

Order **PROCELLARIIFORMES**

A rather distinct group of some 80–100 species of pelagic seabirds, ranging in size from huge to tiny and in habits from aerial (feeding in flight) to aquatic (pursuit-diving for food), but otherwise with similar biology. About three-quarters of the species occur or have been recorded in our region. They are found throughout the oceans and most come ashore voluntarily only to breed. They are distinguished by their hooked bills, covered in horny plates with raised tubular nostrils (hence the name Tubinares). Their olfactory systems are unusually well developed (Bang 1966) and they have a distinctly musky odour, which suggest that they may locate one another and their breeding places by smell; they are attracted to biogenic oils at sea, also no doubt by smell. Probably they are most closely related to penguins and more remotely to other shorebirds and waterbirds such as Charadriiformes and Pelecaniiformes. Their diversity and abundance in the s. hemisphere suggest that the group originated there, though some important groups occurred in the northern hemisphere by middle Tertiary (Brodkorb 1963; Olson 1975).

Structurally, the wings may be long in aerial species and shorter in divers of the genera *Puffinus* and *Pelecanoides*, with 11 primaries, the outermost minute, and 10–40 secondaries in the Oceanitinae and great albatrosses respectively. The tail varies in length, being forked in *Oceanodroma*, forked to pointed in other forms, usually with 12 rectrices but up to 16 in fulmars. The tarsi are light and cylindrical in aerial forms; strong and laterally compressed with legs set far back in aquatic ones. The front toes are webbed; hind toe small or absent. The proventriculus is long and glandular; the gizzard small and twisted; and the small intestine often spiral in *Pterodroma*, presumably to aid absorption of the unusual lipids in their food. Chicks are helpless and covered in down, with two coats except in some Oceanitinae. Some larger species have a darker immature plumage, and the female is often darker than the male in the great albatrosses. The male is usually larger than the female, though smaller in the Oceanitinae and some other small species. Otherwise there is little difference in appearance with sex or age, except that young birds may have more pronounced pale or dark edges to the feathers. Many have simple counter-shaded markings that often appear to have given rise to uniformly dark or, less often, to pale derivatives; some species in most groups are dimorphic or polymorphic. The more complex groups have often developed distinctive markings of the extremities.

Breed more or less colonially on offshore islands, coastal cliffs, or on hills and deserts inland, where they perform complex vocal and aerial displays. The nest is a simple scrape or cup in a burrow or natural hole, sometimes under vegetation. The s. albatrosses build large cone-shaped nests in the open; may be lined with any debris available in the area. Smaller species visit it only at night, though larger ones and those breeding on remote islands may come to nests in the open by day. Parents incubate for spells of several days in turn and generally leave the chick alone soon after it hatches, only returning at long intervals to feed it by regurgitation. In consequence the chick is vulnerable to introduced predators and some species are now greatly reduced and at least two are now extinct. Some species also periodically liable to have unsuccessful breeding seasons. Many young or even old birds may be wrecked ashore and die when they meet bad weather or suffer shortage of food on migration or in the winter. Though it has been claimed that they are also vulnerable to all sorts of pollution, the evidence is weak (Bourne 1976). There is at present anxiety about the effect of some fishing methods, such as long-lining, which may be endangering species such as the great albatrosses.

All species feed at sea on a variety of fish, cephalopods and small marine invertebrates, either socially or alone; larger species may scavenge all sorts of offal or prey on other birds. Most, except perhaps *Pelecanoides*, can digest the complex lipids formed by some marine animals (Clarke & Prince 1976), and may eject them to soil the plumage of their enemies with lethal results (Swennen 1974). Some species can digest wax (Obst 1986). Many now take wastes from whaling and fishing operations (Fisher 1952). All have long life-cycles in proportion to their size; they disperse on fledging and then prospect for nest-sites for 2–12 years in their youth. They usually lay a single large white egg annually; though a successful breeding cycle may be completed in less than a year in at least one tropical species, *Puffinus lherminieri*, it may take 2 years in larger southern ones. Before laying, the birds court for weeks or months, then go to sea for feeding. Incubation lasts 6–8 weeks, and fledging 2–9 months. Once the fat chick fledges it fends for itself, even in species that immediately make a long migration, sometimes to the opposite hemisphere.

Tendency for failed breeders and non-breeders to begin moult before successful breeders. Five strategies of wing-moult in breeding adults: (1) In albatrosses, remiges replaced in staffelmauser interrupted while breeding; in nearly all other species, primaries moulted outwards; possibly simultaneously in some diving-petrels. (2) In most subantarctic and temperate species, moult begins soon after breeding and is completed shortly before next breeding season. (3) In most tropical species, moult aseasonal, between breeding attempts; resumption of breeding apparently depends on when moult completed. (4) In trans-equatorial migrants, wing-moult delayed until they reach non-breeding quarters, where it is completed; moult rapid but no satisfactory evidence for flightlessness. In

some species, body-moult also in winter quarters; in others, at breeding grounds. (5) In some species of high latitudes, rapid moult completed in summer when they breed; some begin moult long before breeding finished.

The history of the classification of the Order is very confused, as is seen by comparing Timmermann's (1965) discussion of their Mallophagan parasites with that by Klemm (1969) of their leg muscles and that by Harper (1978) of their proteins, but it is now widely agreed that the Order is best divided into four families: Diomedidae or large to huge aerial albatrosses; Procellariidae or medium-sized, mainly aerial but sometimes aquatic, petrels, shearwaters and prions; Hydrobatidae or small to tiny, aerial storm-petrels; and Pelecanoididae or small aquatic diving-petrels.

References

- Bang, B.G. 1966. *Acta anat.* 65: 305-415.
- Bourne, W.R.P. 1976. Pp 403-502. In: Johnston 1976.
- Brodkorb, P. 1963. *Bull. Flor. St. Mus. biol. Sci.* 7: 179-293.
- Clarke, A., & P.A. Prince. 1976. *J. Exp. mar. Biol. Ecol.* 23: 15-30.
- Fisher, J. 1952. *The Fulmar*.
- Harper, P.C. 1978. *NZ J. Zool.* 5: 509-549.
- Johnston, R. (Ed.). 1976. *Marine Pollution*.
- Klemm, R.D. 1969. *S. Ill. Univ. Monogr. Sci. Ser.* 2.
- Obst, B.S. 1986. *Wilson Bull.* 98: 189-95.
- Olson, S.L. 1975. *Smithson. Contr. Paleobiol.* 23.
- Swennen, C. 1974. *Ardea* 62: 111-117.
- Timmermann, G. 1965. *Abh. Verh. naturwiss. Vereins Hamburg NF* 8, Suppl. 1-249.

Family PROCELLARIIDAE fulmars, petrels, prions, shearwaters

The family Procellariidae represents the main radiation of medium-sized 'true petrels', characterized by having united nostrils with a median septum and the outer functional primary at least as long as the next. It tends to be dominant among the birds of the Southern Ocean, though in the n. hemisphere the Charadriiformes are more numerous. The giant-petrels *Macronectes* have also developed as large scavengers and predators, showing some convergence in appearance and behaviour with the Diomedidae. The Procellariidae may be divided into four main groups with some intermediate species, which makes it hard to draw distinctions between them.

(1) The fulmars *Macronectes*, *Fulmarus*, *Thalassoica*, *Daption* and *Pagodroma* consist of seven species of surface predators and filter-feeders of rather varying structure and appearance (Voous 1949) that breed in high latitudes but may migrate along cool currents into much lower ones. *Fulmarus* appears to have colonized the n. hemisphere in the Tertiary. Six of the seven species are essentially confined to our region.

(2) The gadfly-petrels *Pterodroma* are a large series of some 30 agile species; 16 breed in our region and another six occur rarely or rather rarely. Their short sturdy bills are adapted for seizing soft prey at the surface, and their twisted intestines, for digesting marine animals with an unusual biochemistry, which are also found throughout the warmer oceans (Imber 1985). They show complex markings of face and wings that must serve as interspecific recognition-marks (Murphy & Pennoyer 1952). Some species placed in this group have an intermediate structure and intergrade with all other groups distinguished here: *Pterodroma (Lugensa) brevirostris*, which moves S in winter, has distinctly big eyes like *Pagodroma*; *Halobaena caerulea* has a plumage similar to that of prions; *Bulweria* has some structural resemblance to shearwaters. At present it is difficult to determine their precise relationships.

(3) The prions *Pachyptila* are a specialized group of six (perhaps five) very numerous species, all in our region, that show a progressive adaptation of a small, agile, cryptically coloured, fulmarine form for filter-feeding on zooplankton. There has been dispute over their classification (Cox 1980; Harper 1980) but the arrangement discussed by Fleming (1941) seems best except that the Broad-billed Prion *P. vittata* appears to intergrade with Salvin's Prion *P. salvini* through *macgillivrayi* of Ile St Paul; so they may be better treated as subspecies of the same species.

(4) The shearwaters *Procellaria*, *Calonectris* and *Puffinus* include some 20 agile species with long bills adapted to catch prey more or less under water throughout the warmer seas (Kuroda 1954); 13 species breed in our region, some migrating into the n. hemisphere; six others are chance or perhaps regular visitors. From the fossil record (Brodkorb 1963; Olson 1975); they seem to have been particularly common in the great Tethys Ocean of the middle latitudes of the n. hemisphere in the Tertiary, so this development of aquatic habits may have occurred there without competition from penguins with a subsequent return S by the more successful forms.

General features of the family are: body, ovate, or elongate in shearwaters; wings, long and narrow, 11 primaries, p10 longest, p11 minute; 20-29 secondaries, short, diastataxic; tail, short, 12 feathers; bill, heavy (*Macronectes*), slender (shearwaters), broad (prions) or stubby (gadfly-petrels), hooked, formed of several horny plates; nostrils in dorsal tube of varying length; legs set far back, laterally flattened but round in gadfly-petrels; three toes, webbed, hind toe vestigial, raised. Oil-gland feathered. Peculiar musky odour. Sexes similar, male usually larger than female. Plumage, black or grey above, white below, or all dark; light and dark morphs in some species. Juveniles and immatures usually like adults.

Cosmopolitan throughout the oceans, essentially pelagic; more abundant in cool or cold waters rich in plankton and mostly away from ice. Swim well but usually aerial except when feeding or resting. Fly with alternate swooping and flapping action close to the surface but often arcing high in some gadfly-petrels. Gait on land, a shuffling crouch, being unable to walk properly with feet set so far back; generally avoid open areas on land, being thus vulnerable to predators. Nest colonially; for the most part in burrows and cavities in all sorts of terrain, sometimes far from the sea and in mountainous areas but some species, e.g. *Macronectes*, nest on open ground. Hole-nesters usually nocturnal at colonies, when often extremely vocal, though generally silent at sea. Migratory and dispersive. Some species divide the year between s. and n. hemisphere, often migrating in large flocks that may settle on the sea in huge dense rafts. Feed mostly on fish, cephalopods and crustaceans obtained by flight-feeding, plunge-diving, surface feeding, surface-diving and underwater pursuit; hydroplaning (Murphy) is a characteristic method used particularly by prions.

Probably all defend small nesting territories to which they return regularly while undisturbed; certainly so in some hole- and burrow-nesting forms. Agonistic and sexual behaviour of nocturnal, hole-nesting species very poorly known but generally seem to have little specialization for visual displays. Tactile actions such as allopreening and billing used but olfactory and vocal communication is probably important. Breeding is usually seasonal, generally with synchronized laying, often after a pre-laying exodus but some may not nest annually; some have shorter

cycles or nest continually. For the most part, little attempt to make substantial nests. Eggs, ovate, mat, white. Clutch-size, invariably one; single-brooded; no replacement laying. Incubation by both sexes in alternate spells of 1-11 days. Single median brood-patch. Incubation period, 45-55 days. Eggshells probably always trampled in nest. Young, semi-altricial, nidicolous; hatched in down. Rarely left alone in nest for first 1-2 weeks. Cared for and fed by incomplete regurgitation by both parents. Nestling period generally shorter in cliff- and ledge-nesting species than in hole-nesters. Young attain greatest weight, often well above that of adult, some days before fledging, by which time weight has been reduced to about the same as an adult, but no clear evidence that young are totally deserted for last few days in nest. Adults and young of most species liable to eject stomach-oil in defence. Young independent at fledging. Maturity reached at minimum of 3-4 years, in some 6-12 years.

REFERENCES

- Brodkorb, P. 1963. *Bull. Flor. St. Mus. biol. Sci.* 7: 179-293.
- Cox, J.B. 1980. *Rec. S. Aust. Mus.* 10: 91-121.
- Fleming, C.A. 1941. *Emu* 41: 134-55.
- Harper, P.C. 1980. *Notornis* 27: 235-86.
- Imber, M.J. 1985. *Ibis* 127: 197-229.
- Kuroda, N. 1954. *On the classification and phylogeny of the order Tubinares, particularly the shearwaters (Puffinus), with special consideration on their osteology and habit differentiation.* Tokyo.
- Murphy, R.C., & J.M. Pennoyer. 1952. *Am. Mus. Novit.* 1580.
- Olson, S.L. 1975. *Smithson. Contr. Paleobiol.* 23.
- Voous, K.H. 1949. *Ardea* 37: 113-22.

Pterodroma rostrata Tahiti Petrel

Procellaria rostrata Peale, 1848, *US. Explor. Exped. Birds* 8: 296 — mountains about 2000 m on Tahiti, Society Islands.

Specifically named *rostrata* (beaked) apparently because the holotype, collected by Dana, savaged the native who carried it so severely, by biting, that he 'thrust the sharp point of the upper mandible through the lower, thus yoking [the bird] with its own jaw' (Peale 1848).

POLYTYPIC Nominate *rostrata* breeds Society and Marquesas Is; *becki* Murphy, 1928, known from Bismarck Arch. and Solomon Is region, breeding grounds unknown; *trouessarti*, Brasil, 1917, breeds New Caledonia.

FIELD IDENTIFICATION Length 38–40 cm; wing-span 84 cm (nominate form). Medium-sized dark-brown and white gadfly petrel with sharply demarcated dark hood; similar to Phoenix Petrel *P. alba* but with distinctive attenuated jizz and languid flight unmatched by other *Pterodroma* spp. Sexes alike. No seasonal plumage changes. Juveniles inseparable.

DESCRIPTION ADULT. Whole head and neck, uniform dark-brown, forming solid dark hood sharply demarcated from white lower breast, belly and central under tail-coverts. Upperparts and upperwings, uniform dark-brown except for upper tail-coverts, which appear as paler brown patch, shape and extent of which varies according to light and angle, from pale-brown area across basal half of uppertail to large pale-brown panels either side of narrow dark line down centre of upper tail-coverts; sometimes whole upperside of tail appears pale brown. Brown of hood continues narrowly along upper flanks. Lower breast, belly and vent, white; outer webs of lateral under tail-coverts, tips of longer under tail-coverts and undersides of rectrices, dark brown, forming narrow dusky rim round rear end. At distance, underwing can appear wholly dark brown, but in close view, pale median-coverts show as conspicuous pale stripe down centre of wing, extending outwards to middle of primary coverts; stripe appears white and broad with ragged edges on most birds; on some, duller greyish-white or silvery. Undersides of remiges, wholly dark brown and glossy; when strongly lit, underwing can appear silvery or whitish, narrowly and diffusely bordered dark. Iris, dark brown. Bill, black; tubed nostrils raised conspicuously over basal third of upper mandible. Tarsi and basal parts of feet, flesh-coloured with black stripe down outer tarsus; toes and rest of feet, black. Subspecies *becki*, known from only two specimens and not yet recorded in our area, considerably smaller than other subspecies (slightly larger than Cookkilaria petrels) though plumages apparently identical to other subspecies but field appearance unknown.

SIMILAR SPECIES Tahiti Petrel has distinctive jizz caused by (1) rather long, narrow wings, with carpals held only gently flexed forward (thus appearing rather straight-winged), and with outerwings also appearing rather narrow and tapering to fine points; (2) small fine head set on long, slender neck; (3) full-gutted body tapering to long tail, which appears narrow and pointed when held closed; broad at base and oval-shaped at tip when spread; (4) large chunky bill appearing large relative to head. Languid direct arcing and banking flight low over water, unlike other gadfly petrels, further emphasizes distinctive jizz. Closely similar to Phoenix Petrel *P. alba*;

differences in structure and flight important in separation: **Phoenix Petrel**, slightly smaller, with head appearing larger, neck shorter; wings appear shorter, with carpals held well forward from where outerwings swept back giving generally more angular wing-shape; outerwing usually appears sharply pointed though can look rounded when primaries gently spread, giving paddle-shaped hand as against longer, usually finely pointed hand of Tahiti; bill, smaller, more delicate, appearing normal in proportion to head; flight of Phoenix

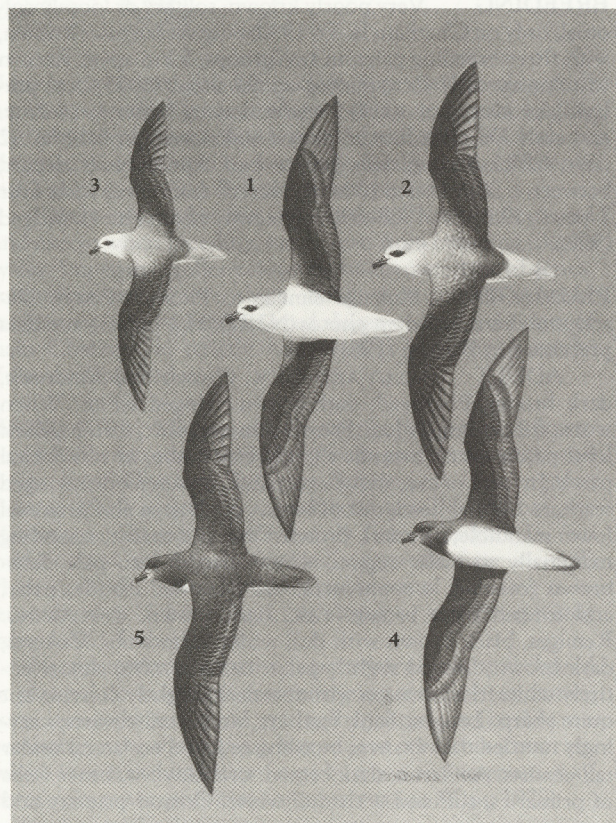


Plate 29

White-headed Petrel
Pterodroma lessonii

1. Adult, ventral, fresh
2. Adult, dorsal, fresh
3. Adult, dorsal, worn

Magenta Petrel
Pterodroma magentae

4. Adult, ventral
5. Adult, dorsal

more impetuous with higher arcing and tighter bounding progression interrupted by sudden changes of direction (flight of Tahiti more languid, on gently drooped wings, soaring and swooping broken by glides low to sea; wing-beats of Tahiti Petrel appear loose and changes of course infrequent). Generally, Phoenix has typical gadfly jizz, quite different from attenuated languid jizz of Tahiti; plumage of Phoenix also differs by: (1) upperparts, slightly darker and more blackish; (2) dark rump and upper tail-coverts uniform with rest of dorsum (without distinct paler-brown area across upper tail-coverts); (3) white patch along inner leading-edge of underwing (lining wholly dark brown on Tahiti); (4) rest of under wing-lining, dark, though, in strong light, may show silvery stripe down trailing third of underwing momentarily (most Tahiti have conspicuous white stripe down centre of underwing); (5) varying white patch on chin and throat, often hard to see. **Intermediate-morph Herald Petrel** *P. arminjoniana* has white submarginal patch behind elbow on underwing, not wholly dark inner leading-edge; all but darkest morphs have large skua-like silvery or white flash on base of primaries on underwing; bold tapering white line extends inwards from primary flash, along bases of greater secondary coverts, down trailing third of underwing (stripe down centre in Tahiti); all morphs have dark upper tail-coverts, uniform with rest of dorsum. **Kermadec Petrel** *P. neglecta* distinguished by white

primary shafts forming skua-like flash on upperwing; by all-dark underwing with varying white submarginal patch and large white flash at base of primaries; dark upper tail-coverts uniform with rest of dorsum. **Light-morph Soft-plumaged Petrel** *P. mollis* and **Magenta Petrel** *P. magentae*, have mainly dark underwings and white belly as in Tahiti but Soft-plumaged smaller (about size of Phoenix Petrel), more compact, with typical *Pterodroma* jizz, dark-grey dorsum crossed by dark M-mark, and large white area on chin and throat above narrow, often incomplete, dark grey chest-band; Magenta slightly larger and distinctly bulkier (*c.f.* Great-winged Petrel *P. macroptera* in size and shape), with larger and stubbier bill also recalling Great-winged Petrel; upperparts sooty-grey; underwing wholly dark, never with white areas on lining.

Highly pelagic gadfly petrel of tropical waters, also occasionally ranging into warmer subtropical waters. Avoid inshore waters except when breeding, preferring shelf-break and pelagic waters, often far from land. Normal flight rather relaxed and low to sea for gadfly petrel, recalling that of Wedge-tailed Shearwater *Puffinus pacificus* rather than more active and manoeuvrable flight of *Pterodroma* spp, and further emphasizes distinctive jizz. Long periods of low arcing and banking on direct course broken by brief bursts of shallow flapping on loose pliable wings. Arcing flight with long gradual ascent and descent; level out into long glides low to sea, with wings held gently drooped below body level. In stronger winds, hold wings more flexed (though still generally straighter winged than other *Pterodroma* and with wing-tips remaining finely pointed); arcing, banking and soaring becomes higher (to above horizon), recalling flight of albatrosses *Diomedea* spp but still appear less manoeuvrable than *Pterodroma*, lacking their sudden direction changes. Probably feed by surface-seizing. Usually seen singly but occasionally form loose flocks and join multi-species feeding flocks in tropical waters. Have been recorded in association with surfacing Pilot Whales *Globiocephala* spp (D.W. Eades). Usually avoid ships but will occasionally accompany them at distance, never following in wake. Gregarious at colonies where strictly nocturnal. Aerial display and associated calling less varied than in tropical *Pterodroma* spp. Main call at colonies, long and elaborate series of whistled notes given in flight, from ground near burrows, and from within burrows; individual notes longer than series of short sharp monosyllabic or disyllabic calls of tropical *Pterodroma* (Thibault & Holyoak 1978). Apparently silent at sea.

HABITAT Marine, pelagic. In e. Indian Ocean, found over warm water (surface-temperatures 26.02–26.42 °C) of intermediate salinity (34.68–34.88 ppt) (Dunlop *et al.* 1988a). Observed off coast of NSW in Dec.–Apr. when e. Aust. Current strongest and sea surface-temperature >25 °C (Holmes 1981). Widespread in e. Pacific, but most abundant over Equatorial Countercurrent (Pitman 1986). Pelagic, with Aust. sightings over and beyond edge of continental shelf, and rarely offshore (Holmes 1977; Dunlop *et al.* 1988a).

Breed on volcanic islands in tropical Pacific Ocean; nest in burrows on mountain ridges and rocky slopes, 200–2000 m asl and up to 12 km inland; nest-sites usually densely vegetated with trees or shrubs (Thibault & Holyoak 1978; Holyoak & Thibault 1984).

Fly in glides, and arc high over surface (King 1967).

DISTRIBUTION AND POPULATION Recorded mostly in s. hemisphere in tropical and subtropical Pacific,

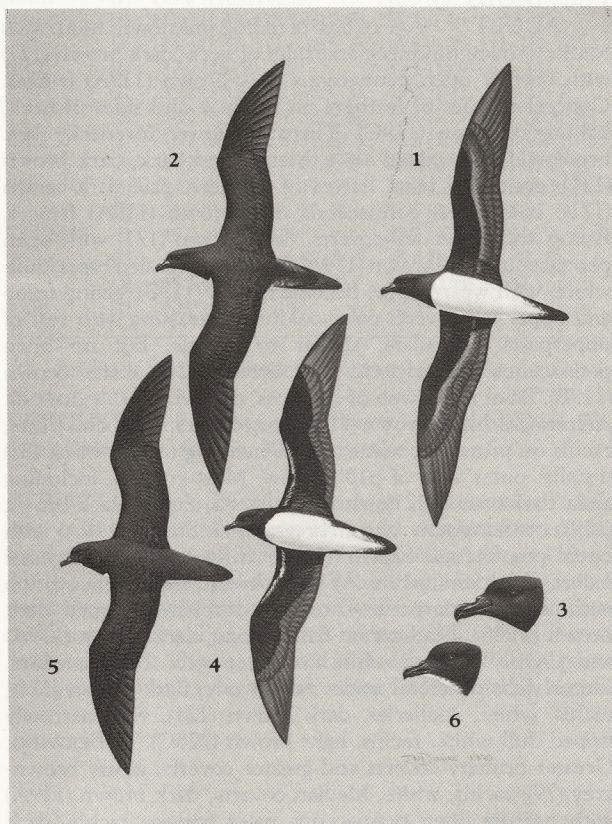


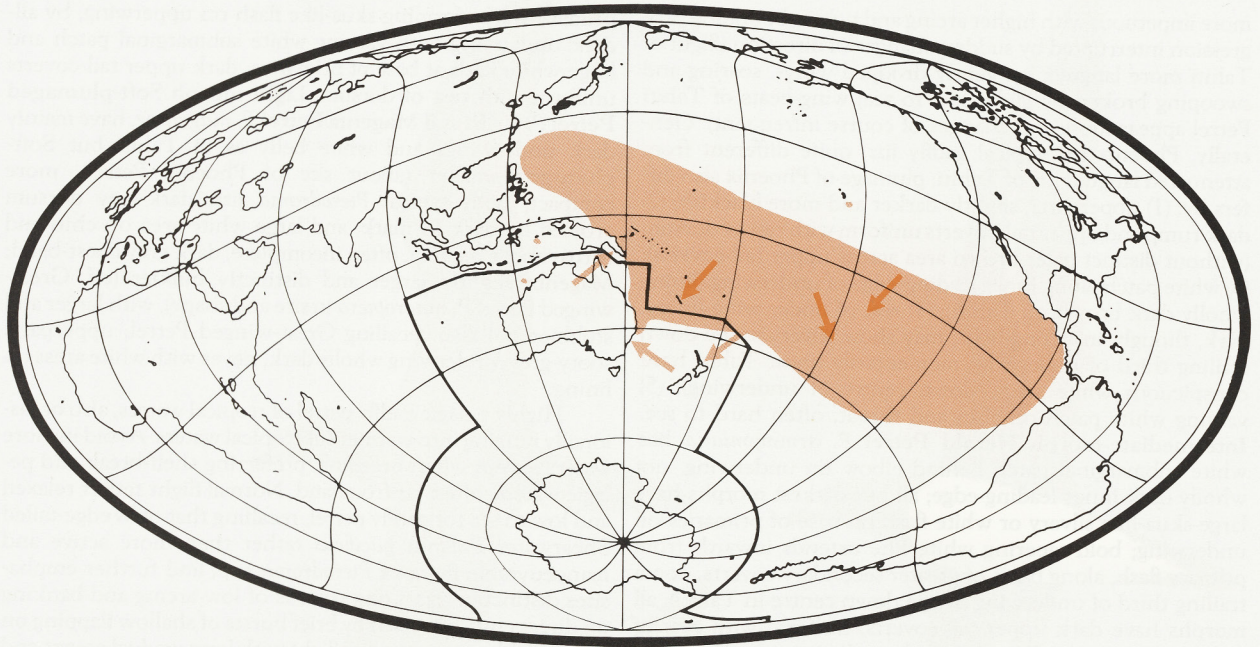
Plate 30

Tahiti Petrel *Pterodroma rostrata*

1. Adult, ventral
2. Adult, dorsal
3. Adult, head

Phoenix Petrel *Pterodroma alba*

4. Adult, ventral
5. Adult, dorsal
6. Adult, head



extending W into e. Indian Ocean; recorded Banda Sea (Cadée 1985), New Guinea (Greensmith 1975; Jespersen 1933), Bismarck Arch., Coral Sea (Norris 1967; Stokes & Corben 1985), nw.-ne. Aust., New Caledonia (de Naurois & Erard 1979), Society and Marquesa Is. Also recorded near Taiwan (Bourne 1967), Kiribati as far as 7°N, central Pacific N to 6°N (Gould & King 1967) and e. Pacific between Mexico and Peru (Pitman 1986). Known to breed only in Society and Marquesa Is and New Caledonia. Plentiful round known breeding islands.

AUST. Reported in ne. waters since 1962 (Norris 1967) and fairly regularly since 1980. Not recorded earlier, no doubt by lack of observers. Hindwood *et al.* (1963) had vague record near Cato I. in 1960–61 but too indefinite to accept. **Qld.** One beachcast, Fraser I., May 1969 (QM 011165; McKean & Vernon 1971); another, N. Stradbroke I., Mar. 1974 (QM 015341; Corben 1975). Offshore and coastal sightings in 1971 and 1980–86 (Qld Bird Reps 1983–86). **NSW.** Irregular coastal and offshore sightings since 1975 off Ballina, Coffs Harbour and Sydney (Holmes 1981; NSW Bird Reps 1983, 1984). **WA.** Three sighted near edge of continental shelf at 16°S Oct. 1987 (Dunlop *et al.* 1988b). **NT.** Aust. Atlas had one unsubstantiated sighting NE of Melville I., Nov. 1980.

MOVEMENTS Not known. Disperses or migrates W to w. tropical Pacific and n. Indian Ocean, but also recorded e. Aust., in n. Pacific near Taiwan, in central Kiribati as far as 7°N and e. Pacific between Mexico and Peru (Bourne 1967; Pitman 1986). Absence of records from Torres Str. suggests birds reach Indian Ocean through Bismarck Sea, waters N of PNG and Indonesia (N.G. Cheshire; D.W. Eades) where reported in Nov. in waters off n. PNG (Greensmith 1975) and July–Aug. off n. Aust. (M.J. Carter), nw. Aust. (Dunlop *et al.* 1988b), Irian Jaya (Jespersen 1933) and in Banda Sea (Cadée 1985). In Coral Sea reported May–Nov. (Norris 1967; Stokes & Corben 1985); off central e. Aust. most common Dec.–Apr. (Holmes 1981; Smyth & Corben 1984; Qld Bird Rep. 1986), presumably non-breeders following e. Aust. Current S.

PLUMAGES

ADULT Age of first breeding unknown. **HEAD AND NECK.** Crown, hindneck and sides of neck, dark brown (121) with narrow open pennaceous dark-brown (119A) fringes. Concealed bases of feathers on hindneck and sides of neck, light grey-brown (119C). Throat to lower foreneck, dark brown (119A). **UPPERPARTS.** Mantle and back, dark brown (121); concealed basal halves of feathers, pale dark-brown (121); have open pennaceous dark-brown (119A) fringes. Rump and upper tail-coverts, dark brown (121) with open pennaceous dark-brown (119A) fringes; concealed bases, dull-white; with wear-fringes become brown (119B), giving rump and upper tail-coverts paler colour, contrasting with rest of upperparts. Scapulars, similar to mantle, but no open pennaceous fringes. **TAIL,** dark brown (121); shafts, brown (219B). Basal inner web of rectrices, dull white. **UPPERWING.** All remiges, black-brown (119); base of inner webs, dull white; rachis on primaries, white at base merging to grey-black (82) distally; outer web of p10 narrow. Most coverts, including alula, dark brown (121); marginal coverts, almost black-brown (119). **UNDERPARTS.** Upper breast, dark brown (119A) with open pennaceous brown (119B) fringes; concealed basal halves of feathers, white. At lower breast, sharp demarcation with white underparts. Lateral vent-feathers tipped dark brown (119A). Feathers on flanks, long, dark brown (119A) and slightly mottled white on inner web. Thighs, white. Outer webs of lateral under tail-coverts, dark brown (121); rachis, white. Axillaries, dark brown (121), very narrowly tipped dull white; rachis, light brown (223C). **UNDERWING.** Greater primary coverts and greater coverts, glossy brown-grey (79); rachis, white. Median coverts, dark brown (119A) with narrow open pennaceous paler fringes; rachis, dark brown (219A). Rest of coverts, dark brown (121) with open pennaceous dark-brown (119A) fringes. When wing spread, glossy greater coverts, greater primary coverts and paler contrasting median coverts, form pale band across underwing.

DOWNY YOUNG, JUVENILE Undescribed.

BARE PARTS Based on photos in Lindsey (1986).

ADULT Iris, dark brown (219). Bill, black (89). Inner tarsus and basal third of foot, excluding outer margin of outer toe, pink (7); rest of legs and feet, grey-black (82).

DOWNY YOUNG, JUVENILE Undescribed.

MOULTS

ADULT POST-BREEDING No data; by analogy with similarly sized petrels, moult probably complete, with primaries moulting outwards; further study required.

POST-JUVENILE At Taveuni I., Fiji, 'immature' female growing flight-feathers in Oct. (Bourne 1967).

MEASUREMENTS

Nominate *rostrata*. (1) Unknown locality, status unknown, skins; methods unknown (Murphy & Pennoyer 1952). (2) Society and Marquesas Is, adults from burrows, skins; methods partly unknown: BILL D = bill depth at base, BDN = bill depth, anterior to nares (de Naurois & Erard 1979). Subspecies *trouessarti*. (3) New Caledonia, adults, skins (de Naurois & Erard 1979).

| | MALES | FEMALES |
|--------|---|---|
| WING | (1) 297.0 (288-308; 10) (2) 297.8 (8.67; 286-307.5; 5) (3) 299.1 (7.95; 290-309; 8) | 289.9 (278-306; 14) 292.5 (5.09; 283-298; 7) 296.2 (3.19; 292-300; 5) |
| TAIL | (1) 115.0 (110-120; 10) (2) 117.0 (1.45; 115.5-119; 5) (3) 114.4 (2.87; 111-118.5; 8) | 116.6 (109.2-121.5; 14) 115.7 (1.45; 111.5-120; 7) 116.9 (4.06; 111-121; 5) |
| BILL | (1) 37.0 (36-39; 10) (2) 35.2 (1.35; 33.2-36.3; 5) (3) 36.3 (1.33; 34.4-38.5; 8) | 35.1 (33.9-36.6; 14) 35.0 (1.32; 33.4-37; 7) 35.4 (1.11; 34.3-36.8; 5) |
| BILL D | (1) 16.2 (0.44; 15.8-17; 5) (3) 17.2 (0.62; 16.1-17.9; 8) | 15.2 (0.50; 14.3-16; 7) * 16.6 (0.54; 15.8-17.3; 5) |
| BDN | (2) 11.8 (0.25; 11.4-12; 5) (3) 12.9 (0.54; 12-13.7; 8) | 11.2 (0.38; 10.5-11.7; 7) * 12.5 (0.49; 11.9-13; 5) |
| TARSUS | (1) 49.0 (47-50; 10) (2) 47.2 (1.06; 46.2-49; 5) (3) 48.5 (0.83; 47.5-50; 8) | 47.2 (45-49.6; 14) 46.4 (1.17; 45-48; 7) 46.7 (0.53; 46-47.1; 5) * |
| TOE | (1) 60.0 (56-64; 10) | 58.3 (56-59.2; 14) |

Additional measurements in Murphy (1928).

WEIGHTS

Few data. Label data from skin (NMNZ): Fiji, Oct., 'immature' female, 300 g, specimen 'very fat'.

STRUCTURE

Details taken from single unsexed adult skin of *rostrata* (AM). Wing, long and slender. Eleven primaries: p10 longest, p9 3, p8 12, p7 32, p6 60, p5 85, p4 110, p3 134, p2 152, p1 169, p11 minute. No emarginations. Eighteen secondaries, four of tertial form. Twelve rectrices, t1 longest, t6 35 mm shorter. Tail, rounded-cuneate. Bill, short; deep at base; maxillary unguis, hooked and robust. Nostrils point forwards; septum subterminal; nares c. 23% of bill length.

Legs, slender and largely laterally compressed. Feet, webbed. Outer and middle toes about equal, inner c. 84% of middle, hind, claw only c. 14%.

GEOGRAPHICAL VARIATION

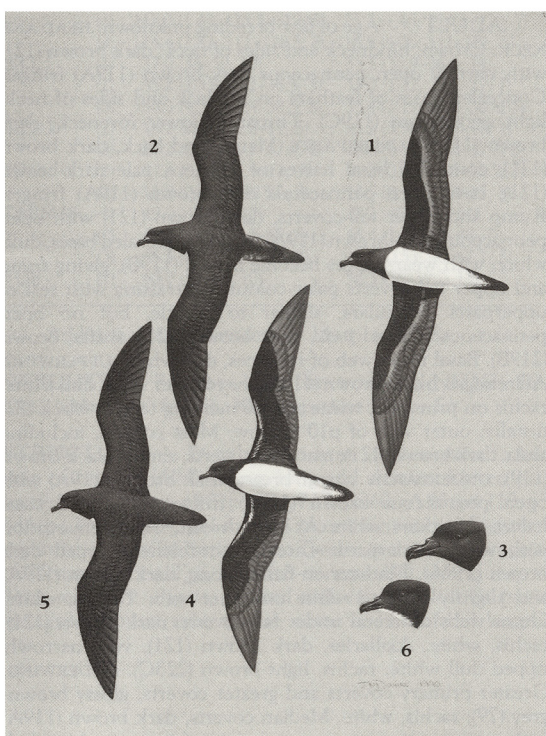
According to latest opinion, species considered to be sufficiently different from other species of *Pterodroma*, in jizz, structure and even colour, to be placed in separate genus *Pseudobulweria* (Imber 1985). Here, treated as one species with three subspecies: *rostrata*, *becki* and *trouessarti*. However, *becki* known only from two specimens collected E of New Ireland and NE of Rendova, Solomon Is, about 1928 (Murphy 1928; Murphy & Pennoyer 1952) and from recent sightings in Bismarck Arch. and Solomon Is, often regarded as full species, only on strength of smaller (15%) size and more slender bill than nominate *rostrata*. Mascarene Petrel, *P. aterrima*, all-dark bird, sometimes regarded as fourth subspecies of *rostrata*. One Qld specimen (McKean & Vernon 1971) could belong to *trouessarti* on all measurements except tail, which fits neither *rostrata* nor *trouessarti*. *Pterodroma rostrata* and *macgillivrayi* form super-species. RMO

REFERENCES

- Bourne, W.R.P. 1967. *Ibis* 109: 141-67.
 Cadée, G.C. 1985. *Ardea* 73: 183-88.
 Coleman, R.J., et al. 1984. *Focus on Stradbroke*.
 Corben, C. 1975. *A'sian Seabird Grp Newsl.* 6: 8.
 de Naurois, R., & C. Erard. 1979. *Oiseau Revue fr. Orn.* 49: 235-9.
 Dunlop, J.N., et al. 1988a. *Aust. J. mar. freshwat. Res.* 39: 661-9.
 Dunlop, J.N., et al. 1988b. *Rec. West. Aust. Mus.* 14: 237-47.
 Gould, P.J., & W.B. King. 1967. *Auk* 84: 591-4.
 Greensmith, A. 1975. *Sunbird* 6: 77-89.
 Hindwood, K.A., et al. 1963. *Tech. Pap. Div. Wildl. Res. CSIRO Aust.* 3.
 Holmes, G. 1977. *A'sian Seabird Grp Newsl.* 8: 20-35.
 Holmes, G. 1981. *Aust. Birds* 16: 24.
 Holyoak, D.T., & J.C. Thibault. 1984. *Mem. Mus. natn. Hist. nat., Ser. A, Zool.* 127.
 Imber, M.J. 1985. *Ibis* 127: 197-229.
 Jespersen, P. 1933. *Vidensk. Meddr Dansk naturh. Foren.* 94: 187-221.
 King, W.B. 1967. *Seabirds of the Tropical Pacific Ocean*. Prelim. Smithsonian. Ident. Man.
 Lindsey, T.R. 1986. *The Seabirds of Australia*.
 McKean, J.L., & D.P. Vernon. 1971. *Mem. Qld Mus.* 16: 141-3.
 Murphy, R.C. 1928. *Am. Mus. Novit.* 322.
 Murphy, R.C., & J.M. Pennoyer. 1952. *Am. Mus. Novit.* 1580.
 Norris, A.Y. 1967. *Emu* 67: 33-54.
 Pitman, R.L. 1986. *Atlas of Seabird Distribution and Relative Abundance in the Eastern Tropical Pacific*. SW Fish. Centre Admin. Rep. LJ-86-02C.
 Smyth, A. & C.J. Corben. 1984. Pp. 363-9. In: Coleman et al. 1984.
 Stokes, A.S., & C. Corben. 1985. *Corella* 9: 25-9.
 Thibault, J.C., & D.T. Holyoak. 1978. *Ardea* 66: 53-6.



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Tahiti Petrel *Pterodroma rostrata*

- 1. Adult, ventral
- 2. Adult, dorsal
- 3. Adult, head

Phoenix Petrel *Pterodroma alba*

- 4. Adult, ventral
- 5. Adult, dorsal
- 6. Adult, head

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