

Identifying giant petrels, *Macronectes giganteus* and *M. halli*, in the field and in the hand

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Abstract

The two similar-looking species of giant petrels, the Northern Giant Petrel *Macronectes halli* and the Southern Giant Petrel *M. giganteus*, are renowned for being difficult to identify. In this paper we review and offer new guidelines on identification of these birds at sea, on land, and as dead specimens. Criteria for identifying giant petrels are available in the scientific literature, especially regarding bill-tip coloration which readily differ from one species to another. Plumage characters, although useful to discriminate species, are not adequately covered at present. Thus, for each species we describe in detail and illustrate distinctive age-related plumage stages, or types, from juveniles through to adult breeders. We also comment on giant petrel biometrics, body weight, and some aspects of their behaviour, in order to help ornithologists and birdwatchers separate males and females, and eventually specimens from South America–Gough Island, Antarctic and sub-Antarctic regions.

Introduction

Giant petrels *Macronectes* are large Procellariiformes with a wingspan usually in excess of two meters in males, slightly less in females, and are similar in size to *Thalassarche* mollymawks. They display a wide range of plumages, from dull-black to brownish-grey and even white, according to age and species. The discovery of two distinct populations breeding at Macquarie Island (Australian Antarctic Territory; Figure 1), laying about six weeks apart (Warham 1962), led Bourne & Warham (1966) to restrict the name *Macronectes giganteus* (Gmelin, 1789) to those birds breeding on Antarctic islands, the Antarctic Peninsula and continent, and on islands of the South Atlantic, and to resurrect the name *Macronectes halli* Mathews, 1912 for birds breeding on sub-Antarctic islands, from South Georgia through the Indian Ocean to the New Zealand area. Voisin & Bester (1981) and Voisin (1982b) showed later that the form breeding on the Falkland and Gough Islands (South Atlantic), as well as on islands off the Argentine coast, represented a well-marked subspecies: *Macronectes giganteus solanderi* Mathews, 1912, for which Carlos *et al.* (2005) proposed the vernacular name South Atlantic Giant Petrel. Hereafter, we follow current usage in referring to *M. halli* as Northern Giant Petrel and *M. giganteus* as Southern Giant Petrel.

Ringed recoveries and subsequent satellite-tracking studies have shown that both species of giant petrel roam the southern ocean widely, especially immatures, but also adults in the breeding and non-breeding seasons (Hunter 1984; Voisin 1990; Parmalee 1992; Trivelpiece & Trivelpiece 1998; González-Solís *et al.* 2000a, b; Patterson & Hunter 2000; Patterson & Fraser 2000, 2003; BirdLife International 2004; González-Solís *et al.* 2008). Antarctic populations of Southern Giant Petrel are especially wide-ranging, and one should not assume that, for example, a Southern Giant Petrel seen off the Argentinean–Brazilian coast at any time of the year is necessarily *M. g. solanderi*.

Recently, Penhallurick & Wink (2004) proposed to re-group *M. halli* as a subspecies of *M. giganteus* on the basis of low mitochondrial cytochrome-*b* gene divergence. Such a position is untenable since both species have long bred sympatrically, and often in close proximity, on South Georgia, Marion, Crozet and Macquarie Islands (Figure 1) without regular interbreeding. A few cases of inter-specific breeding involving male *M. giganteus* paired to female *M. halli* have been reported from Marion (Burger 1978; Cooper *et al.* 2001) and Macquarie Islands (Johnstone 1978), although the resulting eggs did not hatch. Only at South Georgia has occasional hybridisation been reported (Hunter 1982, 1987). Given these circumstances, we can reasonably assume that gene flow between the two species is extremely limited. In birds, many closely related species are known to hybridise regularly, e.g. *Anas* dabbling ducks (Carboneras 1992), and Common *Phylloscopus collybita* and Iberian *P. ibericus* Chiffchaffs (Salomon *et al.* 2003), without merging into one single species. Even if 'their apparent failure to interbreed is not quite as straightforward as if they bred at the same time without interbreeding' (Penhallurick & Wink 2004), *M. giganteus* and *M. halli* do not genetically mix.

Several authors have dealt with giant petrel identification, especially of birds at sea (Johnstone 1971, 1974; Conroy *et al.* 1975; Voisin 1982a; Hunter 1983; Voisin & Teixeira 1998; Jiguet 2000; Shirihai & Jarrett 2002). Here we review, and offer new guidelines on, giant petrel identification at sea, on land, and as dead specimens.

Separating giant petrels from other Procellariiformes

At sea, and in poor light conditions, inexperienced observers may confuse giant petrels with *Diomedea* albatrosses, *Thalassarche* mollymawks or *Phoebastria* sooty albatrosses. When flying, giant petrels adopt a typically hump-backed posture which, when viewed from the side, allows easy separation from albatrosses and mollymawks. Also, the massive, pale bill of giant petrels is quite different to the slender one of mollymawks and sooty albatrosses (Figure 2), and contributes to give them a clumsy appearance. Due to a larger wing-loading (Pennycuik 1982; Obst & Nagy 1992), the flight of giant petrels is more laboured (usually 4–5 flaps followed by a stiff-winged glide) than that of mollymawks and sooty albatrosses, which are of similar size but are decidedly more graceful. *Macronectes halli* and dark form *M. giganteus* can also be distinguished from juvenile Wandering Albatrosses (*sensu lato*) by their dark, not white, underwing and from sooty albatrosses by their short and round, not long and pointed, tail (Figure 2). The white form of *M. giganteus* (see Plumage characters) is distinguished from *Diomedea* albatrosses and mollymawks by its white, not dark remiges, and most often by its diagnostic random dark brown flecking.

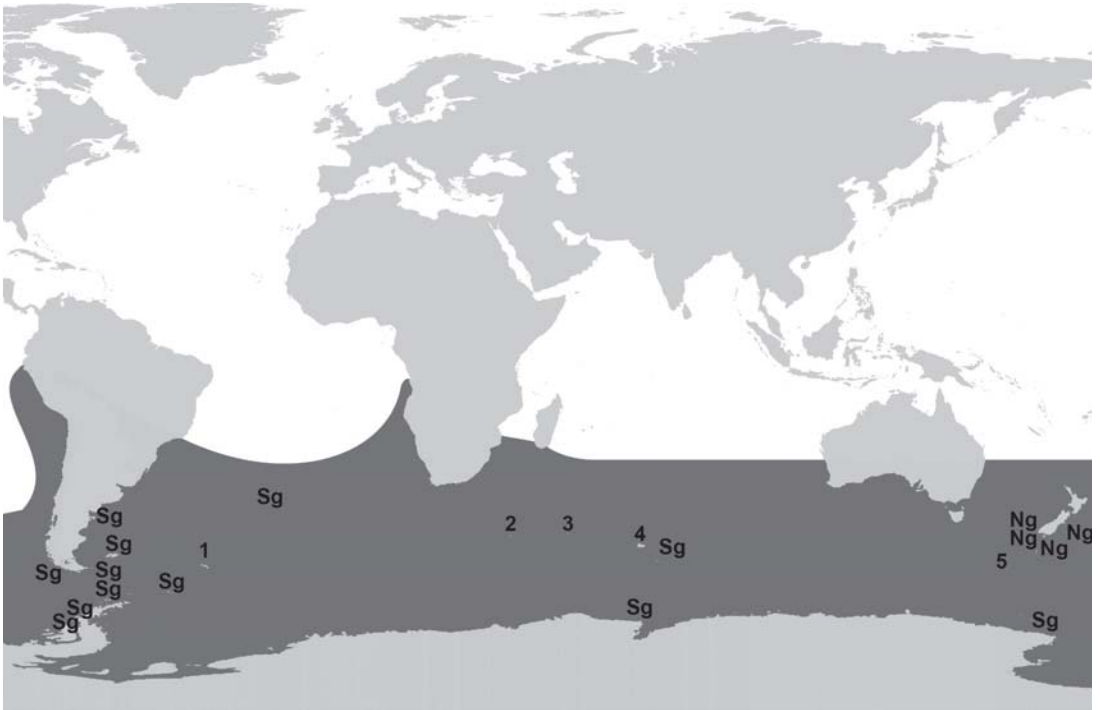


Figure 1. At-sea and breeding distribution of Northern *Macronectes halli* (Ng) and Southern Giant Petrels *M. giganteus* (Sg), and locations where the two species are known to breed sympatrically. (1) South Georgia, (2) Marion Island, (3) Crozet Islands, (4) Kerguelen Island, and (5) Macquarie Island.

On land, separating giant petrels from albatrosses and mollymawks is straightforward for adults, because of their characteristic bill shape, smaller and flattened, not rounded, heads and plumage coloration. Although the bill shape of giant petrel chicks is somewhat different from that of adults, it is distinctive enough to allow separation from mollymawk chicks. Giant petrels nest in a variety of situations, from tight to loose colonies and even in solitary nests. Like all Procellariiformes, giant petrels are rather smelly birds, but their odour is stronger and less 'sweet' than that of albatrosses and mollymawks, and persists for a very long time on old nest material, feathers, and museum specimens, and once experienced is easy to recognise.

Separating *M. halli* and *M. giganteus*

Bill coloration: The best criterion for identifying giant petrels is bill coloration. In breeding *M. halli*, the basic colour of the bill is pinkish-horn to reddish-brown, turning brick-red on the maxillary and mandibulatory ungues, or nails, and sometimes also on the latericorns

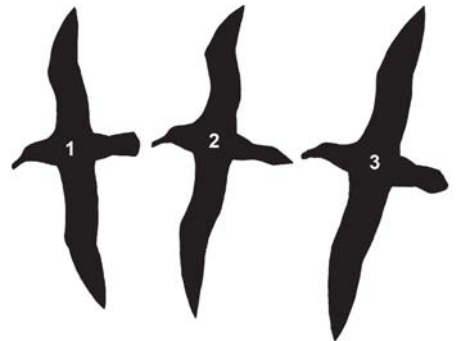


Figure 2. Silhouettes, drawn to about the same scale, of (1) a *Thalassarche mollymawk*, (2) a *Phoebastria sooty* albatross, and (3) a giant petrel *Macronectes*. The birds are similar in size, but giant petrels have massive bills compared to the slender ones of mollymawks and sooty albatrosses. Giant petrels also have a shorter, round tail, which is longer and more pointed in sooty albatrosses.



Figure 3. Northern *Macronectes halli* (plumage type H5; left) and Southern Giant Petrels *M. giganteus* (plumage type G7; right), Abattoir Outlet, Falkland Islands, 2006 © Steve Copsey.



Figure 4. White form Southern Giant Petrel *M. giganteus*, South Georgia, 1998 © Ronald Saldino.

(horny plates running along the maxilla or upper-mandible; Figure 3). A few bluish-black markings can also be found on both nails. The number of birds displaying such markings varies between populations, being frequent in some and rare in others. When seen from a distance and in good light conditions, the bill of *M. halli* may look 'bi-coloured', with an obvious darker tip.

In young *M. halli* chicks, the bill is light brown with a more or less pronounced reddish hue on the nails, and becomes coloured like that of an adult when the mesoptile down (the second set of down) is acquired. The reddish tinge on the bill of fledglings may fade somewhat and some immature birds have entirely yellowish-brown bills, with just a slight red colour on the nails. A few birds in adult plumage encountered at sea may also have uniformly coloured bills, and may be birds taking a 'sabbatical leave' from breeding (Voisin 1988).

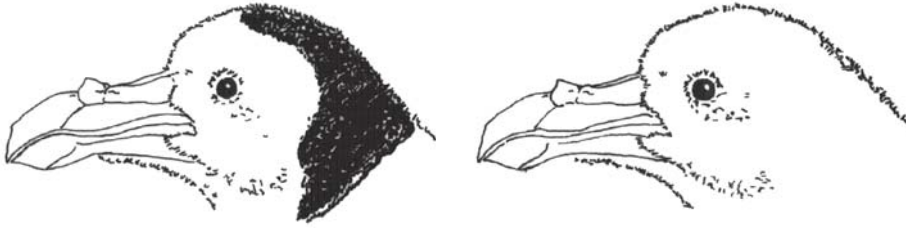


Figure 5. Heads of newly hatched Northern *Macronectes halli* (left) and Southern Giant Petrels *M. giganteus* (right) chicks (redrawn from Voisin 1968).

In *M. giganteus*, the bill is yellowish with green nails, the tinge of which can vary from bluish to apple-green (Figure 3). In birds indulging in sexual displays, this green often extends to the latericorns, and mainly so on their lower part. This is especially so in *M. g. solanderi*, and birds breeding at Gough Island in particular may develop entirely green bills (Voisin & Bester 1981). When seen from a distance, the bill of *M. giganteus* may also appear 'bi-coloured', but the pale green nails contrast only slightly with the remaining yellowish bill.

In young *M. giganteus* chicks, the bill is pinkish-cream with a bluish-green tip, and evolves to a pattern similar to that of adults, but usually somewhat paler. Even though bill colours fade rather in juvenile and immature giant petrels, they remain sufficiently characteristic for specific identification when seen in good light.

Plumage characters: The plumage of *M. giganteus* is dimorphic, with a grey-brown, pale-headed dark form and a white form. According to Shaughnessy (1970), this dimorphism is controlled by two autosomal alleles with white dominant to dark. White form birds (up to 15% in some populations; Shaughnessy 1971) are entirely white from hatching to adulthood, except for a variable amount of dark brown feathers irregularly scattered throughout the body (Figure 4). Bill colour of the white form is identical to that of the dark form. Dark form birds have dark grey legs and feet, while white form ones have legs that vary from bluish-grey to pink-grey. Totally white-



Figure 6. Southern Giant Petrels *Macronectes giganteus*: plumage type G2 (left) and G4 (right), Abattoir Outlet, Falkland Islands, 2006 © Steve Copsey.

plumaged birds (leucistic; Conroy *et al.* 1975), lacking the dark brown mottling of the white form, with a uniform horn-coloured tip to a pinkish beak, and pink legs and feet, are regarded to be homozygous white (Shaughnessy & Conroy 1977). Identification of white form *M. giganteus* is straightforward at all ages, as *M. halli* has no white form.

Chicks: Newly hatched dark form *M. giganteus* chicks are covered with pearl-grey down, sometimes with a slightly darker head. At Gough Island, however, some South Atlantic Giant Petrel chicks appear similar to *M. halli* chicks (Voisin & Bester 1981). At some locations, such as the Crozet and Kerguelen Islands, almost all newly hatched *M. halli* are whitish below and ash-grey on the back, darkest on the crown and nape, where it forms a cap contrasting with a paler forehead, face and sides of head (Voisin 1968; Figure 5). At other sites they are simply darker grey than *M. giganteus* chicks. Chicks of both species in mesoptile down are of the same ash-grey colour.

Juveniles and immatures: Fledgling Northern and dark form Southern Giant Petrels have the same uniform dull glossy blackish-brown to black plumage. According to locality, some individuals may also display a number of white feathers on their forehead and cheeks, as is frequently the case with *M. halli* chicks from the Crozet and Kerguelen Islands.

After one year, these black juveniles moult into uniformly dull brown immatures (Figure 6). These birds remain mostly at sea for up to ten years or more, rarely coming to colonies (Conroy 1972; Hunter 1984; Voisin 1988), and their plumage changes are poorly understood. After each moult, their plumage acquires a more brownish tinge, and the area around the base of the bill becomes mottled and paler (Figure 6). Plumage differences between immature Northern and Southern Giant Petrels, if any, are very slight and of no help in specific identification.

Adults: The plumage of adults, like that of immatures, becomes paler at each moult, but these changes do not progress in the same way in nominate *M. g. giganteus*, in *M. g. solanderi* and *M. halli*.

Identification of white form and 'totally white' Southern Giant Petrels is straightforward. In the dark form of the nominate subspecies, a very few birds breed while still in dark plumage, having the area around the base of the bill paler, mottled yellowish and brown. The plumage then becomes more greyish-brown and the mottling around the base of the bill extends progressively, encompassing the face, sides of the head and throat. The head and neck then gradually become entirely whitish-grey, with a few feathers on the middle of the crown and along the dorsal side of the neck remaining darker brown. Old birds have almost entirely white heads and necks. Even in these, the chest, belly, and undertail are as dark as the upperparts, giving them a characteristic dark-bodied and white-necked appearance. In a few cases, the underparts may be slightly paler than the upperparts, but never whitish. The transition between the whitish colour of the head and neck and the dark colour of the rest of the body is narrow, and from a distance appears as a clear-cut demarcation line. Voisin (1982b) distinguished eight plumage stages in Southern Giant Petrels (Table 1, Figure 7). Many old birds have a pale leading edge to the wing, but this is not a diagnostic feature, as some old *M. halli* at South Georgia also show this character (Hunter 1983; Voisin & Teixeira 1998).

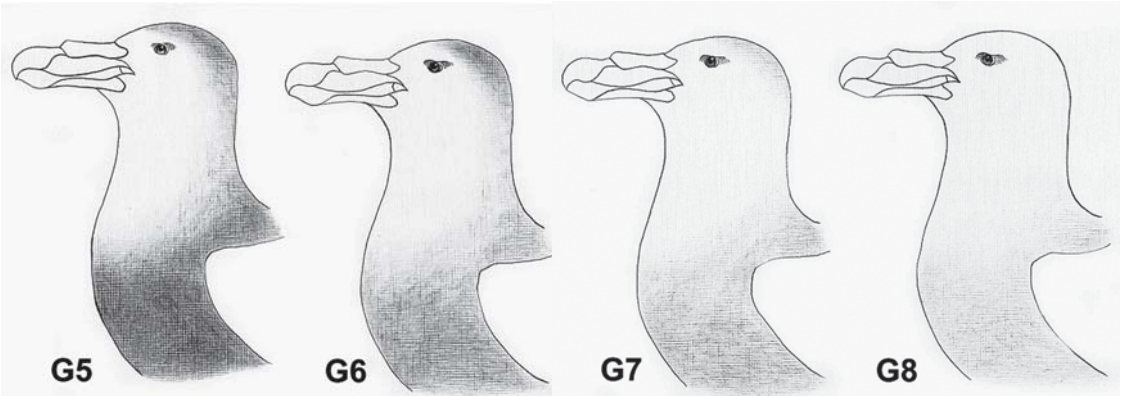


Figure 7. Sketches of 'old' adult Southern Giant Petrels *Macronectes giganteus*, plumages types G5–G8 (based on Voisin 1982b). See Table 1 for descriptions and comments.

Table 1. Plumage types of dark form Southern Giant Petrels *Macaronectes giganteus* (modified from Voisin 1982b). White form birds are white throughout their lives.

Type	Description	Comments
G1	Entirely black birds.	Juveniles (1st calendar year).
G2	Entirely brown birds, the area around the base of the bill not distinctly paler.	Nominate <i>giganteus</i> : immatures; <i>M. g. solanderi</i> : some breeders.
G3	Entirely brown birds, the area around the base of the bill light yellowish-brown.	Nominate: older immatures and a few breeders; <i>M. g. solanderi</i> : breeders.
G4	Brown birds with a pale face and a pale area around the base of the bill.	Both subspecies: breeders.
G5	Brown birds with face, lower forehead and throat all pale; underparts as dark, or almost as dark as upperparts (Figure 7).	Nominate: breeders; <i>M. g. solanderi</i> : breeders (most).
G6	Birds with a pale face, sides of the head, throat and upper foreneck; underparts as G5 (Figure 7).	Nominate: breeders (most); <i>M. g. solanderi</i> : breeders.
G7	Birds with a pale head and neck, still having a brown cap on the head and some dark feathering along the dorsal side of the neck; underparts as G6 (Figure 7).	Both subspecies: breeders.
G8	Birds with entirely whitish heads and necks, with sometimes a few dark feathers on the nape; underparts as G7 (Figure 7).	Both subspecies: breeders.

Notes: Birds belonging to types G7 and G8 show a fairly clear-cut demarcation line between the whitish colour of their heads and necks and the dark colour of the rest of their bodies (Figure 7). An exception to this is *M. g. solanderi* at Gough Island, which shows a more diffuse transition between both colours. Exceptionally, dark form *M. giganteus* may have their underparts slightly paler than their upperparts, but never light grey or whitish. It is not known whether this difference is permanent or just transitory.

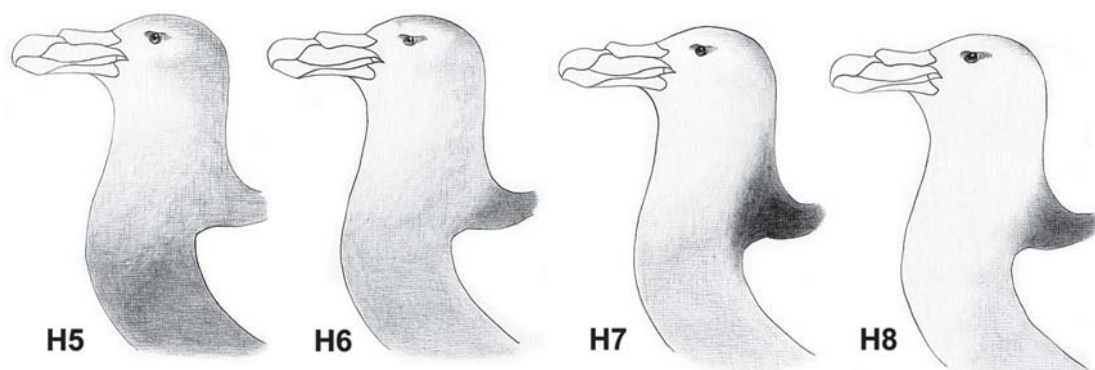


Figure 8. Sketches of 'old' adult Northern Giant Petrels *Macronectes halli*, plumages types H5–H8. See Table 2 for descriptions and comments.

Table 2. Plumage types of Northern Giant Petrels *Macronectes halli*.

Type	Description	Comments
H1	Entirely black birds.	Juveniles (1st calendar year).
H2	Entirely brown birds, the area around the base of the bill not distinctly paler.	Immatures.
H3	Entirely brown birds, the area around the base of the bill light yellowish-brown.	Immatures.
H4	Brown birds with a pale face and a pale area around the base of the bill and on the upperthroat.	May breed. The pale area on upper throat on average a little larger than in <i>M. giganteus</i> .
H5	Brown birds with face, lower forehead and throat all pale (Figure 8).	Breeders.
H6	Birds with a pale face, sides of the head to ear coverts, foreneck paler than hindneck, underparts a little paler than upperparts (Figure 8).	Breeders.
H7	Pale areas on the head larger, nape dark, foreneck much paler than hindneck, underparts much paler than upperparts (Figure 8).	Breeders.
H8	Like H7, but dark areas on the nape and hindneck reduced; chest and belly whitish (Figure 8).	Breeders.

Notes: Types H1–H4 are virtually indistinguishable from types G1–G4 of *M. giganteus*. Type H5 can only be reliably determined in the field when seen in good conditions (see Figures 7 & 8).

The South Atlantic Giant Petrel differs from the nominate subspecies in having a generally darker plumage, with a more intense grey tone. It also acquires a paler head and neck, but more slowly and at an older age. In the Falkland Islands and Argentinean populations, the border between the pale head and neck and darker body is as clear-cut as in nominate *giganteus*, whereas it is more diffuse in the population breeding at Gough Island (Voisin & Bester 1981).

In Northern Giant Petrels, the plumage of young breeders is quite similar to that of young breeding *M. giganteus*, and the two species cannot be separated on that character alone. As birds get older, the face, sides of the head and foreneck become

Table 3. Measurements (mm) and body mass (kg) of male and female Southern Giant Petrels *Macronectes giganteus* from several breeding places. Data are: mean, (\pm standard deviation; range; sample size). (1) Falkland Islands (Voisin 1982b); (2) Chubut, Argentina (Copello *et al.* 2006); (3) Gough Island; (4) Crozet Islands; (5) Antarctic Peninsula (Voisin & Bester 1981); (6) South Orkney Islands (Conroy 1972); (7) Frazier Island, Antarctica; and (8) Macquarie Island (G. W. Johnstone pers. comm.).

		Males		Females	
Wing	(1)	510.8	(9.58; 500–525; 5)	485.5	(9.06; 470–500; 10)
	(2)	517	(12; 507–530; 3)	491	(0.9; 478–508; 8)
	(3)	507.5	(485–535; 4)	484.5	(478, 491; 2)
	(4)	533.2	(14.1; 492–555; 15)	494.9	(23.85; 460–522; 7)
	(5)	510	(25.17; 465–552; 8)	499.8	(13.44; 477–515; 8)
	(6)	553.5	(10.86; 534–571; 13)	518.9	(15.21; 498–541; 13)
	(7)	542	(8.54; 530–550; 7)	512	(7.18; 500–518; 5)
	(8)	552	(10.66; 534–577; 20)	526.8	(8.52; 513–540; 21)
Culmen	(1)	97.9	(3.21; 94.5–102; 5)	84.4	(2.55; 80–89; 10)
	(2)	95.5	(2.6; 91.7–101.2; 18)	82.9	(2.1; 80.12–87.3; 22)
	(3)	95.2	(2.3; 91.5–98.5; 17)	83.3	(2.9; 79.5–88; 12)
	(4)	104.7	(3.97; 97–111; 16)	89.1	(3.28; 84–94; 8)
	(5)	98.5	(2.02; 96–102; 9)	89.1	(3.97; 85.5–95 ; 8)
	(6)	101.4	(2.45; 97.4–108.2; 66)	87.4	(3; 82–97; 73)
	(7)	98.9	(2.29; 96–103.1; 7)	88	(2.09; 85.8–90.4; 5)
	(8)	101.9	(2.15; 95.8–105; 20)	89.7	(2.41; 84.6–93.5; 21)
Tarsus	(1)	93	(1.46; 91.5–95; 5)	84	(2.2; 79.5–86; 10)
	(2)	92.2	(2.1; 87.7–96.9; 15)	84.8	(3.6; 80.5–99.1; 22)
	(3)	95.3	(2.02; 92–99; 17)	88.3	(3.11; 85–95; 12)
	(4)	102	(2.64; 97–107; 14)	95.1	(6.83; 88–111; 8)
	(5)	94.7	(5.12; 85–101; 9)	89	(3.29; 84–93; 6)
	(6)	96.3	(1.69; 94–99; 13)	87.1	(5.45; 82–95; 13)
	(7)	99.3	(2.34; 95.8–102; 7)	90.4	(2.19; 87.8–93.8; 5)
	(8)	102.7	(1.71; 99.5–105.3; 20)	94.2	(1.88; 90.1–98; 21)
Body mass	(2)	3.5	(0.3; 15)	2.5	(0.2; 21)
	(3)	3.77	(0.36; 2.3–4.55; 11)	3.17	(0.11; 2.7–3.9; 11)
	(4)	4.93	(0.34 ; 4.2–5.5; 15)	3.95	(0.17; 4.7–3.3; 8)
	(6)	4.94	(0.41; 4.1–5.8; 37)	3.85	(0.37; 3–4.8; 37)
	(8)	5.14	(0.42; 4.3–5.6; 20)	4.2	(0.44; 3.3–5.2; 21)

Table 4. Measurements (mm) and body mass (kg) of male and female Northern Giant Petrels *Macronectes halli* from several breeding places. Data are: mean, (\pm SD; range; sample size). (1) South Georgia (González-Solís *et al.* 2000b, González-Solís 2004); (2) Crozet Islands (J-FV, unpubl. data); (3) Macquarie Island (G. W. Johnstone, pers. comm.); (4) Chatham Islands (G. W. Johnstone & C. J. Robertson, pers. comm.).

		Males		Females	
Wing	(1)	526	(507–550; 71)	500.6	(479–518; 77)
	(2)	519.7	(2.86; 503–535; 14)	474	(8.76; 435–502; 8)
	(3)	532.7	(2.4; 509–545; 17)	497.2	(1.8; 483–513; 22)
	(4)	525.9	(1.67; 506–538; 20)	496	(2.11; 475–515; 21)
Culmen	(1)	103.7	(98.4–109.4; 71)	89.3	(84.3–94.4; 77)
	(2)	103.3	(0.82; 96–110; 17)	88.3	(1.06; 84–92; 8)
	(3)	103.9	(0.8; 95.1–109.7; 18)	89.8	(0.37; 86.3–92.4; 23)
	(4)	97.8	(0.63; 93.9–104.7; 20)	85.4	(0.42; 81.8–89.5; 21)
Tarsus	(1)	100.8	(95.5–106.9; 71)	90.7	(86.7–94.7; 77)
	(2)	105.7	(2.24; 91–123; 13)	90.8	(1.45; 84–95.5; 8)
	(3)	102.27	(0.71; 94.5–107.1; 18)	92	(0.39; 88.1–95.6; 23)
	(4)	94.4	(0.51; 89.1–98.5; 20)	83.4	(0.49; 80.8–89; 21)
Mass	(1)	4.6	(0.2; 33)	3.7	(0.2; 35)
	(2)	4.47	(0.42; 3.6–5.35; 14)	4.31	(0.62; 3.3–5.35; 7)
	(3)	4.49	(0.37; 3.85–5.4; 16)	3.38	(0.24; 3–3.85; 22)
	(4)	3.66	(0.32; 3.15–4.45; 19)	2.83	(0.17; 2.5–3.25; 21)

more mottled and then gradually whiter, while the crown, nape and back of the neck remain mottled brown (Table 2, Figure 8). With age, the pale grey or whitish colour of the foreneck then extends progressively down the whole chest, belly and undertail coverts. At the same time, the upperparts become greyish-brown (but never as pale as in old *M. giganteus*). In this way, old birds acquire a dark-above, pale-below appearance, quite different from that of *M. giganteus*.

In both species, it is possible that the plumage of males pales more rapidly with age than that of females. This has never been examined systematically, but one published photograph (Anonymous 2002) shows a female *M. halli* ringed as an adult in South Georgia in 1963 and recovered in the Falkland Islands in 2002, and therefore over 40 years old, but still in stage H6 plumage.

Sexual differences: No differences in plumage have yet been demonstrated between male and female giant petrels, except for the possibility (above) that male Northern Giant Petrels become paler sooner with age than females. On the other hand, there is a marked sexual dimorphism in size in both species, males being much larger and about 20% heavier than females (Hunter 1983; González-Solís *et al.* 2000b; González-Solís 2004; J-FV; Tables 3 & 4), and size differences may help distinguish the sexes of a pair at the nest or displaying. However, one should be extremely cautious in using body mass to sex birds, as it may change considerably during the year, with average variations of over 20% having been recorded for each sex in both species on the Crozet Islands (J-FV).

Biometrics: Both giant petrel species are of similar size and mass where they breed sympatrically. Large samples measured at South Georgia (Hunter 1984), and more limited data from Crozet and Macquarie Islands (Tables 3 & 4) both suggest that *M. giganteus* is, on average, larger than *M. halli* although there is much overlap and the characteristics cannot be used in most individuals to confirm the species. Northern and Southern Giant Petrels breeding at localities where the other species does not occur (the Argentinean coast, Falkland and Gough Islands, and Terre Adélie for *M. giganteus*; Chatham Islands for *M. halli*) are smaller in size, and sometimes significantly smaller than their counterparts from other sub-Antarctic islands (Voisin & Bester 1981; Voisin 1982b; Carlos *et al.* 2005; Tables 3 & 4). These differences may be slight but, for instance, a nominate *M. giganteus* and/or a *M. halli* seen amongst *M. g. solanderi* is easily detected, as it is clearly larger (Figure 9).

Voice: The vocalisations of the two species are very similar, and consist of croaking, hissing sounds uttered during quarrelling and displays, as well as a kind of neighing, often emitted when the birds fly low over the observer's head. The calls of *M. giganteus* are higher-pitched and uttered in a faster rhythm than those of *M. halli*, a difference best noticed when birds fly overhead (Voisin 1968, 1978; Shirihai & Jarrett 2002; C. Chappuis pers. comm.). At sea, both species are usually silent, except when quarrelling over food.

Nest location: Giant petrels exhibit a varying degree of coloniality, from lone nests and small groups to large loose or tight colonies. However, lone nests or small groups may have become isolated because reproduction failed at other nests around them. *M. giganteus* reputedly nests more colonially than *M. halli*, but the difference is mainly a matter of statistics, although tight colonies, recalling gull colonies, seem to be encountered regularly in the South Atlantic Giant Petrel (Voisin 1982b). *M. giganteus* generally breeds in more open situations than *M. halli*, but the overlap is large and of little use in field identification, except for the few nests that are more or less hidden in cavities, which are *M. halli* (Voisin 1976, 1986). However, the South Atlantic Giant Petrel at Gough Island may breed in very sheltered sites, with the nest sometimes hidden completely among tussock grass clusters and tree ferns (Johnstone *et al.* 1976; Shaughnessy & Fairall 1976; Voisin & Bester 1981).

Breeding periods: Where both species breed together, *M. halli* commences breeding about six weeks earlier than *M. giganteus* (Table 5). In South Georgia, where the climate is harsher, both species breed about six weeks later than at other sympatric locations (Hunter 1984, 1987). Similarly, *M. giganteus* lays from late October to early November in Terre Adélie (Mougin 1975). In contrast, South Atlantic Giant Petrels from Gough Island lay between late August and early September (Voisin & Bester 1981), whereas in the Falklands (Woods 1975) and Argentina (Humphrey & Livezey 1983; Quintana *et al.* 2005) they lay in late October.

Dead specimens: Museum specimens can be identified by plumage if they are of 'old' breeders. The distinctive coloration of giant petrels' bills fades rapidly after death if the birds are not kept in good conditions. This is especially so for birds that have been kept for a certain time in fluids, some of which (e.g. formalin) can be very

detrimental in this respect. Submergence in seawater and/or other fluids can result in an overall olive-green ground colour, very different from the reddish hue found in live *M. halli*, or the bluish-green in *M. giganteus*. This is often the case in museum specimens, and while enough of the original bill colours may remain to allow, or assist, specific identification in some specimens, others remain unidentified (Bourne & Warham 1966). Decomposition and exposure to sunlight can quickly alter bill colours in dead giant petrels, especially at low latitudes. In the case of freshly dead, stranded specimens, it is advisable to look at the side of the bill lying on the ground, which may have kept its coloration better (Figure 10). *Post-mortem* alteration is certainly the reason for some puzzling bill colour descriptions found on museum labels. Moreover, describing colours can be rather subjective, and such descriptions should be interpreted with caution.



Conclusion

Giant petrels have a reputation for being difficult to identify, but fortunately this is only partly true. If seen at close range (e.g. at sympatric breeding sites), even chicks and juveniles may be specifically identified using bill coloration alone, quite apart from plumage. With the exception of white form *M. giganteus*, bill colour, if seen under good light conditions, can still be the diagnostic

Figure 9. A Northern *Macronectes halli* (background, plumage type H8) and two South Atlantic Giant Petrels *M.g. solanderi* (plumage type G1), Abattoir Outlet, Falkland Islands, 2006 © Steve Copsey.



Figure 10. Freshly dead, stranded Northern *Macronectes halli* (left) and Southern Giant Petrels *M. giganteus* (right), State of Rio Grande do Sul in south Brazil, 2003 © Fernanda I. Colabuono. The side of the bill lying on the ground kept enough of the original colour to allow specific identification.

Table 5. Laying dates of Northern *Macronectes halli* and Southern *M. giganteus* Giant Petrels at locations where the two species breed sympatrically.

Species	Locality	Range of laying dates	Reference
<i>M. halli</i>	South Georgia	19 September–10 October	Hunter (1984, 1987)
	Marion Island	4 August–1 September	Burger (1978); Cooper <i>et al.</i> (2001)
	Crozet Islands	16 August–5 September	Voisin (1968)
	Macquarie Island	11 August–6 September	Johnstone (1978)
<i>M. giganteus</i>	South Georgia	30 October–24 November	Hunter (1984, 1987)
	Marion Island	12 September–25 October	Burger (1978); Cooper <i>et al.</i> (2001)
	Crozet Islands	26 September–17 October	Voisin (1968)
	Macquarie Island	27 September–19 October	Johnstone (1978)

criterion for birds observed far away in the field or at sea, but the observer has mostly to rely on plumage characteristics of 'old' adults (i.e. plumage types H6–H8 for *M. halli* and G6–G8 for *M. giganteus*; see Figures 7 & 8), which means that a number of birds may remain unidentified.

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