

# Occurrence and identification of the Leach's Storm-Petrel (*Oceanodroma leucorhoa*) complex off southern California

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Figure 1. Presumed Leach's or Chapman's Storm-Petrel (left) and presumed Townsend's Storm-Petrel (right) off Santa Barbara, California, 21 July 2007. This photograph conveys well the rangier build and larger size of the paler, browner Leach's/Chapman's versus the smaller size and more compact build of the darker Townsend's. A series of photographs of these individuals supports the consistency of the differences shown here. Photograph by Steve N. G. Howell.

## Abstract

Observers of seabirds over deep water off the Pacific coast of California have long noticed distinct variation in plumage, structure, and size exhibited by members of the Leach's Storm-Petrel (*Oceanodroma leucorhoa*) complex. Herein, variation within the complex is reviewed and tentatively linked to recent observations of Leach's Storm-Petrels off southern California. We discuss provisional identi-

fication criteria and possible occurrence patterns for four taxa within the complex: the widespread Leach's Storm-Petrel, found in both the North Atlantic and North Pacific Oceans (*O. l. leucorhoa*); Chapman's Storm-Petrel (*O. l. chapmani*), breeding in the Coronado Islands and San Benito Islands of Mexico; and two taxa breeding on islets off Mexico's Guadalupe Island (*socorroensis* and *cheimomnestes*), treated herein as full species,

with English names Townsend's Storm-Petrel and Ainley's Storm-Petrel, respectively.

## Background

Leach's Storm-Petrel (*Oceanodroma leucorhoa*) is a rather variable seabird that breeds in both the North Pacific and North Atlantic Oceans. Over the years, it has been the subject of a convoluted taxonomic history, with authors placing variable emphasis on the color and

pattern of the uppertail coverts (often referred to for the sake of brevity as the “rump”), on size and structure, and more recently on breeding season and vocalizations (Loomis 1918, Oberholser 1919, Van Rossem 1942, Austin 1952, Crossin 1974, Ainley 1980, Bourne and Jehl 1982, Ainley 1983, Power and Ainley 1986). The view that has prevailed in recent years (e.g., Power and Ainley 1986 and subsequent literature) is that four taxa should be recognized: nominate *leucorhoa*, breeding in both the North Pacific and North Atlantic, and three taxa breeding on islands off the Pacific coast of Mexico: *chapmani*, *socorroensis*, and *cheimomnestes*.

For Pacific breeders, from Alaska to Baja California, recent authors indicate that variation is clinal, changing from larger, longer-winged breeding populations in the north (nominate *leucorhoa*) to smaller, shorter-winged breeding populations in the south (subspecies *chapmani*). Three other subspecies have been described from southeastern Alaska to northern Baja California (from north to south, *beali*, *beldingi*, and *willetti*), but these taxa are no longer recognized as valid in more recent literature on the complex, particularly following Power and Ainley (1986).

Past authors have argued that these taxa differ subtly in size and rump pattern from members of the Leach's group that breed to the north and south, but more recent research has not found the distinctions to be consistent. Genetic analysis would probably provide greater insight into their relationships with other populations/taxa to the north and south.

In addition to the Pacific coastal populations, at least two distinct taxa breed on islets around Guadalupe Island, about 250 kilometers offshore of Baja California: *socorroensis* in summer, and the slightly larger *cheimomnestes* in winter. That winter and summer breeding populations replaced each other around Guadalupe Island was first documented by Hubbs (1960) and echoed by Crossin (1974). Subsequently, Ainley (1980) described the taxon *cheimomnestes*, noting that “on Guadalupe [Island], the two populations of *O. leucorhoa* [i.e., winter-breeding *cheimomnestes* and summer-breeding *socorroensis*] are morphologically and behaviorally

distinct” and “so different are their songs that, if they met, it is questionable that interbreeding would occur.” The prevailing taxonomic practice of the day was “lumping,” and Ainley described *cheimomnestes* as a subspecies of Leach's Storm-Petrel, also the status he maintained for *socorroensis*. Interestingly, Ainley (1980) drew parallels between the storm-petrels of Guadalupe Island and the “Soft-plumaged Petrel” (*Pterodroma mollis sensu lato*) complex, at that time considered a single species. More recent treatments indicate that “Soft-plumaged Petrels” comprise three or four species (e.g., Robb et al. 2008, Jesus et al. 2009), but the taxa in the Leach's Storm-Petrel complex have languished in obscurity by comparison.

As far as is known, Leach's Storm-Petrels from the North Atlantic and North Pacific have very similar vocalizations, whereas vocalizations of both of the morphologically distinct Guadalupe populations sound different, both from each other and from more northerly-

breeding taxa (Ainley 1980). In light of recent re-evaluations of the biogeography, vocalizations, and speciation of tubenoses (e.g., as summarized for the eastern North Atlantic by Robb et al. 2008), we consider that the data presented by Ainley suggest that at least three species of “Leach's Storm-Petrel” may be recognized in the Pacific. Genetic analysis may elucidate this conclusion. In a forthcoming identification guide to North American petrels, albatrosses, and storm-petrels, Howell (in prep.) will treat the Guadalupe Island taxa as full species, using the English names Townsend's Storm-Petrel for the summer-breeding *O. [leucorhoa] socorroensis* and Ainley's Storm-Petrel for the winter-breeding *O. [leucorhoa] cheimomnestes*. These names recognize the ornithologists who described these taxa, Charles H. Townsend and David G. Ainley.

These potential splits prompt the obvious questions: Do Townsend's and Ainley's Storm-Petrels occur in North American waters? And: how might they be identified at sea relative to

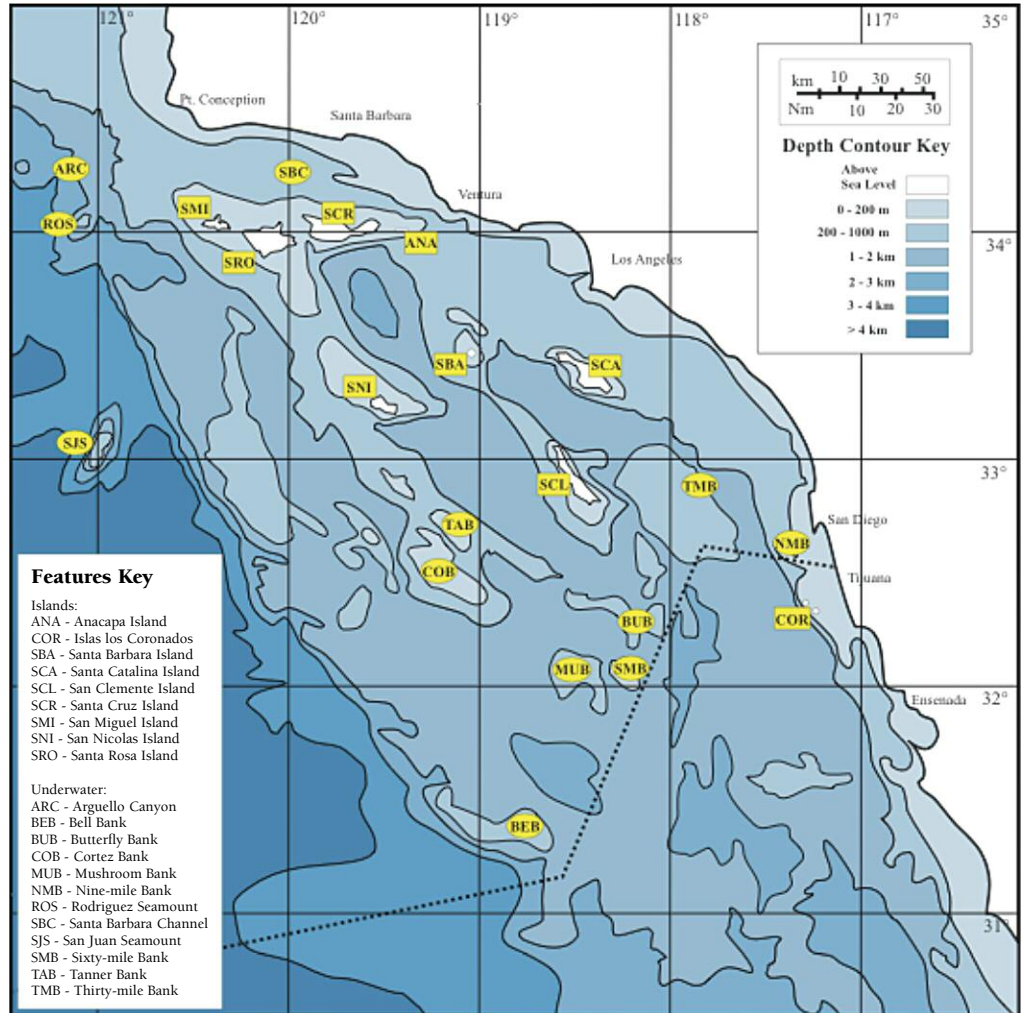
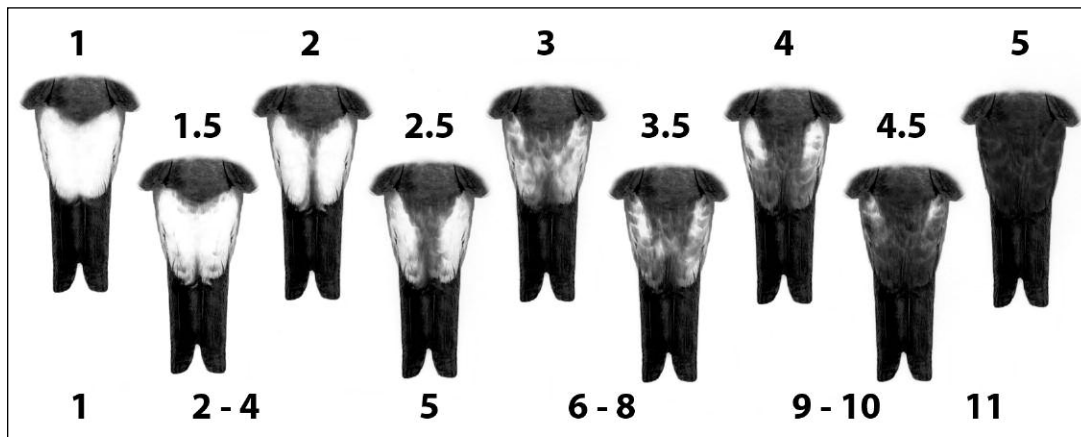


Figure 2. Map of southern California offshore waters and submarine features. Dotted line indicates the international border. Map by Jon Feenstra.



**Figure 3.** Variation in uppertail-covert ("rump") pattern for the Leach's Storm-Petrel complex. Simplified scores and half-scores used here are given across the top, with corresponding Ainley scale values across the bottom. Scores used in this paper range from 1 (white overall, including solidly white) to 5 (dark overall, including solidly dark). Score 1 can have a few dark marks (rarely visible at sea), and score 5 can have a few pale markings, likewise rarely visible at sea. Score 2 is mostly white, score 3 about 50:50 white/dark, and score 4 mostly dark. Scores of 1 and 2 are typical of white-rumped Townsend's, 1.5 and 2.5 are typical of white-rumped Leach's, 2.5–3.5 are typical of Ainley's, and 4–5 are typical of Chapman's and dark-rumped Townsend's. The extent of "rump" patches and depth of tail fork shown here are not intended to convey taxonomic significance. *Illustration by Ian Lewington.*



**Figure 4.** Leach's Storm-Petrel in the western Pacific (26° N 142° E), 22 April 2007. This bird is probably well away from the geographic range of other taxa and appears to be a typical North Pacific example of nominate Leach's. Note the relatively limited white rump band (score 1.5–2), its length (measured along the axis of the body) about equal to the depth of the tail fork. *Photograph by Steve N. G. Howell.*

other taxa in the Leach's complex as well as to other storm-petrels? Here we offer some preliminary thoughts, based on the literature, our review of museum specimens, and our observations of thousands of Leach's Storm-Petrels of various taxa on pelagic trips off California (Figure 1); marine topography off southern California, with many of the areas described below, is illustrated in Figure 2.

What is known of the overall distribution of these four taxa can be summarized as follows.

**Leach's Storm-Petrel** (*O. l. leucorhoa*) breeds in the North Pacific from Alaska south to California; North Atlantic populations are also considered to belong to nominate *leucorhoa*. Populations from southeastern Alaska to northern Baja California average smaller than

Aleutian (and North Atlantic)

Leach's and have been grouped as

the subspecies *beali*, including the

subspecies *beldingi* described from

Oregon (Austin 1952, Crossin

1974). As noted above, the most

recent analysis (Power and Ainley

1986) suggests that variation is

clinal in eastern Pacific breeders,

from larger and whiter-rumped in

the north to smaller and darker-

rumped in the south, and that

*leucorhoa* effectively "intergrades"

with *chapmani* between the Faral-

lon Islands and Coronado Islands

(between 38° and 32° N latitude).

Birds return to colonies from

late February through May; egg

laying is mainly in May–June, with

fledging from Pacific colonies in

mid-August to early November (later north-

wards; Ainley et al. 1974, Gibson and Byrd

2007). The larger northern-breeding Leach's

(with longer and relatively pointed wings)

winters mainly in the central tropical and

equatorial Pacific (Crossin 1974, Spear and

Ainley 2007); Leach's wintering off California

(Briggs et al. 1987, P. Pyle, pers. comm.) have

been attributed to the smaller "*beali*" (with

shorter and blunter-tipped wings), which

winters mainly in the eastern Pacific (Crossin

1974).

**Chapman's Storm-Petrel** (*O. l. chapmani*) breeds on the Coronado Islands and San Benito Islands, Mexico, with a nesting schedule similar to early-breeding *leucorhoa* (mainly May–September). The Coronado and San Benito island groups lie about 500 kilometers

southern California (P. Pyle, pers. comm.).

**Townsend's Storm-Petrel** (*O. socorroensis*) breeds on islets off the south end of Guadalupe Island (mainly Isote Afuera and Isote Negro) and perhaps also locally on the main island, but most storm-petrels there (including the now-extinct Guadalupe Storm-Petrel, *O. macrodactyla*) have been eliminated by feral cats (Ainley 1980, Ainley 1983, Crossin 1974, Jehl and Everett 1985). The population on Isote Negro has been estimated at 4000 birds and on Isote Afuera at 3000 birds (Crossin 1974, Ainley 1983). Egg laying is mainly in late May–June, with fledging in October–November. The known at-sea range lies in the eastern Pacific between 35° N and 10° N (Crossin 1974), but seasonal movements are not well known.

**Ainley's Storm-Petrel** (*O. cheimomnestes*) breeds on three islets (Isote Negro, Isote Afuera, and Gargoyle Rock) off the southern end of Guadalupe Island, Mexico (Ainley 1980, 1983, Crossin 1974, Jehl and Everett 1985). Crossin (1974) proposed reviving the subspecies name *kaedingi* for the winter-breeding population, whose distinctiveness he recognized, but the type specimen of *kaedingi* (Carnegie Museum #22219) is from the summer-breeding population, for which the name *socorroensis* has priority (Ainley 1980).

The breeding population of Ainley's Storm-Petrel may not be in excess of a few thousands birds. Egg laying is mainly in November–December, with fledging in April–May. The at-sea range has not been described previously, but we presume that birds range over waters off the Baja California peninsula during their

apart, and birds breeding on the former island have been treated as the subspecies *willetti*, which has at times been subsumed with more northern populations into the subspecies *beali* (Austin 1952). Power and Ainley (1986) showed, however, that these two island populations were morphologically similar and thus better grouped together.

The wintering range of Chapman's is mainly in the eastern tropical Pacific (Crossin 1974, Spear and Ainley 2007), but some birds may occur north to waters off

breeding season (November–April). Although measurements of Ainley's and Chapman's overlap (Table 1), differences in plumage aspect (such as rump pattern, which is difficult to qualify; see Figures 6 and 16), plumage wear, and molt timing allow many specimens to be identified, particularly when compared with series of specimens collected at the breeding islands.

After breeding, Ainley's Storm-Petrels appear to withdraw southward, based on limited specimen data. An adult female in worn plumage (SDNHM #29925) collected 360 kilometers southwest of Guadalupe Island on 21 May, and a juvenile in fresh plumage (SDNHM #29924) collected 550 kilometers west of Clarión Island, Mexico on 24 May (at about 18° S), both suggest a southward post-breeding dispersal, as does an adult in wing molt (with p4 shed) collected on 11 June at 4° S, 93° W (CAS #484), a location about 400 kilometers southwest of the Galápagos Islands. A specimen completing wing molt (with p9–p10 growing) on 9 October (CAS #471), taken about 500 kilometers south-southeast of Mexico's Revillagigedo Islands, may have been a northbound migrant.

### Potential identification criteria

With the newly described complexity in the Band-rumped Storm-Petrel complex (Smith and Friesen 2007, Smith et al. 2007), criteria for identifying some taxa away from the breeding islands have been proposed (Robb et al. 2008). Members of the Leach's Storm-Petrel complex have not previously had such treatment in the literature, certainly not from the perspective of at-sea identification. For the purposes of this article, we assume observers are familiar with nominate Leach's and do not cover identification of that taxon relative to other species of storm-petrels. The accounts below summarize our thoughts on potential identification criteria, based on study of specimens and encounters with birds at sea off southern California and northwestern Mexico. As in most birds, wing molt in storm-petrels starts with the innermost primary (p1) and progresses sequentially outward to the outermost (p10).

All measurements are given in millimeters (Table 1), but we augment more general "field guide" measurements, such as length and wingspan, with measurements in inches, to which most North American birders are more accustomed. For consistency, all measurements were made by Howell. Wingspan measurements come from 30 fresh specimens of Leach's collected by the late Larry Spear, and by a formula derived from these. In nominate Leach's, wing chord averages 33% (32–34%)



Figure 5. Variation in rump pattern of Leach's Storm-Petrels collected in summer (early May to early July) off Oregon, showing the typical range of *leucorhoa* rump patterns, from all-white (score 1) to having a broad dusky median patch (score 3). Relative to Townsend's, note the relatively long and deeply forked tails of these birds. SDNHM specimens. Photograph by Steve N. G. Howell.



Figure 6. Variation in rump pattern of Chapman's Storm-Petrels collected in summer at colonies off Baja California, showing a typical range from some white (score 2.5) to all-dark (score 5). SDNHM specimens. Photograph by Steve N. G. Howell.

of wingspan, as is true of Fork-tailed Storm-Petrel (*O. furcata*) and Ashy Storm-petrel (*O. homochroa*), among other species of *Oceanodroma*. We have made the assumption that this ratio also holds for Chapman's, Townsend's, and Ainley's, which allows hypothetical wingspans to be calculated from wing chords. Most conventional measurements overlap among all taxa in the Leach's Storm-Petrel complex (Table 1), leading some recent

authors (e.g., Unitt 2004) to suggest that even maintaining nominate *leucorhoa* and *socorroensis* as distinct subspecies might not be tenable. Considered in combination, however, distinctions among vocalizations, measurements, and plumage support the recognition of at least four taxa.

The Leach's Storm-Petrel complex is well known for marked variation in "rump" patterns (technically, the uppertail coverts),

**Table 1.** Comparative measurements (ranges, with means in parentheses; in mm) of Leach's (Pacific birds only), Chapman's, Townsend's, and Ainley's Storm-Petrels. "Rump" indicates the extent of white uppertail coverts (measured at their center, from anterior to posterior edge, *not* laterally). This aspect was not measured on Chapman's specimens, which are mostly dark-rumped. The measurement "Tail > White" indicates the length of tail projecting beyond white uppertail coverts. The Leach's (n=40) were a mix of birds from Alaska and Oregon; all Chapman's, Townsend's, and Ainley's were collected from the breeding islands with the exception of two Chapman's, one Townsend's, and the four specimens of Ainley's that are discussed in the text.

	Wing Chord	Tail	Tail Fork	Rump	Tail > White
Leach's n = 40	145-162 (151)	70-86 (78)	13-25 (19)	15-25 (22)	36-45 (42)
Chapman's n = 40	144-157 (151)	69-82 (77)	14-24 (20)	—	—
Townsend's n = 70	135-147 (142)	66-77 (71)	11-17 (15)	20-30 (24)	30-41 (34)
Ainley's n = 45	141-153 (146)	70-80 (77)	12-20 (16)	20-30 (23)	35-45 (40)



**Figure 7.** Presumed Chapman's Storm-Petrel off southern California (33° N 120° W), 6 September 2006 (rump score 4.5). Note the fairly rangy and long-tailed shape and generally brownish plumage tones. Photograph by Steve N. G. Howell.



**Figure 8.** Presumed Chapman's Storm-Petrel off Santa Barbara, California, 21 July 2007 (rump score 4.5). This photograph conveys well the rangy build, long and narrow tail, bold pale upperwing bands, and overall sooty-brownish plumage of this taxon. Photograph by Steve N. G. Howell.



**Figure 9.** Presumed Chapman's Storm-Petrel (front; rump score 4) and Townsend's Storm-Petrel (behind; rump score 1) off Santa Barbara, California, 21 July 2007. Relative to Chapman's, the Townsend's appears shorter-tailed and darker overall, with a broad white rump band and duller pale upperwing bands. Photograph by Steve N. G. Howell.



**Figure 10.** Variation in rump pattern of Townsend's Storm-Petrels collected in summer at Guadalupe Island, Baja California, showing a typical range from all-white (score 1) to mostly dark (score 4.5); some individuals, not shown here, have solidly dark rumps (Ainley 1980). Also note that the short tails have a relatively shallow tail fork. SDNHM specimens. Photograph by Steve N. G. Howell.

which vary from from all-white to all-dark. A scale of "rump" patterns, grading from all-white (score 1) to all-dark (score 11), was devised by Ainley (1980), who scored 391 Leach's (47 Atlantic and 344 Pacific), 103 Chapman's, 137 Townsend's, and 127 Ainley's. We use a simplified scale of five steps that can be employed more easily in the field (Figure 3; Howell, in prep.; cf. Crossin 1974) and below have converted "Ainley scale" values to our five-step scale; half-step values can be estimated in our scale if desired, such as when evaluating photographs. Basically, our scores of 1–2 equate to white-rumped and 4–5 to dark-rumped, when viewed under at-sea conditions.

Flight manner obviously varies, depending on wind speed and on what a bird is doing. The simplified flight descriptions below con-

vey typical traveling and foraging flight manners in light to moderate winds, which is how most observers see these birds at sea.

**Leach's Storm-Petrel** (length 7.5–8.7" [190–221 mm], wingspan 17.3–19.3" [439–490 mm]). This is the largest and longest-winged taxon (Table 1), and the most familiar point of reference for most observers (Figure 4), although California birds average smaller and shorter-winged than Aleutian and North Atlantic birds. The rump patch is mostly white, often with variable dusky markings concentrated down the center, but a few birds are darker (overall rump score = 1–5, mainly 1–3; Figure 3). Typically,



**Figure 11.** Presumed Townsend's Storm-Petrel off San Diego, California, 20 July 2008. This photograph conveys well the relatively compact build, dark plumage aspect, relatively duller pale upperwing bands than Chapman's, and large white rump patch of this taxon. Note that the extent of the white rump patch (score 1) appears greater than the short tail. Note also the fairly shallow fork in the tail. *Photograph by Steve N. G. Howell.*



**Figure 12.** Presumed Townsend's Storm-Petrel off Santa Barbara, California, 21 July 2007. Besides the fairly dark plumage aspect, note the large white rump patch (score 1) and short tail with a fairly shallow fork. *Photograph by Steve N. G. Howell.*



**Figure 13.** Presumed Townsend's Storm-Petrel off Santa Barbara, California, 21 July 2007. This image suggests a small, fairly compact, and short-tailed bird relative to North Pacific (and North Atlantic) Leach's, although the tail is foreshortened at this angle. The white rump patch (score 1) appears greater in extent than the brown of the tail and could suggest to some observers a Wedge-rumped Storm-Petrel, the largest individuals of which are about the same size as a small Townsend's. *Photograph by Steve N. G. Howell.*

the white rump patch is relatively limited in extent, comprising less than half of the rump/tail projection beyond the trailing edge of the wings (Figure 3). Fully dark-rumped birds are very rare in Pacific Leach's (and unknown in the Atlantic; Flood 2009) but common in Chapman's. From Alaska to Washington, Leach's have a rump score of 1–2, whereas by central California, this changes to a score of 1–5, with most being 1–2 (Figure 5). Good views are needed to assess rump score accurately at sea, and birds scoring 3.5–4.5 can appear solidly “dark-rumped” at a distance.

Wing molt of breeding adults starts in August–October and completes in February–April, with the tail molted in July–September. First-year birds start wing molt in May–July and complete it in October–December; subsequent molts presumably synchronize with the adult schedule (Ainley et al. 1976, Spear and Ainley 2007; Howell, unpubl. data). A few Leach's (and Chapman's) off southern California in late summer and fall show molt of rectrices and inner primaries, but such birds are quite rare, which suggests that most Pacific Leach's may remain to the south in their first summer.

The bounding, nighthawk-like flight of Leach's Storm-Petrel mentioned in field guides is a good thing to learn well as a yardstick for learning the other species. As a rule, relative to other taxa in the complex, nominate Leach's exhibits the most unpredictable use of three-dimensional space in its flight, such that its erratic course is often difficult to track with a camera. That said, the slightly smaller California Leach's may have a “mellower” flight more like that of Chapman's.

Chapman's Storm-Petrel (length 6.8–7.7” [173–196 mm], wingspan 17.2–18.7” [437–475 mm]) averages smaller than Leach's but, on average, has a slightly deeper tail fork (Table 1;



**Figure 14.** Presumed Townsend's Storm-Petrel off Santa Barbara, California, 21 July 2007. This image conveys well the compact build, dark plumage aspect, and short tail of this species. As in Figures 1, 9, and 11–13, the white rump patch (score 1) dominates the caudal projection of the bird, being greater in extent than the short, shallowly forked tail. *Photograph by Steve N. G. Howell.*



**Figure 15.** Presumed Townsend's Storm-Petrel (rump score 4.5), near Sixty-mile Bank off San Diego, California, 7 September 2006. Although perhaps not identifiable to taxon from this photograph, the notably small size and compact shape of this individual were readily apparent in the field to Howell and McGrath, who noted the bird's superficial resemblance to Least Storm-Petrel. Note the relatively rounded wing-tips, which are typical of southern taxa in the Leach's complex (Townsend's, Ainley's, and some Chapman's); the wings of northern-breeding populations tend to be longer and more pointed. *Photograph by Steve N. G. Howell.*

see also Ainley 1980). The uppertail coverts range from having obvious white (on some Coronado Island birds) to being all-dark (on most San Benito Island birds). Overall rump score = 2.5–5, mainly 4–5 (Figures 3, 6–9), with white-rumped birds comprising about 10% of the Coronado population and 0% of the San Benito population (Ainley 1980). The molt schedule of Chapman's appears similar to that of Leach's.

The flight of Chapman's is much like that of Leach's but averages weaker, less confident-looking, with slightly quicker and often shallower wingbeats; Chapman's tends to be easier to track with a camera. At times Chapman's can recall a purposeful Ashy Storm-Petrel, but



**Figure 16.** Typical variation in rump pattern of Ainley's Storm-Petrels collected in winter at Guadalupe Island, Baja California, from mostly white (score 1.5) to heavily mottled with dusky (score 3.5); no Ainley's with all-white or all-dark rumps have been confirmed. SDNHM specimens. Photograph by Steve N. G. Howell.



**Figure 17.** Comparison of fresh-plumaged adult Townsend's Storm-Petrel (left; SDNHM specimen 17672, 13 July; rump score 1) and fresh-plumaged juvenile Ainley's Storm-Petrel (right; SDNHM specimen 37473, 14 April; rump score 2). Despite overlap in most conventional measurements between these two species, the larger bulk of Ainley's is usually readily apparent when the two are compared directly. Photograph by Steve N. G. Howell.

Chapman's is still generally a stronger flier with fairly clipped and jerky wingbeats relative to the more fluttery Ashy.

Townsend's Storm-Petrel (length 6.5–7.2" [165–183 mm], wingspan 16.2–17.5" [411–444 mm]) is the smallest and shortest-tailed taxon in the Leach's complex (Oberholser 1919, Ainley 1980, Table 1). The uppertail coverts are variable, being bright white on some birds (rump score = 1–3, mainly 1–2), mostly dark on others (rump score = mainly 4; Figures 2, 9). Some 80–90% of birds on Isote Negro are dark-rumped, whereas on the nearby Isote Afuera 70–90% are white-rumped (Crossin 1974, Ainley 1983). Analyses of vocalizations and genetics of these populations might shed light on their taxonomic status. The tail is relatively short, and the white rump patch typically comprises half or more of the rump/tail projection beyond the trailing edge of the wings (Figures 9–15).

Assuming molt relates to breeding as in Leach's Storm-Petrel (and given that Townsend's is smaller and may require less time for its complete molt), wing molt in breeding adults likely starts in August–October and completes in February–March; the first-year wing molt may start in June–August and complete in October–December. We have not seen any presumed Townsend's in wing molt off southern California in July–September.

The flight manner of Townsend's requires critical study, but in calm to light winds it is a fairly fast and strong flier, with fairly deep, clipped wing beats and a more direct and steadier (less three-dimensional) flight than the jerkier, more-confident bounding flight of Leach's. Relative to Leach's and Chapman's, Townsend's is smaller (which can be readily apparent, even when direct comparison is



**Figure 18.** Comparison of fresh-plumaged adult Townsend's Storm-Petrel (left; SDNHM specimen 17672, 13 July) and fresh-plumaged adult Ainley's Storm-Petrel (right; SDNHM specimen 30177, 2 November). Collected at corresponding points in their breeding cycles, these specimens with comparable plumage wear illustrate the appreciably darker plumage aspect of Townsend's. Also, as in Figure 17, note the obviously larger bulk of Ainley's. Photograph by Steve N. G. Howell.

lacking) and shorter-tailed, with a shallower tail fork, accounting for its more compact, less rangy shape (Figure 9). The plumage of Townsend's is darker overall, more blackish than brownish, and the white rump patch is often solidly white and more extensive, in relative terms, than on Leach's, with a shorter tail projection beyond the white (Table 1); thus it may even suggest a Wedge-rumped Storm-Petrel (*Oceanodroma [Halocypetna] tethys*). In dark-rumped birds, the pale upperwing band of Townsend's averages duller than the relatively bolder, brighter band of Chapman's (Figures 7–9, 11–14), and it is possible to mistake dark-rumped Townsend's for Least Storm-Petrel (*Oceanodroma [Halocypetna] microsona*) (Figure 15).

Whether Townsend's and Ainley's Storm-Petrels can be distinguished at sea is not currently known, but from specimens, Ainley's appears more like a typical Leach's and is thus generally slightly paler overall than Townsend's, with a duller white rump patch that usually has a dusky median stripe or messy dusky markings that, in series, appear subtly but qualitatively different from Leach's (Figure 16). Akeley's averages larger than



**Figure 19.** Unidentified “Leach’s Storm-Petrel” off San Diego, California, 20 July 2008. Under typical at-sea conditions, and even with reasonable photographs, many birds are best left identified as simply “members of the Leach’s Storm-Petrel complex,” given our limited understanding of identification criteria. This bird may be a California-breeding Leach’s, which appear smaller and less rangy than North Atlantic and Aleutian Leach’s. Photograph by Steve N. G. Howell.



**Figure 20.** Unidentified “Leach’s Storm-Petrel” off Santa Barbara, California, 21 July 2007. This all-dark bird (rump score 5) may simply be a Chapman’s Storm-Petrel, but its relatively compact shape and shallow tail fork—both perhaps artifacts of the angle of the photograph—might suggest Townsend’s. Photograph by Steve N. G. Howell.

Townsend’s, with a longer tail, and a longer tail projection beyond the white tail coverts (Table 1). Specimens of Ainley’s appear bulky relative to those of Townsend’s Storm-Petrel (Figures 17, 18), suggesting that these species may have different wing-loadings and thus different flight manners, but to our knowledge the flight manner of Ainley’s is undescribed. Note that Ainley’s fledge in fresh juvenal plumage at the same time as fresh-plumaged adult Townsend’s are starting to breed, and vice versa.

Ainley’s Storm-Petrel (length 7–7.5” [178–190 mm], wingspan 16.7–18.3” [424–465 mm]). Size similar to Chapman’s but averaging smaller, with a shallower tail fork (Table 1). The uppertail coverts are white with a variable and irregular dusky median stripe or dusky markings (rump score = 1.5–4, mainly 2–3; Figures 3, 16), and the white rump patch typically comprises a little

more than a third of the rump/tail projection beyond the trailing edge of the wings. No dark-rumped Ainley’s have been certainly reported, although a mummified, dark-rumped “chick” found in June 1968 was presumed to have been from the winter-breeding population (Crossin 1974). Such birds might be difficult if not impossible to distinguish at sea from Chapman’s.

Wing molt timing needs study, but breeding birds are not usually molting, and it is reasonable to assume that the adult wing molt extends from April to October. First-year birds probably molt earlier than adults, as in other storm-petrels, and the first-year wing molt of Ainley’s thus may be mainly during January–July. Given that the summer-breeding Leach’s, Chapman’s, and Townsend’s would be in fresh plumage or completing wing molt in spring, any “Leach’s” in the early stages of wing molt during spring, or in advanced wing molt during summer, would be a good candidate for Ainley’s Storm-Petrel.

Relative to Leach’s, Ainley’s is smaller, with shorter, slightly less-pointed wings and a proportionately longer but less deeply forked tail (Table 1). Ainley’s and Chapman’s are similar in size, but most Chapman’s are dark-rumped (a condition unconfirmed in Ainley’s) or have white patches on the rump sides in a pattern atypical of Ainley’s (Figures 6–9, 16). Wing-molt timing of adult Ainley’s probably spans April–October, versus August–April in adult Leach’s and Chapman’s. Further work based upon birds of known taxon may bring to light other characteristics, such as structure or flight manner, that could aid in at-sea identification.

### Occurrence off Southern California

Off California as a whole, Leach’s Storm-Petrels occur mainly between March and November (Ainley 1976). Off southern California, the Leach’s Storm-Petrel complex is considered commonest in June through October and least common in December through May (Briggs et al. 1987). Leach’s Storm-Petrels tend to forage well offshore over warmer waters and thus are rarely found on pelagic day trips into the relatively cooler waters off central and northern California. In southern California, most records of the Leach’s complex are from late summer and fall, which coincides both with warmer waters (warmer than in spring) and with the July–September period when most offshore pelagic trips occur.



**Figure 21.** Presumed Chapman’s Storm-Petrel near Sixtymile Bank off San Diego, California, 7 September 2006. The brown plumage tones (rump score of 4.5 apparent in other photographs), rangy structure, and distinct, deep tail notch indicate that this bird is not a Townsend’s Storm-Petrel. This bird appears typical of what many birders simply call “Leach’s” (or “dark-rumped Leach’s”) off southern California. Photograph by Steve N. G. Howell.



**Figure 22.** Probable Townsend’s Storm-Petrel near Sixtymile Bank off San Diego, California, 7 September 2006. The apparently blackish plumage tones, compact shape, and bold white on the outer uppertail coverts suggest that this bird is a Townsend’s Storm-Petrel (compare with Figure 21), but how much of this could be caused by the angle of the photograph? We suspect that this bird is indeed a Townsend’s Storm-Petrel, but attempting an identification from a single photograph is probably unwise in this case and in many others. Birders fortunate enough to observe storm-petrels in the Leach’s complex in the Pacific would do well to take extensive series of photographs of the birds they observe and to circulate these photographs for discussion, as we continue to refine our understanding of this group. Photograph by Steve N. G. Howell.

Only since the early 2000s have birders started to explore offshore southern California waters with any regularity, although some birders participated in research cruises well offshore dating back through the mid-1980s.

On most recent fall pelagic trips out of Santa Barbara and San Diego, from 60 to 350 "Leach's" have been seen daily, mainly over deeper offshore waters and around banks such as the Tanner Bank, Cortez Bank, and Sixtymile Bank (Figure 2). Based on these observations, we have adduced the following patterns of occurrence for the birds we have documented in southern California waters. With a limited number of trips from which to work, we acknowledge that this portrait of status and distribution is provisional, sometimes conjectural, and certainly incomplete (Figures 19-22).

**Leach's Storm-Petrel.** Presumably there is a northbound migration through offshore waters in February–April, with a southward movement back to the tropical Pacific in September–November, but to what extent the larger northern Leach's occur relative to "beali" Leach's is unknown. Non-breeding immatures (but perhaps not many first-year birds, see above) probably occur in summer and fall off southern California, perhaps mainly in July–September, the period during which non-breeding immatures of other pelagic species are present in numbers off California, e.g., Long-tailed Jaeger (*Stercorarius longicaudus*), Sabine's Gull (*Xema sabini*), and Common Tern (*Sterna hirundo*). Most presumed Leach's occur over deeper offshore waters, at and beyond the shelf break.

The breeding population of Leach's Storm-Petrels on the California Channel Islands was estimated at 159 pairs in 1991; only 19 birds were mist-netted, with about two-thirds white-rumped and one third dark-rumped (Carter et al. 1992). This population may be increasing (fewer than 10 breeding birds were estimated in 1975-1977; Hunt et al. 1980), although more mist-netting effort occurred in 1991, and the 1970s estimate was derived from mark-recapture analyses that may have been flawed (H. R. Carter, pers. comm.). Given that breeding storm-petrels are probably restricted to foraging within a few hundred kilometers of colonies, and that large numbers of non-breeding immatures can be present around colonies in the breeding season, the Channel Islands population may contribute appreciably to the numbers of "Leach's" observed in summer off southern California.

**Chapman's Storm-Petrel.** This taxon (based

on the sheer number of dark-rumped birds seen) is fairly common off southern California, at least during April–October. For example, 65% of 100 birds at Cortez Bank, 10 September 2005, were dark-rumped (score 4-5; JF, pers. obs.), as were 25% of 200 birds between Cortez Bank and Sixtymile Bank, 7 September 2006 (SNGH, pers. obs.); 21% of 190 birds in the vicinity of San Juan Seamount, 21 July 2007 (JF, pers. obs.); 33% of 78 birds south of Santa Cruz Island, 25 July 2009 (SNGH, pers. obs.); 45% of 102 birds from the 4000-meter depth contour west of the Bell Bank to the Bell Bank, 25 August 2009 (JF, SNGH, pers. obs.); and about 90% of 138 birds north of Ninemile Bank, 7 September 2009 (TM, WTH pers. obs.).

In addition to birds from the nearby colony at the Coronado Islands, the fall numbers of Chapman's may include birds from the San Benito Islands, paralleling the well-known annual northward fall incursions into California waters of Black Storm-Petrels (*Oceanodroma [Halocryptena] melania*) and Least Storm-Petrels from Mexican colonies. During April–October, Chapman's tends to occur nearer to shore than nominate Leach's and is regularly found from the Thirtymile Bank out to beyond the shelf edge. Small numbers may occur well offshore in winter, but at this season most "Leach's" off southern California are apparently white-rumped (P. Pyle, pers. comm.).

**Townsend's Storm-Petrel.** In general, 3-5% of all Leach's-type storm-petrels seen on offshore trips in the southern half of the Southern California Bight from late July to mid-September show characteristics of Townsend's Storm-Petrel. Both white-rumped and dark-rumped birds have been seen, with more of the former perhaps reflecting the relative ease with which they can be identified at sea. We have two records outside of this period. About 90% of 110 birds seen 5 June 2008 in the vicinity of the Bell Bank (JF, pers. obs.) were thought to be white-rumped Townsend's, suggesting that their occurrence in California waters may be prone to marked interannual variation. We also have one record of a white-rumped bird, perhaps a juvenile, on 2 November 2008 west of the Cortez Bank (photograph by TM). We suspect that this taxon occurs regularly off southern California, mainly July–October (but see the June observation, above), which mirrors the northward dispersal at this season by sundry Mexican-breeding seabirds, such as Black and Least Storm-Petrels, Guadalupe [Xantus'] Murrelet (*Synthliboramphus [h.] hypoleucus*), and Craveri's Murrelet (*S. craveri*). Townsend's Storm-Petrels have often been observed over deep water just beyond the shelf

break, thus occurring in areas where both Leach's and Chapman's are frequent.

**Ainley's Storm-Petrel.** Despite searching, we have seen no birds that we considered candidates for Ainley's Storm-Petrel, although distinguishing this taxon from California Leach's, and perhaps from white-rumped Chapman's, may not be possible given our present (lack of) knowledge. Although the limited specimen record suggests a southward post-breeding withdrawal during May–October (noted above), it is conceivable that foraging adults range north into United States waters during their winter breeding season (perhaps from September or October onwards?). Any pelagic trips far offshore in winter should be on the lookout for this taxon. A report of 20 "Leach's Storm-Petrels" at the Davidson Seamount on 1 December 1979 (Garrett and Dunn 1981) is intriguing. These birds could have been late southbound or wintering *leucorhoa*, possibly birds of the smaller southerly breeders thought to winter off California (Briggs et al. 1987)—but could some have been Ainley's Storm-Petrels?

## Conclusions

Mark Twain once said that he would rather have his ignorance than another man's knowledge, for his ignorance was far greater. In the case of the Leach's Storm-Petrel complex, however, we would happily trade a lot of ignorance for a little knowledge, and Oberholser's statement of 1919 still rings true today: "Notwithstanding the considerable attention that has been paid to petrels of the *Oceanodroma leucorhoa* group, the last word has evidently not yet been said on the subject."

Our provisional observations indicate that Chapman's and Leach's are the predominant taxa in the Leach's Storm-Petrel complex in waters off southern California, but that small numbers of Townsend's Storm-Petrels also occur in late summer and fall, mainly July through September. As yet, we have no evidence that Ainley's Storm-Petrel enters United States waters, but it may well occur, perhaps mainly in late winter.

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This paper is dedicated to the memory of Luke Cole, a good friend who lived life to its fullest and always enjoyed pushing the frontiers that pelagic birding has to offer.

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