

Census of the Southern Giant-Petrel Population of the Falkland Islands 2004/2005



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Summary

A complete census was taken of all colonies of southern giant-petrels within the Falkland Islands in 2004/05. The breeding population of the islands was estimated to be 19,810 pairs. Southern giant-petrels were found to breed in 38 locations around the islands, with colony size varying from one to 10,936. The majority of colonies were concentrated around the south of Falkland Sound, and to the west of West Falkland. Whilst there has been no previous census of the total population of the islands, there is clear evidence that the population has increased at least since the 1950's. The reasons for such an increase in population were investigated, but remain unclear in light of current knowledge. Development of our understanding of the breeding biology and demography of this species in the Falkland Islands is necessary, as is the need to conduct such a census every five years, with a few key colonies to be monitored every season. From the results obtained here, it seems likely that the conservation status of the southern giant-petrel, currently listed as Vulnerable, should be downgraded.

1. General Introduction

Concerns have been raised over the conservation status of many species of albatross and petrel throughout the world. These concerns derive from observations of significant numbers of these seabirds being killed in longline (e.g. Brothers 1991; Murray et al. 1993; Brothers 1995; Reid et al. 2004) and trawl (Bartle 1991; Sullivan and Reid 2002; 2003) fisheries. In addition, breeding colonies for many species of albatross and petrels have been observed to be in decline over the corresponding period (Gales 1998; Huin 2001).

As part of this concern, in April 2004 the government of the United Kingdom signed the Agreement for the Conservation of Albatross and Petrels. The agreement was signed on behalf of, and with the support of a number of its overseas territories, including the Falkland Islands. This agreement promotes the undertaking of research into population trends, monitoring compliance, and work to halt the decline of listed species. The Falkland Islands Albatross and Petrel Project was begun in order to meet these requirements.

Within the Falkland Islands, the black-browed albatross *Thalassarche melanophris*, southern giant-petrel *Macronectes giganteus* and white-chinned petrel *Procellaria aequinoctialis* have been observed killed regularly in fisheries (Sullivan and Reid 2002; 2003; 2004). In order to understand if this mortality is having a significant detrimental effect on these species, it is important to know their island-wide populations. An island-wide census of black-browed albatross populations was conducted in 2000/2001, which indicated that these were declining (Huin 2001) and will be repeated in 2005/2006, five years after the initial census. Until now there have been no corresponding censuses for either the southern giant-petrel, or the white-chinned petrel.

Whilst the mortality of southern giant-petrels has been lower than the continuing and significant incidental mortality of black-browed albatrosses in fisheries across the Patagonian shelf, this is probably to be expected given the lower estimated populations. In 2002/2003 it was estimated that 100 southern giant-petrels were killed in the Falkland Islands finfish trawl fishery (Sullivan and Reid 2003). There have

been no other accurate estimates of total mortality in other years, nevertheless, limited data has indicated similar rates of mortality in 2001/2002 and in 2003/2004 (Sullivan and Reid 2002; 2004). It has been estimated that the Falkland Islands population of the southern giant-petrel was in the order of 5-10,000 pairs between 1983 and 1992 (Woods and Woods 1997). Thus, the lower mortality of southern giant-petrels compared to black-browed albatross in Falkland Islands waters comes from a much smaller population, and therefore, potentially could be significant to the survival of the species. Woods (1975) suggested the population had increased in the late 19th and early 20th centuries, but had declined in the middle part of the 20th century due to persecution over sheep farming.

The waters around the Falklands Islands have been shown to be important foraging grounds for the southern giant-petrel. They were found to be the eleventh most frequently encountered species during at-sea surveys of the distribution of seabirds around the Falkland Islands (White et al. 2002). They are very common around trawlers and longliners fishing within the Falkland Islands waters, with flocks in excess of 500 southern giant-petrels regularly encountered around these vessels (pers. obs.). Despite this, satellite tracking studies of their foraging range from colonies such as those at South Georgia, have generally shown that few utilise the waters in the region of the Falkland Islands (Birdlife International 2004a). During the summer, only females from South Georgia visit Falklands waters (Gonzales-Solis et al. 2000). Although no tracking of birds has been conducted in winter months, observations at sea around the Falkland Islands show an increase of bird abundance in the winter, suggesting movements from birds breeding farther south (either from South Georgia or the Antarctic peninsula or both) to the area.

The most recent estimate of the world-wide population of southern giant-petrels (from the late 1990's) is approximately 31,000 pairs, which is a decline of 17% from the previously estimated 38,000 pairs made in 1985 (Patterson et al. in press). For this reason the species has been classified by the International Union for the Conservation of Nature (IUCN) as being Vulnerable (which is used for species that are considered to be showing a high risk of becoming extinct in the medium term). The population on Heard Island decreased from 4,000 in the 1950's to 2,350 in 1980 (Marchant and Higgins 1990). The population has also declined by over 50% at several colonies in Antarctica, including Signy Island and Dumont D'Urville (Marchant and Higgins 1990). This decline has been attributed to a combination of causes; mortality in longline fisheries for example caused 2,000-4,000 to be killed in 1997, while it has also been suggested that declines in the population of southern elephant seals, and human disturbance have contributed (Brooke 2004). Nevertheless, in some other colonies the populations have remained relatively stable (e.g. South Georgia, Iles Crozet, Gough Island), while for many colonies there is little reliable or recent data.

Because of these known declines in other areas, and identified fishery mortalities in local waters, there is therefore concern over the status of the southern giant-petrel in the Falkland Islands. In the Falklands there is currently no accurate estimate of what the actual population is, and no knowledge of what the population trends are. There is some knowledge on the location of breeding colonies and 41 have been previously identified. In order to increase knowledge of the population status, it was intended to make an islands wide census of the number of breeding pairs of southern giant-petrels. This will act as a base-line of the population's status, with the census to be

repeated in five years time in order to broadly identify trends in the population. It may also be possible to compare the initial census to previous counts for individual colonies to get an initial indication of any population trend.

2. METHODS

Known or suspected sites were identified by searching through the Falklands Conservation database for reports of sightings of colonies, and by interviewing all Falkland Islands landowners with coastline on their land (where giant-petrel potentially breed). A full census of all known and suspected colonies in the Falkland Islands was conducted between November 2004 and March 2005. In November and December, 11 colonies were visited and all nests with incubating adults were counted. During this period, standing adults and birds not sitting on an obvious nest were not included in the counts. When both adults were present on a nest, they were counted as a single breeding pair. A further five colonies were surveyed by aeroplane (Islander plane from Falkland Islands Government Air Service) and the same method of counting breeding pairs was used as above on the digital photographs taken, using Corel Draw software to join multiple photographs and to mark individual nests. All birds sitting below the high water mark were discarded as being non-breeding individuals.

All five sites photographed previously were over flown again during the chick-rearing period. When chicks were left alone in February, individual chicks were counted, but due to the poor quality of photographs for two colonies, photographs from mid-January were used. In this case, both chicks left alone and nests with adults in attendance were counted. Another 15 colonies were surveyed by boat charter, four of which were already counted during the incubation period and one of which was also surveyed by air during both periods. A final 14 colonies were separately surveyed directly to finish counting all known sites.

Fourteen colonies were counted both during incubation and chick-rearing, giving an estimate of breeding success. Three of these colonies were only counted partially. Average breeding success was used to estimate the original number of breeding pairs for all colonies where only chicks were counted. Due to the range of breeding success, such conversion has an inherent large error rate. Therefore, when colonies were both counted during incubation and chick-rearing, the values obtained during incubation were retained as the most accurate. For colonies only counted during the chick-rearing period, there was two possible ways of calculating an average breeding success. The first was to take the mean of all 14 colonies. The second method involved calculating the sum of all chicks of all colonies and dividing it by the sum of all adults of all colonies. The problem of this second method is that it gives more importance to biggest colonies in the final breeding success. The influence of colony size on breeding success has been investigated, but the first method was retained to avoid any lack of independence between breeding success and colony size.

At all colonies, whether counted directly or by aerial photographs, multiple counts were conducted until all counts fell within five to ten percent of each other. Several factors contributed to the final error that such census creates. Firstly, variation in individual counts of adults produces a source of error. This error was estimated by calculating the minimum and maximum number of adults counted at each site.

Secondly, similar variation exists within counts of chicks and the error was estimated in the same way as in the first point. Thirdly, there was variation in breeding success within sites (due to the first and second type of error mentioned above) and between sites. Variation within sites was calculated by computing the lowest and highest breeding success for each site. The lowest breeding success was calculated as being the lowest number of chicks divided by the highest number of adults; the highest breeding success was calculated as being the highest number of chicks divided by the lowest number of adults. Four extreme breeding successes were calculated using both methods of average (see previous paragraph) and both the highest and lowest were retained to calculate the minimum and maximum number of original breeding pairs. The last source of error comes from colonies that were only surveyed during the chick-rearing period and where no chicks were seen. The error for this comes from either there being no birds breeding, or that there were some, but they had failed before counts took place.

3. RESULTS

Counts were made of the number of breeding pairs in 13 islands/colonies (eight directly and five by aerial photography) during the incubation stage of breeding (Table 1). Four of these had no breeding birds (all in Lafonia). These colonies had a total of 16,093 breeding pairs, with a range in counts of 15,899-16,297. A further two sub-colonies within George Island were counted during incubation.

Thirty-three colonies were counted during chick rearing (six by aerial photography; Table 1). Four colonies that had been visited during incubation that did not have any breeding pairs were not visited during chick rearing. Colonies only counted during chick-rearing had a total of 2,529 chicks present (range 2,506-2,550).

One colony that was known previously to have had breeding pairs (Beauchêne Island) was not visited for logistic reasons. This was because the island is difficult to access, and the colony was known to be small (one pair in 2001; N. Huin, pers. obs.). It is planned to visit this island during a survey of albatrosses in the summer of 2005/2006.

Eleven entire colonies and sections of two colonies had counts made during incubation and during chick rearing (Table 1). A comparison of the number of pairs present at the different times was used to estimate breeding success. The average breeding success was found to be 68.13%. Estimated breeding success had a range of 56.16-70.95%. When the number of pairs is log transformed, success rate is best fit by a quadratic equation ($r^2 = 59.8\%$; $F_{2,10} = 9.93$; $p = 0.004$; Fig. 1), suggesting the success rate declined with increasing colony size, but with a suggestion of it starting to increase again as the colony increased over a certain threshold.

The colony on Governor Island and small parts of the colonies on Steeple Jason were counted both from land and from aerial survey. There was no significant difference between the two methods, but ground survey provided more accurate results (less variation between repetitive counts). Counts from ground survey for both Governor and Steeple Jason islands were therefore retained in the final calculations.

Seven colonies only visited during chick-rearing had no chicks (Table 1). Using the inverse of the breeding success rate as an estimate of the probability of one or more breeding pair having failed before our visit, it was estimated that 5 (range 0-10) breeding pairs used these colonies.

It was estimated that a total of 19,810 pairs of southern giant-petrels breed in the Falkland Islands (Table 1). There were two major concentrations of breeding sites and numbers; at the southern end of Falkland Sound (72%), and off the west of West Falkland (26%) (Fig 2). The island with the greatest number of breeding pairs was Sandy Cay, in the Elephant Cays, with 10,936 breeding pairs. Other colonies with over 1,000 pairs were Barren Island (1,619 pairs), Penn Island (1,543 pairs), Steeple Jason (1,440 pairs) and Golden Knob (1,019 pairs).

During incubation, 1,467 breeding pairs were counted directly. This was 9% of the total number of breeding pairs that were counted. During chick-rearing, 3,767 chicks were counted directly, representing 30% of chicks that were counted. All birds observed were southern giant-petrels. No birds counted, either directly or from the air, were of the white morph.

4. Discussion

All birds examined breeding during this survey were southern giant-petrels. There have been reports of northern giant-petrels (*Macronectes halli*) breeding at Beauchêne Island, and perhaps elsewhere in the islands (Strange 1992). The single pair breeding there in 2001 was southern giant-petrels (N. Huin pers. comm.). Hence, there seems little evidence of the northern giant-petrel currently breeding within the islands. Similarly, there was no sign of any white morph southern giant-petrel breeding in the islands.

Status within the islands

The estimated breeding population of southern giant-petrels for the Falkland Islands is 19,810 pairs. This is much higher than previous estimates of their population within the islands. Between 1984 and 1992, the population was estimated to be between 5-10,000 breeding pairs (Woods and Woods 1997). In 1982 the population was estimated at 3,200 breeding pairs (Croxall et al. 1984). In the 1950's, they were thought to breed on eight colonies within the Falkland Islands, with Elephant Cays the largest, having hundreds of birds (Cawkell and Hamilton 1961). Whilst previous estimates are too vague to estimate a rate of increase, there nevertheless seems to be clear evidence for the breeding population within the Falkland Islands to be increasing.

Of the eight colonies known in the 1950's (Cawkell and Hamilton 1961), only five still existed during 2004/2005. In addition to this, a number of other colonies that have been reported to us were visited during the survey, but no breeding birds were present this year. Some of the abandoned colonies had occupied sites relatively short distances away, suggesting some colonies may move between years. Furthermore, the number has been increasing since the 1950's, so that 38 occupied sites were found during 2004/2005 (out of 47 visited).

The majority of colonies, where there exists historical records, (and especially the larger colonies) show signs of an increase. The largest colony was previously reported to be one island in the Elephant Cays with 1,000 pairs in 1986/1987 (Woods and Woods 1997). During the 1950's there were said to be hundreds of pairs (Cawkell and Hamilton 1961). Sandy Cay and Golden Knob are both within the Elephant Cays and hold significant colonies, with almost 11,000 breeding pairs on Sandy Cay in 2004/2005. Steeple Jason shows a steady increase, with earliest record mentioning that in the 1950's there were "a few dozen or less" (Cawkell and Hamilton 1961). Colonies increased to around 300 pairs in 1987/88 (Kate Thompson, FC) and 1,051 in November 2000 (Huin per obs), to the current number of 1,440 breeding pairs. George Island was not mentioned as having a colony by Cawkell and Hamilton (1961). This had increased to 30 pairs in 1961 (Woods and Woods 1997) and currently holds 647 pairs.

However a few colonies have decreased. In the 1950's Sea Lion Island held almost as many birds as the Elephant Cays (Cawkell and Hamilton 1961). This had declined to five or six pairs in 1986 (Woods and Woods 1997), and currently 21 pairs. Cawkell and Hamilton (1961) mention small colonies on New Island and Rookery Island, neither of which exist now. In 1987, 26 pairs were noted at Low Bay Rincon (Woods and Woods 1997), but none were present during this survey.

Some colonies have been noted to move. A colony was noted on Driftwood Island in the 1950's (Cawkell and Hamilton 1961). This has apparently moved to the adjacent Driftwood Point. Colonies on Tea Point on Barren Island were thought to have declined slightly, while those on areas further to the west had increased (C. May pers. comm.). Tea Point is occasionally visited by tourists. Colonies have been reported in the past from a number of places around Lafonia; some of these no longer exist. In contrast new colonies at Fanny Cove and False Bull Point were recorded. On Steeple Jason, in 2000/2001, there was a colony of 64 pairs on the south-east of the island. During 2004/2005, there were only two nests in the area, however the colony at the neck had increased, so potentially those from the south-east colony had moved to the main colony (which had increased from 619 pairs in 2000/2001; N. Huin pers. obs.).

Colony description

The majority of colonies around the islands were on bare earth. Usually this was either sand or peat. Alternatively, some colonies were on areas of shingle. Some colonies were on shingle or sand spits. A few nests were situated close to tussac bogs or sand grass, though no colonies were situated within areas of tussac. Many were close to the high water line, and at times have been totally or partially washed out. On Steeple Jason one colony is on bare decomposed peat, and two are on bare earth amongst low grassland.

Colony sizes ranged from a single bird to 10,936 pairs. On some islands, such as Sandy Cay, the entire colony was in one area and was relatively compact. Similarly on some islands with large colonies, the birds were in a single compact colony. These included Penn, Governor, and Third Passage Islands, and Grand Jason. On Golden Knob the colony was on three sandy spits at each corner around the central sand hill. On Steeple Jason, there were four colonies scattered around the island. Of these the largest was at the neck, with 992 nests, 660 of which were grouped together, and the rest rather more scattered (Figure 3). The colony in the north-west corner was mostly

in one group, however, the colony on the south-west side consisted of small groups scattered over an area of approximately one square kilometre. George and Barren Islands (Fig. 4) also have large numbers of breeding pairs, but these are scattered widely around the coasts of the islands in groups of 1-430 chicks. Islands with more than one colony are shown in Figs. 3-6, apart for Bleaker Island where no detailed counts were made.

Breeding success

The breeding success rate varied quite considerably between colonies, ranging from 38-100%. Of 13 colonies, ten had a success rate greater than 57%, while three had success rates lower than 50% (Governor Island, Penn Island and a colony on the north-west of Steeple Jason). Of these, the lowest breeding success was recorded at the north-west colony of Steeple Jason. On Steeple Jason, the four colonies had breeding successes of 38%, 63%, 73% and 100%. The north-west colony lies between the landing area for helicopters landing tourists, and a very large colony of albatrosses. Human disturbance is well known as a reason for the failure of southern giant-petrel colonies (Brooke 2004; Patterson et al. in press). This is especially the case in the Falkland Islands where birds are very flighty and will desert nests even whilst incubating. Nevertheless, it is much less clear why the other two colonies had such low breeding success; Penn Island is apparently never visited (E. Anderson pers. comm.), and it is likely Governor Island is also very rarely visited. Another significant source of breeding failure comes from the fact that some nests are built very close to high water mark and are susceptible to flooding by a combination of high wind and high tide.

The breeding success rate found here did not cover the full extent of the breeding period, but can still be compared to other sites. The mean rate found here (68%) was similar compared to that found in a number of other studies. At South Georgia breeding success was 69.9% on average over three years, at Signy Island it was 44.4%, at Pointe Géologie it averaged 52.4% over five years and was around 80% at Heard Island (Marchant and Higgins 1990).

World status

IUCN recently classified southern giant-petrels as being Vulnerable, due to apparent declines in their worldwide breeding population, with an estimated decline of the worldwide breeding population from 38,000 to 31,000 between the 1980's and the late 1990's (Patterson et al in press). They have been reported to have declined in a number of places, including Heard, Macquarie, King George, Penguin and Signy Islands (Patterson et al. in press), though at Macquarie and Signy Islands this has been questioned (R. Alderman pers. comm., R. Phillips pers. comm.). In contrast there have been reported increases in a number of sites in the South Shetland Islands and on the Antarctic continent (Patterson et al. in press). The population has apparently also increased in the South Sandwich Islands, with 800 pairs in 1984 (Marchant and Higgins 1990), and over 1,500 in 1997 (Convey et al. 1999). Nevertheless, the status remains unclear at a number of the most important breeding localities, including South Georgia, and the South Orkney Islands, neither of which have been counted since 1984 (R. Phillips pers. comm.). The South Orkney Islands had the largest number of breeding pairs in the world in the early 1980's (Marchant and Higgins 1990). Given that there have been increases in a number of localities in the south Atlantic, it may be possible that these other areas have in fact increased.

The world status apparently changes with the addition of the figures from this census of the Falkland Islands. Using data from Patterson et al. (in press) but with the Falkland Islands updated from this census, the estimated world population would be 48,046 breeding pairs. On current published figures, the percentage of the world population breeding in the Falkland Islands would be 41.2% (including 22.8% on Sandy Cay). Almost 50% of the world population is in colonies that are apparently increasing (Table 2), while 20% is in colonies that are decreasing. Southern giant-petrels are currently classified as Vulnerable, with the population listed as decreasing by 30% or more in 64 years (Birdlife International 2004b). From the results of this census, it would appear that the population may actually be increasing, and therefore, the species' conservation status should be upgraded. This is an important result, as it would be the first species of seabird to be upgraded for 15 years. From Patterson et al (in press), most colonies that are increasing are in the south-west Atlantic (Fig. 7). Colonies that appear to be decreasing are rather more widespread.

Reasons for the change in the status within the Falkland Islands

Woods (1975) thought the population of southern giant-petrels had increased in the late 19th and early 20th centuries due to sheep farming, but declined in the mid-20th century due to persecution and egg collecting for consumption. In other parts of the world, declines have been attributed to mortality in fisheries, human disturbance, and the decline of southern elephant seals *Mirounga leonina* (Brooke 2004).

Within the Falkland Islands waters, fisheries mortality has been noted to occur (Sullivan and Reid 2002; 2003; 2004). However this is apparently insufficient to significantly affect the population status. Around trawlers operating around the Falklands, flocks of up to 500 southern giant-petrels frequently occur around trawlers to take fisheries offal (T. Reid pers. obs.). Up to 40 trawlers operate within Falklands Islands waters during spring. Thus potentially there could be 20,000 southern giant-petrels around trawlers at any one time (though, given trawlers generally operate in similar areas to each other, the actual figure is likely to be much lower than this as birds fly between them; T. Reid pers. obs.). With 20,000 breeding pairs in the Falklands, it is likely then that this population is in the order of 70,000 birds. Therefore, perhaps Falkland Island birds are using trawlers for a small amount of their time, and hence must be getting food from other sources. Additionally, during winter there is a significant influx of birds from other areas where we do not know the status (White et al. 2002), and so fisheries mortality may be negatively impacting these populations. Within Falkland Islands waters, mitigation measures implemented for trawlers in 2004, while implemented for the impact on albatross, nevertheless correspondingly benefit the southern giant-petrel population.

Human disturbance is often mentioned as a cause of declines in southern giant-petrel populations (Brooke 2004; Patterson et al. in press). Most islands that they breed on in the Falkland Islands, though not reserves, are relatively undisturbed. Of the ten largest colonies with over 100 breeding pairs, only two of them have more or less permanent housing (George and Bleaker Islands), and three have any sheep farming continuing (George, Barren and Bleaker Islands). Six of the other islands are very rarely (or never) visited. Steeple Jason currently has a predominantly un-manned research station (used for approximately 2-4 weeks each summer, though this is likely to increase) on it, as well as having some helicopter tourism. Governor Island and

Steeple and Grand Jason have been used more extensively for sheep farming in the past (Steeple and Grand not since the late 1960's, Governor not since the 1980's), though the other islands were probably never very important for farming. Nowadays, persecution of giant-petrels near sheep carcass is almost certainly non-existent and egg collecting has stopped.

The southern giant-petrel is an opportunist scavenger (Marchant and Higgins 1990). In South Georgia, Macquarie Island, Davis Station (Antarctica) and Signy Island penguins have been found to make up over 70% of their diet, though they also eat crustaceans, fish and cephalopods (Marchant and Higgins 1990). Increase in food availability might be another reason for a population increase. It is difficult to assess if such might be the case in the Falkland Islands, mainly considering that no diet study of this species has taken place. Likely food resources, other than those obtain at sea, might includes those obtained at colonies of elephant seal, South American fur seal *Arctocephalus australis*, South American sea lion *Otaria byronia* (Fig. 8), penguins (Fig. 9) and albatross (Fig. 10). The only notable breeding colony of elephant seal in the Falkland Islands is situated on Sea Lion Island and comprise around 530 pups produced per year and is stable (Galimberti et al. 2001), but the colony of giant-petrel here is decreasing. Sea lions are on the increase in the Falkland Islands (Thompson et al 2004) with a census undertaken in 2003 finding 2,744 pups produced in that season. This represented an increase of 35% since 1995, but only 3.4% of the original population in the 1930's. The distribution map of sea lion colonies and giant-petrel colonies do not show any relationship between the two species (Fig. 5) and influence of sea lion (and a further 14,000 fur seal, mostly all breeding on Bird, New and Beaver islands where no giant-petrel breeds, FC database) is likely to be negligible at the population level of southern giant-petrels. Southern giant-petrels are rarely seen feeding amongst penguin colonies (which are the feeding domain of striated caracara *Phalacrocorax australis* and Falklands skua *Catharacta antarctica*). Gentoo penguin *Pygoscelis papua* population fluctuates between 64,000 and 113,000 pairs in the Falkland Islands (Clausen and Huin 2003), but Rockhopper penguins decreased from 1.5 millions in the 1930's (Putz et al 2003) to 271,000 in 2000 (Clausen and Huin 2003), never justifying the increase in southern giant-petrels. The only time southern giant-petrels feed on albatross is during fledging time when birds patrol the shore of the albatross colonies and attack chicks that fledge by forcing them to land on the water and then drowning them. Most albatross chicks avoid giant-petrels by taking to the wing for their first time only after dark (Huin per obs). Black-browed albatross in the Falkland Islands are unfortunately on the decline, with current population estimate being of 382,000 pairs in 2000, compared to 506,000 pairs in 1980 (Huin 2001). This again does not explain any increase in the giant-petrel population. One other possibility is that southern giant petrels are increasing to take some of the niche at sea vacated by the decline of the black-browed albatross. Southern giant-petrels from the Falkland Islands are generally more marine than in some other parts of their breeding range (Voisin 1982).

While there is clear evidence that the population has been increasing, at least since the 1950's, from the above discussion it is not apparent why this is occurring. The most important colonies are relatively undisturbed. While there is some fisheries mortality, it is apparently not sufficient to halt the current increase. The levels of breeding success, as detailed above, are not greater than for other colonies, suggesting the increasing population may be due to survival at sea. Woods (1975) suggests the

population was increasing through the 19th and early 20th centuries. However there is little evidence from which to judge the population before humans came to the islands. Woods (1975) suggests it had increased because Darwin did not comment on them when visiting in the 1830's. However he mainly stayed in the north-east of East Falkland, neither visiting Lafonia or West Falkland, and hence did not go to the areas they predominantly breed (Armstrong 1992). In order to understand the increase, there would need to be studies carried out on the diet, foraging range and demographics of the local birds. Nevertheless, at least they should be regularly monitored to see if the current population increase continues, if the population reaches a constant level, or if it begins to decline.

5. Conclusions

The Falkland Islands hold a breeding population of almost 20,000 southern giant-petrels. This represents a substantial proportion of the world population, meaning the population here is extremely important. The population in the Falklands has greatly increased since previous estimates. It is unclear as to why this should have occurred. The most important colonies in the island are relatively free of disturbance, and while there is fisheries mortality, it is apparently not sufficient to undermine whatever process is driving the increase. While a substantial amount of the population visits fishing vessels, it is unlikely at the present to be sufficient for this to be the source of the population increase. The observed breeding success rate is no higher than that observed from other stable or declining colonies. This suggests that the increase is due to increased survival at sea rather than increased breeding success. In order to understand the increase, there would need to be studies carried out on the diet, foraging range and demographics of the local birds. Or, alternatively, it could be argued, they are doing well in their undisturbed state, so maybe they should be left alone, especially considering their extreme shyness and susceptibility to disturbance in the Falkland Islands. Nevertheless, at least they should be regularly monitored to see if the current population increase continues, if the population reaches a constant level, or if it begins to decline. Demographic traits of this species are likely to be similar to the black-browed albatross and a similar monitoring regime should be put in place. This would involve a repeat of the full islands census every five year and with some easily accessible colonies to be monitored annually both at least for breeding number and breeding success.

Another important outcome of this census is to re-evaluate the status of this species worldwide. In conjunction with recently published data on the status of the species, it is likely that the threat level to this species might be downgraded to it being Near-Threatened rather than Vulnerable. This would be the first species of procellariiform to accomplish such a change of status in recent years. Communications with relevant stakeholders has been initiated, but further sharing of census results needs to take place. To gain a fuller understanding of the status of the species, it is imperative for censuses to be conducted at a number of sites that have not been visited since the 1980's (or earlier).

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Table 1: Summary of breeding colonies of Southern giant-petrels in the Falkland Islands:

Site		Adult counts			Chicks counts			Final	Breeding success
		Method	Date	Number of pairs	Method	Date	Number of chicks	Number of pairs	%
Steeple Jason	The Neck	direct	08/12/04	992	direct	05/02/05	629	992	63.41
	NW End		08/12/04	234		05/02/05	89	234	38.03
	Above EastBBA		08/12/04	2		05/02/05	2	2	100.00
	AboveWestBBA		08/12/04	212		05/02/05	166	212	78.30
	Total			1,440			886	1,440	
Jason West Cay				direct	28/04/05	2	3		
Grand Jason				direct	08/02/05	559	820		
Beauchêne Island				not surveyed		not surveyed			
Sea Lion Island				direct	18/01/05	14	21		
Lafonia	Fanny point	direct	15/11/04	17	direct	11/01/05	16	17	94.12
	False Bull point	direct	15/11/04	9	direct	11/01/05	8	9	88.89
	Saw Rincon	direct	16/11/04	0			0	0	
	Low Rincon	direct	16/11/04	0			0	0	
	Motley point	direct	16/11/04	1			1	1	
	Long Creek	direct	17/11/04	0			0	0	
	Piojo point	direct	17/11/04	0			0	0	
	Cattle point rincon				direct	03/03/05	0*	0*	
	Cattle point rincon south				direct	03/03/05	0*	0*	
	Driftwood point				direct	03/03/05	7	10	
	Mutiny point				direct	03/03/05	14	21	
Pebble Island					direct	30/01/05	46	68	
NW Passage islet						15/02/02	0*	0*	
Low Island					direct	03/02/05	14	21	
Hope point					direct	03/02/05	1	1	
Governor Island		photo	04/12/04	723	both	10/02/05	351	723	48.55
West Island					direct	10/02/05	44	65	
Dyke Island	Monkey point				direct	10/02/05	34	50	
Ten Shilling Bay						11/02/05	0*	0*	
Albermale	Rookery point				direct	11/02/05	12	18	
Barren Island	all				direct	12/02/05	1,103	1,619	73.08
George Island	all				direct	13/02/05	441	647	73.58
Swan Island	all				direct	14/02/05	48	70	
Carcass Island					direct	15/01/05	2	3	
Bleaker Island	all				direct	30/01/05	128	188	
Burnt Islet					direct	15/02/05	4	6	
Johnson Harbour	Black Point				direct	26/01/05	6	9	
Elephant Beach	Smylies Black point				direct	22/02/05	0*	0*	
Cape Dolphin	Swan pond point				direct	22/02/05	1	1	
North East	Hutchy's south reef				direct	03/03/05	0*	0*	
Lively	Enderby point				direct	03/03/05	14	21	
Rincon Grande					direct	03/03/05	12	18	
Penn Island	all	photo	04/12/04	1,543	photo	04/02/05	643	1,543	41.67
Speedwell Island	Phillips point				photo	04/02/05	23	34	
Speedwell Island	South tip				photo	04/02/05	0*	0*	
Third Passage		photo	27/12/04	405	photo	04/02/05	233	405	57.53
Elephant Cays	Golden Knob	photo	08/12/04	1,019	photo	14/01/05	576	1,019	60.19
Elephant Cays	Sandy Cay	photo	08/12/04	10,936	photo	14/01/05	7,474	10,936	68.34
Total counted				16,093			12,716	19,805	68.13
*Probability of sites with 0 chick having 1 or more breeding pairs								5	
Overall total								19,810	

Note1: bold numbers are values used for computation of total number of breeding pairs

Note2: breeding success in italic come from subsample of colony only

Table 2. Percentage of the world population of southern giant-petrels within colonies that are increasing or decreasing (from Patterson et al. in press, plus figures from this census for the Falkland Islands).

Population trend	Population	Percent
Unknown	13,708	28.5
Stable	1,011	2.1
Decrease	9,401	19.6
Increase	23,926	49.8

Fig. 1. Scatterplot of relationship and regression between breeding breeding success of southern giant-petrel colonies and the number of pairs.

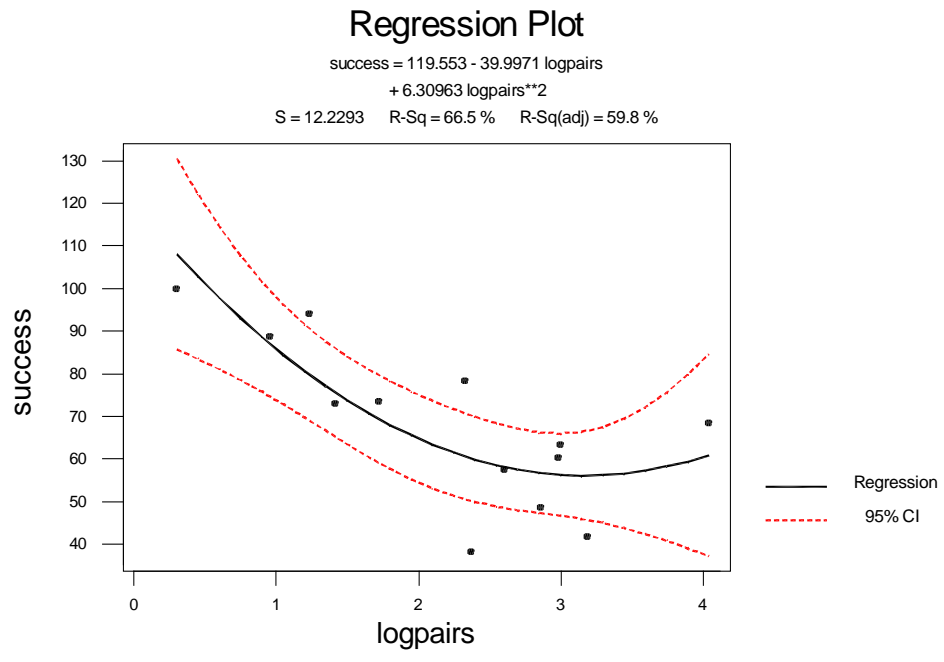


Fig 2. Distribution and size of breeding colonies of southern giant-petrels within the Falkland Islands (number given is the actual or estimated number of breeding pairs).

Fig. 3. Distribution of breeding colonies of southern giant-petrels on Steeple Jason.

Fig. 4. Distribution of breeding colonies of southern giant-petrels on George and Barren Islands.

Fig. 5. Distribution of breeding colonies of southern giant-petrels on Swan Island.

Fig. 6. Distribution of breeding colonies of southern giant-petrels on Elephant Cays.

Fig. 7. Distribution of breeding colonies of southern giant-petrels around the world (from Patterson et al. in press and present census).

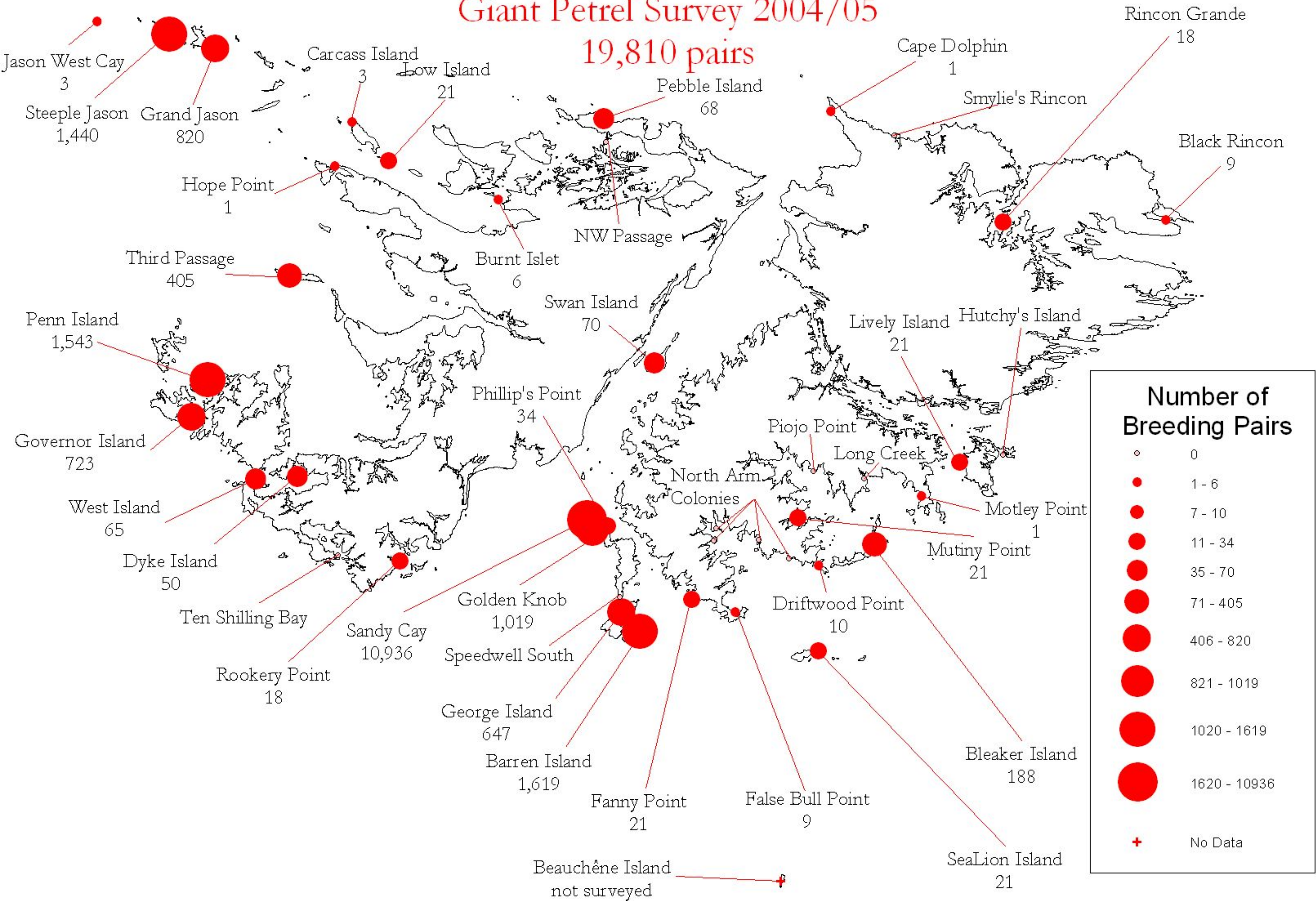
Fig. 8. Distribution of breeding colonies of southern sea lions within the Falkland Islands.

Fig. 9. Distribution of breeding colonies of penguins within the Falkland Islands (data from Clausen and Huin 2003).

Fig. 10. Distribution of albatrosses and southern giant-petrels around the Falkland Islands.

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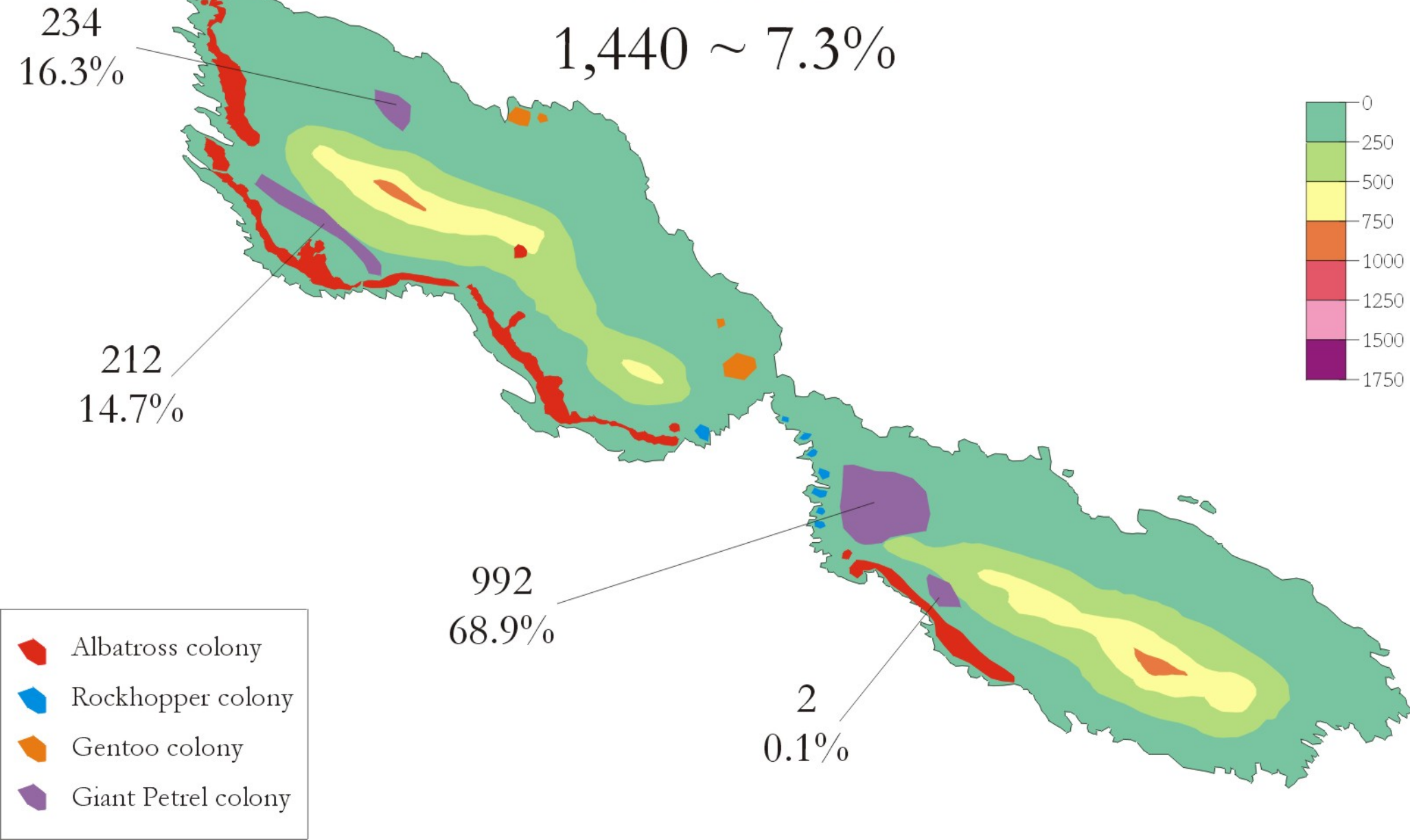
19,810 pairs

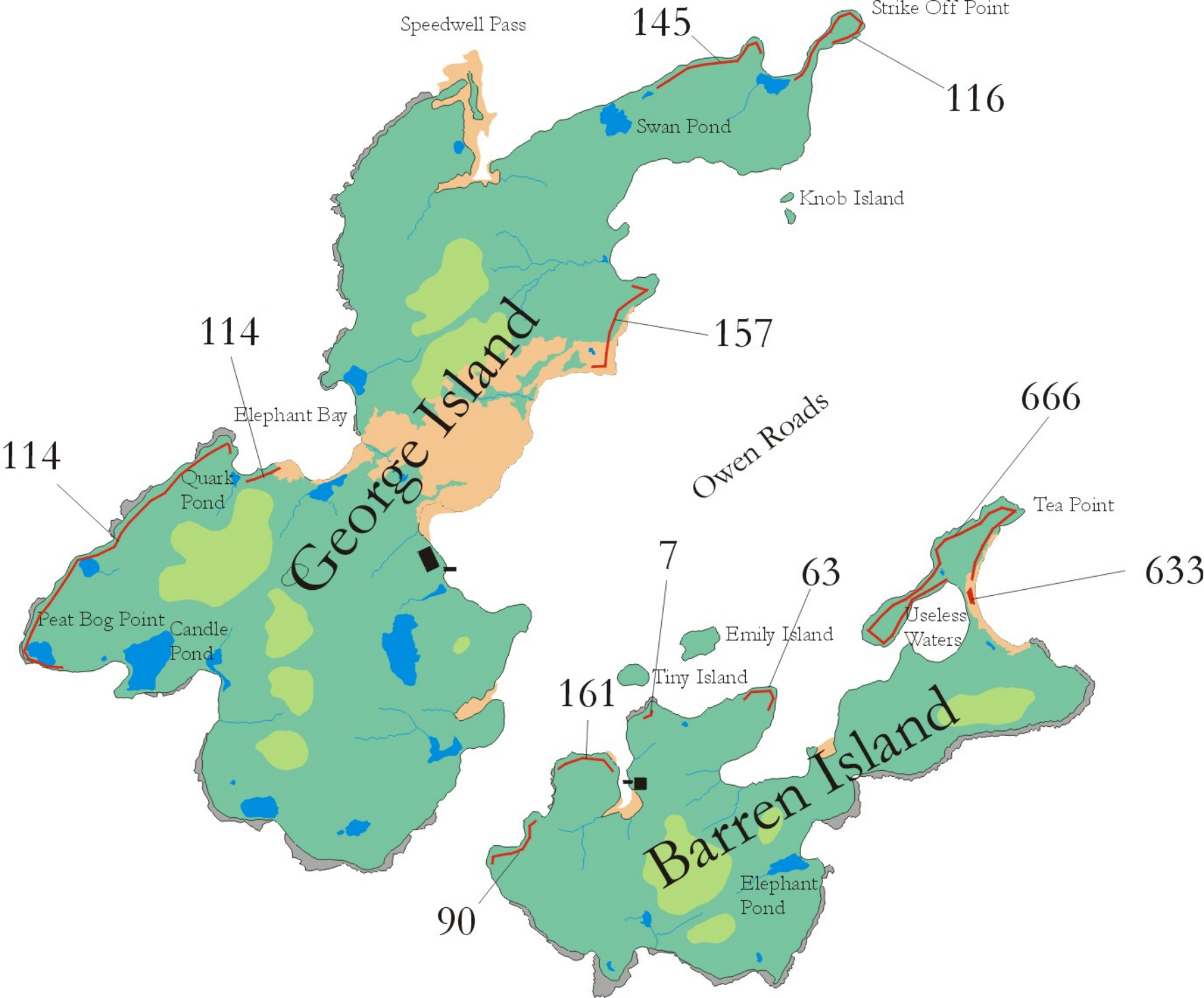


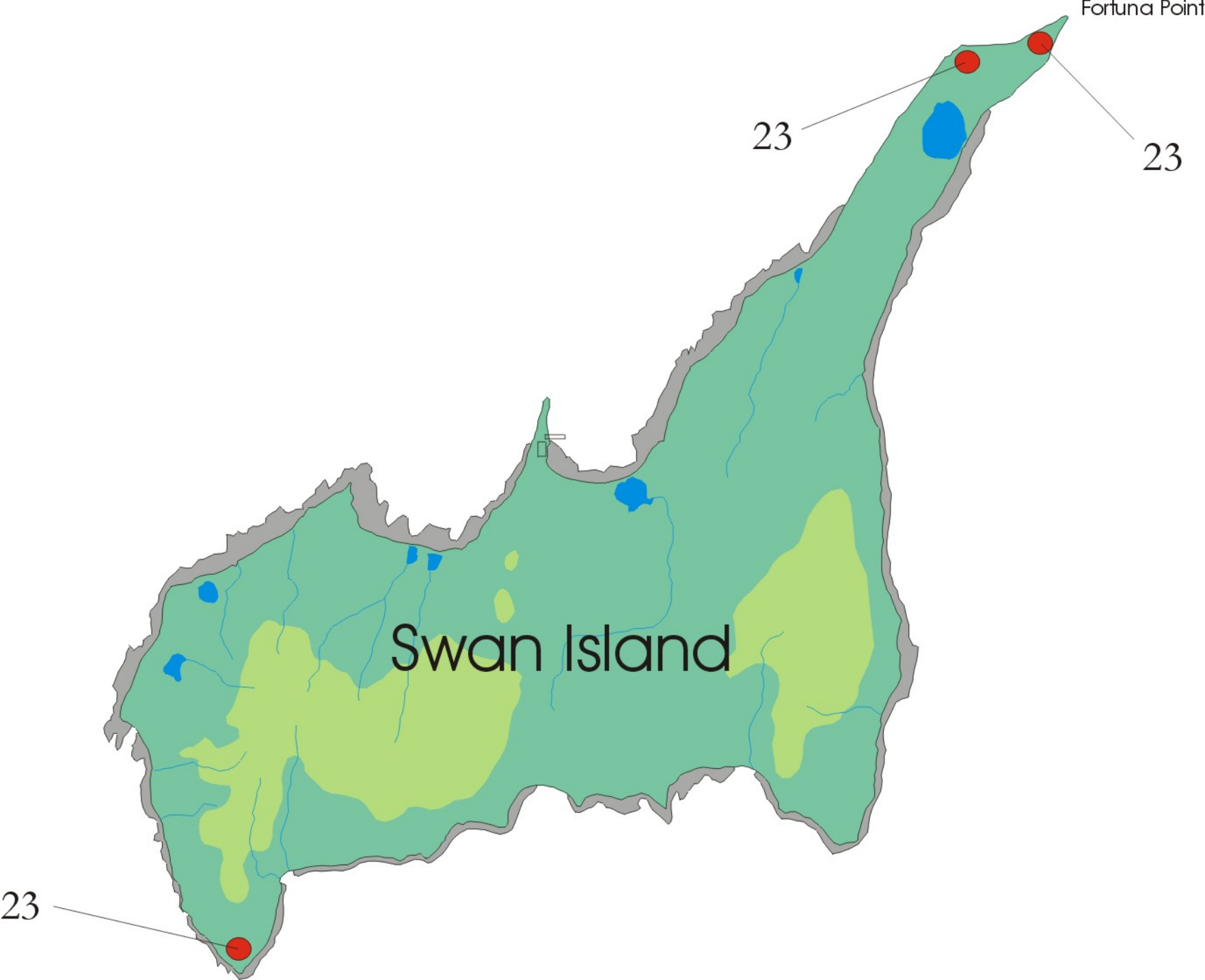
STEEPLE JASON ISLAND

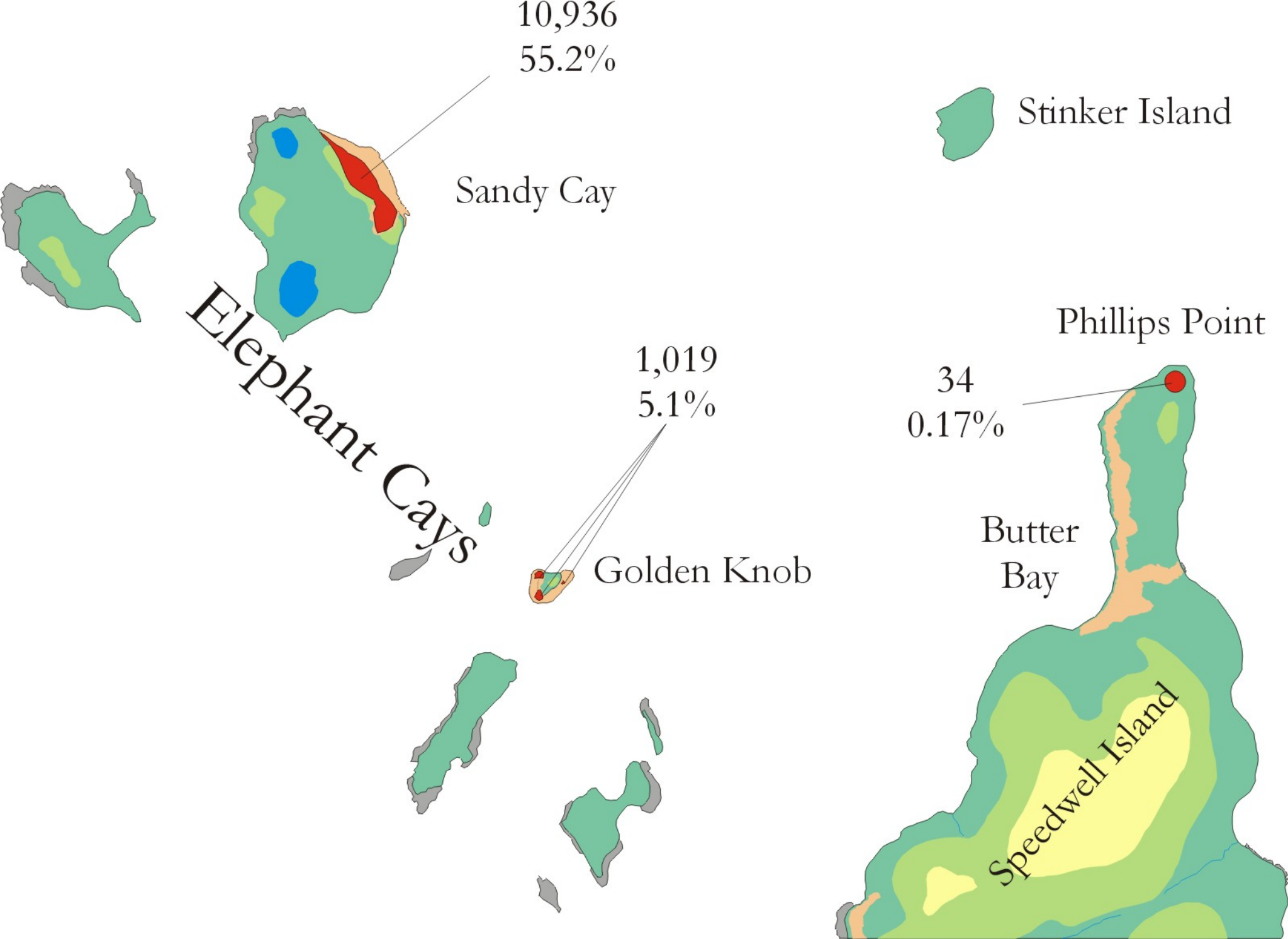
December 2004

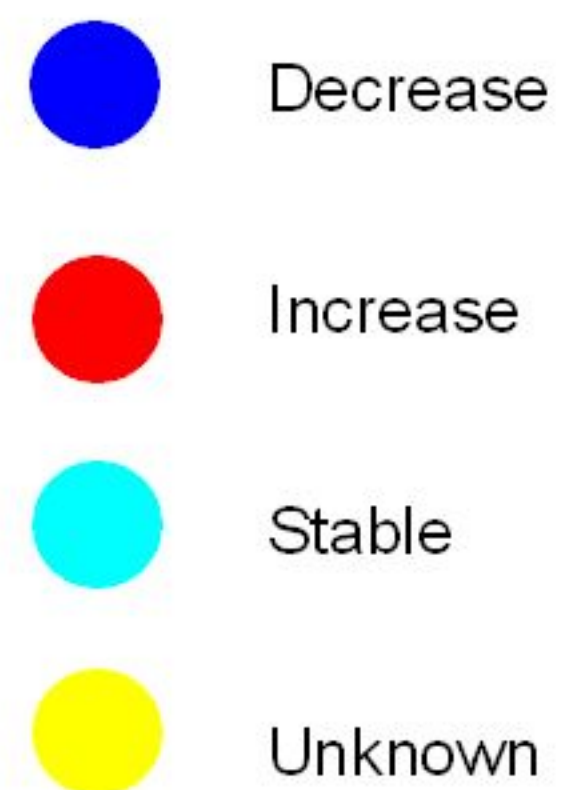
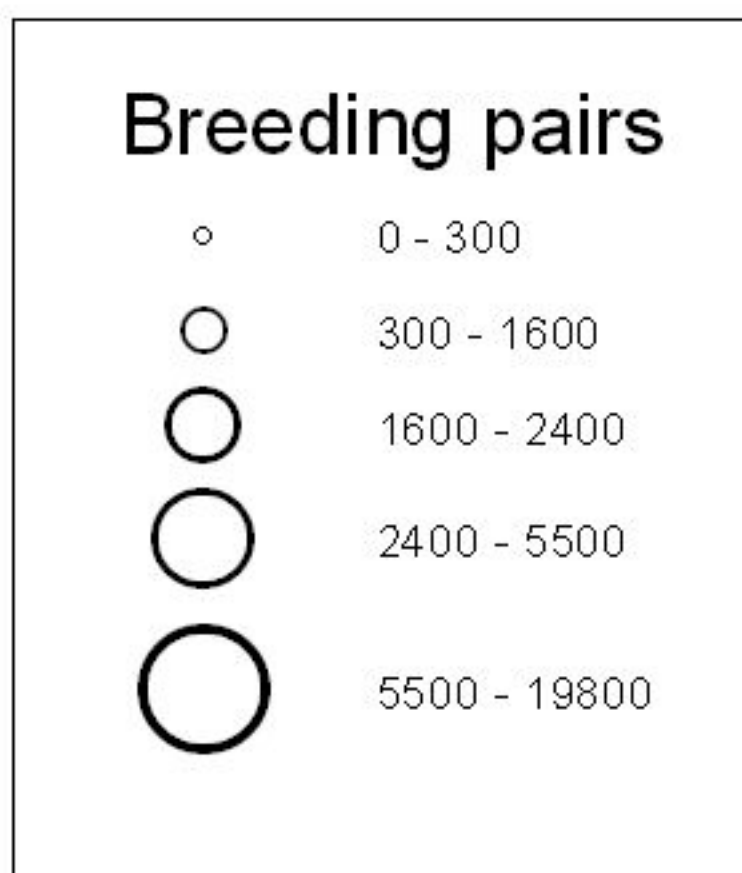
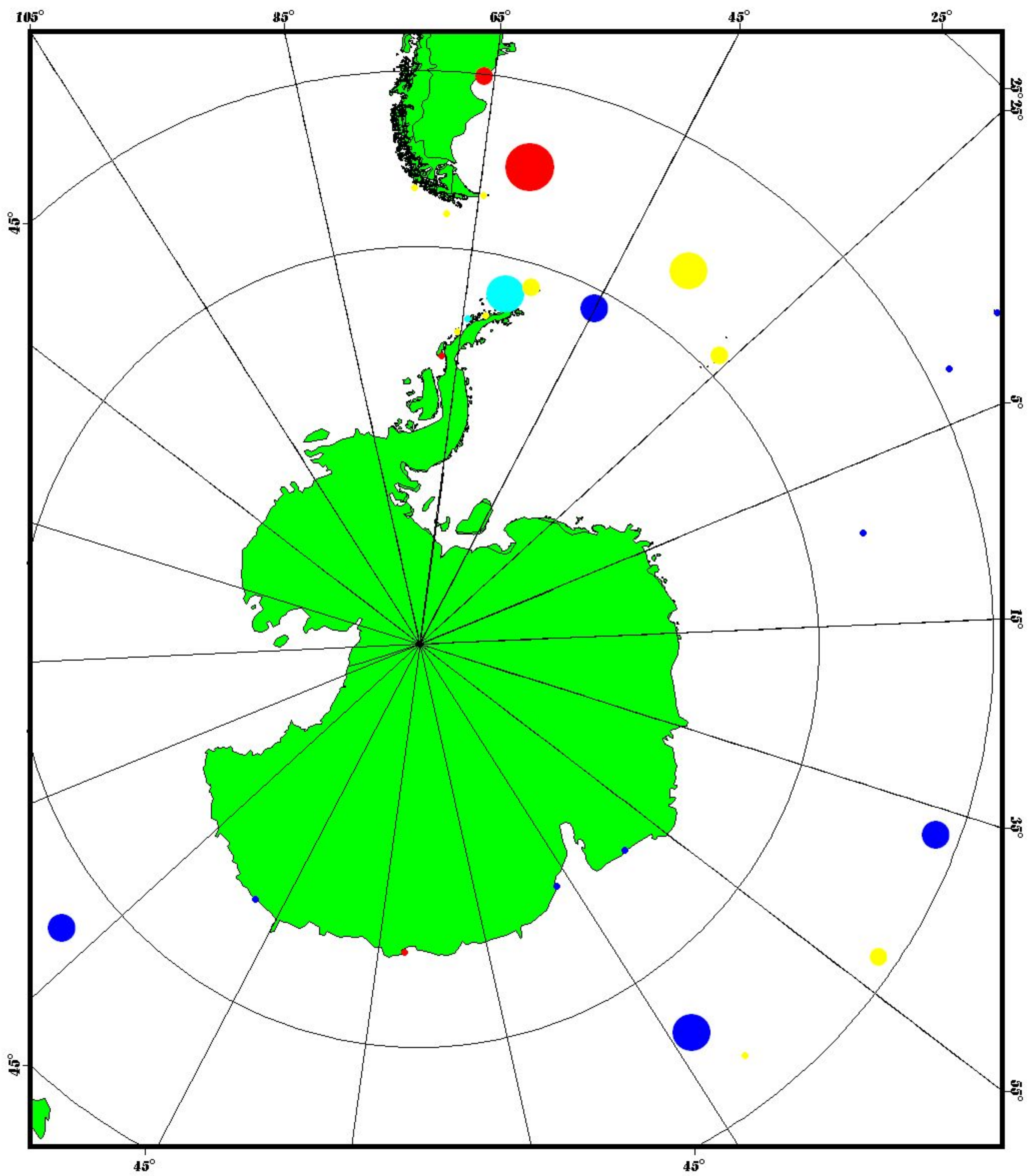
1,440 ~ 7.3%





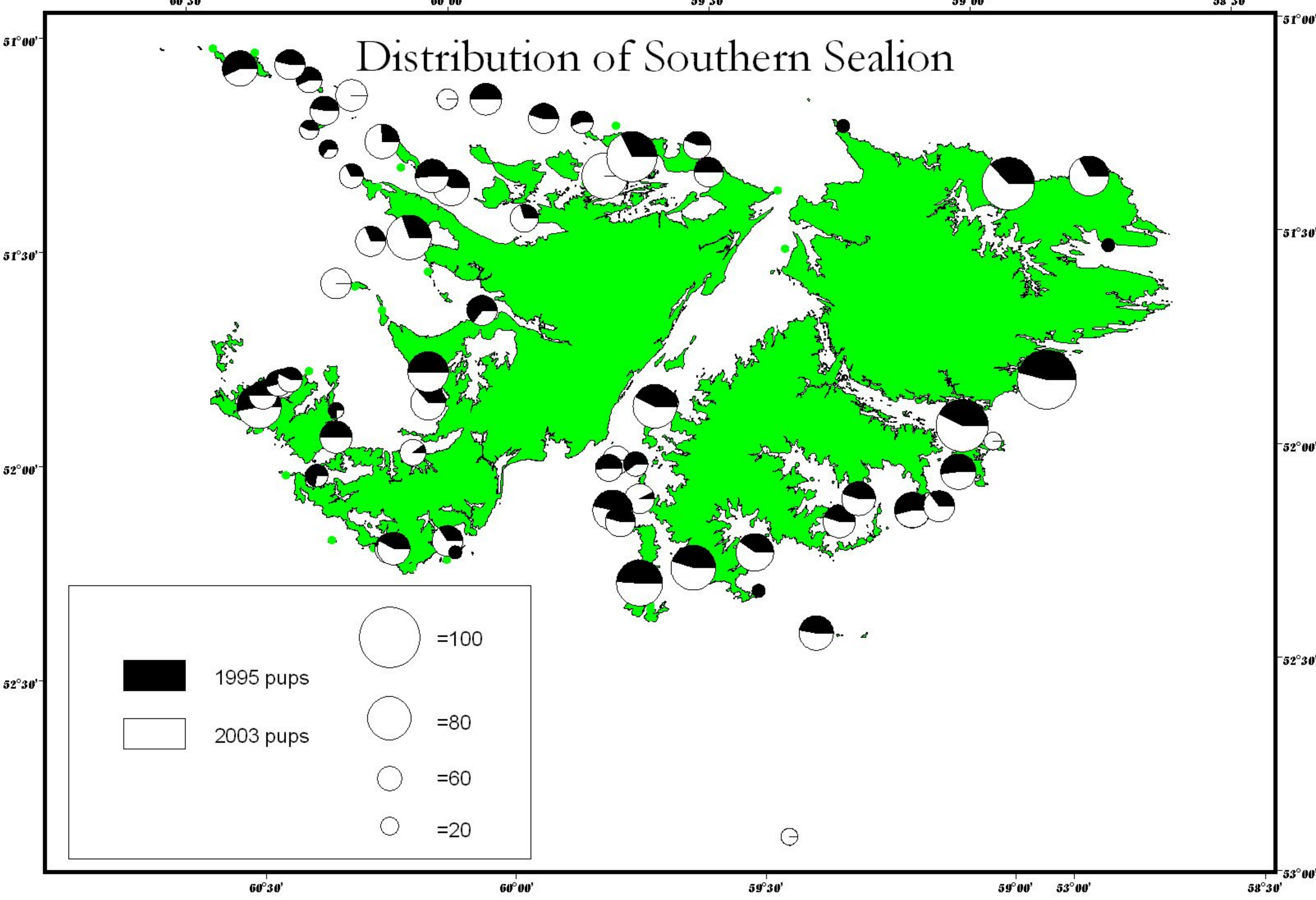






Southern Giant Petrel
World Distribution

Distribution of Southern Sealion



Penguin Census 2000

