

REPORT ON ENVIRONMENTAL INSPECTION OF GOUGH ISLAND AUGUST-SEPTEMBER 1995

Nigel M. Wace

Member: Gough Island Wildlife Reserve Advisory Committee
c/o Australian National University, Canberra
February 1996

EXECUTIVE SUMMARY & RECOMMENDATIONS:

The 1995 Environmental Inspection of Gough Island took place from August 30th to September 7th, during the take-over of Gough 40 to Gough 41 meteorological teams at the Weather Station. Visits were made to the Paarden Island and Wingfield packing depots in Cape Town, and to the *S.A. Agulhas'* berth warehouse at the Cape Town docks, before sailing.

During the outward and return voyages to Gough Island in the *Agulhas*, I had discussions with Mr Alan Waters and with Mr Bernard Dalley, the Tristan da Cunha Administrators, on matters concerning the Tristan and Gough Island environment. In Pretoria, I had discussions with Mr M.V. Laing, the Director of Climatology at the Weather Bureau.

With only a week ashore on Gough, before the start of the growing season, it was hardly possible to extend observations beyond the vicinity of the weather station, which was clean and well maintained. The environmental impacts of reconstructing the helicopter pad, maintaining the aerial arrays and anemometer masts and the supports for the new water tanks, were addressed. The natural re-vegetation of the upper magnetometer hut site was recorded and photographed.

Food imports were inspected as they came ashore, and found to be clean, and free of obvious pathogens or alien organisms which might escape. Very little diesel fuel was spilt during pumping ashore. Solid non-biodegradable wastes were compacted and shipped off the island. Non-biodegradable liquid wastes were also shipped off the island, but sewage and "grey water" from kitchen and bathrooms was piped to the nearby rock beach. These arrangements for waste disposal are generally satisfactory, but synthetic liquids in use at the weather station, such as detergents, cleansers, biocides and all liquids in pressure-pack canisters need assessment for their local and global environmental impacts. Incinerators and fire extinguishers were inspected.

Reports on the present state of the tracks to Seal Beach and Tafelkop are recorded. Whale and dolphin sightings, seal entanglement and beach litter seen by the Gough 40 team are included, as are their reports on numbers of vessels contacted near the island during their tenure.

Geophysical survey of the lavas under the weather station, and periodic air photo runs over the station are needed to detect long term changes in the physical and biological environment.

This inspection has been made by the botanist of the Gough Island Scientific Survey, which set up the first scientific base at The Glen beach in 1955. My overall impression, after four visits to Gough Island spread over 40 years, is that the South African authorities have improved the rigour of their surveillance over necessary imports to the island and their stewardship of the local environment over this period. The personnel at the Weather Station are fully aware of their responsibilities in looking after the island, but they lack the scientific understanding to make the continued observations which conservation of the pristine Gough Island environment as a World Heritage now demands.

The following recommendations are made:

- A. *Relating to inspections in Cape Town to prevent the embarkation of intruding plants and animals reaching Gough Island:*
 1. Stuffed rodents, with examples of their droppings and pictures of rodent evidence, should be prominently displayed in the packing depots at Paarden Island and Wingfield.
 2. Quick-acting (rather than anti-coagulant) poisons should be used in bait stations at the packing depots at Paarden Island, Wingfield, and aboard *S.A. Agulhas*.
 3. The floor of the DEAT clothing store at Paarden Island should be kept clear of fluff by vacuum cleaning.
 4. Weeds growing between concrete paving blocks at the PWD Wingfield Depot should be scraped out, soil sterilants applied, and the cracks sealed to stop regrowth.

5. The ship's officer responsible for berthing *S.A. Agulhas* at Cape Town docks should inspect the fenders and the dockside warehouse where cargo is stored before loading, to ensure that these places are clean and have no attractants for rodents which might get aboard the ship or stow away in cargo for Gough Island.
 6. The unsatisfactory state of affairs relating to rat guards on ships' securing lines, and the cleanliness of the dock warehouses should be brought to the attention of the Port Health Authorities at the Cape Town docks.
 7. Systematic baiting for rodents should be instituted aboard *S.A. Agulhas* before her Gough Island takeover voyage, and that reports of the results of this baiting should be mandatory in any de-ratting certificates for the ship.
- B. Relating to the containers used for shipment of food & equipment:*
8. External-opening cavities in the metal containers used for lifting food and equipment to the island by helicopter, should be squirted through by pressure hoses immediately before shipment.
 9. Food which is repacked at Paarden Island in koskassies should be bought minimally packaged for shipment and storage on Gough Island itself (rather than extravagantly packaged as for display and advertisement in supermarkets).
 10. Cabinets of electronic and other equipment for Gough Island should be cold-treated or fogged with insecticides shortly before shipment.
 11. Long-term observations should be undertaken on the durability and ease of cleansing of any reusable food containers as possible replacements for wooden koskassies, before they are brought into use on Gough Island.
- C. Relating to vegetation management, and intruding biota that has already reached Gough Island:*
12. Vegetation near buildings and catwalks should be mechanically trimmed to not less than 10 cm height above the peat surface, rather than uprooted or treated with herbicides.
 13. Specimens of any plants which are suspected by the weather station personnel not to be native to the island, should be collected, labelled and pressed, for positive identification by the Environmental Inspector at the annual takeover.
 14. The pH of surface waters draining the formerly contaminated ground near the balloon platform and the fuel tanks, should be recorded at the annual takeovers.
 15. The concrete foundations and other remains of the upper magnetometer hut should be left undisturbed for colonization by the existing flora. A visual record of this process should be kept by repeated photography of the site from established photo-points.
- D. Relating to refurbishment or removal of existing structures:*
16. A new metal helipad should be constructed on top of the existing wooden structure.
 17. The unused V-beam aerial system near the helipad, and the single-line aerial running W-E from near the SE corner of Gough House to a mast north of skivvygat, should be dismantled and removed.
 18. The rhombic array presently in use, should be replaced by a smaller double inverted V system.
 19. The stays for the radio aerials and the anemometer mast presently in use, should be flagged.
 20. The base of the tubular metal framework which is no longer needed for the new water tanks, and has been cut off just above the peat, should be extracted at the next takeover.
- E. Relating to new structures at the Weather Station:*
21. A large reel stowing the pipe through which diesel fuel is pumped ashore from *S.A. Agulhas* should be constructed near the staging tanks, from where the pipe can be towed out to the ship.
- F. Relating to waste management:*
22. Empty food cans should be washed out before crushing.
 23. The end of the sewer line should be extended and turned down 3 m into skivvygat.
 24. An inventory of all items to be removed from the island, including surplus food and equipment, as well as wastes, should be compiled before takeover, and all the items should be checked off before the departure of the ship.
 25. Future supplies of all detergents, cleansers, biocides, and liquids delivered in pressure packs which are intended for use on Gough Island should be screened for their environmental impacts before purchase.
- G. Relating to fire prevention and management:*
26. That all burning should be confined to the closed incinerator. The open incinerator should be dismantled and removed from the island.

27. New automatic fire extinguishers which do not use halons (or other gases whose release harms the earth's ozone shield) should be fitted above the generators at the next takeover.
- H. Relating to heavily-used tracks outside the logistic zone:*
28. Standing ropes should be attached to trees or pitons on steep pitches of the frequently used paths leading down to Seal Beach and crossing the nearby stream.
 29. Old gratings now being progressively replaced along the catwalks at the Weather Station should be retained on the island for possible future use on pathways above the forest zone, to protect them from erosion.
- I. Relating to long-term environmental change at the Weather Station:*
30. An engineering geologist with some knowledge of shoreline retreat under wave attack on volcanic coasts, should assess the stability of the lavas underlying all the buildings at the Weather Station (Appendix D).
 31. Air photographs of the logistic zone and the terrain traversed by frequently used tracks from the Weather Station to Tafelkop, should be flown as opportunity offers at every annual takeover (Appendix E).

IN SOUTH AFRICA

Inspection of depots at Paarden Island and Wingfield

The shore establishments where the stores and equipment for Gough Island are assembled and packed were inspected on August 22, before the *S.A. Agulhas* sailed from Cape Town.

Paarden Island: Department of the Environmental Affairs & Tourism (DEAT) depot.

This establishment, where food and other consumables, and bedding and clothing, are assembled and packed, was well maintained and clean. The concrete floors were generally clean, and there was no accumulation of packaging, or other materials which might harbour plant residues or seeds. The food for Gough Island, which is packed in paired metal tins within wooden koskassies, had already been dispatched to the ship at the time of my visit. The whole re-packing operation is kept under cover in the depot: neither the food nor the empty koskassies are stored outside the building. I saw no signs of spilt food on the concrete floor of the depot where the packing takes place.

No signs of rodents (faeces, grease smears) were seen along the wall footings or roof joists, or by the stacked crates and cardboard boxes which remained from the packing of food. Some of the 14 bait stations placed in the depot by Swat Pest Control Company were seen (photo 1). There was no sign of recent rodent visits, but a few old dried faeces were seen near one bait station. A copy of the Swat Co. service report dated 14 August 1995 is attached (Appendix A). The faeces I saw were known to the DEAT staff, and were presumably those referred to in the Swat report dated 8 days previously, but indicate the need for continued vigilance in monitoring the packing depot for signs of rodents.

Slow-acting anti-coagulants such as Bromadiolone are not the most suitable baits to use in these stations, because any rats taking the bait would die elsewhere, and their corpses lost. I **recommend** that quick-acting poisons such as strychnine be used, because any rodents killed will be evident on site, and can be positively identified. It would be useful to know whether any rats which may get into the depot in future are the ship, or black rat (*Rattus rattus*) or the larger brown rat (*R. norvegicus*).

Because of the paramount importance of excluding rodents from Gough Island, I **recommend** that some droppings of both these rat species, together with some mouse droppings, are put in a glass-fronted case together with stuffed specimens of each species, in a prominent place in the depot. Such a display would advertise to all the people who work there, what the animals and their droppings look like, and could therefore increase the rigor of surveillance. Failing stuffed animals and their droppings, good coloured pictures should be displayed. The Swat Company could legitimately use such pictures as an advertisement for the services that they offer.

The Manager at the Paarden Island depot (Mr Sam Oosthuizen) pointed out to me the problem he had with the disposal of surplus packaging after the food for Gough, Marion and SANAE is re-packed in koskassies. The food supplied is often extravagantly over-packaged, because the packaging is used as a marketing aid for display and advertising on supermarket shelves. I **recommend** that food for the island should be bought in bulk, packaged only to the extent necessary to protect it in transit and on Gough. This would reduce the waste of materials, and the potential cover for rodents while the food is repacked in koskassies at the depot.

Mr Oosthuizen also told me that the koskassies may be replaced by returnable plastic containers for food in future. Although such reusable boxes would save a great deal of wood (some of which is incinerated on Gough Island), the plastic boxes may become brittle with use or exposure to ultra-violet light over their expected lifetime. Unlike wood, such plastic is not bio-degradable. Broken pieces could easily accumulate in and around the Weather Station.

I **recommend** that if DEAT considers replacing the wooden koskassies with reusable plastic boxes, that it experiments with small numbers of them for some years on Gough and the other bases to test them for ultra-violet embrittlement, breakage with rough handling, and ease of cleaning, before committing itself to any change. The South African koskassie is a cheap, light, biodegradable or burnable container. It is well-adapted to its task, and should not be replaced without more research on the durability and possible environmental impacts of reusable containers.

Equipment provided through DEAT for use on Gough is packed inside large sealed metal containers. Some of them on the packing floor at the time of my visit had been hosed down on the concrete apron outside the depot after their return from previous trips, and were clean inside and out. Close examination with a torch revealed no sign of animal droppings or soil inside the fork-lift and helicopter-hoist cavities at the base and top ends of the containers inspected. These cavities are likely places for soil, seeds and insects to lodge. I **recommend** that they be squirted with pressure hoses when the containers are cleaned. These sealed metal containers, which are also used for the return of compacted wastes and other materials from the island, are an excellent and environmentally friendly innovation.

The clothing store at Paarden Island has racks of wooden shelving along the walls, and down the centre of the store, housing boots, clothing and bedding. It was clean and neat, but had an accumulation of fluff and other clothing residues on the concrete floor underneath the bottom racks and shelves. Fluff and wool are attractive to mice as nesting materials, and could provide cover or food for invertebrates such as insect larvae. I **recommend** that it be removed periodically by vacuum cleaning. No food is kept in the clothing store, although a small refrigerator presumably has food in it occasionally; but a bait station nearby showed no sign of rodent visits. No rodent droppings or grease smears were seen on the floor of this store, nor along the joists securing the shelves to the walls.

Wingfield: Public Works Department depot

This depot is situated in an old aerodrome hangar, surrounded by a concrete apron, with unmanaged vegetation outside the fenced perimeter. The area used for handling the PWD stores and equipment destined for Gough Island is paved by large concrete slabs, which have grass and herbs growing between them (photo 2). These obviously set seed later in the year. A large metal shed in which the packing takes place is reasonably clean, but not sealed against the influx of seeds or small intruding animals such as spiders, insects or rodents. I saw no animal droppings or grease smears along the metal walls, nor in the small compartment inside the shed used as a canteen, where food is stored in a refrigerator. There were some old cobwebs in the shed and the canteen, but no bait stations were set for rodents anywhere in this depot. No food is handled for packing here, but I **recommend** that some bait stations using strychnine or other quick-acting poisons should be kept here on a continuous basis, as recommended in the appendix to the 1994 report.

The large metal containers similar to those used at the Paarden Island depot, loaded on a trailer about to leave for the docks to be loaded aboard the *S.A. Agulhas*, were clean. They had been hosed down before being filled with equipment for the island. Four green cylindrical plastic water tanks, each of 2700 l capacity, waiting to be taken to the *S.A. Agulhas*, were lying on the concrete outside the shed near the boundary fence (photo 2). They were clean, and had no soil or seeds adhering to them, but were lying amongst weeds which should not be allowed to grow where such equipment is kept before shipment.

A thick growth of weeds growing between the concrete paving slabs here included the following species:

<i>Cynodon dactylon</i>	Bermuda grass	kweekgras
<i>Lolium perenne</i>	ryegrass	drabok
<i>Malva parviflora</i>	mallow	kiesieblaar
<i>Eleusine sp.</i>	goosegrass	osgras
<i>Vulpia bromoides</i>	ratstail fescue	
	langbaardswenkgras	
<i>Trifolium dubium</i>	suckling clover	
<i>Bellis perennis</i>	English daisy	
<i>Plantago lanceolata</i>	ribwort plantain	
	smalblarplantago	

This is not a complete list – many other plants could surely be identified later in the year. None of these species is yet established as a naturalized alien on Gough Island, but all of them (or their close relatives) grow on Tristan da Cunha. They would probably thrive on Gough Island, in a disturbed open site.

I saw no woody plants growing inside the paved area enclosed by the fence, but the Wingfield site is surrounded by a dense growth of wattles and other volunteer woody plants, some of which (including the aggressive *Acacia saligna*: "Port Jackson willow") are growing through the chain link fence. Wattle pods were lying on the concrete paving at the edge of the enclosure. Despite the exterior washing of the metal containers at Wingfield, the most obvious danger of unwanted introductions of plants to Gough Island arises from seeds of the species growing between

the concrete paving. I **recommend** that these intruding plants be scraped out, a total control herbicide applied, and the cracks sealed to prevent regrowth. Wattles and other vegetation should also be cut back from the outside of the fence surrounding the area used for the storage of PWD stores and equipment. This would also be a sensible precaution against wildfires damaging the fencing and materials stored just inside the fence.

Inspection of "A" berth dock warehouse and *S.A. Agulhas* berthing lines

On 17 August I visited the *S.A. Agulhas* at "A" Berth in the docks, where she was loading cargo for Tristan da Cunha and Gough Island. She had 13 lines securing her to the jetty, none of which had rat guards on them (Photo 3). By 22 August when the ship sailed for Tristan and Gough, rat guards had been mounted on some of the lines (Photos 4 & 5).

On both these visits, I looked into the adjacent warehouse where the cargo for Tristan was kept before loading. The back of "A" Berth warehouse was dirty: there was a large pile of maize going mouldy just next to the kiosk, and maize was scattered around the floor of the warehouse itself, and inside the pallets used for loading the ship. Clearly, there had been a cargo including maize loading or unloading from another ship before *S.A. Agulhas* berthed. I talked to the foreman of the warehouse (Mr Norman Higgo) who told me that the maize had been there for some time, but that he had never seen any rats feeding there or elsewhere in the warehouse. He stated categorically that there were no rats anywhere around, although he admitted that he was not there after dark when the warehouse was locked. I looked for rat droppings and grease smears with a torch around the maize and along the wall footings, but found no such direct evidence of rats having been there. The cargo for Tristan included a consignment of seed potatoes which arrived in the warehouse on 18 August, and was stowed in the fore peak aboard *S.A. Agulhas*. Potatoes, as well as maize, are attractive food to rodents, but I saw no evidence of rats having visited the stored potatoes before loading on 22 August.

On 22 August, when the rat guards had been fitted to some of her securing lines there was maize lying on top of the huge rubber tyres which serve as fenders keeping the ship's hull away from the wharf. Some back-spring securing lines lay near this fender, with the rat guard serving as a bridge for any rodent feeding on the maize to get aboard the ship (Photo 4). Any human activity on the jetty, disturbing a rat feeding in this situation could lead to its making its escape by running away from the jetty and up the securing line into the ship.

As a result of these observations, I conclude that despite formal efforts made to ensure that at least some of the cargo loaded aboard the ship was free of rats (see Swat service report of 14 August, Appendix A), and that *S.A. Agulhas* herself was free of rats on 1 August (see de-ratting exemption certificate, Appendix B), she was subsequently berthed in a situation where rats had easy access aboard. I **recommend** that the ship's officer responsible for berthing the ship should look inside the warehouse, and at the fenders, to ensure that they are clear of food or other attractions for rodents. If these are dirty, as they were in this case, the Port Health Authorities should be requested as a matter of urgency to have them cleaned.

Rat guards on the berthing lines are a more difficult problem. I discussed this matter with the Chief Officer in *S.A. Agulhas*, Mr Michael Fowkes. He told me that Cape Town docks presented special problems for berthing, because of strong winds and tidal rise and fall demanding more or less continuous attention to the securing lines. With few crew aboard when the ship is in port, and insufficient power to work the larger winches, many lines are used, and they have to be doubled up. Double lines render the conical metal rat guards useless (photo 5). Mr Fowkes suggested that inquiries be made about substances which are offensive to rats but not to humans, and which are not dangerous to handle. Such rat-repellent substances could be painted on the securing lines, or incorporated into the synthetic fibres of the ropes. I **recommend** that this unsatisfactory situation regarding rat guards on securing lines at the Cape Town docks, and the state of cleanliness of the dock warehouses, be brought to the attention of the Port Health Authorities.

The "De-Ratting Exemption Certificate" issued by the Port Health Officer does not indicate whether there were any rats aboard *S.A. Agulhas* at the time of issue. Its title suggests that the ship is exempted for the need to be de-ratted, but no indication is given of the methods used to determine whether rats were present in the parts of the ship listed on the reverse side of the form. Bait stations, poisons, grease smears, and faeces are not mentioned. No reliance can be placed on the bland statement "none" in the columns labelled "Rat Indication" and "Rat Harbourage", if the methods by which these determinations were made are not mentioned. The form states "No Such Space" against the item "Quarters (Cabin Passengers)", but there *is* such space aboard the *S.A. Agulhas*. I have myself lived aboard the ship in a passenger's cabin for ten days. *Prima facie*, this "De-ratting Exemption Certificate" has little to do with the demonstrated presence or the experimentally inferred absence of rats aboard the ship. I **recommend** that a systematic baiting for rodents be instituted aboard *S.A. Agulhas* before the Gough Island takeover voyage, and that reports of the results of such baiting be made mandatory in any de-ratting certificates issued to the ship.

General comments on pre-shipment surveillance of food and equipment taken to Gough Island.

The above comments, and the major thrust of previous environmental inspectors' reports concerning the possible introduction of new species to Gough Island, have concentrated on more or less conspicuous plants and animals which are known as aggressive invaders of natural habitats, and which move easily in association with human activities. This is a sensible approach to quarantine, drawing on past experience of island invasions by human introductions. Apart from the import of *Tribolium* (flour beetles, which I see as a domestic housekeeping problem outside the scope of this report), little attention has been paid to arthropods, or other invertebrate animals which are known to be moved around readily by humans, and whose effects on the natural environment in Gough Island may be considerable.

Spiders, and insect pupae easily lodge within the equipment cabinets, especially where these are warmed by the electrical apparatus they contain (e.g. computer cases, refrigerator heat pumps and compressors). I saw no ants or spiders (and few cobwebs) during my inspections of the DEAT & PWD packing depots. There are no native ants in any of the Tristan-Gough islands, but introduced ants have been an occasional nuisance at the Tristan settlement since the 1960's. Argentine ants (*Iridomyrmex humilis*) are now widespread in temperate continental regions, and could easily be introduced to Gough Island, where they might have large impacts on the native invertebrates. The venomous Australian red-back spider (*Latrodectus mactans hasseltii*) was taken half way round the world from Australia to Tristan da Cunha in 1968 inside electronic equipment (see Appendix C). The related South African button spider (*L. geometricus*) could easily take up residence inside similar equipment to be taken to Gough Island, when stored at Paarden Island, Wingfield, or elsewhere.

I **recommend** that cabinets of electronic, and other equipment such as refrigerator heat pumps which provide artificially warmed situations attractive as shelters for invertebrate animals, should be cold-treated or fogged with insecticide shortly before their shipment to Gough Island. An entomologist with skills in identifying small invertebrates which associate easily with humans ("inquilines"), should look over the equipment that is to be shipped to the island before it is embarked in the *S.A. Agulhas*. Such a person could be briefly employed in Cape Town before the formal annual inspection, to provide expert advice.

AT SEA

Cargo aboard the *S.A. Agulhas*

Because of the proximity of the Tristan seed potatoes to the maize in A Berth warehouse, I made several visits during the outward voyage to the fore peak, where the Tristan potatoes were stowed. I saw no signs of rat gnawings or droppings in and around them, during torchlight inspections of the sacks of seed potatoes on their pallets.

Accidental plant dispersal to the island on boots & shoes

Plant seed may be introduced to Gough Island unintentionally on the clothing and footwear of visitors. Such carriage can not be prevented, but it should at least be understood so that control measures can be put in place. I asked everybody who was going ashore on Gough, to brush out the welts and soles of the boots and shoes that they would be wearing. This material was later given to Professor Peter Linder of the Botany Department at the University of Cape Town, to see what plants may germinate from the brushings in a controlled experiment in a growth chamber.

Discussions with the Tristan da Cunha Administrators

During the outward voyage, I wrote an overview for the Administrator entitled "*Cargo for Tristan loaded aboard S.A. Agulhas at Cape Town Docks, 22 August 1995*". I discussed with Mr Alan Waters the dangers of moving rats or other alien animals or plants from Tristan to Gough Island. These, and other matters discussed with Mr Waters on the outward voyage, and with Mr Bernard Dalley on the return, which are relevant to this report were:

- i) the impending declaration of Gough Island as a World Heritage site;
- ii) the difficulty of maintaining an environmental overview of Gough Island when visits by qualified scientists are limited to the brief take-over period in winter or spring;
- iii) the possible presence of rodents aboard the fishing vessels operating around Gough Island, and measures that could be written into the new fishing concession to monitor their presence, because of the dangers of shipwreck on the island;
- iv) the policy of the Tristan Administration concerning visits by yachts and cruise ships to Gough Island.

ON GOUGH ISLAND

People landed on Gough for the take-over period

Twenty-seven people landed at the Weather Station for the take-over, including the seven members of Gough 41, replacing the same number in the Gough 40 team. The total number of people ashore during the period August 30 to September 7 was 34:

Department of Environmental Affairs & Tourism - 5

Department of Public Works - 5

Weather Bureau - 3

Support Personnel - 4

Visiting Scientist - 1 (Dr Marthan Bester, Department of Zoology & Entomology, University of Pretoria)

Gough 40 team - 7

Gough 41 team - 7

U.K. Environmental Officers - 2 (Mr Jimmy Glass, Chief Islander & Environmental Officer, Tristan da Cunha; and Dr Nigel Wace, Australian National University).

The ship's doctor, who came to look over the medical supplies, spent a night ashore. Other people from the *S.A. Agulhas* visited the Weather Station briefly during the take-over period, but none slept ashore.

GENERAL STATE OF THE ENVIRONMENT AT THE WEATHER STATION

Inside the buildings

The weather station and its immediate surrounds were clean and tidy on our arrival. The Gough 40 team had obviously worked hard to make them so, and this impression of cleanliness and good order was generally reinforced by closer inspections throughout the week I was ashore. The team said that they managed to keep mice out of the Gough House, and had not seen any evidence of rats. I saw no rodent droppings or grease smears in any of the buildings. There was no evidence of other animals commonly found as human domestic associates. In particular, there were no cobwebs: it is doubtful if any of the common domestic web-building spiders is present on the island yet. This is especially important in relation to *Latrodectus geometricus*, the Cape Town button spider (see above & Appendix C).

Outside the Buildings in the Logistic Zone

A closer inspection of the Weather Station surrounds, confirmed my initial view that the environment had been well looked after. No discarded metal cans, plastic, paper or other rubbish was evident. Building material from previous construction, and old metal gratings had been assembled near the crane for removal from the island. I saw no evidence of oil leaks from the generator huts, fuel stores, or elsewhere.

The Gough 40 team had gone to a great deal of trouble rooting out all the broad-leaved docks (*Rumex obtusifolius*) growing around the paths and buildings. While this shows a commendable attitude towards maintaining a pristine environment, it will not get rid of the plant locally, nor lead to a more general reduction in its abundance on the island. *Rumex obtusifolius* is completely naturalized on Gough Island; it sets large amounts of seed, its seedlings are abundant and its massive rootstocks impossible to remove without disturbing the surrounding vegetation. The species has to be accepted as part of the flora. If it is necessary to get rid of the docks because they cover stored equipment or pathways the stems should be cut back to the rootstock. No weedicide of any sort should be sprayed or broadcast on this species, or any other plants on the island. Pieces of rootstock or cut shoots should be incinerated.

All plants near the catwalks and buildings (whether thought to be native or alien), should be cut back if they interfere with essential activities or make access difficult. I **recommend** that vegetation by the metal cat-walks should be trimmed at more than 10 cm above ground level, rather than uprooted. Any exposure of peat should be avoided because of the opportunities this would provide for the germination of seeds of newly-arriving species of alien plants. Except for potatoes (persisting from former cultivation) and thistles (*Sonchus* spp.: sydisse), no further attempts should be made to root out plants which are thought to be aliens.

If members of the Gough 41 and later teams are uncertain about the status of any plants that they encounter near the Weather Station, I **recommend** that they harvest the seed-heads and burn them in the closed incinerator, but preserve some complete dried specimens by pressing them between paper in the science laboratory. Such collections should be accompanied by a label stating when and where the plant was found, and handed for identification to the U.K. Environmental Inspector at the subsequent annual takeover. It is important that present constraints on the col-

lection of specimens in the Management Plan for the Gough Island Wildlife Reserve (section 5.8.2) do not frustrate the early identification of alien plants or the prevention of their reproductive spread as early as possible.

The areas between the balloon launching platform and the satellite hut which have been contaminated by residues of potassium hydroxide and aluminium, and between the fuel tanks and the generator shed, should be re-vegetated. Hummock-sedge and hard tussock, whose stools grow clear of any remaining pollution, would be best for this purpose. I **recommend** that such limited gardening be permitted, transplanting sedge and tussock stools from within the Gough House enclosure or from near the incinerator. The pH of surface water draining these contaminated areas should be checked at subsequent takeovers, to see how far it differs from the more general values of 5-6 for surface runoff in fernbush vegetation.

Existing Structures away from buildings at the Weather Station

Helicopter Pad

This is showing signs of age, and will need refurbishing soon if it is to remain serviceable. The wooden structure has sagged, and now has an undulating surface which is slippery when wet. Water lies just beneath the sodden boards, and is squeezed out when trodden on.

To remove this entire structure, whose sides measure 30 m, would be a major operation, involving removal of a large amount of wood, and tarred underfelt laid beneath the wood surface. The disposal of a large bulk of sodden wood itself present an environmental problem. Firing it on site, or anywhere else on the island is unacceptable. Exposure of the peat underneath the present structure would present an area of 900 m² to colonizing plants, most of which will be alien species such as broad-leaved dock (*Rumex obtusifolius*), farm grass (*Holcus lanatus*) and creeping bent (*Agrostis stolonifera*), which are already well-established around the Base. An initially bare patch of ground just where people and goods arrive on the island, would offer new intruding species an easy means of gaining a foothold without competition from the established native plants. If the existing helipad were removed, another pad would have to be constructed, thus adding to the environmental impact of human activities on the island.

I **recommend** the proposal put to me by Mr Scottie Morrison, the leader of the PWD team, that a metal helicopter pad should be placed on top of the existing wooden deck (which would be left in place) by drilling holes through the decking and driving stainless steel supports down to the rock underneath. The minimum dimensions required for the landing area of a Puma with a rotor diameter of 15.09 m is a square with minimum sides of 22.63 m (rotor diameter x 1.5), or an area of c. 512 m². The area of some 400 m² outside a new raised metal deck could still be used for baggage and waiting passengers, as the edge of the wooden deck is used now.

Upper Magnetometer Hut foundations

The concrete base of this hut is now almost overgrown by farm grass (*Holcus lanatus*), and the native plants dog catcher (*Acaena sarmentosa*), hummock sedge (*Scirpus sulcatus*) and bracken (*Histiopteris incisa*) are smothering the site. A few metal supports cut off near ground level and an upstanding block of concrete on which Mr Jimmy Glass is standing in photo 7, are the only visible remains of the hut. I **recommend** that these remains be left undisturbed, but that a visual record of the process of recolonization by native plants is kept by repeated photography of the site. None of the newly arrived alien plants which were first recorded here in October 1984 was seen in August 1995, but this visit was too early in the season to find the short-lived annual/biennial species (*Conyza floribunda*, *Lactuca serriola*, *Lolium multiflorum*). The perennial *Senecio burchellii* was not seen at the hut site, or along the nearby streamsides.

Aerial arrays.

The aerial arrays at the Weather Station have attracted attention in past reports, because of the hazard they present to birds. Following discussions with Mr Gert van Eeden, Leader & Radio Technician of the Gough 40 team, I **recommend** as follows:

- a) The single-line aerial running W-E from a mast near the south corner of Gough House (by the radio room) to another mast north of the skivvygat, was not used in 1994-5. It should be removed.
- b) The similar single-line aerial which runs more-or-less N-S from a mast outside the met office to near the cliff-top, was in daily use. The guys supporting the masts for this aerial should be flagged so that bird strikes by day are reduced.
- c) The single wire aerial serving the emergency radio shack is essential for that facility and should remain, but its guys should be flagged.
- d) The V-beam system near the helipad was not used in 1994-5, and should be dismantled and removed.

- e) The rhombic array is in use, but could be replaced by a smaller double inverted V system, presenting a smaller hazard to birds. I **recommend** that this change be made, subject to an environmental impact assessment for the new structure, which must be made to the Tristan Administration.

Aerials and/or their guys can be flagged with fabric strips or plastic spheres. Pending the possible replacement of all radio aerials by a Yagi transceiver system, aerials b, c & e must remain. Once this is brought into service, the unwanted aerials should be dismantled and removed.

Anemometer mast and stays

There are two anemometers at the Weather Station: one on the roof of Gough House has a read-out in the met office underneath; the other, on a large mast in front of Gough House, conforms to the international standards for measuring wind, and is necessary for the formal logging of wind speed and direction. The mast and its stays present a hazard to birds, but this can scarcely be avoided if wind data are to be properly recorded. As with the radio aerials, I **recommend** that the anemometer guys should be flagged.

New Structures

Four new 2700 l plastic water tanks were installed on new decking on the existing metal scaffolding behind Gough House. I inspected the new hardwood decking, which was free of borers or other obvious defects. Some alien woodlice (*Porcellio scaber*), already recorded from the island were found in the old decking. The new tanks themselves had been inspected previously at Wingfield. The old metal scaffolding was later cut down to the size needed for the new tanks, but the butt ends cut off close to the surface of the peat. The wood from the old decking and the asbestos tanks were removed by helicopter. Some broken asbestos fragments and the butt ends of metal scaffolding remained in the peat. I **recommend** that these be removed at the next takeover.

Routine imports of consumables

Food

I watched off-loading of fresh fruit and vegetables from the ship on 2 September. The following were noted: onions, apples, pears, carrots, pumpkins, zucchini, garlic, grapefruit, oranges, tomatoes and potatoes. All were washed and appeared clean and in good condition, except for some mould on the pumpkins and zucchini. I saw no insect eggs or larvae in the few I examined. There were no fresh leafy vegetables, except for frozen broccoli and cauliflower tops supplied as "stir fry" packs. All root vegetables were washed, and free of soil. Six boxes of eggs followed by frozen meat also came ashore. I was satisfied that all the food packaging and the fruit, vegetables, eggs and meat themselves were clean, in so far as it was possible to tell in a hurried visual sampling between their landing in the helicopter sling (Photo 6) and transfer to the cold store.

Koskassies of canned and dried food which had been shipped to the island in previous years, but which had not been consumed or had passed their "use-by" date, were assembled in the emergency base for removal by helicopter. This regular removal of surplus food (and other surplus materials such as unused or obsolete equipment) is very important in preventing the establishment of *de facto* rubbish dumps. I commend this activity, and **recommend** that compiling lists of surplus food and equipment should be undertaken throughout the year, and that the listed items should be checked off the island at the annual takeover. A tendency for unwanted stores to accumulate at the Weather Station will thus be eliminated.

Fuel

Polar diesel fuel was pumped ashore on 4 September. The ship anchored close under the cliffs, but as in previous years some couplings in the floating fuel line parted. The first break occurred while air was being blown through the line, and no oil slick could be seen from the cliff top (Photo 8). Later problems with valves on the pump aboard the ship caused further delays, but 80,000 l of polar diesel was pumped into the holding tanks before dark. If any oil was spilt in the sea, the quantities were very small. No spillages were noted ashore.

Any change in the arrangements for pumping oil ashore which reduces the likelihood of breaks in the fuel line, would be welcome. Placing a large reel ashore, from which a continuous length of heavier gauge pipe than that presently used, can be run out to the ship, is probably the best way of avoiding these recurrent problems with broken lines when pumping fuel. I **recommend** that this idea, which has the support of the ship's engineers, and PWD and DEAT staff, be investigated further. Preliminary work on its implementation should start during the 1996 take-over.

Waste Management & Pollution

Solid Wastes

Waste bins were set out in the kitchen, bathroom, and elsewhere on the base, segregating biodegradables, plastic, metals and burnables. I noted that the appropriate bins were used, at least during the take-over period. The arrival of a new compactor should make it easier for the team to consolidate wastes, but it arrived too late for me to see it in operation. Metal cans are still crushed by a hand-operated lever at the back of the kitchen. The crushed cans fall into old koskassies or larger wooden boxes, from where they are taken to the containers at the crane site. This system seems to be working satisfactorily. The Gough 40 team were well aware of the importance of segregating solid wastes, and I stressed the matter with the new team.

A problem will arise with the compaction of metal cans which have food remaining in them when they are flattened, because food squeezed out of crushed cans will be attractive to rodents and other scavengers. I **recommend** that food cans are washed out before crushing. It is important that the containers with compacted wastes are kept closed on the island, and that they remain so until they reach Cape Town.

Liquid Wastes: Sewage and Waste Water

During the takeover, the wooden supports carrying the sewage line from Gough House to Skivvygat were replaced by braced metal pipes driven into the peat. This should prevent breakage of the line, and subsequent leakage into the local vegetation, as has occurred in the past. Effluent from the end of the pipe falling into the skivvygat sometimes blows around in the wind over the incinerator pad and towards the maintenance building and power shack. This is unsanitary, and could become a health hazard. I **recommend** that the end of the sewage and grey water line be turned down, so that it runs at least three metres into the mouth of Skivvygat.

Liquid wastes which are not biodegradable include the highly alkaline wastes from hydrogen generation made by mixing aluminium chips and potassium hydroxide in the presence of water. These are stored in special plastic containers, and were removed from the island in sealed metal containers. Some drums of used photographic chemicals in the laboratory were not removed. I **recommend** that an inventory of all items to be removed from the island be compiled before the annual takeover, or small items of this sort can be left behind.

In addition to domestic soap and soap powders, a variety of detergents, cleansers and bleaches were in use in the weather station. Those seen were:

Detergents: "Soft Touch" fabric softener (Davosol)

"Sta Soft" fabric softener

(Colegate/Palmolive)

"Omo" (Lever)

Cleansers: "Windowlene" active ammonia

"Handy Andy" ammonia based

"Zeb" caustic soda oven cleaner

"Bowl San" toilet bowl cleaner

Bleaches: "Cremark"

Disinfectants: "Biocidol" (Lever Industrial)

None of these had any indication of the possible effects of their release into the local environment (e.g. phosphate in detergents).

Surface polishes, insecticides and air fresheners in pressure-pack sprays included:

"Duster-plus" surface polisher (Johnson)

"Haze" lavender smell air freshener

"Airoma" air freshener (CGP Holdings)

"Preen" (Reckitt)

"Doom" insect spray

Some of these canisters carried labels stating that they "contained no propellant alleged to damage ozone", or that they were "ozone friendly", or were "AMA approved".

These lists of cleaning fluids and biocides in use at the weather station, indicate an *ad hoc* and demand-driven approach to the supply of materials, which may have undesirable effects on local and global environments. I **recommend** that future supply of all detergents, disinfectants, cleansers, biocides and liquids delivered in pressure pack canisters are screened for their environmental impact, before shipment to Gough Island.

Fires: Prevention and Management

Wildfires originating from the weather station and burning the peat mantles are a major potential hazard for the natural environment. I **recommend** that the open incinerator which was improperly in use during the takeover (photo 9) should be dismantled and removed, because of the danger of sparks setting fire to the nearby stools of hard

(*Spartina*) tussock. Only the closed incinerator should be used to burn chicken carcasses, and other wastes which can not be disposed of down skivvygat or shipped off the island.

Mr Scottie Morrison (PWD Team leader) removed the automatic halon fire extinguishers installed in the generator sheds, and shipped them off the island. He said that he would get advice on replacements, using fire suppressants which are not damaging to stratospheric ozone. I commend his action. Some automatic suppression of fires starting in the generators is imperative because of the dangers of fires fed by diesel fuel, spreading into the native vegetation and peat mantles. It is therefore important that environmentally friendly replacement extinguishers are installed during the 1996 takeover, and I **recommend** that this be done.

Eight samples of peat which had been taken from the sides of a 2 m hole excavated by the PWD near the SW corner of Gough House in November 1976, have recently been examined in the laboratory in Canberra for carbon ash particles. None was found in peat layers dated at 650, 870 and 3135 radio-carbon years before present (Geochron Lab, GX5027). This negative evidence can not be taken as proof that wildfires have never occurred on Gough Island within the last few thousand years. The work suggests that fires were not frequent before the human discovery of the island, over a period when its vegetation (from the pollen record) appears to have been similar to today. It reinforces the importance of preventing wildfires escaping from the Weather Station.

THE ENVIRONMENT AWAY FROM THE LOGISTIC ZONE AT THE WEATHER STATION

Terrestrial

Tracks to Seal Beach

These are the most heavily used paths outside the logistic zone, and become little more than slushy gutters which are very muddy after rain. Because of the free-draining peat and the growth form of the hummock sedge (*Scirpus sulcatus*), erosion of these tracks in the hummock sedge country is minimal. Protective treatment there is not necessary, but I **recommend** that standing ropes should be provided on steep pitches leading down to the stream, where the peat is being stripped off the rocks by walkers scrambling up and down these slopes. Standing ropes already in place on the tussock cliffs should be maintained, both for human safety and to protect the tussock grasses from destruction by cliff scramblers.

Tracks to Tafelkop and South Peak

Mr Jimmy Glass told me that the "Golden Highway" through the forest along the stream leading to Tafelkop is little eroded by walkers, who stay largely on the rocks in the streambed. The steep slopes above the forest under the eastern edge of Tafelkop are badly eroded, with peat slipping down-slope in heavily trampled places. During the 1996 takeover, consideration should be given to placing standing ropes across the most damaged slopes under Tafelkop, in order to keep the damage from walkers to a narrow zone, rather than spread it across the slippery slope. The alternative path from the Weather Station to Tafelkop up Ruin Ridge is seriously eroded, and should be avoided by walkers to prevent more damage until a policy can be agreed on this difficult matter of preferred access routes to the peaks, with minimal damage to the vegetation.

Stripping of peat from steep slopes above the forest, and resulting erosion along pathways, will become increasingly serious environmental problems in future. I **recommend** that the old metal gratings now being progressively replaced along the catwalks at the Weather Station be retained on the island for future use on the worst parts of the eroding upland paths.

Marine

The Gough 40 team reported the presence of plastic bottles, polystyrene fragments, rope and fishing buoys at Glen Beach, where they also encountered an entangled fur-seal which they could not release. Whales were seen offshore in November, and again in late August, and a school of dolphins at Christmas. No oiled seabirds were seen on the beaches. Occasional fishing took place during the year from mainland rocks near The Admiral, where 17 snoek were caught on 4 September.

There were no fishing ships at Gough during the *S.A. Agulhas'* visit, and the Gough 40 team had little contact with them during their year ashore. Mr Shane Rainbird (radio operator) contacted ten vessels near Gough during the year. These were all passers-by, not lee-seekers, and did not come close inshore or attempt landings. They included three cruise ships, three research ships and at least two commercial carriers. Names of these vessels, and such details as could be obtained about their cargoes and destinations, were passed to Tristan weekly.

ENVIRONMENTAL MANAGEMENT OF GOUGH ISLAND AS A WORLD HERITAGE SITE

This is the fifth of the annual reports to the Tristan da Cunha Administration on the state of the environment at the South African weather station on Gough Island. Unlike the previous reports, it has been written by someone with a long experience of the island, and who is familiar with its vegetation and flora. I was botanist of the Gough Island Scientific Survey 1955-56 and am author of most of the descriptive scientific papers on its plants. Since this primary survey 40 years ago, I have been back to the island four times, all based at the Transvaal Bay weather station at the annual takeovers in May 1968, November 1976, October 1984 & September 1995.

The South African authorities are now making a determined effort to prevent damage to the native ecosystems resulting from their operation of the weather station on the island. Their awareness of potential environmental problems and the practical measures taken to exclude unwanted introductions have improved greatly since the 1950s (when goats and sheep were landed at the Glen), the 1960s (when poultry were kept at the weather station), and the 1970s. During this 1995 study, I have been impressed with the rigor of surveillance by the DEAT and PWD over necessary imports to the weather station, but the stringency of de-ratting procedures at the Cape Town docks, aboard the *S.A. Agulhas*, and in the fishing vessels operating around the island needs to be increased. The personnel at the weather station are fully aware of their responsibilities in looking after the island, but they lack the scientific understanding to make continued observations which future conservation of the island requires.

This postscript to my most recent (and briefest) visit, looks at the long-term management of the Gough Island environment as it is effected by the South African weather station, and with the declaration of Gough Island as a UNESCO World Heritage site in December 1995. The Management Plan for the Gough Island Wildlife Reserve has been the frame of reference for this and previous reports. It outlines the existing regulations and provides guidelines for future human activities on the island, but it is not underpinned by adequate knowledge of the native plants and animals, or an understanding of the natural ecological processes which World Heritage management must seek to perpetuate. There is a danger that adherence to the provisions in the Management Plan and in these Annual Reports may be seen as adequate to protect the island environment indefinitely into the future.

Referring to the management of national parks and other wilderness areas in which the plants and animals are protected (such as World Heritage sites), the ecologists Fraser, Darling & Eichhorn stated in 1967 (IUCN publication 7 (1), p.102):

“Those who must manage and superintend, but who are not ecologists, should realise that there can be no manual or handbook by which one can act by referring to page and paragraph. Every national park is unique, every problem is a different species, even if the genus is a big one. We are doing a detective’s job all the time – recognizing trends before they become torrents, finding indicators among plants and animals, or even among communities of plants and animals, on what is going on in the state of the environment with which they are unfamiliar”

Management of the Gough Island weather station within a World Heritage regime will demand more complete information about the biota and the ecological processes on the island than presently exists. In particular:

- a) A more complete inventory of the island’s plants and animals is needed, especially its vascular plants and bryophytes. Most of the island has never been explored or its biota systematically collected or investigated by scientists.
- b) The numbers of species, and the size and density of the huge seabird populations have not been adequately investigated. Close observations of seabirds are particularly important because of the information they can provide on the health of the surrounding oceans in which they feed. Plant nutrient imports to the island are obviously important in maintaining the vegetation, much of which is almost literally ploughed and fertilized by burrowing seabirds.
- c) The dynamics of peat formation and erosion are little understood, although these processes are fundamentally important in habitat maintenance for the ground-nesting seabirds, and in preserving vegetation cover subjected to human trampling on steep slopes.

Although the meteorologists at the weather station are aware of their responsibilities in looking after the island, but they do not have the time or the scientific training to make systematic scientific observations of this sort. Compiling these inventories and investigating these ecological processes will require residence of qualified scientists throughout the year. Little is achieved by quick visits of visiting scientists during the annual takeovers.

Recognition of Gough Island as a World Heritage site incurs a continuing responsibility on the part of the Tristan da Cunha Administration beyond the Conservation Ordinance, the imposition of regulations and the Management Plan, to increase scientific understanding of the island so that it can be adequately managed. This has implications for the future use of the Weather Station in a World Heritage setting.

ACKNOWLEDGEMENTS

I am grateful to Mr Jimmy Glass for much help on Gough Island. Also to Mr Richard Skinner of the South African Department of Environmental Affairs and Tourism and Mr Scottie Morrison of the Public Works Department, the members of the Gough 40 and 41 teams, and the officers in *S.A. Agulhas* and the helicopter pilots and crews attending the Gough 29/30 and 40/41 takeovers, for their cooperation ashore and afloat.

Dr Marthan Bester, Dr Peter Linder, Dr Mike Picker, Dr Brian Rodriguez, Dr Peter Ryan, and especially Mr John Cooper, provided much assistance in South Africa. I am most grateful to them. Peter Ryan kindly formatted the final version of this document.

APPENDICES

A) *Swat pest control service report for Paarden Island (see attached)*

B) *De-ratting exemption certificate for S.A. Agulhas (see attached)*

C) *Venomous Australian spiders introduced to Tristan da Cunha with electronic equipment in 1968 (see attached)*

D) *Coastal retreat under wave attack at Transvaal Bay*

The collapse of the archway in 1992 continues, with large pieces of rock now precariously poised to crash to the beach below. This collapse of the cliff appears to present no immediate threat to any part of the Weather Station at present, but it draws attention to the natural process of coastal retreat, especially near the crane site and the emergency base.

The massive trachyte rock underlying the 2 to 3 m peat mantle on which the Weather Station is built seems to present a secure foundation for all the buildings. A close stereoscopic examination of air photographs taken in 1984 shows that the region between the old archway and South-east Point contains a number of collapse features, such as blowholes and drainage sinks (e.g. skivvygat). The rock-bridged stream on the path to Seal Beach indicates that some drainage takes place within the lavas. The absence of an ordered drainage pattern around the Weather Station, and the few streams running down the cliff-face to the sea also suggests that (as in much volcanic terrain), the rock surface is permeable, and that water does not all drain down slope at the peat/rock interface, but disappears down crevices in the rock itself.

These features might not be a source of concern if the sea cliffs had a continuous beach at their foot to absorb and disperse wave energy. But the coast from the old archway to the precipices near the oil tank where the fuel is pumped ashore, is fronted by plunging cliffs with deep water immediately offshore, and without any tumble-down or boulder beaches protecting the cliff faces from wave attack. According to the Gough 40 team, Gough House shudders when a big swell is directly pounding the cliffs, in the absence of strong winds. This suggests that the whole area between Gough House and the plunging cliffs may be honeycombed by crevices in the rock into which air is compressed by wave action. The crane and the Emergency Base, so close to the edge of the plunging cliff, may not be so solidly founded as they appear.

Coastal retreat under wave attack is episodic, characterised by sudden collapses. I **recommend** that the advice of a coastal geomorphologist who is familiar with volcanic terrain be sought. Seismic investigations could be made to discover how sound are the foundations of the crane and nearby buildings, and tilt-meters installed to give an indication of any small movement of the rock surface. A close watch should also be kept on the concrete apron around the crane, to see if any cracks are evident.

Some high quality air photographs of the Weather Station would be valuable in any scientific assessment of the stability of the land on which the Weather Station has been constructed (See Appendix E).

E) *Air photography of the weather station at annual takeovers.*

The plan of the Station and the stereo-pair of photographs presented here* are from a run of photographs taken by the author from the Puma helicopter at 0900 on 23 October 1984, during the 1984 takeover, before the collapse of the archway. The opportunity presented by good weather and the friendly cooperation of the South African helicopter pilots was used informally to get a run of photos with a low morning sun, so that the cliffed coast was not in shadow. These amateur shots taken with a Hasselblad EL/M camera have proved useful in local terrain analysis (see Appendix D), and for indicating the state of the vegetation cover where it is most likely to suffer from human disturbance. A series of such photographs of the Weather Station taken every few years, would be most useful as a yardstick in assessing human impacts.

I **recommend** that a suitable camera be taken to Gough Island at each annual takeover, so that air-photos of the Weather Station and the pathways to Tafelkop can be obtained when weather conditions allow. An elaborate and expensive programme of air photography using highly trained people and large specialised cameras is not necessary. An opportunistic approach, making use of cloud-free periods when the helicopter is available, are all that is needed to secure a visual record of changes in vegetation and landforms near the Weather Station.

F) *Collection of mice for immuno-contraceptive research by C.S.I.R.O. vertebrate pest biocontrol centre in Canberra, Australia.*

Twelve Elliott traps were set near the Weather Station on two nights during the takeover. These 24 trap-nights yielded 18 mice. Three were caught at the base of the aerial mast near the incinerators, two at the corners of the helipad, four behind the Archway beach near the Seal Beach track. The other nine mice were caught at the top of the penguin rookery on the south side of Seal Beach. Mr Jimmy Glass was a very great help in this work.

Blood serum from these mice was separated from the plasma, chilled, and subsequently freeze-dried in Cape Town; then taken together with the corpses to Canberra. Antibody analyses of the blood samples, and examination of the corpses for parasites, may be useful in engineering a virus to control fertility of the mice on Gough Island, and other places experiencing mouse plagues. *

* Two aerial photos were presented, but did not reproduce adequately. Their captions are as follows:

- A: The weather station on 23 October 1984, before the collapse of the archway. The satellite communication shed north of the balloon launching platform, and changes to the launching platform itself are the only substantial alterations or additions to the buildings made since this photograph was taken. The helipad is 30x30 m.
- B: Stereopair airphotos of the Weather Station, 23 October 1984. The archway opposite the crane site collapsed eight years after this photo was taken. Other collapse features evident in stereo-view are skivvygat, the drainage hole near the balloon launching platform, deep cavities behind the cliff-tops, and steep-sided depressions without drainage exits between the helipad and the sea. (To be viewed with a small stereoscope, 55-75 cm eyepiece separation).