

AMERICAN MUSEUM NOVITATES

Number 276

Published by
THE AMERICAN MUSEUM OF NATURAL HISTORY
New York City

Sept. 8, 1927

59.84, 2 P

ON CERTAIN FORMS OF *PUFFINUS ASSIMILIS* AND ITS ALLIES

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The small shearwaters related to *Puffinus assimilis* have presented a complicated problem to taxonomists, as shown by the tenor of numerous discussions published during the last thirty years. The more important references are the following:

- 1899. Rothschild, W., and Hartert, E., *Novit. Zool.*, VI, pp. 194-197.
- 1912. Mathews, G. M., 'Birds Austral.', II, pp. 50-73.
- 1918. Loomis, L. M., *Proc. Calif. Acad. Sci.*, (4) II, part 2, No. 12, pp. 122-129.
- 1920. Hartert, E., 'Vögel Paläarkt. Fauna,' II, pp. 1421-1423.
- 1926. Hartert, E., *Novit. Zool.*, XXXIII, pp. 349-350.

In addition to studying the evidence and conclusions presented in these papers, the writer has enjoyed the courtesy of seeing proof-sheets of Mr. Gregory M. Mathews's forthcoming list, 'Systema Avium Australasianarum,' which contains certain modifications of this author's former views regarding the birds concerned.

The American Museum of Natural History now possesses examples of these small shearwaters from many parts of the world, a number of forms being represented by large series. The present systematic notes are based not only upon these but also upon skins examined in European Museums during the summer of 1926. Data for a new review of all the subspecies are not available, but, if it be possible to fix the status of several hitherto doubtful forms and to substantiate a division of the group into two species which exhibit a definite geographic correlation, the purpose of this small contribution will be served.

Let us begin with a schematic consideration. A, B, C and D, E, F represent six races of a small, white-breasted, dark-backed *Puffinus*. On ordinary systematic grounds they might all be treated as subspecies of a single species, a course which Dr. Hartert and others have followed. But a study of the specimens shows that A, B, and C are much more closely allied with one another than any of them is with D, E, or F. A similar generalization is likewise applicable to the races of the latter group. When, furthermore, the complex of forms which we may now designate A B C is found to inhabit a distinct climatic or oceanographic zone from D E F, and it appears that each group has "subspeciated"

freely within the limits of its own zone, we may reasonably regard the main groups as specifically distinct. Classification is in large measure a matter of convenience, but the writer believes that in this instance specific differentiation will better reflect the evolutionary and geographic history of the birds, besides facilitating the identification of specimens.

Among the differences between the two groups, Mathews (1912, p. 68) has stressed that one is made up of birds with "blue-black" and the other of birds with "brown-black" upper surfaces. Loomis (1918, p. 122) holds, on the other hand, that "intergradation is complete between the brownish-backed and bluish-backed birds." The writer's experience with three hundred specimens from about thirty localities in the Atlantic, Indian, and Pacific Oceans confirms the opinion of Mathews. Regardless of age or state of plumage, a glance at the dorsal aspect of any specimen has thus far been sufficient to assign it to either the "blue" or the "brown" groups. Moreover, such allocation can always be checked by inspection of the primary quills, which distinguish birds of the respective groups with equal constancy.

The distinctions may be more fully set forth as follows:

1.—Upper surface varying in the different races between slate color and slate black, fading greatly with extreme wear, but always without a trace of brown hue in fresh feathers; inner vanes of the primaries largely white; under tail-coverts mostly white (entirely so among all forms examined except the Madeiran race); part of loral space between culminicorn and angle of mouth, white; color of legs in life, blue. Range: extratropical seas, chiefly in the temperate zone beyond 30° S. latitude, but with one north temperate race (at Madeira) *Puffinus assimilis*.

2.—Upper surface varying from blackish brown to sooty black, but always brownish rather than slaty; inner vanes of primaries without white; under tail-coverts largely or entirely dark; part of loral space between culminicorn and angle of mouth, mostly dark; color of legs in life, flesh color. Range: tropical seas, extending just north of the Tropic of Cancer at the Bonin and Bahama Islands, and to an isolated northern outpost at Bermuda. *Puffinus lherminieri*.

***Puffinus assimilis assimilis* Gould**

Puffinus assimilis Gould, 1838, 'Synops. Birds Austr.,' part 4, Append. p. 7 (New South Wales=Norfolk Island).

Mathews and Hartert now agree in regarding birds from Lord Howe Island as identical with topotypes. The American Museum has received as a gift from the Zoological Museum at Tring two males taken at Roach Islet, Lord Howe Island, June 24, 1914. They represent a short-billed race, with the characteristic slaty-black upper surface. The entire lining of the wing is white. The white area of lores and cheeks passes well above the eye, a few dark feathers speckling the orbital ring. The bill

in life was "blue and black," and the feet "clear blue" with the usual dark color on the outer side of tarsus and third toe.

MEASUREMENTS.—Wing, 171–173 (172); tail, 63; exposed culmen, 24–25 (24.5); depth of closed bill at base, 8–8.7; width of bill at base, 9.2–9.6; tarsus, 35–36 (35.5); middle toe with claw, 41–42 (41.5) mm.

***Puffinus assimilis kermadecensis*, new subspecies**

SUBSPECIFIC CHARACTERS.—Differs from *Puffinus assimilis assimilis* of Lord Howe Island in its larger size, which is especially noticeable in the length of the tarsus and middle toe.

TYPE.—No. 254107, Amer. Mus. Nat. Hist.; ♂ ad.; Herald Island, Kermadec Group, Nov. 19, 1925; R. H. Beck.

RANGE.—Kermadec Islands, Dominion of New Zealand.

Mathews united the Kermadec race with typical *assimilis*, but Hartert (1926, p. 350) pointed out that "the Kermadec birds require a new name, as they have larger bills than the Norfolk and Lord Howe specimens." However surprising it may seem to find a distinct form at islands lying on approximately the same parallel of latitude as Lord Howe and Norfolk, the excellent series at hand admits of no doubt in the matter.

During field work of the Whitney South Sea Expedition, Mr. R. H. Beck and his associates collected forty specimens of this shearwater on or adjacent to Herald and Sunday (Raoul) Islands of the Kermadec Group. The dates extend from Nov. 8 to 19, 1925, and the material includes young birds in advanced downy stages as well as adults. A few of the latter had enlarged gonads, as though the breeding period were still in progress.

From the gray down, which is whitish along the belly and leaden above, the chicks molt into a clear blackish-slate dorsal plumage, with a lighter slaty bloom on the quills and coverts. No feathers show any trace of white margins, but the inner webs of the primaries are pure white over more than half of their width as in all members of the species as restricted in this paper.

Adults appear to be indistinguishable in color and pattern from typical *assimilis*, but all dimensions are larger. Bill, bluish with a black culmen; feet and legs, bluish, the outer toe and outer side of tarsus black.

MEASUREMENTS (10 ♂, 5 ♀).—Wing, 179–201 (190.5); tail, 62–71 (65.5); exposed culmen, 24–27 (26.1); depth of closed bill at base, 8–9.5; least depth of bill, 5.5–6; width of bill at base, 9–10.5; tarsus, 38–42 (39.6); middle toe with claw, 42–46 (44.3) mm.

Females appear to equal the males in size. Curiously enough there are but five adult females in the whole series.

***Puffinus assimilis*, subspecies**

An adult male, Amer. Mus. Nat. Hist. No. 254141, was collected by Mr. Beck in lat. 35° S., long. 175° W., a point about equidistant from the Kermadecs and the North Island of New Zealand, on Dec. 10, 1925. Its extremely long and heavy bill distinguishes it sharply from the Kermadec race, and still more so from typical *assimilis*. The wings and tail, though greatly worn, still indicate the large size of its subspecies. In pattern and color, and description of soft parts, it agrees with the preceding forms, its somewhat lighter dorsal surface being probably attributable to fading.

MEASUREMENTS.—Wing (much abraded), 199; tail, 69; exposed culmen, 29.5; depth of closed bill at base, 10.5; least depth of bill, 7; width of bill at base, 11; tarsus, 39; middle toe with claw, 46 mm.

Mathews (1912, pp. 53, 62, 63, and 69) has given scattered, confused, and defective descriptions of *Puffinus assimilis kempfi*, a new race ascribed to the Chatham Islands, and of *Puffinus assimilis gavia* (Forster), the type locality of which is Queen Charlotte Sound, New Zealand. There is some question about the validity of the name *gavia* as applied to a race of *assimilis*, besides which, the writer has seen no New Zealand specimens for comparison with the American Museum bird. The skin does not agree with Mathews' sketchy description of *kempfi*, so identification must await the arrival of further material.

***Puffinus assimilis munda* (Salvin)**

Nectris munda Salvin, 1876, 'Rowley's Ornith. Miscell.,' I, p. 236 (lat. 48° 27' S., long. 93° W. of London).

Salvin's description of this shearwater was based upon the manuscript records of Banks and Parkinson, accompanied by a pencil drawing. Mathews (1912, pp. 59, 60) has since published Solander's detailed Latin diagnosis. The type, which was collected on Feb. 15, 1769, was not preserved, nor have additional specimens since come to light until the Whitney South Sea Expedition collected six in lat. 49° S., long. 179° W. (south of Antipodes Island), on Feb. 16, 1926. It is a curious coincidence that after one hundred and fifty-seven years, almost to a day, the lost form should be recovered at practically the same parallel of south latitude. The east-west distance between the type locality and the place of capture of our specimens is about 815 nautical miles, but Solander's beautiful description leaves little doubt as to their identity.

SUBSPECIFIC CHARACTERS.—A large, but relatively short-billed, race of *Puffinus assimilis*, the feathers of the slaty dorsal plumage narrowly margined with white.

TYPE.—Non-existent.

REFERENCE SPECIMEN OR NEOTYPE.—No. 211650, Amer. Mus. Nat. Hist.; ♂ ad.; lat. 49° S., long. 179° W., Feb. 16, 1926; R. H. Beck.

ADULT (sexes alike).—Entire upper surface close to slate color (not exactly matched in Ridgway's 'Color Standards,' but Solander's terms "ashy-blackish" and "steely-blackish" are suggestive), the feathers of nape, sides of neck, back, wing-coverts, secondaries, and tail-coverts margined with white, most broadly (2 mm.) on the external and terminal parts of the secondaries; concealed portions of dorsal feathers grayish white; inner two-thirds of inner vanes of primaries white to within 20 or 25 mm. of their tips; pileum slightly more blackish than back, and lacking white borders on the feathers; lores speckled, white on their lower halves, the dark color of the pileum descending below and behind the eye, with a mottled boundary; a narrow white stripe on the lower eyelid; sides of breast covered with slaty, white-margined feathers which blend gradually with the uniform white plumage of the ventral surface; lining of wings and under tail-coverts white like throat and breast. Bill blackish above and terminally, blue on the mandible and toward base of culmicorn; feet and legs blue, with the outer toe and outer side of tarsus blackish.

MEASUREMENTS (3 ♂, 3 ♀).—Wing, 182–196 (190.5); tail, 64–69 (66.8); exposed culmen, 24–27.5 (25.8); depth of closed bill at base, 8.4–10; least depth of bill, 6–6.6; width of bill at base, 10–11.5; tarsus, 39–41.5 (40.3); middle toe with claw, 45–48 (47.1) mm.

All the specimens, which are apparently adults, had small gonads. Two are in more worn plumage than the others and show that the delicate white fringing on the feathers of the upper surface tends to wear away, leaving a uniform gray appearance.

There can be little doubt that *Puffinus elegans* Giglioli and Salvadori, described from the South Atlantic, is close to this form. Mathews states that *elegans* is the Gough Island bird, in which case *Puffinus assimilis munda* perhaps represents a race or type of the species which occurs south of the northern limit of drift ice throughout the subantarctic oceans.

***Puffinus assimilis godmani* Allen**

Puffinus godmani Allen, 1908, Auk, p. 339 (Madeira).

The Madeiran race is the most isolated member of the species, the only one, so far as available material shows, which has crossed the equatorial regions into the northern hemisphere. Its distinctness from the brown-backed, tropical shearwaters of the West Indies and the Cape Verde Islands is highly noteworthy as a zoögeographic phenomenon.

P. a. godmani bears a close general resemblance to typical *P. a. assimilis*, but most specimens of the former show a dusky wash on the outer vanes of the lateral under tail-coverts. Moreover, the white area on

the inner webs of the primaries, which is less extensive in *godmani* than in other subspecies, is finely sprinkled or mottled with gray instead of being pure white. Finally, *godmani* has a relatively longer and more slender bill than the southern subspecies of similar size and appearance.

The material examined comprises specimens labelled Madeira, Porto Santo, the Desertas, and Bugio Island, collected in Feb., June, July, and Sept., together with a typical example (young?) in the Dwight collection, which was taken near Sable Island, Nova Scotia, Sept. 1, 1896.

MEASUREMENTS (4 ♂, 4 ♀).—Wing, 172–187 (176.9); tail, 63–72 (67.1); exposed culmen, 25.5–28 (26.6); depth of closed bill at base, 7.6–8.5; least depth of bill, 4.5–5; width of bill at base, 7.6–8.7; tarsus, 35.5–39 (37.1); middle toe with claw, 40–42 (41.1) mm.

Puffinus lherminieri lherminieri Lesson

Puffinus lherminieri Lesson, 1839, Rev. Zool., II, p. 102 ("Ad ripas Antillarum").

Audubon's shearwater is the typical form of the group characterized by a "brown-black" upper surface and other features listed in the key. The material examined includes an excellent series in The American Museum of Natural History, as well as the type skin of *P. auduboni* Finsch, in the Berlin Museum, and other specimens in foreign collections. Localities represented by the measured skins comprise Barbados, Guadeloupe, St. Thomas, Florida, the Bahamas, Bermuda, Cobbs Island, Va., and Bellport, N. Y.

During the course of the Brewster-Sanford South American Expedition, Mr. R. H. Beck took numerous adults from their burrows on a small islet off the northern end of Barbados, on July 30, 1916, and others at Little Saba Island, St. Thomas, on Aug. 21, 1916. The specimens had already begun to molt, a process which seems to go on among the West Indian shearwaters throughout the summer.

Downy young, in various stages of growth, are well represented in the American Museum collection by birds taken at the Bahamas, St. Thomas, and Guadeloupe during the month of May. The down gives place to a plumage of the adult type, the dorsal surface being of a nearly uniform hue, close to the blackish brown (3) or the fuscous black of Ridgway, without white feather margins except at the sides of the breast.

The lores in this subspecies are mostly dark, with no more than a narrow line of white from the bill to the angle of the mouth. The inner vanes of the primaries, as in all forms of the species, lack white; the lower tail-coverts are mixed but prevailing dark, and the axillaries

and under coverts of the wing are rarely if ever without at least a few dark splotches.

The bill is both long and heavy, though subject to considerable variation. For example, a female taken off its egg at Washerwoman Key, Bahamas, May 15, 1902, has an exposed culmen of only 26 mm. This is nearly 4 mm. below the average of 26 adults, among which the next shortest bill measures 28 mm. Further consideration of such variations will be given under another subspecies. Sexual variation seems to be slight and inconstant.

Bill, black, bluish on the mandible and toward the base of culminicorn; feet and legs, flesh color, with the outer toe and outer side of tarsus blackish.

MEASUREMENTS (26 ♂ and ♀, collected at all seasons).—Wing, 200–216 (208.2); tail, 82–94 (87.2); exposed culmen, 26–32 (29.8); depth of closed bill at base, 9–10.8; least depth of bill, 6–7.5; width of bill at base, 10–13; tarsus, 39–43 (40.3); middle toe with claw, 43.5–48 (45.8).

***Puffinus lherminieri boydi* Mathews**

Puffinus lherminieri boydi Mathews, 1912, 'Birds Austral.,' II, p. 70 (Cape Verde Islands).

This form is substantially a counterpart of the West Indian race in color and proportions, but is very much smaller. The writer previously assigned it to *assimilis* (1924, Bull. Amer. Mus. Nat. Hist., L, pp. 240, 241), but he now concedes that Mathews and Bannerman were right in pointing out its close affinity with the tropical brown-backed and dark-primaried group. Its relationship with the north temperate Madeiran race is as remote as that between any forms of *assimilis* and *lherminieri*.

MEASUREMENTS (2 ♂, 2 ♀).—Wing, 169–180 (176.9); tail, 71–80 (76.5); exposed culmen, 24–29 (26.6); depth of closed bill at base 7–7.5; least depth of bill, 4.6–5; width of bill at base, 10; tarsus, 37–39 (37.5); middle toe with claw, 40–44 (42.5) mm.

***Puffinus lherminieri subalaris* Ridgway**

Puffinus subalaris Ridgway, 1897, Proc. U. S. Nat. Mus., XIX, p. 650 (Chatham Island, Galapagos).

Puffinus lherminieri becki Mathews, 1912, 'Birds Austral.,' II, p. 70 (Culpepper Island).

The American Museum possesses specimens from Wenman, Culpepper, Hood, and Duncan Islands, collected during the months of Jan., Feb., Apr., May, June, and August.

The characters of the subspecies have been fully discussed by the

describer, by Rothschild and Hartert (1899), and by Loomis (1918). Making allowance for every recorded color variation, the race seems to be marked by the absence of dark areas descending from the back over the sides of the chest and by the prevalence of dark feathers on the flanks. From *P. l. therminieri* it differs also in both size and proportions, the tail being relatively as well as absolutely shorter. A curious feature, which appears to distinguish *subalaris* from every other form of either *therminieri* or *assimilis* which has passed through the writer's hands, is that the nasal tubes of the Galapagos race are exceptionally firm and corneous, showing almost no trace of shrinkage in dried skins.

Loomis has satisfactorily disposed of Mathews's description of a second subspecies inhabiting the Galapagos Archipelago.

The dimensions of ten American Museum specimens agree remarkably well with those of ninety-nine recorded by Loomis.

MEASUREMENTS (5 ♂, 5 ♀).—Wing, 189–203 (194.8); tail, 68–75 (71.8); exposed culmen, 24.7–29 (27.7); depth of closed bill at base, 9–10; least depth of bill, 6–6.5; width of bill at base, 10.5–12; tarsus, 34–37 (36); middle toe with claw, 40–43.6 (41.3) mm.

***Puffinus therminieri polynesiae*, new subspecies**

Extensive collections in The American Museum of Natural History show that the central part of the South Pacific Ocean, from the Marquesas and Tuamotu Islands westward within the tropics to Samoa, is occupied by a uniform race of brown-backed *Puffinus*, larger than *subalaris*, smaller than typical *therminieri*, but resembling the latter in the extent of dark, white-edged plumage which descends down the sides of the neck and chest toward the mid-line. In short, this is the race of tropical Polynesia.

Westward, toward Australia, a very distinct subspecies is found. Northwestward, toward and across the equator, or in the region extending from the Phoenix Islands through the Gilberts and Carolines to the Pelew Group, is still another race, resembling the Polynesian form but with a very short bill. Still farther northward, just beyond the tropic of Cancer at the Bonin Islands, is the home of a fourth, extremely well-marked subspecies. These several forms will all be considered in turn.

It would be natural to conclude on geographic grounds that the Polynesian race is the *Procellaria obscura*, of Gmelin, the type locality of which was said to be Christmas Island. Mathews has, however, discarded this specific name because of alleged confusion of forms in its original application,¹ a step in which he has been supported by Hartert

¹Cf. also Pelzeln, 1873, *Ibis*, pp. 47–51, and Mathews and Iredale, 1915, *Ibis*, p. 596.

(1920, p. 1422). The writer regards the intricacies of nomenclature as the most distasteful and least profitable phase of ornithological research, and he prefers to leave the solution of this patent case to others while he attempts to fix the taxonomic, rather than the nominal, status of the forms which occupy certain definite Pacific areas.

It may be said that two recent visits by representatives of the American Museum and the Bishop Museum of Honolulu failed to disclose the presence of the small *Puffinus* at either Christmas or Fanning Islands. If, however, future workers conclude that the name *obscura* is tenable, the nomenclatural changes involved will be simple. The bird here described as *Puffinus lherminieri polynesiae* will become *Puffinus obscurus obscurus* (Gmelin), while *lherminieri* will remain only as the subspecific name of the West Indian race. The distinction between the species *assimilis* and *lherminieri*, as conceived in this paper, will not be affected.

The Polynesian bird may meanwhile be diagnosed as follows:

SUBSPECIFIC CHARACTERS.—Resembling *Puffinus lherminieri lherminieri*, but smaller, with a more slender bill; larger than *P. l. subalaris*, especially in length of tail and tarsus, and differing, furthermore, in the presence of an extensive dark area at the sides of the pectoral region, and in having noticeably shorter and less corneous nasal tubes.

TYPE.—No. 189770, Amer. Mus. Nat. Hist.; ♂ ad.; Tahiti, Society Islands, Aug. 2, 1921; R. H. Beck.

RANGE.—Society, Tuamotu, Marquesas and Samoan Islands, and doubtless other groups in the central part of the tropical South Pacific.

MEASUREMENTS (26 ♂ and ♀, 4 Tahiti, 4 Marquesas, 10 Tuamotus, 8 Samoa).—Wing, 188–212 (202.9); tail, 75–84 (80.1); exposed culmen, 25.5–30 (28.9); depth of closed bill at base, 8–10; least depth of bill, 5.5–6; width of bill at base, 9–11; tarsus, 37.5–41 (39.2); middle toe with claw, 39–43 (41.4) mm.

The material comprises large series of skins, collected by Messrs. R. H. Beck, J. G. Correia, and others, during the explorations of the Whitney South Sea Expedition, as follows:

Society Islands, 1921: Tahiti, Aug. 2, adults, gonads small, "breeding finished." Tuamotu Islands, 1922: Mangareva (Makarua islet), May 3, nesting adults and a fledgling which had nearly lost the down; (Motu Teiko islet), May 4, adults, and young in all stages of growth; (Manui islet), May 8, adults and young. Marquesas Islands, 1923: Hatutu, Oct. 10, breeding adults and a half-grown downy young; Huahuna (Uahuka), Nov. 11, one nesting female. Samoan Islands, 1923: Tau, Manua Group, Dec. 26, 27, breeding adults with enlarged gonads.

Bill black, dark bluish or bluish gray on mandible and at base of culminicorn; feet flesh-color, outer toe and outer side of tarsus blackish.

Length in flesh (♂, Tahiti), 330, extent of wings, 665; (♀, Tahiti), length, 325, extent, 652.

Downy young are of a distinctly lighter gray above than those of *P. l. lherminieri*, while the ventral surface is entirely grayish white (pallid neutral gray of Ridgway) instead of purplish gray with a light central area. The color of fresh dorsal plumage in adults is substantially like that of the West Indian race, though perhaps a shade darker. The crissum and shorter under tail-coverts are white, the other coverts dark, those of intermediate length having whitish tips. The wing lining is prevaillingly white, dark feathers being present among many specimens, but to a lesser extent than the average in *P. l. subalaris*. White feather edgings never appear on the dorsal surface in any stage of growth, but they are present on the dark plumage at the sides of neck and chest.

***Puffinus lherminieri dichrous* Finsch and Hartlaub**

Puffinus dichrous Finsch and Hartlaub, 1867, 'Faun. Centr. Polyn.,' p. 244 (McKean Island, Phoenix Group).

?*Puffinus opisthomelas* var. *minor* Hartlaub, 1867, Proc. Zoöl. Soc. Lond. (Pelew Islands).

SUBSPECIFIC CHARACTERS.—Similar to *Puffinus lherminieri polynesix*, but with a shorter bill (shortest of the species).

TYPE.—Sex undetermined, McKean Island, in the Zoölogical Museum of Berlin.

RANGE.—Western equatorial Pacific, from the Phoenix to the Pelew Groups.

MEASUREMENTS (17 ♂ and ♀, including the type, from McKean, Canton, and Enderbury Islands, Phoenix Group, and from Ponapé, Nauru, "Carolines," and "Pelews." 56 adults measured for length of culmen).—Wing, 188–209 (202); tail, 73–84 (80.2); exposed culmen, 22.6–27 (26); depth of closed bill at base, 8.5–9.2; least depth of bill, 5.5–6; width of bill at base, 9–11.2; tarsus, 36–40 (38.2); middle toe with claw, 39–43 (40.8) mm.

The names *dichrous* and *minor* were published during the same year, 1867, and it is uncertain which has priority. The fact that *Puffinus dichrous* was accompanied by a detailed description, while *minor* is not even certainly applicable to a shearwater of this type, should, however, leave no doubt regarding the superior claims of the former name.

Through the courtesy of Dr. Irwin Stresemann, the writer has had an opportunity of examining the type, together with other specimens in the Berlin Museum from Nauru and the Pelews. These, as well as American Museum skins from the Caroline Islands, all seem to be identical with birds of a large series collected by Mr. J. G. Correia of the Whitney South Sea Expedition, at Canton and Enderbury Islands, Phoenix Group, on March 11 and 19, respectively, 1924. The latter were adults on their breeding grounds, with gonads in various stages of

enlargement. Many were molting the quills of wing and tail.

The colors of fleshy parts in life were as in other members of *Therminieri*. Except for the remarkably short bill, the specimens resemble *P. l. polynesia*, although the dark plumage on the sides of the pectoral region in *dichrous* seems to be more broken on the average, scattered feathers sometimes mottling the breast almost to the mid-line.

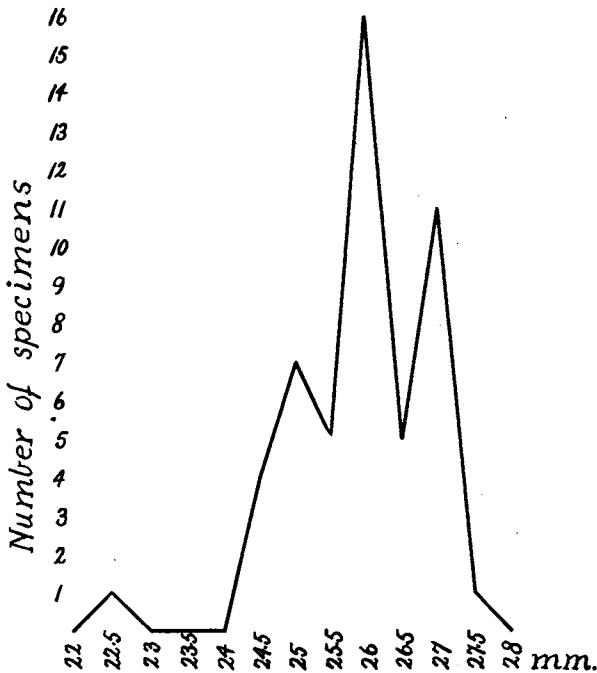


Fig. 1. Length of bill among 50 adults of both sexes of *Puffinus thermanieri dichrous*, from the Phoenix Islands. Mean, 25.9 mm.

Among forty-nine specimens from the Phoenix Islands the bill length ranges between 24.5 and 27 mm. A fiftieth adult, however, has a culmen measuring only 22.6 mm., a sporadic variation of the type noted previously among examples of *P. l. thermanieri*. Since range in dimensions has an important bearing upon critical systematic studies, the writer has prepared the accompanying graph which shows the frequency distribution of bill length among fifty specimens of this subspecies from a single insular group. The selected class range is 0.5 mm. Worthy of special note are the isolated individual just mentioned, and the fact that

the bill length in the largest group (16 individuals) falls on the line of the mean.

***Puffinus lherminieri nugax* Mathews**

Puffinus lherminieri nugax Mathews, 1912, 'Birds Austral.,' II, p. 72 (off Townsville, Queensland, Australia).

Mathews (*loc. cit.*, p. 60) quotes in full Solander's Latin diagnosis of a bird taken in lat. 19° S., long. "213° W.," on June 6, 1770. The colors, description of bill, large size (length, 1 foot; expanse of wings, 2 feet), and the locality all serve to link this reference with a specimen of a very distinct and striking shearwater recently sent from the field by the Whitney South Sea Expedition.

SUBSPECIFIC CHARACTERS.—A large, exceptionally dark-hued race of *Puffinus lherminieri*, with a long and slender bill, the dark feathers of the hind neck, back, secondary coverts, and lateral upper tail-coverts margined or tipped with white.

TYPE.—Non-existent.

REFERENCE SPECIMEN OR NEOTYPE.—No. 215393, Amer. Mus. Nat. Hist.; ♀ ad., ovaries enlarged; Melapav (=Meralav or Star Peak) Islet, Banks Group, New Hebrides Islands, Sept. 14, 1926; R. H. Beck.

DESCRIPTION.—Dorsal surface blackish brown, almost black on the pileum, the feathers of sides of neck and pectoral region broadly, those of hind neck, back, scapulars, and outer tail-coverts narrowly, margined with white; secondary-coverts tipped with white, those of the greater series broadly, forming a distinct bar; a faint fuscous bloom on the primary and secondary quills; lores and circumorbital region blackish brown, excepting a white streak on the lower eyelid only; dark feathers mingling with white along feathered cutting edge of mandible and continuing caudad, forming a mottled border across the cheek, upward into the post-aural region, and then downward to the sides of the breast; ventral surface, from chin to crissum, including the flanks, axillaries, and wing lining except along its anterior border, white; lower aspect of wing and tail quills dark neutral gray; under tail-coverts blackish brown, dark mouse gray, and white, some being one or the other, some particolored, the dark feathers being at least tipped with white. Iris, brown; bill, black, bluish on mandible and at base of culminicorn; feet and legs, flesh-color, the outer toe and outer side of tarsus, black.

MEASUREMENTS.—Length in the flesh, 350 (approx. 13.8 inches); extent of outstretched wings, 700 (approx. 27.6 inches); wing, 207; tail, 77; exposed culmen, 30.5; bill from gape, 43 (approx. 1.7 inches); depth of closed bill at base, 10; least depth of bill, 6; width of bill at base, 11; tarsus, 43; middle toe with claw, 45 mm.

***Puffinus lherminieri bannermani* Mathews and Iredale**

Puffinus bannermani Mathews and Iredale, 1915, *Ibis*, p. 594 (North Iwojima Island, Bonin Group).

SUBSPECIFIC CHARACTERS.—Similar to *Puffinus lherminieri nugax*, but with a decidedly stouter bill, much lighter dorsal coloration, especially on the head and nape which are grayish, and a white stripe above as well as below the eye.

RANGE.—Bonin Islands, Japan.

MEASUREMENTS (9 adults, sex not recorded).—Wing, 206–219 (212.6); tail, 74–81 (77.5); exposed culmen, 28–31 (29.5); depth of closed bill at base, 9–10; least depth of bill, 6.6–7.8; width of bill at base, 11–13; tarsus, 40–42 (41.3); middle toe with claw, 43–47 (44.9) mm.

This form is well described by Mathews and Iredale. Several of the nine American Museum specimens are paratypes, the labels bearing the data North Iwojima, Feb. 1910 and Oct., 1909, St. Dionisio, Jan., 1910, and “Bonin Islands,” Apr. 1909.

The back of *P. l. bannermani* is of the unmistakable “brown black” hue which is characteristic of the whole species. But in this form alone the coloration of head and hind neck is distinctly lighter than that of back and wings. In fresh plumage the nape is close to dark gull gray, at least in certain lights. From shoulder to tail, the specimens resemble very closely our example of the New Hebrides race, but the heads of the two subspecies present a strong contrast. In *nugax* a rich, glossy brownish black plumage covers the pileum and hind neck solidly, not broken by even a superciliary stripe, and forming the darkest area on the body. The same area on *bannermani* is decidedly the lightest part of the dorsal aspect.

In both *nugax* and *bannermani* we encounter for the first time a whitish outlining or scalloping of the dorsal plumage which parallels the condition in one or more races of *assimilis*. The brownish tone, dark under tail-coverts, and dark primary quills, however, are as pronounced as in other forms of *therminieri*.

***Puffinus therminieri bailloni* (Bonaparte)**

Procellaria nugax, a. *bailloni* Bonaparte, 1857, ‘Consp. Gen. Avium,’ II, p. 205 (Mauritius).

Mathews (1912, p. 69) lists under *P. assimilis* two shearwaters from Réunion. A single skin in the American Museum from that island is, however, typical of the species *therminieri*. It is, moreover, indistinguishable from four taken at Aride and Cousine Islets, of the Seychelle Group, during February and March, 1908. For this reason the lot is classed under Bonaparte’s name *bailloni*, and Mathews’s somewhat ironic wish “that no one will name the Seychelle race without carefully examining series from both localities” is followed!

The writer has examined but six examples of this Indian Ocean form, which have proved insufficient as the basis of a satisfactory diagnosis. In size it appears to be closest to the Galapagos bird, although there is no other evidence of close kinship. In all dimensions except thickness of

bill it is smaller than the South Pacific race (*polynesiae*). There is much white in the central part of the under tail-coverts, causing it to resemble the Cape Verde Island and West Indian birds. Its bill is almost as heavy as that of the latter form, although somewhat shorter. Very likely the closest affinities of *bailloni* are with the Atlantic subspecies, *P. l. lherminieri* and *P. l. boydi*.

MEASUREMENTS (5 ♂ and ♀ from the Seychelles, 1 from Réunion).—Wing, 187–200 (192.7); tail, 69–83 (74.2); exposed culmen, 27–28.5 (27.9); depth of closed bill at base, 9–10; least depth of bill, 6.8–7; width of bill at base, 11–12.6; tarsus, 37–40 (37.5); middle toe with claw, 39–42 (40.5) mm.

A NOTE ON DIMENSIONS AND PROPORTIONS

Mere statistics of measurements are difficult to grasp; and the smaller the dimensions, the harder it becomes to translate numerals into an accurate visual concept. It sounds like a very trifling distinction, for example, to say that the depth of bill in one race of *Puffinus* averages 0.5 mm. greater than in another. Yet, when specimens are laid out, the eye instantly seizes upon discrepancies of this magnitude and proceeds to make the most of them. Of such ranges are the comparative terms "bill decidedly heavier," etc., which we find in this and other taxonomic papers. Such comparisons are useful and not misleading when based upon true means.

Proportions are often better criteria of differentiation than absolute measurements. Here again, however, their worth depends upon the representative quality of the material studied, for in a short series a single exceptional variation might greatly affect the mean. In the case of such small units as depth of bill, the error of measurement would be likely to be very high, but larger dimensions, such as length of bill, tail, etc., may advantageously be reduced to accurate proportions through the use of a slide rule.

Among the subspecies of *Puffinus assimilis* and *Puffinus lherminieri*, the length of bill seems to be relatively stable when compared with other structures. In the following table the average length of the exposed culmen is taken as unity, the means of the other dimensions appearing as multiples of the culmen. The values of the several figures are various, depending upon the number of specimens of each form, but as a whole they suggest certain definite proportional differences between the species *assimilis* and *lherminieri*, and also reveal the basis of comparative terms used in the preceding descriptions.

AVERAGE LENGTHS AND RATIO TO CULMEN

	Number of Specimens	AVERAGE LENGTHS AND RATIO TO CULMEN					
		Culmen	Tarsus	Mid-toe	Tail	Wing	
<i>Puffinus assimilis assimilis</i>	2	24.5	35.5	41.5	63	172	7
" <i>hermaderensis</i>	15	26.1	39.6	44.3	65.5	190.5	7.3
" subsp.	1	29.5	39	46	69	199	6.8
" <i>munda</i>	6	25.8	40.3	47.1	66.8	190.5	7.4
" <i>godmani</i>	8	26.6	37.1	41.1	67.1	176.9	6.7
" <i>herminieri herminieri</i>	26	29.8	40.3	45.8	87.2	208.2	7
" " <i>boydi</i>	4	26.2	37.5	42.5	76.5	173	6.6
" " <i>subalaris</i>	10	27.7	36	41.3	71.8	194.8	7
" " <i>polynesia</i>	26	28.9	39.2	41.4	80.1	202.9	7.1
" " <i>dichrous</i>	17	26	38.2	40.8	80.2	202	7.8
" " <i>nugax</i>	1	30.5	43	45	77	207	7
" " <i>barnermani</i>	9	29.5	41.3	44.9	77.5	212.6	7.2
" " <i>bailtoni</i>	6	27.9	37.5	40.5	74.2	192.7	6.9

156 for bill.

