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### IDENTIFICATION AT SEA OF HAWAIIAN AND GALAPAGOS PETRELS

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Petrels of the genus *Pterodroma* are among the most enigmatic of seabirds, often nesting on remote islands, ranging far from land, and posing identification challenges. The Hawaiian and Galapagos populations of the Dark-rumped Petrel (*Pterodroma phaeopygia*) were recently elevated to species rank by the AOU (2002) as the Hawaiian Petrel (*P. sandwichensis*) and the Galapagos Petrel (*P. phaeopygia*), respectively (we use the term "Dark-rumped Petrel" hereafter to refer to the species pair). These taxa appear very similar, and some authors have considered them "doubtfully distinct" at even the subspecies level (Jouanin and Mougin 1979). The Galapagos Petrel averages larger in linear dimensions, whereas the Hawaiian Petrel averages heavier (Simons and Hodges 1998, Tomkins and Milne 1991). There is considerable overlap in all standard measurements, however, and no single variable is sufficient to support the recognition of the two populations as subspecies by the standard 75% rule when the formula presented by Patten and Unitt (2002) is applied to the measurements tabulated by Tomkins and Milne (1991). Genetic and vocal differences have also been reported (Browne et al. 1997, Tomkins and Milne 1991). Here we offer preliminary suggestions for distinguishing these taxa at sea. We believe the characters we describe here will enable the specific identification of birds seen reasonably well, and we encourage observers to test and refine our criteria. We were unable to obtain good photos from Hawaiian waters and have instead used photos from California, which show the characters of the (presumed) Hawaiian Petrels we have seen around Hawaii. The upper photo on this issue's back cover of a presumed Galapagos Petrel was taken by George Armistead on 21 July 2005 near Isla San Cristobal, Galápagos; the lower photo of a presumed Hawaiian Petrel was taken by Malcolm and Michael Boswell off Fort Bragg, Mendocino County, California, on 13 August 2006.

In their original description of the Hawaiian Petrel, Baird et al. (1884) compared one specimen from Hawaii with the Black-capped Petrel (*P. hesitata*) and did not mention the Galapagos Petrel at all. Salvin (1896) listed *sandwichensis* as a synonym of *phaeopygia*. Bryan (1908) revived the name *sandwichensis*, reporting that the Hawaiian birds have more slender bills with thinner, less prominent nostrils and a more strongly deflected terminal nail. He reported that Hawaiian specimens have pure white axillars, lacking the slaty black terminal bands on three or four of these feathers present on Galapagos specimens. Bryan had only one specimen of *phaeopygia* for comparison, however. Loomis (1918) noted overlap in measurements and discredited the differences in color, emphasizing the extent of individual variation and the effect of plumage wear. From 1918 to 2002 the two taxa were ranked as subspecies. No differences in plumage color or pattern have been discussed in the literature since 1918.

We have all seen many Dark-rumped Petrels at sea since 1989, but only in recent years have we looked critically for differences between birds observed around the Hawaiian Islands (presumed Hawaiian Petrels) and birds observed around the Galapagos Islands (presumed Galapagos Petrels). Since 2003, Force and Webb studied 207 presumed Hawaiian Petrels and 303 presumed Galapagos Petrels in their respective ranges, and Howell has seen three Dark-rumped Petrels off California.

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In addition, Howell has examined most specimens of these taxa housed in North American museums.

Given reasonable views, Dark-rumped Petrels appear fairly distinctive at sea, although a fresh-plumaged bird with frosty gray upperparts can suggest the somewhat larger and bulkier Juan Fernandez Petrel (*P. externa*), which has a head pattern similar to that of the Hawaiian Petrel (see below). And as their plumage wears Juan Fernandez Petrels become darker and browner on the upperparts, more like a Dark-rumped Petrel. A clear view of the underwing should resolve any identification dilemma: the Juan Fernandez Petrel has mostly white underwings lacking the wide blackish underwing margins of the Dark-rumped.

*Plumage.* Perhaps the most obvious plumage difference is the pattern on the sides of the head and neck, although a good view is still needed to see and evaluate this feature. On Galapagos Petrels the blackish-brown cap extends diagonally down and back from below the eyes, merging with the dark gray-brown sides of the neck to form an extensive dark hood (back cover upper photo and Figure 1). On Hawaiian Petrels the blackish-brown cap is smaller (the dark extends less below the eye), and white from the neck sides cuts up behind the cap, forming a notch between the cap and the dark sides of the neck, which often appear grayer than on Galapagos Petrels; the gray tends to project down as a bulge forward of the wings (back cover lower photo and Figures 2 and 3). The gray sides of the neck of both species are darker and browner overall in worn plumage. The dark hood of the Galapagos Petrel thus recalls that of a Gould's Petrel (*P. leucoptera*), whereas the cap of the Hawaiian Petrel recalls that of a Juan Fernandez Petrel. At some angles (such as when viewed from below, going away), the cap of Hawaiian Petrels appears "flat," without a bulge on



Figure 1. Presumed Galapagos Petrel off Isla San Cristobal, Galápagos, 19 August 2006. Note the shape of the hood and the bill thicker than in Figure 2.

Photo by George Armistead

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Figure 2. Presumed Hawaiian Petrel off Fort Bragg, Mendocino County, California, 13 August 2006. Note the cap shape and fairly slender bill.

*Photo by Malcolm and Michael Boswell*

the sides of the neck (Figure 4), but this is still distinct from the angled dark hood of a Galapagos Petrel. The head and neck pattern of Galapagos Petrels is rather variable, and some have very extensive dark hoods with dark markings extending in a broken band across the chest (figure 6 of Tomkins and Milne 1991). Even the most lightly marked Galapagos Petrels, however, apparently show a hood distinct from the cap typical of the Hawaiian. These differences in head and neck pattern are difficult to appreciate on museum specimens, which typically have the head and neck somewhat scrunched, but even on specimens the depth of the black cap or hood below the eye is usually less than the eye's depth on the Hawaiian ("capped"), greater on the Galapagos ("hooded").

Another plumage difference that may be helpful involves the width of the dark trailing edge to the secondaries, which often appears relatively broad on Galapagos Petrels, perhaps because of their broader wings, in which the dark secondaries may project more past the tips of the white greater underwing coverts. This feature requires critical evaluation and is also affected by wear and molt, which can be difficult to assess at sea. Nevertheless it may be useful for identifying birds from good photos. One must also keep in mind the effects that different lighting and distance can have on one's impression of a bird seen at sea; for example, on distant Galapagos Petrels the black underwing margins often appear narrower.

Our impression is that at sea Galapagos Petrels often show noticeable dusky smudging or scalloping on the anterior flanks, whereas Hawaiian Petrels do not show any appreciable dark markings there (cf. back cover photos and Figures 4 and 5). Though Bryan (1908) reported this as a consistent difference, Peter Pyle (pers. comm.) found that 17 of 32 specimens of the Hawaiian Petrel from Hawaii (53%) had dark flank markings; more study on this character is needed.

It has been reported that Galapagos Petrels typically have dark forehead spotting

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Figure 3. Presumed Hawaiian Petrel off Ventura County, California, 6 September 2006. Note the cap shape; this bird's bill is appreciably thicker than that of the bird in Figure 2.

*Photo by Steve N. G. Howell*

whereas Hawaiian Petrels have clean white foreheads (Howell and Pyle 1997). Examination of larger samples shows this to be only an average difference and thus not helpful on an individual bird: 134 of 188 Galapagos Petrel specimens (71%) at the California Academy of Sciences had black spotting on the forehead (usually down the midline of the white forehead blaze), while eight of 32 Hawaiian Petrel specimens (25%) at the Bernice P. Bishop Museum in Hawaii had black spotting (P. Pyle, pers. comm.). The pattern of the forehead is affected greatly by plumage wear as the feathers have white tips, a dark subterminal area of varying size, and white bases. Both species can show white mottling on the uppertail coverts, which results from exposure of the white bases of the coverts and varies with plumage wear and molt. The undersides of the primaries of both taxa can be dark, contrasting with the white primary coverts, or tongues of white may extend out on the primaries' inner webs (see back cover photos). Although these white tongues may average more extensive on the Galapagos Petrel, there appears to be enough overlap that this is not a reliable mark (P. Pyle pers. comm.).

*Size, shape, and manner of flight.* Given the vagaries of bird behavior, wind speed, wind direction, and observer experience, the following characters may be helpful but not definitive. The Hawaiian Petrel often appears a little smaller and "zippier" in flight than the larger, rangier, and more "leisurely" Galapagos. This difference is mostly a function of wing-loading, that is, a bird's wing area divided by its mass. Lower wing-loading is characteristic of petrels (such as the Galapagos) that range over equatorial and tropical waters where winds are generally light; higher wing-loading is characteristic of petrels (such as the Hawaiian) that range over subtropical and temperate

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Figure 4. Presumed Hawaiian Petrel off Ventura County, California, 6 September 2006. Note the shallow dark cap and how the cap's apparent shape changes depending on the angle of view (cf. Figures 2 and 3).

*Photo by Steve N. G. Howell*

waters where winds tend to be stronger (Spear and Ainley 1998).

Sometimes Galapagos Petrels appeared to us distinctly long tailed but at other times they looked relatively short tailed (perhaps because of their wider wings); conversely, Hawaiian Petrels often appeared long tailed, an effect perhaps accentuated by their narrower wings. In addition, at certain angles the wings of Hawaiian Petrels occasionally appeared broad based, contributing to their short-winged look. The Galapagos averages stouter billed than the Hawaiian, but measurements overlap extensively; bill size might be a supportive feature for extremes.

*Distribution and habitat at sea.* Pitman (1986) and Spear et al. (1995) mapped the Dark-rumped Petrel's pelagic distribution and noted a distinct break between the ranges of presumed Hawaiian and Galapagos petrels. They reported presumed Hawaiian Petrels between the equator and 30° N (the northern boundary of those authors' study areas). It is now known that the Hawaiian ranges widely in the North Pacific (Spear et al. in press), and the northernmost sighting of a presumed Hawaiian Petrel is about 140 km south of Yanuska Island in the Aleutians (Force pers. obs., NOAA unpubl. data). Tagging of breeding Hawaiian Petrels with radiotransmitters tracked by satellite has shown that in August and September some birds range north to around 51° N, and one individual was tracked to within 660 km of the Oregon coast (J. Adams et al. unpubl. data). The pelagic range of presumed Galapagos Petrels is not known to extend north of about 20° N, over waters well off western Mexico, and this species occurs where the thermocline is shallower and winds are lighter than in the range of the Hawaiian Petrel (Spear et al. 1995). Dark-rumped Petrels photographed off California (e.g., Figures 2 and 3) show features of presumed Hawaiian

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Figure 5. Presumed Galapagos Petrel off Isla San Cristobal, Galápagos, 19 August 2006. Note the hood shape and dark flank markings.

*Photo by George Armistead*

Petrels observed around Hawaii and are distinct from presumed Galapagos Petrels. Distribution at sea, habitat, and satellite tracking also support the identification of these birds as Hawaiian Petrels.

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