) used in the initial construction of the crane area, but given the sensitive nature of this area *vis a vis Sagina* seeds, it is deemed best to leave the area as it is for now.

Entanglement and oiling

One adult Sub-tropical Fur Seal *Arctocephalus tropicalis* at Seal Beach was seen entangled in a packing strap on 27 September 2000. A number of fur-seal pups were released from a large piece of netting that came ashore at Tumbledown Beach on 8 February 2001. No oiled birds were observed, but two birds were found trapped in the centre of the old crane: a Common Diving Petrel *Pelecanoides urinatrix* on 10 October 2000 and a Greater Shearwater *Puffinus gravis* on 21 December 2000. One female Tristan Albatross *Diomedea dabbenena* was found with an old tuna longline hook in her throat. Because the hook was very old and appeared to be causing the bird little distress, it was decided to leave it *in situ*. The bird was incubating an egg at the time of first observation, and subsequently fledged her chick. An adult Gough Moorhen *Gallinula comeri* was found entangled in monofilament fishing line at the base and released on 10 October 2000. A Subantarctic Skua *Catharacta antarctica* fledgling broke its leg after becoming entangled in a support wire at the base; it was freed and apparently fledged.

Fishing

During 2000/01, no unlicensed fishing vessels were seen or overheard on the radio. Very little fishing by team members (*ca* 5 attempts) took place during the year, in part because the base was supplied with fresh fish from the *Edinburgh* and *Kelso*. Gough 46 reported catching some snoek, fivefingers and jacopevers during the year. However, the team reported that the crayfish boats were

catching fish for bait. Limited fishing took place from the *S.A. Agulhas* while she was anchored off Gough, but this was soon stopped once it was pointed out that permission to fish had not been granted by Tristan.

Environmental monitoring and scientific activities

Deryk Yelverton was conservation officer during 2000/01, and did a thorough job, maintaining records of *Sagina* clearing operations as well as activities outside the logistic zone. Chris de Beer, team leader and medic of Gough 47, will act in this capacity during 2001/02. In addition to ensuring that the base runs according to the policies of the management plan, Chris will be responsible for the *Sagina* control programme and co-ordinating volunteer monitoring programmes on seabirds (Yellow-nosed and Tristan Albatross study colonies) and seals (Subtropical Fur-seal pup growth and Southern Elephant Seal census) conducted by the team during the year.

This year saw the end of two-years' biological research at the island. From 1999-2001, the Gough Island Terrestrial Invertebrate Survey (GITIS) has sampled the island's terrestrial and fresh-water macro and meso-invertebrates. Some of the initial results of the survey are summarised in the attached report by Alex Jones. During 2000/01, Richard Cuthbert and Erica Sommer established monitoring protocols for bird species of conservation concern on the island, and also conducted research on the biology of several bird species. During the relief period, we set up the Yellow-nosed Albatross study colony for the coming season and completed the third successive complete island census of Tristan Albatross chicks. We also conducted a census of incubating Southern Giant Petrels

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I thank Richard Cuthbert, Alex Jones and Erica Sommer for their help and observations on Gough Island. I am also grateful to Alma Beukes of DEAT, Mike Murphy of NDPW, Major Andre Stroedel of the SAAF, their respective contingents, the Gough 46 and 47 teams, and Captain Jon Klopper and the officers and crew of the *S.A. Agulhas* for their assistance and co-operation.

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THE GOUGH ISLAND TERRESTRIAL INVERTEBRATE SURVEY (GITIS): CONSERVATION REPORT TO THE TRISTAN ADMINISTRATION, SEPT. 2001

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THE GOUGH ISLAND TERRESTRIAL INVERTEBRATE SURVEY (GITIS).

The GITIS project was set up in order to provide a comprehensive list of the terrestrial invertebrate fauna of Gough Island. The rational for this collection was threefold. Firstly, the survey will allow present conservation threats to the islands native species to be assessed and sensible conservation priorities determined. Secondly, the survey data can be used as a base line to monitor changes in biodiversity and thus form the basis for future biodiversity action plans. And finally, the survey will be of utility in furthering our general biogeographic and taxonomic understanding of invertebrate species of the South Atlantic.

Project funding is provided through the UK governments Darwin Initiative in collaboration with the South African governments Department of Environmental Affairs and Tourism (DEAT). The joint nature of the funding is also mirrored by collaboration between the University of Sheffield in the UK and the University of Pretoria in SA, who together manage the project.

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REPORT SUMMARY

The Gough Island terrestrial invertebrate survey (GITIS) has been cataloguing Gough invertebrate species since September 1999. While at the submission of this report the survey is only midway to completion, preliminary results have identified a significant conservation threat to Gough's native species in the form of accidental introductions of non-native species. In fact, so many invertebrate species have been introduced to Gough that they now equal or exceed the number of native species in many groups. Comparisons between the invertebrate species lists recorded thus far by GITIS with those recorded on Gough in a previous survey by Martin Holdgate in 1955 – 56 (Holdgate 1965) indicates that many introductions have occurred on Gough during the last 46 years, probably as a result of the requirement to supply the island's meteorological station.

The impact that introductions may have on an island's indigenous communities can be potentially devastating. Introduced species can have direct effects on the diversity of native species through predation (Ernsting et al. 1995), herbivory (Leader-Williams et al. 1987) and competition (Gremmen 1997; Gremmen el al. 1998; Frenot et al. 2001) and in addition can exert indirect threats such as modifying local nutrient cycles. These indirect threats can lead to long-term changes in local community structure and biodiversity, affecting all native fauna and flora (Williamson 1996).

It is not only invertebrate introductions that pose a conservation threat to Gough. Introductions of alien plants have been shown to threaten Gough's biodiversity (Gremmen 1999; Gremmen 2000; Gremmen & Barendse, 2000) and the ever-present threat of rats arriving on Gough would certainly be an environmental catastrophe (Wace 1986).

To preserve Gough's unique biodiversity the threats posed by the accidental introduction of alien species need to be taken seriously and all possible precautions must be taken to minimize the risk of human mediated introductions. It is vital that protocols concerning the control of imported materials to Gough, detailed in the management plan for the Gough Island wildlife reserve (Cooper & Ryan 1994), are understood by all visitors to Gough and strictly adhered to.

PERCEIVED THREATS TO GOUGH'S TERRESTRIAL INVERTEBRATE BIODIVERSITY

At a global scale, the 'IUCN Red List' (Hilton-Taylor 2000) describes three main threats to biodiversity. These are the threats from: habitat loss (most notably resulting from agricultural processes), direct loss (through hunting, fishing and collecting etc) and introduced species. Gough's remote location and relatively minimal human presence means that the threats from habitat loss and direct loss are negligible for invertebrates. Alien introductions, however, are known to constitute one of the largest threats to the biotas of Southern Ocean islands (Bonner 1984; Chapuis et al. 1994; Dingwall 1995; Ernsting et al. 1995; Bergstrom & Chown 1999; Chown & Gaston 2000; Chown et al. 2001).

There are three possible outcomes that may result from human mediated invertebrate introductions on Gough. Firstly, and probably most commonly, the introduction fails and may never be observed. Secondly, the introduction succeeds but the species is restricted to Gough base. Such species are usually pests of stored produce and unlikely to spread in the natural habitat. For example, Holdgate observed three pest beetles *Henoticus californicus*, *Cryptophagus dentatus* and *Hylurgus ligniperda* during his survey in 1955 – 56 (Holdgate 1965). After Holdgate's base was abandoned, none of these species has since been recorded, indicating that in the absence of humans they could not survive. The third outcome of an introduction event is that the introduced species successfully spreads throughout the native environment, perhaps even coming to dominate local communities. It is these species that threaten native biodiversity.

Island species are at particular risk from such introductions for two reasons. First, island populations are likely to have evolved in the absence of the horizontal (competition) and/or vertical (predation/parasitism) interactions that such species might introduce into the ecosystem, and therefore be less equipped to deal with them. Secondly, endemic terrestrial species restricted to an island will only have a range size of equal or less than the island's area and small range sizes tend to make species more susceptible to extinction.

Between September 1999 and September 2000, the GITIS project has identified a considerable number of invertebrate species that are likely to have been accidentally introduced to Gough by humans since landfall was first made in 1675 (Wace 1969). These include many species absent from Gough island invertebrate collections made in 1955 – 56 (Holdgate 1965), indicating that introductions have been occurring in recent history.

Appendix 1 provides a provisional list of some of the insect species that are likely to have been accidentally introduced to Gough by humans. A comparison between numbers of introduced and native species provides bleak reading. Table 1. shows that the number of introduced Coleoptera, Diptera and Lepidoptera (the three most specious genera of Gough's macro-invertebrates) is now approximately equal to the number of indigenous species and similar patterns are emerging for the other invertebrate groups. Species in several invertebrate groups are only present on Gough as introductions; these include the Myriapoda (millipedes and centipedes), lumbricid worms (earthworms), Blattidae (cockroaches) and possibly the island's six hymenopteran (wasp) species.

Not only do introduced invertebrates make up a considerable percentage of the total numbers of Gough species, but they are also likely to constitute a considerable percentage of Gough's invertebrate biomass. Based on field

observations either lumbricid worms or the isopod *Porcellio scaber* (a woodlouse), probably contribute most to Gough's total invertebrate biomass. Both of these species are introduced detritivores (an animal which feeds on dead organic matter). The addition of such a large mass of detritivores to Gough (an island naturally depauperate in earthworms and woodlice) is likely to have a long-term effect on nutrient cycles. Gough's peaty soils can only be formed in the absence of the rapid breakdown of organic material. The presence of the introduced detritivores may speed this process considerably, and over the course of many years may radically change Gough's floral and faunal assemblages.

Table 1. Table showing the ratio of introduced to native species in three common insect families

Taxonomic Group	Approximate ratio of introduced to native species
Coleoptera (beetles)	1:1
Diptera (flies)	1:1
Lepidoptera (butterflies and moths)	1:1

It is hard to tell what effect introduced invertebrates are having on Gough's native invertebrates. None of the arthropod species recorded by Holdgate have gone extinct since 1956. Moreover, in the absence of fossil evidence, we cannot know how many native invertebrate species have disappeared in the last 200 years. Nevertheless, there are worrying signs. For example, over the first 12-month collecting period of the GITIS, seven species of sphaerocerid fly were identified. Of these, six are relatively common northern European or Palaearctic species and were found in great numbers. One species, however, was represented by only two individuals and is presently being described as a new endemic. We might speculate that the reason for the relative scarcity of this species is that it is on the verge of extinction due to competition with the introduced northern hemisphere species.

Its not just introduced invertebrates that threaten Gough Island's indigenous species. Mice were accidentally introduced to Gough in the early 19th century by sealing expeditions (Rowe-Rowe & Crafford 1992). Our analyses of mouse stomach contents have shown that mice trapped during 1999 and 2000 in Gough's lowland fernbush habitats (see Wace 1961 for a description of vegetation types) below 300 m ate few invertebrates besides the introduced lumbricid worms. Mice trapped at over 500 m above sea level during the same period, however, were shown to eat many caterpillars of the endemic flightless moth *Dimorphinoctua goughensis* and may constitute a threat to this species. Likewise, it has been suggested that lowland mice on Gough Island may be retarding recruitment of the island tree *Phylica arborea* (Ryan et al. 1989). While our study did not identify any *Phylica* material from stomach contents, the bulk of plant material could not be assigned to species and a detrimental effect of mice on the island tree cannot be ruled out. The low densities of the endemic Gough bunting (compared to similar species on nearby Inaccessible Island), have also been attributed to the presence of mice (Ryan et al. 1989)

In the absence of extensive invertebrate lists for Gough prior to the Holdgate survey of 1955 – 56 it is very difficult to determine the initial impact of mice, but it is possible that they led to the rapid extinction of many native invertebrate species. Given the success of mice on Gough Island, and the extraordinary difficulty of eradicating rodents from large islands (Chown & Cooper 1995), it seems likely that this species will continue to constitute one of the most significant invasive species at this World Heritage site.

Alien plant species can also be a problem as highlighted by the recent *Sagina procumbens* eradication program led by Dr Niek Gremmen (Gremmen 1999; Gremmen 2000; Gremmen & Barendse, 2000). *Sagina* is well known for its invasive tendencies in the Southern Hemisphere. It can form large mats greatly reducing local biodiversity. Fortunately, this species was identified on Gough before it had time to spread from the base area. Last year (2000) the eradication program was successful in removing all known plants and dramatically reducing the seed bank in the soil.

IDENTIFIED CONSERVATION PRIORITIES

1. Minimize the risk of Introductions

In light of the observed numbers of introduced invertebrates, the overriding conservation priority must be to minimize the number of new introductions. The Gough Island management plan, section 5.11 (Cooper & Ryan 1994), details sensible quarantine precautions to this effect and this should be the guiding reference when dealing with these issues. While the Gough team members are provided with copies of this management plan, the seriousness and necessity for these precautions is not always appreciated and every attempt should be made to highlight the reasons behind them. This issue of education and awareness also extends to the Tristan islanders. Since the Gough base was built, Tristaners and Gough team members have built up a strong relationship. This has resulted in sporadic traffic between the islands such as the donation of potatoes from Tristan to Gough. This practice must be seen as a possible channel for the introduction of invasive species (many of which have already radically altered Tristan da Cunha's own

native communities). To address this problem the conservation issues inherent in the transport of produce from Tristan to Gough should be made known to all parties concerned, on both islands. Washing the potatoes completely free of soil on Tristan and packing them in fresh bags is one way to minimize the danger of introductions. The decision as whether to attempt to prevent the passage of all materials between islands is one that should be taken by the Gough Island Wildlife Reserve Advisory Committee (GIWRAC) who review the Gough Island management plan every five years.

While ship to shore contact to Gough should ideally be restricted to the take over period, where an appointed conservation officer can make sure quarantine procedures are adhered to, there will be cases where contact occurs at other times, such as under conditions of *force majeure* or the need to bring onshore emergency supplies. In such cases appropriate quarantine procedures should be supervised by the Gough team's appointed conservation officer or in the absence of a conservation officer the team leader. Appendix 2 lists a suggested quarantine procedure to use in such emergencies.

2. Monitor the spread of Introductions

The earlier an introduced species is recorded the better the chance that it can be contained and eradicated. To this extent, it would be beneficial if the Gough team carry out monthly monitoring programs in the logistic zone of the base area, searching for both re-emergence of *Sagina* (complete eradication of this plant may take many years) and the presence of any other unrecognised species. Once possible introductions are identified they should be recorded, photographed, and the information sent to the Tristan administrator and either Dr Niek Gremmen in the case of plants, Dr Alex Jones in the case of invertebrates or all the above along with the Gough Island Wildlife Reserve Advisory Committee members (GIWRAC) in the case of any mammals, reptiles or amphibians.

Because accidentally introduced species are most likely to arrive in the base area, this area can be quarantined from the rest of the island. One way of doing this is to wash all mud, soil and vegetative material from footwear and clothes prior to leaving the base area.

3. Control, and where possible eradicate, introduced species

Where introduced species are identified, appropriate advice must be sought and action taken as soon as possible. In the case of plant species, weeding and the use of herbicides is the first step in controlling alien species and can be begun the day the problem is identified. All weeded plant material should be burnt in the base's incinerator. In the case of invertebrates in the base area, fumigation of the 'infected' areas must be carried out as soon as possible and repeated as often as possible, even if it appears that there are no more individuals present. At present, there is no indication to suggest that eradication programs for introduced species in the base area would target rare native species (Gremmen, personal communication). However, in order to minimise this possible threat, eradication programs should be targeted as specifically as possible to the introduced species.

CONCLUSIONS

The Gough Island World Heritage Site has the reputation of containing some of the most pristine natural habitats of any temperate oceanic island in the world. However, our observations have revealed this status to be at considerable risk. Even with the strictest quarantine procedures, wherever humans go there will always be a likelihood of accidental introductions. We cannot hope to fully maintain the integrity of any native island community where humans are present, but with vigilance and commitment, the rate of introductions can be minimized.

In the last 200 yrs, Gough's invertebrate communities have probably changed faster than ever before and the stage has now been reached where close to half of the island's macro-invertebrate species are introduced. If this trend is to be halted, or at least slowed significantly, it is critical that all reasonable precautions be taken to preserve Gough's habitats and protect them from further dilution by alien species. The success of this endeavour will require the joint efforts of the Tristan Administration, the Gough Island Wildlife Reserve Advisory Committee (GIWRAC) and South Africa's Department of Environmental Affairs and Tourism (DEAT), and will depend upon the commitment of the Gough Island Base personnel.

REFERENCES

Bergstrom, D. & Chown, S. L. 1999. Life at the front: history, ecology and changes on southern ocean islands. *Trends in Ecology and Evolution* **14**: 427 – 477.

Bonner, W. N. 1984. Introduced Mammals. In: Laws, R. M. (Ed.) Antarctic Ecology, vol 1. 235 – 278. Academic Press, London.

Chapuis, J. L., Boussès, P. & Barnaud, G. 1994. Alien mammals, impact and management in the French subantarctic

islands. *Biological Conservation* **67**: 97 – 192.

Chown, S. L. & Cooper, J. 1995. The impact of feral House Mice at Marion Island and the desirability of eradication: Report on a workshop held at the University of Pretoria, 16-17 February 1995. Directorate: Antarctica & Islands, Department of Environmental Affairs and Tourism, Pretoria.

Chown, S. L. & Gaston, K. J. 2000. Island-hopping invaders hitch a ride with tourists in the Southern Ocean. *Nature* **408**: 637.

Chown, S. L., Gaston, K. J. & Williams, P. H. 1998. Global patterns in species richness of pelagic sea birds: the Procellariiformes. *Ecography* **21**: 342 – 350.

Chown, S. L., Rodrigues, A. S. L., Gremmen, N. J. M. & Gaston, K. J. 2001. World Heritage status and the conservation of Southern Ocean islands. *Conservation Biology*, in press.

Cooper, J. & Ryan, P. 1994. Management plan for the Gough Island Wildlife Reserve. Government of Tristan da Cunha.

Dingwall, P. R. 1995. Progress in conservation of the subantarctic islands. IUCN, Gland.

Ernsting, G., Block, W., MacAlister, H. & Todd, C. 1995. The invasion of the carnivorous caribid beetle *Trechisibus antarcticus* on South Georgia (sub Antarctic) and its effect on the endemic herbivorous beetle *Hydromedion sparsatum*. *Oecologia* **103**: 34 – 42.

Frennot, Y., Gloahuen, J. C., Massé, L. & Lebouvier, M. 2001. Human activities, ecosystem disturbance and plant invasions in subantarctic Crozet, Kerguelen and Amsterdam Islands. *Biological Conservation* **101**: 33 – 50.

Gremmen, N. J. M. 1997. Changes in the vegetation of sub-Antarctic Marion Island resulting from introduced plants. In: Battaglia, B., Valencia, J., Walton, D. W. H. (Eds.) Antarctic communities: Species, Structure and Survival. 417 – 423. Cambridge University Press, Cambridge, UK.

Gremmen, N. J. M. 1999. Recent introductions of *Sagina procumbens* (Procumbent Pearlwort), a potential threat to Gough Island natural ecosystems. Report of the *Sagina* eradication program to the Tristan Administration.

Gremmen, N. J. M. 2000. Eradication of *Sagina procumbens* (Procumbent Pearlwort) in the Gough Island Wildlife Reserve – Manual for the monitoring and eradication of invasive weeds. Report of the *Sagina* eradication program to the Tristan Administration.

Gremmen, N. J. M. & Barendse, J. 2000. Eradication of *Sagina procumbens* (Procumbent Pearlwort) in the Gough Island Wildlife Reserve – Report on the expeditions of May/July and September 2000. Report of the *Sagina* eradication program to the Tristan Administration.

Gremmen, N. J. M., Chown, S. L. & Marshall, D. J. 1998. Impact of the introduced grass *Agrostis stolonifera* on vegetation and soil fauna communities at Marion Island, sub-Antarctic. *Biological Conservation* **85**: 223 – 231.

Hilton-Taylor, C. (compiler). 2000. IUCN red list of threatened species. IUCN, Gland, Switzerland and Cambridge, UK.

Holdgate, W. M. 1965. The biological report of the Royal Society expedition to Tristan da Cunha, 1962, Part 111. The fauna of the Tristan da Cunha Islands. *Philosophical Transactions of the Royal Society of London, Series* B **249**: 361 – 402.

Leader-Williams, N., Smith, R. I. L. & Rothery, P. 1987. Influence of introduced reindeer on the vegetation of South Georgia: results from a long-term exclusion experiment. *Journal of Applied Ecology* **24**: 801 – 822.

Rowe-Rowe, D. T. & Crafford, J. E. 1992. Density, body size, and reproduction of feral house mice on Gough Island. *South African Journal of Zoology* **27**: 1 – 5.

Ryan, P. G., Moloney, C. L. & Watkins, B. P. 1989. Concern about the adverse effects on introduced mice on island tree *Phylica arborea* regeneration. *South African Journal of Science* **85**: 626-627.

Wace, N. M. 1961. The vegetation of Gough Island. *Ecological Monographs* **31**: 337 – 367.

Wace, N. M. 1969. The discovery, exploitation and settlement of the Tristan da Cunha Islands. *Proceedings of the Royal Geographical Society of Australia* (*S. Austral. Branch*) **70**: 11 – 40.

Wace, N. M. 1986. The rat problem on oceanic islands – research is needed. *Oryx* **20**: 79 – 86.

Williamson, M. 1996. *Biological Invasions*. Chapman and Hall, London.

APPENDIX 1. Introduced insect species on Gough Island

Introduced insect species identified on Gough during September 1999 to September 2000. Species not recorded in the Holdgate survey of 1955/56 (Holdgate 1965) are marked as † and species which are primarily pests are labelled *. The Thysanoptera, Homoptera, Hymenoptera and Collembola, all of which contain introduced species, have been omitted from this list due to incomplete analysis.

INTRODUCED INSECT SPECIES CONFINED TO THE METEOROLOGICAL BASE	
GROUP	SPECIES
Blattidae	*Blattella germanica* (German Cockroach)* †
Psocoptera	*Liposcelis* sp. *† *Psyllipsocus ramburii* *†
Coleoptera	Curculionidae - *Sitophilus zeamais* (Maize weevil)* † Ptinidae - *Tipnus unicolor* *† Silvanidae - *Oryzaephilus surinamensis* (Saw toothed grain beetle)*† Cucujidae – either *Cryptolestes/Leptophloeus/Planolestes* sp. (Flat grain beetles)*† Bostrichidae - *Rhyzopertha dominica* (Lesser grain borer)*† Psycodidae - *Psycoda albipennis*
INTRODUCED INSECT SPECIES PRESENT BOTH INSIDE AND OUTSIDE THE METEOROLOGICAL BASE	
Diptera	Sciaridae - *Bradysia* sp. A, *Bradysia* sp. B † Mycetophilidae - *Sciophila parviarelota* † Cecidomyidae - *Micromyini* sp. † Sphaeroceridae - *Leptocera caenosa* †, *Pullimosina heteroneura*†, *Phthitia pulmosula*†, *Thoracochaeta brachystoma*†, *Thoracochaeta zosterae, Spelobia parapusio*† Coeleopidae - *Coelopa africana* † Calliphoridae - *Calliphora croceipalpis, Lucilia sericata* Muscidae - *Fannia canicularis* * Drosophilidae - *Drosophila punctatonervosa* †
Lepidoptera	Tineidae - *Monopis crocicapitella* Oecophoridae - *Endrosis sarcitrella* Noctuidae - *Peridroma saucia*
Coleoptera	Staphylinidae - *Quedius mesomelinus, Notolinus hottentotus* †, *Sepedophilus* sp. †

APPENDIX 2. A suggested protocol for dealing with ship-to-shore transfer of materials to Gough Island occurring at times other than the annual supply visit.

Potential introductions of alien flora and fauna mediated via the need to supply the human population of gough is land poses the greatest threat to the integrity of the gough island world heritage site. The Gough Island Management Plan (Cooper and Ryan, 1994) section 5.11 details protocols for materials coming ashore during the annual supply visit.

It is strongly advised that all ship to shore transfer of materials should only take place during the annual supply visit, and under the supervision of the designated conservation officer. However, it must be accepted that circumstances will arise in which ship to shore contact occurs at other times. In order to minimize the risk of unwanted faunal and floral introductions in such cases the following protocol is proposed.

1. If possible avoid all unnecessary transfer of materials onto the island. On no account, knowingly allow any fresh produce (i.e. vegetables and fruits) or poultry products ashore (see the Gough Island Management Plan section 5.11 for further explanations).
2. Where advance notification is given of ship to shore transfer, advise the sender of the restrictions on transferring materials to the island. Politely request that any items to be sent ashore are checked for pest species and adhered soils prior to shipment.
3. A quarantine area must be designated for the receipt and containment of materials. This should not be located in the main base but in a closed room (such as one of the store rooms) as close to the point of entry as possible. The quarantine area should be equipped with sealable bags and containers, insecticide spray and fumigation tablets.
4. If fresh produce or poultry products do come ashore they should be placed immediately in sealed containers at the point of entry and taken to the base's freezer to be stored. The items should then either (i) be returned to the sender with a polite explanation, (ii) in the case of fresh produce incinerated in sealed bags, or (iii) in the case of poultry products kept in the freezer until the following official supply period when it can be dispatched to south africa. On no account should fresh produce or poultry products be left anywhere other than in sealed containers in the freezer.
5. All other materials coming ashore must also be placed in sealed containers at the point of entry. Those materials which can withstand cold temperatures should then be stored in the freezer for several hours in order to kill any invertebrates which may be present. After which they can be taken to the quarantine area for examination. Items that might be damaged by freezing (e.g. electrical equipment, bottled/canned goods, etc.) should be taken straight to the quarantine area.
6. If the size of items coming ashore precludes them being sealed in a container they should be taken immediately to the designated quarantine area and examined first.
7. When sorting through the materials that have come ashore check carefully for **invertebrates, seeds/spores, fungus**, **vegetation** and **soil** (this may contain invertebrates and seeds). It is advised that at least 2 people are present during the sorting procedure. It is a good idea to open containers, spray inside with insecticide spray, and reseal for 5 minutes before reopening and beginning to unpack.
8. Any alien species that are found should be killed and stored in a 70% ethanol solution (available in the base laboratory) for future reference. Any soil found on the packaging, along with vegetative material and fungus should be places in a sealed bag and incinerated. All packaging should also be incinerated if possible (especially cardboard). As a further precaution it is advised that the quarantine area be fumigated following sorting and before any items are taken into the main base.
9. Any humans who come ashore should be asked to clean their footwear and check their clothes for adhered soil or plant seeds before leaving the ship. If possible, ask visitors to wear clean clothes. Buckets of warm water and disinfectant should be placed at the point of entry and visitors asked politely to again scrub their boots clean. Explain to all visitors the necessity for the procedures used. Read section 5.18 of the Gough Island Management Plan (Cooper and Ryan, 1994) for further explanations regarding visitors.
10. It is important to deal with all visitors in a polite manner. By sending items, such as fresh food, ashore, visitors will assume that they are being helpful and could be offended if their gift is returned without adequate explanation. The Gough Island Management Plan s.5.11 describes the rational for quarantine procedures. All personnel on the island should be familiar with the reasons for quarantine so that the importance of these measures can be explained to visitors.

In dealing with ship-to-shore contact personnel should be polite but firm. Gough is unique because it has had so little human influence. Human mediated arrival of alien plants or animals may result in dramatic changes in the island's biodiversity. Only by maintaining constant vigilance with regard to ship-to-shore transfer can the threat of

introductions be kept to a minimum.