

**PELAGIC OBSERVATIONS,
HAWAII TO FIJI, VIA KIRIBATI AND THE PHOENIX ISLANDS, CENTRAL
PACIFIC, APRIL–JUNE 2022**

by

Robert L. Flood¹, Philip M. Hansbro², Colin Rogers³, Hiroyuki Tanoi⁴, Shoko Tanoi⁴, & Kirk Zufelt⁵

¹*FitzPatrick Institute of African Ornithology, DST-NRF Centre of Excellence, University of Cape Town, Rondebosch 7701, South Africa (live2seabird@gmail.com)*

²*Centre for Inflammation, Centenary UTS & University of Technology Sydney, Faculty of Science, 15 Broadway, Sydney, NSW 2007, Australia (Philip.Hansbro@uts.edu.au)*

³*Colin Rogers, 6 Flavel Avenue, Woodforde, Adelaide, SA 5072, Australia (twitchercolin@gmail.com)*

⁴*5-3-21 Nakada, Taihaku, Sendai, Miyagi 981-1104, Japan (pterodroma.longirostris@gmail.com)*

⁵*1001 Third Line East, Sault Sainte Marie, Ontario, P6A 6J8, Canada (zufelt_k@shaw.ca)*

Recommended citation: Flood, R. L., Hansbro, P. M., Rogers, C., Tanoi, H., Tanoi, S., & Zufelt, K. 2023. Pelagic observations, Hawaii to Fiji, via Kiribati and the Phoenix Islands, Central Pacific, April–June 2022. Pacific Seabird Group Technical Publication Number 5. Available at <https://pacificseabirdgroup.org/psg-publications/technical-publications/>

01 April 2023



Pacific Seabird Group

Pacific Seabird Group Technical Publication Number 5



Phoenix Petrel *Pterodroma alba*, 24 April 2022, off Kiritimati, Kiribati (Kirk Zufelt).

TABLE OF CONTENTS

ABSTRACT	7
INTRODUCTION	7
METHODS	7
RESULTS AND DISCUSSION	10
TUBENOSES	10
Wilson’s Storm-Petrel	10
White-faced Storm-Petrel	11
Black-bellied Storm-Petrel	12
New Zealand Storm-Petrel	13
Polynesian Storm-Petrel	14
Laysan Albatross	16
Matsudaira’s Storm-Petrel	16
Leach’s Storm-Petrel	17
Band-rumped Storm-Petrel	19
Wedge-rumped Storm-Petrel	20
Juan Fernández Petrel	20
White-necked Petrel	21
Vanuatu Petrel	22
Kermadec Petrel	23
Herald Petrel	24
Phoenix Petrel	24
Hawaiian Petrel	27
Mottled Petrel	27
Black-winged Petrel	29
Collared Petrel	29
Cook’s Petrel	31
Tahiti Petrel	32
Beck’s Petrel	33
Fiji Petrel	34
Bulwer’s Petrel	34
Wedge-tailed Shearwater	36
Buller’s Shearwater	38
Sooty Shearwater	38
Flesh-footed Shearwater	40
Christmas Shearwater	41
‘Tropical Shearwaters’	42
OTHER SEABIRDS	47
Brown Noddy	47
Black Noddy	47
Blue Noddy	47
White Noddy	47
Grey-backed Tern	47

Bridled Tern	48
Sooty Tern	48
Black-naped Tern	48
South Polar Skua	48
Pomarine Skua	48
Arctic Skua	48
Laughing Gull	48
Red-tailed Tropicbird	49
White-tailed Tropicbird	49
Great Frigatebird	49
Lesser Frigatebird	49
Masked Booby	49
Red-footed Booby	49
Brown Booby	49
CONCLUSION	50
ACKNOWLEDGEMENTS	51
REFERENCES	51

LIST OF FIGURES

See captions to figures for details.

Figure 1.	Approximate route of expedition	6
Figure 2.	White-faced Storm-Petrel <i>Pelagodroma marina</i>	11
Figure 3.	Black-bellied Storm-Petrel <i>Fregetta tropica</i>	12
Figure 4.	New Zealand Storm-Petrels <i>Fregetta maoriana</i>	13
Figure 5.	Polynesian Storm-Petrel <i>Nesofregetta fuliginosa</i>	15
Figure 6.	Polynesian Storm-Petrels <i>Nesofregetta fuliginosa</i>	16
Figure 7.	Daily counts of Leach's Storm-Petrel <i>Hydrobates leucorhous</i>	17
Figure 8.	Leach's Storm-Petrels <i>Hydrobates leucorhous</i>	18
Figure 9.	Band-rumped <i>H. castro</i> , Wedge-rumped <i>H. tethys</i> , Leach's <i>H. leucorhous</i> Storm-Petrels ...	19
Figure 10.	Juan Fernández Petrel <i>Pterodroma externa</i>	21
Figure 11.	Vanuatu Petrel <i>Pterodroma occulta</i>	22
Figure 12.	Kermadec Petrels <i>Pterodroma neglecta</i>	23
Figure 13.	Herald Petrel <i>Pterodroma heraldica</i>	25
Figure 14.	Phoenix Petrels <i>Pterodroma heraldica</i>	25
Figure 15.	Hawaiian Petrels <i>Pterodroma sandwichensis</i>	26
Figure 16.	Mottled Petrels <i>Pterodroma inexpectata</i>	28
Figure 17.	Black-winged Petrel <i>Pterodroma nigripennis</i>	28
Figure 18.	Collared Petrels <i>Pterodroma brevipes</i>	30
Figure 19.	Cook's Petrels <i>Pterodroma cookii</i>	31
Figure 20.	Cook's Petrels <i>Pterodroma cookii</i>	33
Figure 21.	Fiji Petrel <i>Pseudobulweria macgillivrayi</i>	34
Figure 22.	Bulwer's Petrels <i>Bulweria bulwerii</i>	35
Figure 23.	Wedge-tailed Shearwaters <i>Ardenna pacifica</i>	37

Figure 24.	Buller's Shearwater <i>Ardenna bulleri</i>	38
Figure 25.	Sooty Shearwater <i>Ardenna grisea</i>	39
Figure 26.	Flesh-footed Shearwater <i>Ardenna carneipes</i>	40
Figure 27.	Christmas Shearwater <i>Puffinus nativitatis</i>	41
Figure 28.	Micronesian Shearwater <i>Puffinus dichrous</i>	43
Figure 29.	Comparison of bill lengths of <i>Puffinus</i> shearwaters from expeditions in Pacific	44
Figure 30.	Face of <i>Puffinus</i> shearwaters from current expedition	44
Figure 31.	Underwing-coverts of <i>Puffinus</i> shearwaters from current expedition	44
Figure 32.	Undertail-coverts of <i>Puffinus</i> shearwaters from current expedition	45
Figure 33.	Tips of secondary upperwing-coverts of <i>Puffinus</i> shearwaters from current expedition	45
Figure 34.	Examples of <i>Puffinus</i> shearwaters in primary moult from current expedition	45
Figure 35.	<i>Puffinus</i> shearwaters seen at Niufo'ou, Tonga, during current expedition	46
Figure 36.	Blue Noddy <i>Anous ceruleus</i>	47
Figure 37.	Grey-backed Tern <i>Onychoprion lunatus</i>	47
Figure 38.	South Polar Skua <i>Stercorarius maccormicki</i>	48
Figure 39.	Laughing Gull <i>Leucophaeus atricilla</i>	48

LIST OF TABLES

See caption to table for details.

Table 1.	Survey effort	6
----------	---------------------	---



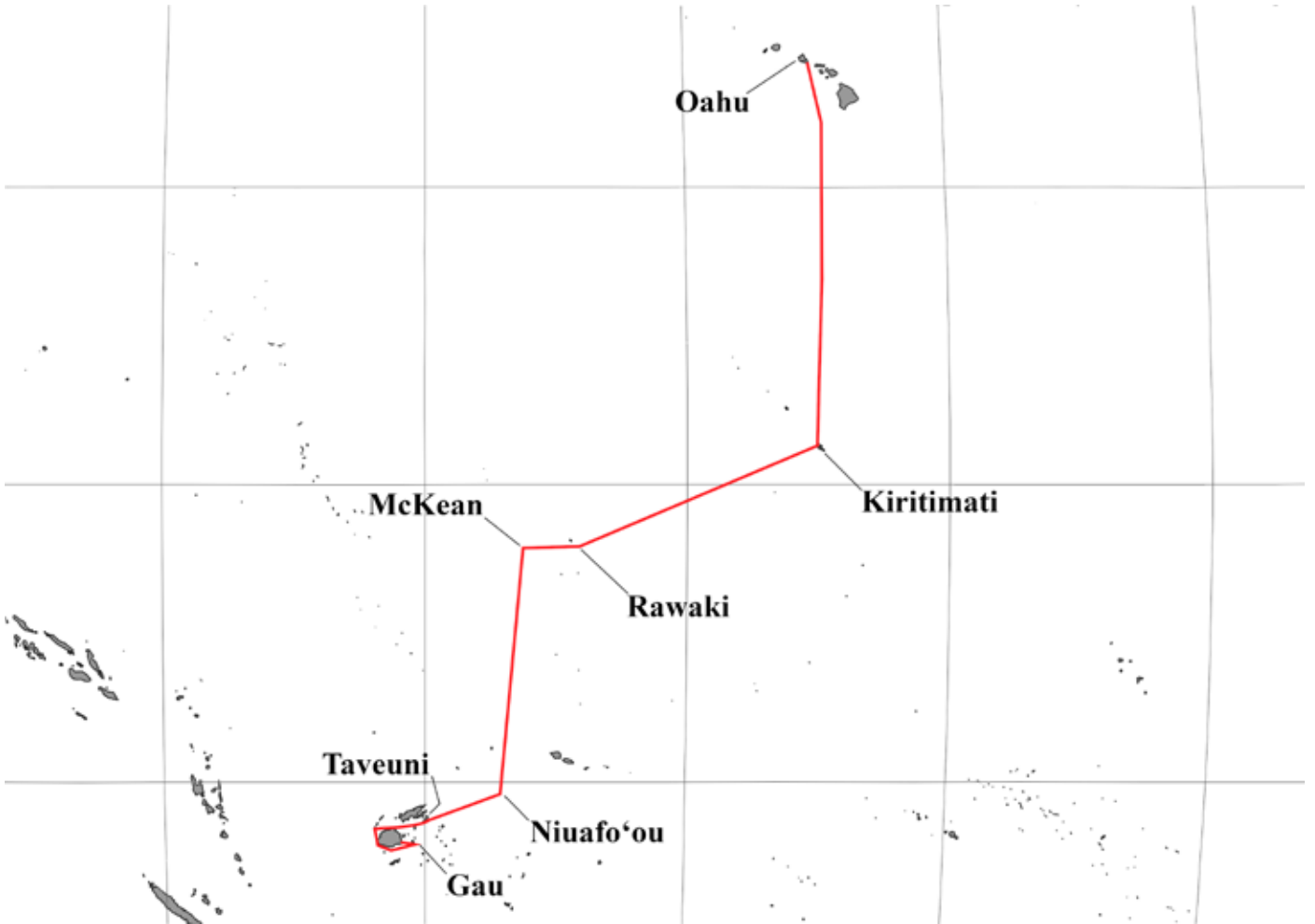


Figure 1. Approximate route of expedition, from Hawaii to Fiji, via Kiribati and the Phoenix Islands.



ABSTRACT

This report documents results from a 41-day, *ca.* 8,000-km pelagic survey of seabirds, with a focus on Procellariiformes (tubenoses), April–June 2022, in the Central Pacific, from Hawaii to the Fiji Islands, via Kiribati and the Phoenix Islands. We report sightings of Beck’s Petrel, Vanuatu Petrel, and New Zealand Storm-Petrel, which provide insight into their largely, if not wholly unknown at-sea ranges. We report sightings in Fiji of White-faced Storm-Petrel, Black-bellied Storm-Petrel, and Buller’s Shearwater, which confirm that the three species are scarce but regular passage migrants there. Few Polynesian Storm-Petrels were observed in the Phoenix Islands, all light morph, some streaked, which indicates that the population remains critically low, and that the dark morph may have been lost. One sighting of Polynesian Storm-Petrel in Fiji provides slim hope that a few breeding pairs survive in the archipelago. Observations of Phoenix Petrel from our current and previous expeditions point to Kiritimati as the species’ current breeding stronghold. Sparse sightings of Bulwer’s Petrel in the Phoenix Islands confirm a critically low population, which is a concern because geographically isolated populations of Bulwer’s Petrel, like this one, may represent cryptic taxa, potentially at species level. Further, one sighting of Fiji Petrel in eight days of continuous chumming in previous sighting hotspots off Gau Island, Fiji, raises yet more concern about the viability of the species. These and numerous other observations given in the report add additional data of seabird range, distribution, and variation in the Central Pacific, and contribute to future consideration of conservation measures in the region.

INTRODUCTION

In April–June 2022, we undertook an at-sea survey of seabirds in the Central Pacific, sailing 29 days from Honolulu, Oahu, Hawaii, to Fiji, via Kiritimati, Kiribati (northern Line Islands), and Rawaki and McKean Islands, Phoenix Islands, with a further 12 days in Fiji, primarily off Taveuni and Gau Islands (Figure 1). The weather, sea state, and daily activities were recorded (Table 1). The expedition covered over 8,000 km and the latitude and longitude limits of the expedition are 21°18’N–18°45’S and 179°20’E–157°51’W.

A baseline understanding of the status of seabirds in the Central Pacific was established by the Pacific Ocean Biological Survey Program (POBSP) in the 1960s and is reported in King (1974). Our pelagic survey from Hawaii to Fiji voyaged from the northeast to the southwest extremities of the central region studied by POBSP. Other key publications that cover portions of this region are Spear *et al.* (1999; southeast Hawaii), Spear & Ainley (2007; eastern tropical Pacific), Schreiber & Ashmole (1969; Kiritimati, Kiribati), Jones (2000; Kiritimati, Kiribati), Thibault & Cibois (2017; East Polynesia), Flood & Zufelt (2021; East Polynesia), Pierce *et al.* (2006, 2008, 2011; Phoenix Islands), Dutson (2011; Melanesia), Jenkins (1980, 1986; Fiji and West Polynesia), Watling (2004; Fiji and West Polynesia), and Shirihai *et al.* (2009; Fiji). Despite these significant pieces of work, there is still much to learn about the seabird life of this vast oceanic realm, as demonstrated by this report and our previous expedition reports (e.g., Flood & Zufelt 2021, Flood *et al.* 2022a). Sadly, the problem of organising and funding oceanic surveys to the remote Pacific is a significant hindrance. Nevertheless, as stated in this and our previous technical reports, surveys are sorely needed because they contribute valuable insights into the life history, ecology, changing abundance, and conservation needs of species (e.g., Spear & Ainley 2007, Mannaerts *et al.* 2014, Carroll *et al.* 2019).

METHODS

The survey vessel was the 18-m expedition yacht *Sauvage*. The survey team comprised eight ornithologists, six aboard at one time, with two leaving and another two joining at Viti Levu, Fiji. A fish-oil drip fixed on the stern of the yacht ran throughout daylight hours. Drifting and chumming sessions used fish oil, dried fish meal mixed with fish oil, and offal from fish that we caught for food. A ‘teaser’ was towed throughout the day, being a mock fish that splashes on the surface, more usually used by fishermen, which attracts the interest of seabirds and often keeps them behind the yacht for longer. Regular counts were made for each species observed. Each day we made a rough conservative estimate of the total number of birds for each species seen (denoted by A). Days sailing were divided into three equal periods covering daylight hours, dawn to dusk (denoted by X, Y, Z). ‘A’ was estimated from counts for each period (A: X, Y, Z). ‘A’ was adjusted downward when specific birds were known to be present over several time periods. Only the total number of birds was recorded (A) when the count was small. The counts for each day sailing are comparable because they are hour-based and result from the same chumming techniques. Counts for days surveying offshore islands were estimated from counts for each activity (e.g., periods drifting offshore and circumnavigating the island).

The next section presents species accounts for the tubenoses recorded during our survey. Each account presents notes on range, our sightings, criteria for species recognition, behaviour, taxonomy, variation, moult, and conservation. Short species accounts for other seabirds follow, which document our survey results. Cetacean sightings are listed in the Appendix. A conclusion rounds off the report. We mainly adhere to the IOC World Bird List v13.1.

Table 1. Survey effort: date in 2022, location, weather and sea conditions, and general notes.

Date	Location	Weather & sea	General notes
16/04	Honolulu, Oahu, Hawaii	NE 17–25 kt, sea 2–3 m	Depart Waikiki Yacht Club at 10:30 Sail E toward Perrier Seamount
17/04	Perrier Seamount	NE 10–25 kt, sea 2–3 m	Dawn–17:00, drift over seamount 17:00–dark, set sail S toward Kiritimati
18/04	At sea	NE 15–20 kt, sea 2–3 m	Day 1, dawn–dusk, sail S toward Kiritimati
19/04	At sea	NE 20–30 kt, sea 3–4 m	Day 2, dawn–dusk, sail S toward Kiritimati
20/04	At sea	NE 15–20 kt, sea 2–3 m	Day 3, dawn–dusk, sail S toward Kiritimati
21/04	At sea	NE 20–30 kt, sea 2–3 m	Day 4, dawn–dusk, sail S toward Kiritimati, <i>ca.</i> 560 km from northern Line Islands
22/04	At sea	NE 15–30 kt, sea 1.5–3 m	Day 5, dawn–dusk, sail S toward Kiritimati, approx. start of doldrums
23/04	At sea	NE 15–20 kt, sea 1–2 m, heavy showers	Day 6, dawn–dusk, sail S toward Kiritimati
24/04	Kiritimati, Kiribati	SE 10–40 kt, sea 1–2.5 m, heavy showers	Dawn–09:00, sail S 50 km to Kiritimati 09:00–13:00, arrival and cruise offshore W of island 13:00–16:30, sail to NE of island 16:60–dark, drift in NW direction Approx. end doldrums
25/04	Kiritimati, Kiribati	SE 10–15 kt, sea 1–2 m, showers	Dawn–15:00, cruise offshore W and N of island 15:00–dark, depart SW for Phoenix Islands, cross mouth of St Stanislas Bay for evening return to colony
26/04	At sea	SE 15–20 kt, sea 1–2 m	Day 1, dawn–dusk, sail WSW toward Phoenix Islands
27/04	At sea	E 5–15 kt, sea 1–2 m	Day 2, dawn–dusk, sail WSW toward Phoenix Islands
28/04	At sea	E 5–15 kt, sea 1–2 m	Day 3, dawn–dusk, sail WSW toward Phoenix Islands
29/04	At sea	E 8–10 kt, sea 1–2 m	Day 4, dawn–dusk, sail WSW toward Phoenix Islands, cross equator <i>ca.</i> 04:00
30/04	At sea	SE 8–10 kt, sea 1–2 m	Day 5, dawn–dusk, sail WSW toward Phoenix Islands
01/05	Rawaki, Phoenix Islands	SE 5–10 kt, sea 1 m	Dawn–09:00, sail 20 km to 5 km E of Rawaki 09:00–13:30, drift 5 km E of Rawaki 13:00–15:00, sail to Rawaki 15:00–16:00, circumnavigate Rawaki 16:00–dark, drift offshore 2 km W of Rawaki
02/05	Rawaki, Phoenix Islands	E 5 kt, sea 1 m	Dawn–10:00, sail 20 km to 5 km E of Rawaki 10:00–13:00, circumnavigate Rawaki 13:00–dark, sail W toward McKean
03/05	At sea	SE 10–15 kt, sea 1 m	Dawn–16:00, sail W toward McKean 16:00–dark, drift <i>ca.</i> 65 km E of McKean
04/05	McKean Island, Phoenix Islands	NE 8–10 kt, sea 1 m	Dawn–10:00, sail W toward McKean 10:00–12:00, circumnavigate McKean 12:00–16:00, drift 8 km NW of McKean 16:00–dark, sail to 2 km W of McKean and drift
05/05	McKean Island, Phoenix Islands	NE 8–15 kt, sea 1 m	Dawn–09:30, drift 8 km SSW of McKean 09:30–11:30, sail to and circumnavigate McKean 11:30–15:30, sail 8 km W of McKean and drift 15:30–dark, sail to McKean, then back and forward 3 km S of McKean
06/05	At sea	NE 15 kt, sea 1 m	Day 1, dawn–dark, depart McKean, sail SW toward Niuafo‘ou, Tonga
07/05	At sea	NE 10–15 kt, sea 1 m	Day 2, dawn–dark, sail SW toward Niuafo‘ou, Tonga
08/05	At sea	NE 8–15 kt, sea 1 m	Day 3, dawn–dark, sail SW toward Niuafo‘ou, Tonga
09/05	At sea	NE 12–15 kt, sea 1 m	Day 4, dawn–dark, sail SW toward Niuafo‘ou, Tonga, Samoa <i>ca.</i> 200 km, 13:00–dark, sail over Field Bank, 12.30°S, 174.75°W
10/05	At sea	NE 5–10 kt, sea 1 m	Day 5, dawn–dark, sail SW toward Niuafo‘ou, Tonga, Wallace <i>ca.</i> 100 km, Samoa <i>ca.</i> 215 km
11/05	At sea	SE 5–15 kt, sea 1 m	09:30 arrive Niuafo‘ou, Tonga 09:30–15:00, circumnavigate Niuafo‘ou, Tonga, and maintenance to sail
12/05	At sea	SSE 15–30 kt, sea 3–4 m	Dawn–10:00, over Hydra Seamount, 15.50°S, 176.40°W 10:00–13:00, sail to Zephyr Reef 13:00–16:00, over Zephyr Reef, 16.03°S, 177.12°W 16:00–dark, sail W toward Taveuni, Fiji

13/05	At sea	SE 15 kt, sea 2–3 m	Dawn–dark, sail W toward Taveuni, Fiji Cross international date line
15/05	At sea	ESE 5–20 kt, sea 2–3 m	Dawn–10:00, off Wailagilala Island in channel, Taveuni <i>ca.</i> 35 km
16/05	Taveuni Island, Fiji	ESE 20–25 kt, sea 2–3 m	Dawn–09:00, drift 15 km E of Taveuni 09:00–13:00, sail up and down 15 km E of Taveuni 13:00–dark, sail up and down 6 km E of Taveuni
17/05	Taveuni Island, Fiji	ESE 20–25 kt, sea 3 m	Dawn–16:00, sail up and down 6 km E of Taveuni 16:00–dark, sail to W of Taveuni for night
18/05	At sea	ESE 20–25 kt, sea 3 m	Dawn–dark, sail to Savu Savu, Vanua Levu Island, Fiji Clear customs and provisioning
24/05	Viti Levu, Fiji	NE 5–10 kt	Depart Port Denarau 09:00, head S, exit reef <i>ca.</i> 12:00
25/05	Gau, Fiji	NE 15–20 kt	Dawn–09:00, sail 17 miles to point 3 09:00–11:30, drift at point 3 11:30–15:00, sail to point 2 15:00–dark, drift at point 2
26/05	Gau, Fiji	NE 15–20 kt	Dawn–13:00, drift at point 2 13:00–17:00, sail to point 1 17:00–dark, drift at point 1
27/05	Gau, Fiji	ENE 10–15 kt	Dawn–12:00, drift at point 2 12:00–15:00, sail to point 1 15:00–dark, drift at point 1
28/05	Gau, Fiji	ENE 10–15 kt, 30 kt afternoon some heavy rain	Dawn–08:00, drift 15 miles E of Gau 08:00–12:00, sail to point 2 12:00–dark, drift at point 2
29/05	Gau, Fiji	NW turning NE 10–15 kt	Dawn–dark, drift at point 2
30/05	Gau, Fiji	ESE 0–5 kt, heavy rain for 1 hour at about 17:00	Dawn–dark, drift at point 2
31/05	Gau, Fiji	ESE turning SE 10–15 kt	Dawn–dark, drift at point 2
01/06	Gau, Fiji	ESE 10–15 kt	Dawn–10:30, drift at point 2 10:30–12:00, sail to point 1 12:00–15:00, drift at point 1 dripping oil 15:00–dark, set slick at point 1



RESULTS AND DISCUSSION

TUBENOSES

WILSON'S STORM-PETREL *Oceanites oceanicus*

Range Transequatorial passage migrant from Antarctic and subantarctic breeding grounds during northward migration, April–May, and southward migration, October–November. Non-breeders, mainly first-year birds, to be expected during breeding season, December–March (as tropical Atlantic Ocean; Flood & Fisher 2013a). POBSP found this species to be widespread in Pacific, with concentration of adults in Central Pacific October–November (King 1974). POBSP offers no clue to the northward extent of movement, nor distribution or activities of birds April–October. **Hawaiian Islands** Scarce in northwest and rare in southeast (Pyle & Pyle 2017, VanderWerf *et al.* 2018). **Micronesia** Fifty-eight specimens from Eniwetok Atoll, Marshall Islands, from 17 April to 29 May 1969 (Huber 1971), nominate except for one *O. o. chilensis* (Pyle & Pyle 2017). Recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006 (none), 26 May to 19 June 2008 (one bird), and 25 November to 10 December 2009 (none; Pierce *et al.* 2006, 2008, 2011). **Melanesia** Probably more widespread as a passage migrant than suggested by a single record of large flock behind a tuna fishing boat (Watling 2004). Scarce migrant throughout Melanesia (Dutson 2011). One off Fiji, May 1994. Observed off Gau Island, Fiji, with one to four birds on four out of 11 days, May 2009 (Shirihai *et al.* 2009) and up to 12 birds on all four days, May 2017 (RLF pers. obs.). Small to moderate numbers on each of nine days October 2009 (Watling 2010). **West Polynesia** Probably widespread as passage migrant (Watling 2004). None recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006, 22–25 May and 20–23 June 2008, and 22–24 November and 11–13 December 2009 (Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Seasonally regular in small to moderate numbers (Thibault & Cibois 2017, Flood & Zufelt 2021).

Sightings Expedition coincided with known northward migration, April–May. However, none recorded between Hawaii and Kiritimati second half of April. Scarce but quite regular thereafter as expedition moved westward to Phoenix Islands, more common as expedition moved southward to Fiji. **26 April** Day 1 sailing west-southwest from Kiritimati to Phoenix Islands (1: 0, 0, 1). **30 April** Last day sailing west-southwest to Phoenix Islands (2: 0, 0, 2). **1 May** Rawaki, Phoenix Islands, five early morning *ca.* 10 km east of island while drifting. One early afternoon while approaching island. **02 May** Rawaki, one mid-afternoon *ca.* 10 km south of island. **03 May** Sailing west toward McKean Island, Phoenix Islands, one mid-morning, two late afternoon while drifting *ca.* 65 km east of McKean. **04 May** One during afternoon drift *ca.* 8 km northwest of McKean. **05 May** Two during morning drift *ca.* 8 km south-southwest of McKean. **08 May** Day 3 sailing southwest toward Niufo'ou, Tonga (5: 3, 1, 1). **12 May** Sailing over Hydra Seamount dawn–10:00 and Zephyr Reef 13:00–16:00 (11: 2, 8, 1). **13 May** Sailing west toward Taveuni Island, Fiji (1: 1, 0, 0). **17 May** Sailing up and down (north–south) 6 km east of Taveuni (2: 0, 1, 1). **25 May** Drift at point 3, off Gau Island, Fiji, then sail to point 2, drift at point 2 (9: 5, 1, 3). **26 May** Drift off Gau at point 2, sail to point 1, drift at point 1 (15: 11, 3, 1). **27 May** Drift off Gau at point 2, sail to point 1, drift at point 1 (5: 3, 0, 2). **29 May** Drift off Gau at point 2 for whole day (25: 12, 5, 8). **30 May** Drift off Gau at point 2 for whole day (4: 2, 0, 2). **31 May** Drift off Gau at point 2 for whole day (6: 4, 0, 2).

Recognition Plumage black and white. *O. o. oceanicus* / *exasperatus* blackish with white wrap-around rump and pale upperwing ulnar bar (*O. o. chilensis* and other *Oceanites* taxa variously have white in underwing-coverts and on underbody). Wings held straightened and wing action stiff. Wing has moderately angled leading edge, straight trailing edge, inner wing shorter than outer wing. Caudal projection long (i.e., rear body and tail behind wings), with toe projection beyond tail end, unless legs retracted. Detailed description in Flood & Fisher (2013a).

Behaviour Attracted to fish oil while sailing and while drifting. In general, flew low over sea with flight style reminiscent of Barn Swallow *Hirundo rustica*. Collected prey by foot-pattering on long spindly legs, 'pogo dancing' or 'walking on water', dips-down head to collect fish oil and other prey.

Taxonomy, variation, & moult Polytypic or clinal. Polytypic taxonomy variously recognises *O. o. oceanicus*, pan-oceanic, breeds subantarctic islands; *O. o. exasperatus*, pan-oceanic, breeds Antarctic coastline and islands of Scotia Sea; *O. o. chilensis* central and south Pacific waters of Chile, possibly Falkland Islands, southwest Atlantic. *Oceanicus* one of the similar-looking *Oceanites*-complex, though taxa other than *oceanicus* / *exasperatus* largely restricted to Pacific waters of Chile, Peru, and Galapagos Islands. No morphological differences between birds observed during expedition and *oceanicus* / *exasperatus* seen elsewhere. On 26 May, primary moult reached p5 on one bird.

Conservation Least Concern (IUCN Red List of Threatened Species). In survey region, migrants recorded during non-breeding season and non-breeders expected during breeding season, so region of some importance to species.

WHITE-FACED STORM-PETREL *Pelagodroma marina*

Range In Pacific, occurs south of equator, breeders from Australasia (*albiclunis*, *dulciae*, *maoriana*) pass through during non-breeding season, April–September, small to moderate numbers, increasingly scarce toward equator. Non-breeders, mainly first-year birds, to be expected during breeding season, October–March. Practically all POBSP sightings fell within a triangular area with points 5°N, 112°W; 8°S, 112°W; 3°S, 100°W (King 1974). **Hawaiian Islands** No records (Pyle & Pyle 2017). **Micronesia** None recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006, 26 May to 19 June 2008, and 25 November to 10 December 2009 (Pierce *et al.* 2006, 2008, 2011). **Melanesia** Vagrant off New Caledonia May–July. Unconfirmed record off Bismark archipelago (Dutson 2011). An old record from Fiji (Watling 2004). Three records from Fiji, including in 11 days of chumming, one off Gau, 16 May 2009 (Shirihai *et al.* 2009). Latter bird had whitish-grey rump as seen in *P. (m.) albiclunis*, which breeds Kermadec Islands, New Zealand, and possibly Norfolk Island, Australia. **West Polynesia** One off Tutuila, American Samoa, September 1992 (Watling 2004). None recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006, 22–25 May and 20–23 June 2008, and 22–24 November and 11–13 December 2009 (Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Seasonally regular, small to moderate numbers, though paucity of records in western sector (Thibault & Cibois 2017, Flood & Zufelt 2021, Flood *et al.* 2021).

Sightings Found only at far south of expedition, exclusively within Fiji. A total of six birds trebles number of documented records in Fiji. Evidence suggests status of species in Fiji waters should be amended to: ‘scarce but regular passage migrant, or irregularly irruptive, at least in May.’ **16 May** One early morning while drifting 15 km east of Taveuni Island, Fiji. **26 May** One in morning while drifting off Gau Island, Fiji, at point 2. **27 May** One in morning while drifting at point 2, off Gau. **31 May** One in morning and one in afternoon while drifting at point 2, off Gau. **01 June** One in morning while sailing from point 2 to point 1, off Gau.

Recognition ‘Tricoloured’ plumage – white, grey, and brownish-black. Much smaller than superficially similar Polynesian Storm-Petrel. Distinctive head pattern with white face, dark grey crown, even darker eye-patch, and white supercilium. Mantle, back and scapulars grey. Upperwing-coverts brownish-grey. Underwing-coverts and underbody almost entirely white. Flight feathers brownish-black. Subtle morphological differences between taxa – darkness of plumage, paleness of rump patch, depth of tail fork, length of legs – largely imperceptible in field.

Behaviour Observed at chum, performed typical behaviour of foot-pattering on long spindly legs – as if walking on water, hang-gliding, and skimming low over sea (Flood & Fisher 2013a).

Taxonomy, variation, & moult Six taxa are generally recognised and some of these may yet be proven to be valid species: *P. m. marina* – South Atlantic, breeds Tristan da Cunha group and Gough Island. *P. m. eadesorum* – central North Atlantic, breeds Cape Verde Islands. *P. m. hypoleuca* – central North Atlantic, breeds Selvagens Islands and Canary Islands. *P. m. dulciae* – northwest Indian Ocean and Tasman Sea, breeds islands off Australia (western Australia to New South Wales). *P. m. maoriana* – southwest Pacific, migrates to southeast Pacific, breeds islands off New Zealand (not Kermadec Islands). *P. m. albiclunis* – southwest Pacific, breeds Kermadec Islands. All birds seen well or photographed during survey identified to southwest Pacific taxa, with sullied pale greyish rump and large, though not deep, dark pectoral breast-side patches. None in primary moult.

Conservation Least Concern (IUCN Red List of Threatened Species).



Figure 2. White-faced Storm-Petrel *Pelagodroma marina*, 27 May 2022, off Gau Island, Fiji (Hiroyuki Tanoi).

BLACK-BELLIED STORM-PETREL *Fregetta tropica tropica*

Range Breeds across sub-Antarctic oceans. In regions covered by current expedition, only previously recorded in Melanesia. **Hawaiian Islands** None recorded (Pyle & Pyle 2017). **Micronesia** None recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006, 26 May to 19 June 2008, and 25 November to 10 December 2009 (Pierce *et al.* 2006, 2008, 2011). **Melanesia** Scarce migrant to southern Melanesia (Dutson 2011). Two confirmed records in Fiji waters (Watling 2004), including one off Gau Island, 16 May 2009 (Shirihai *et al.* 2009). **West Polynesia** No substantiated records (Watling 2004). None recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006, 22–25 May and 20–23 June 2008, and 22–24 November and 11–13 December 2009 (Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Doubtful ever recorded (Thibault & Cibois 2017).

Sightings Found only in far south of expedition, while approaching and within Fiji. Total of 12 birds significantly increases number of documented records in Fiji where status of species should be amended to: ‘scarce but regular passage migrant, at least in May.’ **13 May** Sailing west toward Taveuni (2: 1, 0, 1). **25 May** Two in morning while drifting at point 3, off Gau. **26 May** Two in morning while drifting at point 2, off Gau. Two in afternoon while sailing to point 1, off Gau. **29 May** Two in morning while drifting at point 2, off Gau. **31 May** One in morning and one in afternoon while drifting at point 2, off Gau.

Recognition Medium-sized storm-petrel, in direct comparison appearing notably larger than Wilson’s Storm-Petrel. Compact with a chunky body, short thick neck, and small head. Fairly short caudal projection, including mid-length tail, with rounded tail-end, and short toe projection. Wings medium-length with short broad inner wing, long outer wing, and pointed wing tips. Plumage black and white. Inconspicuous pale upperwing-covert bars, white underwing panels, and white rump patch wrapping over to underside. Black hood extends to upper belly, white lower belly and flanks, vent and undertail-coverts black, diagnostic though variable ragged black central belly stripe connecting hood to vent. Detailed description in Flood & Fisher (2013a).

Behaviour Attracted to fish oil while sailing and while drifting. While sailing, followed oily wash behind yacht, much gliding interspersed with short series of wing flaps, drifting from one side of wash to other, sometimes drifting 50 metres outside wash, then returning to wash, frequently skiing on one leg stretched forward when seen to dip-down head to snatch food items. While drifting with an oily slick, gliding much of time, circled around slick and surface-seized food items.

Taxonomy, variation, & moult Polytypic, nominate form widespread across sub-Antarctic oceans; morphologically distinct *F. t. melanoleuca* (e.g., lacks central black belly band) breeds on Gough Island and in Tristan da Cunha group, though at-sea range unknown. *Fregetta* taxonomy not resolved (Cibois *et al.* 2015, Robertson *et al.* 2016). No morphological differences between Black-bellied Storm-Petrel observed during expedition and nominate form observed elsewhere in Pacific and Atlantic. On 26 May, primary moult reached p5 on one bird..

Conservation Listed as Least Concern (IUCN Red List of Threatened Species). Melanesia may be more important to species than previously thought.



Figure 3. Black-bellied Storm-Petrel *Fregetta tropica*, 26 May 2022, off Gau Island, Fiji (Hiroyuki Tanoi).

NEW ZEALAND STORM-PETREL *Fregetta maoriana*

Range Considered extinct until rediscovered in 2003 off Coromandel Peninsula and in Hauraki Gulf, North Island, New Zealand (Flood 2003, Saville *et al.* 2003, Stephenson *et al.* 2008). Range away from New Zealand wholly unknown apart from sightings involving five birds off Gau Island, Fiji, one May 2017 (Flood & Wilson 2017), and four May 2022 (below and Flood *et al.* 2022b). (Several records off southeast Australia pending assessment by BirdLife Australia Rarities Committee.) **Hawaiian Islands** None recorded (Pyle & Pyle 2017).

Micronesia None recorded (e.g., Jones 2000; Pierce *et al.* 2006, 2008, 2011). **Melanesia** None recorded (Dutson 2011). **West Polynesia** Presumably scarce but regular visitor in May to Fiji waters (probably other months and elsewhere in region). None recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006, 22–25 May and 20–23 June 2008, and 22–24 November and 11–13 December 2009 (Pierce *et al.* 2006, 2008, 2011). **East Polynesia** None recorded (Thibault & Cibois 2017).

Sightings Four individuals at point 2, off Gau Island, Fiji. **29 May** Bird 1 at 11:19–12:20, bird 2 at 15:05–15:24, and bird 3 at 16:13. **30 May** Bird 4 at 16:13–16:22.

Recognition Black-and-white storm-petrel with plumage pattern like other *Fregetta* storm-petrels, particularly Black-bellied (see above) and White-bellied *F. grallaria*, but with dark streaking on white underbody, like recently described New Caledonian Storm-Petrel *F. lineata* (Bretagnolle *et al.* 2022). Bretagnolle and co-workers provide first detailed account of separation from other *Fregetta* storm-petrels. Four individuals observed during current expedition separated by different patterns of dark streaking on white underbody (Flood *et al.* 2022b).

Behaviour Attracted to fish oil while drifting. Steadily quartered fish oil slick, often for extended periods, slowing to dip feed for short periods, with legs dangling, swinging from side to side in breezier conditions, used legs for positioning, but did not foot-patter like Wilson's Storm-Petrel.

Taxonomy, variation, & moult *Fregetta* taxonomy not resolved (Cibois *et al.* 2015, Robertson *et al.* 2016). No morphological differences between birds observed during expedition and seen off New Zealand. None in primary moult, but plumage worn and primary moult likely in following month.

Conservation Listed as Critically Endangered (IUCN Red List of Threatened Species). Range away from New Zealand virtually unknown, so Fiji waters must immediately be considered of high importance to species.



Figure 4. New Zealand Storm-Petrels *Fregetta maoriana*, 29–30 May 2022, off Gau Island, Fiji (top left and bottom right Mike Danzenbaker, others Hiroyuki Tanoi). In chronological order from top left to bottom right.

POLYNESIAN STORM-PETREL *Nesofregatta fuliginosa*

Range Once widely distributed in Pacific, numerous populations now extirpated or severely reduced in number (e.g., Thibault & Cibois 2017). Breeds locally in tropical and subtropical Pacific, from New Caledonia in west to Salas y Gómez in east. POBSP found this species widely distributed along equatorial latitudes, vast majority between 10°N and 10°S, with concentrations around Phoenix and Line Islands referable to breeding populations in these islands (King 1974). **Hawaiian Islands** None recorded (Pyle & Pyle 2017). **Micronesia** POBSP found concentrations at sea in regions of Phoenix Islands, US Minor Outlying Islands Baker and Howland, Jarvis Island, and Kiritimati (King 1974). Kiritimati nesting season well underway May–June 2008 (Pierce *et al.* 2008), breeds primarily July / August–January (Jones 2000), peak egg-laying September–November (King 1974). Birds disperse from island after breeding (Jones 2000). About half of population show dark flecks / streaks on white underparts, but completely dark birds not recorded (King 1974). Nesting areas primarily limited to five small islets in Manulu Lagoon with population estimate 350–450 birds (King 1974). Nesting now restricted to Central Lagoons on Motu Tabu and Motu Upua, at least formerly in Manulu Lagoon, latter now largely drained for salt production, past estimate 1,000–2,000 birds now much reduced (Jones 2000). Minimum June 2007 population estimate at key locations 200–500 pairs (Pierce *et al.* 2007). Most recent estimated total population 300+ pairs (Pierce *et al.* 2020). In Phoenix Islands, McKean Island held largest known population in region (King 1973, 1974), breeding peak April–July / August (1,000 adults) and definite low October and probably later (30 adults; King 1973, 1974). On Rawaki, highest nesting population recorded October–December (300–400 adults), asymmetric with McKean (King 1974). Rawaki and McKean only two islands found by POBSP to hold breeding populations, with every conceivable plumage variation, from light morph to totally dark individuals (King 1974). Recent significant declines; 20–50 pairs on Rawaki April 2006, 50–100 pairs June 2008; and 10+ pairs on McKean April 2006, none in June 2008 (Pierce *et al.* 2006, Pierce *et al.* 2011). Light morph recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006 (four birds), 26 May to 19 June 2008 (two birds), and 25 November to 10 December 2009 (one bird; Pierce *et al.* 2006, 2008, 2011). **Melanesia** Historically, known to have bred in Fiji and Vanuatu, but no recent confirmed breeding or sight records (Watling 2004). Rare breeder, rarely seen at sea (Dutson 2011). One taken on nest on Kadavu Island, Fiji, September 1876 (Watling 2004), no further confirmed records in Fiji until singles 19 July 2008 and 14 May 2009, in 11 days of chumming off Gau Island (Shirihai *et al.* 2009). **West Polynesia** All-dark Samoan storm-petrel thought to be dark-morph Polynesian Storm-Petrel by Murphy & Snyder (1952). Its appreciably larger size compared to other regional populations suggests distinct breeding population. Historically, known to have bred in Samoan archipelago, but no recent confirmed breeding or sight records (Watling 2004). None recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006, 22–25 May and 20–23 June 2008, and 22–24 November and 11–13 December 2009 (Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Northern region, breeding restricted to Line and Marquesas Islands; southern region, breeding restricted to southernmost Austral, Gambier, and Eastern Islands; mostly found at sea near breeding islands (Thibault & Cibois 2017, Flood & Zufelt 2021). All-dark specimen from Tahiti (specimen lost) probably closely allied to Samoan form (see above West Polynesia above; Bourne 1957).

Sightings Closely mirror findings in conservation work over the previous 15 years. Paucity of sightings in region of McKean during known breeding season provides a negative result for anticipated population recovery post conservation efforts. Variably streaked birds were seen but none remotely approaching dark. The dark-morph gene may have been extirpated. **21 April** Day 4 sailing south from Hawaii to Kiritimati ca. 8°N (4: 0, 4, 0). **22 April** Day 5 sailing south to Kiritimati (4: 0, 2, 2). **23 April** Day 6 sailing south to Kiritimati (2: 0, 0, 2). **24 April** Four off Kiritimati 09:00–13:00, three 13:00–dark. **25 April** Ten offshore Kiritimati to departure at 15:00, none after departure. **27 April** Day 2 sailing west-southwest to Phoenix Islands (1: 0, 1, 0), first streaked bird. **28 April** Day 3 sailing west-southwest to Phoenix Islands (1: 0, 1, 0), unable to check if streaked. **29 April** Day 4 sailing west-southwest to Phoenix Islands (2: 1, 0, 1); one bird not streaked, unable to check other bird. **30 April** Day 5 sailing west-southwest to Phoenix Islands (2: 0, 2, 0); one bird lightly streaked, other not streaked. **01 May** Sail west 20 km to Rawaki, dawn–09:00, one lightly streaked. Drift 5 km east of Rawaki, 09:00–13:30, eight birds, one very lightly streaked, three streaked, unable to check other birds. Circumnavigate island, then drift to dark 2 km west of Rawaki, one bird, unable to check if streaked. Reposition overnight. **02 May** Sail west 20 km to Rawaki, dawn–10:00, one bird, unable to check if streaked. Circumnavigate island 10:00–13:00, two streaked birds. Sail west toward McKean, 13:00–dark, one bird, unable to check if streaked. **29 May** Drift all day at point 2, off Gau, one lightly streaked bird.

Recognition Easily identified by its exceptionally large size for a storm-petrel and unique ‘bicoloured’ plumage of regional light morph. Characteristic plumage features are blackish-brown hood, white ‘cut-throat’, broad dark upper-breast band, longest uppertail-coverts white forming a narrow white crescent at tail base, upperwing greater secondary coverts relatively pale forming wing bar with buff pencil line running along tips of coverts. Unique structural features are an oddly small head, large broad wings, and long deeply forked tail.

Behaviour Identical to populations studied at other breeding sites. Approached fish oil slick by gliding,

changing direction by ‘kicking’ off sea with one or other leg, depending on required change of direction. Fed by hanging over slick, facing into breeze, wings held in very shallow V-shape, tail spread open, both legs dangling down, made short to long burst of quivering wingbeats, foot-pattered, dipped head down to collect prey, all actions beautifully fluid. Often feed in this manner at one spot for some time or gliding in gentle curve back toward source of fish oil, then repeat actions. Attracted by dripping fish oil, followed yacht performing sustained sailing glides, rarely made short bursts of wingbeats, crossed wake in one direction, flew wide, then skied to change direction and swung back across wake, and so on, again with fluid actions. Travelling flight in moderate wind, observed from yacht, typically involved sustained sailing glides, mainly in direct line, birds continuously tilted to one side, intermittently skiing using leg on dipped side, ‘kicked’ off sea to gain height, occasionally to change direction, generally progressed quite quickly in one direction.

Taxonomy, variation, & moult Classified as monotypic in most key references (e.g., HBWa 2020) and polymorphic, with exclusively pale morph in East Polynesia. Several birds variously streaked on the underside, more so than populations studied elsewhere (Flood & Zufelt 2021, Flood *et al.* 2021, Flood *et al.* 2022a). None in primary moult, though remiges and rectrices of some birds heavily worn, consistent with birds at end of breeding season (like birds off Marotiri and Rapa October 2019; Flood *et al.* 2021).

Conservation Endangered (IUCN Red List of Threatened Species) with numerous historically extinct populations. Continuation of conservation programs on Kiritimati and in Phoenix Islands vital to prevent extirpation from region. Numbers in Phoenix Islands, in particular McKean Island, apparently remain critically low.



Figure 5. Polynesian Storm-Petrel *Nesofregatta fuliginosa*, 27 April 2022, day 2 sailing west-southwest from Kiritimati toward the Phoenix Islands (Kirk Zufelt). A main goal for the expedition was to photograph at sea the colour variations of Polynesian Storm-Petrel shown in Figure 124 in King (1974). The heavily streaked and dark-morph variants have not been photographed at sea. The hope was that the catastrophic decline of the species in the Phoenix Islands caused by introduced invasive mammals (reported by Pierce *et al.* 2006) had been reversed following successful eradication carried out in 2008 (reported by Pierce *et al.* 2011). Notwithstanding the conservation efforts, we found few Polynesian Storm-Petrels in the environs of the Phoenix Islands, no dark-morph bird, with the most strongly dark-streaked bird shown here. In addition to the breast and flank streaks, the bird’s white ‘cut-throat’ was reduced in size and streaked, the feathering above the thighs was dark smudged, and the white uppertail-coverts had large dark centres. Some other birds were more lightly streaked.



Figure 6. Polynesian Storm-Petrels *Nesofregatta fuliginosa*, 23 April 2022, off Kiritimati (*Hiroyuki Tanoi*). Many birds off Kiritimati and Phoenix Islands had narrow white ‘cut throat’, light streaking on breast and flanks, largely dark under primary coverts and undertail-coverts, and marked uppertail-coverts (latter not shown here).

LAYSAN ALBATROSS *Phoebastria immutabilis*

Range Breeds Hawaii, Japan, and Mexico, disperses across North Pacific. Ranges north of 20°N, but 10°N south of Hawaii (King 1974). **Hawaiian Islands** Population estimate all islands *ca.* 152,250 to 1,953,900 birds (King 1974). *Ca.* 99% of population breed on northwest islands, over 850,000 pairs mid-2010s, smaller tenuous colonies southeast islands (Pyle & Pyle 2017). **Micronesia** None recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006, 26 May to 19 June 2008, and 25 November to 10 December 2009 (Pierce *et al.* 2006, 2008, 2011). **Melanesia** Single records from north of Papua New Guinea and off southern Solomon Islands (Dutson 2011). **West Polynesia** None recorded (Watling 2004). None recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006, 22–25 May and 20–23 June 2008, and 22–24 November and 11–13 December 2009 (Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Single record north of Line Islands, *ca.* 8.50°N, 163.60°W, February 1945 (Thompson 1951, Thibault & Cibois 2017).

Sightings **16 April** One soon after departure. **17 April** Two during afternoon drift over Perrier Seamount.

Recognition Distinctive albatross of North Pacific with no confusion species within its range.

Behaviour Foraging in area and showed little interest in yacht.

Taxonomy, variation, & moult Monotypic. Typical of Hawaii breeding populations. None in primary moult.

Conservation Near Threatened (IUCN Red List of Threatened Species).

MATSUDAIRA'S STORM-PETREL *Hydrobates matsudairae*

Range Breeds Volcano Islands, Japan, January–July, migrates via tropical northwest Pacific to tropical North Indian Ocean. **Hawaiian Islands** None recorded (Pyle & Pyle 2017). **Micronesia** To be expected in western region. Eastern region, none recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006, 26 May to 19 June 2008, and 25 November to 10 December 2009 (Pierce *et al.* 2006, 2008, 2011). **Melanesia** Regular migrant in small numbers around New Ireland and north of Bismarck archipelago (Dutson 2011). One off Gau Island, 13 May 2009, in 11 days of chumming, the only record for Fiji (Shirihai *et al.* 2009). **West Polynesia** None recorded (Watling 2004). None recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006, 22–25 May and 20–23 June 2008, and 22–24 November and 11–13 December 2009 (Pierce *et al.* 2006, 2008, 2011). **East Polynesia** None recorded (Thibault & Cibois 2017).

Sightings **27 April** Late afternoon, Day 2 sailing west-southwest from Kiritimati to Phoenix Islands, *ca.* 0.5°N, 160.25°W, one inspected oily wash for *ca.* 1 minute giving reasonable views permitting safe ID.

Recognition ‘All-dark’ storm-petrel, only likely confusion species Swinhoe’s Storm-Petrel *H. monorhis*. Separation of this species pair covered in detail by Flood & Fisher (2013a). Briefly, Matsudaira’s larger, with relatively small head, longer broader wings, longer caudal projection, deeper tail fork, duller upperwing ulnar bars, typically larger pale patches at primary bases. Flight style different; Matsudaira’s has stronger wingbeats, longer glides, straighter direction, slower manoeuvres. Experience of flight behaviour essential, though.

Behaviour Explored oily wash though did not actively feed.

Taxonomy, variation, & moult Monotypic. Duration of sighting prevented detailed study but appeared typical of birds in northwest Pacific. Not in primary moult.

Conservation Vulnerable (IUCN Red List of Threatened Species). The sighting suggests wider range in Micronesia and that region covering western Micronesia and western Melanesia is important to species even during breeding season.

LEACH'S STORM-PETREL *Hydrobates leucorhous*

Range Nominate widespread in Atlantic and Pacific, breeding at high latitudes of Northern Hemisphere, post-breeding migrating to equatorial waters and Southern Hemisphere. POBSP found nominate race distributed over much of Pacific, with decided centre of abundance in Central Pacific, greatest winter densities in broad belt along equator, significant population of presumably immature and non-breeding adults found Central Pacific in breeding season (King 1974). **Hawaiian Islands** During survey work southeast Hawaiian waters, observed each month, April–June and October–November, with significantly higher density spring, in particular April, compared to autumn (Spear *et al.* 1999). Strandings and single-day offshore boat trip sightings consistent with these findings (Pyle & Pyle 2017). **Micronesia** Recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006 (one bird), 26 May to 19 June 2008 (none), and 25 November to 10 December 2009 (43 birds; Pierce *et al.* 2006, 2008, 2011). **Melanesia** Vagrant with handful of records north of Bismark archipelago and west of Vanuatu (Dutson 2011). **West Polynesia** None recorded (Watling 2004). Recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006 (none), 22–25 May and 20–23 June 2008 (none), and 22–24 November and 11–13 December 2009 (seven birds; Pierce *et al.* 2006, 2008, 2011). **East Polynesia** During 1960s, POBSP collected several specimens off the Line Islands, and recorded birds far east of Marquesas, while quite numerous at sea March–May 1990 during sea-transect between Society and Line Islands (Thibault & Cibois 2017).

Sightings Consistent with known range and movements. Recorded daily from Honolulu departure to 08 May *ca.* 10°S, except 05 May when exploring waters around McKean Island, Phoenix. Estimates of larger flocks gathered behind yacht to nearest '5'. **16 April** Sailing south toward Perrier Seamount (1: 0, 0, 1). **17 April** Over Perrier Seamount, then sailing south toward Kiritimati (95: 25, 40, 30). **18 April** Day 1 sailing south toward Kiritimati (130: 20, 50, 60). **19 April** Day 2 sailing south toward Kiritimati (100: 50, 35, 15). **20 April** Day 3 sailing south toward Kiritimati (90: 25, 40, 25). **21 April** Day 4 sailing south toward Kiritimati (80: 40, 25, 15). **22 April** Day 5 sailing south toward Kiritimati (60: 25, 15, 20). **23 April** Day 6 sailing south toward Kiritimati (45: 15, 10, 20). **24 April** Arrive Kiritimati (5: 2, 3, 0). **25 April** Cruising Kiritimati (2: 2, 0, 0). **26 April** Day 1 sailing west-southwest to Phoenix Islands (14: 1, 5, 8). **27 April** Day 2 sailing west-southwest to Phoenix Islands (60: 15, 30, 15). **28 April** Day 3 sailing west-southwest to Phoenix Islands (27: 10, 2, 15). **29 April** Day 4 sailing west-southwest to Phoenix Islands (40: 10, 10, 20). **30 April** Day 5 sailing west-southwest to Phoenix Islands (7: 1, 6, 0). **01 May** Arrive and cruise off Rawaki, Phoenix (3: 2, 0, 1). **02 May** Cruise off Rawaki (4: 2, 1, 1). **03 May** Sailing west toward McKean Island, Phoenix (4: 0, 0, 4). **04 May** Arrive and cruise off McKean (1: 1, 0, 0). **05 May** Cruise off McKean (0: 0, 0, 0). **06 May** Day 1 sailing southwest toward Niuafou'ou, Tonga (2: 1, 1, 0). **07 May** Day 2 sailing southwest toward Niuafou'ou, Tonga (2: 1, 0, 1). **08 May** Day 3 sailing southwest toward Niuafou'ou, Tonga (2: 2, 0, 0).

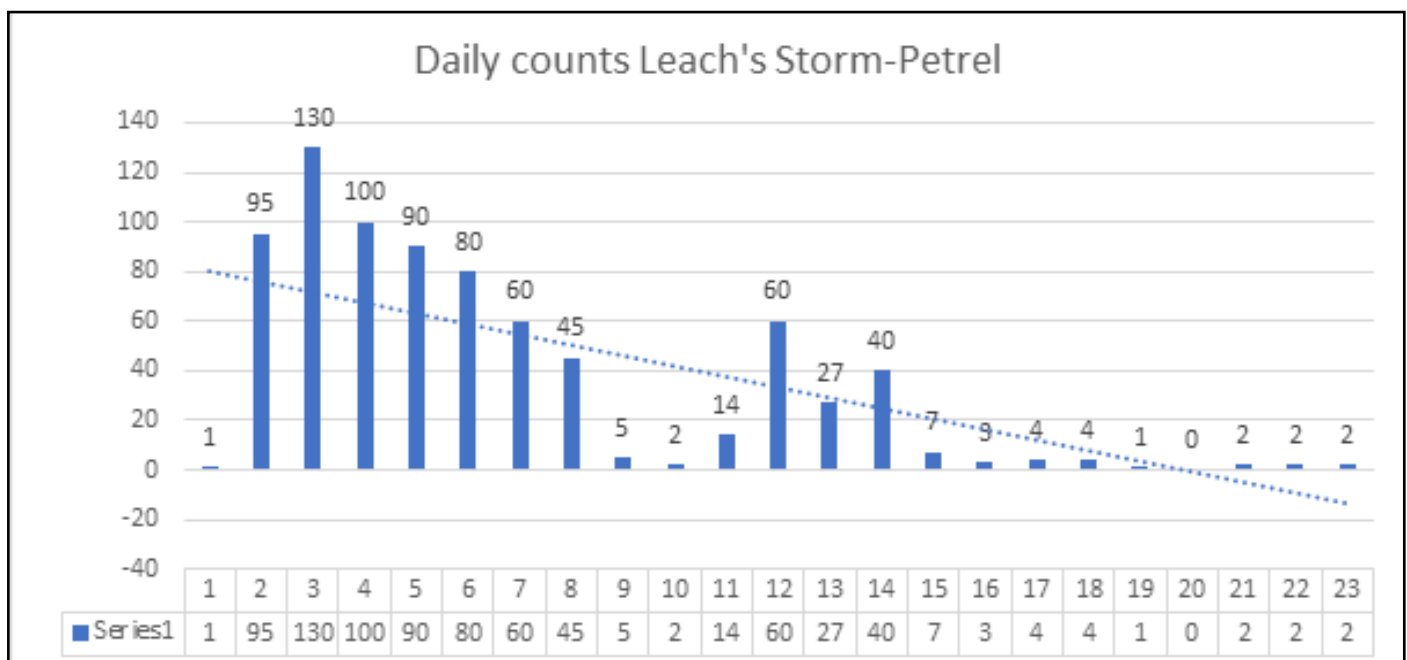


Figure 7. Daily counts of Leach's Storm-Petrel *Hydrobates leucorhous*. Series 1, 1–23 each represents a day, commencing 16 April ('1'), finishing 08 May ('23'). Dotted line an approximate trend line. *Days 1 to 8* Sailing south from Honolulu, Oahu, Hawaii, to Kiritimati. *Days 9 and 10* Off Kiritimati. *Days 11 to 15* Sailing west-southwest to Rawaki, Phoenix Islands. *Days 16 and 17* Off Rawaki. *Day 18* Sailing west to McKean Island, Phoenix Islands. *Days 19 and 20* Off McKean. *Days 21 to 23* Sailing south from McKean toward Field Bank.



Figure 8. Leach's Storm-Petrels *Hydrobates leucorhous*, 18–20 April 2022, south of Hawaii (Kirk Zufelt).

Recognition See Band-rumped Storm-Petrel. Detailed description Flood & Fisher (2013a).

Behaviour While sailing, attracted to oily wash in numbers, at times flocks of 40 or more. Foraged over oily slick with typical buoyant flight, dipped down to collect food, showed interest in splashing teaser.

Taxonomy, variation, & moult Current understanding is Leach's complex comprises nominate form – widespread across Atlantic and Pacific breeding at high latitudes, and Chapman's Storm-Petrel *H. l. chapmani* – breeds northwest Mexico and thought to range into tropical East Pacific (Howell & Zufelt 2019). Minimal variation to rump patch. On 22 April, a presumed Chapman's Storm-Petrel was among nominate form, distinguished by slightly smaller size, browner plumage, all-dark rump with tiny pale side-ovals, rump being paler brown than rest of body. Strong ulnar bars and same flight actions as nominate form. On 26 April, one with dark rump identified as nominate form. No indication of morphological differences between birds observed during expedition and elsewhere in Pacific. On southward sail from Honolulu to Kiritimati, birds mostly wore fresh-looking plumage, thereafter birds wore mostly worn plumage, none in primary moult.

Conservation Vulnerable (IUCN Red List of Threatened Species).

BAND-RUMPED STORM-PETREL *Hydrobates castro* sp.

Range The *castro*-complex is widely distributed across Atlantic and Pacific. Distinct populations breed Japan (recent catastrophic decline), Hawaii, and hot and cool season breeders Galapagos Islands. Presumably disperses widely across Pacific. **Hawaiian Islands** Breeds May–November, population estimates highly uncertain, no confirmed records from islands late November to early April (Pyle & Pyle 2017). Recorded commonly during POBSP south and southwest of islands, one bird south of 8°S, other birds west and northwest to limits of POBSP (King 1974). Central Pacific records probably represent birds from Hawaiian population, though widely ranging populations could occur anywhere in Pacific (King 1974). See Pyle *et al.* (2016) for a discussion about the quandary of Leach’s Storm-Petrel versus Band-rumped Storm-Petrel in Hawaiian waters.

Micronesia None recorded during transect studies Phoenix Islands, 17 April to 06 May 2006, 26 May to 19 June 2008, and 25 November to 10 December 2009 (Pierce *et al.* 2006, 2008, 2011). **Melanesia** Unconfirmed records New Ireland and New Caledonia (Dutson 2011). At least two photographed January 2017 *ca.* 50 km north of Vanuatu (RLF & KZ pers. obs.). **West Polynesia** None recorded (Watling 2004). None recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006, 22–25 May and 20–23 June 2008, and 22–24 November and 11–13 December 2009 (Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Uncertain, though probably scarce visitor to South Equatorial Current (Thibault & Cibois 2017). Two photographed in Marquesas Islands October 2021 (Flood *et al.* 2022a).

Sightings One on margins of Micronesia, Melanesia, and Polynesia, consistent with presumed range. **08 May** Day 3 sailing southwest toward Niuafo‘ou, Tonga, late morning, one in oily wash *ca.* 10.50°S, 174.75°W.

Recognition Details of field separation within complex not yet established and likely to prove challenging. Nominate Leach’s Storm-Petrel *H. leucorhous* and Band-rumped form main confusion pair across Pacific. Leach’s slim in body and wing, pointed wing tips, Band-rumped generally stockier-looking, broader wings, blunter wing tips. Travelling flight, Leach’s wings angled at carpal joints, leading and trailing edges strongly angular, typically outstretched and less angular in Band-rumped. Leach’s quite deep tail fork, typically square-ended in Band-rumped. Leach’s flight more buoyant and erratic compared to methodical flight style of Band-rumped. However, applying these and other criteria at sea is challenging. Detailed descriptions and separation criteria in Flood & Fisher (2013a).

Behaviour While sailing, briefly visited oily wash.

Taxonomy, variation, & moult Taxonomy of *castro*-complex vexed. Likely the four Pacific breeding populations represent distinct taxa. Not known to be separable at sea (Howell & Zufelt 2019).

Conservation Least Concern (IUCN Red List of Threatened Species) does not reflect evidence that complex comprises numerous populations, of which several small and declining. Treated separately, some populations undoubtedly Endangered or Critically Endangered (e.g., catastrophic decline Japanese population).



Figure 9. Band-rumped Storm-Petrel *Hydrobates castro* sp., 08 May 2022, day 3 sailing west-southwest from Kiritimati to Phoenix Islands, *ca.* 10.50°S, 174.75°W (top right; *Hiroyuki Tanoi*). Leach’s Storm-Petrel *Hydrobates leucorhous* (top left) and Wedge-rumped Storm-Petrel *Hydrobates tethys* (bottom left and right) 23 April 2022, north of Kiritimati, *ca.* 4°N, 157°W (*Kirk Zufelt*). Two cryptic taxa picked out from the Leach’s.

WEDGE-RUMPED STORM-PETREL *Hydrobates tethys*

Range Breeds off South America (see Taxonomy), ranges northward to offshore Mexico, and eastward in tropics to *ca.* 150°W (Howell & Zufelt 2019). Central Pacific, recorded to *ca.* 120°W by POBSP (King 1974). **Hawaiian Islands** One 325 km southeast of South Point, Hawaii, 09 October 2010, not accepted by Hawaiian Bird Records Committee (VanderWerf *et al.* 2018, Pyle & Pyle 2017). **Micronesia** None recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006, 26 May to 19 June 2008, and 25 November to 10 December 2009 (Pierce *et al.* 2006, 2008, 2011). One documented with photographs, *ca.* 560 km south of Fanning Island, details to be published elsewhere (H. D. Pratt, pers. comm.). **Melanesia** None recorded (Dutson 2011). **West Polynesia** None recorded (Watling 2004). None recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006, 22–25 May and 20–23 June 2008, and 22–24 November and 11–13 December 2009 (Pierce *et al.* 2006, 2008, 2011). **East Polynesia** None recorded (Thibault & Cibois 2017).

Sightings One in tropics notably beyond western extremity of range pictured in Howell & Zufelt (2019). **23 April** Day 6 sailing south to Kiritimati, one among group of 15 Leach's, *ca.* 4°N, 157°W. See Figure 9 on previous page.

Recognition Similar structure and plumage to Leach's. Picked out by smaller size and fluttery wingbeats. On close inspection, shallower tail fork / notch and distinctive long, wedge-shaped rump, unlike Leach's short, rectangular-shaped rump (details in Howell & Zufelt 2019).

Behaviour Actively foraged and fed over oily wash, like Leach's, including dip feeding, more fluttery flight and quicker actions.

Taxonomy, variation, & moult The Wedge-rumped complex comprises two taxa: nominate form breeds Galapagos Islands, *H. t. kelsalli* breeds inshore islands, central Peru, and Atacama Desert, North Chile (Howell & Zufelt 2019). No indication of morphological differences between birds observed during expedition and those around Galapagos and off Chile and Peru. Not in primary moult.

Conservation Populations combined, Least Concern (IUCN Red List of Threatened Species).

JUAN FERNÁNDEZ PETREL *Pterodroma externa*

Range Endemic breeder of Juan Fernández Islands, December–May (*ca.* 1 million pairs; Brooke 2004). Post-breeding undertakes northward transequatorial migration (HBWa 2020). Clear evidence Juan Fernández Petrel has regular westward dispersal in mid-latitudes of Pacific (Flood & Zufelt 2021, Flood *et al.* 2021). **Hawaiian Islands** Regular during survey work southeast Hawaiian waters, April–June and October–November, highest density June (Pyle & Pyle 2017). POBSP observed highest numbers October, *ca.* half as many June (Spear *et al.* 1999). **Micronesia** None recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006, 26 May to 19 June 2008, and 25 November to 10 December 2009 (Pierce *et al.* 2006, 2008, 2011). **Melanesia** None recorded (Dutson 2011). Tentative record to south Kadavu (Watling 2004). **West Polynesia** None recorded (Watling 2004). Recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006 (none), 22–25 May and 20–23 June 2008 (three birds), and 22–24 November and 11–13 December 2009 (none; Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Seasonally regular and occasionally quite common (Thibault & Cibois 2017, Flood & Zufelt 2021, Flood *et al.* 2022a).

Sightings Eight birds recorded on two sequential days approaching doldrums. **21 April** Day 4 sailing south toward Kiritimati (4: 1, 1, 2). **22 April** Day 5 sailing south toward Kiritimati (5: 1, 3, 1).

Recognition Juan Fernández Petrel lacks white neck collar of smaller-sized White-necked Petrel complex, though worn birds can show narrowish usually rather scruffy whitish neck collar, most typical of old and faded juvenile feathers. Underwing pattern of Juan Fernández Petrel diagnostic: inner wing has dark comma-shaped mark at carpal joint, unlike extended ulnar bar of White-necked Petrel complex; and outer wing has lightly marked, short lesser primary coverts, which are more densely marked in White-necked Petrel complex. Juan Fernández Petrel shows white U-shape distally across longest uppertail-coverts, not present in White-necked Petrel complex, though feature variable and prone to wear and then less evident.

Behaviour As previous expeditions, most flew straight past yacht, though some inspected the oily wash. Travelling flight observed from yacht mainly low, fast, and direct, often tilted and banked, occasionally turned back on themselves, arced in windy conditions.

Taxonomy, variation, & moult Monotypic. No indication of morphological differences between Juan Fernández Petrel observed during expedition and those observed off Juan Fernández Islands. Of eight birds, three were worn and in primary moult. First bird not photographed; second bird very worn with scruffy pale nape and primary moult had reached p4; third bird worn and primary moult had reached p7.

Conservation Vulnerable (IUCN Red List of Threatened Species). Waters south and southeast of Hawaii previously established as important to species.

WHITE-NECKED PETREL *Pterodroma cervicalis*

Range Breeds December–June Kermadec Islands and Phillip Island, Norfolk Island (*ca.* 50,000 pairs; Brooke 2004), non-breeding season mainly moves east to central subtropical Pacific. **Hawaiian Islands** During survey work southeast Hawaiian waters, April–June, seen June, though only in La Niña years 1988 and 1989, and October–November (Spear *et al.* 1999). Regular Hawaiian waters during non-breeding season (Pyle & Pyle 2017). **Micronesia** Recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006 (none), 26 May to 19 June 2008 (one bird), and 25 November to 10 December 2009 (none; Pierce *et al.* 2006, 2008, 2011). **Melanesia** Rare, mostly off New Caledonia, north to Makira Island, Solomon Islands, though not definitely distinguished from Vanuatu Petrel (Dutson 2011). One off Gau Island, Fiji, 18 July 2008, either this species or Vanuatu Petrel (Shirihai *et al.* 2009). Two in nine days off Gau October 2009 (Watling 2010). **West Polynesia** Migrates through region, mainly May–June, may forage south of region while breeding (Jenkins 1980, Watling 2004). Recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006 (two birds), 22–25 May and 20–23 June 2008 (two birds), and 22–24 November and 11–13 December 2009 (nine birds; Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Seasonally regular in small numbers (Thibault & Cibois 2017, Flood & Zufelt 2021).

Sightings Loosely speaking, all three birds within Fiji waters. **12 May** One during evening sailing toward Taveuni Island, Fiji. **13 May** One during morning sailing toward Taveuni Island. **30 May** Drifting off Gau, one in evening at point 2.

Recognition See Juan Fernández Petrel. White-necked Petrel cryptic with Vanuatu Petrel. At-sea identification demands correct assessment of size, Vanuatu Petrel being smaller (Shirihai & Bretagnolle 2010). Most notable plumage differences found in underwings: Vanuatu Petrel typically has none or minimal white ‘tongues’ in inner web at base of under primaries, and greater amount of blackish markings on leading edge of outer wing (Shirihai & Bretagnolle 2010).

Behaviour At-sea behaviour like Juan Fernández Petrel (see above).

Taxonomy, variation, & moult White-necked Petrel and Vanuatu Petrel treated as separate species by Clements Checklist of Birds of the World and IOC World Bird List, while Vanuatu Petrel treated as subspecies by Howard & Moore Complete Checklist of Birds of the World and as subspecies group by Clements Checklist of Birds of the World. No indication of morphological differences between birds observed during expedition and elsewhere in Pacific. None in primary moult.

Conservation Vulnerable (IUCN Red List of Threatened Species).



Figure 10. Juan Fernández Petrel *Pterodroma externa*, 21 April 2022, day 4 sailing south from Hawaii to Kiritimati (*Hiroyuki Tanoi*). Three of the eight birds seen during the expedition were in primary moult. They were non-breeding birds based on the breeding season, December–May; age classification possibilities are a juvenile progressed into second basic moult, an adult failed breeder, or an adult on a sabbatical year.

VANUATU PETREL *Pterodroma occulta*

Range Breeds on Vanua Lava Island, Vanuatu, probably January–June, at-sea range virtually unknown as cryptic with White-necked Petrel. Four previous records suggest widespread range in North and South Pacific: April 1983, roadkill, New South Wales, Australia (Boles *et al.* 1985); January 2006, one, between New Caledonia and Vanuatu (Shirihai *et al.* 2009); September 2018, one photographed, Ogasawara, Japan (Tanoi 2021); and September 2020, one photographed, toward end of primary moult, Ogasawara, Japan (Tanoi 2021). **Hawaiian Islands** None recorded (Pyle & Pyle 2017). **Micronesia** None recorded Kiritimati (Jones 2000). None recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006, 26 May to 19 June 2008, and 25 November to 10 December 2009 (Pierce *et al.* 2006, 2008, 2011). **Melanesia** Probably occurs at sea across southern Melanesia (Dutson 2011). One between New Caledonia and Vanuatu, January 2006 (Shirihai *et al.* 2009). One off Gau Island, Fiji, 18 July 2008, either this species or White-necked Petrel (Shirihai *et al.* 2009). **West Polynesia** None recorded (Watling 2004). None recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006, 22–25 May and 20–23 June 2008, and 22–24 November and 11–13 December 2009 (Pierce *et al.* 2006, 2008, 2011). **East Polynesia** None recorded (Thibault & Cibois 2017).

Sightings An important sighting that adds further insight into virtually unknown at-sea range of taxon. Date of sighting during breeding season, January–June. **22 April** Day 5 sailing south to Kiritimati, one photographed *ca.* 1,000 km north of Kiritimati, *ca.* 6.45°N (details in Flood & Zufelt 2023).

Recognition See White-necked Petrel. Expedition participants experienced with White-necked Petrel. RLF and KZ studied Vanuatu Petrel at Vanuatu, January 2017. Smaller size immediately apparent compared to White-necked Petrels seen during expedition and in forerunning years. Gadfly petrels seen 22 April include six Phoenix Petrels, three Hawaiian Petrels, and 35 Tahiti Petrels (including small Tahiti Petrel, discussed below). Flight behaviour more agile than White-necked due to smaller size. Plumage ‘classic’, with under primaries all-dark (rare on White-necked) and extensive dark markings in short lesser coverts of inner and outer wing (outside typical range of White-necked). Combination of size and plumage aspect safely ID this individual as Vanuatu Petrel.

Behaviour At-sea behaviour like Juan Fernández Petrel (see above).

Taxonomy, variation, & moult See White-necked Petrel for taxonomy. No indication of morphological differences between the Vanuatu Petrel observed during expedition and those observed off Vanuatu. Individual not in primary moult, though central rectrices dropped, had undergone head and body moult – grey mantle, back and scapular feathers, contrast with browner upperwing-coverts.

Conservation IUCN lump Vanuatu Petrel with White-necked Petrel. White-necked Petrel classified Vulnerable (IUCN Red List of Threatened Species). Vanuatu Petrel treated alone probably Endangered.



Figure 11. Vanuatu Petrel *Pterodroma occulta*, 22 April 2022, day 5 sailing from Hawaii to Kiritimati (left Kirk Zufelt, right Hiroyuki Tanoi). Size, structure, and plumage aspect separate this bird from White-necked Petrel.

KERMADEC PETREL *Pterodroma neglecta*

Range In Pacific, breeds mainly November–May, from Lord Howe Island in west, eastwards to Easter Island, Juan Fernández Islands, and Desventuradas Islands (150,000–200,000 birds; Brooke 2004). Recent recognition of substantial population on San Ambrosio (22,686 pairs in accessible areas; Marín *et al.* 2020). Ranges across tropical and subtropical Pacific. **Hawaiian Islands** Uncommon throughout entire region during oceanographic research cruises (Pyle & Pyle 2017). Recorded June and November during survey of southeast Hawaiian waters, POBSP recorded most birds June–January (Spear *et al.* 1999). During same survey, three dark morphs and an intermediate morph recorded June, four light morphs November, POBSP recorded light morph more frequently than dark morph (Spear *et al.* 1999). **Micronesia** Recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006 (one bird), 26 May to 19 June 2008 (none), and 25 November to 10 December 2009 (none; Pierce *et al.* 2006, 2008, 2011). **Melanesia** Rare vagrant, one record from near New Britain, occasionally at-sea off New Caledonia, probably disperses throughout southern Melanesia (Dutson 2011). Presumed regular in Fiji waters and all colour morphs seen (Watling 2004, 2010). May 2009, seen on five out of 11 days involving one to four birds per day, from very pale to all dark (Shirihai *et al.* 2009). **West Polynesia** Recently recorded breeding ‘Ata, Tonga, and occurs across region (Jenkins 1980, Watling 2004). Recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006 (one bird), 22–25 May and 20–23 June 2008 (one bird), and 22–24 November and 11–13 December 2009 (none; Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Breeds southern Austral Islands, southern East Polynesia (*ca.* 1,000 pairs; Thibault & Cibois 2017), southern Tuamotu Islands (several 10s of pairs; Thibault & Cibois 2017), Pitcairn Islands (40,000 pairs; Brooke 1995), and Eastern Islands (small number). At sea, quite common off Pitcairn Islands, uncommon rest of southern East Polynesia, rare or absent elsewhere (Thibault & Cibois 2017, Flood & Zufelt 2021).

Sightings Small number of sightings as expected. **17 April** Light morph during afternoon drift over Perrier Seamount. **18 April** Day 1 sailing south to Kiritimati, two light morphs (2: 1, 1, 0). **11 May** Light morph after leaving Niuafu‘ou, Tonga. **12 May** Light morph over Hydra Seamount. **27 May** Dark morph during afternoon drift at point 2, off Gau Island, Fiji.

Recognition Polymorphic, range of plumages from light to dark. Light morph has similar pattern and brown-toned plumage compared to Herald Petrel. Kermadec Petrel uniquely shows long white primary shafts on upperwing. Structure also separates the two species: Kermadec Petrel compact, thickish neck, stocky body, mid-length caudal projection, shortish tail; Herald Petrel rangy, relatively long narrow neck, slimline body, long tapering caudal projection, including mid-length tail.

Behaviour Showed little interest in fish oil or travelling yacht. Rather, birds continued in typical *Pterodroma* travelling flight behaviour, flying close to yacht perchance. Quite low wing loading and long, medium-width wings reflected in effortless and relaxed flight (Flood & Fisher 2013b).

Taxonomy, variation, & moult Considered polytypic by the four main taxonomic listings, *P. n. juana* southeast Pacific (HBWa 2020). Recent evidence indicates monotypic (Jones *et al.* 2017, V. Bretagnolle *in litt.* 2021). Polymorphic. No indication of morphological differences between Kermadec Petrel observed during expedition and those observed elsewhere in Pacific. None in primary moult.

Conservation Least Concern (IUCN Red List of Threatened Species).



Figure 12. Kermadec Petrels *Pterodroma neglecta*, 11–12 May 2022, Niuafu‘ou, Tonga environs (Hiroyuki Tanoi). As expected, small numbers observed at various points over the course of the expedition.

HERALD PETREL *Pterodroma heraldica*

Range Breeds Raine Island, northeast Australia, and southern Polynesia, from Tonga Islands to Easter Island. Disperses northward after breeding. In Central Pacific, seen most consistently October–February, peaking December (King 1970). Small population breeds Round Island, West Indian Ocean. **Hawaiian Islands** Occasionally recorded all directions from islands (Pyle & Pyle 2017). **Micronesia** None recorded Kiritimati (Jones 2000). None recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006, 26 May to 19 June 2008, and 25 November to 10 December 2009 (Pierce *et al.* 2006, 2008, 2011). **Melanesia** Rare, though probably occurs in small numbers throughout Melanesia (Dutson 2011). **West Polynesia** Possibly breeds Tonga and American Samoa, small numbers occur throughout region (Jenkins 1980, Pyle *et al.* 1990, Watling 2004). Recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006 (one bird), 22–25 May and 20–23 June 2008 (none), and 22–24 November and 11–13 December 2009 (none; Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Occurs throughout region, breeds mainly Pitcairn and Marquesas Islands, smaller colonies Southern Cook, Gambier, and Western Islands (Thibault & Cibois 2017; further details in Flood *et al.* 2022a).

Sightings Three sightings at or near Fiji, Melanesia. **12 May** One over Hydra Seamount early morning while sailing to Taveuni Island, Fiji. **13 May** One late afternoon on approach to Taveuni. **27 May** One in morning drifting at point 2, off Gau Island, Fiji.

Recognition See Kermadec Petrel.

Behaviour Showed little interest in fish oil or travelling yacht. Rather, birds continued in typical *Pterodroma* travelling flight behaviour, flying close to yacht perchance.

Taxonomy, variation, & moult Monotypic. Once considered Pacific race of Trindade Petrel *P. arminjoniana*. Split into two species now generally accepted based on biometrics (Murphy & Pennoyer 1952, Brooke & Rowe 1996), genetics (Booth-Jones *et al.* 2017), and intestinal structure (Imber 1985). Murphy & Pennoyer (1952) considered Herald Petrel polymorphic by incorporating dark petrels that breed on Henderson Island (Henderson Petrel *P. atrata*). This taxonomy remained unchanged until Brooke & Rowe (1996) reported compelling evidence to contrary, i.e., genetic differences, darker brownish-black coloration of Henderson Petrel, and strict assortative breeding with different breeding period on Henderson Island. Split into two species now widely accepted. Main plumage variation in Herald Petrel is morphs, light, intermediate, and dark (see Flood *et al.* 2022c). None in primary moult.

Conservation Least Concern (IUCN Red List of Threatened Species).

PHOENIX PETREL *Pterodroma alba*

Range Breeds year-round Phoenix, Line, Marquesas, Pitcairn Islands, and Easter Island (may have bred Samoa and Tonga). **Hawaiian Islands** Small number of at-sea sightings, some accepted by AOU, but Pyle & Pyle (2017) conclude none identified to exclusion of Tahiti Petrel. **Micronesia** Kiritimati, nests throughout year with two disjunct seasons, November–January and April–June, now restricted to cat-free islets in lagoons, once 20,000–25,000 pairs, much lower now (Jones 2000). June 2007 population estimate at key locations 2,300–3,800 pairs (Pierce *et al.* 2007). Most recent population estimate 10,000+ pairs (Pierce *et al.* 2020). Kiritimati holds largest global population (Pierce *et al.* 2018, 2020). Found in Phoenix Islands, though recent significant declines; 11–20 pairs on Rawaki, April 2006, and 31+ pairs, June 2008 (down from *ca.* 225 individuals reported by Garnett 1983), one bird prospecting Enderbury (none reported by Garnett 1983), none on McKean, April 2006 and June 2008 (none reported by Garnett 1983) (Pierce *et al.* 2006, 2008). Most recent population estimates 20+ pairs Rawaki and less than five pairs Kanton (Pierce *et al.* 2020). Recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006 (one bird outside of transects), 26 May to 19 June 2008 (two birds), and 25 November to 10 December 2009 (one bird; Pierce *et al.* 2006, 2008, 2011). **Melanesia** One 21 May 2009, first confirmed record for Fiji (Shirihai *et al.* 2009). No other records (Dutson 2011). **West Polynesia** Small number of records by experienced observers exist from both Tonga and Fiji (Jenkins 1980, Watling 2004). None recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006, 22–25 May and 20–23 June 2008, and 22–24 November and 11–13 December 2009 (Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Main breeding location Marquesas Islands (*ca.* 300 pairs), though numbers fluctuate, smaller numbers Line, Pitcairn, and Eastern Islands; low population results in few sightings away from breeding islands (Thibault & Cibois 2017, Flood & Zufelt 2021, Flood *et al.* 2022a).

Sightings Expedition records highlight Kiritimati, along with Marquesas Islands (Flood *et al.* 2022a), as last remaining strongholds of Phoenix Petrel and reflect the known catastrophic decline of the species in Phoenix Islands. **21 April** Day 4 sailing south to Kiritimati, most northerly sighting *ca.* 11°N, *ca.* 1,000 km north of Kiritimati (1: 1, 0, 0). **22 April** Day 5 sailing south toward Kiritimati (6: 2, 3, 1). **23 April** Day 5 sailing south toward Kiritimati (2: 2, 0, 0). **24 April** One early morning on approach to Kiritimati, one daytime cruising offshore, 15 in evening. **25 April** Eight during day while cruising offshore Kiritimati, seven late in afternoon



Figure 13. Herald Petrel *Pterodroma heraldica*, 27 May 2022, off Gau, Fiji (Hiroyuki Tanoi).



Figure 14. Phoenix Petrels *Pterodroma heraldica*, 22–24 April 2022, on approach to Kiritimati (Kirk Zufelt).

off mouth of St Stanislas Bay. **26 April** Sailing west toward Rawaki, Phoenix Islands (3: 2, 1, 0). **02 May** One during morning approach to Rawaki, one during evening off Rawaki. **06 May** Day 1 sailing southwest toward Niuafu'ou, Tonga, one after departure from McKean Island, Phoenix. **07 May** Day 2 sailing southwest toward Niuafu'ou, Tonga (1: 0, 1, 0).

Recognition Similar to light-morph Herald Petrel in structure and plumage. However, differs by dark chocolate-brown ground colour, 'all-dark' underwings except for variably chequered marginal forewing lining, and largely white undertail-coverts. Dwarf Tahiti Petrel (see variation for Tahiti Petrel) and Beck's Petrel tricky to separate, especially at distance when size and plumage appear identical. Separated at distance by Phoenix's typically angular wings, generally outstretched on Tahiti Petrel, Tahiti's longer head-and-neck projection forming longer dark hood, and, at close range, Phoenix's pale patch on throat, variably chequered marginal forewing lining, and Tahiti's more robust and distinctly structured *Pseudobulweria* bill (characterised by deep latericorn).

Behaviour Some individuals showed interest in fishy oil wash behind travelling yacht and flew up wash close to stern. Other birds encountered by chance when their flight trajectory crossed our route. Typical *Pterodroma* flight.

Taxonomy, variation, & moult Monotypic. Several individuals in the east of the range, Pitcairn Islands and Easter Island, appear a little more compact with slightly larger head, shorter neck and caudal projection, dumpier body, and several have dusky wash over undertail-coverts. It is possible that the population in the eastern region is more prone to hybridisation due to a very small population, and carries genes, for example, from Herald Petrel and Kermadec Petrel. During the expedition, on 22 April, north of Kiritimati, two presumably non-breeders photographed in primary moult; primary moult reached p7 on one bird and p10 on the other.

Conservation Vulnerable (IUCN Red List of Threatened Species). Phoenix Petrel has suffered concerning population declines, catastrophic in Phoenix Islands, leaving Kiritimati and Marquesas Islands the important strongholds, albeit that they too have experienced a declining population.



Figure 15. Hawaiian Petrels *Pterodroma sandwichensis*, 22–24 April 2022, south of Hawaii (left Kirk Zufelt, right Hiroyuki Tanoi). Regular during sail from Hawaii to Kiritimati until reaching doldrums north of Kiritimati.

HAWAIIAN PETREL *Pterodroma sandwichensis*

Range Breeds April–November exclusively in Hawaii, fledging October–November, ranges across much of subtropical and tropical North Pacific. **Hawaiian Islands** Estimated 3,750–4,500 pairs breed on main islands (Spear *et al.* 1995). Fairly common at sea around islands April–September, uncommon to rare October–March (Pyle & Pyle 2017). **Micronesia** None recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006, 26 May to 19 June 2008, and 25 November to 10 December 2009 (Pierce *et al.* 2006, 2008, 2011). **Melanesia** None recorded (Dutson 2011). **West Polynesia** None recorded (Watling 2004). None recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006, 22–25 May and 20–23 June 2008, and 22–24 November and 11–13 December 2009 (Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Extreme vagrant, one photographed, Gambier Islands (Thibault & Cibois 2017, Flood & Zufelt 2021).

Sightings Seen daily sailing south from Hawaii to Kiritimati until *ca.* 7°S. **16 April** One shortly after departing Waikiki. **17 April** Drifting over Perrier Seamount (14: 3, 4, 7.). **18 April** Day 1 sailing south toward Kiritimati (9: 3, 3, 3). **19 April** Day 2 sailing south toward Kiritimati (8: 6, 1, 1). **20 April** Day 3 sailing south toward Kiritimati (1: 0, 1, 0). **21 April** Day 4 sailing south toward Kiritimati (8: 2, 5, 1). **22 April** Day 5 sailing south toward Kiritimati (3: 3, 0, 0).

Recognition Separated from similar Galapagos Petrel by smaller bill, dark cap not dark cowl, narrower dark ulnar bar in underwing, clean white flanks (Force *et al.* 2007, Pyle *et al.* 2011).

Behaviour Almost all birds attracted by fishy oil wash behind travelling yacht with birds regularly flying 1 km up oily wash to yacht. Typically inspected wash directly behind yacht several times before heading off.

Taxonomy, variation, & moult Previously considered conspecific with Galapagos Petrel *P. phaeopygia* under vernacular name Dark-rumped Petrel. Two taxa recently recognised as good species following genetic studies (Browne *et al.* 1997, Friesen *et al.* 2006). No morphological variation noted. None in primary moult.

Conservation Endangered (IUCN Red List of Threatened Species). Waters around and south of Hawaii evidently of great importance to species.

MOTTLED PETREL *Pterodroma inexpectata*

Range Breeds south New Zealand November–March, migrates April–May to North Pacific and Bering Sea, returns October. **Hawaiian Islands** Survey work southeast Hawaiian waters found densities significantly higher in autumn than spring, mirroring findings of POBSP, with peak counts October (Spear *et al.* 1999). Regular migrant through Hawaiian waters, northward March–April, southward late September–November (Pyle & Pyle 2017). **Micronesia** Recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006 (two birds), 26 May to 19 June 2008 (one bird), and 25 November to 10 December 2009 (one bird; Pierce *et al.* 2006, 2008, 2011). **Melanesia** Uncommon migrant off New Caledonia, perhaps vagrant elsewhere (Dutson 2011). Historically seldom recorded in Fiji waters, but up to three birds seen nearly daily 12–22 May 2009 (Shirihai *et al.* 2009). Strong passage off Gau Island, Fiji, 12–23 October 2009 with highest daily count of 239 (Watling 2010). **West Polynesia** Sightings of northward-moving birds March–May, southward-moving birds October, almost always singles, occasionally twos, rarely threes (Jenkins 1980, Watling 2004). Recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006 (four birds), 22–25 May and 20–23 June 2008 (six birds), and 22–24 November and 11–13 December 2009 (none; Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Few records, though 42 northeast of Line Islands March and May 1990, and recorded several times between Society and Marquesas Islands (Thibault & Cibois 2017).

Sightings On northward passage throughout expedition, from 17 April in the north, to 27 May in the south, demonstrating a protracted period of migration. **17 April** Drifting over Perrier Seamount (2: 1, 1, 0). **19 April** Day 2 sailing south toward Kiritimati (3: 2, 0, 1). **20 April** Day 3 sailing south toward Kiritimati (3: 2, 1, 0). **21 April** Day 4 sailing south toward Kiritimati (2: 1, 1, 0). **23 April** Day 6 sailing south toward Kiritimati (3: 1, 1, 1). **25 April** One on departure from Kiritimati at mouth of St Stanislas Bay. **26 April** Sailing west toward Phoenix Islands (1: 1, 0, 0). **28 April** Sailing west toward Phoenix Islands (3: 0, 0, 3). **29 April** Sailing west toward Phoenix Islands (3: 0, 0, 3). **30 April** Sailing west toward Phoenix Islands (2: 1, 1, 0). **01 May** Singles around Rawaki, Phoenix, early morning, mid-morning, and mid-evening. **02 May** One while circumnavigating Rawaki in morning, one late afternoon after departure. **03 May** Sailing west toward McKean Island, Phoenix (4: 1, 2, 1). **04 May** Two in morning on approach to McKean. **05 May** Around McKean, one early morning, one early afternoon, one mid-evening. **06 May** Day 1 sailing southwest toward Niuafou‘ou, Tonga (1: 1, 0, 0). **13 May** Sailing west toward Taveuni Island, Fiji (1: 0, 1, 0). – International Date Line – **15 May** Sailing west toward Taveuni (2: 0, 0, 2). **26 May** One during morning drift at point 2, off Gau Island, Fiji. **27 May** One during morning drifting at point 2 off Gau, one during afternoon drift at point 1. **29 May** One during afternoon drift at point 2 off Gau.

Recognition Distinctive mid-sized and stocky *Pterodroma* petrel; grey upperside, silvery trailing edge to inner wing, white underside marked with thick black ulnar bar in underwing, densely mottled dark belly.

Behaviour Showed no interest in oily wash while sailing or slick when drifting, mostly flying quickly northwards, in classic high wheeling arcs. A few birds briefly inspected feeding-frenzy activity when flight not as erratic as small-sized *Cookilaria* (subgenus).

Taxonomy, variation, & moult Monotypic. No indication of morphological differences between Mottled Petrel observed during expedition and those observed off New Zealand. None in primary moult.

Conservation Near Threatened (IUCN Red List of Threatened Species). Entire expanse of water covered during expedition clearly crucial to species' migration, though little evidence of foraging and feeding, indicating birds on rapid transit to more productive northern waters.



Figure 16. Mottled Petrels *Pterodroma inexpectata*, 27 May 2022, off Gau, Fiji (Hiroyuki Tanoi).



Figure 17. Black-winged Petrel *Pterodroma nigripennis*, 30 May 2022, off Gau, Fiji (Hiroyuki Tanoi).

BLACK-WINGED PETREL *Pterodroma nigripennis*

Range Breeds mid-November–May in Tasman Sea, Kermadec Islands, New Caledonia, Chatham Islands, and East Polynesia (8–10 million birds; Brooke 2004). Migrates northwards June–November to subtropical and temperate regions for non-breeding season. **Hawaiian Islands** Observed during survey work southeast Hawaiian waters May–June and October–November, not April (Spear *et al.* 1999). One of commonest visiting *Pterodroma* petrels to Hawaiian waters with records year-round, peaking May–December (Pyle & Pyle 2017). **Micronesia** Recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006 (none), 26 May to 19 June 2008 (nine birds), and 25 November to 10 December 2009 (two birds; Pierce *et al.* 2006, 2008, 2011). **Melanesia** Uncommon at sea (Dutson 2011). Species' status uncertain in Fiji waters, though two in May 2009, one fresh plumage, other in heavy moult (Shirihai *et al.* 2009). Two October 2009 (Watling 2010). **West Polynesia** Probably regularly passes through region during post-breeding movements, recently found breeding Tonga (Watling 2004). Recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006 (two birds), 22–25 May and 20–23 June 2008 (eight birds), and 22–24 November and 11–13 December 2009 (17 birds; Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Breeds southern Austral Islands (*ca.* 1,000 pairs in 1989–1990; Thibault & Cibois 2017), probably Marotiri, few 10s of pairs Raivavae (Shirihai 2020). During breeding season, common around Rapa, occasionally observed elsewhere in East Polynesia. Absent from breeding sites in non-breeding season when probably largely absent from East Polynesia (Hutton & Priddel 2002, Thibault & Cibois 2017).

Sightings **21 April** Day 4 sailing south toward Kiritimati (1: 0, 1, 0). **13 May** Sailing west toward Taveuni Island, Fiji (1: 0, 0, 1). **30 May** One during afternoon drift at point 2, Gau Island, Fiji. **01 June** Juvenile mid-morning sailing from point 2 to point 1, off Gau.

Recognition Medium–large-sized *Cookilaria* (subgenus) with predominately pinkish legs (rather than bluish). Forms ID confusion group with Bonin Petrel *Pterodroma hypoleuca* and Chatham Petrel *Pterodroma axillaris* (Flood *et al.* 2016 illustrate plumage differences with Chatham Petrel). Broad diagonal ulnar bar, not as extensive and complex in pattern as Bonin Petrel and Chatham Petrel, but clearly broader than most small-sized *Cookilaria*.

Behaviour Showed little interest in oily wash while sailing or slick formed when drifting, continuing swiftly on their way.

Taxonomy, variation, & moult Monotypic. No indication of morphological differences between Black-winged Petrel observed during expedition and those observed elsewhere in Pacific. None in primary moult.

Conservation Least Concern (IUCN Red List of Threatened Species). Expedition rather early for strong northward passage, but literature clearly demonstrates importance of central North Pacific to species.

COLLARED PETREL *Pterodroma brevipes*

Range Breeds Vanuatu, Fiji, Cook Islands, possibly elsewhere, ranges across tropical West and Central Pacific (Howell & Zufelt 2019), though recorded near Galapagos Islands (Watling 2004). **Hawaiian Islands** None recorded (Pyle & Pyle 2017). **Micronesia** Reported from Kiribati and the Phoenix Islands (Watling 2004). Recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006 (none), 26 May to 19 June 2008 (two birds), and 25 November to 10 December 2009 (none; Pierce *et al.* 2006, 2008, 2011). **Melanesia** Status poorly known, though regular in small numbers across Solomon Islands, Vanuatu, and New Caledonia (Dutson 2011). Regular May 2009 off Gau Island, Fiji, numbers increasing late afternoon, suggesting most / all breeders returning to Gau, 10% dark-bellied birds (Shirihai *et al.* 2009), 17% dark-bellied birds (Watling 1986). Regular May 2017 off Gau (RLF pers. obs.). Common in Fiji waters, recorded all months (Watling 2004). **West Polynesia** Possible breeding reported on Samoa Islands likely to be Herald Petrel, during non-breeding period ranges throughout region (Jenkins 1980, Watling 2004). Recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006 (none), 22–25 May and 20–23 June 2008 (none), and 22–24 November and 11–13 December 2009 (one bird; Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Possibly breeds / bred Rarotonga Island, Southern Cook Islands, Moorea and Tahiti Islands, Society Islands, and Raivavae Island, Austral Islands (Thibault & Cibois 2017, H. Shirihai *in litt.*). Small number of breeders may survive. Otherwise, irregular visitor in small numbers across region (Thibault & Cibois 2017).

Sightings (Abbreviations: L = light morph, I = intermediate morph, D = dark morph.) All but small number of distant individuals photographed. None truly as dark as Magnificent Petrel *P. b. magnificens* described by Bretagnolle & Shirihai (2010). Total of 132 birds observed, 103 light morph (78.0%), 16 intermediate morph (12.1%), 13 dark morph (9.9%). Shirihai *et al.* (2009) and Watling (1986) present their findings in Fiji waters as light or dark. Accordingly, for direct comparison, for 93 birds observed in Fiji waters (from 15 May), 75 light and 18 dark, with percentage ratio light to dark 80.6%:19.4%, compared to Shirihai *et al.* (2009) 90%:10% and Watling (1986) 83%:17%. **08 May** Day 3 sailing southwest toward Niuafu'ou, Tonga, one bird (0L: 0, 0, 0), (0I: 0, 0, 0), (1D: 0, 0, 1). **09 May** Day 4 sailing southwest toward Niuafu'ou, Tonga, passing over

Field Bank, one bird (0L: 0, 0, 0), (0I: 0, 0, 0), (1D: 0, 0, 1). **10 May** Day 5 sailing southwest toward Niuafu'ou, Tonga, five birds (4L: 1, 2, 1), (0I: 0, 0, 0), (1D: 0, 0, 1). **11 May** Approaching Niuafu'ou, one bird (1L: 1, 0, 0), (0I: 0, 0, 0), (0D: 0, 0, 0). **12 May** Over Hydra Seamount, then Zephyr Bank, six birds (4L: 1, 1, 2), (2I: 2, 0, 0), (0D: 0, 0, 0). **13 May** Sailing west toward Taveuni Island, Fiji, 17 birds (11L: 5, 5, 1), (2I: 0, 2, 0), (4D: 3, 1, 0). – International Date Line – **15 May** Light morph early afternoon in channel off Wailagilala Island, Fiji. **16 May** Light morph early morning, two light morphs early evening, intermediate morph late evening, off Taveuni Island, Fiji. **17 May** Intermediate morph mid-morning off Taveuni. **18 May** Sail to Savu Savu, Fiji, light morph mid-morning. **25 May** Off Gau Island, Fiji, eight birds all L. **26 May** Off Gau Island, Fiji, 19 birds (15L: 1, 8, 6), (2I: 1, 1, 0), (2D: 0, 2, 0). **27 May** Off Gau, 14 birds (11L: 5, 3, 3), (1I: 1, 0, 0), (2D: 0, 2, 0). **28 May** Off Gau, four birds (4L: 2, 1, 1), (0I: 0, 0, 0), (0D: 0, 0, 0). **29 May** Off Gau, 26 birds (21L: 7, 6, 8), (4I: 0, 2, 2), (1D: 1, 0, 0). **30 May** Off Gau, 11 birds (8L: 4, 1, 3), (3I: 3, 0, 0), (0D: 0, 0, 0). **31 May** Off Gau, 10 birds (9L: 3, 0, 6), (0I: 0, 0, 0), (1D: 0, 0, 1). **01 June** Off Gau, two light morphs mid-morning.

Recognition Dark and intermediate morphs unique among regional *Pterodroma* species. Light morph makes a confusion pair with Gould's Petrel *P. leucoptera*. Gould's is slightly larger and longer-winged, importantly has narrower black underwing margins, white primary bases, and blackish cowl rather than blackish cap (Howell & Zufelt 2019). Shirihai *et al.* (2009) reported Gould's Petrel from their pelagic work in May 2009, thus we carefully rechecked our photographs and confirm no Gould's Petrel encountered during expedition.

Behaviour Most showed little interest in oily wash or slick formed when drifting, continuing swiftly on their way.

Taxonomy, variation, & moult Polytypic, comprising nominate form and recently described taxon Magnificent Petrel, which breeds Vanua Lava, Vanuatu (Bretagnolle & Shirihai 2010). Polymorphic. No indication of morphological differences between Collared Petrel observed during expedition and those observed elsewhere in Pacific. One bird moulting inner primaries on 29 May.

Conservation Vulnerable (IUCN Red List of Threatened Species).



Figure 18. Collared Petrels *Pterodroma brevipes*, 26–29 May 2022, off Gau, Fiji (Hiroyuki Tanoi). Pale (top left), intermediate (top right), and dark (bottom left) morphs, with little variation on upperside (bottom right).

COOK'S PETREL *Pterodroma cookii*

Range Breeds November–March, Hauraki Gulf, North Island, New Zealand (650,000 mature individuals in 2012; BirdLife International 2021), and Codfish Island, off Stewart Island, New Zealand (15,000 mature individuals and increasing following eradication of Pacific Rats *Rattus exulans* and Wekas *Gallirallus australis*; Rayner *et al.* 2008). **Hawaiian Islands** Rare April (worn plumage), uncommon to moderately common June–November (fresh plumage) (Pyle & Pyle 2017). **Micronesia** Recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006 (none), 26 May to 19 June 2008 (five birds), and 25 November to 10 December 2009 (none; Pierce *et al.* 2006, 2008, 2011). **Melanesia** Rare vagrant, single records off Vanuatu and New Caledonia (Dutson 2011). Seen nine out of nine days off Gau Island, Fiji, in small numbers October 2009 (Watling 2010). **West Polynesia** None recorded (Watling 2004). Recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006 (none), 22–25 May and 20–23 June 2008 (one bird), and 22–24 November and 11–13 December 2009 (none; Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Seasonally regular in small numbers (Thibault & Cibois 2017, Flood & Zufelt 2021).

Sightings Total of twelve birds, mostly reflects known range, though five birds in Fiji waters confirms that species occurs eastern Melanesia (as indicated in Howell & Zufelt 2019). **21 April** Day 4 sailing south to Kiritimati (1: 0, 0, 1). **30 April** Day 5 sailing west-southwest toward Phoenix Islands (2: 1, 0, 1). **03 May** Sailing west to McKean Island (1: 1, 0, 0). **05 May** Off McKean, one in morning while drifting 8 km south-southwest. **07 May** Day 2 sailing southwest toward Niuafo'ou, Tonga (1: 1, 0, 0). **08 May** Day 3 sailing southwest toward Niuafo'ou, Tonga (1: 0, 1, 0). **17 May** Off Taveuni Island, Fiji, juvenile at noon. **28 May** Off Gau Island, Fiji, two in morning while sailing to point 2. **29 May** Two in morning at point 2, off Gau.

Recognition ID confusion species pair with Pycroft's Petrel *P. pycrofti*. Good views or photographs required for safe ID (see Howell & Zufelt 2019). Several reports south of Hawaii likely valid, though not supported by photographs (Pyle & Pyle 2017). Mid-sized *Cookilaria* (subgenus), grey upperparts and dark M-shape across open upperwings, white underparts, narrowish dark ulnar bar across inner wing. Cook's Petrel less compact than Pycroft's Petrel, with relatively longer wings and more slender structure. Pycroft's Petrel has an enlarged head and shorter neck compared to Cook's Petrel. Cook's Petrel has slim dark eye-patch and narrowish white fore supercilium. Pycroft's Petrel has dark hood to below eye and can show short and narrow white fore supercilium. All such impressions change with lighting and angle of view.

Behaviour None showed interest in oily wash or slick formed when drifting, continuing swiftly on their way.

Taxonomy, variation, & moult Monotypic. No indication of morphological differences between Cook's Petrel observed in this expedition and those observed off New Zealand. None in primary moult.

Conservation Vulnerable (IUCN Red List of Threatened Species). Significant population recovery following conservation efforts at breeding colonies, justifying change in status from Endangered to Vulnerable (Rayner *et al.* 2007, 2008).



Figure 19. Cook's Petrels *Pterodroma cookii*, 5 May 2022 (left), off McKean Island, Phoenix Islands; 17 May 2022 (right), off Taveuni Island, Fiji (Hiroyuki Tanoi). Occasionally encountered throughout the expedition.

TAHITI PETREL *Pseudobulweria rostrata*

Range Breeds year-round tropical Pacific Ocean, eastwards from New Caledonia, and various sites Melanesia to East Polynesia. Ranges across tropical and subtropical Pacific (Brooke 2004). World population estimate *ca.* 10,000 pairs (Brooke 2004). Frequency of observation at sea contingent on proximity to breeding colony and size of colony population (e.g., Vanderwerf *et al.* 2006; RLF & KZ pers. obs.). **Hawaiian Islands** During survey work southeast Hawaiian waters, one or two birds 233–244 km from Hawaii (Spear *et al.* 1999). Recorded in small numbers off islands (Pyle & Pyle 2017, Vanderwerf *et al.* 2018). **Micronesia** None recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006, 26 May to 19 June 2008, and 25 November to 10 December 2009 (Pierce *et al.* 2006, 2008, 2011). **Melanesia** Fairly common off New Caledonia and occurs at sea across Melanesia (Dutson 2011). The petrel most frequently seen off Gau Island, Fiji, with ten to 100+ birds per day recorded on 11 days, May 2009, most believed to breed Taveuni Island, northern Fiji (Shirihai *et al.* 2009). Similar findings May 2017 (RLF pers. obs.). **West Polynesia** Range extends across region. Breeds Ta'u, Tutuila, possibly Olosega, American Samoa; observed Tongan waters year-round indicating possible breeding (Watling 2004). Recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006 (one bird), 22–25 May and 20–23 June 2008 (four birds), and 22–24 November and 11–13 December 2009 (none; Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Breeds Society Islands (several 1,000s or more pairs), Marquesas Islands (lower numbers than Society Islands), Gambier Islands (several 10s of pairs); regular at sea except southeast region (Thibault & Cibois 2017, Flood & Zufelt 2021).

Sightings Observations largely reflect known range; increasingly common from 500 km south of Hawaii to Kiritimati, decreasing in numbers while sailing west to Phoenix Islands, scarce in Phoenix Islands, a six-day break in sightings while sailing south to Fiji (a clear break between 'northern' and 'southern' birds), two on approach to Fiji, common off Taveuni Island, Fiji, less common farther south in Fiji. A low percentage of small birds first noted 22 April through to Fiji. One north of Kiritimati on 23 April was Beck's Petrel (see following species account). Others in that region may have been Beck's Petrel, though situation confused by similar-sized 'Dwarf Tahiti Petrel' (see below 'Taxonomy, variation, & moult'). Two birds 12–13 May while approaching Fiji Dwarf Tahiti Petrel. Birds off Taveuni Island, Fiji, all Dwarf Tahiti Petrel, though elsewhere in Fiji some possible regular-sized birds noted. At-sea ranges of Beck's Petrel and Dwarf Tahiti Petrel unknown and excellent photographs required to separate them, however, it is possible that small 'northern' birds were Beck's Petrel, while small 'southern' birds were Dwarf Tahiti Petrel, indicating exclusive foraging zones. **19 April** Day 2 sailing south toward Kiritimati, first bird sighted early morning, *ca.* 460 km south of Hawaii, *ca.* 15.5°N. **20 April** Day 3 sailing south toward Kiritimati (10: 1, 8, 1). **21 April** Day 4 sailing south toward Kiritimati (9: 0, 1, 8). **22 April** Day 5 sailing south toward Kiritimati (35: 15, 3, 17). **23 April** Day 5 sailing south toward Kiritimati (61: 14, 22, 25). **24 April** Arrive Kiritimati *ca.* 09:00 then cruising offshore island (10: 3, 7, 0). **26 April** Day 1 sailing west-southwest toward Phoenix Islands (18: 2, 7, 9). **27 April** Day 2 sailing west-southwest toward Phoenix Islands (11: 3, 3, 5). **28 April** Day 3 sailing west-southwest toward Phoenix Islands (16: 6, 6, 4). **29 April** Day 4 sailing west toward Phoenix Islands (12: 4, 4, 4). **30 April** Day 5 sailing west-southwest toward Phoenix Islands (1: 1, 0, 0). **03 May** Sailing west toward McKean Island, Phoenix Islands (2: 0, 1, 1). **06 May** Day 1 sailing southwest toward Niuafo'ou, Tonga (1: 1, 0, 0). **12 May** Sailing over Hydra Seamount and Zephyr Reef (1: 0, 0, 1). **13 May** Sailing west toward Taveuni Island, Fiji (1: 0, 0, 1). – International Date Line – **15 May** Off Wailagilala Island at dawn, progressed to Taveuni Island, Fiji (18: 1, 6, 11). **16 May** Sail offshore Taveuni, alternating northwards and southwards, distance 15 km during day, 6 km in evening (27: 3, 6, 18). **17 May** As previous day (21: 4, 3, 14). **18 May** Sailing to Suva Suva, Fiji (8: 6, 2, 0). **25 May** One in afternoon while drifting, point 2, Gau Island, Fiji. **26 May** Five in morning drifting at point 2, off Gau; three in afternoon while sailing to point 1, off Gau. **28 May** Drifting at point 2, off Gau (4: 1, 1, 2). **29 May** Drifting at point 2, off Gau (6: 2, 2, 2). **30 May** Drifting at point 2, off Gau (3: 1, 1, 1). **31 May** Drifting at point 2, off Gau (4: 1, 1, 2). **01 June** Off Gau, drifting at point 2, sail to point 1, drift at point 1 (2: 1, 0, 1).

Recognition See Phoenix Petrel and Beck's Petrel.

Behaviour Easily attracted to oily wash behind yacht. Individuals flew up oily wash from at least 1 km back, swooped back and forward off stern, often for prolonged periods.

Taxonomy, variation, & moult Polytypic. All birds had uniform dark underwings, none had whitish underwing stripes. Most birds in Fiji waters seen well or well photographed were 'Dwarf Tahiti Petrel', a form first recognised by Vincent Bretagnolle and Hadoram Shirihai. It is a small, compact, and cryptic form of Tahiti Petrel that may represent a new taxon (see Flood *et al.* subm.). Three 'small Tahiti Petrels' observed after departing Phoenix en route to Fiji probably Dwarf Tahiti Petrel. On 22 April, primary moult noted on two regular-sized birds; primary moult had reached p5 on one bird and p8 on the other bird.

Conservation Near Threatened (IUCN Red List of Threatened Species). Our observations indicate that region from 500 km south of Hawaii to Kiritimati, and on to Phoenix Islands, though not within Phoenix Islands, is important to the species. Fiji waters are important to breeding population of Dwarf Tahiti Petrel on Taveuni.

BECK'S PETREL *Pseudobulweria becki*

Range Known only from specimens collected by Beck in 1928 and 1929 until rediscovered in 2007 by Hadoram Shirihai, with suspected breeding at New Ireland, Papua New Guinea (Shirihai 2008). No nest found, though a satellite-tracked bird was over land at night seven times; mainly over southern New Ireland, where the signal was also lost for extended periods suggesting occupancy of an underground burrow (Rayner *et al.* 2019). No confirmed at-sea observation away from environs of suspected breeding grounds. **Hawaiian Islands** None recorded (Pyle & Pyle 2017). **Micronesia** None recorded. **Melanesia** Suspected breeding at New Ireland, Papua New Guinea (Shirihai 2008, Rayner *et al.* 2019). Recorded in rafts at Silur Bay, New Ireland (Shirihai 2008, Flood *et al.* 2017, Rayner *et al.* 2019). The satellite-tracked bird mentioned above migrated 1,400 km west to north of West Papua (Rayner *et al.* 2019). **West Polynesia** None recorded (Watling 2004). **East Polynesia** None recorded (Thibault & Cibois 2017).

Sightings A low percentage of 'small Tahiti Petrels' observed from 22 April while sailing south toward Kiritimati. Only small bird well photographed between Hawaii, Kiritimati, and Phoenix Islands, presumed to be Beck's Petrel. **23 April** Day 6 sailing south to Kiritimati, one photographed *ca.* 180 km north of Kiritimati, *ca.* 4.15°N (details in Flood & Zufelt 2023).

Recognition Good view as presumed Beck's Petrel approached stern, close views off stern. RLF and KZ quickly realised bird was smaller than regular-sized Tahiti Petrel, of which 61 logged that day. Looked closer in size to Phoenix Petrel, of which two logged that day. Exact time of sighting recorded so correct photographs retrieved for study. Indeed, first impression at distance was Phoenix Petrel, but structure and plumage colour soon confirmed a Tahiti-type petrel. Field sightings and photographs conformed with species descriptions (Shirihai 2008, Harrison *et al.* 2021): Same basic shape and plumage as Tahiti Petrel but differed as follows: shorter wingspan and narrower wings; shorter bill, though quite deep at base; slighter, slimmer, more elongated body; longer more pointed caudal projection and more extensive undertail; whitish indent at shoulder between dark flanks and hood; more rapid wingbeats, more manoeuvrable, sharper turns, giving different jizz when approaching stern; not compact like Dwarf Tahiti Petrel.

Behaviour Attracted to oily wash behind yacht. Flew up oily wash from distance and swooped past stern.

Taxonomy, variation, & moult Monotypic. Meets criteria for identification given by Shirihai (2008) and Harrison *et al.* (2021). Not in primary moult.

Conservation Critically Endangered (IUCN Red List of Threatened Species). The sighting north of Kiritimati gives the first indication of waters used by and thus important to the species.



Figure 20. Presumed Beck's Petrel *Pseudobulweria becki*, 23 April 2022, *ca.* 180 km north of Kiritimati, *ca.* 4.15°N (Kirk Zufelt). The first truly oceanic record of this species away from the breeding grounds.

FIJI PETREL *Pseudobulweria macgillivrayi*

Range Mostly unknown. Type specimen collected on Gau Island, Fiji, in 1885 and reported by English zoologist George Robert Gray (Shirihai *et al.* 2009). Went unrecorded for 130 years until rediscovered on Gau in 1984 by Dick Watling. Thereafter, groundings on Gau and four documented (published, excluding ebird) sets of sightings offshore Gau are all that confirm the species remains extant. No nest found. **Hawaiian Islands** None recorded (Pyle & Pyle 2017). **Micronesia** None recorded. **Melanesia** Rediscovered on Gau Island, Fiji, 1984 (Watling 1986). Only reliably recorded on Gau and over nearby waters, mainly to south, with eight over 11 days May 2009 and three over nine days October 2009 (Priddel *et al.* 2008, Shirihai *et al.* 2009, Watling 2010). Singles off Gau 16 April 2014 (photographed) and 19 May 2017 (RLF pers. obs.). Handful of records of all-dark *Pseudobulweria* in Bismarck archipelago either this species or undescribed taxon (Shirihai 2008, Bird 2017, Flood *et al.* 2017). **West Polynesia** None recorded (Watling 2004). **East Polynesia** None recorded (Thibault & Cibois 2017).

Sightings One sighting in eight days of searching, continuous fish-oil drip in daylight hours, setting oily slicks mainly evening time each day. **30 May** At 17:30, while drifting at point 2, off Gau Island, Fiji, an individual explored oily slick for several minutes.

Recognition Fiji Petrel closely related to Tahiti and Beck's Petrels, having same overall shape, though plumage all-dark and overall size evidently smaller. Detailed discussion about ID in Shirihai *et al.* (2009).



Figure 21. Fiji Petrel *Pseudobulweria macgillivrayi*, 30 May 2022, off Gau, Fiji (Hiroyuki Tanoi).

Behaviour Explored oily slick for several minutes before departing.

Taxonomy, variation, & moult Monotypic. Too few birds ever seen or handled for meaningful observations on variation. Not in primary moult.

Conservation Near Threatened (IUCN Red List of Threatened Species). Just one bird recorded in eight days during expedition. In 2017, one bird found in four days. More successful searches in 2009 (Shirihai *et al.* 2009) and 2014 (KZ *et al.* pers. obs.). However, same basic chumming techniques employed, suggesting decline in breeding birds? D. Watling noted pre-2009 strandings on Gau occurred on average every other year, but rate of strandings decreased (pers. comm. 2022). Factual evidence for grave concern about plight of this rarest of tubenoses.

BULWER'S PETREL *Bulweria bulwerii*

Range Breeds on islands throughout disjointed pan-oceanic range, mainly tropical waters (Flood & Fisher 2013a). **Hawaiian Islands** Minimum of 76,555 pairs breed northwest Hawaii, egg-laying late May to early June, fledging September (Harrison 1990). Estimated 92,000 pairs (Pyle & Pyle 2017). Like POBSP, Spear *et al.* (1999) observed Bulwer's Petrel during survey work in southeast Hawaiian waters, spring only, respectively reporting peak densities May and June. Seen regularly, small to moderate numbers around breeding colonies throughout Hawaiian waters, though virtually absent November–March when presumably disperse into tropical Pacific (Pyle & Pyle 2017). **Micronesia** McKean Island, Phoenix Islands, conservative estimate 1,000 birds October (King 1974). Garnett (1983) reported 500 individuals Rawaki, Phoenix Islands, and 200 individuals McKean, breeding in areas of coral rubble. April 2006, just one bird seen Rawaki, at least five pairs June 2008, none on McKean April 2006 and June 2008, when breeding pairs should be prospecting, indicating catastrophic collapse and near-loss of species from Phoenix Islands (Pierce *et al.* 2006, 2008). Population estimates 2006–2009 less than 50 pairs Rawaki, none on McKean (Pierce 2011). Recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006 (none), 26 May to 19 June 2008 (none), and 25 November to 10 December 2009 (one bird; Pierce *et al.* 2006, 2008, 2011). **Melanesia** Uncommon migrant Bismarck archipelago and Solomon Islands July–November, may occur year-round (Dutson 2011). Two unconfirmed reports Fiji waters (Watling 2004). **West Polynesia** None recorded (Watling 2004). Recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006 (none), 22–25 May and 20–23 June 2008 (none), and 22–24 November and 11–13 December 2009 (seven birds; Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Breeds only Marquesas Islands, where widespread and common breeder in Austral summer, present year-round (Thibault & Cibois 2017), perhaps two types occur (Flood *et al.* 2022a).

Sightings Observations sailing south from Hawaii to Kiritimati reflect the known size of the Hawaiian population. The tiny number in region of Phoenix Islands reflects the known catastrophic decline in island group and that population remains critically low despite eradication of introduced invasive mammals from key islands, McKean and Rawaki. **16 April** Four birds after departure Waikiki. **17 April** Drifting over Perrier Seamount (8: 4, 2, 2). **18 April** Day 1 sailing south toward Kiritimati (7: 5, 2, 0). **19 April** Day 2 sailing south toward Kiritimati (31: 5, 9, 17). **20 April** Day 3 sailing south toward Kiritimati (11: 3, 6, 2). **21 April** Day 4 sailing south toward Kiritimati (12: 1, 3, 8). **22 April** Day 5 sailing south toward Kiritimati (15: 6, 8, 1). **23 April** Day 6 sailing south toward Kiritimati (13: 5, 3, 5). **24 April** Arrive Kiritimati and cruising around island, three birds. **25 April** Cruising around Kiritimati, one bird, depart 15:00 crossing mouth of St Stanislas Bay, three birds. **26 April** Day 1 sailing west-southwest toward Phoenix Islands (2: 0, 0, 2). **27 April** Day 2 sailing west-southwest toward Phoenix Islands (1: 0, 1, 0). **28 April** Day 3 sailing west-southwest toward Phoenix Islands (1: 0, 1, 0). **30 April** Day 5 sailing west toward Phoenix Islands (1: 0, 0, 1). **01 May** Activities around Rawaki, two birds during early morning, one early afternoon flew from island out to sea. **03 May** Sailing west toward McKean Island, Phoenix, one bird in afternoon.

Recognition Populations across oceans differ in physical structure (Howell & Zufelt 2019). Following gives generic description of ‘the basic’ Bulwer’s Petrel. Peculiar shape, ‘all-dark’ plumage, buff ulnar bars, effortless flight all contribute to feel of something prehistoric. Typical structural characteristics: small head, long slim body, long wedge-shaped tail; very long arched wings, long arm, very long attenuated hands, pointed wing tips. Although not an issue for experienced seabirders, separation from ‘all-dark’ Pacific storm-petrels detailed in Flood & Fisher (2013a).

Behaviour Most birds observed in travelling flight where very low wing loading and very long flexible wings result in unique buoyant flight that separates this species from all other petrels. Several birds explored oily slick.

Taxonomy, variation, & moult Monotypic, but geographically / temporally isolated cryptic taxa / species likely (Howell & Zufelt 2019). Birds seen well between 26 April and 03 May inclusive impressed all observers with their larger size compared to Hawaiian population. None in primary moult.

Conservation Least Concern (IUCN Red List of Threatened Species). Possibly involves cryptic taxa / species, thus conservation status requires careful attention.



Figure 22. Bulwer’s Petrels *Bulweria bulwerii*, 20 April 2022, day 3 sailing south from Hawaii to Kiritimati (*Hiroiyuki Tanoi*). The population in the Phoenix Islands has undergone a catastrophic decline, but the small number of them that we logged appeared notably larger than the birds shown here north of Kiritimati.

WEDGE-TAILED SHEARWATER *Ardenna pacifica*

Range Breeds Pacific Ocean and South Indian Ocean, seasons vary between populations (*ca.* 5.2 million birds; Brooke 2004). Tropical populations largely sedentary, others migrate to tropics (Flood & Fisher 2020). **Hawaiian Islands** Breeds most islands, adults arrive at colonies March, most depart September–November, remain absent from colonies, scarce Hawaiian waters January–February (Pyle & Pyle 2017). Population *ca.* 70,000 birds across Hawaii group (King 1974); *ca.* 230,000 pairs in northwest Hawaiian Islands and *ca.* 87,000 pairs in southeast Hawaiian Islands (Pyle & Pyle 2017). About 98% of birds breeding Hawaii light morph, proportion dark birds southeast Hawaiian waters 7.8% spring and 5% autumn (respectively, $n = 115$ and 60; Spear *et al.* 1999). POBSP recorded 17.1% dark morph spring and 3.3% autumn (respectively, $n = 6,640$ and 421; Spear *et al.* 1999). In summer and early fall, *ca.* 70 dark-morph birds reported within *ca.* 370 km southeast of Hawaii Island (Force & Ballance 2009), with flocks of several hundred dark-morph birds more recently (P. Pyle pers. comm.). To southwest, POBSP estimated 2,500 birds using Johnston Island; to northwest, POBSP estimated 13,600 birds using French Frigate Shoals, very large populations farther northwest (King 1974). **Micronesia** POBSP estimated 12,000+ birds using Taongi, Marshall Islands (King 1974). Maximum population estimate Kiritimati 6,000 birds (King 1974). Kiritimati, nests May–October, largely on small rat-free islets, population estimates ranging over years from 6,000 to 1 million birds, occasional massive die-offs, leaves islands after breeding (Jones 2000). Minimum population estimate at key locations June 2007, 4,500–8,000 pairs (Pierce *et al.* 2007). Found on three Phoenix Islands, though recent significant declines: 250+ pairs Rawaki April 2006, 20+ pairs June 2008 (down from *ca.* 10,000 individuals reported by Garnett 1983), 47 pairs Enderbury (24 individuals reported by Garnett 1983), one or two flying by McKean April 2006, none in June 2008 (down from *ca.* 500 individuals reported by Garnett 1983) (Pierce *et al.* 2006). Population estimates 2006–2009 500+ pairs Rawaki and Enderbury (Pierce 2011). Recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006 (47 birds), 26 May to 19 June 2008 (five birds), and 25 November to 10 December 2009 (24 birds; Pierce *et al.* 2006, 2008, 2011). **Melanesia** Dark morph a locally common breeder, occurs at sea across Melanesia, probably including migrants from Central Pacific (Dutson 2011). May 2009, seen on eight out of 11 days, from one to 15+ birds per day, while chumming off Gau Island, Fiji; breeds many islands in Fiji, including Gau (Shirihai *et al.* 2009). **West Polynesia** Breeding confirmed Tonga and Niue, suspected Samoa and American Samoa, dark morph dominant, light morph rarely reported (Jenkins 1980, Watling 2004). Recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006 (61 birds), 22–25 May and 20–23 June 2008 (14 birds), and 22–24 November and 11–13 December 2009 (53 birds; Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Localised, dark morph breeding or possibly breeding at 25 localities Line Islands, Marquesas Islands (a few localities), Society Islands (scarce), Cook Islands, Gambier Islands, northern Austral Islands, Eastern Islands (latter possibly occasional); occurs at sea in these regions (Thibault & Cibois 2017, Flood & Zufelt 2021).

Sightings Observations largely reflect known populations and morph mix in regions crossed. **16 April** After departure from Waikiki, one light morph and one dark morph. **17 April** Drifting over Perrier Seamount (72: 6, 12, 54), light morph except one intermediate morph and one dark morph. **18 April** Day 1 sailing south toward Kiritimati (252+: 250+, 1, 1), all light morph, the 250+ mostly rafting birds. **19 April** Day 2 sailing south toward Kiritimati (72: 49, 15, 8), light morph except three dark morph. **20 April** Day 3 sailing south toward Kiritimati (4: 2, 2, 0), all light morph. **21 April** Day 4 sailing south toward Kiritimati (220: 50, 24, 146), *ca.* 85% dark morph (including a few intermediate morph). **22 April** Day 5 sailing south toward Kiritimati (60: 40, 15, 5), dark morph except two light morph. **23 April** Day 6 sailing south toward Kiritimati (82: 12, 55, 15), all dark morph. **24 April** Arrive Kiritimati 09:00 then cruise offshore, 70 dark morph and one light morph on approach, 82 dark morph during day, ‘many’ dark morph during evening with two light-intermediate morph. **25 April** ‘Many’ dark morph throughout day, with many 1,000s of dark morph heading toward mouth of St Stanislas Bay during evening. **26 April** Day 1 sailing west-southwest toward Phoenix Islands (53: 25, 11, 17), dark morph except four light-intermediate morph. **27 April** Day 2 sailing west-southwest toward Phoenix Islands (22: 10, 1, 11), dark morph except three light-intermediate morph. **28 April** Day 3 sailing west-southwest toward Phoenix Islands (84: 40, 3, 41), dark morph except two light-intermediate morph. **29 April** Day 4 sailing west-southwest toward Phoenix Islands (57: 11, 1, 45), all dark morph. **30 April** Day 5 sailing west-southwest toward Phoenix Islands (17: 10, 3, 4), all dark morph. **01 May** Arrive Rawaki, Phoenix Islands, activities around Rawaki, 41 birds on approach, four thereafter, all dark morph. **02 May** Activities around Rawaki, sail west toward McKean Island, Phoenix Islands, at 13:00, one in morning and three in afternoon, all dark morph. **03 May** Sailing west toward McKean (9: 1, 2, 6), all dark morph. **04 May** Activities around McKean, 14 dark morph. **05 May** Activities around McKean, 11 dark morph. **06 May** Day 1 sailing southwest toward Niuafo‘ou, Tonga (17: 6, 3, 8), all dark morph. **07 May** Day 2 sailing southwest toward Niuafo‘ou, Tonga (55: 3, 22, 30), all dark morph. **08 May** Day 3 sailing southwest toward Niuafo‘ou, Tonga (12: 6, 2, 4), all dark morph. **09 May** Day 4 sailing southwest toward Niuafo‘ou, Tonga, passing over Field Bank (64: 29, 17, 18), all dark morph. **10 May** Day 5 sailing southwest toward Niuafo‘ou, Tonga (9: 2, 4, 3),

all dark morph. **11 May** Activities around Niuafo'ou, five dark morph. **12 May** Sailing over Hydra Seamount and Zephyr Reef, three dark morph. **18 May** Sailing to Savu Savu, Fiji, one dark morph. **24 May** Depart reef Viti Levu, Fiji, sail toward Gau Island, Fiji, two dark morph. **27 May** Morning drifting at point 2, off Gau, two dark morph, afternoon drifting at point 1, two dark morph. **28 May** Early morning drifting east of Gau, one dark morph, afternoon drift at point 2, off Gau, two dark morph. **29 May** Drift at point 2, off Gau, four dark morph. **30 May** Drift at point 2, off Gau, three dark morph. **31 May** Drift at point 2, off Gau, one dark morph.

Recognition Medium–large shearwater. All morphs differ from similar-sized / plumaged *Ardenna* shearwaters by buoyant flight, small head, long neck, slim body, large wings, and long wedge-shaped caudal projection. 'All-dark' *Procellaria* petrels are much larger and chunkier with stronger flight.

Behaviour Rarely showed interest in travelling yacht or oily wash. Most seen in travelling flight or feeding frenzies along with *Anous* and *Gygis* terns, boobies, other shearwaters, and frigatebirds. Low wing loading permits graceful and buoyant flight with smooth actions. In light wind, keeps low and makes long sailing glides, with occasional springy wing flaps when it rises a few metres, then slowly descends. In stronger winds, makes extended sailing and wheeling glides without flapping wings.

Taxonomy, variation, & moult Polytypic, nominate breeds South Pacific – main colonies Norfolk, Kermadec, Fiji, and Tonga Islands; *A. p. chlororhyncha* breeds South Indian Ocean – Madagascar to western Australia, North Pacific Ocean – Japan to Revillagigedo Islands off western Mexico, and South Pacific Ocean – New Caledonia to Marquesas and Pitcairn Islands. Light morph commonest morph North Pacific, virtually all light morph Japan, dark morph outnumbers light morph *ca.* 2:1 Revillagigedo Islands, great majority dark morph South Pacific and Indian Oceans, intermediate morph occurs infrequently.

Consistent with known taxonomy and morph mix, expedition noted birds in south around Tonga and Fiji differed from more northerly ones from earlier in expedition. Northern birds, great percentage light morph, from 16 April Hawaii departure, up to and including 21 April, then dramatic switch 22 April, *ca.* 6.5°N, to dark morph with few light and intermediate birds thereafter. Dark-morph birds dark chocolate brown and dark/ish bill tip. Southern birds, 100% dark morph (not even intermediate morph), basically cold greyish brown, bill pale grey no dark tip, impression of larger broader wings and less rakish overall structure. Mainly during 04–06 May, at McKean Island, 100% dark-morph birds clearly on northward passage, notably worn and some in early stages of primary moult. Indicates a distinct population undertaking post-breeding dispersal / migration, presumably from more southerly region such as Tonga and Fiji.

Conservation Least Concern (IUCN Red List of Threatened Species).



Figure 23. Wedge-tailed Shearwaters *Ardenna pacifica*; (left) light morph, 19 April 2022, day 2 sailing south from Hawaii to Kiritimati (*Kirk Zufelt*); (right) dark morph, 8 May 2022, day 3 sailing southwest from Phoenix Islands to Niuafo'ou, Tonga (*Hiroyuki Tanoi*). Predominantly light morph for the first three days sailing south from Hawaii to Kiritimati, sudden switch to dark morph shortly thereafter. Notable northward passage 04–06 May, less intense 07–08 May, of worn and moulting dark-morph birds (shown here).

BULLER'S SHEARWATER *Ardenna bulleri*

Range Breeds Poor Knights Islands, North Island, New Zealand, September–May, and undertakes clockwise transequatorial migration in Pacific (*ca.* 2.5 million individuals; Brooke 2004). **Hawaiian Islands** Occurs regularly in small numbers, northward April–August, southward October–November (Pyle & Pyle 2017). **Micronesia** Recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006 (none), 26 May to 19 June 2008 (four birds), and 25 November to 10 December 2009 (none; Pierce *et al.* 2006, 2008, 2011). **Melanesia** Vagrant with a few historical records (Dutson 2011). Five records Fiji, including singles on two out of 11 days chumming off Gau Island (Shirihai *et al.* 2009). **West Polynesia** Considered vagrant, but possibly annual in small numbers (Jenkins 1980, Watling 2004). Recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006 (none), 22–25 May and 20–23 June 2008 (eight birds), and 22–24 November and 11–13 December 2009 (none; Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Seasonally regular in small numbers (Thibault & Cibois 2017, Flood & Zufelt 2021).

Sightings Observations concentrated in Fiji environs, coupled with May records of Shirihai *et al.* (2009), confirm species regular though scarce migrant to region, at least in May. **12 May** Sailing over Hydra Seamount and Zephyr Reef, two mid-morning. **15 May** On approach to Taveuni Island, Fiji, one late morning. **16 May** Offshore Taveuni, one mid-afternoon. **25 May** Drifting at point 3, Gau Island, Fiji, one mid-morning, sailing to point 2, one early afternoon. **26 May** Drifting at point 2, off Gau, one early morning. **27 May** Drifting at point 2, off Gau, two during morning, drifting at point 1, one late afternoon. **29 May** Drifting at point 2, off Gau, two during afternoon. **30 May** Drifting at point 2, off Gau, one mid-morning, one late afternoon.

Recognition A distinctive medium–large shearwater with no like-shearwater in Pacific. Lightly built, graceful and buoyant flight, long broadish wings, quite long wings, boldly marked plumage, dark grey cap, solid mid-grey hindneck, well defined dark M-pattern across mid-grey open upperwings, underside largely clean-white.



Figure 24. Buller's Shearwater *Ardenna bulleri*, 25 May 2022, off Gau, Fiji (Hiroyuki Tanoi). Worn individual.

SOOTY SHEARWATER *Ardenna grisea*

Range Breeds November–April southeast Australia, New Zealand, southern South America, Falkland Islands (20+ million birds, vast majority in Pacific, recent significant decline; Brooke 2004). Clockwise transequatorial migrant non-breeding season in Atlantic and Pacific. **Hawaiian Islands** During surveys southeast Hawaiian waters, April–June and October–November, recorded all months except June, significantly higher densities autumn, especially November (Spear *et al.* 1999). Common migrant through Hawaiian waters, northward mainly March–April, southward mainly September–November, lower numbers May–August (Pyle & Pyle 2017). **Micronesia** Recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006 (two birds), 26 May to 19 June 2008 (seven birds), and 25 November to 10 December 2009 (one bird; Pierce *et al.* 2006, 2008, 2011). **Melanesia** Classified vagrant, with single records from New Britain, south of Vanuatu, and New Caledonia, though author noted probably overlooked and may occur across Melanesia (Dutson 2011). Few seen off Gau Island, Fiji, most days 13–22 May 2009 (Shirihai *et al.* 2009). Two to eight birds daily 20–21 and 23–25 May 2017, with exceptional passage of 30+ on 19 May 2017 (RLF pers. obs.). **West Polynesia** Almost certainly occurs annually on migration through region, most common northward May, scarcer southward September–November (Jenkins 1980, Watling 2004). Recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006 (none), 22–25 May and 20–23 June 2008 (120 birds), and 22–24 November and 11–13 December 2009 (22 birds, plus 41 Sooty or Short-tailed; Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Seasonally regular in small numbers (Thibault & Cibois 2017, Flood & Zufelt 2021).

Behaviour Sometimes attracted to oily wash, made brief investigation before moving on, other times passed by showing little interest. Associated with seabird feeding frenzies.

Taxonomy, variation, & moult Monotypic. No indication of morphological differences between those observed during expedition and breeders at New Zealand. None in primary moult.

Conservation Vulnerable (IUCN Red List of Threatened Species). Our sightings in Fiji waters confirm region more important to species than previously thought.

Sightings On northward passage throughout regions visited by expedition, confirming regular passage migrant in May through Micronesia and Melanesia. **16 April** Two after departure from Waikiki. **17 April** Drifting over Perrier Seamount (1: 1, 0, 0). **18 April** Day 1 sailing south toward Kiritimati (11: 3, 4, 4). **19 April** Day 2 sailing south toward Kiritimati (7: 7, 0, 0). **20 April** Day 3 sailing south toward Kiritimati (2: 2, 0, 0). **21 April** Day 4 sailing south toward Kiritimati (1: 1, 0, 0). **22 April** Day 5 sailing south toward Kiritimati (8: 0, 3, 5). **23 April** Day 6 sailing south toward Kiritimati (13: 3, 6, 4). **26 April** Day 1 sailing west-southwest toward Phoenix Islands (2: 1, 1, 0). **28 April** Day 3 sailing west-southwest toward Phoenix Islands (3: 0, 0, 3). **29 April** Day 4 sailing west-southwest toward Phoenix Islands (1: 1, 0, 0). **30 April** Day 5 sailing west toward Phoenix Islands (3: 1, 0, 2). **01 May** Activities offshore Rawaki, Phoenix, four during day. **02 May** Activities offshore Rawaki, 13:00 depart west toward McKean Island, Phoenix, three during day. **03 May** Sail west toward McKean (12: 8, 2, 2). **04 May** Activities offshore McKean, two during morning. **05 May** Activities offshore McKean, six during day. **06 May** Day 1 sailing southwest toward Niufo'ou, Tonga (2: 0, 2, 0). **07 May** Day 2 sailing southwest toward Niufo'ou, Tonga (4: 3, 0, 1). **08 May** Day 3 sailing southwest toward Niufo'ou, Tonga (1: 1, 0, 0). **09 May** Day 4 sailing southwest toward Niufo'ou, Tonga, passing over Field Bank (5: 1, 0, 4). **12 May** Sail over Hydra Seamount and Zephyr Reef (17: 0, 11, 6). **13 May** Sail west toward Taveuni Island, Fiji (8: 8, 0, 0). – International Date Line – **15 May** On approach to Taveuni (5: 0, 2, 3). **16 May** Offshore Taveuni, four during day. **17 May** Offshore Taveuni, 11 during day. **18 May** Sail to Savu Savu, Fiji, six during day. **25 May** Morning point 3, off Gau Island, Fiji, afternoon point 2, six during day. **26 May** Morning point 2, off Gau, afternoon point 1, six during day. **27 May** Morning point 2, off Gau, afternoon point 1, four during day. **28 May** Point 2, off Gau, one during day. **29 May** Point 2, off Gau, one during day.

Recognition Separation of Sooty Shearwater from Short-tailed Shearwater *A. tenuirostris* is notoriously difficult (basic separation criteria in Howell & Zufelt 2019, detailed separation criteria in Flood & Fisher 2020). Sooty tends to have more athletic build, long narrow wings, and powerful flight, Short-tailed more compact with dashing flight. Typically, Sooty has high contrast between whitish in underwing-coverts and blackish under primaries, more subdued Short-tailed, but some Sooty have wholly dark underwing-coverts. Rule of thumb, under primary coverts paler than under secondary coverts in Sooty, reverse of Short-tailed. Sooty uniquely has contrasting dark shafts to greater primary coverts. Short-tailed bill shorter with longer nasal tubes as proportion of bill.



Figure 25. Sooty Shearwater *Ardenna grisea*, 25 May 2022, off Gau, Fiji (Mike Danzenbaker). Observed most days in small numbers as birds headed northwards in the early stages of a clockwise transequatorial migration ‘around’ the Pacific. All birds were carefully checked for Short-tailed Shearwater *A. tenuirostris* and no candidate was seen indicating that Short-tailed follows a different route / timing in its migration.

Behaviour On migration, mainly alone or loosely associated with one or two other Sooty. Birds focused on northward migration, few distracted by yacht or oily wash. Conversely, on northern and southern feeding grounds, Sooty easily attracted to chum. Flight direct, strong, energetic, and fast, including high wheeling arcs in windy conditions. Cover ground very quickly. On 07 May, a South Polar Skua *Stercorarius maccormicki* persistently attacked a Sooty.

Taxonomy, variation, & moult Monotypic. No morphological variation noted from birds seen elsewhere in Atlantic and Pacific. None in primary moult.

Conservation Near Threatened (IUCN Red List of Threatened Species). Whole region clearly of importance to the species during passage, though may only feed opportunistically.

FLESH-FOOTED SHEARWATER *Ardenna carneipes*

Range Breeds November–March islands south of Australia and around New Zealand, migrates to North Pacific April–May, returning September–October. Small population St Paul Island, South Indian Ocean. Disperses widely into North Indian and North Pacific Oceans (Flood & Fisher 2020). **Hawaiian Islands** Occurs sporadically on migration, northward April–May, southward September–November (Pyle & Pyle 2017). **Micronesia** Passage through Phoenix Islands discovered by Pierce *et al.* (2006). Recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006 (nine birds), 26 May to 19 June 2008 (two birds), and 25 November to 10 December 2009 (none; Pierce *et al.* 2006, 2008, 2011). Previously not known from these waters (e.g., Watling 2004). **Melanesia** Uncommon migrant throughout region (Dutson 2011). Two records Fiji, both Gau Island, one 21 May 2009, one February 2009 (Shirihai *et al.* 2009). Two October 2009 (Watling 2010). **West Polynesia** Included in old Samoan lists, confirmed early 2000 when specimen retrieved from American Samoan waters, no other records (Watling 2004). Recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006 (73 birds), 22–25 May and 20–23 June 2008 (three birds), and 22–24 November and 11–13 December 2009 (none; Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Rare visitor (Thibault & Cibois 2017, Flood & Zufelt 2021).

Sightings Observations consistent with known status in regions visited during expedition. **19 April** Day 2 sailing south toward Kiritimati, banded female photographed early morning (details in caption to Figure 26). **08 May** Day 3 sailing southwest toward Niuafu‘ou, Tonga (2: 0, 1, 1). **09 May** Day 4 sailing southwest toward Niuafu‘ou, Tonga, passing over Field Bank (3: 2, 1, 0). **10 May** Day 5 sailing southwest toward Niuafu‘ou, Tonga (14: 0, 7, 7). **12 May** Sailing over Hydra Seamount and Zephyr Reef (1: 0, 1, 0). **13 May** Sailing west toward Taveuni Island, Fiji (1: 0, 1, 0). **16 May** Off Tavenui (1: 0, 1, 0). **17 May** Off Tavenui (2: 1, 1, 0). **18 May** Sailing to Savu Savu, Fiji (2: 0, 1, 1). **24 May** One after exiting reef, Viti Levu, Fiji, heading to Gau Island, Fiji. **27 May** One in evening at point 1, off Gau. **31 May** One in afternoon at point 2, off Gau.

Recognition Quite large ‘all-dark’ *Ardenna* shearwater, rather strongly built, mid-depth pinkish bill, mid-sized rounded head, long thickish body, long broadish wings. Rangy structure, quite slender pale pinkish to dark brownish-grey bill, small squarish head, long and slim body, wings relatively long and large compared to body size. Flight less buoyant than Wedge-tailed.

Behaviour Easily attracted to oily wash behind yacht and slick set while drifting. Followed sailing yacht for extended periods, investigating teaser and oily wash close to stern. Repeatedly rested for short periods on sea.

Taxonomy, variation, & moult Monotypic. No morphological variation noted from birds observed at breeding grounds in Australia and New Zealand. None in primary moult.

Conservation Near Threatened (IUCN Red List of Threatened Species). Evidence of widespread decline (Priddel *et al.* 2006, Jamieson & Waugh 2015). Passage through Phoenix Islands recently discovered (Pierce *et al.* 2006) demonstrating importance of region for species.



Figure 26. Flesh-footed Shearwater *Ardenna carneipes*, 19 April 2022, day 2 sailing south from Hawaii to Kiritimati (Kirk Zufelt). Metal band number: Z-66192. Date banded: 12/12/2016. Age/Sex at first marking: Adult (3+)/ Female. Banding location: Ohinau Island, New Zealand. Latitude/Longitude: -36.7254 / 175.8783.

CHRISTMAS SHEARWATER *Puffinus nativitatis*

Range Two disparate breeding populations, respectively in North and South Pacific (combined population *ca.* 50,000–150,000 birds; Brooke 2004). Northern population breeds Hawaii, April–October. Probably ranges west to northern Micronesia (Howell & Zufelt 2019). Southern population breeds Phoenix Islands, Micronesia, to Eastern Islands, East Polynesia, October–March (Thibault & Cibois 2017). Probably migrates toward Middle America (Howell & Zufelt 2019). **Hawaiian Islands** Northernmost breeding at northwest Hawaii, returning February, breeding late spring to early fall, *ca.* 3,000 pairs, departures mostly complete early November (Pyle & Pyle 2017). **Micronesia** Kiritimati, nests year-round on protected islets in lagoons, seasonal peak December–February, 6,000–15,000 birds (Jones 2000). June 2007 population estimate at key locations 4,000–7,000 pairs (Pierce *et al.* 2007). Found on three Phoenix Islands, though recent significant declines: Rawaki *ca.* 500+ pairs April 2006, 435+ pairs June 2008 (down from *ca.* 3,000 individuals reported by Garnett 1983); one or two pairs Enderbury (up from three individuals reported by Garnett 1983), no pairs McKean April 2006 and June 2008 (down from *ca.* 50 individuals reported by Garnett 1983) (Pierce *et al.* 2006). Recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006 (four birds), 26 May to 19 June 2008 (six birds), and 25 November to 10 December 2009 (none; Pierce *et al.* 2006, 2008, 2011). **Melanesia** Vagrant recorded several times north of Bismark archipelago, could occur anywhere at sea (Dutson 2011). Observed at sea off Fiji (Watling 2004). May 2009, one recorded in 11 days chumming off Gau, second record for Fiji (Shirihai *et al.* 2009). **West Polynesia** Observed at sea off Tuvalu (Watling 2004). Recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006 (none), 22–25 May and 20–23 June 2008 (none), and 22–24 November and 11–13 December 2009 (one bird; Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Widespread patchy distribution, breeding or possibly breeding *ca.* 27 localities in island groups Line, Marquesas (several 10s of pairs), Society (possibly extirpated), Gambier, Pitcairn, Austral, and Eastern (4,000–7,000 pairs). Total population East Polynesia less than 10,000 pairs (Thibault & Cibois 2017). **Sightings** Low numbers sailing south from Hawaii, April at start of breeding season, not surprising given recent population estimates from across islands. Low numbers Kiritimati and Phoenix Islands, April at end of breeding season, expected given post-breeding dispersal. **16 April** After departure from Waikiki, two during afternoon. **17 April** Drifting over Perrier Seamount (4: 1, 0, 3). **18 April** Day 1 sailing south toward Kiritimati (2: 1, 0, 1). **19 April** Day 2 sailing south toward Kiritimati (1: 1, 0, 0). **20 April** Day 3 sailing south toward Kiritimati (1: 0, 1, 0). **21 April** Day 4 sailing south toward Kiritimati (1: 1, 0, 0). **22 April** Day 5 sailing south toward Kiritimati (1: 1, 0, 0). **24 April** Arrival at Kiritimati and cruising offshore, two early morning, six during day, 12 in evening. **25 April** Cruising offshore Kiritimati, depart 15:00 crossing mouth of St Stanislas Bay, 10 early morning, five during day, 12 in evening. **26 April** Day 1 sailing west-southwest toward Phoenix Islands, one early morning. **01 May** Arrive Rawaki, Phoenix, activities around island, six early morning, one during day, one at dusk. **02 May** Morning activities around Rawaki, two birds, depart 13:00 west toward McKean Island, one bird.



Recognition A fairly distinctive, smallish shearwater, chocolate-brown shearwater. In addition to smaller size and colour, separated from Short-tailed and Sooty Shearwaters by dark underwing-coverts, typically paler in Short-tailed, whitish in Sooty, though some of both species can have dark underwing-coverts.

Behaviour Showed little interest in sailing yacht or oily wash. Great majority seen in travelling flight.

Taxonomy, variation, & moult Monotypic, northern and southern populations possibly diverged. Birds at Kiritimati, and on subsequent dates, noticeably larger than those seen south of Hawaii. None in primary moult.

Conservation Least Concern (IUCN Red List of Threatened Species).

Figure 27. Christmas Shearwater *Puffinus nativitatis*, 24 April 2022, off Kiritimati (Kirk Zufelt). Low numbers off Kiritimati at the end of the breeding season to be expected in April given post-breeding dispersal.

‘TROPICAL SHEARWATERS *Puffinus* sp.’

Range See ‘Taxonomy’. Widespread across Micronesia, Melanesia, and Polynesia, regions crossed during the expedition. Breeding phenology and at-sea ranges largely unknown, though most found near actual / possible breeding localities, so populations likely sedentary. **Hawaiian Islands** None recorded (Pyle & Pyle 2017). **Micronesia** Micronesian Shearwater *P. dichrous* first confirmed breeding Kiritimati 1965. Breeding known only from Central Lagoon, peak egg-laying June–November, past estimate 2,000 birds, may have increased significantly since 1980 (Jones 2000). June 2007 population estimate at key locations 3,100–4,100 pairs (Pierce *et al.* 2007). Found on three Phoenix Islands, recent significant declines (Pierce *et al.* 2006, 2008): Rawaki – 800+ pairs April 2006, 530+ pairs June 2008 (down from *ca.* 12,000 individuals reported by Garnett 1983); Enderbury – *ca.* 50 pairs (up from three individuals reported by Garnett 1983); McKean – *ca.* 60 pairs April 2006, *ca.* 50 pairs June 2008 (down from *ca.* 5,000 individuals reported by Garnett 1983). Combined population estimates 2006–2009, 1,000+ pairs Rawaki, Enderbury, and McKean (Pierce 2011). Recorded during transect studies in Phoenix Islands, 17 April to 06 May 2006 (16 birds), 26 May to 19 June 2008 (three birds), and 25 November to 10 December 2009 (nine birds; Pierce *et al.* 2006, 2008, 2011). **Melanesia** Melanesian Shearwater *P. gunax* generally uncommon, but quite common off Temotu, eastern Solomon Islands, and north Vanuatu (Dutson 2011). Breeds Fiji, where recorded every month of year (Watling 2004). During at-sea searches for Fiji Petrel, none reported 13–22 May 2009 (Shirihai *et al.* 2009), three on one day during 19–21 and 23–25 May 2017 (RLF pers. obs.). **West Polynesia** Polynesian Shearwater *P. polynesiae* breeds Tonga and American Samoa, breeding suspected Samoa, where frequently observed, apparently sedentary (Jenkins 1980, Watling 2004). Recorded during transect studies Samoa to Tokelau return, 14–16 April and 07–10 May 2006 (four birds), 22–25 May and 20–23 June 2008 (two birds), and 22–24 November and 11–13 December 2009 (one bird; Pierce *et al.* 2006, 2008, 2011). **East Polynesia** Polynesian Shearwater *P. polynesiae* breeds or probably breeds 22 islands in tropical waters (Thibault & Cibois 2017, Flood & Zufelt 2021). See Flood *et al.* (2022a) for distinctly different morphologies of Marquesas and Tahiti populations, both East Polynesia.

Sightings None encountered until three days sailing from Hawaii, entering Micronesia, *ca.* 560 km from northern Line Islands, suggesting origin from nearest islands Kingman / Palmyra, possibly Teraina / Tabuaeran. None seen for three days until arrival at Kiritimati where *ca.* 200 found one evening. Few while sailing from Kiritimati to Phoenix Islands, still in Micronesia, where birds regularly encountered in small numbers, though *ca.* 800 birds found 5 km east of Rawaki, suggesting island population increase since 2008. From four to 12 encountered daily sailing from Phoenix to Niufo‘ou, Tonga, a kingdom in West Polynesia. Very few in Fiji, Melanesia. **21 April** Day 4 sailing south toward Kiritimati (3: 2, 1, 0). **24 April** Arrival and cruising offshore Kiritimati, 11 during day, 25 during evening. **25 April** Cruising Kiritimati, 15:00 departure crossing mouth of St Stanislas Bay, dawn 11 flying away from island, eight during day, *ca.* 200 evening flying toward St Stanislas Bay. **26 April** Day 1 sailing west-southwest toward Phoenix Islands (2: 2, 0, 0). **27 April** Day 2 sailing south toward Kiritimati (1: 0, 1, 0). **01 May** Activities offshore Rawaki, Phoenix. Dawn to 09:00 12 flying out to sea and *ca.* 800 birds 5 km east in large mixed species feeding frenzy (few same location next day). Few during day, 14 birds returning to island late evening. **02 May** Activities offshore Rawaki, 13:00 depart west toward McKean Island. At dawn 22 flying out to sea, few during day. Evening return, first birds offshore 16:45, 17:27, and 17:45, with 38 at dusk flying to island. **05 May** Activities offshore McKean. Evening return, first birds 6 km offshore 15:30, 16:25, and 16:55, then eight at dusk by island. **07 May** Day 2 sailing southwest toward Niufo‘ou, Tonga (4: 0, 1, 3). **08 May** Day 3 sailing southwest toward Niufo‘ou, Tonga (5: 2, 0, 3). **09 May** Day 4 sailing southwest toward Niufo‘ou, Tonga, passing over Field Bank (12: 0, 3, 9). **10 May** Day 5 sailing southwest toward Niufo‘ou, Tonga (2: 1, 0, 1). **11 May** Activities offshore Niufo‘ou, early morning four flying away from island, two during day. Evening return to island from 16:45 with 12 by dusk. **12 May** Sailing over Hydra Seamount and Zephyr Reef (1: 1, 0, 0). **24 May** Leave reef Viti Levu, 12:00 and sail toward Gau Island, Fiji, one in afternoon. **30 May** Drifting point2, off Gau Island, one in morning.

Recognition See captions to Figures 28–35. Basic differences summarised in Howell & Zufelt (2019): Melanesian Shearwater – averages largest and longest-billed, darkest above, blackish crown, dark undertail-coverts. Micronesian Shearwater – averages smallest and shortest-billed, compact, dark undertail-coverts. Polynesian Shearwater – averages mid-sized in body and bill, compact, dark undertail-coverts. Also see ‘Polynesian Shearwater’ in Flood *et al.* (2022a).

Behaviour Nothing to distinguish birds from different regions. At presumed breeding islands, began gathering offshore late afternoon / early evening, main numbers seen late dusk when commenced return to burrows. Occasional birds in travelling flight on open ocean, keeping low, direct course, mainly continuous rapid wingbeats, some short glides, tilting and banking, none in rising arcs, though mostly calm conditions. Feeding typically in small to large mixed species frenzies including *Anous* and *Gygis* terns, boobies, other shearwaters, and frigatebirds. Actual feeding activity included snorkelling, surface diving, skim diving, plunge diving, underwater swimming.

Taxonomy, variation, & moult *Puffinus* taxonomy in tropical Pacific complex and unresolved. Currently three taxa of ‘Tropical Shearwater complex’ recognised in tropical west Pacific – *P. gunax* (Melanesia), *P. dichrous* (Micronesia), and *P. polynesiae* (Polynesia) (Austin *et al.* 2004, Howell & Zufelt 2019). Variation covered in ‘Recognition’. Primary moult noted 25 April on one bird Kiritimati (reached p7 / p8); 01 May on two birds Rawaki (one reached p3, other growing p10); and 11 May on several birds at Niufo‘ou, Tonga (one reached p3).

Conservation Least Concern (IUCN Red List of Threatened Species) treating all forms as ‘Tropical Shearwater’. Urgent need for clearer understanding of taxonomy and thereafter conservation requirements.



Figure 28. Micronesian Shearwater *Puffinus dichrous*, 1 May 2022, off Rawaki, Phoenix Islands (Kirk Zufelt).



Figure 29. Comparison of bill lengths of *Puffinus* shearwaters from recent expeditions in western and central Pacific. From left to right, birds from Tahiti, Tonga, Marquesas, Kiritimati, and Rawaki (Kirk Zufelt). Longest bills on birds off Tahiti and Tonga (Polynesia), shortest bills on birds off Kiritimati and Rawaki (Micronesia). Quite short bills on birds from Marquesas (Polynesia). Taxonomy of Pacific *Puffinus* shearwaters not resolved.



Figure 30. Face of *Puffinus* shearwaters from current expedition. Left off Kiritimati, centre and right off Rawaki (Kirk Zufelt). Face markings quite consistent across Kiritimati and Rawaki populations. Solidly dark cap with border running from just above gape line, under eye, to ear coverts, border straight in some birds, bulging beneath eye in others. Some had distinct pale eye-ring (right bird), partial on others (left bird), just a fragment on rest (centre bird). Also, complete or broken pale pencil line running behind eye.



Figure 31. Underwing-coverts of *Puffinus* shearwaters from current expedition. Top row Kiritimati (Hiroyuki Tanoi), bottom row Rawaki (Kirk Zufelt). Variation in extent of dark markings apparently greater at Kiritimati.



Figure 32. Undertail-coverts of *Puffinus* shearwaters from current expedition. Left and centre from Rawaki, right Kiritimati (*Kirk Zufelt*). In all cases, lateral undertail-coverts dark. Some variation found in undertail-coverts at Rawaki, from clean-white (left) to some dark smudgy markings (centre). Variation in undertail-coverts at Kiritimati ranged from clean-white to substantial dark smudgy markings (right).



Figure 33. Tips of secondary upperwing-coverts of *Puffinus* shearwaters from current expedition. Left and right Kiritimati (*Hiroyuki Tanoi*), centre Rawaki (*Kirk Zufelt*). Variation in whitish / buff tips to upperwing greater secondary coverts, from fully whitish-tipped (left), to whitish-tips largely worn away on inner coverts (centre), to whitish-tips mostly worn away and remainder dirty in appearance (right). Freshest plumages had complete set of whitish tips, forming a whitish pencil line across inner wing. Worn plumages had only a hint of remnant buff tips to the outermost greater secondary coverts. Many were intermediate. Ages of birds unknown.



Figure 34. Examples of *Puffinus* shearwaters in primary moult from current expedition. Top row Kiritimati (*Hiroyuki Tanoi*), bottom row Rawaki (*Kirk Zufelt*). All stages of primary moult found at both island locations.



Figure 35. *Puffinus* shearwaters seen at Niuafu'ou, Tonga, on 11 May 2022 (top two rows Kirk Zufelt, bottom row Hiroyuki Tanoi). At least a dozen birds were seen close to the island and all reasonable quality photographs taken that day included here. Top-left bird recently commenced primary moult and lacks pale tips to upperwing greater secondary coverts. Bottom-left bird presumably with fresh plumage as upperwing greater secondary coverts clearly white-tipped forming a pale pencil line across the inner wing (apparently same centre-left bird). Right-hand column shows underwing-coverts and face markings consistent between birds. Lateral undertail-coverts dark in all cases, with variable dark smudgy markings in undertail-coverts.

OTHER SEABIRDS

Brown Noddy *Anous stolidus* Polytypic, nominate widespread and quite common to common breeder in tropical oceans. Nominative widespread. *A. [s.] galapagensis* endemic to Galapagos Islands. After departure from Waikiki until dark, 160 birds logged. None seen on southward passage to Kiritimati. Small numbers around Kiritimati until departure at dusk with 110 heading toward St Stanislas Bay. None seen on passage from Kiritimati to Phoenix Islands. Common around Rawaki and McKean Islands, few between the two islands. Sailing from Phoenix Islands to Fiji, none except 22 birds on 07 May and 42 birds on 09 May, possibly from nearby atolls. Off Taveuni Island, Fiji, 16–17 May, 320–380 birds logged daily. Thereafter, seen most days involving from one to three birds.

Black Noddy *Anous minutus* Polytypic, nominate widespread breeder in tropical Pacific where it is locally common. Nominative breeds locally from northwest Australia and Micronesia to northwest Hawaii. *A. [m.] americanus* breeds tropical Atlantic. *A. [m.] melanogenys* endemic to Hawaii. *A. [m.] tenuirostris* breeds from Mascarene Islands. Small numbers on first two days after departing Waikiki. Apart from one mid-ocean, next observations around Kiritimati, where quite common. None seen on passage Kiritimati to Phoenix Islands. Common around Rawaki and McKean Islands, none between them. One or two birds on two days passage from Phoenix Islands to Fiji. Off Taveuni Island, Fiji, 16–17 May, 140–300 birds logged daily. Common around Viti Levu with 210 birds on 18 May as we sailed to customs, and ca. 900 birds while sailing inside and outside reef. Seen daily off Gau Island, daily counts varied between three and 66. A notable 480 birds close to Gau on 01 June.

Blue Noddy *Anous ceruleus* Local breeder possibly year-round in tropical central South Pacific. One to six birds daily around Kiritimati. One on day before arrival at Rawaki, Phoenix Islands. Daily counts of ten and 36 on two days around Rawaki. Only other record involved five birds around McKean.

White Noddy *Gygis alba* Polytypic, generally quite common to common breeder in the tropical Indian and Pacific Oceans. After departure from Waikiki until dark, 60 birds logged. One to six birds on four days during passage to Kiritimati. Twenty to forty daily around Kiritimati. Small numbers on most days between Kiritimati and Phoenix Islands. Up to 20 daily around Rawaki and four or five daily around McKean Island. Unlike Black and Brown Noddies, found daily at sea from Phoenix to Fiji, from one to six a day. None recorded around Gau Island, Fiji.

Great Crested Tern *Thalasseus bergii* Polytypic, widespread on islands coastal regions of Southern Africa, Indian Ocean, Western and Central Pacific. Nominative breeds Southern Africa, *T. [b] thalassina* Tanzania and Madagascar, *T. [b] velox* Red Sea, Persian Gulf and North Indian Ocean, *T. [b] cristatus* Southeast Asia, China, and Australia. None seen until Kiritimati. A few at Kiritimati 24–25 April. One was at Niuafu'ou, Tonga, 11 May. One was off Taveuni Island, Fiji, 16 May. Thirteen were inside the reef of Vanua Levu Island, Fiji, 18 May. Two were off Gau Island, Fiji, 29 May.

Grey-backed (Spectacled) Tern *Onychoprion lunatus* Local in tropical Western and Central Pacific. Singles at sea sailing south from Hawaii to Kiritimati, 21 April and 23 April. Eight on arrival Kiritimati, 24 April. Next day, an exceptional 37 single-species flock (a few other terns in vicinity) with Orcas and six more same day – the single largest group that we have encountered of this species. Singles seen on three days of the five-day passage to Phoenix Islands. At Rawaki, Phoenix Islands, 18 and 11 were recorded on consecutive days. Quite common at McKean Island, including juveniles. Thereafter, singles on 17 May off Taveuni Island, Fiji, and 24 May inside the reef Viti Levu, Fiji.



Figure 36. Blue Noddy *Anous ceruleus* (Hiroyuki Tanoi). Most seen around Kiritimati and Rawaki. **Figure 37.** Grey-backed Tern *Onychoprion lunatus* (Kirk Zufelt). Exceptional numbers at Kiritimati.

Bridled Tern *Onychoprion anaethetus* Polytypic, localised in tropics: nominate Eastern Bridled Tern occurs Indian Ocean and West Pacific. Western Bridled Tern *O. [a.] melanopterus* occurs Atlantic and East Pacific. None encountered until Tavenui Island, Fiji, with two 17 May and three 18 May. Thereafter, just one bird 24 May inside the reef of Viti Levu.

Sooty Tern *Onychoprion fuscatus* Polytypic, subspecies definition complex, widespread in tropical oceans. Seen almost every day of the expedition and the only tern to be a truly pelagic forager. Notable counts: Hundreds seen, including juveniles, on 18 April, first day sailing south from Hawaii. Day 4 sailing south, 21 April, a Sooty Tern persistently harassed a Leach's Storm-Petrel (kleptoparasitic behaviour), over 250 birds that day. Many hundreds early next morning. *Ca.* 115 on Day 6 sailing south, 23 April. Large numbers around Kiritimati with 440 on 25 April. Large numbers while sailing from Kiritimati to Phoenix Islands, most adults, 150+ each day, except 905 on Day 3 of passage, halfway to Phoenix, and 820+ on Day 4 of passage, three-quarters way to Phoenix. Numbers around Rawaki 01–02 May uncountable, same McKean 04–05 May, plenty at sea between two islands. Numbers declined steadily sailing south to Fiji, 07 May – 90 birds, 08 May – 51 birds, 09 May – 43 birds, 10 May – three birds, thereafter to end of expedition, from one to three birds daily.

Black-naped Tern *Sterna sumatrana* Polytypic, widespread breeder tropical Indian and Pacific Oceans. Nominant breeds from western Southeast Asia to Central Pacific. *S. [s.] mathewsi* breeds Seychelles to Maldives. Only found in Fijian waters, three off Taveuni Island on 17 May, two there next day, and seven inside the reef, Viti Levu, 24 May.

South Polar Skua *Stercorarius maccormicki* Monotypic, widespread breeder in Antarctic, transequatorial migrant March–October in Atlantic and Pacific. On 07 May, one made prolonged attack on a Sooty Shearwater, the shearwater surface diving to escape, two days sailing south of McKean Island, Phoenix Islands. One near to Vanua Levu Island, Fiji on 18 May.

Pomarine Skua *Stercorarius pomarinus* Monotypic, widespread breeder mainly on Arctic tundra, transequatorial migrant October–May in Atlantic, Pacific, and Indian Oceans. Six fully spooned adults in total. One over Perrier Seamount just south of Hawaii, 17 April. One on Day 2, 19 April, sailing south toward Kiritimati, two next day. One approaching Rawaki, Phoenix Islands, 30 April. One Day 3, 08 May, sailing from Phoenix Islands to Niuafu'ou, Tonga.

Arctic Skua *Stercorarius parasiticus* Monotypic, widespread breeder mainly on Arctic tundra, transequatorial migrant September–May in Atlantic, Pacific, and Indian Oceans. An adult Day 3, 20 April, sailing south from Hawaii to Phoenix Islands.

Laughing Gull *Leucophaeus atricilla* Polytypic, nominate breeds Western Atlantic, from West Indies, Venezuela to French Guiana. *L. [a.] megalopterus* breeds North American Atlantic coast, from Maine to Texas, Pacific coast from southern California to West Mexico. A great surprise, a first-winter bird followed the yacht for several hours on Day 3, 20 April, sailing south from Hawaii to Kiritimati. The bird was *ca.* 4,500 km west of usual range.



Figure 38. South Polar Skua *Stercorarius maccormicki* (*Hiroyuki Tanoi*). Just two birds during expedition. **Figure 39.** Laughing Gull *Leucophaeus atricilla* (*Kirk Zufelt*). *Ca.* 4,500 km west of non-breeding range.

Red-tailed Tropicbird *Phaethon rubricauda* Monotypic, locally common in tropical South Indian, Central and East Pacific Oceans. Singles observed on first three days sailing south from Hawaii, 17–19 April, including an immature bird, and last two days approaching Kiritimati. Three were seen both days around Kiritimati 24–25 April. Sailing to Phoenix Islands, one on 26 April, four on 28 April, and one 30 April. Numerous at Rawaki 01–02 May. Next day, three en route to McKean Island. At least 50 at McKean 04–05 May. Then none until singles 08 May, 10 May, and 11 May sailing to Niuafu‘ou, Tonga.

White-tailed Tropicbird *Phaethon lepturus* Polytypic, nominate widespread, locally quite common including in tropical Pacific. Sailing south from Hawaii to Kiritimati, one Day 1, 18 April and one Day 5, 22 April. Sailing west-southwest from Kiritimati to Phoenix Islands, one Day 3, 28 April and one next day. Then none until singles on three days approaching Niuafu‘ou, Tonga, 08–10 May. Singles on consecutive days approaching Taveuni Island, Fiji, 12–13 May. One off Taveuni 17 May. Singles off Gau Island, Fiji, 26 May, 29 May, and two 30 May.

Great Frigatebird *Fregata minor* Monotypic, widespread, locally quite common in tropical Indian and Pacific Oceans (small population South Atlantic). First observed on approach to Kiritimati with three 23 April, several over next two days around island, and one after departure 26 April. At Rawaki, Phoenix Islands, uncountable numbers 01–02 May. At McKean Island, Phoenix Islands, *ca.* 700 each day 04–05 May. Three at Niuafu‘ou, Tonga 11 May.

Lesser Frigatebird *Fregata ariel* Polytypic, nominate widespread, locally quite common in tropical Indian and Central Pacific Oceans (tiny relict population in South Atlantic proposed as distinct taxon). As Great Frigatebird, first seen on approach to Kiritimati with one 23 April, and 20–30 over next two days around the island. On approach to Rawaki, Phoenix Islands, two 29 April and three 30 April, with uncountable numbers around island 01–02 May. At McKean Island, Phoenix Islands, *ca.* 1,000 each day 04–05 May. Sailing south to Niuafu‘ou, Tonga, four 08 May and one 09 May. Two at Niuafu‘ou on 11 May. Observed daily sailing west to Taveuni Island, Fiji, with three 12 May, one 13 May, two 15 May, three 16 May. One to three daily at Taveuni 16–18 May. Two to four most days off Gau Island, Fiji, 24 May to 01 June.

Masked Booby *Sula dactylatra* Monotypic, widespread, mainly quite common in tropical Indian and Pacific Oceans. Singles close to Hawaii 16–17 April. Seen daily 20 April to 06 May, from one to six birds at sea, 15 each day off Kiritimati 24–25 April, and in Phoenix Islands, at least 150 daily at Rawaki 01–02 May and *ca.* 800 daily at McKean Island. Numbers fell away thereafter with six while sailing away from McKean 06 May and one 09 May. **Nazca Booby** *S. [d.] granti* photographed south of Hawaii (one), 17 April, and Day 4, sailing from Hawaii to Kiritimati, 21 April, consistent with reports of recent range expansion (Vanderwerf *et al.* 2008).

Red-footed Booby *Sula dactylatra* Monotypic, quite common to common in tropical Indian and Pacific Oceans (smaller numbers in Atlantic). Seen practically every day of the expedition. Notable counts: ‘many’ at Kiritimati 24 April. In Phoenix Islands, up to 85 Rawaki 01–02 May and ‘many’ McKean Island 04–05 May. At least 150 Niuafu‘ou, Tonga, 11 May. Over 40 each day off Taveuni Island, Fiji, 16–17 May. Common off Gau Island, Fiji, with 25–70 each day 24 May to 01 June.

Brown Booby *Sula leucogaster* Polytypic, *S. [l.] plotus* generally quite common in the tropical Indian and Pacific Oceans. Most seen around islands with small numbers at sea. A few on departure from Waikiki Yacht Club 16 April. Sailing south toward Kiritimati, two on 21 April and one 22 April. At Kiritimati, 24–25 April, six each day. Single 29 April en route to Phoenix Islands. In Phoenix Islands, at Rawaki, 01–02 May, *ca.* 30 each day, and at McKean Island ‘common’. Singles on 06 and 10 May, sailing south to Niuafu‘ou, Tonga. About 20 at Niuafu‘ou 11 May. Up to nine per day 13–18 May in region of Taveuni Island, Fiji. Over 20 Viti Levu, Fiji, 24 May. Off Gau Island, Fiji, one to four each day, 25 May to 01 June. **Brewster’s Booby** *S. [l.] brewsteri* photographed off Hawaii on 16 April (one male) and at McKean Island 04 May (two males), consistent with reports of recent range expansion (Vanderwerf *et al.* 2008).



CONCLUSION

This report documents results of a 41-day-long, *ca.* 8,000-km pelagic survey of seabirds, with a focus on tubenoses Procellariiformes, April–June 2022, in the Central Pacific, from Hawaii to the Fiji Islands, via Kiribati and the Phoenix Islands. Our observations add to the understanding of seabird range, distribution, and variation in the Central Pacific, and contribute to future consideration of conservation measures in the region. The following are key findings from the expedition.

We report sightings of three taxa of tubenose that give insight into their largely / wholly unknown at-sea ranges. (1) First documented record of Beck’s Petrel away from suspected breeding grounds, at *ca.* 5,500 km northeast of New Ireland, Papua New Guinea. (2) Third documented record of Vanuatu Petrel away from breeding grounds, at *ca.* 4,500 km northeast of Vanua Lava Island, Vanuatu. (3) Second documented record of New Zealand Storm-Petrel away from breeding grounds, at *ca.* 2,000 km north of the Hauraki Gulf, New Zealand.

Further, for Fiji, we report six White-faced Storm-Petrels, which trebles the number of documented records, on five days in the period 16 May to 01 June; 12 Black-bellied Storm-Petrels, which increases the number of documented records sevenfold, on five days in the period 13–31 May; and 12 Buller’s Shearwaters, which more than trebles the number of documented records, on seven days in the period 15–30 May; and for these three species, we recommend the formal status in Fiji, ‘scarce but regular passage migrant, at least in May.’

Limited observations of Polynesian Storm-Petrel in the Phoenix Islands confirm that the local population remains critically low. The expedition did not find the dark morph previously known from the Phoenix Islands – the dark-morph gene may have been lost, though several streaked light morphs were documented. One sighting of Polynesian Storm-Petrel in Fiji, with other recent sightings July 2008 and May 2009, give slim hope that a remnant few breeding pairs survive from a historically much larger population.

Our current and previous expeditions underscore the importance of Kiritimati as the current main stronghold of Phoenix Petrel, especially given the known catastrophic decline of the species in the Phoenix Islands, and no evidence of recovery there, at least not from our observations. Three sightings of Herald Petrel support the suggestion that it occurs in small numbers throughout Melanesia. Mainly during 04–06 May, at McKean Island, a population of 100% dark-morph Wedge-tailed Shearwaters was on northward passage, all in worn plumage and some in early stages of primary moult, presumably coming from the Tonga / Fiji region.

The tiny number of Bulwer’s Petrels seen in the Phoenix Islands reflects the known catastrophic decline there and confirms that the population remains critically low, despite eradication of introduced invasive mammals from key islands. Bulwer’s Petrels seen well in the Phoenix Islands impressed all observers with their larger size compared to the Hawaiian population. This is important because geographically isolated populations of Bulwer’s Petrel, as in the Phoenix Islands, may represent a cryptic taxon / species. One sighting of Fiji Petrel in eight days’ continuous chumming off Gau Island, Fiji, raises concern about the viability of the species. Findings about the proposed ‘Dwarf Tahiti Petrel’, a distinct population that could be a distinct taxon, will be reported later.

The *Puffinus* ‘Tropical Shearwaters’ *sensu lato* around Kiritimati compared to those in the Phoenix Islands showed some variation, for example, in the extent of markings in the underwing-coverts and in the undertail-coverts. However, there was no apparent difference in structure and all had the short bill typical of Micronesian Shearwater *P. dichrous*. However, the birds at at Niuafu‘ou, Tonga were long billed and in all other respects were consistent with Melanesian Shearwater *P. gunax*.

Sightings of Brewster’s Booby and Nazca Booby, both historically restricted to offshore tropical west America, provide more evidence of the spread of these species into the Central Pacific.

Appendix: Cetacean sightings

21 April	20 Spinner Dolphin <i>Stenella longirostris</i>
24 April	Six Common Bottlenose Dolphin <i>Tursiops truncatus</i>
25 April	Four or five Orca <i>Orcinus orca</i> , including large male, with feeding frenzy, including Common Bottlenose Dolphin, tuna, Wedge-tailed Shearwater, Phoenix Petrel, <i>Anous</i> and <i>Gygis</i> terns, and boobies
28 April	30 Pygmy Killer Whale <i>Feresa attenuata</i>
30 April	Three Short-finned Pilot Whale <i>Globicephala macrorhynchus</i> , 20 mixed Pantropical Spotted Dolphin <i>Stenella attenuata</i> and Spinner Dolphin
04 May	One Beaked whale sp. (breaching), three Common Bottlenose Dolphin
08 May	20 Pantropical Spotted Dolphin
09 May	30 Pantropical Spotted Dolphin

ACKNOWLEDGEMENTS

Thanks to Didier and Sophie Wattrelot for safe passage on their expedition yacht *Sauvage* and for the excellent services they provided throughout the 41-day expedition. We acknowledge the other expedition members Mike Danzenbaker and Mike Deverell. We are grateful for the professional copy-editing by Caroline Dudley. Thanks to Ray Pierce, Doug Pratt, Peter Pyle, and Dick Watling for feedback on an earlier text that permitted us to improve the final manuscript.

REFERENCES

- Austin, J. J., Bretagnolle, V., & Pasquet, E. 2004. A global molecular phylogeny of the small *Puffinus* shearwaters and implications for systematics of the Little-Audubon's Shearwater complex. *Auk* 121: 847–864.
- Bird, J. P. 2017. Observations of an all-dark *Pseudobulweria* petrel in the Bismarck Sea, with a review and discussion of recent records. *Bulletin of the British Ornithologists' Club* 137 (4): 272–277.
- BirdLife International. 2021. Species factsheet: *Pterodroma cookii*. [Downloaded from <http://www.birdlife.org> on 10 January 2023.]
- Boles, W. E., Bartram, K., & Clancy, G. P. 1985. First Australian specimen of the White-necked Petrel. *Australian Birds* 19: 51–54.
- Booth Jones, K., Nicoll, M. A. C., Raisin, C., Dawson, D. A., Hipperson, H., Horsburgh G. J., Groombridge, J. J., Ismar, S. M. H., Sweet, P., Jones, C. G., Tatayah, V., Ruhomaun, K., & Norris, K. 2017. Widespread gene flow between oceans in a pelagic seabird species complex. *Molecular Ecology* 26: 5716–5728.
- Bourne, W. R. P. 1957. The Sooty Petrel of Latham, *Fregetta fuliginosa* (Gmelin). *Bulletin of the British Ornithologists' Club* 77: 40–42.
- Bretagnolle, V., & Shirihai, H. 2010. A new taxon of Collared Petrel *Pterodroma brevipes* from the Banks Islands, Vanuatu. *Bulletin of the British Ornithologists' Club* 130: 286–301.
- Bretagnolle, V., Flood, R. L., Gaba, S., & Shirihai, H. 2022. *Fregetta lineata* (Peale 1848) is a valid extant species endemic to New Caledonia. *Bulletin of the British Ornithologists' Club* 142: 111–130.
- Brooke, M. de L., 1995. The modern avifauna of the Pitcairn Islands. In: Benton, T. G., & Spencer, T. (Eds.), *The Pitcairn Islands: biogeography, ecology, and prehistory. Biological Journal of the Linnean Society* 56: 199–212.
- Brooke, M. de L., 2004. *Albatrosses and Petrels Across the World*. Oxford, UK: Oxford University Press.
- Brooke, M. de L., & Rowe, G. 1996. Behavioural and molecular evidence for specific status of light and dark morphs of the Herald Petrel *Pterodroma heraldica*. *Ibis* 138: 420–432.
- Browne, R. A., Anderson, D. J., Houser, J. N., Cruz, F., Glasgow, K. J., Hodges, C. N., & Massey, G. 1997. Genetic diversity and divergence of endangered Galápagos and Hawaiian Petrel populations. *The Condor* 99 (3): 812–815. doi:10.2307/1370494
- Carroll, M., Wakefield, E., Scragg, E., Owen, E., Pinder, S., Bolton, M., Waggitt, J., & Evans, P. 2019. Matches and mismatches between seabird distributions estimated from at-sea surveys and concurrent individual-level tracking. *Frontiers in Ecology and Evolution* 7: article 333. doi:10.3389/fevo.2019.00333
- Cibois, A., Thibault, J.-C., LeCroy, M., & Bretagnolle, V. 2015. Molecular analysis of a storm petrel specimen from the Marquesas Islands, with comments on specimens of *Fregetta lineata* and *F. guttata*. *Bulletin of the British Ornithologists' Club* 135: 240–246.
- Dutson, G. 2011. *Birds of Melanesia*. Christopher Helm: London.
- Flood, R. L. 2003. The New Zealand Storm-petrel is not extinct. *Birding World* 16: 479–482.
- Flood, R. L., & Fisher, A. 2013a. *North Atlantic Seabirds: Storm-petrels & Bulwer's Petrel (revised edition)*. Pelagic Birds & Birding Multimedia ID Guides: Scilly.
- Flood, R. L., & Fisher, A. 2013b. *North Atlantic Seabirds: Pterodroma Petrels*. Pelagic Birds & Birding Multimedia ID Guides: Scilly.
- Flood, R. L., & Fisher, E. 2020. *North Atlantic Seabirds: Shearwaters, Jouanin's & White-chinned Petrels*. Pelagic Birds & Birding Multimedia ID Guides: Scilly.
- Flood, R. L., & Wilson, A. 2017. A New Zealand Storm-petrel *Fregetta maoriana* off Gau Island, Fiji, in May 2017. *Bulletin of the British Ornithologists' Club* 137: 278–286.
- Flood, R. L., & Fisher, E. 2020. *North Atlantic Seabirds: Shearwaters, Jouanin's & White-chinned Petrels*. Pelagic Birds & Birding Multimedia ID Guides: Scilly.
- Flood, R. L., & Zufelt, K. 2021. Pelagic observations Gambier Islands to Tahiti via Austral Islands, October–November 2019, and past expeditions in East Polynesia. Pacific Seabird Group Technical Publication Number 3, 49 pp. Available at pacificseabirdgroup.org/psg-publications/technical-publications/

- Flood, R. L., & Zufelt, K. 2023. Sighting of a Beck's Petrel *Pseudobulweria becki* and a Vanuatu Petrel *Pterodroma [cervicalis] occulta* in remote Oceania, and the process of identification. *Marine Ornithology* 51: in press.
- Flood, R. L., Wilson, A. G., & Zufelt, K., 2016. At-sea Sightings of Chatham Petrel *Pterodroma axillaris* confirm use of waters off New Zealand. *Marine Ornithology* 44: 221–224.
- Flood, R. L., Wilson, A. C., & Zufelt, K. 2017. Observations of five little-known tubenoses from Melanesia in January 2017. *Bulletin of the British Ornithologists' Club* 137: 226–236.
- Flood, R. L., Zufelt, K., Bretagnolle, V., & Shirihai, H. 2021. Pelagic birds around Rapa and Marotiri, French Polynesia, October–December 2019, with notes on Rapa Shearwater *Puffinus myrtae* and Titan Storm-petrel *Fregetta [grallaria] titan*. *Bulletin of the British Ornithologists' Club* 141: 387–411.
- Flood, R. L., Tanoi, S., & Zufelt, K. 2022a. Pelagic observations during a circumnavigation of the Marquesas Islands, French Polynesia, September–October 2021. Pacific Seabird Group Technical Publication Number 4. Available at pacificseabirdgroup.org/psg-publications/technical-publications/
- Flood, R. L., Danzenbaker, M., Hansbro, P., Rogers, C., Tanoi, H., & Tanoi, S. 2022b. More New Zealand Storm Petrels *Fregetta maoriana* off Gau Island, Fiji, in May 2022. *Bulletin of the British Ornithologists' Club* 142: 380–382.
- Flood, R. L., Zufelt, K., Danzenbaker, M., Tanoi, S., Bretagnolle, V., & Shirihai, H. 2022c. The dark-Morph Herald Petrel *Pterodroma heraldica*. *Bulletin of the British Ornithologists' Club* 142: 354–365.
- Flood, R. L., Zufelt, K., Bretagnolle, V., & Shirihai, H. Subm. First evidence of a distinct population of dwarf Tahiti Petrel *Pseudobulweria rostrata* (ssp?). *Bulletin of the British Ornithologists' Club*
- Force, M. P., & Balance, L. T. 2009. A Pink-footed Shearwater in Hawai'i. *ELEPAIO* 69: 39–40.
- Force, M. P., Webb, S. W., & Howell, S. N. G. 2007. Identification at sea of Hawaiian and Galapagos Petrels. *Western Birds* 38: 242–248.
- Friesen, V. L., González, J. A., & Cruz-Delgado, F. 2006. Population Genetic Structure and conservation of the Galápagos Petrel (*Pterodroma phaeopygia*). *Conservation Genetics* 7 (1): 105–115.
- Garnett, M. C. 1983. A management plan for nature conservation in the Line and Phoenix Islands. Unpubl. report. www.mauichalet.com/li
- Harrison, C. S. 1990. *Seabirds of Hawaii*. Ithaca and London: Cornell University Press.
- Harrison, P., Perrow, M., & Larsson, H. 2021. *Seabirds: The New Identification Guide*. Barcelona, Spain: Lynx Edicions.
- HBWa: del Hoyo, J., et al. (Eds.) 2020. *Handbook of Birds of the World Alive*. www.hbw.com
- Howell, S. N. G., & Zufelt, K. 2019. *Oceanic Birds of the World: A Photo Guide*. New York: Princeton University Press.
- Huber, L. N. 1971. Notes on the migration of the Wilson's Storm Petrel (*Oceanites oceanicus*) near Eniwetok Atoll, western Pacific Ocean. *Notornis* 18:38–42.
- Hutton, I., & Priddel, D. 2002. Breeding biology of the Black-winged Petrel, *Pterodroma nigripennis*, on Lord Howe Island. *Emu-Austral Ornithology* 102: 361–365.
- Imber, M. J. 1985. Origins, phylogeny and taxonomy of the gadfly petrels *Pterodroma* spp. *Ibis* 127: 197–229.
- Jamieson, S. E., & Waugh, S. M. 2015. An assessment of recent population trends of Flesh-footed Shearwaters (*Puffinus carneipes*) breeding in New Zealand. *Notornis* 62: 8–13.
- Jenkins, J. A. F. 1980. Seabird records from Tonga – an account based on the literature and recent observations. *Notornis* 27: 205–234.
- Jenkins, J. A. F. 1986. *The Seabirds of Fiji: an account based on the literature and recent observations*. Australasian Seabird Group Newsletter No. 25, November.
- Jones H. L. 2000. *Maiuia Mannikibani Kiritimati: The Birdlife of Christmas Island*. Dames & Moore.
- Jones, K. A. B., Nicoll, M. A. C., Raisin, C., Dawson, D. A., Hipperson, H., Horsburgh, G. J., Groombridge, J. J., Ismar, S. M. H., Sweet, P., Junes, C. G., Tatayah, V., Ruhomaun, K., & Norris, K. 2017. Widespread gene flow between oceans in a pelagic seabird species complex. *Molecular Ecology* 26: 5716–5728. doi:10.1111/mec.14330
- King, W. B. 1970. *The Trade Wind Zone Oceanography Pilot Study Part VII: Observations of seabirds March 1964 to June 1965*. Special Scientific Report Fisheries No. 586. Washington Fish and Wildlife Services.
- King, W. B. 1973. Conservation status of birds of Central Pacific Islands. *The Wilson Bulletin* 85: 89–103.
- King, W. B. (Ed.). 1974. *Pelagic Studies of Seabirds in the Central and Eastern Pacific Ocean*. Smithsonian Contributions to Zoology, Number 158. City of Washington, USA: Smithsonian Institution Press
- Mannaerts, G., Booker, H., & Aulert, C. 2014. *Marine Birds and MPA Monitoring*. Report established by the

- RSPB and the 'Agence des aires marines protégées for the Protected Area Network Across the Channel Ecosystem (PANACHE) project. Project founded by the INTERREG France (Channel) – England (2007–2013) program, 53 pp.
- Marín, M., Gonzáles, R., & Trucco, S. 2020. Population status of the Kermadec Petrel *Pterodroma neglecta* at San Ambrosio Island, Chile. *Marine Ornithology* 48: 209–214.
- Murphy, R. C., & Pennoyer, J. M. 1952. Larger petrels of the genus *Pterodroma*. *American Museum Novitates* 1580: 1–43.
- Murphy, R. C., & Snyder, J. P. 1952. The 'Pealea' phenomenon and other notes on Storm Petrels. *American Museum Novitates* 7: 1–16.
- Pierce, R. J. 2011. *Biosecurity Guidelines for the Phoenix Islands, Kiribati*. Biodiversity Conservation Lessons Learned Technical Series 8. Apla, Samoa: Critical Ecosystem Partnership Fund (CEPF) and Conservation International Pacific Islands Program (CI-Pacific).
- Pierce, R. J., Etei., T., Kerr, V., Saul, E., Teatata, A., Thorsen, M., & Wragg, G. 2006. *Phoenix Islands Conservation Survey and Assessment of Restoration Feasibility: Kiribati*. Eco Oceania Pty Ltd report for Conservation International Samoa and Pacific Islands Initiative C/-Auckland University Auckland.
- Pierce, R. J., Anderson, R., VanderWerf, E., & Young, L. 2007. *Surveys and Capacity Building in Kiritimati (Christmas Island, Kiribati), June 2007, to Assist in Restoration of Populations of Bokikokiko and Seabirds*. Eco Oceania Pty Ltd report for Government of Kiribati.
- Pierce, R. J., Anterea, N., Anterea, U., Broome, K., Brown, D., Cooper, L., Edmonds, H., Muckle, F., Nagle, B., Oakes, G., Thorsen, M., & Wragg, G. 2008. *Operational Work Undertaken to Eradicate Rats and Rabbits in the Phoenix Islands, Kiribati, May–June 2008*. Pacific Expeditions Ltd report for Government of Kiribati, NZ Department of Conservation, NZAID and Pacific Invasives Initiative.
- Pierce, R. J., Anterea, N., Coulston, G., Gardiner, C., Shilton, L., Taabu, K., & Wragg, G. 2011. *Atoll Restoration in the Phoenix Islands, Kiribati: Survey Results in November–December 2009*. Biodiversity Conservation International Lessons Learned Technical Series 7. Apla, Samoa: Critical Ecosystem Partnership Fund (CEPF) and Conservation International Pacific Islands Program (CI-Pacific).]
- Pierce, R. J., Brown, D., VanderWerf, E., & Taabu, K. 2018. *Guidelines for Monitoring Birds and Invasive Species at Kiritimati, Kiribati*. Eco Oceania Pty Ltd report for Government of Kiribati.
- Pierce, R. J., Vanderwerf, E., Cranwell, S., Taabu, K., Ghesteeme, T., Withers, T., with support from OSNZ and others. 2020. *A Conservation Action Plan for Two Endangered Seabirds – Phoenix Petrel (Pterodroma alba) and Polynesian Storm-petrel (Nesofregatta fuliginosa), 2020-2025*. Eco Oceania Pty Ltd.
- Priddel, D., Carlile, N., Fullagar, P., Hutton, I., & O'Neill, L. 2006. Decline in the distribution and abundance of Flesh-footed Shearwaters (*Puffinus carneipes*) on Lord Howe Island, Australia. *Biological Conservation* 128: 412–424.
- Priddel, D., Carlile, N., Moce, K., & Watling, D. 2008. A review of records and recovery actions for the Critically Endangered Fiji Petrel *Pseudobulweria macgillivrayi*. *Bird Conservation International* 18: 381–393.
- Pyle, R. L., & Pyle, P. 2017. *The Birds of the Hawaiian Islands: Occurrence, History, Distribution, and Status*. Version 2 (1 January 2017). Honolulu, HI, USA: B.P. Bishop Museum. <http://hbs.bishopmuseum.org/birds/rhp-monograph>
- Pyle, P., Spear, L., & Engbring, J. 1990. A previously unreported population of Herald Petrel on Ta'u Island, American Samoa. *Colonial Waterbirds* 13: 136–138.
- Pyle, P., Webster, D. L., & Baird, R. W. 2011. Notes on petrels of the Dark-rumped Petrel complex (*Pterodroma phaeopygia/sandwichensis*) in Hawaiian waters. *North American Birds* 65: 364–367.
- Pyle, P., Webster, D. L., & Baird, R. W. 2016. White-rumped dark storm-petrels in Hawaiian Island waters. *Birding* February: 58–73.
- Rayner, M. J., Clout, M. N., Stamp, R. K., Imber, M. J., Brunton, D. H., & Hauber, M. E. 2007. Predictive habitat modelling for the population census of a burrowing seabird: a study of the endangered Cook's Petrel. *Biological Conservation* 138 (1–2): 235–247.
- Rayner, M. J., Parker, K. A., & Imber, M. J. 2008. Population census of Cook's Petrel *Pterodroma cookii* breeding on Codfish Island (New Zealand) and the global conservation status of the species. *Bird Conservation International* 18 (3): 211–218.
- Rayner, M. J., Baird, K. A., Bird, J., Cranwell, S., Raine, A. F., Maul, B., Kuri, J., Zhang, J., Gaskin, C. P. 2019. Land and sea-based observations and first satellite results support a New Ireland breeding site for the Critically Endangered Beck's Petrel *Pseudobulweria beckii*. *Bird Conservation International* 30 (1): 58–74.

- Robertson, B. C., Stephenson, B. M., Ronconi, R. A., Goldstien, S. J., Shepherd, L., Tennyson, A., Carlile, L., & Ryan, P. G. 2016. Phylogenetic affinities of the *Fregetta* storm-petrels are not black and white. *Molecular Phylogenetics and Evolution* 97: 170–176. doi: 10.1016/j.ympev.2016.01.004
- Saville, S., Stephenson, B., & Southey, I. 2003. A possible sighting of an ‘extinct’ bird – the New Zealand Storm-petrel. *Birding World* 16: 173–175.
- Schreiber, R. W., & Ashmole, N. P. 1969. Breeding seasons on Christmas Island, Pacific Ocean. *Ibis* 112: 363–394.
- Shirihai, H. 2008. Beck’s Petrel *Pseudobulweria becki*, and other tubenoses from the Bismarck archipelago, Papua New Guinea. *Bulletin of the British Ornithologists’ Club* 128 (1): 3–16.
- Shirihai, H. 2020. A new breeding gadfly on Raivavae Island, Austral Islands (Australes), French Polynesia: Black-winged Petrel *Pterodroma nigripennis*. Report available on request from author. Reference in Flood *et al.* 2021.
- Shirihai, H., & Bretagnolle, V. 2010. First observations at sea of Vanuatu Petrel *Pterodroma (cervicalis) occulta*. *Bulletin of the British Ornithologists’ Club* 130 (2): 132–140.
- 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. *Bulletin of the British Ornithologists’ Club* 129 (3): 129–148.
- Spear, L., & Ainley, D. 2007. Storm-petrels of the Eastern Pacific Ocean: Species Assembly and Diversity along Marine Habitat Gradients. *Ornithological Monographs* 62: 1–77.
- Spear, L. B., Ainley, D. G., Nur, N., & Howell, S. N. G. 1995. Population size and factors affecting at-sea distribution of four endangered procellariids in the tropical Pacific. *Condor* 97: 613–638.
- Spear, L. B., Ainley, D. G., & Pyle, P. 1999. Seabirds in southeastern Hawaiian waters. *Western Birds* 30: 1–32.
- Stephenson, B. M., Flood, R. L., Thomas, B., & Saville, S. 2008. Rediscovery of the New Zealand Storm-petrel (*Pealeornis maoriana* Mathews 1932): two sightings that revised our knowledge of storm petrels. *Notornis* 55: 77–83.
- Tanoi, H. 2021. White-necked Petrel and Vanuatu Petrel. *Birder* 35: 48–51. (In Japanese.)
- Thompson, D. Q. 1951. Notes on distribution of North Pacific Albatrosses. *Auk* 68: 227–235.
- Thibault, J.-C., & Cibois, A. 2017. *Birds of Eastern Polynesia: A Biogeographic Atlas*. Barcelona, Spain: Lynx Edicions.
- Vanderwerf, E. A., Pierce, R. J., Gill, V. A., Wragg, G., Raust, P., & Tibbitts, T. L. 2006. Pelagic seabird surveys in the Tuamotu and Gambier archipelagos, French Polynesia. *Marine Ornithology* 34: 65–70.
- Vanderwerf, E. A., Becker, B. L., Eijzena, J., & Eijzena, H. 2008. Nazca Booby *Sula granti* and Brewster’s Brown Booby *Sula leucogaster brewsteri* in the Hawaiian Islands and Johnston and Palmyra atolls. *Marine Ornithology* 36: 67–71.
- VanderWerf, E. A., David, R.E., Donaldson, P., May, R., Pratt, H. D., Pyle, P., & Tanino, L. 2018. First report of the Hawaii Bird Records Committee. *Western Birds* 49:2–23.
- Watling, D. 1986. Rediscovery of a petrel and new fauna records on Gau Island. *Oryx* 20: 31–34.
- Watling, D. 2004. *A Guide to the Birds of Fiji & Western Polynesia including American Samoa, Niue, Samoa, Tokelau, Tonga, Tuvalu, and Wallis & Futuna*. Environmental Consultants: Suva, Fiji. Privately published.
- Watling, D. 2010. Chumming for the Fiji Petrel *Pseudobulweria macgillivrayi*, Gau, Fiji. Report 2010/4, NatureFiji-MareqetiViti, Suva, Fiji.

