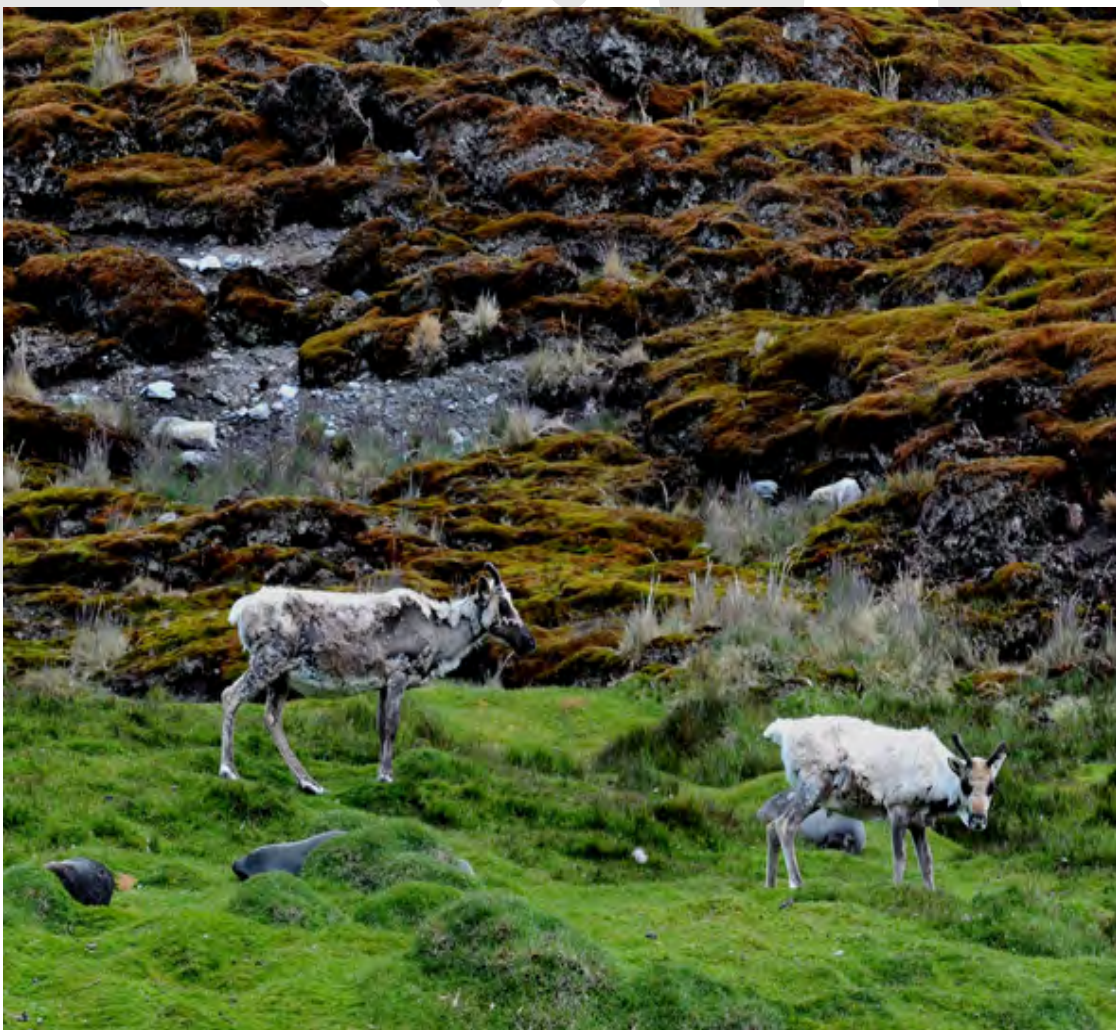




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Report from reconnaissance January 1st - 31st 2012 regarding eradication of reindeer on South Georgia



Report 2012 – 1

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Frontpage photo

Reindeer grazing on *Poa annua*, an alien invasive grass species on South Georgia. The degraded mossbank above has replaced tussac stools being overgrazed by reindeer. Hound Bay, Barff Peninsula, January 7, 2012. Photo: Carl Erik Kilander.

Foreword

The reindeer population on South Georgia is the result of introductions from Norway starting about a hundred years ago. Over the last decades it has become apparent that the reindeer herds originating from these introductions are seriously threatening native plant communities and a number of animal species on the island. Following a wide consultation, the Government of South Georgia and the South Sandwich Islands (GSGSSI) took the decision in early 2011 to responsibly and humanely eradicate the reindeer from South Georgia. By March 2011 an expert advisory group was established to inform the most appropriate way to achieve the eradication, with reference to best practice guidelines around the world.

Senior Adviser Carl Erik Kilander from the Norwegian Nature Inspectorate (part of the Directorate for Nature Management) and professor Bernt-Erik Sæther from the Norwegian University of Science and Technology (NTNU) were participating members of this advisory group. These members proposed a method based on Sámi traditional knowledge: herding and corralling the reindeer, succeeded by a controlled culling, and emphasized that this solution would render possible a recovery of reindeer meat and possibly other commercially valuable parts, given that a satisfactory market could be found. It was agreed by Government of South Georgia and the South Sandwich Islands (GSGSSI) that the proposed method of herding and corralling should be investigated further.

With reference to the Norwegian proposal the Norwegian Nature Inspectorate (a division of Directorate for Nature Management), was requested by GSGSSI to do a reconnaissance to survey the reindeer and their habitats on South Georgia, with the aim of assessing the feasibility of herding and corralling the reindeer prior to eradication.

During the period January 1 – 31, 2012 Adviser Henrik I. Eira and Senior Adviser Carl Erik Kilander from Norwegian Nature Inspectorate undertook nineteen days of reconnaissance on the two peninsulas inhabited by reindeer on South Georgia, Busen and Barff (encompassing areas towards Royal Bay). This report sums up the output of the reconnaissance and concludes with a number of recommendations to be considered, as a basis for the further planning of herding/corralling and eradicating the reindeer on South Georgia. The recommendations are based on Sámi reindeer herders' traditional knowledge and the impressions gathered during the reconnaissance.

During their stay on South Georgia Mr. Kilander and Mr. Eira greatly benefited from the cooperation, accommodations and transport services provided by local GSGSSI representatives and personnel from British Antarctic Survey (BAS). For this we extend our sincere gratitude.

Trondheim, Norway, May 2012



Reidar Andersen

Director - Norwegian Nature Inspectorate

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1 Abstract

Chapters 2-3 of this report gives a background and explain the necessity of eradicating the reindeer on South Georgia. **Chapters 4-14** describe outputs, assessments and recommendations from a reconnaissance of the reindeer herds and their habitats during the period January 1st-31st, 2012. The reconnaissance was undertaken by Norwegian Nature Inspectorate (SNO) on request from Government of South Georgia and South Sandwich Islands (GSGSSI). The main results can be summarized as follows:

- The main areas inhabited by reindeer on South Georgia were assessed. Approximately 2150 reindeer were counted during the reconnaissance: approximately 800 on Busen and approximately 1350 on Barff (encompassing areas towards Royal Bay). As some areas were not completely covered by the survey, the report indicates a likely minimum of approximately 1000 animals on Busen and an anticipated minimum of 2000-2500 on Barff/Royal Bay. The level of uncertainty of the figures is higher regarding the Barff herd than that of the Busen. Based on the reconnaissance and looking at surveys from previous years, the report indicates a likely minimum summer population of reindeer on South Georgia of 3000-3500 reindeer (January 2012).
- The attached reconnaissance maps show the number and distribution of reindeer and their main track patterns and also include recommended areas for gathering and corralling, as well as the routes along which the herding is likely (or possible) to be carried out. The maps also show areas recommended for eradication by ground shooting.
- Based on the reconnaissance, herding and corralling is considered a feasible method for eradicating the great majority of the two herds on the island (Busen and Barff/Royal Bay). Ground shooting will be necessary to remove animals that are in areas which are difficult to access. This is estimated to be 10-20 percent of each herd, although it may be higher in the area from St. Andrews Bay to Royal Bay. A more thorough helicopter reconnaissance to the south of St. Andrews Bay should be carried out prior to the final choice of method for eradicating reindeer in this area.
- The eradication of the Barff herd (encompassing Royal Bay) should take place one year after the Busen herd. This means the eradication of the larger herd will benefit from the experience gained on the Busen, and necessary adjustments can be implemented. In addition, the fencing material used on Busen can then be transferred to the Barff, given that necessary biosecurity measures have been taken. For logistical capacity reasons and with regards to total costs (including fence material and costs related to hiring a fishing vessel), the option of gathering and recovering carcasses from both herds in one season does not seem feasible.

- The report lists a number of recommendations to be considered as a basis for the further planning of herding/corralling and culling the reindeer herds on South Georgia. The issue of recovering meat from the reindeer carcasses is a core factor regarding the further planning of the logistics and should therefore be clarified as soon as possible (during the first half year of 2012).

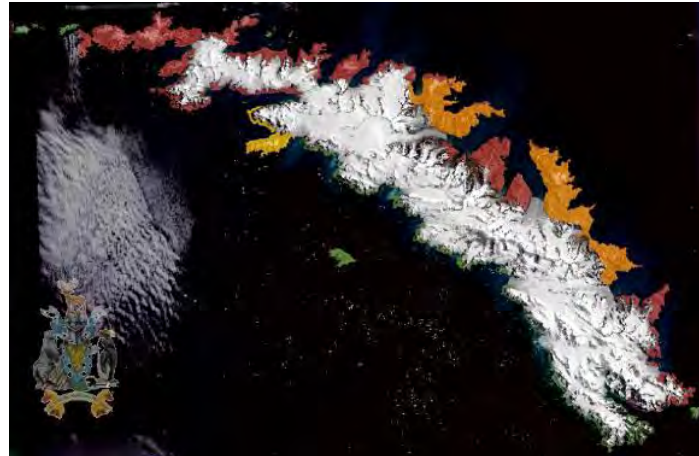


Figure 1. Location of the areas inhabited by reindeer (in orange) on South Georgia (*source: SGHT*)



Figure 2. Location of the two reindeer herds (Barff + Royal Bay are considered one herd) (*source: SGHT*)

2 The early history on the introduced reindeer

Today's population of reindeer in South Georgia is the result of three documented introductions from Norway, carried out by Norwegian whalers (Leader-Williams, 1988):

- 1911: 10 animals (3 males and 7 females) - Ocean Harbour (Barff Peninsula)
- 1911/12: 5 animals - Leith Harbour (Busen Peninsula)
- 1925: 7 animals (3 males and 4 females) - Husvik Harbour (Busen Peninsula)

The first introduction was done by the founder of Grytviken whaling station, Mr. Carl Anton Larsen together with his brother, Lauritz Larsen (see facsimile of letter, Figure 3).



Figure 3. Facsimile of a letter dated 11th November 1911 from C. A. Larsen to the South Georgia Magistrate (*source: BAS Archives, ref LS7/3/7*)

3 Why should the reindeer herds on South Georgia be eradicated?

The sub-Antarctic island South Georgia is renowned for its pristine character and an extraordinarily rich wildlife. With the exception of historic whaling stations, the island reveals very few signs of human activity. However, over the years humans have introduced a number of alien plant and animal species which are now causing extensive damage to South Georgia's natural habitats. Besides problems caused by rats (introduced by sealers a couple of hundred years ago), the descendants of the reindeer that were once brought to South Georgia by Norwegian whalers, account for the most severe damage on the island's ecosystem.

Due to the growing negative impact of reindeer grazing on the natural habitats on South Georgia, a comprehensive paper was issued in July 2010 by the GSGSSI (Christie, 2010). The GSGSSI paper has been subject to a public consultative round (2010) and concludes that a total eradication of the reindeer population on the island is required.

The GSGSSI paper contains numerous examples on the environmental impact of reindeer grazing and trampling on the island's natural habitats. The report states that South Georgia does not have any native herbivorous animal species. For this reason the native vegetation is sensitive to any grazing pressure (Moen and MacAlister, 1994). The following quotes from the paper (based on publications by authors named in parenthesis) illustrate much of the detrimental environmental impact caused by reindeer grazing and trampling on South Georgia:

- *"The introduced reindeer have had a serious detrimental impact on vegetation across the range of herds on the island. Exclosure experiments in affected areas have shown dramatic changes in vegetation composition, with complete recovery of native Poa flagellata and Acaena magellanica inside the enclosures, whilst the introduced Poa annua continues to spread in grazed areas. Trampling and grazing in combination have caused localized erosion, leading to a high proportion of bare earth in affected areas (Vogel et al., 1984)."*
- *"Overall, the results from the (enclosure) study show that removal of reindeer would be necessary to allow the recovery of more natural plant communities on South Georgia (Upson, 2009)."*
- *"Additional damage to vegetation occurs in summer when animals rub the velvet off their antlers on tussac stools (Kightley and Lewis-Smith, 1976)."*
- *"Erosion to bare substrate of several vegetation types leads to reduction in area that can be occupied by indigenous invertebrates (Key and Key, 2009)."*
- *"Tussac grass is important in stabilizing soil, and as a habitat for invertebrates and burrowing bird species, and the consequences of overgrazing by reindeer are far-reaching (Leader-Williams, 1985)."*
- *"Reindeer has been acknowledged as being a threat to white-chinned petrels (Procellaria aequinoctialis) (Birdlife, 2009). This species is listed Vulnerable in the IUCN redlist (Wolfaardt, 2009)."*



Figure 4. Tussac-grass in an area ungrazed by reindeer – Maiviken, Thatcher Peninsula



Figure 5. Heavily grazed tussac stools after years of overgrazing, Sörling Beach, Barff Peninsula



Figure 6. Reindeer grazing on *Poa annua* (alien invasive grass species). The mossbank and eroded patches above have resulted from tussac grass being heavily overgrazed by reindeer. Hound Bay, Barff Peninsula.



Figure 7. Remains of tussac stools after decades of overgrazing by reindeer. Husvik, Busen Peninsula

As part of the project "South Georgia Environmental Baseline Survey" the report "South Georgia Environmental Mapping Report" by Sally Poncet and Jenny Scott (Poncet and Scott, 2003) was issued by GSGSSI. This report contains a section on "Degraded" vegetation categories which clearly illustrate the impact of reindeer grazing on the vegetation. Excerpts from the report:

"In this study, 'degraded' is used as a general term to describe vegetation which has been modified markedly by effects of animals, notably reindeer and fur seals, and/or introduced plant species, the commonest on South Georgia being Poa annua. Elephant seals and penguins may also 'degrade' vegetation through heavy usage."

"Most plant communities in reindeer areas are 'degraded' to some extent, in terms of being modified by grazing pressure. These changes have been well documented in the literature (Leader-Williams, 1988)."

"Differences between grazed and non-grazed sites were very noticeable during our surveys, although with the exception of the 3 categories below, the differences could usually be accommodated within our general plant community definitions."

"We distinguished two plant 'communities' or map units which appear to have formed as a result of severe reindeer grazing, either with the added influence of seals (tussac, moss and Poa annua) or without ('hard mossbank'). The former community was not recorded in non-reindeer areas, whereas the latter may occur there in small patches (see Section 2.1). The criteria for including them as map units were that they occurred at a number of sites as visually distinct mappable categories and did not fit easily into any of the other categories identified. We also distinguished a third map unit ('tussac and mud') which includes vegetation that has been severely modified by the activity of fur seals to the extent that most tussac is destroyed leaving bare ground which may eventually erode down to bedrock."

SGEBS 'short mixed grassland' category also includes areas dominated by the introduced grass Poa annua, either as a consequence of reindeer grazing, or reindeer grazing combined with fertilization by gentoo penguin colonies, or fertilization from king penguin colonies or fur seals. 'Degraded' vegetation with abundant introduced plant species commonly occurs around and within old whaling stations, presumably the result of repeated passage of people and vehicles during periods of permanent human occupation. This vegetation is usually in patches too small to map, with the exception of several 'short mixed grassland' patches near the whaling station in Grytviken."

The cumulative impact of ongoing changes in wildlife distribution and activity on vegetation and in particular on 'dark' and 'light' tussac and Poa annua, and the communities 'tussac, moss and Poa annua', and 'tussac and mud' communities, may serve as a relatively rapid indicator of environmental change over time."

The eradication of reindeer should be carried out before the eradication of rats

South Georgia Heritage Trust (SGHT) is undertaking an ongoing project of eradicating rats on South Georgia. The rats have a number of ecosystem consequences including damage to vegetation and predation of a number of ground nesting bird species. The rat eradication project will be carried out in close cooperation with GSGSSI. This project will utilize helicopters spreading poisonous bait pellets. Rats are found in large parts of the vegetated areas of South Georgia, including the areas inhabited by reindeer. For animal welfare reasons the eradication of rats on Busen and Barff-Royal Bay cannot start before the reindeer herds have been eradicated. Given the necessary funding, SGHT is awaiting the eradication of reindeer on Busen, which is their planned next phase of the rat eradication. For this reason the

eradication of reindeer is required to start on this peninsula and should be carried out as soon as possible.

Talks with Ms. Sally Poncet on the impact of reindeer grazing on natural habitats and the importance of eradicating reindeer on South Georgia

During the late part of our stay on South Georgia (January 27th) we met with Ms. Sally Poncet. Ms. Poncet has nearly three decades of field experience on South Georgia and holds extensive knowledge on South Georgia's climate and vegetation, as well as wildlife, history and geography. She was a co-author of "A Visitor's Guide to South Georgia" (Poncet and Crobie, 2005) and has carried out a number of field studies and surveys related to vegetation and wildlife on the island. As referred to above, her field studies have also encompassed areas grazed by reindeer ("South Georgia Environmental Mapping Report", Poncet and Scott, 2003).

Ms. Poncet told us that the Barff Peninsula holds three times the grazing area of the Busen. Over the last 10-15 years she learned that the reindeer population did increase faster on the Barff than on the Busen. She suggests this may be as a consequence of a lower mortality rate among the calves on the Barff Peninsula than those on the Busen. She pointed to the winter temperatures being mainly higher on the Barff as compared to the Busen Peninsula. The winter temperatures on the Busen are normally more affected by glaciers as compared to the Barff. For South Georgia as a whole the winters have seemingly become milder over the last 10-15 years.

During our talk Ms. Poncet proposed that the eradication of reindeer on South Georgia is likely to have a positive impact on the natural habitats and that the benefits would be seen soon after the eradication. Ms. Poncet explained that the rats are benefiting from the absence of reindeer grazing on the tussac vegetation. She therefore emphasized the importance of eradicating the rats shortly after the eradication of reindeer. She highlighted that it is thought likely the rat population might increase significantly already 1-2 years after the eradication of reindeer. As to the impact of reindeer grazing on the bird life she pointed to a plateau above Godthul as an example. In this area the white-chinned petrel has completely disappeared as a nesting species, due to removal of tussac stools through heavy reindeer grazing over several decades.

4 The course of the reconnaissance

During the period January 1st-31st the Norwegian Nature Inspectorate (SNO), represented by Senior Adviser Carl Erik Kilander and Adviser Henrik Eira, made a survey of the areas on South Georgia inhabited by the reindeer: Busen Peninsula, Barff Peninsula and the adjacent area towards Royal Bay. Mr. Eira is a Sámi reindeer herder by origin and has extensive experience with regards to practical reindeer herding and corralling. Dr. Martin Collins, who is Director & Chief Executive Officer at GSGSSI, took part in most of the reconnaissance. His extensive knowledge of South Georgia was a great asset to the survey and the many discussions regarding logistical challenges connected to the eradication of reindeer on the island.



Figure 8. Dr. Martin Collins, GSGSSI, and Henrik I. Eira from the Norwegian Nature Inspectorate (SNO) during reconnaissance outside of Husvik whaling station, Busen Peninsula

During this month Dr. Martin Collins and ourselves had our main base at King Edward Point. From this base we were transported by staff from the British Antarctic Survey (BAS) to field huts in the following locations:

- January 5-8: Sörling Beach, Barff Peninsula
- January 11-13: Corral Bay, Barff Peninsula
- January 16-19: Carlita Bay, Busen Peninsula
- January 19-20: Jason Harbour, Busen Peninsula

These huts were used as base camps for extensive reconnaissance walks on the two peninsulas.



Figure 9. Three of the huts used during the field work (left to right): Sörling Beach (Barff), Corral Bay (Barff) and Carlita Bay (Busen)

On January 23rd-28th we sailed along the northern coast of South Georgia onboard the GSGSSI fishing inspection vessel, MV Pharos (including making landings with Zodiacs from this ship), as follows:

- January 23: sailing from King Edward Point to Godthul where we went ashore, then sailing along the coastline to Ocean Harbour (anchoring at Gold Harbour during the night)
- January 24: surveying (from the ship) the coastline from Moltke Harbour in Royal Bay to St. Andrews Bay where we went ashore. Continued sailing towards Husvik Harbour on Busen Peninsula during the night.
- January 25: Surveying (from the ship) the coastline of the Busen Peninsula from Husvik Harbour to Fortuna Bay where we were set ashore. Walked across from Fortuna Bay along the Shackleton walk through Shackleton Valley to Strömness whaling station. Continued surveying (from the ship) the coastline from Strömness through Leith and across to Tönsberg Point near Husvik whaling station.
- January 26-28: partly sailing towards the northwestern part of the South Georgia coast (to pick up field parties of biologists) and partly staying anchored near Tönsberg Point due to strong winds. Arrived at King Edward Point on January 28.

In addition, we spent two days (January 3-4), hiking into the areas surrounding King Edward Cove, in order to view vegetation unaffected by reindeer grazing (see figure 4).

During our stay on South Georgia a total of 19 days were spent doing observations in the field, including six days of sailing and surveying from the GSGSSI fishing inspection vessel Pharos (a couple of landings by Zodiac were included). Our month-long stay did not allow for additional days of field observations, due to logistical limitations and also a few days of unfavourable weather conditions (notably strong winds).



Figure 10. The GSGSSI fishing inspection vessel, MV Pharos, during reconnaissance, Strömness Harbour, Busen Peninsula.

The following factors were of particular interest during the reconnaissance:

- The number, distribution and general condition of reindeer on each of the two peninsulas Busen and Barff (encompassing the adjacent areas towards Royal Bay)
- Flight behaviour related to our presence in the field (a few fleeing distances were measured)
- The state of the areas grazed by reindeer (see examples, figures 5-7)
- Identification of suitable areas for gathering the herds of the two peninsulas into corrals: one main location for each of the peninsulas (see figures 26-27)
- Reindeer track patterns, including narrow passages suitable for blocking by fences during herding of the animals towards gathering areas/corrals
- Identification of physically isolated areas within Busen and Barff-Royal Bay uninhabited by reindeer

Many of these factors are related to geographical information which is compiled on the attached reconnaissance maps.

5 Observations and comments regarding the reconnaissance of the Barff herd

We had our first encounter with the Barff herd on January 5th. The group was comprised of 12 reindeer males (figure 11) which started running away at approximately 75 meters. Our second encounter – approximately 35 reindeer on the plain inside Sörling Beach - started fleeing at a distance of approximately 240 meters. Distances were measured by a laser measurer (Nikon Laser Rangefinder Forestry 550).



Figure 11. Our first encounter with reindeer during the reconnaissance: a group of bucks. Sörling Beach, Barff Peninsula, January 5th, 2012.

On the inner part of the plain inside Sörling Beach we found a fenced square sample of tussac vegetation which had been ungrazed for approximately 30 years (figure 12). The tussac stools looked quite intact inside the fence. All tussac vegetation outside the fence was obviously long since gone. Nearby this site we encountered a herd of approximately 25 reindeer males approaching as close as 25-30 meters before turning around.

On our second day on the Barff Peninsula (January 6th) we walked east-northeast towards Ocean Harbour. Approximately 25 reindeer were observed along this stretch. On the plain at Ocean Harbour and the adjacent slopes approximately 160 reindeer were observed, of which females and calves were dominating. Approximately 30 males could be easily identified.

In the area between Ocean Harbour and Penguin Bay approximately 160 reindeer were counted, most of which were grazing on the slopes below a large colony of nesting gentoo penguins.



Figure 12. Exclosure of vegetation sample ungrazed by reindeer, Sörling Beach, Barff Peninsula



Figure 13. Reindeer herd at Ocean Harbour. Degraded vegetation (mossbank) and exposed mineral soil from previous overgrazing can be seen in the upper parts of the hillside.

In the vicinity of Penguin Bay we counted a total of approximately 200 reindeer. Elsewhere on the Barff Peninsula we counted an additional 350-400 reindeer (January 6th). Laser measurements showed typical fleeing distances of 230-240 meters for most of the reindeer herds encountered this day. Due to the penguin colonies, the use of helicopter in the area from Ocean Harbour to Penguin Bay is not recommended and therefore an increased number of personnel will be required during the gathering operation.



Figure 14. Reindeer grazing at Hound Bay, Barff Peninsula

On our third day on the Barff (January 7th) four herds totaling 130-140 reindeer were observed in the flat area surrounding Hound Bay. In the area around the bay we observed that the tussock grass was entirely gone, due to reindeer grazing (figure 15).



Figure 15. Tussock-grass heavily grazed and degraded into mossbank.
Hound Bay, Barff Peninsula

During the first three days of surveying the Barff Peninsula a number of reindeer carcasses were found, some of which had antlers as well as remains of winter fur (figure 16). This together with the position in which some of these carcasses lay on the ground, indicate that a number of animals have died from starvation during the wintertime.

On January 7th we proceeded from Hound Bay through Lönnberg Valley along the steep slopes to the southeast and east of Ellerbeck Peak, near the edge of the Nordenskjöld Glacier, then along Sörling Beach back to the hut. Footprints from reindeer were observed several places along this rather demanding route (we were told that this area was entirely blocked by the glacier until approximately 2006). Based on observed foot prints we found that the reindeer track seems to go “one-way” from Lönnberg Valley downwards to the steep slope under Ellerbeck Peak towards Sörling Beach. Two reindeer females and two calves were observed high up on the steep slopes above the track as we approached Sörling Beach. In addition, a small herd of male reindeer was seen, on the slope just above the front of the Nordenskjöld Glacier.



Figure 16. Reindeer carcass near Hound Bay, Barff Peninsula. The winter fur tells about harsh winter conditions for the reindeer in this area.

uring these first three days of reconnaissance on the Barff Peninsula we counted approximately 700 reindeer. The proportion of males seemed considerably higher than typically found in populations of wild reindeer in Norway (which are normally subject to hunting). Most of the reindeer encountered on the Barff Peninsula so far seemed to be in generally good condition.

Our second round of reconnaissance on the Barff Peninsula took place January 11th-12th and started from the Corral Bay hut. We spent the first day hiking to Rookery Bay on the

northeastern side of the Barff Peninsula. Approximately 110 reindeer were observed in this area. These animals seemed less skittish than those observed around Ocean Harbour and Hound Bay. The animals seemed to accept our presence fairly well. Rookery Bay is exposed to the sun most of the day, and spring is likely to come early on this side of the peninsula. The proportion of calves seemed to be relatively high, indicating good grazing conditions in this part of the Barff Peninsula. Although some of the tussac obviously is heavily grazed, much of the tussac still seems to be intact.

We made a third round of reconnaissance of the Barff Peninsula towards Royal Bay by sailing on the GSGSSI fishing inspection vessel, MV Pharos, January 23-24. During the first morning we did the reconnaissance from a Zodiac along Rookery Bay and westwards. No reindeer were observed.

We made a landing at Godthul that first afternoon. We walked uphill to a plateau to look for reindeer and also to assess the grazed vegetation. 63 reindeer were counted. The animals appeared in 5 herds (32 + 11 + 5 + 2 + 13 animals). The vegetation shows signs of having been heavily grazed (figure 17).



Figure 17. Vegetation degraded by reindeer grazing above Godthul, Barff Peninsula.

During the early morning of January 24th we sailed towards Moltke Harbour in Royal Bay (figure 18). Approximately 40 reindeer were observed on the low ground behind Moltke Harbour. 15 reindeer were counted between this area and the northern end of Sacramento Bight. Large parts of this area cannot be seen from the sea but we anticipate that the area contains several additional animals. Considering the relatively large grazing area, the total number of reindeer from Moltke Harbour to Sacramento Bight is estimated to be 100-200

reindeer. Herding these animals towards the planned slaughtering enclosure at Sörling Beach will most likely be very demanding (including challenges connected to passing through the beach belt of St. Andrews Bay). One should therefore be prepared for the alternative of eradicating these reindeer by shooting on the ground.



Figure 18. Area with reindeer, Moltke Harbour (north), Royal Bay.

Along the stretch from Royal Bay to Sacramento Bight (Calf Head) approximately 100 reindeer were observed. From Calf Head to St. Andrews Bay another approximately 100 reindeer were counted. A total of 260-270 reindeer were observed from Royal Bay to the southern end of St. Andrews Bay. These animals stay in relatively inaccessible areas, and one should be prepared for ground shooting. These locations are also very exposed to strong winds, which should be taken into consideration during the further planning.

By the early afternoon of January 24 we landed a Zodiac at the northern end of St. Andrews Bay to count the reindeer in the area and to assess possible tracks for the herding operation towards the northwest. We found two passages that seem accessible, leading across to Hound Bay (see reconnaissance map). However, it was hard to detect distinct animal tracks towards these passages (notably towards the passes to the north-northwest of the northernmost river on St. Andrews Bay). We counted a total of 40 reindeer within the king penguin colony (mainly concentrated on the north side of the rookery) and 7 reindeer in the adjacent area to the northwest. It will be difficult to gather and drive the reindeer out of this area without a substantial disturbance of king penguins and seals. Therefore, we consider shooting from the ground (rifle with silencer) to be the preferred method in this area. A seemingly good local

population of giant petrels and brown skuas will probably be able to “clean” the reindeer carcasses within a reasonable time span. Alternatively, the easiest accessible reindeer herd on the north side of the rookery could be driven across to Hound Bay.



Figure 19. Grazing reindeer by the King penguin rookery at St. Andrews Bay, Barff Peninsula, January 24th, 2012.

6 Observations and comments regarding reconnaissance of the Busen herd

Our first round of reconnaissance on the Busen Peninsula took place from January 16th to 18th. During the first hike 45 reindeer were counted in the near surroundings of the Carlita Hut and 40 reindeer in Olsen Valley. Approximately 175 reindeer comprising several herds of up to 40 animals each were observed during the first day. We measured the fleeing distance with a laser measurer as we approached the various herds. The fleeing distance for these herds varied from 95 to 175 meters. Most of the herds consisted of females with calves.



Figure 20. Reindeer herd in Olsen Valley, Busen Peninsula, January 17th, 2012.

On January 17th we walked along Olsen Valley towards the whaling station at Husvik where we observed 42 reindeer (although these had already been counted the day before). In close proximity to Husvik whaling station we counted a total of 42 reindeer distributed in 3-4 small herds.



Figure 21. Reindeer herd near Gentoo colony, Husvik Harbour, January 17th, 2012.

After assessing the area behind and around the whaling station we found that a possible gathering of the Busen herd in this location will require a lot of fencing, due to the restricted 200 metre zone surrounding the station. Hence, the shore line at the station will not function as a natural part of the main enclosure.

The area around Jason Harbour seems to be an important grazing area for reindeer year-round. We discovered several remains of reindeer carcasses and also parts of antlers, indicating that reindeer stay in this area during the late autumn and most likely all through the year. Large parts of the tussac vegetation around Jason Harbour have been heavily grazed and is now replaced by dense moss banks.



Figure 22. Jason Harbour, Busen Peninsula.

On January 25th we started sailing from Husvik Harbour at 07.30 and made observations of the terrain along the little peninsula of Tönsberg Point and further around the outer parts of the Busen Peninsula, towards Fortuna Bay. We were set ashore at Fortuna Bay before noon. Photographs were taken to illustrate the level of grazing in the area above the landing site. We hiked along the Shackleton Walk across to Shackleton Valley and Strömness. Just after our landing at Fortuna Bay we encountered 12 large male reindeer. These bucks seemed very little affected by our presence and started to withdraw at only 10-12 meters distance. A bit higher up on the Fortuna Bay side a herd of approximately 25 reindeer, consisting of females with a few calves, started running away at approximately 30 metres distance. In addition, on the

west side of Whistle Cove (innermost part of Fortuna Bay) we had previously observed approximately 20 reindeer (spotted from the ship prior to the landing). A total of approximately 55 reindeer were observed in the area surrounding Fortuna Bay. Along the walk towards Strömness we counted another 70-80 reindeer. All in all, approximately 130 reindeer were found from (and including) Fortuna Bay, through to Strömness whaling station.



Figure 23. Grazing reindeer at Fortuna Bay, Busen Peninsula, January 25th, 2012.

7 Estimate of the reindeer population on South Georgia

In the course of the reconnaissance we observed a total of approximately 2150 reindeer. The basis of this total count is discussed in the following two chapters. On the Busen Peninsula 814 reindeer were encountered, whereas 1351 were counted on Barff Peninsula and the adjacent areas towards Royal Bay. The count of some of the animal groups included in these figures were approximate numbers (as groups of 40-50 animals or more were sometimes hard to count exactly), so the total count for each of the two main herds should be regarded as approximate numbers. All observations were done on foot or from the GSGSSI inspection vessel MV Pharos. As we had no option of surveying from the air, some of the reindeer areas could only be partly investigated.

We were not in a position to observe all the animals in each of the main herds. However, by using our own counts and assessing the grazing conditions and reindeer tracks in areas that could only be partly inspected from the ship, we would estimate that the Barff herd has a minimum summer population of 2000-2500 reindeer, of which an estimated 4-500 animals (quite uncertain number) are located to the south of St. Andrews Bay.

At a first glance the reindeer on both peninsulas seem to be in relatively good condition. However, based on the amount of carcasses and the relative amount of calves, we got the impression that the Busen herd is likely to face a significant decline fairly soon if no measures are taken to reduce the numbers. This is also illustrated by the heavily degraded vegetation over large parts of the Busen Peninsula inhabited by reindeer. We found heavily grazed and degraded vegetation on the Barff Peninsula as well. Nevertheless, these animals seemed to be in generally better condition than observed on the Busen Peninsula.

In addition to the 814 reindeer counted during our reconnaissance on the Busen Peninsula we predict that the Busen herd might contain another two hundred reindeer or more, which would result in an estimated summer population (January 2012) of a minimum 1000 animals. Based on this and previous surveys we predict that the reindeer population on South Georgia in January 2012 will be between 3000 and 3500. A possible net increase due to new calves being born before the expected start of eradication (January-February 2013) should be added (depending on the winter weather conditions). However, the exact number of the entire population can obviously not be found until the eradication process has come to an end.

Because the weather conditions did not allow landings between Royal Bay and St. Andrews Bay, there is a need for an aerial survey (helicopter) to be carried out before finishing the detailed preparations prior to the detailed planning of eradicating the animals. This need particularly applies to the fairly wide vegetated belt adjacent to the northern shoreline of Royal Bay and the possible passages to be used in case of herding.

8 Identification of suitable gathering areas and slaughtering corrals

a) Sörling Beach – Barff Peninsula



Figure 24. This plain area inside Sörling Beach seems to be a very applicable site for corralling the Barff herd.

We surveyed this location on January 5th. The vegetated plain behind the Sörling Beach (see attached reconnaissance map, Barff Peninsula) seems to be a suitable site for corralling most of the Barff herd. The location provides a number of benefits:

- Many reindeer tracks lead into this area from various directions
- The plain behind the Sörling Beach contains sufficient grazing ground and fresh water supply (running water) for a large herd of reindeer prior to the slaughtering process (up to several weeks if necessary).
- The area is relatively sheltered, which is important regarding fencing and slaughtering.
- The surrounding waters allow ships and smaller boats to operate in relation to the transport of equipment onshore and reindeer carcasses to a vessel off shore.
- There are no colonies of penguins or other birds, and relatively few seals are resting here at this time of the year.
- All-terrain-vehicles (ATVs) can be operated in relatively large surrounding areas (Sörling Valley and Lönnerberg Valley) without causing special problems. Based on the skittish behaviour of the reindeer observed during our survey on the Barff, we regard the use of ATVs near the main gathering area a necessity in order to successfully herd all the reindeer towards the lead fences and the main corral.

- The waters next to Sörling Beach provide good anchoring sites for ships like the MV Pharos and a suitable vessel for butchering etc (trawler).
- The beach is suitable for the use of a tender boat for transportation between a ship and the corral area onshore (getting fencing material etc ashore and slaughtered animals off to the ship outside)
- The terrain inside this beach is suitable for the use of ATVs for transport on land.
- The short distance to the BAS base at King Edward Point will also be an asset regarding transport/accommodation and in case of any emergencies.



Figure 25. Reindeer at Sörling Beach, Barff Peninsula, January 5th, 2012.

Based on a series of laser measurements we calculated that a total of 2000 metres of fences will be needed for the main enclosure at Sörling Beach. In addition, fencing material will be needed for leadfences onto the main enclosure as well as short stop-fences in narrow passages along the herding route, plus an inner fence system for the slaughtering area. This needs to be assessed more in detail.

b) Tönsberg Point – Busen Peninsula



Figure 26. A very suitable corral site for the Busen herd was detected on Tönsberg Point, just to the east of Husvik whaling station, January 25th, 2012.

This location was investigated on January 25th. Tönsberg Point has a number of benefits for gathering and corralling the Busen herd:

- The area provides sufficient grazeland and fresh water supply for gathering the entire herd of reindeer from Busen (estimated to approximately 1000 animals) for a period of several weeks (if necessary)
- Tönsberg Point is favourably located in the central part of Busen Peninsula. The major part of the Busen herd can be driven towards the outer half of Tönsberg Point. Reindeer from Carlita Bay and Olsen Valley can be herded by use of ground personnel and ATVs towards Husvik. This also applies to the herding process through parts of the distance from Fortuna Bay (ATVs can be used through Shackleton Valley to Strømness).
- Tönsberg Point has a favourable location in relation to Husvik, and the old villa at the whaling station of Husvik will obviously provide an important base for housing personnel and storing equipment etc.
- The topography of Tönsberg Point allows for closing off the gathering area with a minimum of fencing material.

- Husvik Harbour provides good anchoring sites for ships like the MV Pharos and a suitable vessel for butchering etc (trawler).
- The beach on the southern side of Tönsberg Point is suitable for the use of a tender boat for transportation between a ship and the gathering area onshore (getting fencing material etc ashore and slaughtered animals off to the ship outside).
- The terrain inside this beach is suitable for the use of ATVs for transport on land.



Figure 27. Tönsberg Point contains a number of ponds providing sufficient amounts of pure fresh water during the gathering and corralling of the Busen herd.

In case there the need for additional gathering sites on the Busen Peninsula might arise, Carlita Bay and Jason Harbour on the southern side of the peninsula could be considered. Jason Harbour might be needed if the herding of reindeer from Jason Harbour and Allen Bay towards Husvik Harbour turns out to be too difficult. However, the limited occurrence of fresh water in these locations is a major disadvantage for corralling and slaughtering reindeer here.

9 About the reconnaissance maps

Attachments 1-3 show the reconnaissance maps. The maps include distribution (numbers) of reindeer as observed in the different parts of Busen, Barff and Royal Bay. The number of reindeer counted in each main location is shown on the map. Question marks indicate presence of reindeer without knowing the number of animals. The maps show the main reindeer tracks and barriers, as well as passages that must be blocked/controlled during the gathering process towards the locations for gathering/corralling. The identification of narrow passages and terrain barriers is crucial to a successful planning and preparations ahead of cost-effective gathering operations. The terrain barriers also indicate where isolated herds of reindeer can be found (local herds which will have to be eradicated by shooting from the ground). Such isolated reindeer sites may have been accessed during periods of heavy snow which created temporary corridors.

10 Survey of a fishing vessel

During our stay at King Edward Point Dr. Martin Collins and Mr. Keiron Fraser from GSGSSI plus ourselves inspected a large fishing vessel (trawler) which was anchored nearby. We found that a fishing vessel of this size would be suitable for the entire operation of skinning, gutting, butchering and cooling/freezing reindeer meat from reindeer slaughtered onshore:

- Such a vessel provides enough space for installing a slaughtering line on the main deck
- A vessel like this has most of the equipment needed for butchering, tenderizing (chilled hanging), wrapping and freezing the meat. However, some adaptations will be needed to accommodate hanging the carcasses during the gutting and skinning, and also the transfer of carcasses to the underlying deck for cutting (butchering), cooling, wrapping and freezing
- A large fishing vessel will normally offer sufficient facilities for accommodating a group of butchers (cabins and other facilities)

11 Comments regarding proper time frame for slaughtering and butchering

Based on the findings of the reconnaissance, January is thought to be too early for slaughtering/butchering with regards to general quality of the meat. This is due to a very thin fat layer this early in the season and also because of problems associated with loose hair from the remaining winter fur (figure 28) which will cling to the surface of butchered meat. If this meat is to be marketed for sale, the slaughtering should start around the middle of February at the earliest. By that time the weight of the calves will normally have doubled as compared to the first half of January, and they will be more able to withstand the gathering and corralling process. Ideally, the culling process and recovery of South Georgia reindeer meat should take place from the middle of February to the middle of March (i.e. before, and up until the beginning of the rutting season).



Figure 28. Reindeer male at Ocean Harbour, Barff Peninsula. This image (January 6th) shows that the summer fur is still hidden under a substantial amount of winter fur. For this reason butchering should ideally not start until mid-February at the earliest.



Figure 29. Female reindeer with calves photographed January 17th, Husvik Harbour. These calves should grow another month to become more robust for the process of herding and coralling.

12 The expected value of reindeer meat from recovered carcasses

The high percentage of adult males indicates that the net weight of recovered reindeer carcasses will be relatively high. Based on many years of experience with reindeer herding and weighing of reindeer carcasses at normal slaughtering time, we estimate the average net weight of reindeer carcasses in South Georgia at mid-February to be as follows:

- calves: 18-20 kg
- females (1.5 years and older): 30-32 kg
- males (1.5 years and above): app. 50-55 kg

At this stage it is our impression that most herds with females have a relatively low percentage of calves (maybe as low as 20-30 % of the number of adult females). Given a recovery rate of 80 percent of the two herds (Busen: approximately 1000 and Barff 2000-2500 animals), the following minimum of recovered meat should be expected:

Busen (2013):	$0,8 \times 1000 \times 35 \text{ kg} = 28\,000 \text{ kg}$	= 28 tonnes
Barff (2014):	$0,8 \times 2250 \times 35 \text{ kg} = 63\,000 \text{ kg}$	= 63 tonnes
Total (2013-2014):		91 tonnes

However, the estimate of 35 kilos average net weight is conservative, so a total in the proximity of **100 tonnes** of recovered reindeer meat may prove closer to the real figure. Given a minimum average selling price of GBP 10-12 pr kilo (in Norway normally more), the total gross value of recovered reindeer meat should amount to a minimum of GBP 900 000 – 1000 000. However, if the market situation only allows for selling the highest meat quality (fillets and hind legs), the total value will be lower, possibly closer to GBP 500 000. However, time needed to butcher an animal is almost the same, even if only hind legs and fillets can be utilized, and therefore efforts should be made to sell lower quality cuts as well.

13 The further planning of the reindeer eradication

By the end of the reconnaissance the further preparations for the reindeer eradication were discussed with Director of Fisheries & Chief Executive Officer, Dr. Martin Collins at GSGSSI. The following issues were included and partly concluded upon during this meeting:

- The costs associated with equipment (fencing etc) for the herding/corralling method are likely to be relatively low. However, the relatively high costs of Norwegian personnel has been emphasized, as this is likely to constitute a substantial proportion of the total costs.
- Reindeer on the Busen Peninsula must be eradicated first, as the upcoming phase of the rat eradication will take place there. Besides, the experience gained on Busen will obviously be useful for the planning of the even larger operation on Barff the following year. In addition valuable knowledge to assist in eradication of animals on the Barf Peninsula will be gained by first working in an area with the lowest number of reindeer. The focus of detailed planning for the 2013 season should be towards the eradication of the Busen herd. However, the maximum supply of fencing material and related tools/equipment (which will apply to the Barff-Royal Bay area) should be purchased and shipped to South Georgia before start-up in January 2013, in order to minimize transportation. When the herding and slaughtering of the Busen herd is completed, the enclosure and other fencing material can be taken down and transported to Sörling Beach on the Barff Peninsula, being left in place for the second start-up in the early part of 2014.
- Two portable huts for four people should be provided on Tönsberg Point. When the eradication on Busen is finished, one or both huts can be moved to the Barff Peninsula for use in 2014. In addition, the MV Pharos can be used to provide additional accommodation if needed.
- The Husvik villa will be an important base for the eradication operations on the Busen Peninsula. This villa is currently closed, due to asbestos which has to be removed before further use can be allowed. The removal of asbestos is planned to take place before the end of 2012.
- A suitable boat with a hydraulic ramp (cargo tender) will be needed for necessary transport between a ship (MV Pharos and a vessel for slaughtering/butchering) and the shore.
- A successful herding process through the whaling stations at Husvik, Stømness and Leith requires that special permission for the reindeer herders to move inside the 200-meter protection zone around the constructions can be given (only when strictly necessary to keep in control of the herded animals).
- The potential market for reindeer meat and the identification of buyers/importers must be clarified before doing further planning for the slaughtering and butchering process as countries may have different requirements for slaughtering and butchering (reference made to the strict regulations in most actual markets, with which the slaughtering and butchering process must comply)

- If any of the meat cannot be utilized or sold, a collective herding/coralling and controlled culling rather than individual killing of all the animals from the ground is still recommended
- We have been informed that GSGSSI plans to establish a system to monitor the recovery/changes of vegetation and other elements of the grazed habitats as the reindeer herds have been eradicated. This will be very important in order to assess the impact of the removal of reindeer trampling and grazing.
- We consider that a minimum of 3, or preferably 4, quadbikes (ATVs) should be provided to ensure effective herding operations toward the erected enclosures. The ATVs will be particularly important in areas like Hound Bay, Olsen Valley and the areas around Carlita Bay and Husvik whaling station. At least one sturdy ATV trailer should also be provided (for transportation of fencing materials etc)
- Slaughtering and driving operations will be discussed with other experts in the reindeer herding community in Norway in order to ensure that personnel are suitably skilled to take part in both the driving/gathering process and the slaughtering/-butchering. It may also be possible to use crew from the fishing vessel for handling and wrapping the butchered meat before freezing .
- Henrik Eira will concentrate his inputs to the logistics planning on a detailed dimensioning of fences, enclosures, poles, netting, wires, coloured cloth streamers, necessary tools, etc. In this regard there will be a special challenge regarding the erection of fences on solid rock and boulders/screes. A lightweight machine drill for rocks will be an important tool.
- Hurtigruten (a Norwegian coastal steamer company) should be contacted regarding the possible transport of equipment and fencing material etc from Norway on their expedition cruise ship Fram which visits Stanley and Grytviken annually.
- Maps for the further logistics planning: a new map for the Busen Peninsula is expected to be finished by the end of April 2012. This map will be very useful.
- GSGSSI will provide the following equipment needed for the field operations to come: Tents, inflated mattresses, primuses, survival suits and other safety equipment (ICOM/VHF-radios, a couple of Iridium-phones, first-aid kits, poles for protection against fur seals), electricity generators, fuel, cutlery, dinner plates, pans and kettles etc.
- A medical doctor should be available within acceptable reach and should give personnel involved in the project first-aid training (including the treatment of seal bites) before they are deployed into the field

14 Main conclusions and recommendations

1. The Norwegian proposal of herding and gathering the reindeer on South Georgia into enclosed gathering areas and corrals based on Sámi traditional knowledge is considered to be a feasible method. This method will mean it is possible to undertake a controlled culling of reindeer and recovery of a great majority of carcasses.
2. The reindeer located in the most inaccessible sites should be eradicated by shooting on the ground. The shooting operation has to be carried out by experienced marksmen using rifles with silencers.
3. Feasible locations for enclosures/corrals have been identified as follows:
Busen Peninsula: Tönsberg Point, just to the east of Husvik whaling station.
Barff Peninsula and the areas towards Royal Bay: Sörling Beach, located in the southeastern part of Cumberland East Bay.
Both locations have a sheltered location and satisfy the need for grazing and fresh water during the gathering and slaughtering process (several weeks if necessary). The beach areas and adjacent sea water in the two sites are found to be suitable for the combined use of a cargo tender and a fishing vessel (preferably a trawler) to be anchored near the shoreline.
4. A controlled culling by use of a bolt action device should be applied prior to the transport of un-skinned carcasses (with heads and blood removed) to a fishing vessel anchored nearby. This will enable compliance with strict regulations related to animal welfare.
5. Assuming that a market for the reindeer meat can be found, a mobile slaughtering line should be mounted on the fishing vessel mentioned above (i.e. a vessel with sufficient freezing capacity and facilities for butchering, cooling/ tenderizing and wrapping the butchered meat). This will enable compliance with strict regulations related to hygiene.
6. The use of skilled personnel including an authorized slaughter firm from the Sámi herders community in Norway is considered ideal for the herding, gathering and slaughtering/butchering process. These operations will be very demanding – technically and physically – and will require personnel with considerable experience in order to be successful.
7. In order to ensure that the reindeer calves are sufficiently robust to stand the herding and corralling, the process of herding and driving the animals towards the enclosures should not start until the late part of January at the earliest. Slaughtering should ideally take place during the last half of February or the first part of March. By this time the weight of the calves have normally doubled since early January and the animals will also have gotten rid of most of the loose strands of hair from the winter fur, which is a prerequisite for a hygienic handling with the meat.
8. It is recommended that the eradication process starts on the Busen Peninsula as soon as possible (January-March 2013). The Busen herd is estimated to be a minimum of 1000 animals which is about half of the estimated herd in the Barff-Royal Bay area. Although hard to judge at this stage, an estimated 10-20 percent of the Busen herd will be difficult to herd and gather successfully. This percentage will probably be higher in

the Barff-Royal Bay area. Most of the animals to be eradicated by ground shooting are located in isolated/inaccessible places. A helicopter reconnaissance of the areas towards Royal Bay is considered necessary for clarification of the number of animals in this area and whether they should be shot from the ground or herded.

9. The eradication of reindeer on the Barff Peninsula and the adjacent areas towards Royal Bay should take place one year later. The experience gained on the Busen can be used to make any necessary adjustments to herding or corralling methodology. The fencing material used on Busen can then be transferred to the gathering area on Barff (Sörling Beach), ready to be used the year after. For economic and logistical reasons the idea of gathering and recovering carcasses from both herds in one season is not realistic. The phased approach, proposed here will also minimize risks involved (including the challenge of dealing with unfavourable weather conditions).
10. A decision about recovery of the meat from the reindeer carcasses is important in order to plan logistics and should therefore be decided upon as soon as possible (during the first half year of 2012). The estimated amount of butchered reindeer meat that can be recovered (given a minimum of 80 percent of the reindeer being herded and corralled) is approximately 30 tonnes on Busen and 60 tonnes on Barff .
11. If the meat cannot be recovered within a reasonable cost frame, we still recommend a collective corralling and controlled culling rather than individual shooting of all the animals from the ground.

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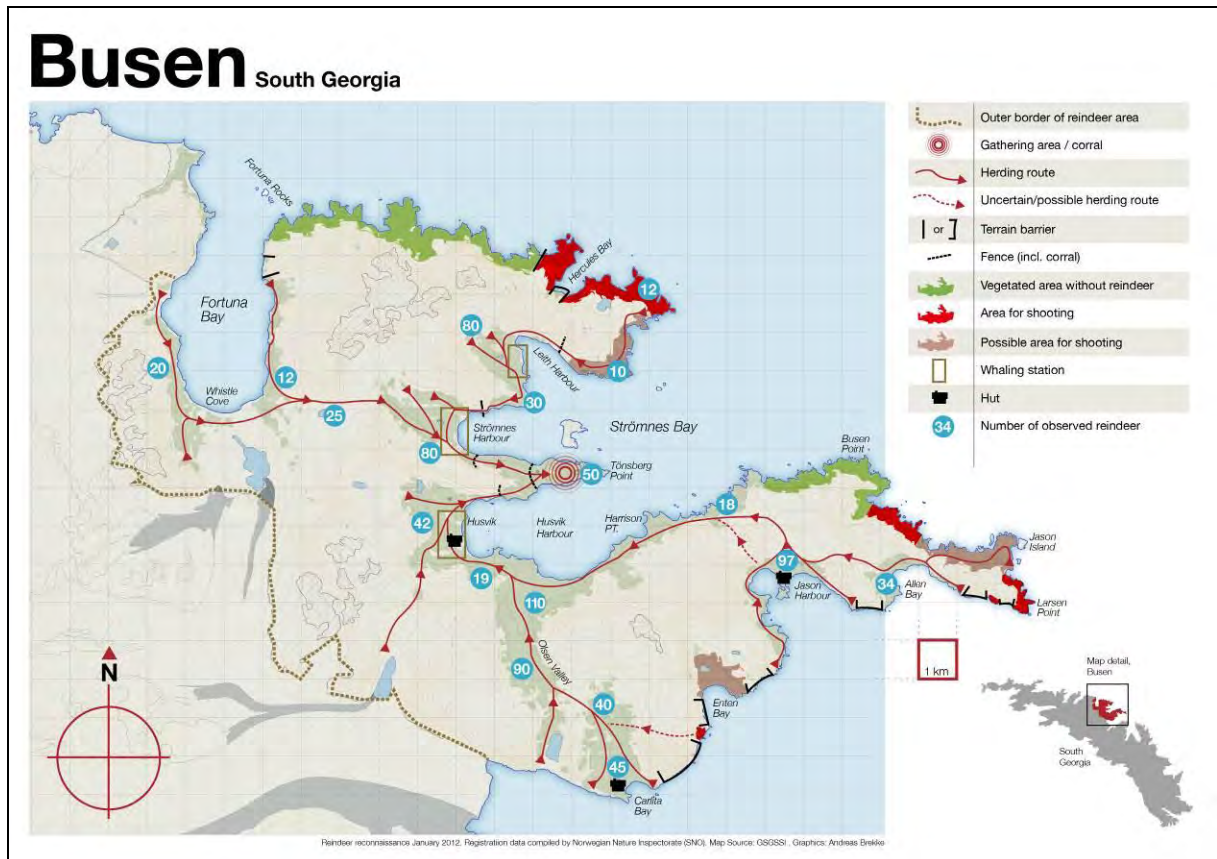
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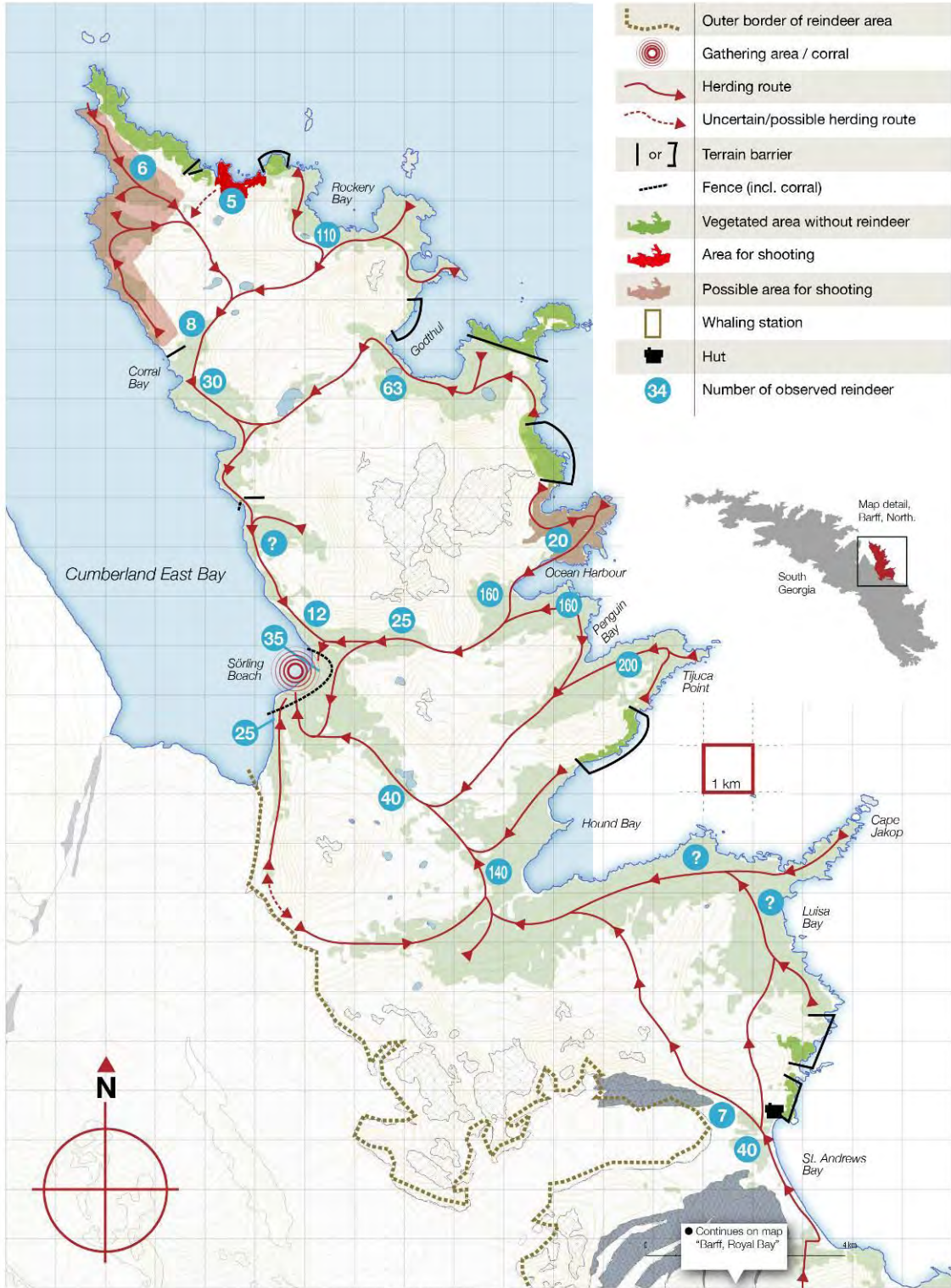
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Attachments 1-3: Reindeer reconnaissance maps, January 2012



Barff (Northern part) South Georgia



Reindeer reconnaissance January 2012. Registration data compiled by Norwegian Nature Inspectorate (SNO). Map Source: GSGSSI. Graphics: Andreas Brekke

Barff-Royal Bay South Georgia

