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## A NEW STORM-PETREL SPECIES FROM CHILE

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**ABSTRACT.**—We describe a new species of storm-petrel, *Oceanites pincoyae* (Pincoya Storm-Petrel), from the Puerto Montt and Chacao channel area, Chile. The description is based on 1 specimen collected at sea in Seno Reloncavi on 19 February 2011 and 11 other individuals that were caught, examined, and released. The new taxon's foraging ecology and behavioral habits are unique among the southern Oceanitinae, including “mouse-runs” and repeated diving beneath the surface to retrieve food items. Its distinctive appearance includes bold white ulnar bars, extensive white panels to the underwing, and white to the lower belly and vent. Among species of *Oceanites*, it is unique in showing white outer vanes to the outer two pairs of rectrices. It further differs from all other storm-petrels in having a distinctive juvenile plumage. Morphometrically it is distinct from *Oceanites gracilis gracilis* (Elliot's Storm-Petrel) and smaller than *O. oceananicus chilensis* (the Fuegian form of Wilson's Storm-Petrel), having a shorter tarsus and longer middle toe. There also appear to be differences in the timing of breeding and molt between the new taxon and both *O. o. chilensis* and *O. g. gracilis*. We estimate the population size of the new species as ~3,000 individuals. *Received 9 April 2012, accepted 19 September 2012.*

**Key words:** Chile, Chiloe Island, Hydrobatidae, *Oceanites pincoyae*, new species, Puerto Montt.

## Una Nueva Especie de Petrel de Tormenta de Chile

**RESUMEN.**—Describimos una nueva especie de petrel, *Oceanites pincoyae*, del área de Puerto Montt y el canal de Chacao, Chile. La descripción se basa en un espécimen coleccionado en el mar en Seno Reloncavi el 19 de febrero de 2011, y en 11 individuos adicionales que fueron capturados, examinados y liberados. La ecología de forrajeo y los hábitos de comportamiento del nuevo taxón son únicos entre los demás Oceanitinae del sur, incluyendo “carreras de ratón” y buceos repetidos por debajo de la superficie para obtener el alimento. Su apariencia única incluye barras cubitales gruesas y blancas, parches blancos extensos por debajo del ala, y vientre bajo y cloaca blancos. Entre las especies de *Oceanites*, es único en mostrar el vexillo exterior blanco en las dos parejas exteriores de rectrices. Además se diferencia de otros petreles por tener un plumaje juvenil distinto. Morfométricamente se diferencia de *Oceanites gracilis gracilis* por tener el tarso más corto y el dedo medio más largo, y es más pequeño que *Oceanites oceananicus chilensis*. También parece haber diferencias en el momento de reproducción y muda entre el nuevo taxón y *O. o. chilensis* y *O. g. gracilis*. Estimamos un tamaño poblacional de la nueva especie de unos 3000 individuos.

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THE PROCELLARIIFORMES, with their four families—Diomedidae (albatrosses), Procellariidae (petrels and shearwaters), Hydrobatidae (storm-petrels), and Pelecanoididae (diving petrels)—are the most diverse of all seabird orders in both size and form and are also the most wide ranging. They vary in size, from the larger albatrosses, which can weigh in excess of 11,300 g, to the sparrow-sized storm-petrels that weigh just 20 g. As a group, they are cosmopolitan, occurring across all the world's oceans, from the seas of Antarctica to the High Arctic. Many members are long-distance migrants and, in the case of the Short-tailed Shearwater (*Puffinus tenuirostris*) and Wilson's Storm-Petrel (*Oceanites oceanicus*), are generally considered to be among the most numerous seabirds on the planet. Generally, the Procellariiformes are thought to be large, gregarious, and found in open environments, and therefore not easily overlooked.

Taxonomically, the order Procellariiformes is in a state of flux, with new, cryptic species emerging from within populations of known taxa. For example, Robb et al. (2008) have suggested that four species should be recognized in the North Atlantic population of the *Oceanodroma castro* complex. The situation is similar in the eastern Pacific, where cryptic species are suggested within that region's *O. leucorhoa* complex (Howell et al. 2009).

Unlike the emergence of cryptic species from assemblages of known taxa, the appearance of a completely new procellariiform taxon, and one with a viable population that has somehow escaped detection, has not occurred for some 60 years, the last such discovery being *Pterodroma ultima*, Murphy's Petrel (Murphy 1949), described from a specimen collected in 1922 at Oeno in the Pitcairn Group. Indeed, in the past 90 years, only one other completely new procellariiform taxon, Matsudaira's Storm-Petrel (*Oceanodroma matsudaira*; Kuroda 1922), with a viable population, has emerged, from a specimen collected in Sagami Bay, Honshu. Disregarding the recent spate of emerging cryptic taxon from previously known assemblages of taxa, the last new species of storm-petrel to be described was thus *O. matsudaira* some 90 years ago.

Storm-petrels include some of the least known and most enigmatic species of seabirds in the world, as illustrated by such taxa as Hornby's Storm-Petrel (*Oceanodroma hornbyi*), Lowe's Storm-Petrel (*Oceanites gracilis galapagoensis*), and the New Zealand Storm-Petrel (*Fregetta maoriana*), whose breeding sites remain undiscovered. They are the smallest of all seabirds, and the family Hydrobatidae is divided into two subfamilies: Oceanitinae and Hydrobatinae, which are hypothesized to have originated in opposing hemispheres (del Hoyo et al. 1992). The southern group, Oceanitinae, consists of eight species in five genera: *Oceanites* (2 species), *Garrodia* (1), *Pelagodroma* (1), *Fregetta* (3), and *Nesofregetta* (1) (Onley and Scofield 2007, Robertson et al. 2011). Some authors consider *Garrodia* to be congeneric with *Oceanites* (e.g., Marchant and Higgins 1990).

The genus *Oceanites* includes Wilson's Storm-Petrel (*O. o. oceanicus*) and Elliot's Storm-Petrel (*O. g. gracilis*), which are divided into three and two subspecies, respectively: *O. o. oceanicus* (Kuhl, 1820), *O. o. exasperatus* (Mathews, 1912), and *O. o. chilensis* (Murphy 1936; see Palma et al. 2012); and *O. g. gracilis* (Elliot, 1859) and *O. g. galapagoensis* (Lowe, 1921) (Onley and Scofield 2007). Only two *Oceanites* taxa, *O. g. gracilis* and *O. o. chilensis*, are known to occur regularly in the nearshore coastal waters of western South America (Spear and Ainley 2007). Both are small black-and-white storm-petrels. In addition to those two taxa, however,

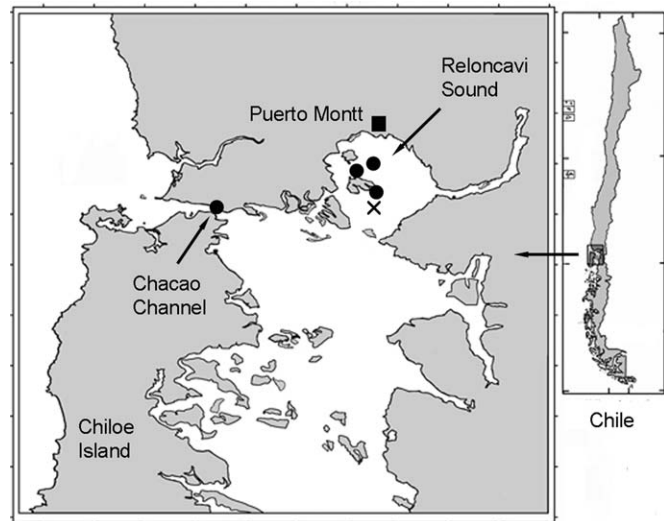


FIG. 1. Map of Chile with insert showing Seno Reloncavi (Reloncavi Sound) and approximate position of sightings (black circles) of the new taxon. The black "X" marks approximate position of holotype collection.

observations of a mysterious, unidentified, small, well-marked black-and-white storm-petrel in the Chiloe and Puerto Montt area of Chile have been reported for some time (O'Keeffe et al. 2009, P. Harrison unpubl. data, A. Jaramillo unpubl. data). The first sightings were probably those of P.H. (abbreviations refer to names of authors) in March 1983; he was heading south on a passenger vessel near Isla Guar, in the sheltered waters of Seno Reloncavi, approximate position 41°45'S, 72°52'W (O'Keeffe et al. 2009) (Fig. 1). Most subsequent observations of the presumptive new storm-petrel have been made by birders crossing Chacao channel on the ferry from the mainland to Chiloe Island, Chile. There have been no claimed sightings from continental, shelf, or pelagic waters. Sightings from the ferry have been sporadic. M.P. recorded only two of these storm-petrels during one of 18 crossings of the channel made since 1991, which suggests, perhaps, that the species is extralimital in this sector of Chiloe, albeit just 45 km west of the mouth of Seno Reloncavi. In February 2009, the first images of the unknown storm-petrel were obtained by S.E., which further indicated that they may be a previously undescribed taxon (O'Keeffe et al. 2009).

Prior to these sightings and subsequent expeditions to the Seno Reloncavi area of western Chile, two storm-petrels had been collected in 1972 and 1983 by Andor Kovacs, inland, at El Bolson, Argentina, just 80 km east of observations from Chile. Originally identified as *Oceanites oceanicus*, the two specimens lay in obscurity for almost 20 years until reidentified by M.P. as *O. gracilis*, partly on the basis of the white pattern on the belly (Pearman 2000). M.P. noted that the southern limit for mainland *O. g. gracilis* was Valparaiso, Chile (33°02'S; Murphy 1936, Araya and Millie 1997), and concluded that

Being an endemic species to the Galápagos and Humboldt Current, a population of *O. gracilis* at 42°S where the specimens were collected seems unlikely. Nevertheless it is conceivable that a large-sized *gracilis* has been overlooked in this area. (Translated from the Spanish; Pearman 2000:142)

P.H. subsequently visited the Museo Argentino de Ciencias Naturales (MACN) on 27 January 2011 and examined the two specimens.

To resolve the identity of the presumptive new storm-petrel, four pelagic voyages were undertaken by a team (P.H., M.S., C.G., K.B., and S.M.) in the Seno Reloncavi area, between 17 and 21 February 2011, south of Puerto Montt (Fig. 1). The route used each day was to reach an approximate position of 41°42'S, 72°52'W, off the Punta Redonda Lighthouse. Fish scraps were used to attract the birds within range of air-powered net guns and camera lenses. Capture and handling of birds (by C.G. and K.B.) were conducted under permit 0049 issued by Servicio Agrícola y Ganadero. P.H. took all morphometric measurements, including flattened wing chord, tail length, tarsus, middle toe length (with nail), and exposed culmen. Birds were also weighed to the nearest gram using a 100-g Pesola scale. The position and number of primaries in active molt were recorded. P.H. measured the holotype, which was a bird in fresh plumage, and recorded the following additional measurements: head and bill length (to back of head), bill depth at gonys, nostril tube length, bill to gape, and wing span. All measurements were taken to the nearest 0.1 mm. Dive duration was assessed using a Seico Pathfinder stopwatch. Digital images were taken using two Canon systems: EOS 1D coupled to Canon EF400 mm 1:4 DO IS lens and EOS7D coupled to Canon EF400 mm 1:5.6 lens. Images were generally obtained using the AV mode set to 1,200 s<sup>-1</sup> at 640 ISO. Birds were photographed at chum slicks, weed and flotsam lines, and commute flights over the ocean, generally at distances of ≤30 m.

A second visit to the Seno Reloncavi area was made in mid-winter by P.H. and M.S., 26–27 July 2011, to confirm anecdotal observations of local fishermen and ferry operators that the new taxon is present throughout the winter period. Surface water temperature was measured using an Orvis mercury thermometer.

Morphometric data from the presumptive new taxon (Appendix) was compared with other Southern Ocean storm-petrels (subfamily Oceanitinae) (Table 1) to identify the generic relationships of the new species. Subsequent museum research was carried out by A.J. at the American Museum of Natural History, New York, and by M.S. at various Chilean museums where other storm-petrel specimens were examined and the following morphometric data recorded: flattened wing chord, exposed culmen, tail length along central rectrices, tarsus length, and mid-toe length (with nail). A total of 47 individuals were measured by P.H., A.J., and M.S.: 7 *O. g. gracilis*, 26 *O. o. chilensis*, and 14 of the new taxon, including the type specimens of the new species and *O. o. chilensis*. Birds of different sexes and ages were considered together because some specimens were not sexed.

To determine whether there are size differences among *chilensis*, *gracilis*, and the new species, mensural data from the three taxa were compared using analysis of variance (Sokal and Rohlf 2012). We conducted a principal component analysis (PCA) using a correlation matrix to characterize the mensural data in multivariate space; only eigenvalues >1 were used to interpret the data.

TABLE 1. Morphometrics and mass (means ± SD) of *O. pincoyae* compared with other extant storm-petrel taxa (subfamily Oceanitinae) of the Southern Oceans. For data from studies in which standard deviation was not given, range is presented in parentheses. Where sample size varied between measures, the range of sample size is given. All measurements are from specimens unless otherwise noted.

Taxa	n	Sex	Wing (mm)	Tail (mm)	Culmen (mm)	Tarsus (mm)	Mid-toe + claw (mm)	Mass (g)
<i>Oceanites pincoyae</i> <sup>1</sup>	12–14	Unknown	136.5 ± 2.6	57.6 ± 3.1	11.3 ± 0.4	31.7 ± 1.4	26.3 ± 1.1	26.7 ± 2.4
<i>O. oceanicus chilensis</i> <sup>1</sup>	3–27	Unknown	140.0 ± 2.9	60.2 ± 3.3	11.5 ± 0.6	34.2 ± 1.4	23.7 ± 1.6	30.0 ± 2.0
<i>O. gracilis gracilis</i> , Peru, Chile <sup>2</sup>	46	23♀, 23♂	126.0 (117.0–132.0)	55.9 (48.0–57.0)	11.1 (10.5–11.6)	29.9 (28.0–31.5)	22.2 (21.0–23.0)	—
<i>O. g. gracilis</i> <sup>3</sup>	2	Unknown	—	—	—	—	—	16.5
<i>O. g. galapagoensis</i> , Galápagos Islands <sup>2</sup>	14	7♂, 7♀	135.3 (130.0–146.0)	57.0 (53.0–60.0)	11.2 (10.5–12.0)	30.7 (28.5–32.0)	22.9 (21.6–24.0)	—
<i>O. g. galapagoensis</i> (live bird) <sup>3</sup>	1	♀	—	—	—	—	—	17.0
<i>O. o. exasperatus</i> , Signy Island, South Orkney Islands (live birds) <sup>4</sup>	69–644	Unknown	151.4 ± 3.9	69.6 ± 2.3	12.6 ± 0.7	34.2 ± 1.1	29.6 ± 1.0	37.6 ± 0.3
<i>O. o. oceanicus</i> , Iles Crozet (live birds) <sup>5</sup>	29–31	Unknown	143.0 ± 4.0	—	12.1 ± 0.4	34.8 ± 1.1	—	32.0 ± 3.0
<i>O. o. oceanicus</i> , South Georgia (live birds) <sup>6</sup>	12	Unknown	143.3 (140.0–148.0)	62.5 (59.6–68.0)	12.5 (11.8–13.0)	34.7 (33.1–33.6)	27.5 (26.0–28.7)	—
<i>Garrodia nereis</i> , New Zealand sub-Antarctic Islands (skins) <sup>7</sup>	24–27	♀	133.2 ± 3.7	67.0 ± 3.0	12.9 ± 0.4	33.4 ± 1.4	—	—
	16–17	♂	127.4 ± 3.6	62.9 ± 2.1	13.0 ± 0.5	31.7 ± 1.5	—	—
<i>G. nereis</i> , Chatham Island (live birds) <sup>8</sup>	11–16	♀	134.9 ± 3.1	66.0 ± 2.4	13.0 ± 0.3	32.3 ± 0.9	—	—
	13–19	♂	129.5 ± 2.5	63.4 ± 1.9	12.7 ± 0.4	31.8 ± 1.1	—	34.0 ± 2.9
<i>Fregetta maoriana</i> , New Zealand <sup>3</sup>	4	Unknown	148.7 ± 3.7	66.0 ± 1.5	13.4 ± 0.3	35.9 ± 0.9	29.5 ± 1.2	33.2 ± 2.5
<i>Fregetta tropica</i> , Signy Island, South Orkney Islands, live birds <sup>9</sup>	15–16	♀	170.8 ± 5.5	79.4 ± 3.5	15.1 ± 0.7	40.8 ± 1.2	29.2 ± 0.1	—
	10	♂	162.3 ± 5.0	77.6 ± 4.0	15.3 ± 0.5	39.6 ± 0.8	25.1 ± 0.8	—
<i>F. grallaria segethi</i> , Robinson Crusoe Island, Juan Fernan- dez Archipelago <sup>6</sup>	63	12♀, 51♂	155.6 (146.0–163.0)	73.3 (71.0–77.0)	13.2 (12.6–14.0)	35.1 (33.0–37.0)	21.6 (20.0–22.6)	—

References: <sup>1</sup> Present study, <sup>2</sup> Murphy 1936, <sup>3</sup> Stephenson et al. 2008, <sup>4</sup> Beck and Brown 1972, <sup>5</sup> Jouventin et al. 1985, <sup>6</sup> Murphy and Snyder 1952, <sup>7</sup> Marchant and Higgins 1990, <sup>8</sup> M. J. Imber reported in Marchant and Higgins 1990, <sup>9</sup> Beck and Brown 1971.



During the course of the five pelagic trips in the Seno Reloncavi area, >3,000 sightings of the new taxon were made, >2,000 images recorded, and 1 specimen collected by P.H. All storm-petrels judged to be the new taxon showed consistent and conspicuous plumage differences from both *O. o. chilensis* and *O. g. gracilis*, and morphological differences were also apparent. All available evidence indicates that the unidentified taxon recently observed in the Puerto Montt and Chacao channel area should be regarded as a new species by either the biological or ecological species concept (Helbig et al. 2002), and we propose the name:

***Oceanites pincoyae*, sp. nov.**

Pincoya Storm-Petrel

*Colondrina de mar Pincoya* (Spanish)

**Holotype.**—Adult female, Museo Nacional de Historia Natural in Santiago, Chile (MNHN 5376), collected on 19 February 2011 by P.H. at sea in Seno Reloncavi south of Puerto Montt, Chile, at 41°47.799'S, 72°53.418'W.

**Diagnosis: Morphology.**—Typical *Oceanites* structure with (1) small size with short rounded wings; (2) square-cut tail with conspicuous white rump; (3) protruding feet with bright yellow webs, (4) lack of flattened, spade-like toes; (5) relatively long tarsus and middle toe; and (6) lack of protruding nostrils. Sexes similar. Distinguished from all other *Oceanites* by (1) striking plumage, which includes bold white ulnar bars and a *Fregetta*-type underwing pattern; (2) extensive white to lower belly and ventral area; (3) white outer vanes to the basal third of R5 and R6; and (4) longer middle toe and claw than either *O. g. gracilis* or *O. o. chilensis*. The new species is larger than *O. g. gracilis* but overlaps in size with both *O. g. galapagoensis* and *O. oceanites chilensis*. It is smaller than *O. o. oceanicus* and *O. o. exasperatus* (Table 1).

**Description of holotype.**—Color descriptions in capitals follow Smithe (1975). Plumage: Active molt, P3 growing out. Upperparts: Entire head, mantle, scapulars, back and upper rump blackish-brown (Sepia, Color 119). Nape, mantle and scapulars, back and upper rump with silvery-gray wash in good light. Some scapulars and longest tertials narrowly but distinctly edged with white. Upper tail coverts white (with white rachis) forming continuous white, lunate-shaped rump band 28.4 mm wide in center. Underparts: Chin slightly paler and grayer than upper head parts. Breast, upper belly, upper flanks, and central tail coverts between legs to base of tail paler and grayer in tone than upperparts with scattered whitish tips to crissum feathers. Lower flanks and lateral tail coverts white, forming a contiguous white band with rump and joining ventrally above legs on lower belly to form inverted "U" shape on lower belly. Longest lateral undertail coverts white, with those at base of tail dark with narrow fringes and tip forming narrow white crescents. Tail: Above and below blackish-brown (Sepia, Color 119), the two outermost feathers, R5 and R6, with extensive white to the bases of both inner and outer vanes pointing backward in a triangular shape toward the tail tip. The white on the outer vanes of R5 and R6 extending to the outermost edge and then back toward the tip of the tail for 25–30 mm; the outer vanes are wholly dark from there to the tip. The rachis is white for three quarters of its length (~45 mm). Upperwing: Lesser coverts, carpal coverts, primary coverts, primaries and secondaries blackish-brown (Sepia, Color 119) with narrow pale fringes to innermost P1–P7 primary coverts and with distinctive white fringes

to inner three secondaries. Inner vanes of primaries with silvery sheen. Prominent whitish wing bar extending outward from tertials and inner three secondaries across greater and median coverts to reach the innermost greater primary coverts. Underwing: Lesser and median coverts, primaries and secondaries blackish-brown (Sepia, Color 119) with indistinct white bases to primaries in good light, the innermost secondaries narrowly fringed with white. Greater underwing coverts white, extending to include the innermost median primary coverts to form a white central panel; greater primary coverts pale brown (Light Drab, Color 119C) subtly fringed with white. Bare parts: Iris dark brown; bill black; legs and feet black with bright yellow webs in center bordered with black.

**Measurements of holotype.**—All measurements were taken from a live bird. Head and bill length 32.9 mm; exposed culmen 11.5 mm; bill depth at gonys 4.5 mm; nostril length 6.5 mm; bill to gape 12 mm; flattened wing chord 134 mm; tarsus length 31 mm; mid-toe length (with nail) 26.5 mm; tail length along central rectrices 57 mm; wing span 330 mm; mass 24 g.

**Paratypes.**—In addition to the holotype, there are two paratypes. (1) Juvenile female, Museo Argentino Ciencias Naturales, MACN 52481, collected 15 February 1972 at El Bolson, Argentina, by A. Kovacs; wing 138 mm, tail 61 mm, tarsus 31.5 mm, exposed culmen 9.5 mm, middle toe with nail 26 mm. (2) Male, MACN 53381, collected 5 November 1983 at El Bolson, Argentina, by A. Kovacs; wing 137 mm, tail 53 mm, tarsus 30.5 mm, exposed culmen 10 mm, middle toe with nail 27 mm. Both were originally identified as *O. oceanicus* and subsequently as *O. gracilis* (Pearman 2000).

**Etymology.**—The specific epithet is derived from Pincoya, from Chilotan mythology. She is the spirit of the Chilotan Sea, good and helpful to fishermen, and comes to the aid of shipwrecked Chiloe Islanders. It is hoped that by naming the new species after a local Chilean entity, the residents of the area will be encouraged to adopt the storm-petrel as a symbol for the conservation of their marine environment.

#### REMARKS

**MACN specimens.**—In January 2011, P.H. examined the two Argentine specimens of "white-bellied storm-petrels": MACN 52481, labeled as a juvenile female; and MACN 53381, labeled as a male. Both had yellow webs to the feet and showed prominent white margins to feather tips across the upperwing coverts, this being more obvious in the juvenile female MACN 52481, on which the white fringes to the sides of each feather measured 2 mm, with 12- to 18-mm-wide white tips to each feather extending backward along the rachis in a narrow wedge. In MACN 52481, white feather margins also occurred on the inner secondaries and longer tertials. Both specimens showed white feathers in the belly and ventral regions and were noticeably smaller than the *O. o. exasperatus* and *O. o. chilensis* skins housed at MACN. The white ulnar bars and distribution of white on the belly and vent were consistent with the images of the presumptive new taxon from Chile (O'Keeffe et al. 2009) but inconsistent with any known storm-petrel taxa. A cursory examination of the (closed) underwing of the specimens showed extensive white across the underwing coverts, a feature not known in any *Oceanites* species. Although

originally identified as *O. oceanicus* and subsequently as *O. g. galapagoensis*, the uniqueness of the plumage features plus the different morphometrics when compared with mainland *O. g. gracilis* left P.H. in no doubt that the MACN specimens were an undescribed taxon. Three weeks later, on 17 February 2011, the team was at Puerto Montt and the expedition was underway.

**Puerto Montt storm-petrel expeditions.**—During the February 2011 expedition, *O. pincoyae* was found to be abundant within the sheltered “inland” waters of Seno Reloncavi; most were observed in water at depths of 100–200 m. They outnumbered all other seabirds combined. On most days, during traveling between chumming stations at a speed of 7 knots, it was not unusual to see 10–15 *O. pincoyae* per minute. Only ~500 were seen on the first day, likely because of rough conditions, but thereafter, in calmer conditions (on 18, 19, and 21 February), >1,000 were seen each day, sometimes in single massed flocks of several hundred at chumming slicks or around local hake fishing boats that were discarding fish entrails. Other species seen included small numbers of

*O. o. chilensis*, Black-browed Albatross (*Thalassarche melanophris*), Pink-footed Shearwater (*Puffinus creatopus*), Sooty Shearwater (*P. griseus*), Chilean Skua (*Stercorarius chilensis*), and Magellanic Penguin (*Spheniscus magellanicus*).

During the July 2011 winter visit to the same area by P.H. and M.S., *O. pincoyae* were still evident in good numbers (despite winds  $\geq 60$  km h<sup>-1</sup>), with  $\leq 40$  individuals at chum slicks. The assemblage of species was markedly different from that on the February visit, including many Southern Fulmars (*Fulmarus glacialisoides*) and White-chinned Petrels (*Procellaria aequinoctialis*), with lesser numbers of Sooty Shearwaters and Common Diving Petrels (*Pelecanoides urinatrix*); no other species of storm-petrel was observed.

**Plumage characters.**—All birds considered to be *O. pincoyae* showed prominent white ulnar bars, obvious central white panels across the underwing coverts, and white on the lower belly and ventral region (Fig. 2). These striking plumage features, inconsistent with any known taxon of storm-petrel, give field characters intermediate between *Oceanites* and *Fregetta*. The ulnar bar is the

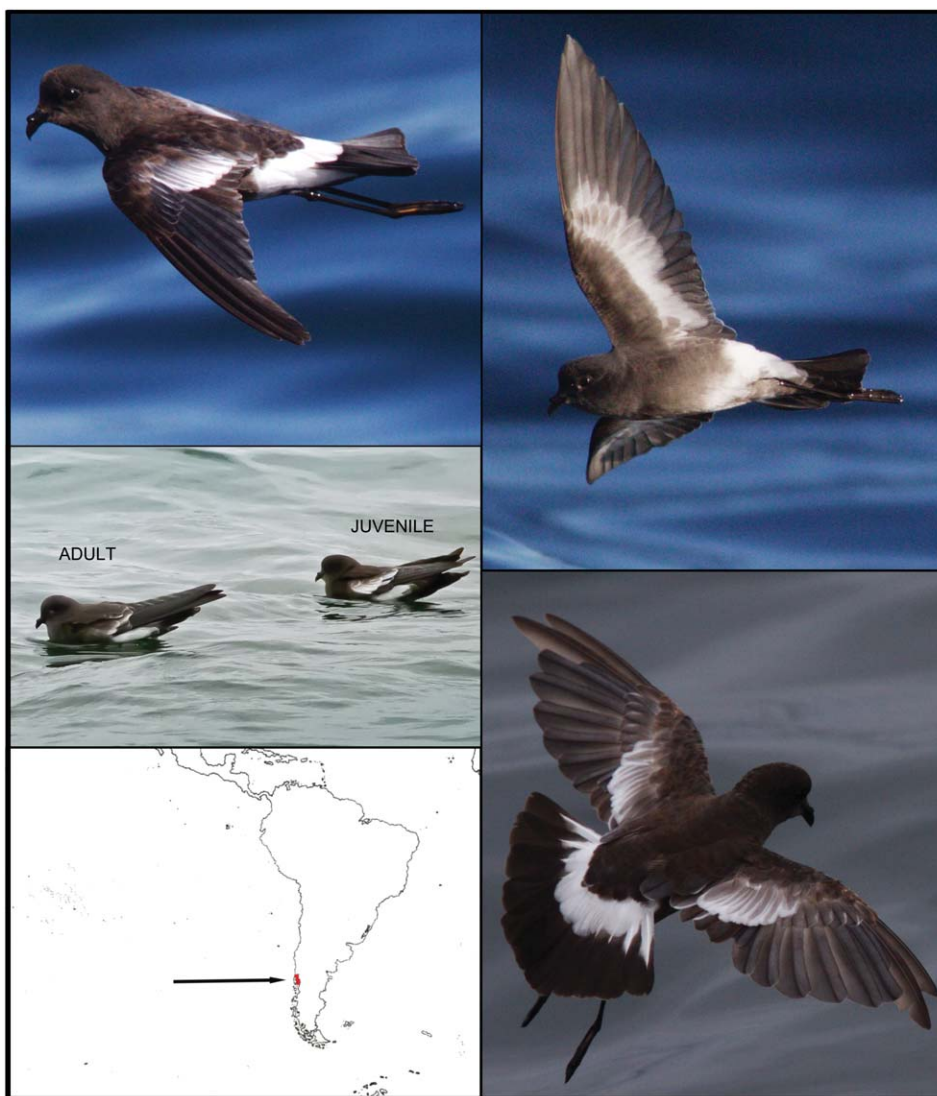


FIG. 2. Identification features and at-sea distribution of the Pincoya Storm Petrel (*Oceanites pincoyae*). (Images by P. Harrison, Seno Reloncavi, Chile, February 2011.)

whitest and most obvious of any small, black-and-white Southern Ocean storm-petrel and is especially striking in juveniles and freshly molted adults. The white central panel to the underwing is unlike that of any other *Oceanites* species (which have generally dark underwings) and recalls the underwing of a *Fregetta* sp. or European Storm-Petrel (*Hydrobates pelagicus*). The white ventral area of *O. pincoyae* superficially recalls well-marked examples of both *O. g. gracilis* and *O. g. galapagoensis*, but the pattern and distribution of white are different. Unlike those two taxa, the white underparts of *O. pincoyae* are restricted to the lower belly and ventral area and end in a line more or less level with the hind wing, producing, in well-marked birds, a classic wrap-around “dipped-in-white” appearance to the lower body and rump. By

comparison, in well-marked *O. g. gracilis* and *O. g. galapagoensis*, the white extends from the ventral area to form a white central belly patch well forward of the hind wing (Fig. 3). Finally, both at sea and in the hand, *O. pincoyae* has a diagnostic tail pattern showing an all-white outer vane to the basal two-thirds of R5 and R6 (Fig. 4). This feature is not found in any other *Oceanites* spp., and within the Oceanitinae it occurs only in *F. tropica*, *F. grallaria*, and *F. maoriana*.

**Juvenile plumage.**—Juveniles were encountered on all days of the February 2011 expedition, occasionally in rafts of  $\geq 50$  birds. Juveniles resemble adults, but the dorsal plumage is generally blacker and the underparts grayer in tone. Most juveniles have a white loreal spot. The white fringe to the sides and the

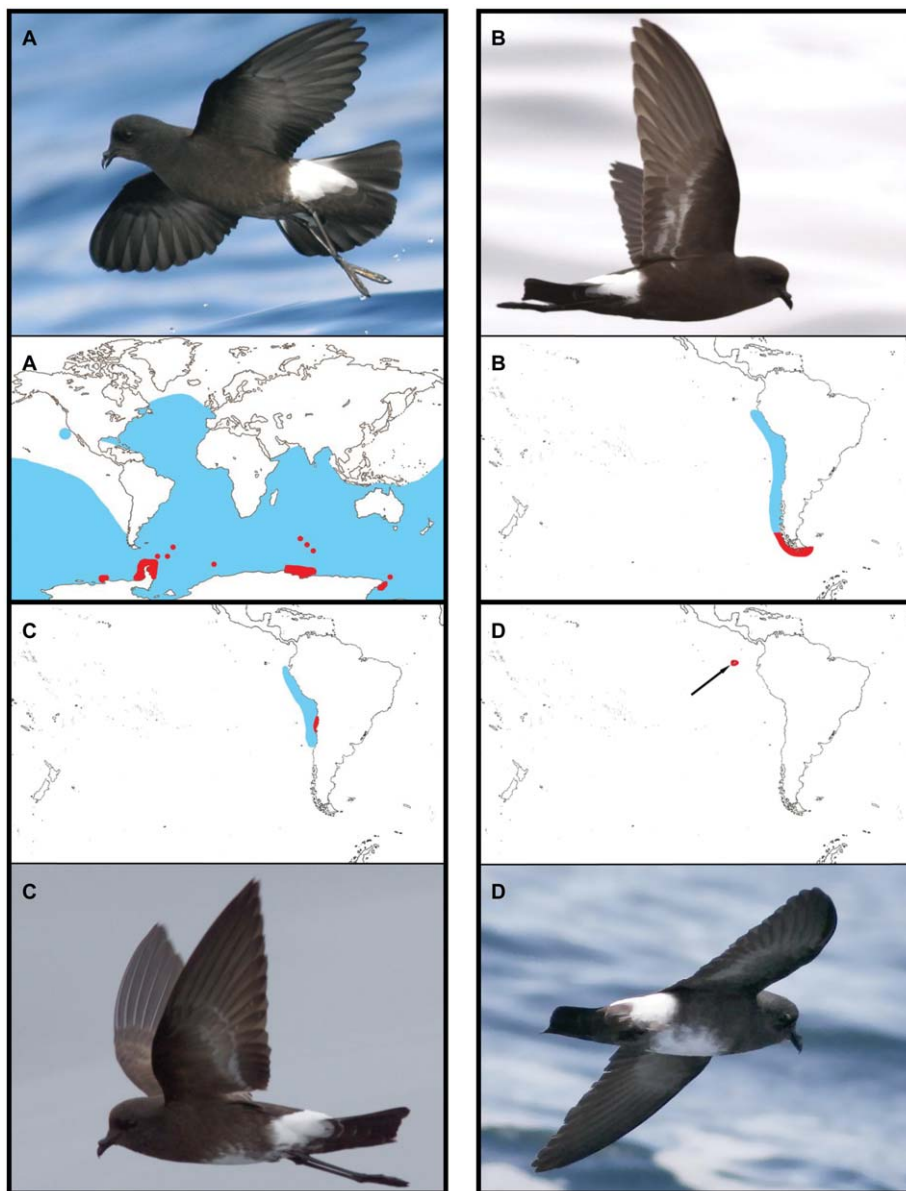


FIG. 3. At-sea distribution of (A) Wilson's Storm-Petrel (*Oceanites oceanicus oceanicus*–*O. o. exasperatus*), (B) Wilson's Fuegian Storm-Petrel (*O. o. chilensis*), (C) Elliot's Storm-Petrel (*O. gracilis gracilis*), and (D) Lowe's Storm-Petrel (*O. g. galapagoensis*). (Wilson's Petrel by Rohan Clarke, off Victoria, Australia, April 2009. All other images by P. Harrison, off Chile, October 2010, and Galápagos Islands, April 2000.)





FIG. 4. Tail pattern of *Oceanites pincoyae* (left), showing white outer vanes to R5 and R6; and that of *O. oceanicus chilensis* (right), showing dark outer vanes to R5 and R6. Note also differences in ulnar bar on the upperwing coverts. (Images by P. Harrison, Seno Reloncavi, Chile, February 2011.).

corresponding white tip to each of the greater and median coverts are also much brighter and broader in extent than in adult birds, giving juveniles a broader, brighter, and much more noticeable ulnar bar (Fig. 2). The innermost three to five secondaries and longer tertials are also broadly edged with white, which increased the apparent “at sea” length of the ulnar bar. This gave a striking appearance both in flight and when resting on the water (Fig. 2). Some juveniles showed darker vent and lower belly areas due to scattered dark tips to feathers; with wear, these dark tips abrade to give increasingly whiter underparts (in *O. o. chilensis* the reverse occurs; some juveniles have scattered white tips in the ventral and belly areas; with wear these white tips abrade to give increasingly darker underparts; P.H. pers. obs.).

**Feather lice.**—Two lice were collected from the holotype and identified by Ricardo Palma (Museum of New Zealand Te Papa Tongarewa, Wellington, New Zealand): one male *Philoceanus robertsi* (Clay 1940) and one male *Austromenopon enigki* (Timmermann 1963). *Philoceanus robertsi* has been recorded from *O. o. oceanicus*, *O. o. exasperatus*, and *Hydrobates pelagicus*, and *A. enigki* has been found on *Pelagodroma marina* (see Price *et al.* 2003:91, 212).

**Morphometrics.**—Although similar in color pattern to *gracilis*, the new taxon appears to be larger than *Oceanites g. gracilis* specimens from Peru and Chile and is similar in size to *O. o. chilensis* and smaller than the nominate and *O. o. exasperatus* (Table 1). *Oceanites g. gracilis* is distinctly smaller than the other two Chilean species, *O. o. chilensis* and *O. pincoyae* (Table 2). Analysis of variance (ANOVA) showed that wing length differed among these three storm-petrel taxa ( $F = 32.47$ ,  $df = 2$  and  $44$ ,  $P < 0.001$ ), and post hoc Tukey’s HSD tests showed that all three taxa were significantly different at  $P < 0.05$ . Similarly, the ANOVA for

tail length was significant ( $F = 12.64$ ,  $df = 2$  and  $44$ ,  $P < 0.001$ ), and a post hoc Tukey’s HSD test determined that *O. pincoyae* and *O. o. chilensis* did not differ ( $P > 0.05$ ), although they were significantly longer tailed than *O. g. gracilis*. Likewise, tarsus length differed among the three taxa ( $F = 19.30$ ,  $df = 2$  and  $44$ ,  $P < 0.001$ ), and post hoc Tukey’s HSD tests showed that *O. o. chilensis* had a significantly longer tarsus than the other two taxa, but that *O. g. gracilis* and *O. pincoyae* did not differ from each other. Toe-length differences were significant ( $F = 27.87$ ,  $df = 2$  and  $44$ ,  $P < 0.001$ ) and a post hoc Tukey’s test showed that *O. pincoyae* had the longest toes, and *O. g. gracilis* the shortest. Culmen length did not differ among species ( $F = 0.48$ ,  $df = 2$  and  $44$ ,  $P = 0.62$ ) but mass did ( $F = 41.10$ ,  $df = 2$  and  $14$ ,  $P < 0.001$ ), and post hoc Tukey’s HSD test showed that *O. g. gracilis* is significantly lighter than the other two taxa. Potential differences can arise through comparisons of

TABLE 2. Morphometric measurements (means  $\pm$  SD) of three species of *Oceanites*.

	<i>O. gracilis</i> <i>gracilis</i> ( $n = 8$ )	<i>O. oceanicus</i> <i>chilensis</i> ( $n = 25$ )	<i>O. pincoyae</i> ( $n = 14$ )
Wing (mm)	129.25 (5.60)	140.00 (2.86)	136.50 (2.60)
Tail (mm)	52.88 (3.04)	60.21 (3.26)	57.64 (3.05)
Tarsus (mm)	30.55 (1.01)	34.15 (1.42)	31.77 (1.44)
Middle toe (mm)	20.77 (1.52)	23.70 (1.63)	26.29 (1.05)
Culmen (mm)	11.31 (0.54)	11.48 (0.58)	11.34 (0.41)
Mass (g)	14.0 (2.65); $n = 3^a$	30.0 (2.00); $n = 3^a$	26.7 (2.41); $n = 12^a$

<sup>a</sup> Sample size ( $n$ ) refers to mass.



TABLE 3. Factor loadings from the first two axes from the principal component analysis of morphological features of *Oceanites gracilis*, *O. oceanicus chilensis*, and *O. pincoyae*.

Factor loadings	PCA axis 1	PCA axis 2
Wing	0.889	0.093
Tail	0.803	0.124
Tarsus	0.820	-0.170
Middle toe	0.461	-0.674
Culmen	0.334	0.801
Eigenvalues	2.43	1.15
Explained variance (%)	48.58	22.99
Cumulative explained variance (%)	48.58	71.57

measurements taken from live birds and museum specimens because specimens tend to shrink (Winker 1993). Hence, the shorter wing and tail of *O. pincoyae* (live birds) compared with *O. o. chilensis* (museum specimens) probably represents an underestimate of the difference.

The PCA excluded the two *O. pincoyae* from Argentina and one *O. o. chilensis* because data were missing for some variables. In addition, mass was not included in the analysis. The first two axes were the only axes with eigenvalues >1, and they accounted for 71.57% of the variance in the morphological data (48.58% and 22.99%, respectively; Table 3). The first component reflects general size, as all factor loadings are positive and of roughly similar magnitude. The second component represents a shape component, where positive values on PC2 correspond to a relatively longer bill and shorter tarsus and middle toe (Table 3). A plot of PCA factors 1 and 2 shows that *O. g. gracilis* differs both in size and shape from both *O. o. chilensis* and *O. pincoyae* (Fig. 5). While the white belly of *O. pincoyae* suggests that it may be a southern population of *O. g. gracilis*, the PCA of morphometrics showed that the new taxon is a larger bird with some shape differences as well. There is much overlap between *O. o. chilensis* and *O. pincoyae*, although important differences in certain attributes of *O. pincoyae*, such as a shorter wing, shorter tarsus, and longer toes show it to be similar, but not equivalent, to *O. o. chilensis* in shape and size (Table 2). Observations at sea show *O. pincoyae* to have a different foraging style than *O. o. chilensis*, and this may explain the subtle differences in toe and tarsus lengths. Noteworthy differences in toe morphology are found in other storm-petrels, such as the broad and spade-like toes of *Fregetta*.

**Foraging strategies.**—During daylight, unless feeding or resting, *O. pincoyae* occurred singly or in small groups. However, they formed large loafing rafts and aggregations at profitable feeding areas, sometimes comprising hundreds of individuals. Their traveling flight is very purposeful, usually fast and direct, 2–5 m above the sea surface, with a swallow-like flight style and action. When stopping to investigate something on the surface of the sea, the species was commonly observed to climb sharply from horizontal flight, flutter and stall, and then, with legs dangling, drop rapidly tern-like to the sea surface. Some birds then foot-pattered, walked, and jumped with wings outstretched, parallel to the sea's surface, dipping forward to retrieve morsels or, with a flick of their wings, become completely submerged. Some birds simply executed a fluttering stall and dove without hesitation beneath the surface. Dives lasted 1–3 s; birds appeared to use their wings for propulsion

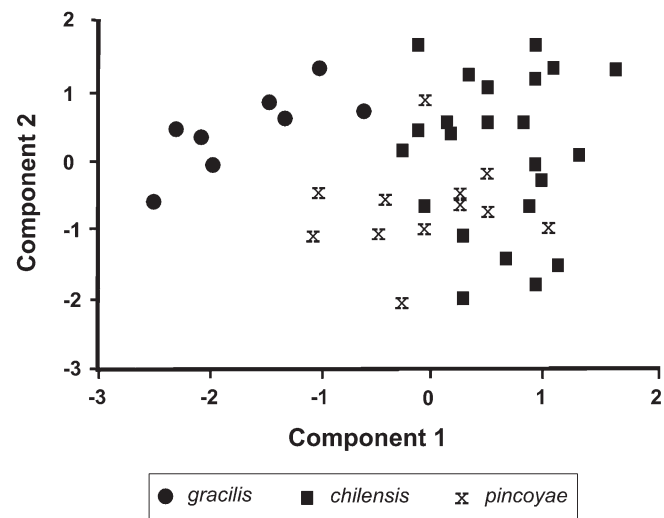


FIG. 5. Representation of the morphological variation in *Oceanites* generated from the first two axes in the principal component analysis. Component 1 can be considered a measurement of size. Component 2 is a shape component; increases in this component correspond to a relatively longer bill, shorter tarsus, and middle toe. The figure shows that *Oceanites gracilis gracilis* is a group apart from *O. o. chilensis* and *O. pincoyae*, with *O. pincoyae* having a shorter tarsus and longer middle toe than *O. o. chilensis*.

under the water. Some food items were too large to swallow, and several birds were seen flying off carrying larger food items hanging in their bills. At profitable foraging–feeding locations, birds were energetic feeders–scavengers and were highly competitive, occasionally tugging and robbing food from each other. When feeding in groups they did so with noisy, sparrow-like, incessant chatter.

When moving from a resting position to walking or running, the species would often keep their wings folded or tucked closely to the sides of their body and run with their feet below the surface, with tarsi half submerged. Their appearance during this activity prompts the analogy with a mouse: small, dark, and furtive, scurrying hither and thither over wave crests and along wave furrows (Fig. 6). In this manner, rafting birds seemed to make efforts to remain in a cohesive group, stragglers getting up and running forward to catch up to the main group. The “mouse-run” was also employed to reach food items ahead of competitors, birds running over the ocean on half-submerged tarsi before surface-seizing or fully submerging.

Rafts of birds were seen in all conditions (e.g., from calm to strong winds and rough seas) and varied from just 3 or 4 to >300 birds. Although adults and juveniles were seen together, many rafts were made up of predominantly one age class or the other; this was apparent in the first hours of daylight (and may suggest that the juveniles were actively fledging from nearby nesting sites to form offshore congregations). While resting, the species has a hunched, small-headed appearance with the bill held pointing downward at 45 degrees. The birds, although buoyant, sit flat and low in the water with their long wings raking upward above the level of the head and with P7–P10 protruding several inches beyond the tail tip (Fig. 2).



FIG. 6. The “mouse-run” of *Oceanites pincoyae* with tarsi half-submerged and wings held tight and close to the body. (Images by P. Harrison, Seno Reloncavi, Chile, February 2011.)

Species are adapted to specific oceanic conditions, and this can result in geographic isolation and ecological segregation along biophysical gradients in the ocean (Spear and Ainley 2007). Within the five presently recognized *Oceanites* taxa, geographic segregation into different marine habitats is well illustrated: *O. o. exasperatus* and *O. o. oceanicus* breed at high latitudes south of the Polar Front and are transequatorial migrants to 70°N (Marchant and Higgins 1990). The smaller *O. o. chilensis* is confined to the southern hemisphere, breeds well above the Antarctic Convergence in the Tierra del Fuego region, and migrates to cold or cool slope and shelf waters of the Humboldt Current region, extending out to 550 km and north to 3°S (Spear and Ainley 2007). *Oceanites g. gracilis* is a cool-water endemic of the Humboldt Current region and ranges from 33°S to 3°N out to 500 km, with highest densities over the continental shelf (Spear and Ainley 2007). Of the five known *Oceanites* taxa, the most unique, from an ecological perspective, is *O. g. galapagoensis*. All other *Oceanites* species have pelagic marine ecologies, whereas *O. g. galapagoensis* is a resident inshore species of cool to warm waters restricted to the Galapagos archipelago and rarely ventures >100 km from the shoreline (Loomis 1918, Murphy 1936, Crossin 1974). Compared with the five presently described *Oceanites* taxa, *O. pincoyae* is more similar to *O. g. galapagoensis* in both its ecological preferences and morphometric data than other species (Table 1 and Appendix). To date, this taxon has been observed only within the shallow, sheltered bays of the Chilean fjord system, in water <300 m deep. *Oceanites pincoyae*'s oceanographic needs are thus clearly distinct from those of the migratory, offshore *O. o. chilensis* and are much more akin to those of the warmer-water taxon *O. g. galapagoensis*.

In the Southern Hemisphere, *O. oceanicus* rarely sits on the water or alights (0.5% of 4,182 observations; Obst et al. 1987). *Oceanites pincoyae* is thus unusual in its foraging ecology. They also fly higher and stronger than other *Oceanites* spp., 2–5 m above the surface. The flight attitude of *O. pincoyae* is more reminiscent of *F. maoriana*: swift, direct, and purposeful. However, a unique feature during feeding activity was the exaggerated upward “tick” in

the horizontal flight path usually followed by a downward fluttering stall, then a vertical descent, with some birds becoming completely submerged. These are unique traits; *O. pincoyae* therefore appears to both locate and retrieve food in a different manner than other Southern Ocean storm-petrels, including *O. oceanicus* and *O. gracilis*. The new taxon does not skate or skip like species in the genera *Fregetta* and *Nesofregetta* or bound like *Pelagodroma* spp. It was not observed sitting on the surface and belly-feeding like *Oceanodroma castro* or *Hydrobates pelagicus*. It is smaller and daintier and has a smaller head than *Oceanites oceanicus*. During foot pattering, it appears to use its feet more as anchors, often completely submerging feet and legs to midtarsi with the wings usually held much flatter than in *O. oceanicus*, which tends to hold its wings in a shallow “V.”

**Molt.**—Most adult *O. pincoyae* observed in February were in active wing molt, with the inner primaries growing out or missing. Storm-petrels have one complete molt per year, and their wing molt is often protracted over the 5–7 months following breeding (Howell 2010). Storm-petrels have 10 functional primaries, and the wing molt begins with the innermost primary (P1) and proceeds sequentially outward to the outermost functional primary P10 (which is shorter than P9 and usually hidden from view). The timing of the molt cycle can be helpful in separating one taxon from another because different taxa often breed at different seasons, and wing molt and breeding do not overlap appreciably (Bolton et al. 2008, Howell 2010). In some species (e.g., *Oceanodroma castro*, *O. leucorhoa*, and *O. homochroa*), primary molt begins when chicks are well grown and ends before the commencement of the next period of egg laying (Howell 2010). In other taxa, such as all three races of *Oceanites oceanicus*, wing molt does not occur until well after the end of breeding, when birds are in winter quarters (R. Beck in Murphy 1936). Within the southern *Oceanites*, *O. pincoyae* are unique in that they molt at the end of or immediately after their breeding attempt.

**South American Oceanites: Breeding seasons.**—Only two *Oceanites* taxa, *O. g. gracilis* and *O. o. chilensis*, are known to

breed in continental South American waters. Distributional data on breeding storm-petrels are poor, however, and despite at-sea population estimates of 396,400 and 858,700 during spring and autumn for *O. g. gracilis* (Spear and Ainley 2007), only a handful of nests or eggs have ever been found. Murphy (1936) considered *O. g. gracilis* to be a winter breeder, but eggs have now been found in May, August, and January (Marín 1982, Schlatter and Marín 1983, Hortal and Torres-Mura 2003), and it seems unlikely that a colonial storm-petrel would have an extended egg-laying period of some 9 months. This could suggest that two seasonal populations may be involved with bimodal laying. The situation is further confused by inland records of this species in Chile,  $\leq 150$  km from the coast and at elevations  $>600$  m (Marín 2002), in March–April and October–November. Whether these records refer to inland breeding birds is unclear. The situation is similar in *O. o. chilensis*, which is a confirmed breeder in the Fuegian region. No colonies of *O. o. chilensis* are known north of  $50^{\circ}\text{S}$ . It appeared that juveniles were actively fledging during the February 2011 expedition. Roberts (1940) outlined the breeding biology of *O. o. oceanicus*'s approximately 129-day breeding cycle: return to colony or nest site with courtship period 3–4 weeks, incubation period 46 days, and fledging period 56 days. This is similar to figures given in Marchant and Higgins (1990) for the family Hydrobatidae: incubation period 40–50 days and nesting period 59–73 days. On the basis of the foregoing data and the fact that *O. o. chilensis* has been found with newly laid eggs in January (Murphy 1936, P.H. unpubl. data), we tentatively conclude that *O. pincoyae* would need to arrive at their colonies in the first or second week of October, with eggs laid from mid-November, in order to fledge chicks in mid- to late February. Conversely, *O. o. chilensis* would fledge chicks in April or May. Although speculative, these differences in breeding times appear to be supported by the difference in the timing of wing molt. In *O. pincoyae*, molt of innermost primaries P1–P4 begins in early to mid-February in the latter part of the breeding season and on the breeding grounds. In *O. o. chilensis*, however, primary molt occurs after the postbreeding northward migration, in winter quarters off the coasts of northern Chile, Peru, and Ecuador, in May to June (Murphy 1936, A. Wetmore in Murphy 1936).

**Population and distribution.**—Despite our incomplete knowledge of the breeding distribution of both *O. g. gracilis* and *O. o. chilensis*, neither taxon is known to breed within 800–1,000 km of Puerto Montt, and there appear to be significant differences in egg-laying dates and molt timings of those two taxa and *O. pincoyae*. So far, *O. pincoyae* has been seen only in the sheltered waters of the Chiloe region. It appears to occupy a central breeding location between the northerly *O. g. gracilis* and the southerly *O. o. chilensis*. It seems unlikely that such a boldly marked bird as *O. pincoyae* could escape detection for so long unless it had a restricted and somewhat sedentary range away from shipping routes and such accessible and often-visited areas as Punta Arenas, Iquique, Valparaíso, Mejillones, and Arica (day-long seabirding pelagic trips are regularly undertaken from the latter three locations). The observation of S. Imberti (pers. comm.) and the midwinter visit to Seno Reloncavi by P.H. and M.S. suggest that *O. pincoyae* does not move north into the greater Humboldt Current region after breeding but remains as an inshore resident within the extensive shallow bays of the Chilean fjord system. We tentatively suggest, therefore, that *O. pincoyae* is a geographically

isolated taxon, with *O. o. chilensis* breeding to the south and *O. g. gracilis* to the north. During the February 2011 expedition, the new taxon outnumbered all other seabirds combined; we estimate a population of 3,000 individuals.

**Conservation.**—In common with all other members of the family Hydrobatidae, *O. pincoyae* is expected to lay just a single egg per breeding attempt and annual productivity is expected to be low (Marchant and Higgins 1990). The breeding grounds are unknown but are expected to be within the Seno Reloncavi–Chiloe area, although inland sites among the mountains cannot be discounted. Seno Reloncavi and the Chilotan Sea are protected inland waters with regular, small-scale shipping traffic of both commercial and passenger vessels that dock and discharge at nearby Puerto Montt, a coastal city of  $\sim 176,000$  people. The possibility of a shipping accident or oil spill are constant and continuing threats. The protected waters of Seno Reloncavi have also seen a recent proliferation of commercial mussel and salmon farms. These operations utilize numerous large buoys and flotation platforms or devices that are usually filled with granular polystyrene. These items often break up and release tiny granular pellets that can be picked up and ingested by seabirds, including *O. pincoyae*. With a growing human population in the area and an expected increase in boat traffic, these are causes for concern. The conservation status of *O. pincoyae* is unknown, and we hope that its description here as a new taxon will help initiate surveys for its breeding grounds to safeguard its future.

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APPENDIX. Puerto Montt storm-petrel species (*Oceanites pincoyae*)—biometric data table.

Bird no.	Date	Latitude	Longitude	Age	Wing (mm)	Tail (mm)	Bill length (mm)	Tarsus (mm)	Middle toe (mm)	Mass (g)	Wing span (mm)	Bill to gape (mm)	Nostril length (mm)	Bill depth (mm)	Samples taken
1	2/18/2011	41°48.505S	72°52.034W	Adult	138	60	11	31	26	26	320	11.5	7.5	4.5	Feathers
2	2/18/2011	41°48.505S	72°52.034W	Adult	137	62	11.5	31	27	24	322	12	6	5	Feathers
3	2/18/2011	41°48.505S	72°52.034W	Juvenile	137	60	11.5	32	27	22	320	11.5	7	4.75	Feathers
4	2/19/2011	41°47.799S	72°53.418W	Adult	134	57	11.5	31	26.5	24	330	12	6.5	4.5	Feathers and blood
5	See below														
6	2/19/2011	41°47.799S	72°53.418W	Juvenile	138	56	10.5	32	27	26	320	Not taken	Not taken	Not taken	Feathers (body only)
7	2/19/2011	41°47.799S	72°53.418W	Adult	134	52	11.5	31	26	26	330	14	6	6	Feathers
8	2/19/2011	41°47.799S	72°53.418W	Adult	138	56	12	34	27	28	327	14	6.5	5	Feathers
9	2/19/2011	41°47.799S	72°53.418W	Adult	138	59	12	31	24	28	330	14	6	5	Feathers
10	2/19/2011	41°47.799S	72°53.418W	Adult	140	62	11.5	34	28	30	325	12.5	6	4.5	Feathers
11	2/21/2011	41°47.804S	72°53.421W	Adult	138	59	11.4	34	26	30	330	13	5.5	4.5	Feathers
12	2/21/2011	41°47.804S	72°53.421W	Juvenile	134	55	11	33	25	26	324	12	5.6	4.7	Feathers
	Mean				136.9	58	11.4	32.18	26.318182	26.364	325.2727	12.65	6.26	4.845	
	SD				1.608	2.38	0.3375	1.102	0.9147727	1.4545	2.840909	0.716327	0.245714	0.34143	
	95% CI				0.03	0.04	0.006381	0.021	0.0172954	0.0275	0.053713	0.013543	0.004646	0.00646	
5	19 February 2011			Juvenile	130	57	11	30	26	28	290	Not taken	Not taken	Not taken	Feathers

Note: Bird no. 5 was excluded from calculation of means and standard deviations because of shortened primaries.