BREEDING DISTRIBUTION AND POPULATION STATUS OF THE NORTHERN GIANT PETREL *MACRONECTES HALLI* AND THE SOUTHERN GIANT PETREL *M. GIGANTEUS*

D.L. PATTERSON,[1] E.J. WOEHLER,[2*] J.P. CROXALL,[3] J. COOPER,[4] S. PONCET,[5] H.-U. PETER,[6] S. HUNTER[7] & W.R. FRASER[1]

[1]*Polar Oceans Research Group, PO Box 368, Sheridan, Montana, 59749, USA*
(patterdo@3rivers.net)
[2]*Australian Antarctic Division, Channel Highway Kingston, Tasmania, 7050, Australia*
Current address: School of Zoology, University of Tasmania, Sandy Bay, Tasmania, 7005, Australia
[3]*British Antarctic Survey, Natural Environmental Research Council, High Cross, Madingley Road, Cambridge, CB3 0ET, UK*
[4]*Animal Demography Unit, Department of Zoology, University of Cape Town, Rondebosch, 7701, South Africa*
[5] *South Georgia Surveys, Stanley FIQQ, 1ZZ, Falkland Islands*
[6]*Polar and Bird Ecology Group, Institute of Ecology, Friedrich Schiller University Dornburger Str. 159, D-07743, Jena, Germany*
[7]*Department for Environment, Food and Rural Affairs, Ground Floor, Foss House, Peasholme Green, York, YO62 6RD, UK*

Received 19 August 1998, revised 11 June 2008, accepted 5 July 2008

SUMMARY

PATTERSON, D.L., WOEHLER, E.J., CROXALL, J.P., COOPER, J., PONCET, S., PETER, H.-U., HUNTER, S. & FRASER, W.R. 2008. Breeding distribution and population status of the Northern Giant Petrel *Macronectes halli* and Southern Giant Petrel *M. giganteus. Marine Ornithology* 36: 115–124.

Compilation of existing population data through the 1999/2000 season for Northern Giant Petrels *Macronectes halli* and Southern Giant Petrels *M. giganteus* indicates that the total breeding population of Northern Giant Petrels is approximately 11 210 pairs, an increase of 30% since an earlier estimate. The total breeding population for Southern Giant Petrels is currently estimated at 30 575 breeding pairs, with strong local-scale variability in population trends. Limitations to the data used in the current synthesis would indicate that current population estimates should be regarded as conservative.

INTRODUCTION

Until 1966, giant petrels were regarded as a single species. Early research by Bourne & Warham (1966), however, identified northern and southern forms, which are today recognized as sibling species with a circumpolar distribution in the Southern Ocean (Hunter 1984a). Southern Giant Petrels *Macronectes giganteus* are more abundant at the higher latitudes, although colonies occur as far north as the Falkland Islands, Isla Noir, Chile and Chubut Province, Argentina. Northern Giant Petrels *M. halli* are found primarily on the sub-Antarctic islands located north of the Antarctic Polar Front. Both species are considered among the principal scavengers of the Southern Ocean, although some studies indicate that both species are also significant terrestrial predators at some localities (Hunter 1985, 1987, 1991a; Hunter & Brooke 1992; Emslie *et al.* 1995; Briggs & Humpidge unpub. data). Although limited interbreeding between the two species has been reported (Hunter 1987), with some studies even suggesting that a third species may exist (Voisin & Bester 1981), the two species are reproductively isolated at sympatric breeding localities (Warham 1962, Hunter 1984a). The two primary mechanisms maintaining reproductive isolation are breeding behaviour and chronology, with Northern Giant Petrels breeding up to six weeks earlier than the southern species does (Hunter 1984a). Both species lay a single egg per year, and evidence suggests that, on average, 30% of their respective potential breeding populations do not breed each season (Voisin 1988).

Recent analyses of long-term population data suggest that breeding populations of Northern and Southern Giant petrels are changing, increasing at some localities, while decreasing at others (Woehler *et al.* 2001). In most areas, however, causal factors have not been specifically identified, in part because of the relatively high proportion of adults that may be absent because of breeding sabbaticals from the colonies each year. As a result, and especially in the case of short-term studies, relating population changes to specific environmental or anthropogenic factors has been difficult, inviting extreme caution before any definitive conclusions are reached. However, particularly where long-term population decreases have been documented, factors such as introduced predators and fisheries activities have been implicated (Rounsevell & Brothers 1984, Jouventin & Weimerskirch 1991, Woehler 1996). These and other factors, including a paucity of new studies and a deficiency of giant petrel population monitoring, were identified in 1992 by the Scientific Committee on Antarctic Research Bird Biology Subcommittee (SCAR-BBS) as compelling reasons for undertaking a comprehensive review of the available current and historical data on the distribution and abundance of breeding populations of both giant petrel species.

METHODS

Current and historical accounts of Northern and Southern Giant petrels were reviewed and compiled to obtain data on the distribution and abundance of the breeding populations. Unpublished survey data from numerous sources, localities and investigators were also obtained and incorporated. Censuses within each region were assigned accuracy codes based on the stage in the breeding cycle at which the censuses were conducted (Table 1). These codes divide into several categories or types: "N" (nest) counts indicate that censuses recorded the total number of active nests; "C" (chick) counts indicate that censuses recorded the total number of chicks; "A" (adult) counts indicate that censuses recorded the total number of adults; and "I" (incomplete) counts denote partial censuses. The A-type censuses are potentially the least accurate, because they simply include adults that were occupying territories and not necessarily breeding. Because pre-breeders and sabbatical breeders tend to occupy nest sites irregularly and unpredictably, A-type surveys may generate an overestimate of the actual breeding population. For localities without a comprehensive breeding population census, records detailing breeding individuals without any census ("B"), former breeding ("FB") and adults not necessarily breeding ("P"), were also included as a historical record. Census years were standardized to reflect the austral split season; thus, a census conducted during February 1990 is recorded as the year 1989 (i.e. the 1989/90 season). Latitude and longitude are expressed in decimal format with degrees south and west given as negative, and east, as positive. The coordinates for colony locations are approximate and were taken from various sources. Data presentation and results closely follow Woehler (1993c) to maintain uniformity with past syntheses.

Four problems were encountered in compiling the population data for Northern and Southern Giant petrels. First, the two species were not differentiated until 1966 (Bourne & Warham 1966) and therefore early population estimates and banding records refer to some combination of the two species. To investigate long-term trends in these populations, subsequent researchers employed survival estimates and band recoveries to determine the relative proportions of each species in the historical population data (see Hunter 1984a). The data provided by these researchers were thus incorporated into this review without further adjustment and should be treated with caution in terms of the species to which they refer.

Second, many early published and unpublished records cite the presence of giant petrels at particular localities, but fail to record abundance, breeding status and thoroughness and accuracy of the census; in many cases the localities also lack contemporary data. As a result, trends in breeding population size cannot be determined for those localities. Nonetheless, the data are valuable from a historical perspective, providing they are viewed with caution when used to evaluate long-term population trends in light of contemporary censuses.

TABLE 1
Census and accuracy codes

Census codes	Meaning
N	Census specifies total nests
C	Census specifies total chicks
A	Census specifies total adults at occupied territories
B	Birds present and breeding, no census performed or reported in literature
P	Birds observed in the area, no breeding individuals found
FB	Former resident breeder
I	Incomplete census
Accuracy codes	**Meaning**
1	Accurate to ±5%
2	Census based on overall colony area
3	Accurate to ±10%–15%
4	Accurate to ±25%–50%
5	Accurate to one order of magnitude

Third, although some giant petrel populations occur in areas where considerable research has been undertaken, the vast majority of breeding localities are infrequently surveyed, and hence population trends are difficult to assess. This problem is compounded by discrepancies inherent in the different census types, the occasional use of different names for the same locality and census dates relative to the nesting chronology of giant petrels. Because these data offer historical value, they were not removed from this compilation. Again, however, breeding population trends for these localities should be regarded with caution until contemporary censuses are available and agreement is reached on locality nomenclature.

Finally, many censuses exhibit overlap in coverage so that the boundaries of specific localities could not always be determined. For example, in the vicinity of Point Thomas, Admiralty Bay, King George Island, Lesinski (1993) combined all Southern Giant Petrel censuses into one figure. However, Trivelpiece *et al.* (1980), Jablonski (1986), and Myrcha (1993) provide separate locality names for each census site. Where such problems exist, all censuses are listed to maximise the available regional information, and unofficial names are noted with their geographic position.

In compiling available population data and attempting to ascertain regional population trends, we encountered a final challenge. Across a region, population censuses are typically not synoptic in nature, and thus regional trends are far more difficult to determine than are trends for individual localities. Moreover, for localities that are infrequently visited or surveyed, it is difficult to place single, brief surveys into context; environmental or anthropomorphic factors (e.g. unseasonal storm events, overflight activity) of limited duration but with lasting consequences on the breeding population may not be readily apparent (S. Hunter unpubl. data). Although more recent census data have become available during the interim

TABLE 2
Regional population estimates for
Southern Giant Petrels *Macronectes giganteus*

Region	Estimated population[a] (breeding pairs)	Trends
Antarctic Continent	290	
Prince Edward and Marion Is	1 800	
Îles Crozet	1 060	
Îles Kerguelen	4	
Heard I and MacDonald Is	4 400	
Macquarie I	2 300	
Antarctic Peninsula	1 190	
South Shetland Is	5 409	
South Orkney Is	3 400	
South Sandwich Is	1 550	
South Georgia & Bird I	4 650	
Falkland Is[a]	3 122	
South America[a]	1 350	
Tristan da Cunha and Gough I	50	
TOTAL	30 575	

[a] Recent censuses have revealed further breeding population changes at some localities. Population figures presented here are based on the most recent available census at each locality up to the manuscript cutoff date of 1999/2000. Readers are encouraged to view this compilation as a historical record, and to review the additional literature cited in Appendix 4 for further and important information.

between the first and final drafts of this compilation, the most recent data presented in this manuscript are from the 1999/2000 season.

RESULTS

Population data for Northern Giant Petrels and Southern Giant Petrels are given in Table 2 and in Appendixes 1–3 (electronic only, available at www.marineornithology.org/abs/36_2/Patterson). Corresponding census localities are detailed in Figs. 1 and 2 for Northern Giant Petrels, and in Figs. 3–5 for Southern Giant Petrels. According to the most recent censuses at each locality, the estimated world population of breeding Northern Giant Petrels is approximately 11 210 pairs (Appendixes 1 and 2). This total suggests an increase of 30% since the last published estimate (8600 pairs, Hunter 1985). In contrast, the total breeding population of Southern Giant Petrels is estimated at 30 575 pairs (Table 2, Appendix 3), a decrease of 20% relative to Hunter's (1985) estimate of 38 000 breeding pairs. Because some localities have not been surveyed since Hunter's (1985) report was published, these estimates and trends should be regarded as conservative.

Regional population trends vary (Table 2 and Appendix 2). Census data at many locations are comparatively dated or of low accuracy (or both), preventing detailed assessments of population trends. Accurate assessments and more robust conclusions regarding population status and trends await contemporary data for many localities.

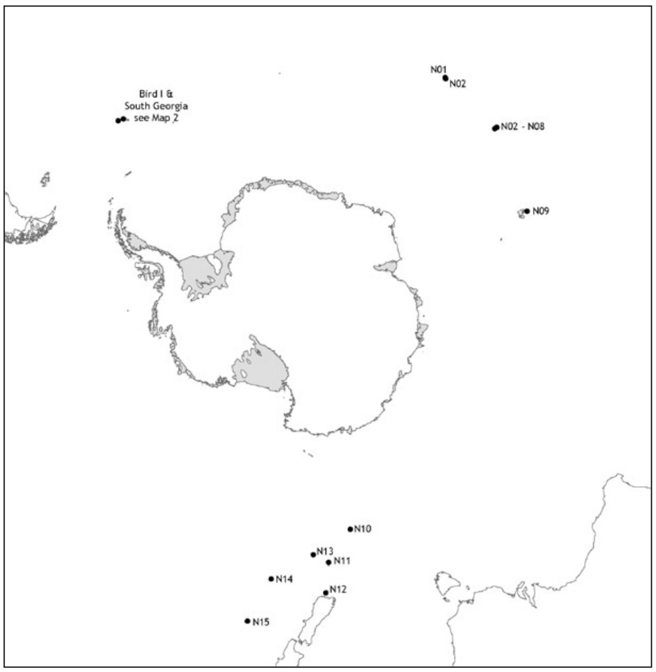

Fig. 1. Distribution of nesting localities of Northern Giant Petrels *Macronectes halli.* Nesting sites at South Georgia and at Bird Island are shown in Fig. 2.

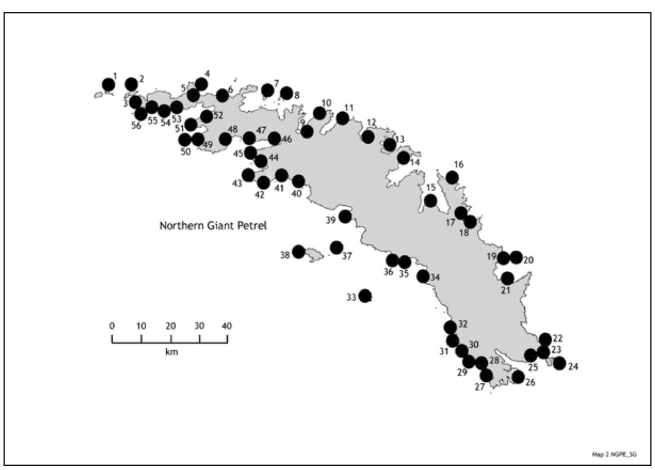

Fig. 2. Distribution of nesting localities of Northern Giant Petrels *Macronectes halli* at South Georgia and Bird Island.

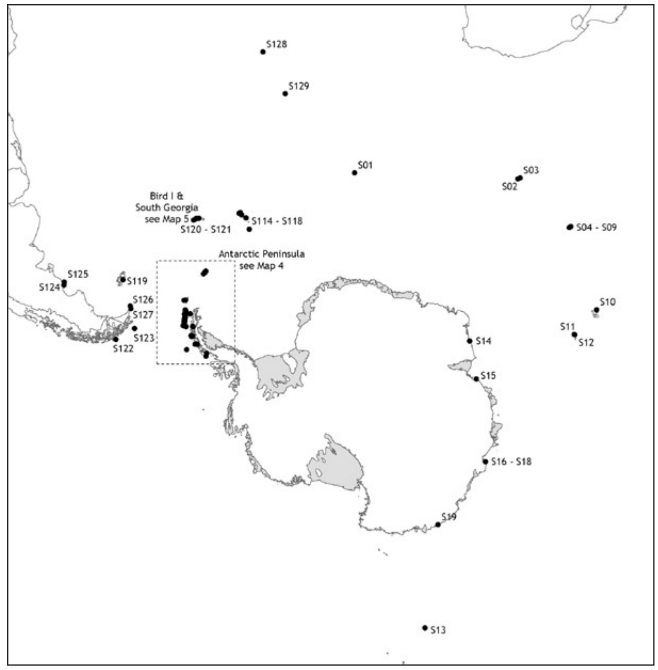

Fig. 3. Distribution of nesting localities of Southern Giant Petrels *Macronectes giganteus*. Nesting sites throughout the Antarctic Peninsula are shown in Fig. 4, and those at South Georgia and Bird Island are shown in Fig. 5.

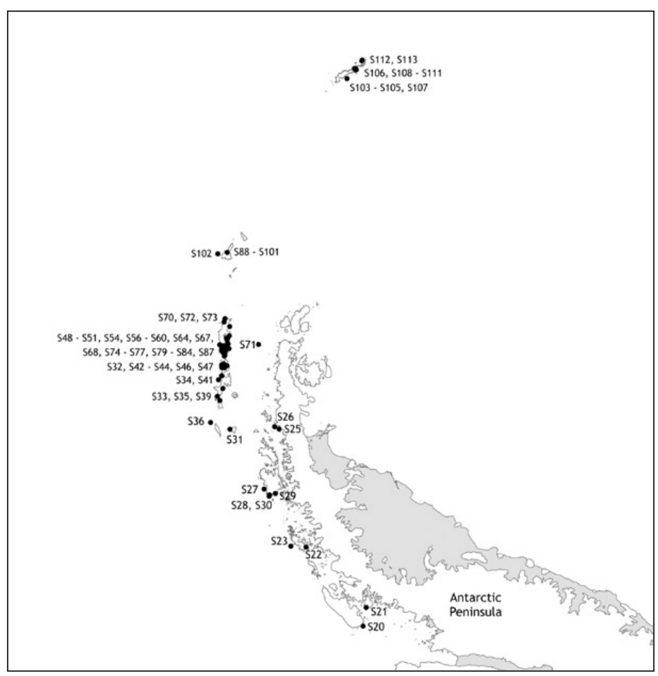

Fig. 4. Distribution of nesting localities of Southern Giant Petrels *Macronectes giganteus* in the Antarctic Peninsula.

DISCUSSION

Northern Giant Petrel populations appear to be increasing, and those of some Southern Giant Petrels appear to be decreasing. The cautionary note repeated throughout this synthesis is that the current comparison of global population trends is based partly on Hunter's (1985) totals. Hunter's (1985) global population estimate was a reasonable estimate using the best data available at the time; but the primary focus of that manuscript was not to come up with a definitive global population estimate. Thus, unless trends are reinforced by multiple censuses, it is advisable to view the population change data conservatively, especially with infrequently visited breeding sites. It is difficult to evaluate long-term population change with infrequent and questionably timed censuses for a species with highly variable breeding effort (i.e. sabbatical pairs, recruitment) and equally variable productivity within the breeding season (see Peter *et al.* 1991, Cooper *et al.* 2001, Ryan *et al.* 2003). Despite these limitations and cautions, the broad trend for Northern Giant Petrels is of a population increase, and although Southern Giant Petrel population trends vary by region and locality, the trend is mainly of stable-to-decreasing breeding populations. However, departures from these apparent trends are evident at localized scales. For example, in the case of Southern Giant Petrels, populations have been extirpated at Tristan da Cunha, and decreases have been documented at King George Island, most likely because of station activity. In contrast, populations are increasing on Anvers, Nelson and Laurie islands. The causal factors responsible for local-scale variability are poorly understood because the frequency of censuses for many breeding localities is insufficient to determine true population trends.

In the case of Southern Giant Petrels in particular, there is evidence to suggest that the extent of some existing colonies has yet to be fully documented. Reports of discoveries of new breeding colonies are still occurring, for example, in the sparsely populated areas of Tierra del Fuego, South America, where ornithological research is gaining a renewed momentum. Indeed, it seems highly probable that new colonies will be discovered in South America, given the vast areas that remain unexplored and the tendency of giant petrels to nest discretely in small colonies.

Many localities where giant petrels have been recorded breeding lack any recent population censuses. Most of what is known about the population status of these two species is thus based on data from a few sites in the Southern Ocean. Furthermore, many of these sites have also been associated with extensive human activity, which obviously raises the issue of how such activity has influenced currently observed trends, and whether these trends are representative of broader-scale ecologic processes (Fraser & Trivelpiece 1994). Conversely, changes in giant petrel breeding populations have also been observed in relatively undisturbed areas (Woehler *et al.* 1990), thus encouraging us to consider non-anthropogenic factors within the scope of long-term population trends. Assessment of trends on the basis of current data for these two species suggest that further work, even on a limited scale, would add substantially to current knowledge. Such work should focus especially in those areas where accurate censuses from the early 1970s and 1980s are available, but have not yet been repeated.

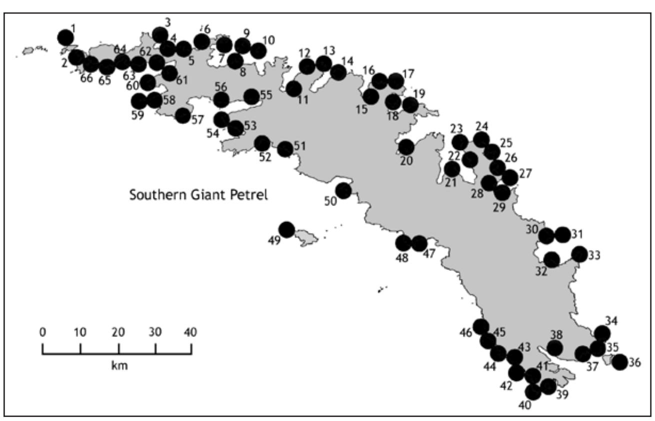

Fig. 5. Distribution of nesting localities of Southern Giant Petrels *Macronectes giganteus* at South Georgia and Bird Island.

Changes in Northern and Southern Giant petrel populations are better documented in some regions than in others. Based on the longer-term data, it is now possible to begin identifying some of the underlying factors that may be contributing to the observed trends. These, discussed below, include feeding and breeding habitat preferences, human disturbance and changes in oceanic foraging patterns.

The world population of Northern Giant Petrels appears to have increased nearly 30% since the last published account (Hunter 1985). This apparent increase has been most notable on Macquarie Island, the Prince Edward Islands and Bird Island. In contrast, breeding populations at some other areas show a decrease, as, for example, on Ile de la Possession (H. Weimerskirch, unpubl. data, Appendix 1). Northern Giant Petrels utilise carrion resources extensively during the vulnerable early chick phase (Croxall & Prince 1980; Hunter 1984a, 1985, 1987; Hunter & Brooke 1992), when most chick mortality occurs. Hunter (1984a) proposed that elevated breeding success attributable to greater carrion availability was one of the mechanisms responsible for increasing Northern Giant Petrel populations. In the presence of a relatively abundant local food source, Northern Giant Petrels may remain closer to their breeding areas and have longer brood and guard phases, and thus may be able to feed chicks at more frequent intervals than may Southern Giant Petrels (Hunter 1984a, Hunter & Brooke 1992). Briggs & Humpidge (unpubl. data) supported this hypothesis when reporting that the estimated 60% increase in the Northern Giant Petrel breeding population on Bird Island, South Georgia, between 1978 and 1996 coincided with a tripling in the Antarctic Fur Seal *Arctocephalus gazella* populations (Boyd 1993). Similarly, the Northern Giant Petrel population at Macquarie Island is believed to have increased because of its dependence on land-based seal carrion (Johnstone 1977). Thus, the recent increases observed in Northern Giant Petrel populations may reflect increased breeding success arising from these conditions.

The world population of Southern Giant Petrels is estimated at 30 575 pairs, nearly 20% fewer than Hunter's (1985) estimate of 38 000 pairs. Marked decreases in population size have occurred at Heard, Macquarie, Marion, King George, Penguin and Signy islands. Increases in population size, however, have been recorded in the Frazier Islands, at Ile de la Possession, on the southern coast of Anvers Island, at Hannah Point West (Livingston Island), Harmony Point (Nelson Island) and on Laurie Island. Although Southern Giant Petrels are more likely to rely on pelagic food resources (Johnstone 1977), Conroy (1972) and Hunter (1984a, 1985, 1991a) observed that carrion is an important food source at some localities during certain seasons. D.R. Briggs & R. Humpidge (unpubl. data) suggested that fledgling production of Southern Giant Petrels on

Bird Island may be a result of enhanced carrion supplies from the increasing Antarctic Fur Seal population. On Heard Island, a 43% decrease in Southern Giant Petrel fledgling production has been attributed in part to a 60% reduction in pup production of Southern Elephant Seals *Mirounga leonina* (Woehler 1991).

Increasing human activity around the Antarctic Continent is regarded as a serious threat to wildlife populations at some localities. Continued anthropogenic pressures, including interactions with commercial fisheries, habitat destruction, overflight activity and the effects of non-native species have thus been identified as possible determinants of change in giant petrel populations (Croxall *et al.* 1984b; Jouventin *et al.* 1984; Rounsevell & Brothers 1984; Woehler 1991, 1996; Chupin 1997; Micol & Jouventin 2001; Peter & Pfeiffer 2007). Population decreases of Southern Giant Petrels in the vicinity of research stations are well documented and directly support the idea that this species is highly vulnerable to human disturbance (Croxall *et al.* 1984b; Jouventin *et al.* 1984; Chupin 1997; Rootes 1988; Peter *et al.* 1989, 1991; Marchant & Higgins 1990; Woehler *et al.* 1990; Myrcha 1993; Chupin 1997; Micol & Jouventin 2001; Woehler *et al.* 2002; Peter & Pfeiffer 2007). Population trend data for the South Shetland Islands indicate that while the breeding population size may not change appreciably over the short term, annual breeding success may be adversely affected by human activity (Peter *et al.* 2007). In some cases, a greater rate of egg loss, without a decrease in breeding effort, has been documented in proximity to research stations (Sierakowski 1991). This situation may, in turn, lead to a reduction in recruitment and subsequent decreases in local breeding populations (Woehler *et al.* 2003). Additionally, Southern Giant Petrels have been known to move breeding localities in response to anthropogenic pressure (Pfeiffer & Peter 2004, Peter *et al.* 2007). However, not all displaced pairs are documented as breeding at other localities, and newly colonised areas often retain only a fraction of the originally displaced population (Micol & Jouventin 2001). Northern Giant Petrels, in contrast, are non-colonial and prefer nesting areas with greater vegetative cover (Hunter 1984a), a factor that may limit the extent of nest failure and abandonment caused by human disturbance. At present, there is little evidence that tourism plays a significant role in negatively affecting the nesting success of giant petrels.

On some islands (e.g. Tristan da Cunha), eggs and chicks were taken for subsistence, resulting in substantial decreases and local extinctions (Elliott 1957, Williams 1984). Cawkell & Hamilton (1961) reported that giant petrel eggs were collected in high numbers on the Falkland Islands during the early 1950s because of their reputation for having the best flavour. In addition, giant petrels were killed on the Falkland Islands because they attacked cast domestic Sheep *Ovis aries* and were considered a menace to livestock (Cawkell & Hamilton 1961, Marchant & Higgins 1990). Habitat degradation caused by introduced Caribou *Rangifer tarandus,* Sheep, Mouflon *Ovis musimon* and European Rabbits *Oryctolagus cuniculus* on sub-Antarctic islands have also adversely affected the nesting success of other petrel species (Jouventin *et al.* 1984).

Perhaps a more serious threat is the increase in commercial fishing activities in the Southern Ocean. The activity of such fleets is thought to play a role in decreased survival of dispersing juvenile giant petrels (Jouventin & Weimerskirch 1991, Patterson & Hunter 2000). Both Northern and Southern Giant petrels are known to interact with fishing vessels at some point during their pre-breeding or breeding phases (González-Solís *et al.* 2000, Nel *et al.* 2002, Sullivan *et al.* 2006). Southern Giant Petrels, however, are more likely to follow ships than are their congeners (Johnstone 1974), and thus they may be more susceptible to mortality from commercial fishing activities (González-Solís *et al.* 2000). In analyses of band recoveries, Hunter (1984b) and Patterson and Hunter (2000) estimated that roughly 10% of reported giant petrel fledgling mortality was directly related to fisheries interactions. However, Voisin (1988) had suggested that an abundance of garbage and offal generated from fishing activities had allowed the giant petrel population at Îles Crozet to increase.

Although many regions such as the northern Antarctic Peninsula are mainly frequented by krill harvesters, the spread of commercial longline fisheries may substantially increase hook-related mortality. Near Palmer Station (Anvers Island, Antarctic Peninsula), the instances of fish hooks found near Southern Giant Petrel nests or embedded in adult breeding birds have increased substantially over the last 10 years (W.R. Fraser & D.L. Patterson unpubl. data). Using at-sea observations, Woehler (1996) documented a 75% decrease in observed abundance of Northern Giant Petrels in Prydz Bay, Antarctica. Although interactions with commercial fisheries cannot be the exclusive cause of population decreases, it could prove to be an underestimated source of mortality in giant petrels.

CONCLUSIONS

The results of this compilation suggest that Northern Giant Petrel populations are increasing, and that some Southern Giant Petrel populations are decreasing. However, analyses of population trends are somewhat limited by incomplete census data and the awareness that underlying factors influencing population change are not always apparent. Moreover, stochastic events at a breeding locality may alter within-season productivity preceding or following a survey, thus giving a false impression about the stability or trajectory of the population, especially in the case of localities with variable or low breeding success. Breeding localities throughout the two species' distributions are subject to a wide variety of influences that may alter demographic parameters. These may include factors as varied as the effects of large-scale changes in marine processes on prey availability and the potential effects of humans, including research stations and commercial fishing. The need for rigorous contemporary censuses of breeding populations of Northern and Southern Giant petrels is plainly apparent, because it is only through long-term monitoring and research that relationships between trends and causality are likely to be discerned.

ACKNOWLEDGEMENTS

We thank Ian Newton for supplying difficult-to-obtain references and Peter Shaughnessy for references and helpful comments on earlier drafts of this manuscript. The authors acknowledge Phil Trathan for his assistance in compiling data. JPC and SP thank Fran Prince and Kate Menchini for help in extracting and processing South Georgia data, and Jerome Poncet for his skill in facilitating data collection at South Georgia, South Orkneys, the South Sandwich Islands and the Antarctic Peninsula. Robert Crawford and Onno Huyser provided referee's comments that greatly improved the final manuscript. Financial support for developing this manuscript was provided by research grants OPP-9320115, OPP-9505596, OPP-9605596, OPP-0130525, OPP-0217282, OPP-0224727 and OPP-052361 to W.R. Fraser.

REFERENCES

1. AGUIRRE, C.A. 1995. Distribution and abundance of birds at Potter Peninsula, 25 de Mayo (King George) Island, South Shetland Islands, Antarctica. *Marine Ornithology* 23: 23–31.
2. ANDERSSON, K.A. 1905. Das hoehere Tierleben im antarktischem Wissenschaftliche Ergebnisse der Schwedischen. *Südpolarexpedion* 5: 19–57.
3. ANON. 1993. Scientific Committee on Antarctic Research Working Group on Biology, Bird Biology Subcommittee. Minutes of meeting, 7–8 June 1992. Bariloche, Argentina. *Marine Ornithology* 21: 79–104.
4. ARAYA, B. & ARAVENA, W. 1965. Las aves de Punta Armonia, Isla Nelson, Antartica chilena; censo y distribucion. *Publicacione Instituto Antartico Chileno* 7: 1–18.
5. ARAYA, B. & ARIETA, A. 1971. Las aves de Caleta Potter, Isla Rey Jorge, Antartica Chilena—censo y distribution. *Revista de Biologia Marina, Valparaiso* 14: 121–128.
6. ARDLEY, R.A.B. 1936. The birds of the South Orkney Islands. *Discovery Reports* 12: 349–376.
7. BAKKEN, V. 1991. Fugle og Selundersøkelser på Bouvetøya i desember/januar 1989/90. *Norsk Polarinstitutt Meddelelser* 115: 1–30.
8. BANNASCH, R., FEILER, K. & RAUSCHERT, M. 1984. Fortsetzung der biologischen Untersuchungen im Gebiet der sowjetischen Antarktisstation "Bellingshausen". *Geodätische und Geophysikalische Veröffentlichungen, Reihe I* 11: 1–63.
9. BANNASCH, R. & ODENING, K. 1981. Zoologische Untersuchungen im Gebiet der sowjetischen Antarktisstation "Bellingshausen". *Geodätische und Geophysikalische Veröffentlichungen, Reihe I* 8: 3–20.
10. BENNETT, A.G. 1926. A list of the birds of the Falkland Islands and Dependencies. *Ibis* 2: 306–333.
11. BONNER, W.N. & LEWIS SMITH, R.I. 1985. Conservation areas in the Antarctic. Cambridge, UK: Scientific Committee on Antarctic Research. 298 pp.
12. BOURNE, W.R.P. & WARHAM, J. 1966. Geographical variation in the giant petrels of the genus *Macronectes*. *Ardea* 54: 45–67.
13. BOYD, I.L. 1993. Pup production and distribution of breeding Antarctic Fur Seals *Arctocephalus gazella* at South Georgia. *Antarctic Science* 5: 17–24.
14. BRETAGNOLLE, V. 1988. Social behaviour of the Southern Giant Petrel. *Ostrich* 59: 116–125.
15. BRETAGNOLLE, V., WEIMERSKIRCH, H. & JOUVENTIN, P. 1991. Have giant petrels *Macronectes* spp. really increased at Iles Crozet? *Marine Ornithology* 19: 73–74.
16. BRIGGS, D.R. & HUMPIDGE, R. 1996. Changes in breeding populations of Northern Giant petrels *Macronectes halli* and Southern Giant Petrels *Macronectes giganteus* at Bird Island, South Georgia. Unpublished scientific report. Cambridge, UK: British Antarctic Survey.
17. BRIGGS, D.R. & HUMPIDGE, R. 1997. British Antarctic Survey. Unpublished scientific report. Cambridge, UK: British Antarctic Survey.
18. CAWKELL, E.M. & HAMILTON, J.E. 1961. The birds of the Falkland Islands. *Ibis* 103a: 1–27.
19. CHUPIN, I. 1997. Human impact and breeding success in Southern Giant Petrel *Macronectes giganteus* on King George Island (South Shetland Islands). *Korean Journal of Polar Research* 8: 113–116.
20. CLARK, G.S., GOODWIN, R.D. & VON MEYER, A.P. 1984. Extension of the known range of some seabirds on the coast of southern Chile. *Notornis* 31: 320–324.
21. CLARKE, W.E. 1906. Ornithological results of the Scottish National Antarctic Expedition. II. On the birds of the South Orkney Islands. *Ibis* 6: 145–187.
22. CONROY, J.W.H. 1972. Ecological aspects of the biology of the Giant Petrel, *Macronectes giganteus,* in the maritime Antarctic. *British Antarctic Survey Scientific Reports* 75: 1–74.
23. CONVEY, P., MORTON, A. & PONCET, J. 1999. Survey of marine birds and mammals of the South Sandwich Islands. *Polar Record* 35: 107–124.
24. COOPER, J. & BROWN, C.R. 1990. Ornithological research at the sub-Antarctic Prince Edward Islands: a review of achievements. *South African Journal of Antarctic Research* 20: 40–57.
25. CORIA, N.R., BLENDINGER, P. & MONTALTI, D. 1996. The breeding birds of Cape Geddes, Laurie Island, South Orkney Islands, Antarctica. *Marine Ornithology* 24: 43–44.
26. CORIA, N.R., FAVERO, M., SILVA, P. & CASAUX, R.J. 1995. Breeding birds of Duthoit Point, Nelson Island, South Shetland Islands, Antarctica. *Marine Ornithology* 23: 61–64.
27. CROXALL, J.P. & MCINNES, S.J. 1986. Giant Petrel (*Macronectes* spp.) breeding status and distribution. Scientific report. Cambridge, UK: British Antarctic Survey. 24 pp.
28. CROXALL, J.P., MCINNES, S.J. & PRINCE, P.A. 1984a. The status and conservation of seabirds at the Falkland Islands. In: Croxall, J.P., Evans, P.G.H. & Schreiber, R.W. (Eds). Status and conservation of the world's seabirds. Technical publication no. 2. Cambridge, UK: International Council for Bird Preservation. pp. 271–291.
29. CROXALL, J.P. & PRINCE, P.A. 1980. Food, feeding ecology and ecological segregation of seabirds at South Georgia. *Biological Journal of the Linnean Society* 14: 103–131.
30. CROXALL, J.P., PRINCE, P.A., HUNTER, I., McINNES, S.J. & COPESTAKE, P.G. 1984b. The seabirds of the Antarctic Peninsula, islands of the Scotia Sea and Antarctic Continent between 80°W and 20°W: their status and conservation. In: Croxall, J.P., Evans, P.G.H. & Schreiber, R.W. (Eds). Status and conservation of the world's seabirds. Technical publication no. 2. Cambridge, UK: International Council for Bird Preservation. pp. 637–660.
31. DERENNE, P., LUFBERY, J.X. & TOLLU, B. 1974. L'avifaune de l'Archipel Kerguelen. *Comité National Français des Recherches Antarctiques* 33: 57–87.
32. ELLIOTT, H.F.I. 1957. A contribution to the ornithology of the Tristan da Cunha group. *Ibis* 99: 545–586.
33. EMSLIE, S.D., KARNOVSKY, N. & TRIVELPIECE, W. 1995. Avian predation at penguin colonies on King George Island, Antarctica. *Wilson Bulletin* 107: 317–327.
34. FAVERO, M., BELLAGAMBA, P.J. & FARENGA, M. 1991. Abundancia y distribucion especial de las poblaciones de aves de Punta Armonia y Punta Dedo, Isla Nelson, Shetland del Sur. *Rivista Italiana di Ornithologia* 61: 8–20.
35. FEVOLDEN, S. & SØMME, L. 1977. Observation on birds and seals at Bouvetøya. *Norsk Polarinstitutt Årbok* 1976: 367–371.
36. FRASER, W.R. & PATTERSON, D.L. 1999. Southern Giant Petrel *Macronectes giganteus* population censuses for the Palmer Station area, Antarctic Peninsula 1976–1999 [unpubl. data]. 2 pp.

37. FRASER, W.R. & TRIVELPIECE, W.Z. 1994. Workshop on researcher-seabird interactions, July 15–17, 1993. Monticello, MN: Joint Oceanographic Institutions Inc. 57 pp.
38. FURSE, J.R. & BRUCE, G. 1971. Ornithology report. In: Burley, M.K. (Ed). Joint Services Expedition: Elephant Island, 1970–71. Annex F. London, UK: Ministry of Defense. pp. F1–F11.
39. GAIN, L. 1914. Oiseaux antarctiques. Deuxième Expédition Antarctique Française, 1908-1910. Paris, France: Masson et Cie. 200 pp.
40. GALES, R., BROTHERS, N., TERAUDS, A. & COPSON, G. Population status, productivity and at-sea records of albatrosses and giant petrels breeding at Macquarie Island [unpubl. ms].
41. GONZÁLEZ-SOLÍS, J., CROXALL, J.P. & WOOD, A.G. 2000. Foraging partitioning between giant petrels (*Macronectes* spp.) and its relationship with breeding population changes at Bird Island, South Georgia. *Marine Ecology Progress Series* 204: 279–288.
42. HAFTORN, S. & VOISIN, J.F. 1982. The Southern Giant Petrel *Macronectes giganteus* on Bouvet Island. *Fauna Norvegica Cinclus* 5: 47–48.
43. HAHN, S., PETER, H.U., QUILLFELDT, P. & REINHARDT, K. 1998. Population estimates of the birds of Potter Peninsula. In: Wiencke, C., Ferreyra, G., Arntz, W. & Rinaldi, C. (Eds). The Potter Cove coastal ecosystem, Antarctica, Synopsis 1998. *Berichte zur Polarforschung* 299: 174–181.
44. HOLDGATE, M.W. & BAKER, P.E. 1979. The South Sandwich Islands: I. General description. *British Antarctic Survey Scientific Reports* 91: 1–76.
45. HUMPHREY, P.S. & LIVEZEY, B.C. 1983. Giant Petrels (*Macronectes giganteus*) nesting in Chubut, Argentina. *Le Gerfaut* 73: 3–8.
46. HUNTER, S. 1983. The food and feeding ecology of the giant petrels *Macronectes halli* and *M. giganteus. Journal of Zoology* 200: 521–538.
47. HUNTER, S. 1984a. Breeding biology and population dynamics of giant petrels *Macronectes* at South Georgia (Aves: Procellariiformes). *Journal of Zoology* 203: 441–460.
48. HUNTER, S. 1984b. Movements of giant petrels *Macronectes* spp. ringed at South Georgia. *Ringing and Migration* 5: 105–112.
49. HUNTER, S. 1985. The role of giant petrels in the Southern Ocean ecosystem. In: Siegfried, W.R., Condy, P.R. & Laws, R.M. (Eds). Antarctic nutrient cycles and food webs. Berlin: Springer-Verlag. pp. 534–542.
50. HUNTER, S. 1986. An internationally coordinated study into the dispersal of giant petrels *Macronectes.* Report to the SCAR Bird Biology Subcommittee. Cambridge, UK: Scientific Committee on Antarctic Research. 11 pp.
51. HUNTER, S. 1987. Species and sexual isolating mechanisms in sibling species of giant petrels *Macronectes. Polar Biology* 7: 295–301.
52. HUNTER, S. 1991a. The impact of avian predator-scavengers on King Penguin (*Aptenodytes patagonicus*) chicks at Marion Island. *Ibis* 133: 343–350.
53. HUNTER, S. 1991b. The impact of introduced cats on the predator–prey interactions of a sub-Antarctic avian community. In: Kerry, K.R. & Hempel, G. (Eds). Antarctic ecosystems. Ecological change and conservation. Berlin: Springer-Verlag. pp. 365–371.
54. HUNTER, S. & BROOKE, M. de L. 1992. Diet of giant petrels *Macronectes* spp. at Marion Island, Southern Indian Ocean. *Colonial Waterbirds* 15: 56–65.
55. HUYSER, O. 2000. Southern Giant Petrel. In: Barnes, K.N. (Ed). The ESKOM red data book of birds of South Africa, Lesotho and Swaziland. Johannesburg, South Africa: BirdLife South Africa. 134 pp.
56. COOPER, J., BROOKE, M. de L., BURGER, A.E., CRAWFORD, R.J.M., HUNTER, S. & WILLIAMS, A.J. 2001. Aspects of the breeding biology of the Northern Giant Petrel (*Macronectes halli*) and the Southern Giant Petrel (*M. giganteus*) at sub-Antarctic Marion Island. *International Journal of Ornithology* 4: 53–68.
57. IMRAY, H. 1957. Biology report, Base Y. Internal report AD6/2Y/1957/N. Cambridge, UK: British Antarctic Survey. 4 pp.
58. IMSHAUG, H.A. 1972. R/V *Hero* Cruise 71-5 to Isla de Los Estados. *Antarctic Journal of the United States* 7: 42–44.
59. INGHAM, S.E. 1959. Banding of giant petrels by the Australian National Antarctic Research Expeditions, 1955–58. *Emu* 59: 189–200.
60. JABLONSKI, B. 1980. Distribution and numbers of birds and pinnipeds on Penguin Island (South Shetland Islands) in January 1979. *Polish Polar Research* 1: 109–116.
61. JABLONSKI, B. 1986. Distribution, abundance and biomass of a summer community of birds in the region of the Admiralty Bay (King George Island, South Shetland Islands, Antarctica). *Polish Polar Research* 7: 217–260.
62. JEHL, J.R., TODD, F.S., RUMBOLL, M.A.E. & SCHARTZ, D. 1978. Notes on the avifauna of South Georgia. *Gerfaut* 68: 534–550.
63. JOHNSTONE, G.W. 1972. Notes from a summer trip to Davis, Antarctica. *Australian Bird Bander* 10: 52–56.
64. JOHNSTONE, G.W. 1974. Field characters and behaviour at sea of giant petrels in relation to their oceanic distribution. *Emu* 74: 209–218.
65. JOHNSTONE, G.W. 1977. Comparative feeding ecology of the Giant Petrels *Macronectes giganteus* (Gmelin) and *M. halli* (Matthews). In: Llano, G.A. (Ed). Adaptations within Antarctic ecosystems. Washington, DC: Smithsonian Institution. pp. 647–668.
66. JOUVENTIN, P., STAHL, J.C., WEIMERSKIRCH, H. & MOUGIN, J.L. 1984. The seabirds of the French sub-Antarctic islands and Adélie Land, their status and conservation. In: Croxall, J.P., Evans, P.G.H. & Schreiber, R.W. (Eds). Status and conservation of the world's seabirds. Technical publication no. 2. Cambridge, UK: International Council for Bird Preservation. pp. 609–624.
67. JOUVENTIN, P. & WEIMERSKIRCH, H. 1990. Long-term changes in seabird and seal populations in the Southern Ocean. In: Kerry, K.R. & Hempel, G. (Eds). Antarctic ecosystems. Ecological change and conservation. Berlin: Springer-Verlag. pp. 208–213.
68. JOUVENTIN, P. & WEIMERSKIRCH, H. 1991. Changes in the population size and demography of southern seabirds: management implications. In: Perrins, C.M., Lebreton, J.D. & Hirons, G.J.M. (Eds). Bird population studies: their relevance to conservation and management. Oxford: Oxford University Press. pp. 297–314.
69. LAW, P. 1958. Australian coastal exploration in Antarctica. *Geographical Journal* 124: 151–162.

70. LESINSKI, G. 1993. Monitoring of birds and pinnipedians on King George Island (South Sheltland Islands) in 1989/1990. *Polish Polar Research* 14: 75–89.
71. LORENZ, H. 1985. Wissenschaftlicher Bericht über die Teilnahme an der 28. SAE. Station Bellingshausen 1982–84, Berlin [unpubl. report]. 41 pp.
72. MARCHANT, S. & HIGGINS, P.J. 1990. Handbook of Australian, New Zealand and Antarctic Birds. Vol. 1. Ratites to Ducks. Part A. Ratites to Petrels. Melbourne: Oxford University Press. 735 pp.
73. MICOL, T. & JOUVENTIN, P. 2001. Long-term population trends in seven Antarctic seabirds at Pointe Géologie (Terre Adélie). Human impact compared with environmental change. *Polar Biology* 24: 185–195.
74. MOENKE, R. & BICK, A. 1987. Wissenschaftlicher Bericht über die Teilnahme an der 30. SAE. Potsdam, Berlin, unveroeffentliches Manuskript, 88 pp.
75. MURRAY, M.D. 1972. Banding giant petrels on Frazier Islands, Antarctica. *Australian Bird Bander* 10: 57–58.
76. MURRAY, M.D. & LAUDERS, D.J. 1990. Faunistic studies at the Windmill Islands, Wilkes Land, East Antarctica, 1959–1980. Kingston, Tasmania: Australian National Antarctic Research Expeditions, Antarctic Division, Department of the Arts, Sport, the Environment, Tourism, and Territories. 45 pp.
77. MYRCHA, A. 1993. Birds. In: Rakusa-Suszczewski, S. (Ed). The maritime Antarctic coastal ecosystem of Admiralty Bay. Warsaw, Poland: Polish Academy of Science, Department of Antarctic Biology. pp. 129–141.
78. NADLER, T. & MIX, H. 1989. Wissenschaftlicher bericht über die teilnahme an der 32. SAE. Potsdam, Berlin, unveroeffentliches Manuskript, 66 pp.
79. NEL, D.C., RYAN, P.G. & WATKINS, B.P. 2002. Seabird mortality in the Patagonian Toothfish longline fishery around the Prince Edward Islands, 1996–2000. *Antarctic Science* 14: 151–161.
80. NOVOATTI, R. 1962. Birds and mammals of Ardley Island, South Shetland Islands. *Polar Record* 11: 338.
81. OEHME, H. 1990. Das biologische Programm "Bellingshausen"—Bericht ueber die vergangenen 10 Jahre und die Konzeption zukuenftiger Forschungsarbeit. *Geodätische und Geophysikalische Veröffentlichungen, Reihe I* 16: 375–386.
82. OLROG, C.C. 1958. Observaciones sobre la avifauna Antartica y de alta mar desde el Rio de la Plata los 60 degree de latitud sur. *Acta Zoologica Lilliana* 15: 19–33.
83. PARMELEE, D.F. 1992. Antarctic birds: ecological and behavioral approaches. Minneapolis, MN: University of Minnesota Press. 203 pp.
84. PARMELEE, D.F. & FRASER, W.R. 1987. Southern Giant Petrel (*Macronectes giganteus*) population censuses, Palmer Station area, Antarctic Peninsula, 1974–1987 [unpubl. data]. 5 pp.
85. PARMELEE, D.F. & PARMELEE, J.M. 1987. Movements of Southern Giant Petrels ringed near US Palmer Station, Antarctica. *Antarctic Journal of the United States* 12: 14–21.
86. PATTERSON, D.L. & HUNTER, S. 2000. Giant petrel *Macronectes* spp. band recovery analysis from the International Giant Petrel Banding Project, 1988/89. *Marine Ornithology* 28: 69–74.
87. PETER, H.-U. 1999. Southern Giant Petrel (*Macronectes giganteus*) censuses [unpubl. data]. 2 pp.
88. PETER, H.-U., BANNASCH, R., BICK, A., GEBAUER, A., KAISER, M., MOENKE, R. & ZIPPEL, D. 1989. Bestand und reproduktion ausgewaehlter antarktischer Voegel und Robben im Suedwestteil von King George Island. *Wissenschaftliche Zeitschrift Friedrich-Schiller-Universotaet Jena. Naturwissenschaftliche Reihe* 38: 645–657.
90. PETER, H.-U., KAISER, M. & GEBAUER, A. 1988. Untersuchungen an Voegeln und Robben auf King George Island (South Shetland Islands, Antarktis). *Geodätische und Geophysikalische Veröffentlichungen, Reihe I* 14: 1–127.
91. PETER, H.-U., KAISER, M. & GEBAUER, A. 1991. Breeding ecology of Southern Giant Petrels *Macronectes giganteus* on King George Island (South Shetland Islands, Antarctic). *Zoologische Jahrbuecher, Abteilung für Systematik, Geographie und Biologie der Tiere* 118: 465–477.
92. PETER, H.-U. & PFEIFFER, S. 2000. Southern Giant Petrel (*Macronectes giganteus*) censuses [unpubl. data]. 6 pp.
93. PONCET, S. 2002. Seabird surveys at South Georgia [unpubl. data]. 24 pp.
94. PONCET, S. & PONCET, J. 1978. Ornithological report, Avian Island, 1978–79. Internal report AD6/2R/1978/Q. Cambridge, UK: British Antarctic Survey. 12 pp.
95. PONCET, S. & PONCET, J. 1998. Southern Giant Petrel population censuses of the Antarctic Peninsula, South Shetland Islands and South Orkney Islands [unpubl. data]. 10 pp.
96. PRÉVOST, J. 1965. Note sur le baguage des oiseaux de l'Archipel de Pointe Géologie de 1950 a 1963. *Oiseau* 35: 17–21.
97. PRINCE, P.A. 1984. Breeding Bird Survey, South Georgia bird surveys. Unpublished scientific report. Cambridge, UK: British Antarctic Survey.
98. PRINCE, P.A. & CROXALL, J.P. 1983. Birds of South Georgia: new records and re-evaluations of status. *British Antarctic Survey Bulletin* 59: 15–27.
99. PRINCE, P.A. & PAYNE, M.R. 1979. Current status of birds at South Georgia. *British Antarctic Survey Bulletin* 48: 103–118.
100. PRINCE, P.A. & PONCET, S. 1988. British Antarctic Survey: South Georgia breeding birds survey 1986/87–1987/88 [unpubl. data]. 30 pp.
101. PUNTA, G. An update of the population status and biological and taxonomic aspects of the Southern Giant Petrel *Macronectes giganteus* in Chubut, Argentina [unpubl. manuscript].
102. PUNTA, G. & SARAVIA, J. 1991. A newly discovered colony of Southern Giant Petrels *Macronectes giganteus* on Isla Gran Robredo, Chubut Province, Argentina. *Marine Ornithology* 19: 131–133.
103. ROBY, D.D., SALLABERRY, A.M. & BRINK, K.L. 1986. Nota sobre nidificacion de Petreles (Procellariiformes) en Isla Ardley, Shetland del Sur. *Serie Cientifica, Instituto Antarctico Chileno* 34: 67–72.
104. ROOTES, D.M. 1988. The status of birds at Signy Island, South Orkney Islands *British Antarctic Survey Bulletin* 80: 87–119.
105. ROUNSEVELL, D.E. & BROTHERS, N.P. 1984. The status and conservation of seabirds at Macquarie Island. In: Croxall, J.P., Evans, P.G.H. & Schreiber, R.W. (Eds). Status and conservation of the world's seabirds. Technical publication no. 2. Cambridge, UK: International Council for Bird Preservation. pp. 587–592.
106. SAUNDERS, A. 1950. A camera in the Antarctic. London, UK: Winchester Publications. 160 pp.

107. SCHIAVINI, A.C.M., FRERE, E. & YORIO, P. 2000. Distribución reproductiva y abundancia de les aves marinas de la Isla Grande de Tierra del Fuego, Isla de los Estados e Islas de Año Nuevo (Provincia de Tierra del Fuego, Antartida e Islas del Atlantico Sur). Chapter 9. In: Yorio, P., Frere, E., Gandini, P. & Harris, G. (Eds). Atlas de la distribución reproductiva y abundencia des les aves marinas en el litoral Argentino. Plan de Manejo Integrado de la Zona Costera Patagonica. Fundacion Patagonia Natural y Wildlife Conservation Society. Buenos Aires: Instituto Salesiano de Artes Gravicas. pp. 179–221.
108. SCOTLAND, C.D. 1958. Powell Island ornithological report. Internal report AD6/2H/1957/Q2. Cambridge, UK: British Antarctic Survey. 4 pp.
109. SIERAKOWSKI, K. 1991. Birds and mammals in the region of SSSI No. 8 in the season 1988/89 (South Shetlands, King George Island, Admiralty Bay). *Polish Polar Research* 12: 25–54.
110. SILVA, M.P., FAVERO, M., CASAUX, R. & BARONI, A. 1997. The status of breeding birds at Harmony Point, Nelson Island, Antarctica in summer 1995/96. *Marine Ornithology* 26: 75–78.
111. SLADEN, W.J.L, WOOD, R.C. & MONAGHAN, E.P. 1968. The USARP banding program 1958–1965. In: Austin, O.L. (Ed). Antarctic bird studies. Washington, DC: American Geophysical Union. pp. 213–262.
112. SOAVE, G.E. & CORIA, N. 2000. Breeding flying birds in the region of the Fildes Peninsula, King George Island, Antarctica. *Marine Ornithology* 28: 37–40.
113. STEPHENS, D.R.K. 1958. Ornithological notes 1957–58, Admiralty Bay. Internal report AD6/2G/1958/Q. Cambridge, UK: British Antarctic Survey.11 pp.
114. STONEHOUSE, B. 1958. Notes on the ringing and the breeding distribution of the Giant Petrel *Macronectes giganteus. Ibis* 100: 204–208.
115. STONEHOUSE, B. 1995. Southern Giant Petrel (*Macronectes giganteus*) population census, Hannah Point, South Shetland Islands [unpubl. data]. 2 pp.
116. STRANGE, I.J. 1981. The Falkland Islands. 2nd edition. Newton Abbot, UK: David and Charles. 256 pp.
117. SULLIVAN, B.J., BRICKLE, P., REID, T.A., BONE, D.G. & MIDDLETON, D.A.J. 2006. Mitigation of seabird mortality on factory trawlers: trials of three devices to reduce warp cable strikes. *Polar Biology* 29: 745–753.
118. THOMAS, T. 1986. L'effectif des oiseaux nicheurs de l'Archipel de Pointe Géologie (Terre Adélie) et son évolution au cours de trente dernières années. *Oiseau* 56: 349–368.
119. TICKELL, W.L.N. & SCOTLAND, C.D. 1961. Recoveries of ringed giant petrels *Macronectes giganteus. Ibis* 103a: 260–266.
120. TRIVELPIECE, W.Z., BUTLER, R.G. & VOLKMAN, N.J. 1980. Feeding territories of Brown Skuas. *Auk* 97: 669–676.
121. TUFFT, R. 1957. Preliminary biology report, Livingston Island summer survey 1958. Internal report AD6/2D 1957/N2. Cambridge, UK: British Antarctic Survey. 6 pp.
122. VAN FRANEKER, J. 1994. Southern Giant Petrels (*Macronectes giganteus*), population census 1984–85, Frazier Islands [unpubl. data]. 1 pp.
123. VOISIN, J.F. 1976. Observations sur les petrels geants de l'ile aux cochons (Archipel Crozet). *Alauda* 44: 411–429.
124. VOISIN, J.F. 1988. Breeding biology of the Northern Giant Petrel *Macronectes halli* and the Southern Giant Petrel *M. giganteus* at Ile de la Possession, Iles Crozet, 1966–1980. *Cormorant* 16: 65–97.
125. VOISIN, J.F. 1991. Giant petrels *Macronectes* spp. have increased at Iles Crozet between 1966 and 1980. *Marine Ornithology* 19: 75–77.
126. VOISIN, J.F. & BESTER, M.N. 1981. The specific status of giant petrels *Macronectes* at Gough Island. In: Cooper, J. (Ed). Proceedings of the Symposium on Birds of the Sea and Shore, 1979. Cape Town: African Seabird Group. pp. 215–222.
127. WARHAM, J. 1962. The biology of the Giant Petrel *Macronectes giganteus. Auk* 79: 139–160.
128. WARHAM, J. & BELL, B. 1986. Giant petrel survey data. In: Hunter, S. An internationally coordinated study into the dispersal of Giant Petrels *Macronectes.* Report to the Subcommittee on Bird Biology, Scientific Committee on Antarctic Research. Cambridge, UK: Scientific Committee on Antarctic Research 11 pp.
129. WATKINS, B.P. 1981. Seabird observations at Bouvet Island. *South African Journal of Antarctic Research* 10: 38–40.
130. WEIMERSKIRCH, H. 1995. Southern Giant Petrels (*Macronectes giganteus*), and Northern Giant Petrels (*M. halli*), population censuses of the Kerguelen Archipelago, 1994–95 [unpubl. data]. 1 pp.
131. WEIMERSKIRCH, H. & JOUVENTIN, P. 1987. La demographie des oiseaux et pinnipedes des T.A.A.F. In: Actes du Colloque sur la Recherche Française dans les Terres Australes, Strasbourg: Centre National de la Researche Scientifique. pp. 95–108.
132. WEIMERSKIRCH, H., JOUVENTIN, P., MOUGIN, J.L., STAHL, J.C. & VAN BEVEREN, M. 1985. Banding recoveries and the dispersal of seabirds breeding in French Austral and Antarctic Territories. *Emu* 85: 22–33.
133. WEIMERSKIRCH, H., ZOTIER, R. & JOUVENTIN, P. 1989. The avifauna of the Kerguelen Islands. *Emu* 89: 15–29.
134. WHITE, M.G. 1966. Preliminary report on field studies in the South Shetland Islands, 1965–66. Internal report AD6/2H/1966/N6. Cambridge, UK: British Antarctic Survey. 10 pp.
135. WILLEY, I.M. 1968. Adelaide Island bird report. Internal report AD6/2T/1968Q. Cambridge, UK: British Antarctic Survey. 12 pp.
136. WILLIAMS, A.J. 1984. The status and conservation of seabirds on some islands in the African sector of the Southern Ocean. In: Croxall, J.P., Evans, P.G.H. & Schreiber, R.W. (Eds). Status and conservation of the world's seabirds. Technical publication 2. Cambridge, UK: International Council for Bird Preservation. pp. 627–634.
137. WILLIAMS, A.J. & IMBER, M.J. 1982. Ornithological observations at Gough Island in 1979, 1980 and 1981. *South African Journal of Antarctic Research* 12: 40–45.
138. WILLIAMS, A.J., SIEGFRIED, W.R., BURGER, A.E. & BERRUTI, A. 1979. The Prince Edward Islands: a sanctuary for seabirds in the Southern Ocean. *Biological Conservation* 15: 59–71.
139. WILTSHIRE, A.J. & SCOFIELD, R.P. 2000. Population estimate of breeding Northern Giant Petrels *Macronectes halli* on Campbell Island, New Zealand. *Emu* 100: 186–191.
140. WOEHLER, E.J. 1991. Status and conservation of the seabirds of Heard Island and the McDonald Islands. In: Croxall, J.P. (Ed). Seabird status and conservation: a supplement. Technical publication 11. Cambridge, UK: International Council for Bird Preservation. pp. 263–275.
141. WOEHLER, E.J. 1993a. Antarctic seabirds: their status and conservation in the AAT. *RAOU Conservation Statement* 9: 1–8.

142. WOEHLER, E.J. 1993b. Pers. comm.
143. WOEHLER, E.J. 1993c. The distribution and abundance of the Antarctic and Subantarctic penguins. Cambridge, UK: Scientific Committee on Antarctic Research. 76 pp.
144. WOEHLER, E.J. 1996. Concurrent decreases in five species of Southern Ocean seabirds. *Polar Biology* 16: 379–382.
145. WOEHLER, E.J. & JOHNSTONE, G.W. 1988. Banding studies of Giant Petrels *Macronectes* spp., at Macquarie Island. *Papers and Proceedings of the Royal Society of Tasmania* 122: 143–152.
146. WOEHLER, E.J. & JOHNSTONE, G.W. 1991. Status and conservation of the seabirds of the Australian Antarctic Territory. In: Croxall, J.P. (Ed). Seabird status and conservation: a supplement. Technical publication 11. Cambridge, UK: International Council for Bird Preservation. pp. 279–308.
147. WOEHLER, E.J., MARTIN, M.R. & JOHNSTONE, G.W. 1990. The status of Southern Giant Petrels *Macronectes giganteus* at the Frazier Islands, Wilkes Land, East Antarctica. *Corella* 14: 101–106.
148. WOODS, R. & WOODS, A. 1997. Atlas of breeding birds of the Falkland Islands. Stanley, Falklands: Falklands Conservation. 190 pp.
149. WYLIE, J.P. 1957. Biological report, Anvers Island, 1957. Internal report AD6/2N/1957/N. Cambridge, UK: British Antarctic Survey. 13 pp.
150. ZIPPEL, D. 1986. Teilbericht (Ornithologie) über die wissenschaftlicher Ergebnisse waehrend der 30. SAE im Untersuchungsgebiet King George [unpubl. report]. Berlin, Germany. 65 pp.

APPENDIX 4

We note the following references that have been published recently, but that have not been included in the post-1999/2000 manuscript cutoff. Readers may wish to consult these references for new population data.

CREUWELS, J.C.S., STARK, J.S., WOEHLER, E.J., VAN FRANEKER, J.A. & RIBIC, C.A. 2005. Monitoring of a Southern Giant Petrel *Macronectes giganteus* population on the Frazier Islands, Wilkes Land, Antarctica. *Polar Biology* 28: 483–493.

CUTHBERT, R.J. & SOMMER, E.S. 2004. Population size and trends of four globally threatened seabirds at Gough Island, South Atlantic Ocean. *Marine Ornithology* 32: 97–103.

NAVEEN, R., FORREST, S., DAGIT, R.G., BLIGHT, L.K., TRIVELPIECE, W.Z. & TRIVELPIECE, S.G. 2000. Censuses of penguin, Blue-eyed Shag and Southern Giant Petrel populations in the Antarctic Peninsula region, 1994–2000. *Polar Record* 36: 323–334.

PFEIFFER, S. & PETER, H.-U. 2003. Umsetzung des Umweltschutzprotokoll—Ausfuehrungsgesetzes (AUG), Teilvorhaben 3: Grunddaten und Umweltindikatoren für die Entwicklung von Managementplaenen für von Besuchern besonders stark frequentierten Anlandungsgebieten in der Antarktis. Uba-Text 22-03, Berlin/Germany: Federal Environmental Agency. 247 pp.

PFEIFFER, S. & PETER, H.-U. 2004. Ecological studies toward the management of an Antarctic tourist landing site (Penguin Island, South Shetland Island.). *Polar Record* 40: 345–353.

QUINTANA, F., PUNTA, G. & COPELLO, S. 2006. Population status and trends of Southern Giant Petrels (*Macronectes giganteus*) breeding in North Patagonia, Argentina. *Polar Biology* 30: 53–59.

REID, T.A. & HUIN, N. 2008. Census of the southern giant-petrel population of the Falkland Islands 2004/2005. *Bird Conservation International* 18: 118-128.

RYAN, P., COOPER, J., DYER, B.M., UNDERHILL, L.G., CRAWFORD, R.J.M. & BESTER, M.N. 2003. Counts of surface-nesting seabirds breeding at Prince Edward Island, summer 2001/02. *African Journal of Marine Science* 25: 441–451.

TENNYSON, A., TAYLOR, R., TAYLOR, G., IMBER, M. & GREENE, T. 2002. Unusual bird records from the Antipodes Islands in 1978–1995, with a summary of other species recorded at the island group. *Notornis* 49: 241–245.

WILTSHIRE, A. & HAMILTON, S. 2003. Population estimate of Northern Giant Petrels (*Macronectes halli*) on Antipodes Island, New Zealand. *Notornis* 50: 128–132.

WOEHLER, E.J., RIDDLE, M.J. & RIBIC, C.A. 2003. Long-term population trends in Southern Giant Petrels in East Antarctica. In: Huiskes, A.H.L., Gieskes, W.W.C., Rozema, J., Schorno, R.M.L., van der Vies, S.M. & Wolff, W.J. (Eds). Antarctic Biology in a Global Context. Leiden, Netherlands: Backhuys. pp. 290–295.