Southern Giant Petrel

Macronectes giganteus

Pétrel géant antarctique
Petrel Gigante del Sur

CRITICALLY ENDANGERED | ENDANGERED | VULNERABLE | NEAR THREATENED | **LEAST CONCERN** | NOT LISTED

Sometimes referred to as
Antarctic Giant Petrel
Giant Fulmar
Stinker
Nelly

Photo © Graham Robertson

TAXONOMY

Order Procellariiformes
Family Procellariidae
Genus *Macronectes*
Species *M. giganteus*

In 1966, Bourne and Warham [1] listed the differences between the two *Macronectes* taxa, including plumage colouration, behaviour and breeding biology. This synopsis led to the general acceptance that the two giant petrel taxa, *Macronectes giganteus* and *M. halli*, were separate species. Genetic data reported by Nunn and Stanley (1998) [2] suggested a very recent split between the two species. In 2004, Penhallurick and Wink [3] argued that the percentage divergence of the mitochondrial gene for cytochrome *b* was insufficient for the two *Macronectes* taxa to be recognised at the specific level. However, Rheindt and Austin (2005) [4] later highlighted conceptual problems with the work by Penhallurick and Wink and argued that sympatric, morphologically distinct taxa that breed at different times of year, should be viewed as separate species. While hybridisation between *M. giganteus* and *M. halli* has been observed at several breeding localities [5, 6, 7] the frequency is low (e.g. 1.5% at South Georgia (Islas Georgias del Sur) [7].

CONSERVATION LISTINGS AND PLANS

International

- Agreement on the Conservation of Albatrosses and Petrels – Annex 1 [8]
- 2010 IUCN Red List of Threatened Species – Least Concern (downlisted from Near Threatened in 2009) [9]
- Convention on Migratory Species - Appendix II [10]

Australia

- *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC ACT*) [11]
  - Vulnerable
  - Migratory Species
  - Marine Species
- Recovery Plan for Albatrosses and Giant Petrels (2001) [12]
- Threat Abatement Plan 2006 for the incidental catch (or bycatch) of seabirds during oceanic longline fishing operations [13]

New South Wales

- *Threatened Species Conservation Act 1995* – Endangered [14]

Queensland

- *Nature Conservation Act 1992* – Endangered [15]

Tasmania

- *Threatened Species Protection Act 1995* – Vulnerable [16]

Victoria

- *Fauna and Flora Guarantee Act 1988* - Vulnerable [17]

Argentina

- Technical document/Draft National Plan of Action (NPOA) [18]
- Categorización de las Aves de Argentina 2008 - *Decreto Nacional N° 666 /1997* [19, 20] - Vulnerable

Chile

- National Plan of Action for reducing by-catch of seabirds in longline fisheries (PAN-AM/CHILE) 2007 [21]

Falkland Islands (Islas Malvinas)

- *Conservation of Wildlife and Nature Ordinance 1999* [22]
- *Fisheries (Conservation and Management) Ordinance 2005* [23]
- Falkland Islands FAO National Plan of Action for Reducing Incidental Catch of Seabirds In Longline Fisheries 2004 [24]

France

- *Ministerial Order of 14 August 1998 (Arrêté du 14 août 1998)* [25] - Listed Protected Species

South Africa

- *Sea Birds and Seals Protection Act, 1973 (Act No. 46 of 1973) (SBSPA)* [26]
- *Marine Living Resources Act (Act No. 18 of 1996): Policy on the Management of Seals, Seabirds and Shorebirds: 2007* [27, 28]
- National Plan of Action (NPOA) for Reducing the Incidental Catch of Seabirds in Longline Fisheries 2008 [29]

South Georgia (Islas Georgias del Sur)

- *Falkland Island Dependencies Conservation Ordinance 1975* [30]
- FAO International Plan of Action-Seabirds: An assessment for fisheries operating in South Georgia and South Sandwich Islands [31]

Tristan da Cunha, UK Overseas Territories

- *The Conservation of Native Organisms and Natural Habitats (Tristan da Cunha) Ordinance 2006* [32]

Uruguay

- National Plan of Action for Reducing the Incidental Catch of Seabirds in Uruguayan Fisheries (PAN - Aves Marinas Uruguay) 2007 [33]

BREEDING BIOLOGY

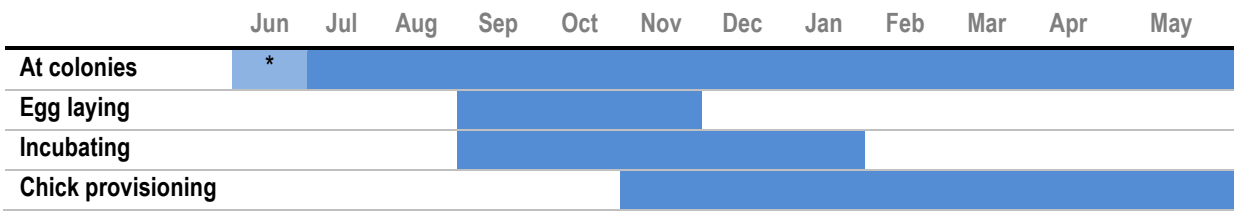
The breeding range of *M. giganteus* extends from *c.* 40°S (Gough Island) to nearly 68°S in West Antarctica. There are some differences in the breeding chronology of southern and northern populations [34, 35, 36, 37, 38]. Size dimorphism is pronounced; morphometrically males are up to 15% larger and can weigh up to 40% more than females [39].

Although *M. giganteus* breeds annually in loose colonies, breeding activities are interspersed with “sabbatical” periods; non-breeding periods lasted on average 1.4 years and occurred approximately every 1.7 years at Ile de la Possession [40]. In one year, some 20-40% of breeders were deemed to be on sabbatical [40]. Birds arrive at colonies from July – August through to September, depending on latitude and location [41]. At the Antarctic sites, eggs are generally laid in mid-October to mid-November, over approximately a 21 day period [34, 41]. Laying tends to be earlier at lower latitudes, starting in late August on Gough Island [42], and late September on Marion Island [35], Macquarie Island and Iles Crozet [6]. On average, eggs are incubated for *c.* 60 days, hatching late October to late January [41]; egg losses tend to be noticeably higher than chick losses [35, 43]. Young chicks are brooded and guarded for 24-26 days until they attain thermal independence. Males deliver food to the chicks more frequently than do females; male chicks fledge later and with a higher body mass than females [35, 44]. Chicks fledge from March to late May, generally *c.* 100–130 days after hatching [34, 35, 41]. In Patagonia, the fledging period lasts from late March to late April after only 86-125 days in the nest [36].

Failed breeders do not lay a replacement egg but tend to remain in the colony for up to nine days after loss of the egg. Although young birds may return earlier to the colony, (earliest return recorded at 2.5 years [34]), age of first breeding is around 5-6 years [41], with a peak at 7-8 years on South Georgia (Islas Georgias del Sur), and 9-11 years on Macquarie Island [45].

Although *M. giganteus* exhibited a high degree of fidelity to their breeding island, the location of their actual nest sites appeared rather "unstable" as nests were rarely used in two consecutive years, instead, colonies moved to another area in the general vicinity of the previous location [40].

Table 1. *Breeding cycle of* M. giganteus *across all sites*. *See text for site-specific periods*.



* birds tend to be present year round at colonies but numbers are lowest around mid-winter

BREEDING STATES

Table 2. *Distribution of the global* M. giganteus *population among the Antarctic Treaty area and Parties to the Agreement.*

	Antarctic Treaty	Argentina	Australia	Chile	Disputed*	France	South Africa	United Kingdom
Breeding pairs	20%	6%	11%	2%	53%	2%	5%	<1%

*A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Islas Malvinas), South Georgia and the South Sandwich Islands (Islas Georgias del Sur e Islas Sandwich del Sur) and the surrounding maritime areas.

BREEDING SITES

Colonies of *M. giganteus* occur on 10 oceanic islands or island groups between *c*. 40°S and 60°S, six islands off South America, four locations in East Antarctica, and numerous sites on the Antarctic Peninsula (Figure 1). Two islands, Tristan da Cunha and Bouvet Island, used to have small populations which are now extinct on Tristan da Cunha and appear to be so on Bouvet.

It is currently very difficult to estimate the sizes of the breeding populations of *M. giganteus* at some locations for a number of reasons, including small and widely dispersed colonies, and a substantial part of the breeding population absent in any one year as birds can take years off from breeding. The latest BirdLife assessment for IUCN in 2009 [46] estimated a total of 46,800 breeding pairs equivalent to approximately 100,000 mature individuals, with about 40% of the global breeding population found on the Falkland Islands (Islas Malvinas) (Table 3). The information presented in Table 3 estimates the population at just over 50,000 breeding pairs; however this is in the absence of comprehensive recent data (less than 10 years old) from the Antarctic breeding sites.

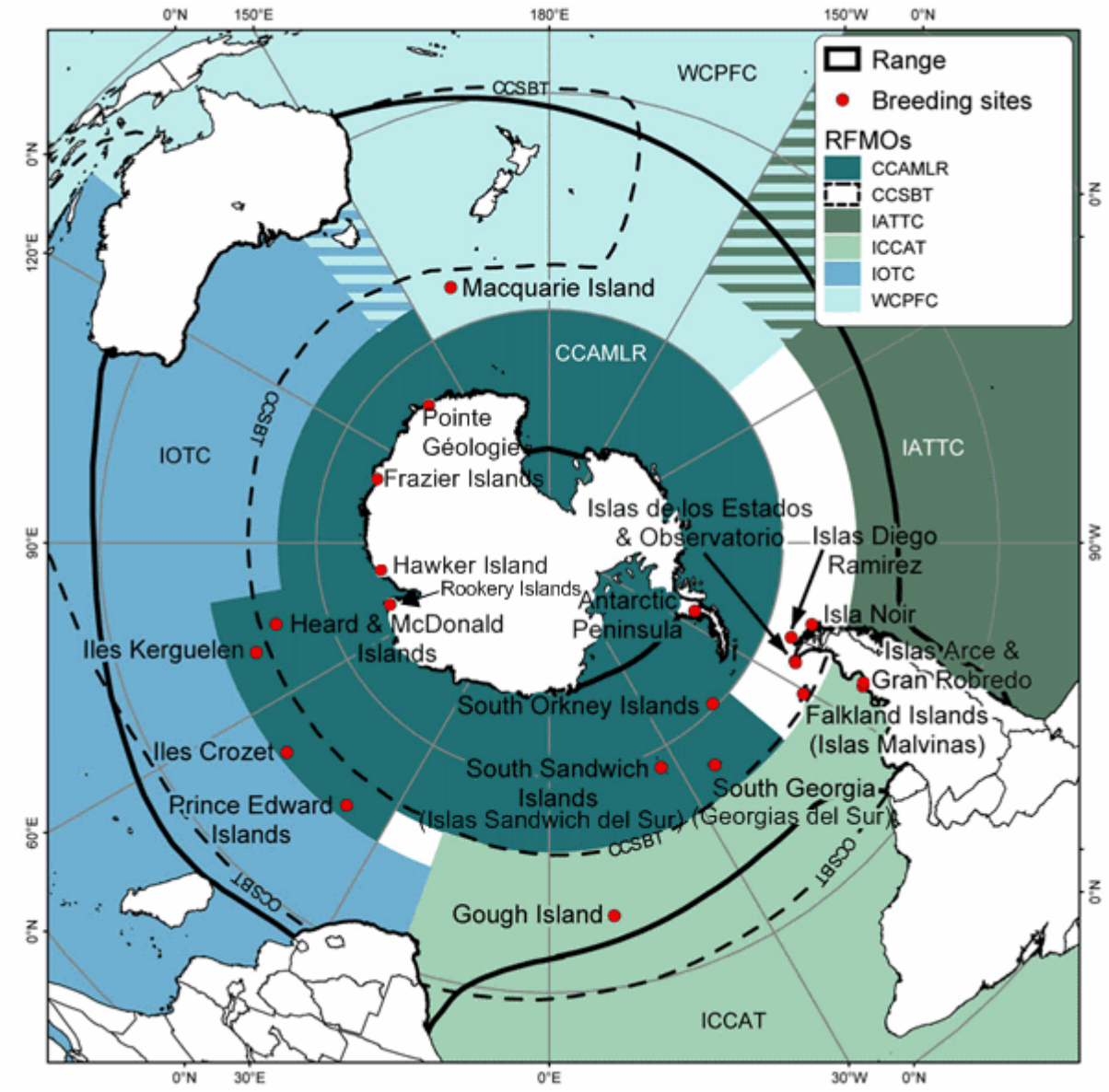


Figure 1. The location of the breeding sites and approximate range of M. giganteus *with the boundaries of selected Regional Fisheries Management Organisations (RFMOs) also shown.*

CCAMLR – Commission for the Conservation of Antarctic Marine Living Resources
CCSBT - Convention for the Conservation of Southern Bluefin Tuna
IATTC - Inter-American Tropical Tuna Commission
ICCAT - International Commission for the Conservation of Atlantic Tunas
IOTC - Indian Ocean Tuna Commission
WCPFC - Western and Central Pacific Fisheries Commission

Table 3. Monitoring methods and estimates of the population size (annual breeding pairs) for each breeding site. Table based on unpublished data (Instituto Antártico Argentino (IAA) – Potter Peninsula, Harmony Point and Laurie Island; Australian Antarctic Division (AAD) - East Antarctica and Heard Island; Tasmanian Department of Primary Industries and Water (DPIW) - Macquarie Island; Centre d'Etudes Biologiques de Chizé, Centre National De La Recherche Scientifique (CNRS) – Pointe Géologie and Ile de la Possession; R.J.M. Crawford, Marine & Coastal Management, Department of Agriculture, Fisheries and Forestry (DAFF) and P.G. Ryan, University of Cape Town – Marion Island; P.J.N. de Bruyn, University of Pretoria - Bouvet Island) and published references as indicated.

Breeding site location	Jurisdiction	Years monitored	Monitoring method	Monitoring accuracy	Annual breeding pairs (last census)
Antarctic Peninsula	Antarctic Treaty	2005, 2006, 2007	A	Variable	1,190 (1999) [47]
Total					**1,190**
% of all sites					**2.4%**
Adélie Land					
Pointe Géologie 66°40' S, 140°01' E	Antarctic Treaty	1955-2005	A	High	8-9 (2005)
East Antarctica		1999, 2001, 2007	A	High	*c.*300
Frazier Islands 66° 23'S, 110°17' E		1989, 1997,1998, 2001	A	High	248 (2001) [48]
Hawker Island 68°38' S, 77°51' E	Antarctic Treaty	?	-	-	no data
Giganteus Island 67°35' S, 62°30' E		?	-	-	no data
Total					**300**
% of all sites					**0.6%**
South Orkney Islands		?	F	Unknown	3,350 [46]
Laurie Island 60°44' S, 44°37' W	Antarctic Treaty				
Cabo Geddes		1994-2006	A	High	187 (2006)
Watson Peninsula		1995, 2005-2006	A	High	280 (2006)
Total					**3,350**
% of all sites					**6.7%**
South Shetland Islands		?	F	Unknown	5,400 [46]
Potter Peninsula, King George Island 62°00' S, 58°00' W		1994-2007	A	High	87 (2007)
Harmony Point, Nelson Island 62°00' S, 59°00' W	Antarctic Treaty	2001-2005	A	High	485 (2005)
Point Fort William, Greenwich Island 62°29' S, 59°47' W		1991, 1992, 2001, 2004, 2007	B	High	109 (2007) [49]
Barrientos Island, Aitcho Islands 62°24' S, 59°45' W		2007	B	High	78 (2007) [49]
Total					**5,400**
% of all sites					**10.8%**
Isla Observatorio 54°39' S, 64°08' W	Argentina	2004	A	Medium	500 (2004) [36]
Isla de los Estados 54°54' S, 64°39' W	Argentina	1971	-	-	no data
Isla Arce 45°00' S, 65°50' W	Argentina	2005	A	High	448 (2005) [50]
Isla Gran Robredo 45°08' S, 66°03' W	Argentina	2005	D	High	1,883 (2005) [50]
Total					**2,831**
% of all sites					**5.6%**

Heard Island 53°12' S, 73°32' E	Australia	2004	A	Unknown	*c.* 3,500 (2004)
McDonald Islands 53°02' S, 72°42' E	Australia	1979	-	-	no data
Macquarie Island 54°30' S, 158°55' E	Australia	1996-1999, 2001-2004, 2006-2007	A	High	2,125 (2007)
Total **% of all sites**					**5,625** **11.2%**
Islas Diego Ramirez 56°31' S, 68°44' W	Chile	1981	F	Unknown	182 (1981)
Isla Noir 54°28'S, 73°01'W	Chile	2004	F	Unknown	1,000 (2004)
Total **% of all sites**					**1,182** **2.4%**
Falkland Islands (Islas Malvinas)	Disputed*	2005	A, D	Unknown	*c.* 19,529 (2005) [51]
Total **% of all sites**					**19,529** **38.9%**
South Georgia (Islas Georgias del Sur) 54°00' S, 38°36' W	Disputed*	1971,1986-1988, 2006, 2007	F	Unknown	5,500 [46]
Total **% of all sites**					**5,500** **11.0%**
South Sandwich Islands (Islas Sandwich del Sur)	Disputed*	1996	Various	Variable	1,550 [47]
Total **% of all sites**					**1,550** **3.1%**
Îles Crozet 46°26' S, 51°47' E					
Île de la Possession		1980, 1986-1987,1992-2008	A	High	158 (2008)
Île de l'Est	France	1983	F	Unknown	323 (1983) [52]
Île des Pingouins		1983	F	Unknown	50 (1983) [52]
Îles des Apôtres		1983	F	Unknown	10 (1983) [52]
Île aux Cochons		1976	F	Unknown	550-600 (1976) [53]
Total **% of all sites**					**1,141** **2.3%**
Îles Kerguelen 49°09' S, 69°16' E	France				
Rallier du Baty Peninsula		1987	F	High	3-5 (1987) [54]
Bouvet Island 54°26' S 3°24' E	Norway	1977, 1978, 1989, 2001, 2008	-	-	0 (2008)
Prince Edward Islands					
Marion Island 46°54' S, 37°45' E	South Africa	1985 – 2008	A	High	1,343 (2008)
Prince Edward Island 46°38'S, 37°57'E		2002, 2009	A	High	*c.* 1,000 (2002) [55]
Total **% of all sites**					**2,343** **4.7%**
Gough Island 40° 21' S, 009° 53' W	UK	2002	F	High	225-245 (2002) [56]
Total **% of all sites**					**245** **0.5%**
Total					***c.* 50,170**

* see Table 2 footnote

CONSERVATION LISTINGS AND PLANS FOR THE BREEDING SITES

International

Antarctica

- Antarctic Treaty System [57]
- Antarctic Specially Protected Areas (ASPAs) with individual management plans (area numbers in brackets) [58]:
  Adélie Land – Pointe Géologie Archipelago (120)
  East Antarctica – Rookery Islands (102), Frazier Islands (160) [59], Hawker Island (167) [60]
  South Orkney Islands – South Powell and adjacent islands (111), Coronation Island (114)
  South Shetland Islands – Coppermine Peninsula, Robert Island (112); Byers Peninsula, Livingstone Island (126); West shore Admiralty Bay (128), Potter Peninsula (132), Lions Rump (151), and Ardley Island, Maxwell Bay (150), King George Island; Harmony Point, Nelson Island (133)
  Palmer Archipelago – Litchfield Island (113)
  Antarctic Peninsula – Avian Island (117), Cierva Point and islands (134)
- Antarctic Specially Managed Areas (ASMAs) with individual management plans (area numbers in brackets) [58]:
  South Shetland Islands - Admiralty Bay, King George Island (1)
  Palmer Archipelago - South-west Anvers Island and Palmer Basin (7)

Gough Island

- UNESCO World Heritage List – Gough Island Nature Reserve (criteria iii, iv. inscribed 1996 [61])
- Ramsar Convention List of Wetlands of International Importance (designated 2008) [62]

Heard Island and McDonald Islands

- UNESCO World Heritage List (inscribed 1997) [63]

Macquarie Island

- UNESCO World Heritage List (inscribed 1997) [63]
- UNESCO Biosphere Reserve - Man and the Biosphere Programme (inscribed 1977) [64]

Iles Crozet, Iles Kerguelen, and Prince Edward Islands

- Ramsar Convention List of Wetlands of International Importance (inscribed 2007 and 2008) [62]

Argentina

Isla Arce and Isla Gran Robredo

- Parque Interjurisdiccional Marino Costero Patagonia Austral - *Ley Nº 5.668* [65], *Ley Nacional N°26.446* [66]

Australia

Heard Island and McDonald Islands

- National Heritage List – *EPBC Act 1999* (listed 2007) [11]
- Heard Island and McDonald Islands (HIMI) Marine Reserve - *EPBC Act 1999* (declared 2002) [11]

Macquarie Island

- Register of Critical Habitat - *EPBC Act 1999* (listed 2002) [11]
- Register of the National Estate (until February 2012) – *Australian Heritage Commission Act 1975* (listed 1977) [67]
- National Heritage List – *EPBC Act 1999* (listed 2007) [11]

Tasmania

Macquarie Island

- Nature Reserve - *Nature Conservation Act 2002* (Tasmania) [68]
- Macquarie Island Nature Reserve and World Heritage Area Management Plan 2006 [69]
- Plan for the Eradication of Rabbits and Rodents on Subantarctic Macquarie Island 2007 [70]

Falkland Islands (Islas Malvinas)

- Nature Reserves - *Conservation of Wildlife and Nature Ordinance 1999* [22]

France

Crozet and Kerguelen Islands

- National Nature Reserve (*Réserve Naturelle Nationale*) - Décret n°2006-1211 [71]. Specific areas have higher level of protection (Integral Protection Areas, *Aires de Protection Intégrale*): Iles Crozet except Ile de la Possession; some islands and coastal areas in Kerguelen.

French Southern Territories (Terres australes et antarctiques françaises, TAAF)

Iles Crozet (some coastal areas of Possession Island); Iles Kerguelen (Sourcils Noir, some islands and coastal parts of Golfe du Morbihan)

- Areas Reserved for technical and Scientific Research (*Zones Réservées à la Recherche Scientifique et Technique)* Arrêté n°14 du 30 juillet 1985 [72], now included in Natural Reserve Management Plan [71].

South Africa

Prince Edward Islands

- Special Nature Reserve (declared in 1995) - *National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003)* [73]
- Prince Edward Islands Management Plan 1996 [74]

South Georgia (Islas Georgias del Sur)

- South Georgia Environmental Management Plan [75]
- South Georgia: Plan for Progress. Managing the Environment 2006 – 2010 [76]

Bird Island, Albatross Island and Annekov Island

- Specially Protected Area (SPA) - South Georgia: Plan for Progress. Managing the Environment 2006 – 2010 [76]

Tristan da Cunha, UK Overseas Territories

Gough Island

- Nature Reserve - *The Conservation of Native Organisms and Natural Habitats (Tristan da Cunha) Ordinance 2006* [32]
- Gough Island Management Plan 1994 [77]

POPULATION TRENDS

Currently there are relatively few published data available that allow robust analyses of population trends (Table 4). Continuous data are very rare; intervals between consecutive counts can be more than a decade and past counts generally included only a sub-set of all colonies on a particular island. Counting units (adults, nest, eggs, chicks) often differ between counts, time of counts is highly variable or count dates are not always reported.

Where data are available, it appears that the breeding populations have decreased at Potter Peninsula, South Shetland Islands (Figure 2), and Cabo Geddes, South Orkney Islands (Figure 3) since the mid 1990s, but this trend appears to be reversing since 2004/2005. At subantarctic Marion Island, the breeding population has decreased at an average of 3.8% per year since 1985 (Figure 4), but since 1997 the decline has proceeded at only 1.2% per year. In contrast, a small increase (average 0.6% per year) has been observed at Macquarie Island from 1996 to 2007 (Figure 5), and an average annual increase of 3.8% at Isla Gran Robredo for the period 1990 to 2004 (Figure 6). The population on Île de la Possession increased at an average of 9.2% per year during 1999-2004, following a period of stable population between 1980 and 1999 [78].

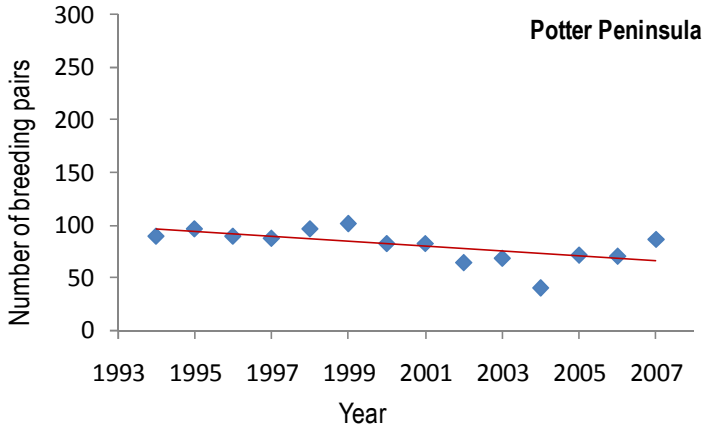


Figure 2. Counts of nesting pairs at Potter Peninsula with a simple regression line fitted. Figure based on unpublished IAA data, not to be used without data holder's permission.

Populations on the Falkland Islands (Islas Malvinas), South Georgia (Islas Georgias del Sur), and Gough Island have also been reported to be increasing [47, 51, 56]. No linear trend has been detected at Isla Arce between 1987 and 2004 [50].

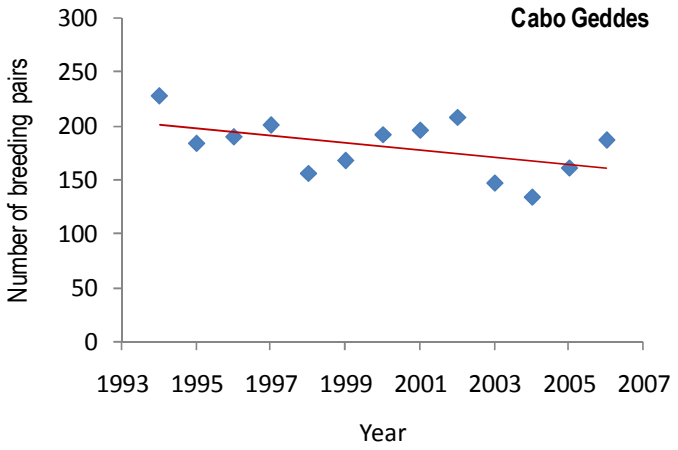


Figure 3. Counts of nesting pairs at Cabo Geddes with a simple regression line fitted. Figure based on unpublished IAA data, not to be used without data holder's permission.

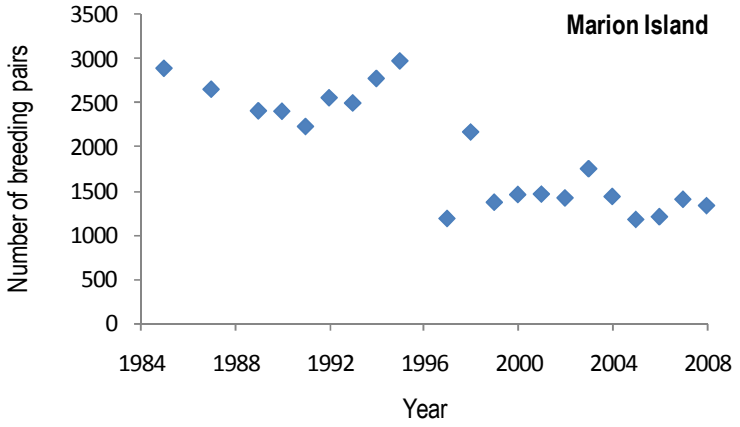


Figure 4. Counts of nesting pairs on Marion Island. Figure based on unpublished R.J.M. Crawford, Marine & Coastal Management, DAFF and P.G. Ryan, University of Cape Town data, not to be used without data holder's permission.

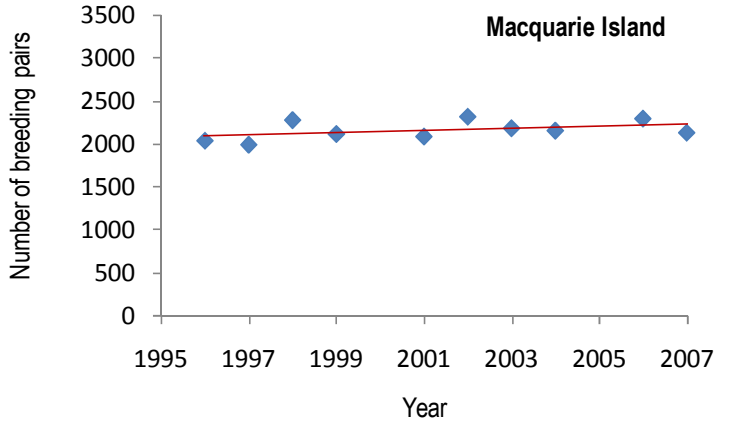


Figure 5. Counts of nesting pairs on Macquarie Island with a simple regression line fitted. Figure based on unpublished DPIW data, not to be used without data holder's permission.

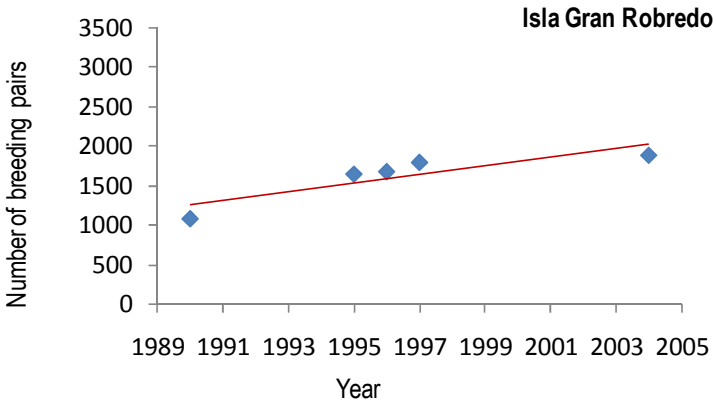


Figure 6. Counts of nesting pairs on Isla Gran Robredo with a simple regression line fitted. Figure based on Quintana et al. *2006* [50]

Table 4. *Summary of population trend data for* M. giganteus.

Breeding site	Current Monitoring	Trend Years	% average change per year [79] (95% Confidence Interval)	Trend	% of population for which trend calculated
Antarctic Peninsula	?	-	-	-	-
Adélie Land	?	-	-	-	-
East Antarctica	?	-	-	-	-
South Orkney Islands Cabo Geddes	?	1994-2006	-1.9 (-0.8, -2.9)	Decreasing	100%?
South Shetland Islands Potter Peninsula	?	1994-2007	-3.1 (-1.7, -4.5)	Decreasing	100%?
Isla de los Estados	?	-	-	-	-
Isla Observatorio	?	-	-	-	-
Isla Gran Robredo [1]	Yes	1990-2004 [2]	3.8 (3.3, 4.4)	Increasing	100%
Isla Arce	Yes	1987-2004 [2]	-	No linear trend [50]	100%
Heard Island	No	-	-	-	-
McDonald Islands	No	-	-	-	-
Macquarie Island	Yes	1996 – 2007 [2]	0.6 (0.3, 1.0)	Increasing	100%
Isla Noir	?	-	-	-	-
Islas Diego Ramirez	?	-	-	-	-
South Georgia (Islas Georgias del Sur)	?	?	-	Increasing [47]	?
Falkland Islands (Islas Malvinas)	?	1982-2005	-	Increasing [51]	100%
South Sandwich Islands (Islas Sandwich del Sur)	?	-	-	-	-
Îles Crozet					
Île de la Possession [77]	Yes	1980-2005	1.6 (0.3, 2.8)	Increasing	100%
		1980-1999	0 (-,-)	Stable	100%
		1999-2004	9.6 (2.9, 16.3)	Increasing	100%
Îles Kerguelen	?	-	-	-	-
Prince Edward Islands					
Marion Island	Yes	1985-2008 [2]	-3.8 (-3.7, -3.9)	Decreasing	100%
		1997-2008	-1.2 (-0.9, -1.6)	Decreasing	100%
Gough Island	?	1979-2002	-	Increasing [56]	100%

[1] Based on Quintana *et al.* 2006 [50]

[2] Missing data: Macquarie Island 2000, 2005; Marion Island 1986, 1988, 1996; Isla Gran Robredo 1991-1994, 1998-2003; Isla Arce 1988-1994, 1998-2000, 2004

Very little is known about rates of adult and juvenile survival in *M. giganteus*. Given the late maturation of these birds, long-term, relatively intensive banding studies are required to obtain information on the survival of juveniles. The flighty nature of many adults and their tendency to move around make resightings of adults difficult. Breeding success has been estimated in a number of colonies and is summarised in Table 5.

Table 5. *Summary of demographic data for* M. giganteus*. Table based on unpublished data (IAA –South Shetland Islands, Watson Peninsula and Cabo Geddes; DPIW - Macquarie Island; R.J.M. Crawford, Marine & Coastal Management, DAFF and P.G. Ryan, University of Cape Town – Marion Island) and published references as indicated.*

Breeding site	Mean breeding success (±SD; Years)	Mean juvenile survival	Mean adult survival
Antarctic Peninsula	No data	No data	No data
Adélie Land	No data	No data	No data
East Antarctica	No data	No data	No data
South Orkney Islands			
Signy Island	No data		
Watson Peninsula	75.0% (±5.2%; 2005-2006)	No data	No data
Cabo Geddes	72.6% (±5.8%; 2001-2006)		
South Shetland Islands			
Potter Peninsula	72.8% (±8.8%; 1994-2007)	No data	No data
Harmony Point	58.0% (±16.0%; 2004-2005)	No data	No data
Isla de los Estados	No data	No data	No data
Isla Observatorio	No data	No data	No data
Isla Arce	79.3% (±17.1%; 1983, 1988, 1996-1998, 2002-2003, 2005) [50]	No data	No data
Isla Gran Robredo	74.4% (±13%; 1989, 1991, 1996-1998, 2005) [50]	No data	No data
Heard Island	No data	No data	No data
McDonald Islands	No data	No data	No data
Macquarie Island	45.6% (±7.5%; 1996-2007)	No data	No data
Islas Diego Ramirez	No data	No data	No data
Isla Noir	No data	No data	No data
Falkland Islands (Islas Malvinas)	No data	No data	No data
South Georgia (Islas Georgias del Sur)	69.9% (±4.5%, 1979-1982) [38]	No data	No data
South Sandwich Islands (Islas Sandwich del Sur)	No data	No data	No data
Îles Crozet			
Île de la Possession	42.6% (±4.9% SE; 1981-2005) [78]	No data	91.7% (1996-1980)[1] [40]
Îles Kerguelen	No data	No data	No data
Prince Edward Islands			
Marion Island	46.1% (±10.2%; 2002-2007)	No data	84% (1984-1995)
Gough Island	No data	No data	No data

[1] recorded as an average mortality of 8.3% in 3 cohorts

BREEDING SITES: THREATS

A number of threats to *M. giganteus* has been reported from various breeding sites. However, a detailed evaluation is difficult because many breeding sites have not been visited for a long time. Threats include plastic ingestion, pollution, human disturbance, predation by introduced animals and habitat destruction by grazing animals. Changes in sea ice extent and duration in conjunction with food availability may have led to a delayed arrival of *M. giganteus* at Dumont D'Urville, Adélie Land [80].

Under the Antarctic Treaty, 16 of the breeding sites of *M. giganteus* are listed as Antarctic Specially Protected Areas or Antarctic Specially Managed Areas but only two (Frazier Islands, Hawker Island) were established with the exclusive purpose to protect breeding *M. giganteus*.

Table 6. *Summary of known threats causing population level changes at the breeding sites of* M. giganteus (see Glossary and Notes).

Breeding site	Human disturbance	Human take	Natural disaster	Parasite or Pathogen	Habitat loss or degradation	Predation by alien species	Contamination
Antarctic Peninsula							
Palmer Station	low? [a]	no	no	low? [b]	no	no	?
Adélie Land	no	no	no	no	no	no	no
East Antarctica	?	?	?	?	?	?	?
South Orkney Islands	?	?	?	?	?	?	?
South Shetland Islands							
Potter Penisula	low? [a]	no	no	low? [b]	no	no	no
Penguin Island	high? [a]	no	no	no	no	no	no
Fildes Peninsula	high? [a]	no	no	no	no	no	?
Isla de los Estados	no	no	no	no	no	no	no
Isla Observatorio	no	no	no	no	no	no	no
Isla Arce	no	no	no	no	no	no	no
Isla Gran Robredo	no	no	no	no [b]	no	no	no
Heard Island	no	no	no	no	no	no	no
McDonald Islands	no	no	medium [c]	no	no	no	no
Macquarie Island	no	no	no	no	no [d]	no [d]	no
Isla Noir	no	no	no	no	no	no	no
Islas Diego Ramirez	no	no	no	no	no	no	no
Falkland Islands (Islas Malvinas)	no	no	no	no	no	no	no
South Georgia (Georgias del Sur)	no	no	no	no	no	no	no
South Sandwich Islands (Islas Sandwich del Sur)	no	no	no	no	no	no	no
Iles Crozet	no	no	no	no	no	no	no
Iles Kerguelen	no	no	no	no	no	no	no
Prince Edward Islands	low	no	no	no	no	no	no
Gough Island	no	no	no	no	no	no	no

[a] At a number of colonies, for example at Signy Island [81], at Pointe Géologie [82], and on King George Island [83] the establishment of research bases may have influenced the birds to settle elsewhere; some negative effects on breeding success have been reported [81]. Many colonies are naturally relatively well protected because of their remoteness or difficult accessibility. Tourism may be an issue at some sites [84].

[b] Avian pox virus was isolated from a chick near Palmer Station [85]. At this stage it is neither known how far spread the virus is in *M. giganteus* populations nor how the infection occurred. It is highly likely that the chick received contaminated food from its parents. Because of the vast foraging range of adults it is impossible to determine where the contagion was originally encountered. There has also been a report of avian cholera in one individual at Potter Peninsula, King George Island [86]. Antibodies were found for avian adenovirus and *Salmonella pullorum* in a sample of 25 birds on Isla Gran Robredo in 1999-2001 but all were negative for antibodies to several other viruses [87].

[c] Volcanic activity is a threat on McDonald Islands.

[d] At Macquarie Island, introduced cats *Felis catus* and Black rats *Rattus rattus*, have preyed on eggs and/or chicks. The cats were eradicated in 2002. An eradication programme which targets *R. rattus* and *Mus musculus* (as well as European rabbits *Oryctolagus cuniculus,* which damage the breeding habitat), commenced in 2010 [70] but had to be abandoned due to exceptionally poor weather. It will recommence in 2011.

FORAGING ECOLOGY AND DIET

The diet of *M. giganteus* has largely been studied through food delivered to chicks. It is highly varied, reflecting their scavenging nature. Penguin parts were most commonly found in regurgitates [34, 88, 89]. Remnants of other birds (e.g. burrowing petrels), seal meat (adults, pups, placentae) and some cephalopod remains were also identified [88, 89]. Between 56.5 and 69.4% of samples from Islas Arce and Gran Robredo colonies during the 2001 to 2004 breeding seasons contained cephalopods, mainly *Illex argentinus* [89]. Diet composition can vary with location. Crustaceans were more important at Bird and Signy Islands than at Îles Crozet or Macquarie Island. Fish appeared to be rare in the summer diet comprising mainly Nototheniidae [90], but occurred in between 9.8 and 23.2% of samples from Islas Arce and Gran Robredo [89]. At Marion Island, the winter diet comprised mainly king penguin *Aptenodytes patagonicus* chicks [43]. At Signy Island, carcasses of Weddell seals *Leptonychotes weddelli* provided an important food source from August to November [34]. Anthropogenic items (mainly plastics, but also vegetables, plastic lines, rope, paper, wood and aluminium) were found in 64.5 to 78.4% (average 72.7%) of the samples from Islas Arce and Gran Robredo [89]. Some differences occur in the diet composition of females and males: females seem to feed more pelagically than males who in turn seem to consume mainly carrion [44, 91].

MARINE DISTRIBUTION

In the past, understanding of the dispersal of *M. giganteus* was based on banding recoveries. Retrieval rates were usually very low [92, 93, 94, 95]. However, even the few individuals recovered had dispersed widely from their natal islands and reached the shores of South Africa, Australia, South America, New Zealand and Easter Island [92, 93, 94, 95].

Lately, a number of satellite-tracking studies has confirmed the wide dispersal of this species (see Figures 7 and 8). Satellite-tracked fledglings departing Macquarie Island travelled south to Antarctica or to the west coast of South America [95] (Figure 7). Incubating adults also foraged around the Antarctic ice edge, the Polar Front and the Antarctic circumpolar current front (Figure 8), whereas during the chick provisioning phase breeding birds concentrated their activity close to Macquarie Island [94]. Adult breeders in Patagonia showed a wide distribution over the Patagonian Shelf, with foraging occurring exclusively within the shelf boundaries from coastal areas up to the shelf break [96, 97]. Females foraged primarily away from the coast and males mainly visited coastal areas [96]. However, both sexes have the ability to use either foraging strategy, with males undertaking long pelagic trips to the middle shelf and females foraging in more coastal areas [96]. Satellite-tracking during incubation at Bird Island, South Georgia (Islas Georgias del Sur), has also confirmed different foraging patterns by males and females: males remained close to South Georgia (Islas Georgias del Sur) whereas females performed longer trips to more distant areas [98]. In winter, the birds tended to return to the same foraging areas they occupied during chick rearing but remained there for extended periods [99].

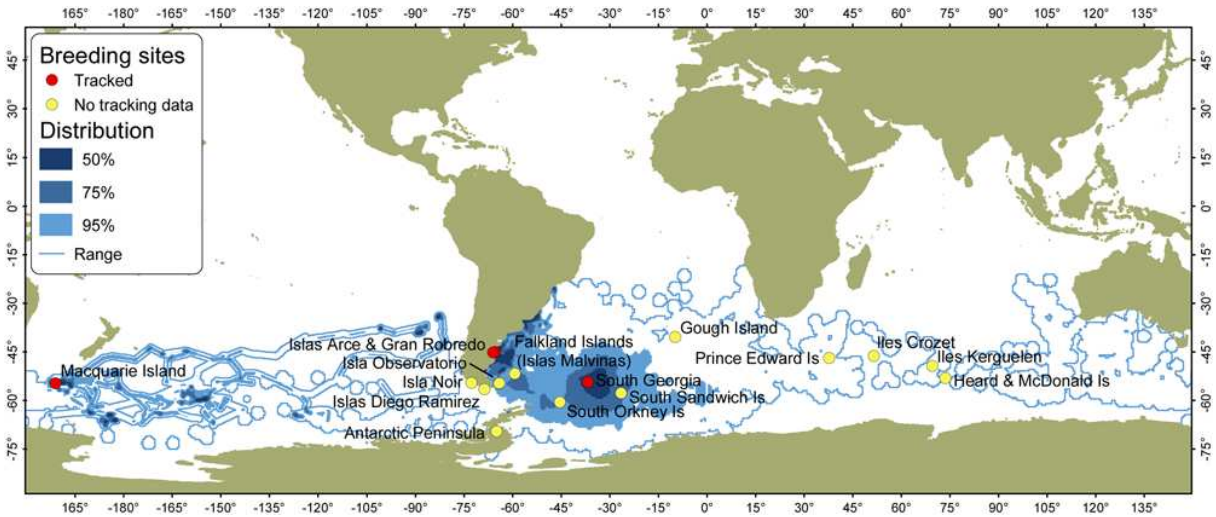


Figure 7. *Satellite-tracking data from non-breeding adult* M. giganteus (Number of tracks = 54). *Map based on data contributed to the BirdLife Global Procellariiform Tracking Database [100].*

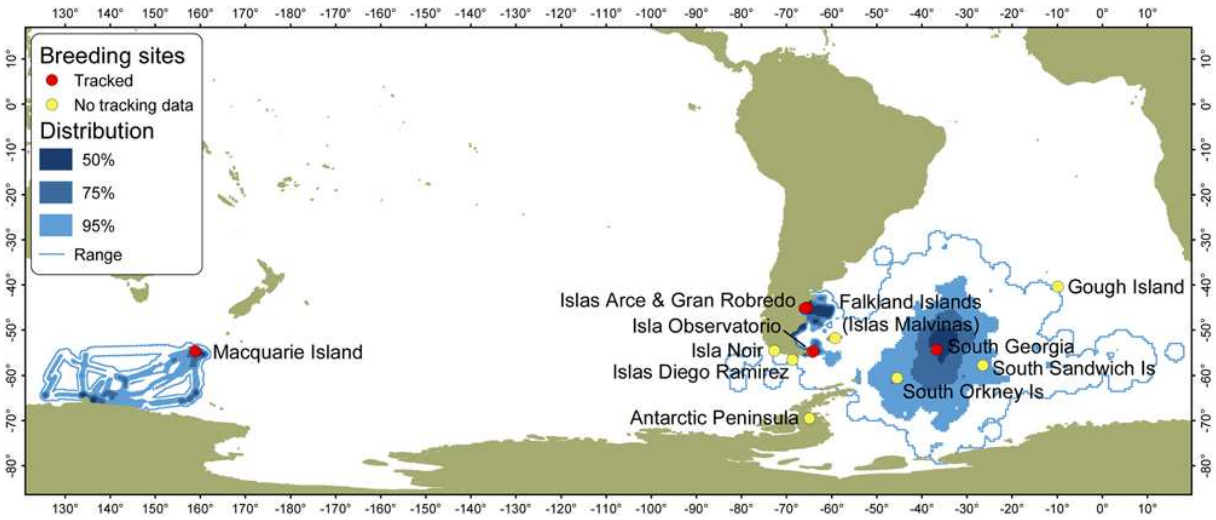


Figure 8. *Satellite-tracking data from breeding adult* M. giganteus (Number of tracks = 111). *Map based on data contributed to the BirdLife Global Procellariiform Tracking Database [100]*

Due to its circumpolar distribution, *M. giganteus* overlaps with the management areas of all major Regional Fisheries Management Organisations (Table 7), including SWIOFC (South-West Indian Ocean Fisheries Commission), SIOFA (Southern Indian Ocean Fisheries Agreement), and SEAFO (South-East Atlantic Fisheries Organisation), aimed at ensuring the long-term conservation and sustainable use of fishery resources other than tuna, as well as the yet to be established South Pacific Regional Fisheries Management Organisation (SPRFMO) covering both pelagic and demersal fisheries in the region.

Table 7. *Summary of the known ACAP Range States, non-ACAP Exclusive Economic Zones and Regional Fisheries Management Organisations that overlap with the marine distribution of* M. giganteus.

	Resident/ Breeding and feeding range	Foraging range only	Few records - outside core foraging range
ACAP Range States	Argentina Australia Chile France Norway[1] South Africa UK	Brazil New Zealand Uruguay	-
Exclusive Economic Zones of non-ACAP countries	-	Namibia	Angola?
Regional Fisheries Management Organisations[2]	CCAMLR CCSBT ICCAT WCPFC SIOFA SWIOFC SEAFO SPRFMO	IATTC IOTC	-

[1] May no longer breed on Bouvet Island

[2] See Figure 1 and text for list of acronyms

MARINE THREATS

In the 1990s, the numbers of *M. giganteus* reported killed in legal commercial fisheries in the Southern Ocean were low [101, 102, 103, 104] However, the number of *M. giganteus* killed in illegal, unregulated and unreported (IUU) fisheries was considered to be much higher. The Commission for the Conservation of Antarctic Living Resources (CCAMLR) estimated that potentially several thousands of these birds were killed incidentally by IUU vessels from 1997 to 1999, particularly in sub-Areas 58.6 and 58.7 (Indian Ocean) [102, 103, 104]. Since 2004, the bycatch of seabirds including *M. giganteus* in the convention area has been virtually eliminated in the legal fisheries [105]. No *M. gignateus* have been reported killed in the CCAMLR area since 2005. With regard to IUU fishing, new estimates indicate that IUU fishing effort and, hence, seabird bycatch has significantly decreased in recent years although some areas may remain more vulnerable than others [105]. In New Zealand fisheries (longlines and trawls), only eight *M. giganteus* were observed killed from October 1996 to September 2005 [106].

There is a marked spatio-temporal association between the at-sea distribution of *M. giganteus* from Patagonia during the breeding period and the fishing activity on the Patagonian Shelf, mainly with the trawl fleet [107]. However, females from all colonies spend a greater percentage of their time at sea in areas targeted by longline fisheries [107]. Although *M. giganteus* have been observed attending high-seas Argentine hake *Merluccius hubbsi* trawlers operating in Golfo San Jorge, no incidental captures were reported [108, 109]. The reported seabird bycatch in a sample of sets and hauls from the Argentinean Kingclip *Genypterus blacodes* longline fishery between December 2000 and September 2001 did not include *M. giganteus* either [110]. However, an analysis of the seabird bycatch along the Patagonian Shelf by Argentine longline fishing vessels between 1999 and 2001 identified an average of 3.8% of reported captures to be *M. giganteus,* with annual captures of all species estimated to average 1,160 birds [111].

Other marine threats experienced by *M. giganteus* include oil staining of plumage and injuries from nets or other fishing gear, swallowing of debris and entanglement in fishing gear [112, 113, 114], as well as contamination with organochlorine pesticides [115] and heavy metals [116]. The global extent of these threats to *M. giganteus* is unknown.

KEY GAPS IN SPECIES ASSESSMENT

Southern Giant Petrels tend to be susceptible to human disturbance [34, 82, 85]. This makes the species difficult to study and information gaps still exist in terms of their at-sea distribution, as well as adult and juvenile survival rates. The colonies of this species are usually small and multiple colonies occur on the same island making all-island censuses logistically difficult. Census work is further complicated as an estimated 15-40% of potential breeders may not attend their breeding colony in any one year [40]. Therefore population data are incomplete for many sites and reliable long-term data on population trends are rare. The lack of such data should be addressed with some urgency.

Macronectes giganteus interact with both longline and trawl fisheries and more comprehensive information on rates of incidental mortality would assist with the assessment of the impacts of these interactions. Similarly, rates of secondary ingestions of hooks are poorly known. The extent and impact of marine pollution is largely unknown.

Photo © Kieran Lawton

REFERENCES

1. Bourne, W.R.P. and Warham, J. 1966. Geographical variation in the giant petrels of the genus *Macronectes. Ardea* **54**: 45–67.
2. Nunn, G.B. and Stanley, S.E. 1998. Body size effects and rates of cytochrome b evolution in tube-nosed seabirds. *Molecular Biology & Evolution* **15**: 1360-1371.
3. Penhallurick, J. and Wink, M. 2004. Analysis of the taxonomy and nomenclature of the Procellariiformes based on complete nucleotide sequences of the mitochondrial cytochrome b gene. *Emu* **104**: 125-147.
4. Rheindt, F.E. and Austin, J.J. 2005. Major analytical and conceptual shortcomings in a recent taxonomic revision of the Procellariiformes - a reply to Penhallurick and Wink (2004). *Emu* **105**: 181-186.
5. Burger, A.E. 1978. Interspecific breeding attempts by *Marcronectes giganteus* and *M. halli. Emu* **78**: 234-235.
6. Johnstone, G.W. 1978. Interbreeding by *Macronectes halli* and *M. giganteus* at Macquarie Island. *Emu* **78**: 235.
7. Hunter, S. 1982. Interspecific breeding in giant petrels at South Georgia. *Emu* **82**: 312-314.
8. ACAP. *Agreement on the Conservation of Albatrosses and Petrels. http://www.acap.aq*.
9. IUCN. 2010. *2010 IUCN Red List of Threatened Species. Version 2010.3.* www.iucnredlist.org
10. Bonn Convention. *Convention on the Conservation of Migratory Species of Wild Animals*. http://www.cms.int/
11. Australian Government. 1999. *Environment Protection and Biodiversity Conservation Act 1999*. http://www.comlaw.gov.au/comlaw/management.nsf/lookupindexpagesbyid/IP200401830?OpenDocument
12. Department of Environment and Heritage. 2001. *Recovery Plan for Albatrosses and Giant-Petrels 2001-2005*. http://www.deh.gov.au/biodiversity/threatened/publications/recovery/albatross/index.html
13. Department of Environment and Heritage. 2006. *Threat Abatement Plan for the incidental catch (or bycatch) of seabirds during oceanic longline fishing operations* http://www.environment.gov.au/biodiversity/threatened/tap-approved.html
14. Department of Environment and Climate Change. 2005. *Threatened Species Conservation Act, 1995, New South Wales*. http://www.legislation.nsw.gov.au/viewtop/inforce/act+101+1995+FIRST+0+N
15. Environmental Protection Agency. 2007. *Nature Conservation Act 1992, Queensland*. http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/N/NatureConA92.pdf
16. Tasmanian Government. *Threatened Species Protection Act (1995)*. http://www.dpiw.tas.gov.au/
17. Department of Sustainability and Environment. 2007. *Fauna and Flora Guarantee Act 1988, Victoria*. http://www.dpi.vic.gov.au/dse/nrenpa.nsf/FID/-0488335CD48EC1424A2567C10006BF6D
18. Favero, M. and Gandini, P. 2007. *Technical document - Incidental mortality of Albatrosses ad Petrels associated with fisheries: towards the development of a national plan of action in Argentina.* Universidad Nacional de la Patagonia Austral, the Universidad Nacional de Mar del Plata, the Wildlife American Bird Conservancy (ABC) and the Wildlife Conservation Society.
19. López-Lanús, B., Grilli, P., Di Giacomo, A., Coconier, E., and Banchs, R. 2008. *Categorización de las Aves de Argentina. Según su estado de conservación.* Aves Argentinas/AOP y Secretaría de Ambiente y Desarrollo Sustentable. http://www.ambiente.gov.ar/?idarticulo=5620

20. Government of Argentina. 1997. Decreto Nacional 666/97. Decreto reglamentario sobre conservación de la fauna silvestre. *BOLETIN OFICIAL - 25/07/1997.* http://www2.medioambiente.gov.ar/mlegal/fauna_flora/dec666_97.htm
21. Subsecretaría de Pesca. 2006. *Plan de Acción Nacional para reducir las capturas incidentales de aves en las pesquerías de palangre (PAN-AM/CHILE).* 26 pp. www.subpesca.cl/mostrararchivo.asp?id=5768
22. Falkland Islands Government. 1999. *Conservation of Wildlife and Nature Bill 1999.* The Falkland Islands Gazette. Supplement **10** (13). http://www.falklandconservation.com/wildlife/conbill.html
23. Falkland Islands Government. 2005. *Fisheries (Conservation and Management) Ordinance 2005*. Falkland Islands Government: Stanley.
24. Falklands Conservation. 2004. *Falkland Islands FAO National Plan of Action for Reducing Incidental Catch of Seabirds In Longline Fisheries 2004.* Unpublished report to the Royal Society for the Protection of Birds (RSPB), UK.
25. Gouvernement de la République Française. 1998. Arrêté du 14 août 1998 fixant sur tout le territoire national des mesures de protection des oiseaux représentés dans les Terres australes et antarctiques françaises. *Le Journal Officiel de la République Française n°236 du 11 octobre 1998.* p. 15405 http://www.legifrance.gouv.fr/home.jsp
26. Government of South Africa. 1973. Sea Birds and Seals Protection Act, 1973 (Act No. 46 of 1973). Available from http://faolex.fao.org/
27. Department of Environmental Affairs and Tourism. Republic of South Africa. 2007. *General Notice 1717 of 2007. Marine Living Resources Act, 1998 (Act 18 of 1998): Publication of Policy on the Management of Seals, Seabirds and Shorebirds.* Government Gazette **Vol 510** (No. 30534): 3-31. http://www.info.gov.za/view/DownloadFileAction?id=74648
28. Department of Environmental Affairs and Tourism. 2007. *General Notice 1768 of 2007. Sea Birds and Seals Protection Act, 1973 (Act No. 46 of 1973): Publication of Policy on the Management of Seals Seabirds and Shorebirds: Correction.* Government Gazette (No. 30575): 2. http://www.info.gov.za/view/DownloadFileAction?id=75663
29. Department of Environmental Affairs and Tourism. 2008. *South Africa National Plan of Action for Reducing the Incidental Catch of Seabirds in Longline Fisheries.* Department of Environmental Affairs and Tourism: Cape Town. 32 pp.
30. Government of South Georgia and the South Sandwich Islands. 1975. *Falkland Islands Dependencies Conservation Ordinance (1975)*. http://www.sgisland.gs
31. Varty, N., Sullivan, B.J., and Black, A.D. 2008. *FAO International Plan of Action-Seabirds: an assessment for fisheries operating in South Georgia and South Sandwich Islands.* BirdLife International Global Seabird Programme. Royal Society for the Protection of Birds. The Lodge, Sandy, Bedfordshire, UK. 96 pp.
32. Saint Helena Government. 2006. The conservation of native organisms and natural habitats (Tristan da Cunha) Ordinance 2006. *Saint Helena Government Gazette Extraordinary* **44**: 1-13.
33. Domingo, A., Jiménez, S., and Passadore, C. 2007. *Plan de acción nacional para reducir la captura incidental de aves marinas en las pesquerías uruguayas.* Dirección Nacional de Recursos Acuáticos. Montevideo. 76 pp. http://www.dinara.gub.uy/web_dinara/index.php?option=com_content&view=article&id=77&Itemid=111
34. Conroy, J.W.H. 1972. Biological aspects of the biology of the giant petrel, *Macronectes giganteus* (Gmelin), in the maritime Antarctic. *British Antarctic Survey Report* **75**: 75 pp.
35. Cooper, J., Brooke, M., Burger, A.E., Crawford, R.J.M., Hunter, S., and 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.

36. Quintana, F., Schiavini, A., and Copello, S. 2005. Estado poblacional, ecologia y conservacion del Petrel gigante del Sur en Argentina. *El Hornero* **20**: 25-34.
37. Copello, S. and Quintana, F. 2009. Breeding biology of the Southern Giant Petrel (*Macronectes giganteus*) in Patagonia, Argentina. *Ornitología Neotropical* **20**: 369-380.
38. Hunter, S. 1984. Breeding biology and population dynamics of giant petrels *Macronectes* at South Georgia (Aves: Procellariiformes). *Journal of Zoology (London)* **203**: 441-460.
39. Copello, S., Quintana, F., and Somoza, G. 2006. Sex determination and sexual size-dimorphism in Southern Giant-Petrels (*Macronectes giganteus*) from Patagonia,Argentina. *Emu* **106**: 141-146.
40. Voisin, J.-F. 1988. Breeding biology of the Northern giant petrel *Macronectes halli* and the Southern giant petrel *M. giganteus* at Ile de la Possesion, Iles Crozet, 1966-1980. *Cormorant* **16**: 65-97.
41. Marchant, S. and Higgins, P.J., eds. 1990. *Handbook of Australian, New Zealand, and Antarctic Birds*. Vol. 1 Ratites to Ducks. Oxford University Press: Melbourne. 1536 pp.
42. Johnstone, G., Shaughnessy, P., and Conroy, J. 1976. Giant-petrels in the South Atlantic: new data from Gough Island. *South African Journal of Antarctic Research* **6**: 19-22
43. de Bruyn, P.J.N., Cooper, J., Bester, M.N., and Tosh, C.A. 2007. The importance of land-based prey for sympatrically breeding giant petrels at sub-Antarctic Marion Island. *Antarctic Science* **19**: 25-30.
44. Hunter, S. and de L Brooke, M. 1992. The diet of giant petrels *Macronectes* spp at Marion Island, Southern Indian Ocean. *Colonial Waterbirds* **15**: 56-65.
45. Woehler, E. and Johnstone, G. 1988. Banding studies of giant petrels, *Macronectes* spp., at Macquarie Island. *Proceedings of the Royal Society of Tasmania* **122**: 143-152.
46. BirdLife International. 2009. *Macronectes giganteus*. In: IUCN 2009. IUCN Red List of Threatened Species. Version 2009.2. http://www.iucnredlist.org/ Downloaded on 08 December 2009
47. Patterson, D.L., Woehler, E.J., Croxall, J.P., Poncet, S., Peter, H.-U., Hunter, S., and Fraser, W.R. 2008. Breeding distribution and population status of the Northern giant petrel *Macronectes halli* and the Southern giant petrel *M. giganteus. Marine Ornithology* **36**: 115-124.
48. Creuwels, J.C.S., Stark, J.S., Woehler, E.J., van Franeker, J.A., and 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.
49. Koester, F. and Piedrahita, P. 2007. Censos del Petrel Gigante del Sur *Macronectes giganteus* y las Skúas *Catharacta* spp. en la Punta Fort Williams-Isla Greenwich y la Isla Barrientos, Shetland del Sur, Antártida. *Revista Tecnológica ESPOL* **20**: 89-95.
50. Quintana, F., Punta, G., Copello, S., and Yorio, P. 2006. Population status and trends of Southern Giant Petrels *(Macronectes giganteus)* breeding in north Patagonia, Argentina. *Polar Biology* **30**: 53-59.
51. Reid, T.A. and Huin, N. 2008. Census of the Southern Giant Petrel population of the Falkland Islands 2004/2005. *Bird Conservation International* **18**: 118-128.
52. Jouventin, P., Stahl, J.C., Weimerskirch, H., and Mougin, J.L., 1984. *The seabirds of French Subantarctic Islands & Adélie Land, their status and conservation*, in *Status and conservation of the world's seabirds.* J.P. Croxall, P.G.H. Evans, and R.W. Screiber (Eds). ICBP Technical Publication
53. Derenne, P., Mugin, J.L., Steinberg, C., and Voisin, J.-F. 1976. Les oiseaux de l'ile aux Cochons, archipel Crozet (46 06'S, 50 14'E). *Com. Nat. Fr. Rech.Antarct.* **40**: 107-148.
54. Weimerskirch, H., Zoiter, H., and Jouventin, P. 1988. The avifauna of Kerguelen Islands. *Emu* **89**: 15-29.
55. Ryan, P., J, C., Dyer, B., Underhill, L., and Crawford, R. 2003. Counts of surface-nesting seabirds breeding at sub-Antarctic Prince Edward Island, summer 2001/02. *African Journal of Marine Science* **25**: 441-451.

56. Cuthbert, R. and Sommer, E.S. 2004. Population size and trends of four globally threatened seabirds at Gough Island, South Atlantic Ocean. *Marine Ornithology* **32**: 97-103.
57. Antarctic Treaty 1959. http://www.ats.aq/documents/ats/treaty_original.pdf
58. Secretariat of the Antarctic Treaty. 2009. *Area Protection and Management / Monuments*. http://www.ats.aq/e/ep_protected.htm
59. Australian Antarctic Division. 2003. *Management Plan for Antarctic Specially Protected Area No 160: Frazier Islands, Windmill Islands, Wilkes Land, East Antarctica*. http://www.aad.gov.au/MediaLibrary/asset/MediaItems/ml_382324301388889_ASPA160FrazierIslandsManagementPlan.pdf
60. Australian Antarctic Division. 2006. *Management Plan for Antarctic Specially Protected Area No 167*. http://www.aad.gov.au/default.asp?caseid=27073
61. World Heritage Committee. 2004. *Report on the twenty-eighth session of the World Heritage Committee.* WHC-04/28. COM/26. Suzhou, China.
62. Ramsar Convention on Wetlands. http://www.ramsar.org/
63. United Nations Educational Scientific and Cultural Organization. *World Heritage List*. http://whc.unesco.org/en/list
64. UNESCO's Man and the Biosphere Programme (MAB) - Macquarie Island. http://www.unesco.org/mabdb/br/brdir/directory/biores.asp?mode=all&code=AUL+03
65. La Legislatura de la Provincia del Chubut. 2007. *Parque Interjurisdiccional Marino Costero Patagonia Austral – Ley Nº 5.668.* Boletín Oficial Nº 10363 7-8. http://www.chubut.gov.ar/boletin/archives/pdf/Noviembre%2008,%202007.pdf
66. Government of Argentina. 2008. Ley Nacional 26.446. http://legislacion.elderecho.com.ar/index.php?accion=8&record=2435
67. Australian Government. Department of the Environment, Water, Heritage, and the Arts. *Register of the National Estate (RNE)*. http://www.environment.gov.au/heritage/places/rne/index.html
68. Tasmanian Government. Nature Conservation Act 2002. http://www.parks.tas.gov.au/manage/parksres/reserves.html.
69. Parks and Wildlife Service. 2006. *Macquarie Island Nature Reserve and World Heritage Area Management Plan.* Parks and Wildlife Service, Department of Tourism, Arts and the Environment. Hobart.
70. Parks and Wildlife Service and Biodiversity Conservation Branch. 2007. *Plan for the Eradication of Rabbits and Rodents on Subantarctic Macquarie Island.* Department of Tourism, Arts and the Environment & Department of Primary Industries and Water. Hobart.
71. Gouvernement de la République Française. 2006. Décret n°2006-1211 du 3 octobre 2006 portant création de la Réserve Naturelle des Terres Australes Françaises. *Journal Officiel de la République Française n°230 du 4 octobre 2006.* p.14673. http://www.legifrance.gouv.fr/home.jsp
72. Terres Australes et Antarctiques Françaises. 1985. *Arrêté n°14 du 30 Juillet 1985 relatif à la création de zones réservées à la recherché scientifique et technique dans les TAAF. Mises à jour / extensions : Décisions n°2006 – 22, n°108 du 16 juin 1989, n°147 du 13 septembre 1990, du 19 juillet 1991 ; arrêté 2002 - 42 du 18 décembre 2002*. http://www.taaf.fr/spip/spip.php?article354
73. Government of South Africa. 2004. *National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003).* Government Gazette **464** (No. 26025, 18 February 2004): 1-50. http://www.info.gov.za/view/DownloadFileAction?id=68034
74. Prince Edward Islands Management Plan Working Group. 1996. *Prince Edward Islands Management Plan.* Pretoria: Department of Environmental Affairs and Tourism. Republic of South Africa.
75. McIntosh, E. and Walton, D.W.H. 2000. *Environmental Management Plan for South Georgia.* Published by the British Antarctic Survey on behalf of the Government of South Georgia and South Sandwich Islands. 104 pp.

76. Pasteur, E. and Walton, W. 2006. *South Georgia: plan for progress, managing the environment 2006-2010.* . Published by the British Antarctic Survey on behalf of the Government of South Georgia and the South Sandwich Islands. 75 pp. http://sgisland.org/pages/gov/PlanProgress.htm
77. Cooper, J. and Ryan, P.G. 1994. *Management Plan for the Gough Island Wildlife Reserve.* Edinburgh, Tristan da Cunha.
78. Delord, K., Besson, D., Barbraud, C., and Weimerskirch, H. 2008. Population trends in a community of large Procellariiforms of Indian Ocean: Potential effects of environment and fisheries interactions. *Biological Conservation* **141**: 1840-1856.
79. Pannekoek, J. and van Strien, A. 2006. TRIM 3.53 (TRends & Indices for Monitoring data). Statistics Netherlands, Voorburg. http://www.cbs.nl/en-GB/menu/themas/natuur-milieu/methoden/trim/default.htm
80. Barbraud, C. and Weimerskirch, H. 2006. Antarctic birds breed later in response to climate change. *Proceedings of the National Academy of Science* **103**: 6248-6251.
81. Rootes, D.M. 1988. The status of birds at Signey Island, South Orkney Islands. *British Antarctic Survey Report* **80**: 87-119.
82. Micol, T. and Jouventin, P. 2001. Long-term population trends in seven Antarctic seabirds at Pointe Geologie (Terre Adelie) - Human impact compared with environmental change. *Polar Biology* **24**: 175-185.
83. 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.
84. Pfeiffer, S. and Peter, H.-U. 2004. Ecological studies toward the management of an Antarctic tourist landing site (Penguin Island, South Shetland Islands). *Polar Record* **40**: 345-353.
85. Shearn-Boschsler, V., Green, D.E., Converse, K.A., Docherty, D.E., Thiel, T., Geisz, H.N., Fraser, W.R., and Patterson-Fraser, D.L. 2008. Cutaneous and diphtheric avian poxvirus infection in a nestling Southern giant petrel (*Macronectus giganteus*) from Antarctica. *Polar Biology* **31**: 569-573.
86. Leotta, G.A., Rivas, M., Chinen, I., Vigo, G.B., Moredo, F.A., Coria, N., and Wolcott, M.J. 2003. Avian cholera in a southern giant petrel *(Macronectes giganteus)* from Antarctica. *Journal of Wildlife Diseases* **39**: 732-735.
87. Uhart, M.M., Quintana, F., Karesh, W.B., and Braselton, W.E. 2003. Hematology, plasma biochemistry, and serosurvey for selected infectious agents in southern giant petrels from Patagonia, Argentina. *Journal of Wildlife Diseases* **39**: 359-365.
88. Johnstone, G.W. 1977. 'Comparative feeding ecology of the giant petrel *Macronectes giganteus* (Gmelin) and *M. halli* (Mathews)'. *Adaptations within Antarctic ecosystems*. G.A. Llano (Ed) Proceedings of the Third SCAR Symposium on Antarctic Biology. 647-668.
89. Copello, S., Quintana, F., and Perez, F. 2008. The diet of the southern giant petrel in Patagonia: fishery-related items and natural prey. *Endangered Species Research* **6**: 15-23.
90. Warham, J. 1962. The biology of the giant petrel *Macronectes giganteus. The Auk* **79**: 139-160.
91. Hunter, S. 1983. The food and feeding ecology of the giant petrels *Macronectes halli* and *M. giganteus* at South Georgia. *Journal of Zoology* **200**: 521-538.
92. Ingham, S.E. 1959. Banding of giant petrels by the Australian National Antarctic Research Expeditions, 1955-1958. *Emu* **59**: 189-200.
93. Murray, M.D. 1972. Banding giant petrels on Frazier islands, Antarctica. *The Australian Bird Bander* **10**: 57-58.
94. Patterson, D.L. and Hunter, S. 1999. Giant petrel *Macronectes* spp. banding recovery analysis from the International Giant Petrel Banding Project, 1988/89. *Marine Ornithology* **28**: 69-74.
95. Trebilco, R., Gales, R., Baker, G., Terauds, A., and Sumner, D. 2008. At sea movement of Macquarie Island giant petrels: Relationships with marine protected areas and Regional Fisheries Management Organisations. *Biological Conservation* **141**: 2942-2958.

96. Quintana, F., Dell'Arciprete, P., and Copello, S. 2010. Foraging behaviour and habitat use by the Southern Giant Petrel on the Patagonian Shelf. *Marine Biology* **157**: 515-525.
97. Quintana, F. and DellÁrciprete, P. 2002. Foraging grounds of Southern Giant Petrels *(Macronectes giganteus)* on the Patagonian shelf. *Polar Biology* **25**: 159-161.
98. González-Solís, J., Croxall, J.P., and 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.
99. Gonzales-Solis, J., Croxall, J.P., and Afanasyev, V. 2008. Offshore spatial segregation in giant petrels *Macronectes* spp: differences between species, sexes and seasons. *Aquatic Conservation: Marine and Freshwater Ecosystems* **17**: S22-S36.
100. BirdLife-International. 2004. 'Tracking ocean wanderers: the global distribution of albatrosses and petrels.'. *Results from the Global Procellariiform Tracking Workshop, 1-5 September 2003*. BirdLife International: Cambridge (UK). Gordon's Bay, South Africa.
101. Nel, D.C., Ryan, P.G., and Watkins, B.P. 2002. Seabird mortality in the Patagonian toothfish longline fishery around the Prince Edward Islands, 1996-2000. *Antarctic Science* **14**: 151-161.
102. CCAMLR. 1997. *Report of the Sixteenth Meeting of the Scientific Committee, SC-CAMLR-XVI*. Hobart, Australia. 438 pp.
103. CCAMLR. 1998. *Report of the Seventeenth Meeting of the Scientific Committee, SC-CAMLR-XVII.* Hobart, Australia. 517 pp.
104. CCAMLR. 1999. *Report of the Eighteenth Meeting of the Scientific Committee, SC-CAMLR-XVIII.* Hobart, Australia. 461 pp.
105. Agnew, D.J. and Kirkwood, G.P. 2005. A statistical method for estimating the level of IUU fishing: application to CCAMLR subarea 48.3. *CCAMLR Science* **12**: 119-141.
106. New Zealand Department of Conservation. 2008. *Summary of autopsy reports for seabirds killed and returned form observed New Zealand fisheries.* Science and Technical Publishing, DOC: Wellington. 110 pp.
107. Copello, S. and Quintana, F. 2009. Spatio-temporal overlap between the at-sea distribution of Southern Giant Petrels and fisheries at the Patagonian Shelf. *Polar Biology* **32**: 1211-1220.
108. Gonzalez-Zevallos, D., Yario, P., and Caille, G. 2007. Seabird mortality at trawler warp cables and a proposed mitigation measure: A case of study in Golfo San Jorge, Patagonia, Argentina. *Biological Conservation* **136**: 108-116.
109. Gonzalez-Zevallos, D. and Yorio, P. 2006. Seabird use of discards and incidental captures at the Argentine hake trawl fishery in the Golfo San Jorge, Argentina. *Marine Ecology-Progress Series* **316**: 175-183.
110. Gandini, P. and Frere, E. 2006. Spatial and temporal patterns of seabirds by-catch in the Argentinean Longline Fishery. *Fishery Bulletin* **104**: 482-485.
111. Favero, M., Khatchikian, C.E., Arias, A., Rodriguez, M.P.S., Canete, G., and Mariano-Jelicich, R. 2003. Estimates of seabird by-catch along the Patagonian Shelf by Argentine longline fishing vessels, 1999-2001. *Bird Conservation International* **13**: 273-281.
112. Petry, M.V. and da S. Fonesca, V.S. 2002. Effects of human activities in the marine environment on seabirds along the coast of Rio Grande do Sul, Brazil. *Ornithologica Neotropical* **13**: 134-142.
113. Nel, D.C. and Nel, J.L. 1999. Marine debris and fishing gear associated with seabirds at sub-Antarctic Marion Island, 1996/97 and 1997/98: in relation to longline fishing activity. *CCAMLR Science* **6**: 85-96.
114. Copello, S. and Quintana, F. 2003. Marine debris ingestion by Southern giant petrels and its potential relationships with fisheries in the Southern Atlantic Ocean. *Marine Pollution Bulletin* **46**: 1513-1515.
115. Luke, B.G., Johnstone, G.W., and Woehler, E.J. 1989. Organochlorine pesticides, PCBs and mercury in Antarctic and sub-Antarctic birds. *Chemosphere* **19**: 2007-2021.
116. González-Solís, J., Sanpera, C., and Ruiz, X. 2002. Metals and selenium as bioindicators of geographic and trophic segregation in giant petrels *Macronectes* spp. *Marine Ecology-Progress Series* **244**: 257-264.

COMPILED BY

Barbara Wienecke, Australian Antarctic Division and Wiesława Misiak, ACAP Secretariat

CONTRIBUTORS

Flavio Quintana
Centro Nacional Patagónico (CONICET), Argentina and Wildlife Conservation Society, USA

Mark Tasker
Vice-Chair, ACAP Advisory Committee

ACAP Taxonomy Working Group
Contact: Michael Double
Mike.Double@aad.gov.au

ACAP Breeding Sites Working Group
Contact: Richard Phillips
raphil@bas.ac.uk

ACAP Status and Trends Working Group
Contact: Rosemary Gales
Rosemary.Gales@dpiw.tas.gov.au

ACAP Seabird Bycatch Working Group
Contact: Barry Baker
barry.baker@latitude42.com.au

BirdLife International
Global Seabird Programme
Contact: Cleo Small
Cleo.Small@rspb.org.uk
Maps : Frances Taylor
Satellite-tracking data contributors: Flavio Quintana (Centro Nacional Patagonico, Argentina), Rosemary Gales, Rachael Alderman (Department of Primary Industries and Water (DPIW), Tasmania, Australia), John Croxall, Richard Phillips, Jacob Gonzalez-Solis, Andy Wood (British Antarctic Survey).

RECOMMENDED CITATION

Agreement on the Conservation of Albatrosses and Petrels. 2010. ACAP Species assessment: Southern Giant Petrel *Macronectes giganteus.* Downloaded from http://www.acap.aq on 20 October 2010.

GLOSSARY AND NOTES

(i)
Years.
The "split-year" system is used. Any count (whether breeding pairs or fledglings) made in the austral summer (e.g. of 1993/94) is reported as the second half of this split year (i.e. 1994).

The only species which present potential problems in this respect are *Diomedea* albatrosses, which lay in December-January, but whose fledglings do not depart until the following October-December. In order to keep records of each breeding season together, breeding counts from e.g. December 1993-January 1994 and productivity counts (of chicks/fledglings) of October-December 1994 are reported as 1994.

If a range of years is presented, it should be assumed that the monitoring was continuous during that time. If the years of monitoring are discontinuous, the actual years in which monitoring occurred are indicated.

(ii) Methods Rating Matrix (based on NZ rating system)

METHOD
A Counts of nesting adults (Errors here are detection errors (the probability of not detecting a bird despite its being present during a survey), the "nest-failure error" (the probability of not counting a nesting bird because the nest had failed prior to the survey, or had not laid at the time of the survey) and sampling error).
B Counts of chicks (Errors here are detection error, sampling and nest-failure error. The latter is probably harder to estimate later in the breeding season than during the incubation period, due to the tendency for egg- and chick-failures to show high interannual variability compared with breeding frequency within a species).
C Counts of nest sites (Errors here are detection error, sampling error and "occupancy error" (probability of counting a site or burrow as active despite it's not being used for nesting by birds during the season).
D Aerial-photo (Errors here are detection errors, nest-failure error, occupancy error and sampling error (error associated with counting sites from photographs), and "visual obstruction bias" - the obstruction of nest sites from view, always underestimating numbers).
E Ship- or ground- based photo (Errors here are detection error, nest-failure error, occupancy error, sampling error and "visual obstruction bias" (the obstruction of nest sites from view from low-angle photos, always underestimating numbers)
F Unknown
G Count of eggs in subsample population
H Count of chicks in subsample population and extrapolation (chicks x breeding success - no count of eggs)

RELIABILITY
1 Census with errors estimated
2 Distance-sampling of representative portions of colonies/sites with errors estimated
3 Survey of quadrats or transects of representative portions of colonies/sites with errors estimated
4 Survey of quadrats or transects without representative sampling but with errors estimated
5 Survey of quadrats or transects without representative sampling nor errors estimated
6 Unknown

(iii) Population Survey Accuracy
High Within 10% of stated figure;
Medium Within 50% of stated figure;
Low Within 100% of stated figure (eg coarsely assessed via area of occupancy and assumed density)
Unknown

(iv) Population Trend

Trend analyses were run in TRIM software using the linear trend model with stepwise selection of change points (missing values removed) with serial correlation taken into account but not overdispersion.

(v) Productivity (Breeding Success)

Defined as proportion of eggs that survive to chicks at/near time of fledging unless indicated otherwise

(vi) Juvenile Survival

defined as:

1 Survival to first return/resight;
2 Survival to x age (x specified), or
3 Survival to recruitment into breeding population
4 Other
5 Unknown

(vii) Threats

A combination of scope (proportion of population) and severity (intensity) provide a level or magnitude of threat. Both scope and severity assess not only current threat impacts but also the anticipated threat impacts over the next decade or so, assuming the continuation of current conditions and trends.

		Scope (% population affected)			
		Very High (71-100%)	High (31-70%)	Medium (11-30%)	Low (1-10%)
Severity (likely % reduction of affected population within ten years)	Very High (71-100%)	**Very High**	**High**	**Medium**	**Low**
	High (31-70%)	**High**	**High**	**Medium**	**Low**
	Medium (11-30%)	**Medium**	**Medium**	**Medium**	**Low**
	Low (1-10%)	**Low**	**Low**	**Low**	**Low**

(viii) Maps

The satellite-tracking maps shown were created from platform terminal transmitter (PTT) and global-positioning system (GPS) loggers. The tracks were sampled at hourly intervals and then used to produce kernel density distributions, which have been simplified in the maps to show the 50%, 75% and 95% utilisation distributions (i.e. where the birds spend x% of their time). The full range (i.e. 100% utilisation distribution) is also shown. Note that the smoothing parameter used to create the kernel grids was 1 degree, so the full range will show the area within 1 degree of a track. In some cases the PTTs were duty-cycled: if the off cycle was more than 24 hours it was not assumed that the bird flew in a straight line between successive on cycles, resulting in isolated 'blobs' on the distribution maps. It is important to realise that these maps can only show where tracked birds were, and blank areas on the maps do not necessarily indicate an absence of the particular species.