A new taxon of Collared Petrel *Pterodroma brevipes* from the Banks Islands, Vanuatu

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SUMMARY.—A new taxon of all-dark and small-sized Collared Petrel *Pterodroma brevipes* is described from northern Vanuatu. The description is based on six specimens held at the American Museum of Natural History collected in 1927 east of Mera Lava, in the Banks Islands. We recently discovered the new taxon to be rather abundant around the Banks Islands, apparently located its breeding grounds, and described its unique feeding behaviour. The new taxon differs from other populations of *P. brevipes*, which mostly breed elsewhere in Vanuatu and in Fiji, in its combination of smaller size, with shorter wings but relatively longer tail, and shorter bill and tarsus. More importantly, unlike any other populations of *P. brevipes* which all are polymorphic, present evidence suggests that the new taxon occurs solely in a monomorphic dark form. The new taxon is at least as distinctive as many other recognised races and even species of petrels. Subspecies rank is allocated tentatively; with future study, the new taxon might merit species status.

Mostly due to predation by alien mammals at the breeding sites or direct harvesting by Man, many petrel taxa are globally threatened (www.birdlife.org/datazone). Some were even thought to be extinct but have been recently rediscovered, e.g., Zino's Petrel *Pterodroma madeira* (Zino & Zino 1986), Magenta Petrel *P. magentae* (Crockett 1979, 1994), Vanuatu Petrel *P.* (*cervicalis*) *occulta* (Totterman 2009, Shirihai & Bretagnolle 2010), Mascarene Petrel *Pseudobulweria aterrima* (Jouanin 1970, Bretagnolle *et al*. 1998), Beck's Petrel *P. becki* (Shirihai 2008) and New Zealand Storm Petrel *Oceanites* (*Pealeornis*) *maoriana* (Saville *et al*. 2003). The increase in pelagic trips specifically designed to search for rare petrels never before seen at sea has also yielded the first documented at-sea records of Zino's Petrel *Pterodroma madeira* (Shirihai 2009) and Fiji Petrel *Pseudobulweria macgillivrayi* (Shirihai *et al*. 2009). In addition to rediscoveries, previously unrecognised petrel taxa may have been overlooked due to a combination of lack of knowledge and their remote ranges, one example being the still unresolved case involving the Black-capped Petrel *Pterodroma hasitata* complex of the Caribbean (Howell & Patterson 2008, Shirihai *et al*. 2010a).

We first became aware of the existence of a new form of Collared Petrel *Pterodroma brevipes* in northern Vanuatu in 1997, while studying specimens in the American Museum of Natural History, New York (AMNH), when VB found six dark-coloured specimens, collected at sea, by Rollo Beck during the Whitney South Sea Expedition in January 1927. These specimens were collected exactly at the same location (east of Mera Lava; Fig. 14) and at the same time as the *P. occulta* specimens that were suggested to represent a new species of petrel (Imber & Tennyson 1981). Then, during pelagic work in Melanesian waters post-2003, especially in January–March 2006 and 2007, HS photographed obviously different petrels on several occasions, including four extremely dark *brevipes* over the Torres Rise, *c*.150 km west of the Bank Islands (14°39'S, 165°16'E) on 16 February 2007. These observations led to new research into their identity: further visits were made to AMNH (in August 2008 and March 2010 by HS), and a special expedition was made to the Banks group in December 2009 (HS & VB) where we conducted observations on *P. brevipes*, and apparently discovered

Figure 1 (top). Five specimens of Collared Petrel *Pterodroma brevipes* collected in Fiji, in the interior of Viti Levu (University Museum of Zoology, Cambridge, UK), showing the basic colour variation in the species. Plumage types are adopted from Watling (1986), which were used to score specimens and live birds at sea. From right to left: 'pure white'—the two right-hand specimens (this category includes completely clean white-bellied birds as well as those with a few very indistinct dark feather tips); 'grey peppering'—the middle specimen, with variable dark mottling and dappling, giving the underparts a blotchy appearance, but with a predominantly white belly; 'smoky'—fourth from right, with variable grey wash, but ground colour still pale and contrasts with breast-band, and many birds appear faintly blotched below (much individual variation between this, the previous and next categories); 'dark grey'—the left-hand specimen, with rather medium / dark and uniform grey pigments, and the dark breast-band is not obvious but still detectable in most. No 'extreme dark grey' type was found in collections other than in *P. b. magnificens* (Fig. 2). The percentage of each colour type is given in Table 2 (Hadoram Shirihai, © Tubenoses Project)

Figure 2 (bottom). Five left-hand specimens from the Banks Islands, northern Vanuatu (all held in AMNH) of *Pterodroma brevipes magnificens*, with left to right, AMNH 216921 and 222193 (both 'extreme dark grey'), 216919 (holotype) and 215400 (both 'dark grey'), and 216920 (borderline 'dark grey' but placed under 'smoky' because some *P. b. magnificens* can appear slightly paler grey below). The 'extreme dark grey' type seems unique to *P. b. magnificens*, it being found in two of the five specimens illustrated here (i.e. 40%), or in *c.*42% of birds scored during pelagic observations in the Banks (Table 2). The right-hand, pale-bellied bird (AMNH 216923) was collected at the same locality and on the same date as the others but is not *P. b. magnificens* (see text) (Hadoram Shirihai, © Tubenoses Project)

the new form's breeding island. We compare our findings to *P. brevipes* observed at sea off Gau Island, Fiji (*cf*. Shirihai *et al*. 2009).

Murphy (1929), Bourne (1983) and Imber (1985) tackled the complexity posed by the subgenus (or superspecies) *Cookilaria*. All recent authors have chosen to treat *P. brevipes* and Gould's Petrel *P. leucoptera* as separate species (e.g., Watling 1986, Brooke 2004). Furthermore, Imber & Jenkins (1981) validated New Caledonian Petrel *P. l. caledonica* de Naurois, 1978, as a race of Gould's Petrel from New Caledonia, distinct from nominate *P. l. leucoptera* which breeds on Cabbage Tree Island, New South Wales, Australia. Since Murphy (1929) and Bourne (1983) no one has inferred that *P. brevipes* remains poorly known taxonomically, although Imber (1985) questioned whether more than one subspecies might be involved. Other than the pioneering work on *P. brevipes* by Watling (1986), no one has extensively examined the variation presented by this taxon. Despite that the holotype's provenance is doubtful (Murphy 1929), the type and co-type are indeed assignable to *P. brevipes* (pers. obs.). Our familiarity with all populations assigned to *P. brevipes* and *P. leucoptera* known to date, involving specimens in some of the world's major museums and live individuals in or around all of the breeding islands, has yielded the discovery of a new taxon of *P. brevipes*.

The morphometric differences found in six of the seven AMNH specimens (see below for AMNH 216923, which we consider separately) were augmented by study of plumage variation at sea, and by the apparently distinctive pelagic feeding behaviour. For our purposes here, we will focus mostly on standard morphological differences from all other populations of *P. brevipes*. Given that this work remains in progress (a thorough genetic analysis is currently ongoing), and the lack of any comparative acoustic studies, we conservatively assign the new taxon subspecies rank, under the following name:

Pterodroma brevipes magnificens subsp. nov.
Magnificent Petrel

Holotype.—See Fig. 2. American Museum of Natural History, New York (AMNH 216919). Male collected on 28 January 1927 by R. H. Beck at sea east of Mera Lava, Banks Islands, north Vanuatu. Precise locality unknown, but based on the original label, the AMNH catalogue, and the Whitney South Sea Expedition diary by Frederick P. Drowne, this is *c*.30 nautical miles east of Mera Lava (*cf*. Imber & Tennyson 2001). We are uncertain of the age of the holotype: all feather tracts are apparently of the same generation, suggesting a recently fledged bird, but many of the larger upperwing-coverts, tertials and scapulars are already worn and bleached browner, suggesting an adult. The bill is uniform black (without obvious horn-coloured markings characteristic of older individuals), which might also support the notion that it is juvenile, but in contrast the primary tips are round (not pointed) suggesting an adult. Finally, Beck labelled it as a male at 'nesting' stage, suggesting enlarged gonads, but Murphy who examined the specimens not long after they were skinned concluded that these were juveniles in slightly worn plumage (Murphy unpubl. MS at AMNH).

Measurements of the holotype.—Wing length 208.0 mm; tail length 97.0 mm; culmen (bill length from feathers) 23.0 mm; bill depth (at top of maxillary unguis to base of mandibular unguis) 8.0 mm; tarsus length 27.8 mm.

Paratypes.—See Fig. 2 and Table 1 (for mean values). AMNH 215400 (female), 216921 (male), 216920 (male) and 222193 (female), all collected by R. H. Beck at sea at the same locality as the holotype, on 28/29 January 1927. Measurements (by HS) as follows: AMNH 215400: wing 212.0 mm; tail 99.0 mm; culmen (to feathers) 21.5 mm; bill depth (top of

TABLE 1

Morphometrics of *Pterodroma brevipes magnificens*, other populations of Collared Petrel *P. brevipes* and Gould's Petrel *P. leucoptera*. Mean is given, followed by standard deviation and range. Details of measured specimens are presented in Appendix 1. A total of 120 specimens (all adults) were measured by VB. Specimens from the Banks Islands (n=6) were compared to other *P. brevipes*: we used both parametric (ANOVA) and non-parametric (Kruskal-Wallis) tests, because of reduced sample size. Significant tests appear in bold.

	N	Wing	Tail	Culmen	Bill depth	Bill width	Tarsus
P. brevipes magnificens (Banks Islands, Vanuatu)	6	210.3 ± 6.3 (206–222)	97.5 ± 4.6 (89–102)	22.9 ± 1.1 (21.5–24.6)	7.8 ± 0.5 (7.1–8.3)	9.8 ± 0.4 (9.5–10.4)	26.2 ± 1.2 (25.3–27.8)
AMNH 216923 (Banks Islands, Vanuatu)	1	224	107	24.0	7.4	9.95	27.5
P. brevipes (south Vanuatu)	16	216.9 ± 5.1 (208–224)	98.8 ± 4.3 (92–108)	24.3 ± 0.9 (22.6–25.7)	8.1 ± 0.5 (7.5–9.4)	10.5 ± 0.9 (9.4–12.4)	27.9 ± 1.6 (26.2–29.8)
P. brevipes (Fiji)	17	216.5 ± 5.0 (203–226)	96.9 ± 4.8 (86–103)	24.0 ± 1.0 (21.8–25.4)	7.8 ± 0.3 (7.4–8.5)	9.6 ± 0.7 (7.3–10.5)	27.4 ± 1.1 (25.2–29.4)
P. leucoptera caledonica (New Caledonia)	16	222.3 ± 6.5 211–234)	88.8 ± 6.1 (79–99)	25.6 ± 0.9 (23.1–26.8)	8.8 ± 0.4 (8.2–9.4)	10.4 ± 0.6 (9.4–11.9)	30.5 ± 1.3 (28.1–32.5)
P. l. leucoptera (Cabbage Tree Islands)	64	223.6 ± 4.7 (213–233)	96.3 ± 4.7 (85–112)	24.8 ± 0.8 (22.7–27.1)	9.2 ± 0.5 (8.4–10.8)	11.5 ± 0.6 (10.3–13.0)	30.2 ± 1.4 (27.7–34.2)
Comparison between *P. b. magnificens* and other *P. brevipes*							
ANOVA F (p)	39	**7.74 (0.008)**	0.03 (0.87)	**7.91 (0.008)**	1.17 (0.29)	0.44 (0.51)	**9.78 (0.003)**
Kruskal-Wallis X^2 (p)	39	**5.77 (0.02)**	0.003 (0.95)	**5.72 (0.02)**	0.72 (0.4)	0.64 (0.42)	**5.22 (0.02)**

maxillary unguis to base of mandibular unguis) 7.6 mm; tarsus 27.6 mm. AMNH 216921: wing 206.0 mm; tail 89.0 mm; culmen 23.0 mm; bill depth 7.1 mm; tarsus 25.25 mm. AMNH 216920: wing 212.0 mm; tail 101.0 mm; culmen 24.6 mm; bill depth 8.3 mm; tarsus 25.4 mm. AMNH 222193: wing 217.0 mm; tail 97.0 mm; culmen 22.0 mm; bill depth 8.1 mm; tarsus 25.8 mm. All sexual organs described as 'nesting' or 'enlarged'. Another specimen, AMNH 216922, could not be located during HS's visit in 2010: measurements were made by VB in 1997: wing 222.0 mm; tail 102.0 mm; culmen 23.4 mm; bill depth 7.4 mm; tarsus 25.3 mm.

***Description of the holotype*.—**(see Fig. 2). Lower half of forehead to feathers around bill, front three-quarters of lores, and lower ear-coverts, chin and throat (almost to upper breast) pure white[1], forming solid white face that contrasts markedly with the rest of overall very dark plumage. Forehead mottled extensively with dark brown[2] feather tips, while white area of lower ear-coverts also unclean (slightly dappled with small dark[3] spots). Border between white throat and dark grey breast rather clear but some very fine paler grey[4] feather tips punctuate lower throat / upper breast border, forming mottling effect. From upper forehead there is a short whitish[5] supercilium (spotted and poorly defined)

Colour code footnotes: colour of type (AMNH 216919) measured directly against RAL Classic K1 colour book (02RALK1) and photos of the type also white-balanced and measured digitally by ColorSchemer Studio 2 (=CSS) scale software:

[1] RAL 9010/Pure white = CSS f9fafc (in parts unclean, forming RAL 9001/Cream & 9002/Grey white, or CSS e2e5d4 & cac8bb, respectively).

[2] RAL 8019/Grey brown = CSS 47444b.

[3] RAL 7022/Umbra grey & 7021/Black grey = CSS 5f677c & 3d3b3c.

[4] RAL 7030/Stone grey & 7012/Basalt grey = CSS 9d9789 & 605c6a.

[5] RAL 9010/Pure white = CSS f9fafc (in parts spotted with RAL 7022/Umbra grey & 7021/Black grey = CSS 5f677c & 3d3b3c).

starting just above dark lores in front of eye. Upper ear-coverts and area around eye and upper forehead onto crown / nape blackish with sooty-brown[6] hue, slightly darker / blacker than rest of upperparts. Much of upperparts very dark, the larger/outer scapulars, tertials, back and rump, smaller upperwing-coverts and uppertail being predominately dusky brown[7], whilst mantle and smaller/inner scapulars and larger upperwing-coverts paler due to presence of extensive blue-grey[8] bases (with brownish[9] tips); latter form scaly pattern. Uppertail-coverts paler (mid) blue-grey[10], approaching tone of underparts, and contrasting with dark grey-brown[11] rectrices. Only folded wing can be described, but dorsal contrast suggests the new taxon has only a relatively moderately developed upperwing M pattern[12]. Underwing pattern impossible to describe from folded wing, but most of larger coverts and flight feathers predominantly dark grey[13], without any visible paler grey or whitish bases and inner webs to remiges. Lesser primary-coverts carpal area and secondary-coverts form a black[14] area contrasting with whitish[15] inner coverts, axillaries and median secondary-coverts. Much of breast and belly dark ashy slate-grey[16], becoming slightly more uniform, darker[17] and more solid on breast. Narrow pale feather tips on belly, rear flanks and, especially, around legs to undertail-coverts produce slightly paler grey[18] and less uniform (more flecked) appearance, but do not disturb overall dark and uniform-looking underparts. Original label states iris colour as 'brown' and bill 'blue', but bill and feet are now black[19], and tarsal skin brownish[20].

The case of AMNH 216923.—R. Beck collected seven specimens at the same location (in two days). While the seven birds should be, at first glance, considered a single sample, one specimen shows striking differences. Indeed Beck collected a single pale-bellied bird, AMNH 216923 (see Fig. 2). In addition to being the only pale bird, this specimen is also larger (wing 223/224 mm, tail 107 mm, exposed culmen 24 mm and tarsus 27.5 mm). Finally, unlike the other six specimens, this specimen had 'small', i.e. undeveloped sexual organs. We thus tentatively conclude that it was a non-breeding wanderer from another *P. brevipes* population, probably southern Vanuatu, where *P. brevipes* are larger overall compared to birds from the Banks (see below). During December 2009 no similarly plumaged *P. brevipes* were observed (see below), further suggesting that any other pale *Cookilaria* must be rare in these waters, at least at this season.

Diagnosis.—*P. b. magnificens* differs from all populations of *P. brevipes / leucoptera* according to morphometrics and most importantly, plumage (see Table 1 for biometric data for *P. b. magnificens* and all other populations, and Table 2 for coloration). In mean values, the bill (exposed culmen) and tarsus length of *P. b. magnificens* is consistently smaller than

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[6] RAL 7012/Basalt grey & 8022/Black brown = CSS 3e332f & 040e1a.
[7] RAL 8011/Nut brown, 8022/Black brown & 5004 Black/blue = CSS 1b1d12, 332f2c & 262217.
[8] RAL 7016 Anthracite grey = CSS 293138.
[9] RAL 8019 Grey brown = CSS 201F17.
[10] RAL 5007 Brilliant blue = CSS 4E545D.
[11] RAL 7021/Black grey (mostly outer webs) & 8022 Black brown (mostly inner webs) = CSS 110d02 & 21231e, respectively.
[12] RAL 8022/Black brown = CSS 060803.
[13] RAL 7026/Granite grey = CSS 71677f.
[14] RAL 9004/Signal black = CSS 0e0d09.
[15] RAL 9010/Pure white = CSS f9fafc.
[16] RAL 7012/Basalt grey = CSS 45453C.
[17] RAL 7021 Black grey = CSS 302c2d.
[18] RAL 7037 Dusty grey = CSS 635d5f.
[19] RAL 9011 Graphite black = CSS 040f0b.
[20] RAL 8028 Terra brown = CSS 3b2d22.

TABLE 2

Comparison of degree (by %, see Watling 1986) of ventral darkening between *P. b. magnificens* and other Collared Petrel *P. brevipes* populations: the scale is illustrated using specimens (Figs. 1) and birds photographed at sea (Figs. 4–11). Data are drawn from the following samples. **1**. *P. b. magnificens*: Banks Islands, northern Vanuatu (*n*=5), including the holotype, all held at AMNH (note 1: the 20% 'smoky' pattern involves the borderline case AMNH 216920, which could be described as 'dark grey' but some *P. b. magnificens* can appear a shade paler grey below). **2**. *P. b. magnificens*: live birds scored off the Banks Islands, northern Vanuatu, in December 2009 (Appendix 2) when 180 sightings of *P. b. magnificens* all involved birds that were dark ventrally, but only 57 could be properly evaluated for this analysis, as either 'dark grey' or 'extreme dark grey' (note 2: the 10.53% 'smoky' pattern involves six borderline birds, which could be categorised as 'dark grey' but are treated as 'smoky' because some *P. b. magnificens* can appear slightly paler grey below). **3**. *P. brevipes*: other populations from Fiji and Vanuatu, specimens from AMNH, the Natural History Museum, Tring, and the University Museum of Zoology, Cambridge, UK (*n*=26). **4**. *P. brevipes*: live birds captured and scored on Gau Island, Fiji (*n*=140) by Watling (1986) (note 3: Watling 1986 did not divide scored birds into 'dark grey' or 'extreme dark grey'). **5**. *P. brevipes*: live birds scored at sea off Gau Island, Fiji (*n*=98) during the Fiji Petrel *Pseudobulweria macgillivrayi* expedition (Shirihai *et al*. 2009; pers. obs) (note 4: the 2.04% 'extreme dark grey' involves two borderline cases with an underwing pattern almost as in the 'extreme dark grey' type but their underparts were still rather pale.

	Pure white	Grey peppering	Smoky	Dark grey	Extreme dark grey
1. ***P. b. magnificens***: type series, Banks Islands, northern Vanuatu (*n*=5)	0%	0%	20%[1]	40%	40%
2. ***P. b. magnificens***: birds at sea off Banks Islands, northern Vanuatu (*n*=57)	0%	0%	10.53%[2]	47.37%	42.11%
3. ***P. brevipes***: other populations from Fiji and Vanuatu. Museum specimens (*n*=26)	50.00%	23.08%	11.54%	15.38%	0%
4. ***P. brevipes***: live birds captured on Gau Island, Fiji (*n*=140)	37.00%	17.00%	29.00%	17.00% [c]	?[3]
5. ***P. brevipes***: live birds at sea off Gau Island, Fiji (*n*=98)	37.76%	21.43%	23.47%	15.31%	2.04%[4]

Fijian or other Vanuatu populations of *brevipes* by 4.6–5.8% and 4.4–6.1%, respectively. It is also consistently shorter winged (by 2.9–3.4%), but less so in tail (up to 1.3% shorter than some populations, but 0.4% longer than *P. brevipes* in Fiji and Vanuatu). Thus *P. b. magnificens* appears elongated posteriorly with a relatively longer tail but short rounded wings, which are especially appreciable in flight (Figs. 8–12). Its bill depth and width are similar to other populations of *P. brevipes* on Fiji and Vanuatu. As the only specimens available from Gau Island, Fiji, are preserved in liquid (Suva Museum, Fiji) we could not measure these birds, but measurements were presented in Watling (1986). *P. b. magnificens* also differs from birds on Gau in its 10.51% shorter culmen, 1.4% shorter wing and 6.21% shorter tail. Tarsus (mean 26.1 mm) as measured by Watling (1986) for birds from Gau is much shorter than any other population of *P. brevipes*. We assume that this reflects different measuring protocols and therefore do not compare our data with his for tarsus length.

Using the 120 specimens measured by VB in various museums (see Acknowledgements and Appendix 1) permitted further statistical analyses. Wing and culmen, and to a lesser extent, tarsus, differ significantly between the six birds from the Banks (treating AMNH 216923 apart) and all other *P. brevipes* (Table 1). Then we used a Principal Component Analysis (PCA), a multivariate analysis that permits using all of the biometric parameters simultaneously. The PCA revealed that the birds from the Banks are well separated from all

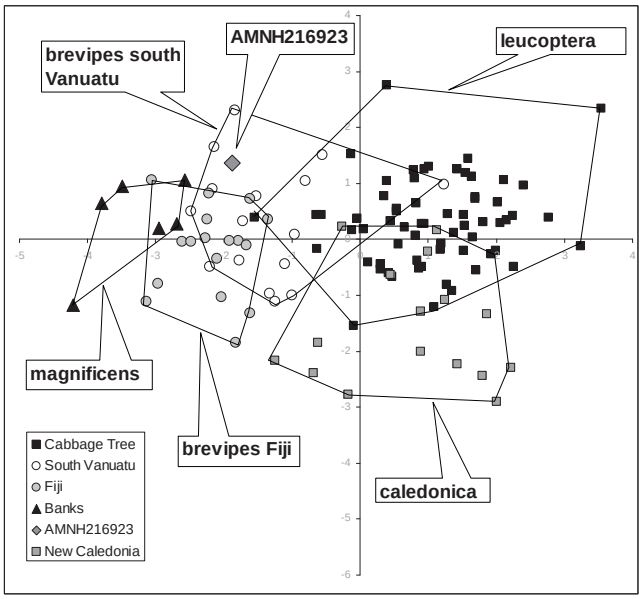
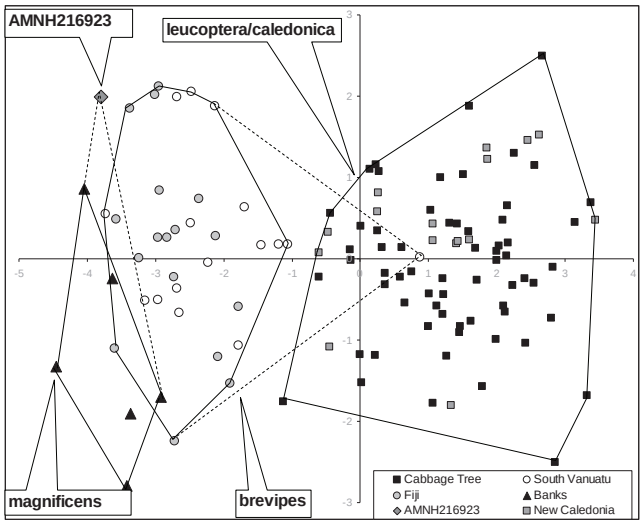


Figure 3. Results of multivariate analyses performed on 120 specimens belonging to the *P. leucoptera-brevipes* complex. Six biometric characters were used: wing, tail and tarsus lengths; and culmen, bill depth at hook and bill width at base. Solid lines represent the Minimum Convex Polygon (MCP) including all specimens from a given form. In both cases, first and second axes are presented. 3a) A Principal Component Analysis investigates whether the different forms split from each other. 3b) A canonical Discriminant Analysis is performed to separate *P. brevipes*, *P. leucoptera* and *P. b. magnificens*. MCP are also shown with (dots), or without (solid lines) outliers (see text).



P. brevipes (either from other islands of Vanuatu, or from Fiji; see Fig. 3a). The PCA also suggests that AMNH 216923 does not belong to *P. b. magnificens*. A bird from Tanna Island (AMNH 366704, a male collected on 2 April 1936) is a strong outlier. It was collected with three other birds on the same day and at the same colony; the others are typical *brevipes* from Vanuatu. AMNH 366704 differs mainly by its relatively longer tarsus and bill dimensions. Original measurements made by the collector (MacMillan) agree very well with our measurements (longer tail, larger bill). We also conducted a Discriminant Analysis, considering *P. leucoptera / caledonica* a single taxon, *P. brevipes* (Fiji and southern Vanuatu) as a single taxon, birds from the Banks a third taxon, and AMNH 216923 as a supplementary individual (i.e., the individual is not used in the discriminant function). The results (Fig. 3b) also indicate that birds from the Banks are at the extreme of the range shown by *P. brevipes*.

These statistics indicate in biometrics *P. b. magnificens* is at the extreme range of continuous variation within *brevipes*, and is at least distinctive as other close taxa. In particular, Imber & Jenkins (1981) supported separating *P. l. caledonica* from *P. l. leucoptera* given its only 2–3% larger mean bill, tarsus, tail and wing lengths. If biometrics might suggest clinal variation (with *P. b. magnificens* at the extreme), the most striking difference concerns coloration. Table 2 compares the morphs of *P. b. magnificens* and other populations of *P.*

brevipes. We follow Watling's (1986) categorisation of colour variation in *P. brevipes* (see Fig. 1; compare also Figs. 2, 4–12). *P. b. magnificens* immediately recalls dark-morph *P. brevipes* on Viti Levu, Kadavu and Gau (Fiji), or from southern Vanuatu. However, in plumage *P. b. magnificens* differs from the latter in being monomorphic and solely occurring in a dark form. During December 2009 (see Appendix 2), all of the 180 *P. b. magnificens* observed were dark. Furthermore, of the latter, the 57 birds observed at close range or photographed at sea were categorised ventrally as 'dark grey' (Figs. 8–9) or 'extreme dark grey' (Figs. 10–12). The latter two accounted for *c*.90% of *P. b. magnificens* off the Banks, while the other 10% were only slightly paler grey ventrally (Fig. 8). In contrast, in all other populations of *P. brevipes* dark birds represent at most 17%. Being solely dark, *P. b. magnificens* completely lacks pale plumage types, 'pure white' and 'grey peppering', which form 54–73% of *brevipes* in other populations. Type 'smoky', which could be considered 'midway' in the spectrum of variation is also absent in *P. b. magnificens*, with only single incidences of borderline cases between 'smoky' and 'dark grey' (Table 2). Furthermore, the dark coloration of *P. b. magnificens* is on average even darker than that in other *P. brevipes* populations, with the darkest birds ('extreme dark grey') comprising *c*.40% of individuals scored in the Banks. Such birds have very dark underparts, and lack or have very faint breast-bands, and the very dark underwing shows only small white areas on the innerwing-coverts and the larger median covert row, with the remaining coverts and remiges dark grey or black.

The nature and degree of differentiation of *P. b. magnificens* versus other *P. brevipes* populations is at the same or a higher level than that seen in several other closely related petrels. Examples include the scarcely differentiated three taxa that comprise the *P. feae* complex (Shirihai *et al*. 2010, Gangloff *et al*. in prep.), the limited plumage differences between Vanuatu and White-necked Petrels (Imber & Tennyson 2001, Shirihai & Bretagnolle 2010), between the two races of Gould's Petrel, *P. l. caledonica* vs. *P. l. leucoptera* (Imber & Jenkins 1981) and between Cook's *P. cookii* and Pycroft's Petrels *P. pycrofti* (Shirihai 2007). Given that one of the key reasons for splitting Collared from Gould's Petrel is the former's dimorphic coloration, that *P. b. magnificens* is monomorphic acquires even greater significance.

***Breeding locality and season*.—**In Appendix 2, we detail how *P. b. magnificens* was discovered to be presumably breeding on Vanua Lava Island. Although we did not observe any nests, we found clear evidence of breeding there. *1*. Petrels were seen coming close to land during the late afternoon / evening, when they seemed to 'mill' around at sea below the island, as if waiting for darkness to fly inland. *2*. In one case this involved a displaying pair close to the island. *3*. We obtained tape-recordings of display calls at the island's summit. These calls are typical calls of *P. leucoptera / brevipes*, and included flight (*titi*) as well as ground calls. Indeed, several birds were heard calling from the ground, both early at night and prior to morning departure.

The relatively large number of sightings, 180 in just eight days at sea, in the Banks suggests that *P. b. magnificens* is rather abundant locally. It could also breed on other islands in the Banks with similar habitat, especially Santa María Island (Gaua), where these petrels were also observed (see Appendix 2).

The breeding season in *P. b. magnificens* seems differentiated from other populations of *P. brevipes* for which data are available, although at this stage this is speculative. Based on the type series and our own observations (Appendix 2), *P. b. magnificens* breeds either in the austral summer or slightly earlier. Many that we saw in late December (if not most) were recent fledglings based on plumage condition (see, e.g., Figs. 9 and 11), although it seems odd that recent fledglings should remain close to their natal island. Birds collected in late January had enlarged gonads, which suggests either a rather extended breeding period or that the breeding season is actually summer. Totterman (2009), who visited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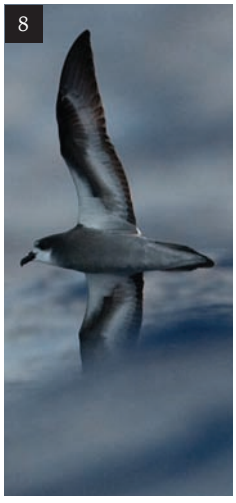
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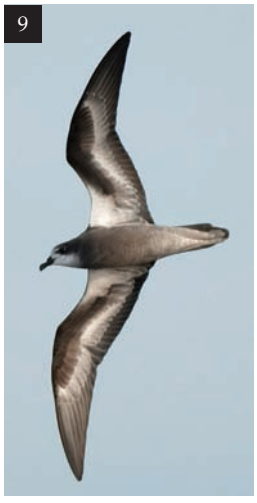
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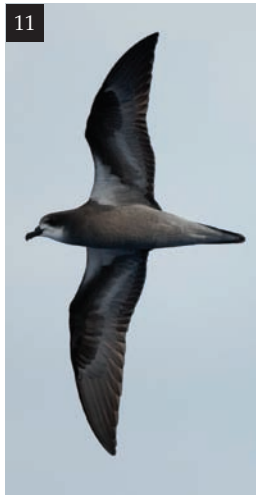
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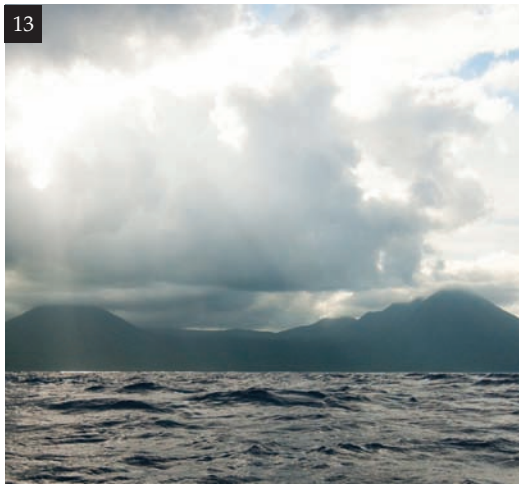
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the Vanuatu Petrel colony in March, apparently did not detect any *P. brevipes*, possibly indicating that they had not yet arrived at the colony. In contrast, most other populations of *P. brevipes* are autumn / winter breeders, sometimes from February / March or even later. For example, six chicks were collected in June on Kadavu, Fiji, and one in July on Tanna, southern Vanuatu (AMNH), while a fledgling was collected in September on Rarotonga, in the Cook Islands (National Museum, Wellington). The breeding season on Aneityum Island, southern Vanuatu, is apparently somewhat earlier: those collected by MacGillivray in February were apparently already well advanced in their breeding (MacGillivray 1860, Marchant & Higgins 1990, Brooke 2004). Watling (1986) mentioned that the only confirmed breeding in Fiji involves nests with chicks in May–June, with no evidence that the species breeds year-round.

The dispersal range and possible migration of *P. b. magnificens* remain to be elucidated, but we expect photographic evidence to become available concerning its occurrence away from the Banks.

***Marine ecology and behaviour*.—**During December 2009, we carefully observed the foraging behaviour of *P. b. magnificens*. Unless feeding, during daylight at sea the taxon generally occurs singly. However, the feeding behaviour of these small *Pterodroma* off the Banks seems unique among *Cookilaria* (and perhaps all gadfly petrels), as they form sparse aggregations, almost invariably in association with mixed feeding frenzies of

Legends to plates on facing page

Figures 4–7. Plumage variation in Collared Petrel *Pterodroma brevipes* off Gau, Fiji (upper four images, from left to right): 'pure white'—the palest and cleanest white example, note the well-developed white supercilium but narrowest dark underwing bar; 'grey peppering'—blotchy underparts due to (highly variable) dark mottling and dappling, but belly predominantly white (birds of the last two categories dominate in nominate *P. brevipes* but are absent in *P. b. magnificens*); 'smoky'—dusky grey wash with ground colour still paler than next category and usually appears faintly blotched below, but dark breast-band distinctive (frequent in all *P. brevipes* but lacking in *P. b. magnificens* other than three borderline cases); and 'dark grey'—the usual darkest example found in Fiji (even darker birds are extremely rare) (Hadoram Shirihai, © Tubenoses Project)

Figures 8–11. Plumage variation in *P. b. magnificens* off the Banks, northern Vanuatu (lower four images, from left to right). 'Dark grey'—left-hand two birds (Fig. 8–9), such dark examples are virtually identical to nominate, with rather mid / dark and uniform grey underparts, and dark breast-band strongly reduced, but most *P. b. magnificens* tend to have less white in underwing. 'Extreme dark grey'—right-hand two birds (Fig. 10–11), represents the darkest category (and matches the holotype of *P. b. magnificens*), but in these waters even darker birds are observed. In particular, note the very dark underparts with virtually no darker breast-band and very dark underwing with only small pure white areas on the innerwing-coverts and larger median coverts, while the dark underwing bar almost encompasses half the wing's width (the broadest in any gadfly petrel)—this type is found in *c.*42% of *P. b. magnificens* off the Banks, but birds partially approaching it number *c.*2% off Gau, Fiji. Collectively, 'dark grey' and 'extreme dark grey' birds comprise *c.*90% of *P. b. magnificens* off the Banks, the other 10% are still quite dark, whereas in all other populations of *P. brevipes* the dark morph represents at most 17% of birds (see text and Table 2). Note that the bird in Fig. 8 was the palest *P. b. magnificens* observed off the Banks, considered borderline between 'smoky' and 'dark grey' plumage types. Such birds and the 'dark grey' type compromised *c.*58% of *P. b. magnificens*, which are identical in plumage to the darkest examples of dark-morph *P. brevipes* in other populations (Hadoram Shirihai, © Tubenoses Project).

At sea, it is very difficult to evaluate the precise extent of grey and white/grey areas in the underwing-coverts, or the width of the diagonal bar. And, in photos their appearance varies with the angle and light, and several images will be needed to reliably evaluate these features. We do not recommend attempting to identify *P. b. magnificens* away from its presumed breeding area.

Figure 12. Magnificent Petrel *Pterodroma brevipes magnificens*, in typical low flight—note that when sunlit the dark blue-grey underparts appear warmer and rustier brown. This bird belongs to the 'extreme dark grey' type (found in *c.*42% of *P. b. magnificens* off the Banks). Note the extremely limited pure white on the underwing, with small white innerwing-coverts, while the dark underwing bar is very broad (Hadoram Shirihai, © Tubenoses Project)

Figure 13. Vanua Lava (the presumed breeding island of Magnificent Petrel *Pterodroma brevipes magnificens*) from the north, showing its two volcanic cones (Hadoram Shirihai, © Tubenoses Project)

terns, noddies, boobies and shearwaters. Most such large mixed seabird concentrations we encountered included up to ten *P. b. magnificens*. For example, on 19 December 2009 the largest concentration of *P. b. magnificens* (ten) was among a flock of *c.*150 Wedge-tailed *Puffinus pacificus* and 40 Audubon's Shearwaters *P. lherminieri*, with 50 Sooty Terns *Onychoprion fuscatus*, many tens of noddies and small groups of Red-footed Boobies *Sula sula*. The same day we estimated that at least every flock of *c.*100 mixed seabirds contained on average three *P. b. magnificens*.

P. b. magnificens locate themselves at the rear of such flocks. The first birds to find fish shoals are the Sooty Terns and, as they start to dive, the *P. lherminieri* dive below the surface, before the *P. pacificus*, noddies and boobies join in, forming an energetic feeding frenzy; *Fregata* also attack the *Sula*. Then, as the flock disperses (or follows the terns) *P. b. magnificens* clean up any remaining fish scraps and / or squid on the surface. Local fisherman explained that a seasonally present small Bonito (or perhaps Skipjack Tuna *Katsuwonus* sp.) which is a very aggressive predator of other fish and squid, leaves many scraps floating on the surface that the petrels take. *P. b. magnificens* approach the flocks most characteristically, in very low flight (often between the waves and almost storm petrel-like) most like Bulwer's Petrels *Bulweria bulwerii* when patrolling for food (i.e. similar technique, height, mode and approach, and overall shape). Their dark coloration adds significantly to the *Bulweria* impression. Several times we also observed *P. b. magnificens* join the same feeding frenzy as Vanuatu Petrels: unlike *P. b. magnificens*, Vanuatu Petrel is specialised in aerial chasing and catching flying fish and squid, which escape the Pacific Tuna. Unlike Vanuatu Petrel, *P. b.*

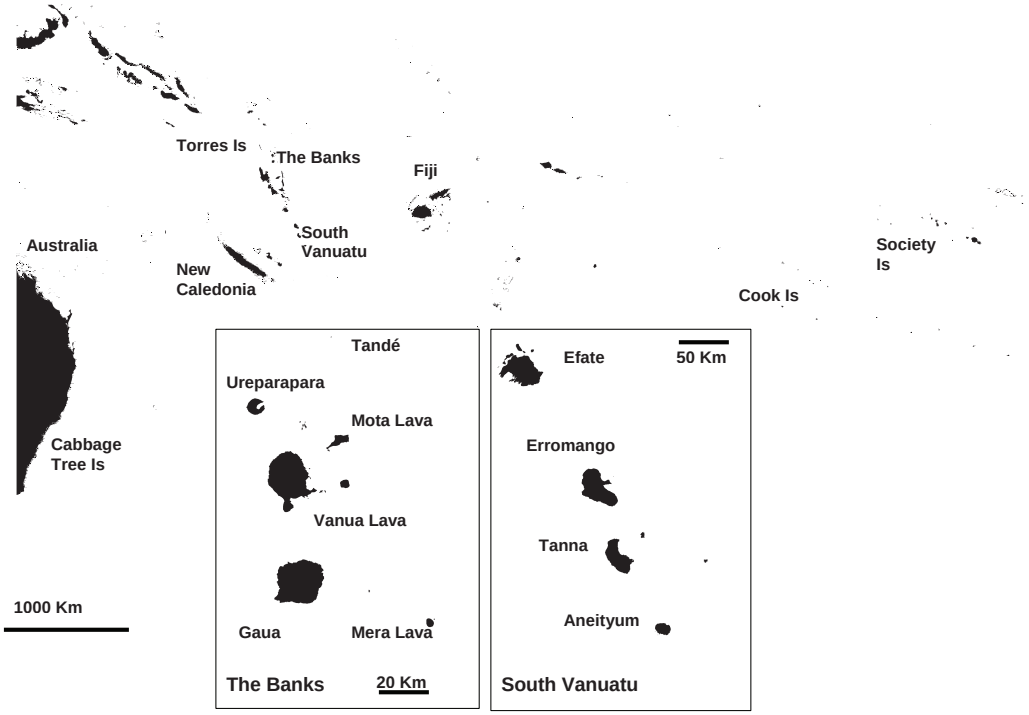

Figure 14. Map showing all localities cited in the text; at left, enlarged map of the Banks Islands, northern Vanuatu, where the pelagic survey in December 2009 was conducted (see Appendix 2). The type locality of *P. b. magnificens* is *c.*30 nautical miles east of Mera Lava, and the presumed breeding locality, the island of Vanua Lava is also shown.

magnificens is a scavenger that remains behind the flock, commencing to feed only as the flock starts to disperse or moves to the next location.

To our knowledge, these are the first observations of *Pterodroma* petrels forming constant feeding associations with inshore terns and boobies. Occasionally other gadfly petrels feed similarly, especially White-necked / Vanuatu and Juan Fernández Petrels *P. externa*, as well as several *Cookilaria* (De Filippi's *P. defilippiana*, Stejneger's *P. longirostris*, Gould's and Collared Petrels) and Black-winged Petrel *P. nigripennis* (pers. obs.), but such behaviour is never as habitually observed as in *P. b. magnificens* off the Banks. Interestingly, it is also the only gadfly petrel to our knowledge feeding so close to islands, which may be related to its very dark coloration (Bretagnolle 1993). However, it remains to be seen if such behaviour is seasonal, and to what degree it depends on factors such as oceanographic features.

Identification at sea.—*P. b. magnificens* mirrors several other subspecies and 'cryptic species' of petrels in lacking absolute diagnostic characters to separate it at sea from the dark morph of other *P. brevipes* populations. Especially away from the breeding islands, *P. b. magnificens* will not be separable with certainty: according to our observations *c*.60% of birds are identical to the darkest examples in other *P. brevipes* populations.

Nonetheless, *c*.40% of *P. b. magnificens* are even darker, and thus referred to the 'extreme dark grey' type, which has uniformly very dark underparts and much of the underwing, with a limited area of pure white on the innermost coverts and the larger row of median coverts, and a small white throat (see Figs. 9–10). In such birds the dark underwing bar almost covers half the width of the wing, i.e. the broadest of any gadfly petrel, even broader than Chatham Petrel *Pterodroma axillaris*. Unfortunately these differences are of limited use for field identification, because their correct appreciation at sea (and in photographs) is often hampered by the influence of light and angle of view, or it changes in relation to the way the wing is held. Much experience is also required to evaluate such differences correctly.

Furthermore, *P. b. magnificens* is, apparently, very distinctive in its feeding flight behaviour, but also to some extent at other times. It habitually flies very low, with short and low (steep) banks and arcs, long and very low glides, often with sudden sharp turns. Many times the birds adopt the flight mode and path of Bulwer's Petrel or prions (*Pachyptila*), a similarity heightened by their distinctive structure, with relatively short wings but a proportionately long pointed tail. Our impression is that it will prove possible to distinguish these birds on the basis of their distinctive flight behaviour and shape alone, given prolonged views and previous experience with *P. brevipes*. Furthermore, they are often notably slight-bodied and smaller with a shorter bill.

Away from their breeding islands, *P. b. magnificens* compared to dark-morph individuals of other *P. brevipes* populations cannot be reliably identified, but this should not prevent observers recording and photographing them. Only by such means might it eventually be possible to identify areas preferred by birds with extremely dark underparts and underwings, generally slighter / smaller size and the flight and feeding behaviours of *P. b. magnificens*.

We should emphasise that the plumage variation described here, based on our pelagic observations and photographs (from Fiji, Vanuatu and elsewhere in the tropical Pacific) of *P. b. magnificens* and other *P. brevipes* populations, is completely new, i.e. *contra* all previous handbooks and field guides (e.g. Harrison 1985, Carboneras *in* del Hoyo *et al*. 1992, Onley & Scofield 2007), which wrongly illustrate the underwing pattern and different morphs. This emphasises the need to combine field observations with a comprehensive review of museum material.

Taxonomic rank.—Available evidence suggests that *P. b. magnificens* should not be viewed within monotypic *brevipes*. It is diagnosable using the following combined features.

(i) Biometrically, *P. b. magnificens* is smaller (especially culmen, tarsus and wing) than other *P. brevipes* populations. (ii) Its plumage is unique within the *P. brevipes* complex in being monomorphic, and 40% darker than any dark morph of *P. brevipes*. (iii) It apparently breeds in the austral summer (but see above), unlike all other *P. brevipes* populations known to date.

Without comparative molecular analysis and playback experiments between *P. b. magnificens* and other *P. brevipes* populations, it is impossible to exclude either of Helbig *et al*.'s (2002) categories *4.1* (full species) or category *4.2* (allospecies). We conservatively rank *P. b. magnificens* as a subspecies of *P. brevipes* pending acoustic or molecular studies of the entire *P. brevipes / leucoptera* complex to be completed. Although the subspecies rank appears, to some extent, to be falling out of 'favour' in avian taxonomy, we favour such a conservative designation in this case.

We also emphasise that our recent molecular work on several petrel complexes (Gangloff *et al*. submitted, in prep.) have revealed considerable problems in using only cytochrome-*b* gene (cyt-*b*) markers, especially to establish species limits. Even using the Cytochrome Oxydase 1 gene (CO1) in addition to cyt-*b* divergence does not solve the problem of designating taxonomic ranks. In fact, we consider it highly advisable to combine molecular work with rigorous playback-response experiments, and analyses of morphology and behavioural ecology. Such integrative work is now in progress for the entire *leucoptera / brevipes* complex, which should help to resolve the taxonomic rank of *magnificens*. However, such work is likely to take several years and while in progress we consider it important recognise *magnificens*, at least subspecifically.

Conservation.—During our relatively short expedition in December 2009 we found *P. b. magnificens* to be not rare off the Banks. It is far more frequently encountered than Vanuatu Petrel, and is perhaps the second-most numerous petrel after *Puffinus pacificus*, being at least as common as Audubon's Shearwater *P.* (*lherminieri*) *gunax* (see Appendix 2). Nevertheless, Vanua Lava is the most populated island in the Banks and we suspect that feral pigs, cats *Felis catus* and introduced rats *Rattus* spp. could be significant threats to a small-sized petrel such as *P. b. magnificens*. On Mt. Suretamatai, we found no evidence of any alien mammals, but pigs occur only a few km from the volcano. No rats were trapped, though a single night trap was realised in December 2009.

Islanders suggested that local communities heavily exploited petrels and especially shearwaters on the Banks for many generations until the 19th century, but in recent years they have apparently only been infrequently harvested at most (Totterman 2009). Harvesting of Collared Petrels is especially well known from Fiji (Watling 1986) and apparently still occurs on Tanna (www.positiveearth.org/vanbirds/), but it remains to be seen if this practice still affects *P. b. magnificens* on the Banks.

Totterman (2009) found evidence at the summit of Mt. Suretamatai of predation on Vanuatu Petrels, perhaps by Peregrine Falcons *Falco peregrinus*, which species has been recorded hunting Gould's and Collared Petrels around or near colonies in Fiji and Australia, respectively (Watling 1986, Marchant & Higgins 1990). We found several Swamp Harriers *Circus approximans* on the slopes of the volcano, which species could also be a predator of petrels.

Vanua Lava volcano is still partially active, and a serious eruption would be devastating for its breeding petrels, as could be a major tropical cyclone in November–March, when both Vanuatu Petrel and *P. b. magnificens* are breeding.

According to BirdLife International, Collared Petrel is currently listed as Near Threatened because it is assumed to have a small and declining population, with very small

and isolated subpopulations (www.birdlife.org/datazone). The conservation status of *P. b. magnificens* is unevaluated.

Etymology.—The subspecies epithet expresses our constant impression when watching these all-dark *Cookilaria* at sea. The new taxon represents one of the most attractive, if not *the* most attractive of gadfly petrels.

Acknowledgements

Particular thanks to Mary LeCroy at AMNH, as well as to Peter Capainolo, Paul Sweet and Thomas J. Trombone for their highly supportive attitude to our study and help with collecting DNA samples from specimens. We also thank staff at the Natural History Museum, Tring, particularly Mark Adams and Robert Prŷs-Jones, and Mike Brooke at the University Museum of Zoology, Cambridge (UK), for their assistance. Specimens were also measured at the Wellington, Sydney, Melbourne and Paris museums: we sincerely thank their curators (Sandy Bartle, Walter Boles, Wayne Longmore and Eric Pasquet) for access to specimens in their care. James Dean provided photographs and measurements of the type and co-type of *P. brevipes* in NMNH, Washington. We thank our fellow workers in December 2009: Audrey Sternalski, Orian Shirihai, Jakob Wikstrom, Eyal Jacobson and Maya Dvori-Jacobson, as well as the many people on Vanua Lava, Mota Lava and Uréparapara for their logistical help and welcome during our visit to the Banks Islands. François Levionnois (New Caledonia) helped HS charter boats especially in 2006–07. Dick Watling collaborated with HS during the Fiji Petrel expeditions and provided essential information on Collared Petrels in Fiji. Bill Bourne and Mike Imber kindly sent copies of several publications and suggested many improvements to the submitted draft (although not all of their suggestions were followed), Sandy Bartle helped with various issues relating to taxonomy and specimens, and Guy Dutson shared his records of Collared Petrel from the Solomons. Finally, Guy Kirwan and Kees Roselaar helped with some references and practical suggestions.

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APPENDIX 1: Specimens examined.—In both biometric and plumage analyses we used only specimens confirmed to be adults (or definitely full grown), with more or less similar feather wear and with also of birds collected on or in the vicinity of the breeding islands.

P. b. magnificens BANKS ISLANDS, NORTHERN VANUATU: AMNH 215400 (paratype), 216919 (paratype), 216920 (paratype), 216921 (holotype), 216922 (holotype) and 222193 (paratype).
P. b. brevipes THE BANKS, NORTHERN VANUATU: AMNH 216923.
P. b. brevipes TANNA ISLAND, SOUTHERN VANUATU: AMNH 336697–707.
P. b. brevipes ERROMANGO ISLAND, SOUTHERN VANUATU: AMNH 336476.
P. b. brevipes ANEITYUM (ANATOM) ISLAND, SOUTHERN VANUATU: BMNH 88.5.18.126–128.
P. b. brevipes ÉFATÉ ISLAND, SOUTHERN VANUATU: AMNH 211696.
P. b. brevipes VITI LEVU ISLAND, FIJI: AMNH 528336, 528337; BMNH 1879.6.2.3., 1888.5.18.125; Cambridge museum 9-pro-11-0-1, 9-pro-11-0-2, 9-pro-11-0-3, 9-pro-11-0-4, 9-pro-11-0-8.
P. b. brevipes KADAVU ISLAND, FIJI: AMNH 250890, 250892, 250893, 250899.
P. b. brevipes FIJI: Australian Museum, Sydney: A.2691-2, O.735.
P. b. brevipes GAU ISLAND, FIJI: Suva Museum (SMF) (specimens preserved in liquid) F581, F596, F591, F579, F582, F593, F590, F564, F586, F587.
P. l. leucoptera CABBAGE TREE ISLAND, AUSTRALIA: AMNH 528259–262, 528264–276, 528278, 528280–285, 528289–291, 528306, 528309–314, 529279; National Museum, Wellington 1265, 11378, 19268; Melbourne 4817, 4839–50, 4855; Australian Museum, Sydney: 03.02.41, O.65628, O.35175-6, O.16503-5, O.16507, O.16275, O.30238–40, O.63491, O.67676, O.5419, O.30237, O.16762, O.16991
P. l. caledonica NEW CALEDONIA: AMNH 824271; MNHN 1977.71, 1978.1019, 1978.1021–1978.1028, 1999.3100–1999.3102; National Museum, Wellington 2309.

APPENDIX 2: Pelagic survey in the Banks Islands, December 2009.—We visited the Banks Islands, Torba province, on 13–28 December 2009. These observations represent the first dedicated pelagic seabird survey since the Whitney South Sea Expedition in January 1927. The expedition covered the islands described below, and in the ocean around them we studied *P. b. magnificens* (see also map 1):

Santa María (14°16′S, 167°29′E) is the largest of the Banks Islands (342 km^2), with very rugged terrain reaching to Mt. Garat (797 m), the peak of the active composite volcano in the centre of the island. The volcano has a 54 km^2 caldera, within which is the crater lake, Lake Letas, the largest lake in Vanuatu. The most recent eruption was in 2010, but much of the caldera rim is still cool and forested. There are few beaches on the island, but many extensive reefs with sheltered waters inside. The island has a rather small human population, whose location changes based on volcanic activity. We checked the ocean south and north-west of the island on 18–19 December. On 18 December we operated a transect between the island of Santo (15°32′S, 167°14′E) and Santa María. All *P. brevipes*-type petrels observed, 41 in total, were *P. b. magnificens*:

the first was at 15°18.925′S, 167°19.221′E (at 11.14 h), and the last at 14°49.312′S, 167°26.907′E (18.06 h), with max. 12 at one location. Most *P. b. magnificens* were associating with inshore feeding frenzies of terns and noddies, boobies and shearwaters, which yielded the following totals: Wedge-tailed Shearwater *Puffinus pacificus* 300, Audubon's Shearwaters *P.* (*lherminieri*) *gunax* 20, Polynesian Storm Petrel *Nesofregetta fuliginosa* 2 at midnight just as we were about to anchor off West Gaua Island at 14°19.447′S; 167°25.322′E: the birds were attracted to the lights and hovered for *c.*2 minutes around the back of the boat (both were white-bellied), Great Frigatebird *Fregata minor* 3, Red-footed Booby *Sula sula* 50, Brown Booby *S. leucogaster* 20, Sooty Tern *Onychoprion fuscatus c.*75, Bridled Tern *O. anaethetus* 10, Black *Anous minutus* and Brown Noddies *A. stolidus* 100s with largest feeding concentrations off Santo (14°54.489′S, 167°22.555′E), and Pomarine Skua *Stercorarius pomarinus* 2 attacking the noddies. On 19 December at least 30 *P. b. magnificens* in sparse aggregations and feeding with other seabirds, mostly north-west of Gaua at *c.*14°04.15′S, 167°02.46′E: we encountered at least five major mixed seabirds concentrations within just three hours, all with 3–10 *P. b. magnificens*. Other seabirds included: Wedge-tailed Shearwater 250, Audubon's Shearwater 90, Great Frigatebird 20, Red-footed Booby 100, Brown Booby 30, Sooty Tern 70, Black and Brown Noddies *c.*200, and White Tern *Gygis alba* 3.

Vanua Lava (13°47′S, 167°28′E) is the second largest of the Banks (314 km²) and is very mountainous. Mt. Suretamate (= Mt. Suretamatai or Sere Ama, 921 m) is an active volcano (last major eruption 1965), but the island's highest point is 946 m. Its human population, of over 1,300, mostly lives in Sola (the capital of Torba province), in the east of the island, or Port Patteson. To the east are the islets of Kwakea and Ravenga. We used Sola as a base to access Uréparapara, Tandé and Mota Lava islands. On 24 December HS circumnavigated Vanua Lava in a small motor skiff, when *c.*15 *P. b. magnificens* were seen. Towards evening, from 17.00 h, six petrels came close inshore at the north-west corner of the island (13°44.263′S, 167°20.705′E) just 3–5 nautical miles out. These were probably breeders returning to colonies on the west side of Vanua Lava: at one stage two birds socialised, with one repeatedly following the other for a few seconds. Their behaviour suggested that they made landfall via a canyon at 13°44.300′S, 167°24.900′E. The voyage also yielded: Tahiti Petrel *Pseudobulweria rostrata* 1, Wedge-tailed Shearwater *c.*300, Audubon's Shearwaters *c.*50 (two adults were more worn, at end of active moult in wings, with still unmoulted and growing outer primaries), Great Frigatebird 20, Red-footed Booby 100s, Brown Booby 10s, Sooty Tern *c.*80, Black and Brown Noddies many 100s, but more of former, and Pomarine Skua 1 attacking noddies. On night of 26/27 December 2009 VB & A. Sternalski visited Mt. Suretamate to find the colony of Vanuatu Petrel (Totterman 2009, Shirihai & Bretagnolle 2010). The moon was nearly full, but clouds and rain meant that few petrels were calling, although VB sound-recorded several typical *P. brevipes / leucoptera*-type calls. Together with the observations at sea, this provides strong evidence of the petrel's breeding grounds.

Uréparapara (Parapara, 13°31′32″S, 167°19′36″E) is an extinct volcano whose cone reaches 764 m and has been breached by the sea on the east coast. It is the third-largest island in the Banks group (39 km²). The island is mostly covered by plantations and dense forest. The human population was estimated recently at *c.*500. We searched for petrels on both land (VB & A. Sternalski) and at sea (HS) on 20–23 December 2009. The original human population apparently numbered many thousands and any possible petrel population was probably extirpated long ago. However, some islanders showed VB & A. Sternalski an inactive breeding colony with *c.*5–7 empty burrows, whose diameter seemed concordant with a small petrel or, more likely, a large storm petrel such as *Nesofregetta*. The search at sea produced very few seabirds, including just one *P. b. magnificens*, 20 nautical miles offshore (13°15.119′S, 167°12.526′E) on 20 December.

Tandé (Vot Tandé or Vot Ganai, 13°15′34″S, 167°38′33″E) is 25 miles north-east of Uréparapara and was reached on 22 December 2009. Tandé has quite substantial vegetation and many breeding seabirds. It is uninhabited and relatively inaccessible because landing is not easy: the eastern, northern and southern sides are constantly exposed to big seas. En route to the island we observed seven *P. b. magnificens*. No petrel was seen at night around Tandé.

Mota Lava and Ra (13°40′15″S, 167°40′29″E) are relatively small (Ra is just a small islet), with white sand beaches and coral reefs on the west sides, but massive rocks in the centre and on the east side. Few people live on Mota Lava. HS visited the open ocean north and north-east of the island on 25–27 December 2009 (*cf.* Shirihai & Bretagnolle 2010), when 86 *P. b. magnificens* were observed: 17 on 25 December, 47 on 26 December and 22 on 27 December (with most in the evening when petrels are closer to Vanua Lava). Again these *P. b. magnificens* were observed with mixed seabird feeding flocks, e.g. Vanuatu Petrel 9 on 25 December, 18 on 26 December and 16 on 27 December; Wedge-tailed Shearwater max. 70, Audubon's Shearwater 20, Great Frigatebird 10, Red-footed Booby 70, Brown Booby 6, Sooty Tern 35, Black and Brown Noddies *c.*200.