BIRDS COLLECTED DURING THE WHITNEY SOUTH SEA EXPEDITION. X

ON PTERODROMA COOKII AND ITS ALLIES

By Robert Cushman Murphy

In a recent study of Puffinus assimilis and its allies (1927, Amer. Mus. Novit., No. 276), I have endeavored to show that these small shearwaters are readily distinguishable as two species, differing in color characters as well as in zoogeographic distribution, and each represented by several subspecies. It now appears that the small Pacific petrels of the genus Pterodroma or "Cookilaria" present interrelationships of a curiously parallel type. The birds of this group were originally described under a variety of specific names, but in subsequent treatment they have either been "lumped" under one species, as by Mathews (1912, 'Birds Austral.,' II, p. 168), or else interspersed among other petrels, many of which are not closely related to the natural aggregation that forms the subject of this paper. Examples of the latter type of systematic treatment are those of Godman (1908, 1909, 'Monogr. Petrels,' parts III and IV, pp. 209, 212, 214, 243, 245, 247, 250, 252) and Mathews (1927, 'Syst. Avium Australasianarum,' pp. 120, 122, 123). Mathews even goes so far as to place one form (Pterodroma brevipes) in a different genus from the others, and to group the remainder in a specific and subspecific arrangement which, it seems to me, does not accord with the criteria of relationship.

For the preparation of this revision I have made use of large series of petrels obtained during the Whitney South Sea Expedition and the Brewster-Sanford South American Expedition, as well as of other specimens in the collections of The American Museum of Natural History and of similar institutions in the United States and Europe.

The oldest names applicable to the two species which seem to include all the forms under consideration are Pterodroma cookii (Gray) and Pterodroma leucoptera (Gould). Representatives of these may be distinguished as follows:

1Previous papers in this series comprise American Museum Novitates, Nos. 115, 124, 149, 322, 337, 350, 356, 364, and 365.
1. Crown, nape, sides of neck and breast, concolor with back, and close to the neutral gray series of Ridgway's 'Color Standards.' ... *Pterodroma cookii.*

2. Crown, nape, sides of neck and breast, much darker than back, forming a sharp contrast, and mainly sooty black ... *Pterodroma leucoptera.*

Examples of *P. cookii* always have more or less white on the inner vanes of the primaries; in *leucoptera* the condition is more variable. Moreover, the races of the latter species are mostly smaller, with relatively longer tails. A careful study of coloration and proportions, however, shows that the simplest and most certain way to distinguish the two species is by means of the invariable characteristics noted in the above key. In other respects, the races of both exhibit a certain parallelism in the nature of their variations.

In the following systematic section, only essential and inclusive references are cited.

Measurements of the specimens referred to in the text are published for convenience in a single table on p. 17.

**Pterodroma cookii cookii** (Gray)

*Procellaria cookii* Gray, 1843, in Dieffenbach's 'Travels in New Zealand,' II, p. 199 (New Zealand).


*Pterodroma cookii cookii* Mathews, 1912, 'Birds Austral.,' II, p. 166, Pl. LXXXVII.

**Adults** (sexes alike).—Forehead, mainly white, but with a freckling of gray-centered feathers from the median base of the culmen, the gradual transition from white to gray plumage taking place on the anterior part of the crown, in the lores, and along the cheeks and sides of neck, which have a somewhat scalloped effect; crown, nape, interscapulars, lower back, upper tail-coverts, sides of neck, and sides of breast, gray (slightly lighter and more slaty than the neutral gray of Ridgway), the feathers of all these parts more or less margined with white in fresh plumage, most persistently so on the anterior part of the crown and the sides of neck and breast; (prolonged wear exposes the darker subterminal parts of the feathers, causing the crown and back to appear somewhat spotted with dark neutral gray and to show the blackish streaks of the feather shafts); a large, roughly triangular, blackish-brown patch on the rump; a narrow white infraorbital line, not easily discernible in all specimens, and beneath this a conspicuous broader stripe of dark neutral gray or blackish, which loops around the anterior canthus of the eye and extends caudad over the ear-coverts, widening as it blends with the gray feathers along the side of the neck; the boundary between gray dorsal, and white ventral, plumage more or less mottled through the intermingling of the colors along the cheeks and sides of neck and breast, some specimens showing also a faint dusting of gray along the white flanks; wings, blackish brown (3), with horny brown quill shafts, becoming lighter basally; the greater coverts and secondary quills contrast with the remainder of the wing in that they have a distinct neutral gray bloom and are externally and narrowly margined
with white; inner vanes of remiges largely white, the sharply-marked white areas on
the primaries extending as a pointed wedge from the base throughout about three-
quarters of the length of each quill; central rectrices, largely neutral gray, terminally
tinged with blackish brown; lateral rectrices, generally comprising the four outer
pairs, somewhat variable, but as a rule white, heavily speckled with light neutral gray;
inner webs of these quills sometimes pure white, sometimes pale gray, and sometimes
showing an intermediate speckling; outer webs; usually either solidly gray or heavily
speckled; entire ventral surface of body, from chin to under tail-coverts, white;
lining of wing, white, except along its anterior edge, where a mixture of blackish brown,
white, and neutral gray feathers with white emarginations, produces a narrow,
irregularly mottled border.

Considerable variability is noteworthy in the amount of white emargination on
the dorsal plumage, the conspicuousness and extent of the blackish infraorbital patch,
the extent of white feathering above the eye, which sometimes gives the appearance
of a supraorbital stripe, the general hue of the gray parts of the plumage (due mainly
to wear), the conspicuousness of the rump patch, which is in some cases only slightly
evident, and the wide range in markings on the outer quills of the tail.

Two specimens, Mokohinou Islets, fifteen miles northwest of Great
Barrier Island, east coast of North Island, New Zealand, January 3,
1926; a good series from between lat. 34° S., long. 176° W., and lat. 39°
S., long. 179° W., December, 1925; others from lat. 47° S., long. 175°
E., February, 1926.

The pelagic localities lie east of both islands of New Zealand, from a
point southeast of the Kermadec southward to waters west of Bounty
Island. The Mokohinou birds may be regarded as topotypes and the
others agree with them. Only one specimen, a female taken at sea on
December 10, appeared to be in breeding condition.

All forms of Pterodroma cookii and leucoptera seem to have black
bills and, of course, brown irides. The only differences in flesh colors
are those of the tarsi and feet. In our specimens of P. c. cookii, these
are noted as "tarsus, upper third of foot, and inner toes, blue; remainder
black."

Pterodroma cookii axillaris (Salvin)

Southeast, Island, Chatham Islands); 1896, 'Cat. Birds Brit. Mus.,' XXV, p. 418,
Pl. vii; Godman, 1909, 'Monogr. Petrels,' part IV, p. 252, Pl. lxxxii.

Subspecific Characters.—Of smaller size than typical cookii, except in length
of tail, and with a notably shorter bill; white of forehead more restricted, dark feather-
ers being thickly interspersed medially from the base of the bill, and through the loral
region; inner wing and a wide external border, in ventral aspect, as well as axillaries,
blackish; dark rump-patch nearly obsolete.
Seven specimens in the American Museum collection, including several of the type series obtained by Hawkins; others examined in the Frankfort and British Museums. The only dated specimens were taken during May, 1892.

The Whitney Expedition visited Rangatira and the other islands of the Chatham Group during March, 1926. Since this petrel was not found, it seems likely that the nesting season had not commenced.

One statement in Salvin’s excellent description is not borne out by my observations on a dozen or more skins, namely, that the dorsal surface in this race is “paler” than that of the typical *cookii*. However, the same author appears to have amended this in the ‘Catalogue.’ Godman states that the crown is slightly darker than the back, but this difference, when detectable, seems to be due to uneven plumage wear. It is also sometimes evident in the typical race, but there is certainly no approach to the definite contrast between pileum and back which is characteristic of all forms of *Pterodroma leucoptera*.

The maximum bill length in *axillaris* hardly attains the minimum measurement in a long series of typical *cookii*.

**Pterodroma cookii nigripennis** (Rothschild)


Subspecific Characters.—Of intermediate size between the two preceding races, but with a longer tail than either, the minimum range of tail-length equalling or exceeding the maxima for typical *cookii* and *axillaris*; white area on inner vanes of primaries reduced, appearing only basally on the outermost quill, and on the proximal half of the second; gray area at sides of neck and breast more extensive than in other races of *cookii*, having a tendency to join across the breast and to extend, in the form of vermiculate bars, toward the throat and along the whole length of the flanks; feathering in front of and below the eye usually more densely black than in other forms of the species.

An excellent series of specimens from the Kermadec Islands (Herald and Macauley Islands, November, 1925; also numerous older examples from Raoul, or Sunday, Curtis, Meyer, and Macauley Islands, some of them dated February, 1895); three specimens from Bass Rock, about fifty miles east by south from Rapa Island, Austral Group, February 27, 1922; and numerous Kermadec examples examined in the museums at Berlin and Tring.

The specimens from Bass Rock are indistinguishable from Kermadec toptotypes. Some of the Herald Island birds were taken from the nest.
Beck's notes made at Herald, Curtis, and Macauley Islands, between November 13 and 20, 1925, state that many of these petrels were seen entering or emerging from their burrows during the daytime. Some of the holes contained well-developed young, but in certain adults the condition of the gonads seemed to indicate that the eggs had not long been laid. The claws of some of the breeding birds were worn down from the labor of burrowing.

Beck records the flesh colors as "tarsus and upper part of foot, flesh color; remainder black, including the whole length of the outer toe."

**Pterodroma cookii orientalis**, new subspecies


Subspecific Characters.—Very similar to Pterodroma cookii cookii, but averaging larger, and with a more pronounced appearance of scalation on the dorsal surface, due to broader and more general white emargination of the feathers.

Type.—No. 364, Brewster-Sanford Coll., Amer. Mus. Nat. Hist.; σ ad.; 200 miles west of Callao, Peru; June 9, 1913; R. H. Beck.

Range.—Off the west coast of South America, in the warm ocean waters to westward of the upwelling zone of the Humboldt Current. Specimens from 50 to 400 miles off the coasts of Peru and Chile, between 12° and 34° south latitude. Breeding ground not known.

Twenty specimens from the following points in the eastern South Pacific: 200 miles west of Callao, Peru, June 6–10, 1913; 50–80 miles west of Ancon, Peru, June 12–16; within five miles of Masatierra Island, Juan Fernandez Group, Chile, December 19, 1913.

These specimens are apparently the first of an indubitably cookii type to be recognized from the eastern South Pacific. If they had been collected near the New Zealand region, it would take considerable temerity to attempt to separate them from the typical form. However, our twenty specimens show that the average dimensions are greater than those revealed in a large series of P. c. cookii, and that the maximum ranges, particularly in the length of the wing, are decidedly larger. Moreover, in orientalis the scalation of the back, and particularly that of the crown, is very pronounced, the broadly white-edged feathers extending well toward the nape.

When we consider that the petrels of this group have a more restricted individual and racial range than was formerly believed, no choice is left but to give the bird of the South American coast a distinct systematic ranking.
P. c. orientalis is the closest to the typical form of any of the races of cookii recognized in this study. Beyond a doubt, the bird has been collected before and has, not unnaturally, been confused with defilippiana, the resident race of Juan Fernandez. To an ornithologist with only one or two examples of each at his disposal, such confusion might be almost unavoidable. When, however, the two are represented by good series of specimens collected throughout the same oceanic region, and reinforced by breeding examples of defilippiana taken from their nests, such doubts are immediately resolved. P. c. orientalis has a slender and smooth black bill of exactly the same type as that of cookii from New Zealand. P. c. defilippiana, on the other hand, has a remarkably deep, heavy bill, in which the plates of the latericorn, unguis, etc., have a strong tendency to be rugose, and even to develop a laminated aspect, so that they are more or less marked with fine horny lines. The bills of fledgling young, as well as adults, of defilippiana, have, as a matter of fact, this characteristic appearance, and even in such early stages they are pronouncedly deeper and heavier than the bills of adult specimens of P. c. cookii and P. c. orientalis.

Of the breeding ground of P. c. orientalis we know nothing, but it may be pointed out that the islands of San Felix and San Ambrosio lie about midway in its range. The implication may even now be capable of solution by examination of specimens in the British Museum, for on July 21, 1879, Coppinger collected at San Ambrosio a small petrel which has been recorded by Sharpe as defilippiana.

With regard to possible previous confusion of these forms, we may note, furthermore, the following remarks by Godman ('Monogr. Petrels,' p. 245): "Æ. defilippiana is very closely allied to . . . Æ. cooki, and may yet prove to be identical with it, in spite of the difference of habitat. . . . I have examined several specimens . . . , and find them difficult to separate."

To this I can only say that the differences are absolutely clean-cut, and would, I believe, be obvious to any ornithologist who had once seen abundant material. In short, the bill characters of the two are so distinctive that once recognized they could never again be mistaken in either nestling or adult birds. The real systematic problem is not, indeed, to find criteria which distinguish orientalis from defilippiana, but rather those which separate orientalis from typical cookii. In the latter case we are forced to the use of average measurements, and the relatively slight differences in pattern noted above.
The colors of the feet in *orientalis* are apparently exactly as in typical *cookii* of the New Zealand region. All our specimens appeared to be non-breeding birds, which is natural since most of them were obtained during the heart of the southern winter.

**Pterodroma cookii defilippiana** (Giglioli and Salvadori)

*Estrelata defilippiana* Giglioli and Salvadori, 1869, Ibis, p. 63 (off northern Chile).


**Subspecific Characters.**—Distinguishable from all other forms of *Pterodroma cookii* by the great depth of the bill and the length of the tail; in the latter character it is approached only by *P. c. nigripennis*.

Adults and young from Masatierra Island, Juan Fernandez, January 20, 1914. Other adults taken over the ocean within about five miles of Masatierra, December 30, 1913, January 3–22, 1914. Pelagic specimens as follows: 100 miles west of Valparaiso, December 3; lat. 33° S., long. 74° W. (between Valparaiso and Juan Fernandez), December 5; 200 miles west of Callao, June 6–9, 1913; 50–80 miles west of Ancon, Peru, June 12–16.

The pelagic range of *P. c. defilippiana* is thus extended far to the northward of previous records. Many of our specimens were collected in company with examples of *P. c. orientalis* but, as stated above, the two are easily separable.

Beck found these petrels nesting under ledges of rock on the main island of Masatierra, and also saw evidences of their occupation at the neighboring islet of Santa Clara, where, however, he obtained none. All of the adults collected during December and January had small gonads, showing that the egg-laying period had long passed by. Lönnberg reports eggs from Santa Clara collected on August 9, 1917.

The depth of the bill of *defilippiana*, in front of the nostrils, ranges from 8–8.5 mm., and the width of the maxilla at the base from 11–12 mm. In *P. c. orientalis* the respective measurements are: depth 6–6.8, width of maxilla 9.5 mm. Salvin's plate of this petrel, in Rowley's 'Ornithological Miscellany,' is much better than the later figure in Godman's 'Monograph,' in its depiction of the heavy bill. The color of the feet seems to be as in typical *cookii*, with the tarsi and upper third of the two inner toes light blue.
Although Giglioli and Salvadori state that examples of defilippiana followed their ship to a point "not far from the Peruvian coast," the figures for their position show that they refer to a locality several hundred miles from any part of the continental shore. It is altogether probable that the oceanic ranges of both P. c. defilippiana and P. c. orientalis lie exclusively in the subtropical part of the Pacific Ocean, well beyond the cool zone of the Humboldt Current. Neither species has been encountered within about fifty miles of the coast, nor is it likely that they can be found on any short boat excursions from land. The cool waters that fringe the west coast of South America, with the lowest temperatures within a few miles of the shore, are inhabited mainly by Tubinares of quite a different type, including such south temperate and subantarctic genera as Oceanites, Macronectes, Priocella, and Puffinus griseus.

**Pterodroma leucoptera leucoptera** (Gould)


*Pterodroma cookii leucoptera* Mathews, 1912, 'Birds Austral.,' II, p. 171, Pl. LXXXVIII.

Adults (sexes alike).—Forehead and greater part of lores, white, but freckled with a few black-centered feathers, especially along the mid-line from the bill to the anterior border of the crown, where the transition to dark plumage is abrupt; circum-orbital region, except for a narrow white infraorbital stripe and a variable amount of speckling in front of the eye, sooty black; crown, and a definite mantle which includes the nape, anterior part of the interscapular region, sides of neck, and a large and conspicuous patch at the side of the breast, sooty black; back and upper tail-coverts, close to light neutral gray, each feather with a faintly discernible dark shaft streak and, in fresh plumage, a narrow white terminal margin; a large, more or less triangular sooty black patch on the rump; wings, blackish brown (3), with a pointed, wedge-like white or mottled white area on the inner vanes of the quills, usually less definite and less extensive than in *P. cookii* cookii; greater coverts and secondary quills, neutral gray, externally margined with white; tail quills, neutral gray, the central pairs with sooty terminations, the outer pairs mottled gray and white, much as in *P. cookii* cookii: entire ventral surface, from chin to lower tail-coverts, white; wing lining, white, with the anterior margin mottled as in *P. cookii* cookii.

Two specimens, both females, taken during the Whitney South Sea Expedition. One was shot at sea, November 7, 1925, in lat. 27° S., long. 178° E. (northwest of the Kermadec Islands); the other was "blown ashore, starved," on the beach at Efate Island, New Hebrides, June 4, 1926.
Fig. 1. Ranges of the races of two species of *Pterodroma* in the Pacific Ocean, based solely upon specimens examined during the preparation of this paper. Crosses mark the position of breeding grounds.

A, *Pterodroma cookii cookii* (New Zealand); B, *P. c. axillaris* (Chatham Islands); C, *P. c. nigripennis* (Kermadec Islands, and Bass Rocks or Maretiri); D, *P. c. orientalis* (breeding ground unknown); E, *P. c. defilippiana* (Masatierra Island, Juan Fernandez).

1. *P. leucoptera leucoptera* (east coast of Australia and neighboring tropical and subtropical Pacific); 2, *P. l. masafuera* (Masafuera Island, Juan Fernandez); 3, *P. l. hypoleuca* (tropical and subtropical Pacific in the northern hemisphere); 4, *P. l. brevipes* (Melanesian groups).

The oceanic ranges of all the forms are doubtless more extensive than indicated and characterized by pronounced overlapping. The actual breeding areas are probably everywhere exclusive, as at the Juan Fernandez Islands.
These two are identical with Gould's type specimen from Port Stephens, which has been kindly lent to me by the Academy of Natural Sciences, of Philadelphia, through the courtesy of Dr. Witmer Stone. In both pattern and measurements the type differs only minutely from our two recently collected birds. However, the oil of decades has soaked into the dorsal plumage of the old specimen, turning the back dark, while the hue of the head and nape has browned with age. For these reasons, the distinction in color between head and back, which is characteristic of the species, is more or less obscured.

Most of the published descriptions of the typical race of *P. leucoptera* have been based upon the same group of three or more aged and greasy specimens. Mathews has already called attention to this fact, and has, on p. 172 of his monographic work, amended the earlier descriptions. His only statement, with which I cannot agree, points out alleged differences in appearance between the sexes.

Gould's plate is in no way diagnostic; it might represent some form of *Pterodroma cookii* even better than the bird he had named *leucoptera*. It is curious, moreover, that although Godman and Mathews give good textual descriptions of this petrel, their plates (both said to be based upon paratypes) resemble each other very little. Neither one is a good illustration of the bird, for both fail to reveal many striking features, such as the contrast in color between crown and back, the extent of the black feathering at the side of the neck, the white emargination of fresh plumage on back and wings, the mottling on the outer rectrices, etc. Godman's plate is the better of the two, that of Mathews showing practically none of the characters of a recently collected specimen.

Beck's notes on the label of our specimen taken at sea near the Kermadec Islands give the length of the dead bird in the flesh as 310 mm., and the expanse of the outstretched wings as 730 mm. The ovaries were slightly enlarged. The color of the tarsus and upper third of the foot was whitish or flesh, the remainder black.

The comments by Gould, Godman, and others as to where this petrel has been, or has not been, observed at sea during various voyages may all be discounted. In view of the confused identifications of various races of *P. leucoptera* and *P. cookii*, when represented by specimens in the hand, it is absolutely certain that they have not been correctly distinguished in life. Thus Salvadori states that *leucoptera* was not seen during the cruise of the 'Magenta,' whereas we now know that this vessel spent much time within the common oceanic range of at least three petrels between which that author could hardly have discriminated in the field,
namely, \textit{P. leucoptera masafueræ}, \textit{P. cookii orientalis}, and \textit{P. cookii defilippiana}. Never has the fundamental importance of systematic work been more apparent.

\textbf{Pterodroma leucoptera masafueræ} Lönnberg


\textbf{Subspecific Characters.}—Distinguishable from \textit{Pterodroma leucoptera leucoptera} as follows: size slightly smaller, excepting the tail, which is apparently longer than in the typical race; crown less blackish, and the dark coloration more restricted, terminating rather sharply at the nape, whereas in typical \textit{leucoptera} it extends caudal into the scapular region and very definitely into the patch at the sides of the breast (in \textit{masafueræ} the latter areas are distinctly gray rather than sooty black); white feathering extending much higher on the forehead, usually terminating in a line drawn through the center of the eyes, some specimens having practically clear white foreheads (in the typical form the extreme breadth of the whitish forehead, measured from the base of the culminicorn, is about 12 or 13 mm.; in \textit{masafueræ} it averages about 23 mm.); the tarsi are grayish black, instead of flesh-color.

Ninety specimens, collected by R. H. Beck during the course of the Brewster-Sanford South American Expedition, as follows: twenty miles north of Masafuera Island, December 20 and 22, 1913; two to eight miles from the coast of Masatierra Island, December 19, 30, 1913, January 3–29, February 9, 1914.

Beck was unable to land at Masafuera, owing to rough seas; consequently he obtained no specimens at their nests. The petrels of this species breed only at Masafuera, whereas \textit{P. cookii defilippiana} occupies the main island of Juan Fernandez (Masatierra), and the neighboring islet of Santa Clara, in an equally exclusive manner. The interesting circumstances are described by Lönnberg from the observations and collections of Bäckström. Both species mingle indiscriminately in the waters around the islands, while wandering examples of \textit{P. cookii orientalis} likewise enter the same region. In view of the distinctive characters of \textit{P. leucoptera masafueræ}, it seems extraordinary that the bird remained unnoted in literature until Lönnberg's description appeared in 1921.

Most of our specimens collected during January and February had reduced gonads; among those taken in December, there was evidence that the breeding season had not long passed, while bare abdomens indicated that some were still either incubating the egg or brooding young.

There is considerable variation in the plumage, which seems to be correlated with moult and wear. Thus, December specimens have very gray backs, scaled with white feather edgings. The line of demarcation
between the back and the darker gray of crown and nape is very sharp. Through the effect of abrasion the white margins on the back disappear rapidly, so that they show scarcely at all among birds collected during February or late January. The back becomes progressively spotted with black, owing to the appearance at the surface of the dark feather-shafts as the distal margins of the feathers wear away; for the same reason the line of demarcation between nape and back becomes less distinct. Variation is also great in the relative whiteness of the forehead, the speckled area being more extensive in some specimens than in others. Again, the tail quills also vary widely, those of some birds being clear gray even to the outermost, while in others the outer pairs are heavily speckled.

The central rectrices are practically black distally.

A single aberrant specimen (Brewster-Sanford Coll., No. 1941, ♂) requires special notice. This bird, which was taken within five miles of Masatierra on February 9, 1914, is much smaller in every dimension than any other in the large series, the bill, for example, being 3 mm. shorter than the minimum length among the others. Its measurements, which are not included in the table on p. 17, are as follows: wing, 210; tail, 95; culmen, 21; tarsus, 27; middle toe with claw, 32 mm.

This specimen shows no evidence of being a young bird. Moreover, my experience with petrels convinces me that fledglings which have already taken to sea are not, as a rule, smaller in length of bill, wing, etc., than mature birds. Two explanatory hypotheses are admissible. The first, which is by no means impossible, is that the abnormally small specimen represents a distinct race of the species from some unknown breeding station. The second, and more likely, is that the bird is merely a dwarf of *P. leucoptera masafuerxe*. Such phenomena are known, and I have already pointed out a similar case of an abnormally short-billed shearwater in a frequency-distribution graph of fifty adults of *Puffinus herminieri dichrous* (1927, Amer. Mus. Novit., No. 276, p. 11). Such a specimen would be troublesome to a systematist if it chanced to form one of only four or five skins. When, however, it is the only anomaly among ninety, it may be justifiably disregarded in subspecific diagnosis.

*Pterodroma leucoptera hypoleuca* (Salvin)


Subspecific Characters.—Differs from the preceding races of *P. leucoptera* in its larger size, which is most marked in the length of the tail, and in having no white on the primary quills; the wing lining, moreover, is mostly dark, except on its innermost feathering.

Eight specimens in the American Museum collection: three males, two females, Laysan Island, Hawaiian Group, September, 1895, April, 1903, January and February, 1913; three unsexed specimens, Bonin or Ogasawara Islands, January and February, 1910. Other specimens from Laysan examined in the Berlin Museum.

This form is strongly reminiscent of *P. leucoptera masafueræ*, with the white or white-edged feathers running well over the forehead, and, in some instances, covering most of the crown. It would, in fact, be difficult to distinguish certain specimens of the two forms were it not for the fact that *masafueræ* has conspicuous white areas on the inner vanes of the primaries, whereas in *hypoleuca* these quills are uniformly dark as in "*P. orquata*" (*P. leucoptera brevipes*) with which the original describer compared it. Both *hypoleuca* and *brevipes* clearly belong in the Formenkreis of *Pterodroma leucoptera*.

"Krusenstern Island," the type locality of Salvin’s specimen, appears in Brigham’s ‘Index to the Islands of the Pacific’ only as a synonym for Tikahau, of the Tuamotu Group, south of the equator. According to Godman and Mathews, the locality referred to is one of the Marshall Islands, in the eastern part of the present Japanese Mandate Territory. However, I can find no island in the Marshall Group to which the name Krusenstern has ever been applied. A better supposition, it seems to me, is that the type came from one of the islets which have been called "Krusenstern Reef," southwest of Laysan, in the Hawaiian Group. This islet of uncertain position has doubtless been visited by the Japanese feather collectors who once worked at Laysan, and through such hands the type skin may have reached Yokohama. The range of the subspecies probably covers a wide area in the tropical and subtropical North Pacific, for Laysan and Bonin specimens are indistinguishable.

**Pterodroma leucoptera brevipes** (Peale)


*Procellaria torquata* Macgillivray; 1860, Zoologist, XVIII, p. 7132.

Æstrelata leucoptera Salvin, 1876, Ibis, p. 393 (footnote).

Æstrelata torquata Salvin, 1891, Ibis, p. 411, Pl. IX; Godman, 1908, ‘Monogr. Petrels,’ part III, p. 209, Pl. LVII.

Pterodroma brevipes Mathebs, 1927, 'Syst. Avium Australasianarum,' p. 120.

Subspecific Characters.—Smaller than any of the preceding races of P. leucopetera, except in length of tail, in which it equals or slightly exceeds the typical form; occurs in two phases, of which the gray is diagnostic; white-breasted examples are distinguishable from other subspecies by one or more of the following characters: primary quills entirely dark (as in the larger P. l. hypoleuca); white forehead very narrow (as in P. l. leucopetera); a tendency toward fine, dark gray peppering of the white ventral plumage, apparently always present at the sides of the breast, and extending in many specimens as a band across the breast and along the whole length of the flanks. In fact, the varying density and extent of this dark speckling produces every stage of intergradation between white-breasted and gray-breasted phases of the subspecies.

Twenty-seven specimens, as follows: one white-breasted, one intermediate, and five gray-breasted adults, taken at sea, thirty miles east of Meralav (Melepav or Star Peak) Island, Banks Group, New Hebrides, January 27–29, 1927; twenty adults and young, all of the white-breasted, or nearly white-breasted, phase, taken at the nests on Kandavu Island, Fiji Group, June, 1925. A male from the mountains of Viti Levu, Fiji Group, May, 1878, examined in the Berlin Museum.

Our Fijian adults had mud from their burrows upon the bills and feet, but no details about the capture can be found in Beck's notes. The young are mostly well advanced, and some of them have all but lost the down. According to the labels, the tarsi and upper part of the feet were flesh-colored in nestling birds, and blue in adults, the distal parts of webs and toes being black.

Mature specimens of this race in the white-breasted phase, and with a minimum amount of fine gray speckling at the sides of the breast, are almost counterparts of typical leucopetera. No doubt the two have often been confused, as they probably were by Salvin (1876) when he recorded "Estrelata leucopetera" as a breeding bird of the Fiji Islands. The presence or absence of the white patch on the inner vanes of the primaries may, however, always serve to distinguish the two forms, besides which they are of slightly different proportions, brevipes having a smaller bill, tarsus, and foot. Moreover, the gray speckling referred to is never entirely absent from specimens of brevipes. Ordinarily it extends more or less across the breast, down the flanks, and onto the white under tail-coverts. Other specimens are far more heavily marked, the ultimate state being complete saturation of the ventral plumage, caudal from the throat, with dark pigment. The race should not properly be called dichromatic, because the extreme phases are connected by specimens exhibiting every intergrading stage from pure white to very dark gray.
Many of our specimens, especially the young birds, show on the head and neck the white filoplumes mentioned by Stejneger. Salvin (1891, p. 412) speaks of nestlings only a few days old, from Aneiteum, New Hebrides, as being "covered with black down." Our nestlings from Kandavu, are, as stated above, nearly full-grown, and the long mesoptyle down is plumbeous-gray on the dorsal surface and whitish on the ventral surface.

Salvin's plate of the wandering example of this petrel shot on the Welsh coast is not a good likeness of specimens before me, failing altogether to show the rich blackish-brown tone of the wings, sides of neck, nape, crown, and infraorbital region. Godman's plate is better, although the back is too dark and there is little indication of the invariable and characteristic fine gray speckling on the sides of the neck of white-breasted examples. Finally, the color of the legs is not correct for adult birds.

It is odd that the alleged type locality of Peale's "Procellaria brevipes," which is near Peter Island in the eastern South Pacific, south of the antarctic circle, has never been questioned. Peale's published remarks are as follows: "Two specimens were shot on the 21st day of March, in latitude 68° S., longitude 95° W. . . . The labels having been displaced after the specimens were sent home, the sex cannot be given with certainty now, but they are believed to be males." This comment, written some years after the reported capture of the specimens, is enough to throw some doubt on all of the data. The race is unquestionably equatorial in its normal distribution, even though a record made in the antarctic may be no more remarkable than the one made in the British Isles.

GENERAL REMARKS

The above notes are believed to cover all of the known forms of the two species except the "Æstrelata longirostris" of Stejneger, (1893, Proc. U. S. Nat. Mus., XVI, p. 618, Hondo, Japan). This I have not seen, but it is clearly a member of the leucoptera Formenkreis. In fact, hardly any item of the original description, including the length of the bill and of the nasal tubes, the white wedge on the inner webs of the primaries, the white sprinkling on the rectrices, and the clear white lining of the wing, would serve to distinguish it from the type skin of Pterodroma leucoptera leucoptera. The tail, however, seems a little too long, according to Stejneger's measurements.
A certain parallelism in the races of the species *cookii* and *leucoptera* has already been mentioned. Thus, the length of bill and tail varies in the two groups in much the same manner, although, as a whole, *cookii* is the longer-billed species, *leucoptera* the longer-tailed. *P. c. orientalis* bears about the same relationship to typical *cookii* that *P. l. masafueræ* does to typical *leucoptera*. *P. c. axillaris* is, in general appearance, a sort of analogue of *P. l. hypoleuca*, while *P. c. nigripennis* can be paired in a similar way with *P. l. brevipes*, both the latter forms having a tendency toward vermiculate or speckled markings not found in another race of either species. Throughout all of these superficial resemblances, however, the specific distinctions clearly hold.

As with the races of *Puffinus assimilis* and *Puffinus lherminieri*, those of the two species of petrels under discussion have a somewhat different general distribution. Thus, the known breeding grounds of all forms of *Pterodroma cookii* lie to southward of the tropic of Capricorn. In other words, the species is characteristic of the south temperate Pacific Ocean. *Pterodroma leucoptera*, on the other hand, is mainly a tropical or subtropical petrel. *P. leucoptera leucoptera* extends its breeding range only a little to the southward of the tropics on the Australian coast; *P. l. hypoleuca*, in like manner, penetrates into subtropical island groups of the northern hemisphere. *P. l. masafueræ* seems less true to type, for it nests at an island beyond latitude 33° S. The case may, however, be more apparent than real, for Masafuera lies in an essentially subtropical ocean. It is interesting, and doubtless significant, that of the two islands of Juan Fernandez, which lie nearly a hundred miles apart in an east-west line, the local race of *Pterodroma leucoptera* has occupied the offshore island, while the race of *Pterodroma cookii* is confined exclusively to the inshore island which is influenced more by the cool littoral waters of the Chilean coast.

All in all, the two species show striking resemblances in distribution, and even in the respective differences of their pattern and color, to the phenomena exhibited by the Formenkreise of *Puffinus assimilis* and *Puffinus lherminieri*. 
Measurements of the Races of *Pterodroma cookii* and *Petrodroma leucoptera*

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<th>Wing</th>
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<th>Tarsus</th>
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<td>23.5 26 24.4</td>
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