First observations at sea of Vanuatu Petrel *Pterodroma* (*cervicalis*) *occulta*

by Hadoram Shirihai & Vincent Bretagnolle

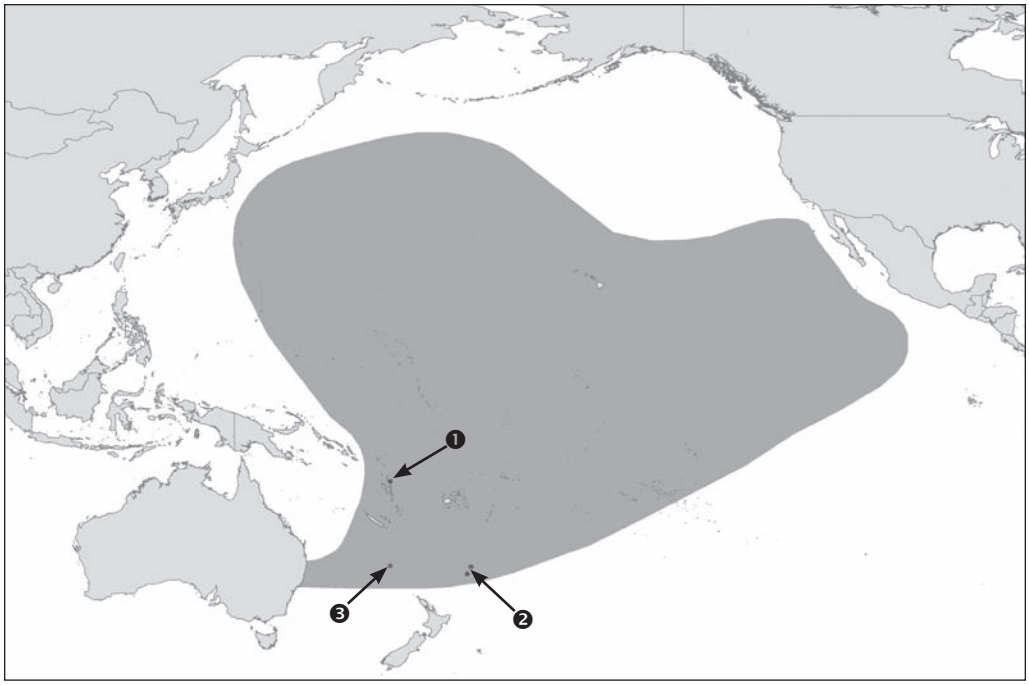
Received 21 March 2010

SUMMARY.—We present the first observations at sea of Vanuatu Petrel *Pterodroma* (*cervicalis*) *occulta*, as well as briefly reviewing the history of this poorly known seabird. A comprehensive review of the field characters of Vanuatu Petrel is provided, along with a discussion of its relative size differentiation from White-necked Petrel *P. cervicalis*. The feeding behaviour of this petrel is described, and suggested ways of finding this rare petrel at sea—off one of the most remote tropical Pacific islands—are also given.

In recent years, pelagic trips have led to repeated rediscoveries of long-lost taxa, e.g. New Zealand Storm Petrel *Oceanites maoriana* (Saville *et al*. 2003) and Beck's Petrel *Pseudobulweria becki* (Shirihai 2008), and have also yielded the first documented at-sea observations of Fiji Petrel *P. macgillivrayi* (Shirihai *et al*. 2009). The same is now true for Vanuatu Petrel *Pterodroma* (*cervicalis*) *occulta*, which was initially collected by Rollo Beck during the Whitney South Sea Expedition, on 28–29 January 1927, off the Banks Islands, Vanuatu. Six specimens, now held in the American Museum of Natural History (AMNH), New York, were taken 30 nautical miles east of the Banks archipelago. For almost 60 years, due to taxonomic uncertainty and the undetected differences between Juan Fernández *P. externa* and White-necked Petrels *P. cervicalis*, these specimens were labelled *P. externa*. Subsequently, they were referred to the smaller *P. cervicalis* (Falla 1976). Recently, Imber & Tennyson (2001) elected to describe these distinctly smaller specimens as a new species. However, R. C. Murphy, in an unpublished manuscript, was first to postulate that the Vanuatu birds might represent something 'new', and in 1962 Bill Bourne planned to name them as a subspecies for Robert (later Sir Robert) Falla, but was unable to complete his idea (W. R. P. Bourne *in litt*. 2010).

The first sign that Vanuatu Petrel was still extant came when a specimen was found (apparently roadkilled) in eastern Australia in April 1983 (Boles *et al*. 1985). The specimen is held in the Sydney museum (examined by VB). Boles *et al*. (1985) correctly assigned the specimen to the smaller form of White-necked Petrel from Vanuatu by matching its size with the AMNH specimens.

As part of our ongoing tubenoses project (Shirihai & Bretagnolle in prep.) we have visited New Caledonian and southern Vanuatu waters on several occasions since December 2005. On 2 January 2006, between New Caledonia and Vanuatu (20°16′24.73″S, 168°10′39.69″E), a single Vanuatu Petrel was seen. On 29 January 2007, two (possibly three) birds were again seen off southern Vanuatu (19°27′20.80″S, 168°28′19.36″E). They were tentatively identified as Vanuatu Petrel based on their apparently relatively smaller size, in side-by-side comparisons with Tahiti Petrel *Pseudobulweria rostrata*, and more solidly black tips to the underwing. Furthermore, in January 2006, HS visited the Kermadec Islands to study variation in White-necked Petrels (see below). These records provided indirect evidence that a breeding population of Vanuatu Petrel existed somewhere, probably in Vanuatu. Because no documentation was obtained, these records were not published, and we elected to obtain new evidence in Vanuatu in December 2009, when a special expedition



Distribution of *Pterodroma cervicalis* as given for White-necked *P. cervicalis* and Vanuatu Petrels *P.* (*c.*) *occulta* combined, with the numbered arrows indicating the three breeding grounds: (1) on Vanua Lava, Banks Islands, Vanuatu, where Vanuatu Petrel breeds (population unknown, but possibly a few tens to a few 100s of pairs); the main breeding island of White-necked Petrel on (2) Macauley Island, Kermadec Islands (with *c.*50,000 pairs in 1988, possibly increasing); and the second small colony on (3) Phillip Island, off Norfolk Island (a few pairs only). Migrates to the North Pacific Ocean with the estimated range shown. (Adapted from the BirdLife International species factsheet online at www.birdlife.org, based on Marchant & Higgins 1990, Imber & Tennyson 2001 and Totterman 2009.)

to study Vanuatu Petrel was arranged. During this visit (to the Banks Islands) we obtained 43 sightings of Vanuatu Petrel on 25–27 December, and 14 individuals were photographed; the first photographically documented records of this poorly known species at sea.

In February 2009, Totterman (2009) located the species' breeding area atop a volcanic cone on the east side of Vanua Lava island, in the Banks group. This breeding colony was well known to the islanders, especially those from Vanua Lava and the nearby Mota Lava Islands, who formerly harvested the fledglings in the burrows. VB visited this colony in December 2009.

Finally, on 7–9 February 2010, P. Harrison recorded 21 Vanuatu Petrels off northern Vanuatu (during a voyage between New Zealand and Papua New Guinea); some of these were photographed and can be seen on the Zegrahm Expeditions website (www.zeco.com).

Although some sources already consider Vanuatu and White-necked Petrels as separate species (e.g. Onley and Scofield 2007), it should be mentioned that neither Brooke (2004) nor BirdLife International (www.birdlife.org/datazone/species/index.html) recognises *P. occulta* specifically. For now, we prefer to complete our own genetic and acoustic work on this matter before commenting on the taxonomy of Vanuatu Petrel.

Vanuatu Petrel is virtually unknown to science, but birders and researchers are increasingly seeking information as to its separation from White-necked Petrel. Here, we

TABLE 1
Comparison of measurements (specimens from breeding islands only; AMNH and Australian Museum at Sydney) of Vanuatu *Pterodroma* (*cervicalis*) *occulta* and White-necked Petrels *P. cervicalis*. Note overlap in extreme values in all measurements except bill height at hook. Tail is longer in Vanuatu in relation to wing. Bill size appears to be the best separating character, but this is very difficult to appreciate in the field. Although sample sizes are small, there are statistical differences but overlap in extreme values (even in wing).

	Wing				Tail				Tarsus			
	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.
P. cervicalis (*n*=22)	303.45	6.12	292.0	315.0	126.27	5.68	117.00	137.00	39.76	1.27	37.6	42.7
P. (c.) occulta (*n*=5)	288.4	4.8	281.0	294.0	124.2	8.17	117.00	137.00	36.21	1.66	33.9	37.9
	Culmen				Bill height				Bill width			
	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.
P. cervicalis (*n*=22)	35.60	1.16	33.5	37.30	13.14	0.50	12.3	14.30	17.17	0.79	15.4	18.5
P. (c.) occulta (*n*=5)	32.17	1.07	31.0	33.75	11.40	0.77	10.1	12.10	14.58	0.90	13.6	15.8

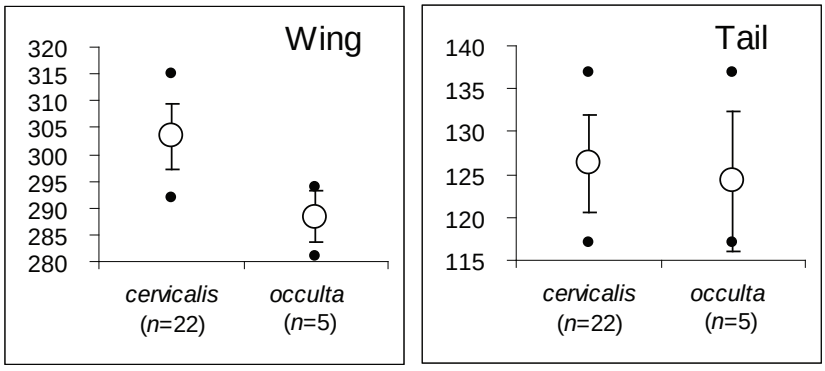


Figure 1. Biometrics of Vanuatu Petrel *Pterodroma* (*cervicalis*) *occulta* (based on four of the six AMNH specimens and that held at the Australian Museum, Sydney) and White-necked Petrel *P. cervicalis* (AMNH specimens). Data shown are means (empty circles), SD (vertical bars) and extreme values (black dots). Note that wing length differs (although there is some overlap), whilst tail length is closer matched.

will focus on the differences between the two forms at sea and discuss their separation. We also utilise specimen data, based on our examination of the six individuals at AMNH, as well as the Australian bird, completed by studies of White-necked Petrels at several major museums.

Identification of Vanuatu Petrel at sea

Vanuatu Petrel is smaller than White-necked Petrel, but virtually identical in plumage (see Imber & Tennyson 2001, Totterman 2009). As such, pelagic identification depends almost exclusively on a correct evaluation of size, and to a lesser extent of underwing pattern. These characters and their reliability are now discussed.

Size and proportion.—At sea, the overall impression is that, on average, Vanuatu Petrel is at most *c*.10% smaller (but usually much less) and slighter than White-necked Petrel. Published biometrics (Imber & Tennyson 2001) and our own data (Table 1) suggest that there is little overlap between them, but this depends on the character investigated. Our biometric data (Fig. 1) suggest that Vanuatu Petrel is smaller only by *c*.5% in wing length and *c*.2% in tail length than White-necked Petrel (8% and 9%, respectively, in Imber

TABLE 2
Comparison of the amount of white on the exposed primary bases and inner webs of the underwing in White-necked *Pterodroma cervicalis* (from the Kermadec Islands) and Vanuatu Petrels *P.* (*c.*) *occulta* (from Mota and Vanua Lava, Banks Islands). Scores for plumage characters (mostly underwing) were made by direct observations at sea and by checking images from each individual; to prevent double-counts we studied the photographs to confirm individual identification based on the underwing and head markings, which differ individually. In birds scored 1–2 the exposed white is prominent in the field. The white on birds scored 3 is small but still visible at sea, especially in photographs. On birds scored 4–5 the white is at most very limited (and best seen on photographs) and the wingtip usually looks almost solid black and sharply defined from the white coverts. The latter categories collectively represent 60% of Vanuatu Petrels, but only 9% of White-necked Petrels, while score 2 is very infrequent in Vanuatu Petrel but scores 1–3 account for 71% of White-necked Petrels. No Vanuatu Petrels scoring 1 have been found to date.

Degree of white in primaries →	Score 1: extreme white	Score 2: substantial white	Score 3: limited white	Score 4: insignificant white	Score 5: no white
P. cervicalis (*n*=120)	26.5%	44.5%	20%	6.5%	2.5%
P. (*c.*) *occulta* (*n*=33)	-	9%	30.5%	39.5%	21%

& Tennyson 2001). Although our biometric data for Vanuatu Petrel are almost identical to those of Imber & Tennyson (2001), there is some discrepancy for *P. cervicalis*, probably related to the age of specimens. Because all our measurements of *P. cervicalis* were taken at AMNH, from birds collected at approximately the same time as Vanuatu Petrel, we feel confident in our data. Based on these, Vanuatu Petrel is proportionately longer tailed than White-necked Petrel, with their wing/tail ratios being 2.3 and 2.4, respectively. Totterman (2009) suggested a 20% difference in wingspan, but his wing measurements were incorrect. Bill dimensions are more diagnostic, with Vanuatu Petrel being 9–15% smaller in length, depth and width, with no overlap in bill height (though the sample is limited). However, these differences appear too subtle for use at sea, meaning that there no clear-cut differences in shape, proportions and jizz useful for field identification. Overall, Vanuatu Petrel is only slightly smaller, but often appears slighter than White-necked Petrel, with some but not all birds appearing longer / slimmer tailed. Concerning size differences, three obstacles must be considered by field observers. *1*: there is much individual size variation in both taxa. The smallest White-necked can appear confusingly small and lighter built than average-sized individuals—thus the species can frequently appear relatively small and slender. In turn, Vanuatu Petrel often looks as large and chunky as White-necked. *2*: the correct evaluation of size differences at sea is realistic only in side-by-side comparisons, or if compared with another familiar petrel species nearby. *3*: sea conditions affect flight mode and hence the impression of overall size and structure (thus jizz), whilst changes in light conditions also exert a strong influence on size appreciation. Our conclusion is that such fine estimates of size at sea (or in photographs) are difficult, and generally impossible to reliably detect.

Underwing pattern.—The two taxa differ by the amount of the white on the exposed primary bases toward the tips (as already suggested by Imber & Tennyson 2001, and tentatively illustrated in Onley & Scofield 2007), with Vanuatu Petrel generally tending to have more restricted white (i.e. more solid black wingtips—see Fig. 2). In contrast, White-necked tends to have a broader white area on the exposed bases and inner webs of the primaries (especially from the second or third outermost primary towards the seventh primary—see Fig. 3). The nature of these differences mirrors the case between two taxa of Cory's Shearwater *Calonectris diomedea* in the Atlantic (Gutiérrez 1998, Howell & Patterson 2008). However, our observations and photographs from the breeding islands of both forms reveal the presence of substantial individual variation in both taxa, and thus significant

overlap and intermediate birds, which prevent using this feature as absolutely diagnostic (see Table 2).

Unfortunately, variation in White-necked Petrel includes 9% of birds with extensive black wingtips, like typical Vanuatu Petrels. Fig. 8 shows almost the extreme ends of the spectrum of variation in White-necked Petrel, whilst Fig. 4 shows a Vanuatu Petrel with some white in the primaries (score 3). Evaluating the degree of white in the primaries on the underwing is often made more difficult by the angle of view and wing movements, e.g. if the primaries are held more tightly or more spread out, or the extent of any shade. Fig. 9 demonstrates that even in the same bird or a single image, it is possible to acquire different impressions of this feature, making it essential that multiple photographs of the same bird are evaluated.

In addition, Vanuatu Petrel may tend to have the dark leading edge to the underwing, the diagonal bar and the trailing edge broader and more solidly black than most White-necked Petrels. Again, however, we found considerable individual variation in both forms (and thus complete overlap between them). Nevertheless, in both, there is a tendency for paler birds (or birds with whiter primary bases) to have weaker / narrower dark markings, whilst, on average, darker individuals tend to have broader black linings to the underwing.

Separation by range?—Range maps are presented in Marchant & Higgins (1990, also reproduced by BirdLife International) and Brooke (2004), but these authors lump Vanuatu Petrel under *P. cervicalis*. Brooke (2004) indicated that in the non-breeding season there is a generally broad-front movement to the north-west Pacific. Any dispersal range differences between Vanuatu Petrel and *P. cervicalis* away from the breeding islands are wholly unknown, but study of photographed birds from the western Pacific, including off eastern Australia, clearly suggests that *P. cervicalis* is frequent in these waters, and it is therefore likely that the ranges of the two forms overlap somewhere between Australia and Vanuatu, at least at some seasons. Brooke (2004) estimated the world population of White-necked Petrel (which nests almost exclusively on the Kermadec Islands) at *c*.50,000 pairs, or at least 150,000 birds, though current numbers are apparently even larger. The population of

Legend to figures on opposite page

Figure 2. Vanuatu Petrel *Pterodroma* (*cervicalis*) *occulta*, off Mota Lava, Banks Islands, December 2009; note the slightly more spread primaries on the right (top) wing with some white primary bases exposed (Hadoram Shirihai, © Tubenoses Project)

Figure 3. White-necked Petrel *Pterodroma cervicalis*, Kermadec Islands, January 2006, showing obvious white on the bases of the primaries (score 2), which occur in nearly 50% of birds in the Kermadec Islands (see Table 2), but is rare in Vanuatu Petrel *P. occulta* (<10%) (Hadoram Shirihai, © Tubenoses Project)

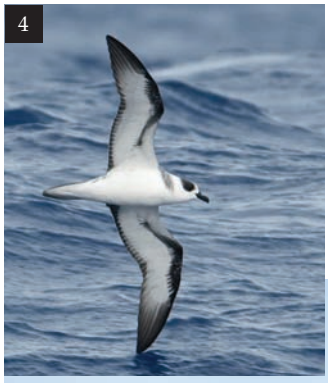
Figures 4–5. Comparison between Vanuatu Petrel *Pterodroma* (*cervicalis*) *occulta*, off Mota Lava, near Vanua Lava, Banks Islands, December 2009 (left) and White-necked Petrel *P. cervicalis*, Kermadec Islands, January 2006 (right). The two have virtually identical underwing patterns making them impossible to assign to species away from the breeding islands. Both show some white on the primary bases and their inner webs (score 3), with the Vanuatu Petrel showing fractionally more but insufficient to score 2 (see Table 2). Such birds constitute 20% of White-necked Petrels and 30% of Vanuatu Petrels. The smaller bill of Vanuatu Petrel is not apparent when comparing these two images, in which both seem to have the same-sized bill, albeit perhaps even slightly shorter and more slender still in the White-necked Petrel (Hadoram Shirihai, © Tubenoses Project)

Figure 6. White-necked Petrel *Pterodroma cervicalis*, Kermadec Islands, January 2006, showing extensive white on the primary bases (score 1), which type has to date not been found in Vanuatu Petrel *P.* (*c.*) *occulta*, and might reliably identify White-necked Petrel (Hadoram Shirihai, © Tubenoses Project)

Figure 7. Vanuatu Petrel *Pterodroma* (*cervicalis*) *occulta*, off Mota Lava, Banks Islands, December 2009; some appear chunkier like this bird, and seem to hardly differ in size and proportions from White-necked Petrel *P. cervicalis* (Hadoram Shirihai, © Tubenoses Project)


2


3


4


5


6


7

Figure 8. White-necked Petrels *Pterodroma cervicalis*, Kermadec Islands, January 2006, showing the extreme spectrum of variation, with the right bird having an underwing type similar to many Vanuatu Petrels *P.* (*c.*) *occulta*. Note the general tendency for those with whiter wingtips to also have a weak dark leading edge and diagonal bar (left bird) whereas birds with more solid dark wingtips also have the black border to the underwing better developed (right). Note also how these birds vary in size. Our study revealed that all stages of variation in the underwing pattern exist in White-necked Petrels in the Kermadec Islands (Hadoram Shirihai, © Tubenoses Project)

Figure 9. White-necked Petrel *Pterodroma cervicalis*, Kermadec Islands, January 2006; the left (top) wing appears to have more contrasting and blacker primary tips than the right wing, due to the slightly different angle of the light (Hadoram Shirihai, © Tubenoses Project)

Figures 10–11. Comparison between Vanuatu Petrel *Pterodroma* (*cervicalis*) *occulta*, off Mota Lava, near Vanua Lava, Banks Islands, December 2009 (left) and White-necked Petrel *Pterodroma cervicalis*, Kermadec Islands, January 2006 (right), showing the lack of any obvious differences in bill size and structure; the tail of Vanuatu Petrel appears slightly longer and more pointed, but this is due to the angle and flight mode (Hadoram Shirihai, © Tubenoses Project)

Vanuatu Petrel is unknown, but almost certainly much smaller, perhaps just 1% of that of White-necked. Thus, over much of the Pacific, even close to Australia and further north, the probability of seeing White-necked is far greater than that of Vanuatu Petrel.

Identification recommendations.—To conclude, the identification process is clouded by much individual variation and overlap between the two forms. In practice, birds away from their respective breeding islands cannot be reliably identified to one form or the other. However, this should not prevent observers from recording and photographing birds, and this may eventually lead to the discovery of an area where most birds show more solidly black underwing tips and generally lighter / smaller size.

At-sea behaviour of Vanuatu Petrel

During three days (25–27 December 2009) we spent considerable time observing Vanuatu Petrels off Vanua Lava and Mota Lava. Late in the afternoon, petrels gathered at sea before flying to Vanua Lava, and in the morning they were regularly seen close to Mota Lava (although they probably returned to the ocean before dawn). They were seen especially around 13°32.506′S, 167°42.431′E and 13°34.257′S, 167°37.417′E. Later in the evening, a few birds were seen just a few miles off Mota Lava at 13°35.287′S, 167°37.751′E. During the day we found few Vanuatu Petrels (max. 5 in one location) with feeding 'frenzies' of other seabirds, mostly between 13°24.285′S, 167°40.982′E and 13°23.689′S, 167°46.996′E. The species obviously specialises in taking flying fish and squid, and is usually found either at the sides or in front of the feeding 'frenzies' of boobies (*Sula* spp.) and noddies (*Anous* spp.), targeting flying fish by gliding at high speed to catch their prey in the air. Some aerial pursuits lasted up to 300 m (with sharp turns and zigzags) and up to two minutes. Future observations may elucidate ecological differences between the two forms, but the smaller size of Vanuatu Petrel seems to match its range at lower, warmer latitudes.

Observing Vanuatu Petrel

We found that one could travel around the Banks Islands for days and not see any Vanuatu Petrels. At least in December, Vanuatu Petrel is very locally distributed, apparently being mainly found along a very narrow corridor to the north-east of Vanua Lava. Our work off Vanua Lava was mostly in a small (7-m) boat with a single engine, but this proved dangerous in the usually very rough ocean to the north. Field observers could visit Mota Lava and watch off the north coast, from where they would be almost guaranteed to see Vanuatu Petrels arriving from the north-east in late afternoon / evening, in December–May at least.

Acknowledgements

We thank all our fellow members of the Banks Expedition in December 2009: Audrey Sternalski, Orian Shirihai, Jakob Wikstrom, Eyal Jacobson and Maya Dvori-Jacobson. We also thank the many great people from the islands Vanua Lava, Mota Lava and Ureparapara, for their logistical help and welcome during our visit to the Banks. Also thanks to François Levionnois (New Caledonia) for helping HS organise his pelagic work in 2005–07, and to Bill Bourne for interesting discussions and encouragement. Particular thanks to Walter Boles, Curator of Birds at the Australian Museum, Sydney, for access to the Vanuatu Petrel specimen, and to the collections in New York (Paul Sweet), Tring (Robert Prŷs-Jones) and Paris (E. Pasquet).

References:

Boles, W. E., Bartram, K. & Clancy, G. P. 1985. First Australian specimen of the White-necked Petrel. *Australian Birds* 19: 51–54.

Brooke, M. 2004. *Albatrosses and petrels across the world*. Oxford Univ. Press.

Falla, R. A. 1976. Notes on the gadfly petrels *Pterodroma externa* and *P. e. cervicalis*. *Notornis* 23: 320–322.

Gutiérrez, R. 1998. Flight identification of Cory's and Scopoli's Shearwaters. *Dutch Birding* 20: 216–225.

Howell, S. N. G. & Patterson, J. B. 2008. Variation in Cory's and Scopoli's Shearwaters. *Alula* 14: 12–21.
Imber, M. J. & Tennyson, A. J. D. 2001. A new petrel species (Procellariidae) from the south-west Pacific. *Emu* 101: 123–127.
Marchant, S. & Higgins, P. J. (eds.) 1990. *Handbook of Australian, New Zealand & Antarctic birds*, vol. 1. Oxford Univ. Press, Melbourne.
Murphy, R. C. 1928. Birds collected during the Whitney South Sea Expedition. IV. *Amer. Mus. Novit*. 322.
Murphy, R. C. & Pennoyer, J. M. 1952. Larger petrels of the genus *Pterodroma*. Whitney South Sea Expedition of the American Museum of Natural History (1920–1941). *Amer. Mus. Novit*. 1580.
Onley, D. & Scofield, P. 2007. *Albatrosses, petrels and shearwaters of the world*. Christopher Helm, London.
Saville, S., Stephenson, B. & Southey, I. 2003. A possible sighting of an 'extinct' bird—the New Zealand Storm Petrel. *Birding World* 16: 173–175.
Shirihai, H. 2008. Rediscovery of Beck's Petrel *Pseudobulweria becki*, and other observations of tubenoses from the Bismarck archipelago, Papua New Guinea. *Bull. Brit. Orn. Cl*. 128: 3–16.
Shirihai, H. & Bretagnolle, V. In prep. *Albatrosses, petrels and shearwaters of the world: a handbook to their taxonomy, identification, ecology and conservation*. Christopher Helm, London.
Shirihai, H., Pym, T., Kretzschmar, J., Moce, K., Taukei, A. & Watling, D. 2009. First observations of Fiji Petrel *Pseudobulweria macgillivrayi* at sea: off Gau Island, Fiji, in May 2009. *Bull. Brit. Orn. Cl*. 129: 129–148.
Totterman, S. 2009. Vanuatu Petrel (*Pterodroma occulta*) discovered breeding on Vanua Lava, Banks Islands, Vanuatu. *Notornis* 56: 57–62.

Addresses: Hadoram Shirihai, c/o Ausserdorfstraße 6, 8052 Zurich, Switzerland, e-mail: albatross_shirihai@hotmail.com. Vincent Bretagnolle, CEBC-CNRS, 79360, Beauvoir sur Niort, France.