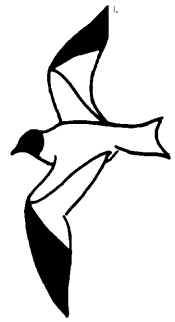


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BIOLOGY OF THE BLACK-VENTED SHEARWATER

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In light of newly available information and the recent trend toward considering the Black-vented Shearwater (*Puffinus opisthomelas*) and its close relatives as distinct species, not subspecies of the Manx Shearwater (*Puffinus puffinus*), it seems appropriate to summarize current knowledge of the Black-vented Shearwater's biology. For this study, I drew information from the literature, data on specimens in the San Diego Natural History Museum (SDNHM), Western Foundation of Vertebrate Zoology, Los Angeles (WVZ), Museum of Vertebrate Zoology, University of California, Berkeley (MVZ), Los Angeles County Museum of Natural History (LACM), California Academy of Sciences, San Francisco (CAS), Carnegie Museum of Natural History, Pittsburgh (CMNH), British Columbia Provincial Museum, Victoria (BCPM), American Museum of Natural History, New York (AMNH), the United States National Museum, Washington, D. C. (USNM), my own field notes of more than 10 years from islands and waters off California and Mexico, and communication with knowledgeable observers.

BREEDING DISTRIBUTION

The known breeding grounds of the Black-vented Shearwater are confined to Isla Guadalupe, Isla Natividad, and Islas San Benito off the Pacific coast of Baja California, Mexico (Figure 1). The species was described (Coues 1864) from a specimen (USNM 16990) taken at sea near Cabo San Lucas by John Xantus on 20 July 1859. In early 1886, W. E. Bryant (1887) heard numerous birds calling at night and found a decayed specimen on top of Isla Guadalupe, but occupied nests were not found there until 1892 (Anthony 1896). Other nesting sites remained undiscovered until 1897, when A. W. Anthony found a few nests on Islas San Benito (Anthony 1900a) and discovered the vast colony at Isla Natividad (Anthony 1900b, Kaeding 1905).

At Isla Guadalupe, the birds have been reported as "rather common" at several sites but at no place in any large colony (Anthony 1900b). In 1906, they were "abundant at night about the perpendicular cliffs near the north

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end of the island" (Thayer and Bangs 1908). Nests were found in natural holes in the lava or under large boulders (Anthony 1896). More recently, colonies were found and studied by Carl L. Hubbs on small offshore islets at the south end of the island (Jehl and Everett 1985).

Little is known of the extent of the breeding population at Islas San Benito. As at Isla Guadalupe, nesting birds inhabit a few small caves and crevices scattered about the islands and are "not very abundant" (Anthony 1900a). On 14 April 1968, J. R. Jehl, Jr. (pers. comm.) found 20 active nests on San

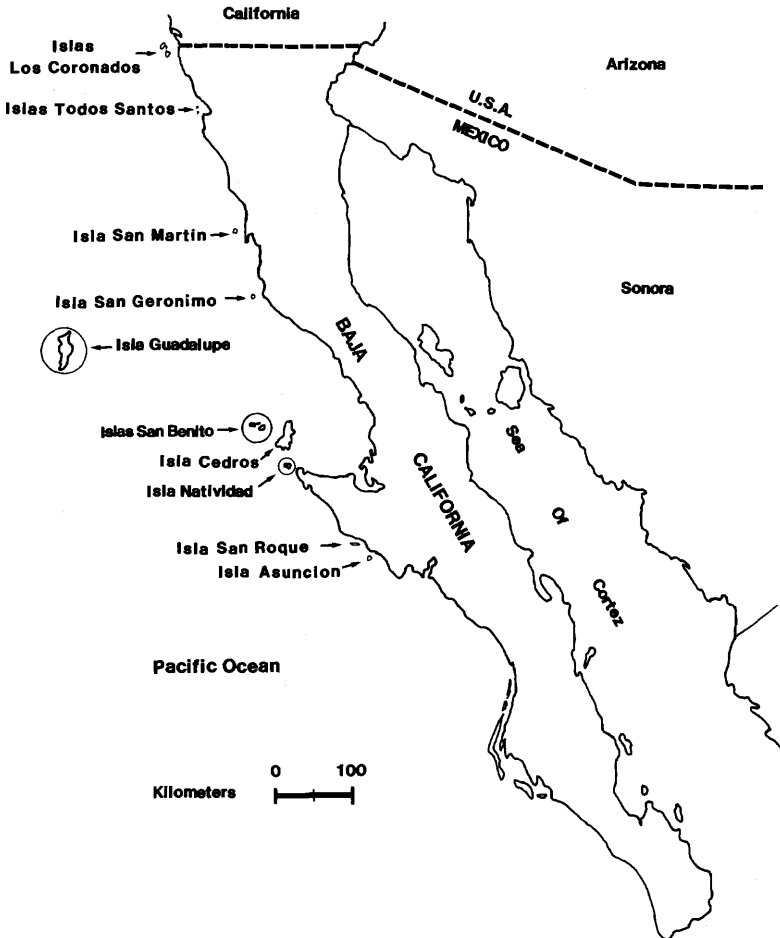


Figure 1. Principal seabird breeding islands of Baja California's Pacific coast, with documented breeding locales of *P. opisthomelas* circled.

Benito Este before he stopped searching. In 1975, Boswall (1978) found birds in seven locations, three of which had large downy chicks. R. L. DeLong and R. S. Crossin (unpubl.), during their work with the Pacific Ocean Biological Survey Program in 1968, estimated up to 150 breeding pairs on the island group. In February 1981, during the breeding season, I observed up to 350 birds near the islands at dusk.

The fine sandy soil of the south and east portions of Isla Natividad seems to best suit the burrowing habit of these birds, for the island clearly has been the stronghold of the species. Anthony (1900b) reported finding "thousands of burrows . . . like a honeycomb." In 1930 J. R. Pemberton collected eggs at Natividad (WFVZ) and noted "an immense colony. . . probably 250,000 occupied burrows." This figure is undoubtedly a great exaggeration. In April 1968 DeLong and Crossin (unpubl.) estimated 5000 burrows on the island. During my stay on the island in July 1987 I estimated, in areas of apparent highest density of burrow entrances, an average of 25 burrow entrances per 100 square meters. If the major colony is not larger than 4 square kilometers, which is my best estimate, this suggests not more than 10,000 burrows. The actual figure is probably somewhere between 5000 and 10,000 burrows, but this does not necessarily reflect population size or potential, since many burrows could be unoccupied or occupied by Cassin's Auklets (*Ptychoramphus aleuticus*). Also, the extent to which Black-vented Shearwaters inhabit areas on Natividad other than the main colony is unknown. Banks (1964) saw "thousands" of birds near the island on 21 April 1963 and noted that burrows were abundant and "most were occupied." In late March 1981 I saw 500-1000 birds staging at dusk near the south end of the island. In February 1987 I saw several hundred during a dusk transit 10 km west of Natividad. On 25 April 1987 R. L. Pitman (pers. comm.) saw "thousands . . . probably 10,000" near the south end of the island in the Canal de Dewey. No census has been attempted, but it seems likely this island gave rise to the enormous flocks of this species that were formerly reported at sea (see below).

UNCONFIRMED BREEDING REPORTS

There have been several erroneous reports of breeding by this species at other locales. The record of eggs collected by Captain C. M. Scammon at Santa Barbara Island (Brewster 1902) off southern California was later corrected by A. B. Howell (1917). Nelson (1921) reported shearwater burrows at Isla San Geronimo, near Punta Baja, but these were probably made by Cassin's Auklets, which breed abundantly there but had deserted the island by the time of his visit in August 1905. The A.O.U. Check-list (1957) listed Isla Asuncion (south of Natividad) as a breeding locale, perhaps on the casual comment of G. D. Hanna (1925), who reported "burrows of Cassin's Auklet or some shearwater everywhere." Hanna and A. W. Anthony (1923) again mentioned shearwater burrows on Asuncion and Isla San Roque, but I can find no additional evidence to support these claims. Although the most recent edition of the Check-list (A.O.U. 1983) has deleted the reference to Asuncion, it perpetuates the idea that Isla San Martin, off San Quintin, is a known breeding site. This idea probably resulted from the reports of A. B. Howell

(1910, 1911), who inferred breeding on Islas Los Coronados and Isla San Martin from sightings of birds near the islands during breeding season. Grinnell (1928) correctly questioned Howell's suppositions, which Friedmann et al. (1950) apparently accepted without question. This inclusion on the Mexican check-list was the sole reason (B. Monroe pers. comm.) for the retention of the island as a breeding locale on the North American check-lists (A.O.U. 1957, 1983). I know of no report or evidence of Black-vented Shearwaters nesting on Isla San Martin. I found no burrows on the island during several visits since 1979, but crevices and caves abound. Large flocks are frequently seen at nearby banks and at Cabo Colnett, north of the island. Feral cats are now well established at San Martin (pers. obs.), so it is unlikely that shearwaters will successfully breed there in the near future.

Wilbur (1987) reported Isla Cedros (near Isla Natividad) as a breeding locale, on the basis of information published by Banks (1964) and observations by K. Garrett. Both Banks (1964) and Garrett (pers. comm.) reported only birds seen near the island during the breeding season; neither suggested the birds were actually nesting.

At one time Isla Raza, in the Sea of Cortez, was identified as a nesting site on the basis of the presence of "old shearwater burrows" (Bancroft 1927). A. J. van Rossem (1945), who was with Bancroft when they found these burrows, was not totally convinced that they were of Black-vented Shearwaters, and the report was subsequently discarded (Palmer 1962). Recent work on Raza (Boswell and Barrett 1978) has not revealed any Black-vented Shearwaters breeding. The reference by Leigh (1941, p. 157) to shearwaters nesting on George's Island, in the northern Sea of Cortez, was unsupported and appears to be an assumption. Sightings in the northern Sea of Cortez during the breeding season in the last few years have led to speculation of local breeding (Anderson 1983), which awaits confirmation.

Many potential nesting sites exist in Baja California. It is possible that *P. opisthomelas* formerly bred at some of the islands mentioned above but was extirpated or deserted the colonies. Other locales where breeding is suspected, on the basis of sightings of birds in the immediate vicinity, include Rocas Alijos (Pitman 1985) and Isla San Geronimo (Pitman pers. comm.).

BREEDING SEASON

Current information allows the breeding phenology of the Black-vented Shearwater to be outlined as follows: At Isla Natividad birds begin nocturnal visits to nests as early as November (Lamb 1927). At Isla Guadalupe fresh eggs have been found by 5 March (Jehl and Everett 1985) and as late as late June (J. R. Jehl Jr., R. S. Crossin, unpubl.). These dates can vary somewhat from year to year, and even from colony to colony in the same year (Crossin unpubl.). Typically, colonies are well occupied by early January and the peak of laying is in early April (Anthony 1900b, Kaeding 1905, Banks 1964). Young have been found as early as late April, and by mid-June many burrows have a chick (Jehl and Everett 1985). Fully grown young have been found in early July (pers. obs.) and early August (Anthony 1925). By mid-August most colonies have been vacated. The breeding season appears to be slightly later than that of Townsend's Shearwater (*P. auricularis*) (Jehl 1982), but this

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hypothesis should be tested after further studies on both species. At Isla Natividad from 4 to 8 July 1987 I found several occupied burrows with large downy young and fresh carcasses of juveniles with small amounts of down still clinging to the body.

DISTRIBUTION AT SEA

Black-vented Shearwaters are found commonly from the breeding grounds north to Point Conception ($34^{\circ} 50' N$) and south to Cabo San Lucas ($23^{\circ} N$) and are possibly regular south along the coast of mainland Mexico (Jehl 1974) to near the Gulf of Tehuantepec (Figure 2). Lack of field work in the



Figure 2. Distribution of *Puffinus opisthomelas*. Star indicates the only locality of extralimital occurrence documented with specimens.

southern range and problems of identification where the range of *P. opisthomelas* overlaps that of *P. auricularis* account for the uncertainty.

The species typically occurs within 25 km of the coast (except at Isla Guadalupe), but wandering individuals have been noted far offshore from Baja California at Rocas Alijos (24° 57' N, 115° 45' W) (Pitman 1985) and in California waters off San Clemente, Santa Cruz (Howell 1917, G. McCaskie pers. comm.), and San Miguel islands (Jehl 1973a). It has also entered large bays on the west coast of Baja California, such as Bahia San Bartolome (Townsend 1923) and Bahia Magdalena (Bancroft 1932, specimens SDNHM).

After breeding, some birds move north into the Southern California Bight, where they reach peak numbers from November to January (Ainley 1976). Extrapolations of density estimates from fall 1977 surveys (Briggs et al. 1987) indicate peak numbers of 20,000 to 30,000 individuals during this season. This pattern differs from that reported earlier (Anthony 1896, Howell 1917, Grinnell and Miller 1944), which suggested peak abundance from July to September. This discrepancy can be accounted for only by tremendous flexibility in the breeding and migration schedule or insufficient field data during the early part of this century. In recent years, however, very few birds have been seen in late summer off southern California (pers. obs.).

Dispersal north of Point Conception is irregular, varying from year to year. In some years, large numbers can be seen in fall as far north as the Monterey Bay region (Stallcup 1976, Beck 1910), but in other years the species is absent there. North of Monterey Bay verified records are few. There is one published observation from Southeast Farallon Island off San Francisco (three birds seen on 28 October 1975, DeSante and Ainley 1980). Briggs et al. (1987) reported "one record of three probable Black-vented Shearwaters near Eureka in December 1981." Anthony (1896) reported Black-vented Shearwaters as "not uncommon on several occasions off the Columbia River during the summer months and in November and January." Anthony, who was a reliable observer, unfortunately did not publish additional information on these sightings. On 29 August 1929, small white-bellied shearwaters "possibly . . . Black-vented" were observed just off Newport, Oregon (Gabrielson et al. 1930). The species is included on the Oregon check-list (Crabtree and Nehls 1981) on the basis of a more recent sight record; it is considered hypothetical in Washington (Wahl 1975, Mattocks et al. 1976) and regarded as very rare in British Columbia on the basis of a few midsummer sightings (e.g., Martin 1942, Guiguet 1953, Martin and Myres 1969, Guzman and Myres 1983) and five fall and winter specimens taken near Albert Head, Vancouver Island, in the late 1800s (Kermode 1904, Fannin 1898). I have examined three of these (BCPM 89, 1494, and 1495) and confirmed their identification.

Recent midsummer sightings of small black and white shearwaters in Alaska (Kessel and Gibson 1978), as well as some of the British Columbia reports, may pertain to the Manx Shearwater (*Puffinus puffinus*, sensu A.O.U. 1983) which is a long-distance migrant whose propensity for occasional wandering is well established (Palmer 1962, Slater 1970, Kinsky and Fowler 1973). The Manx Shearwater's normal migration places it in higher latitudes in the northern summer, and it is more accustomed to cooler water than is the Black-vented Shearwater (Ainley 1976). Harrison (1983) suggested that these northern sightings may pertain to the Newell's Shearwater of Hawaii (*P. auricularis*

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newelli), but in light of its tropical distribution (King and Gould 1967) this appears less likely. Specimens will be required to settle the question of origin of these North Pacific vagrants.

South of Cabo San Lucas, the status and distribution of *P. opisthomelas* are poorly known. Additionally, there is potential for confusion because mixed-species (*opisthomelas/auricularis*) flocks occur in the region (Jehl 1974, 1982, Pitman 1986). Although the fifth edition of the A.O.U. Check-list (1957) reported Isla Clarion as a location of occurrence, I know of no supporting evidence. In any case, this was deleted from the sixth edition (1983), presumably as a result of the Black-vented Shearwater's absence from Jehl and Parkes' (1982) list of birds of the Revillagigedo Islands. Helbig (1983) reported "about 2000" near Puerto Vallarta, Jalisco, on 27 November 1980. Willett took two specimens (LACM 18954, 86400) at Bahia Tenacatita, Jalisco, on 18 February 1938. Pitman (unpubl.), during several cruises off southwest Mexico, has identified Black-vented Shearwaters on three occasions: a flock of 26 on 13 February 1980 about 30 nautical miles (nm) west of Bahia Navidad,



Figure 3. *Puffinus opisthomelas* in worn plumage, photographed 16 August 1984 in the central region of the Sea of Cortez, near Bahia de Los Angeles.

Photo by Bernie Tershy and Craig Strong

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Jalisco, 1 on 4 June 1982 40 nm off Manzanillo, Colima, and 3 on 29 September 1986 about 40 nm off the southern coast of Michoacan. His notes for the region contain numerous other sightings, which because of viewing conditions could be identified only as "Manx-type" shearwaters. Murphy (1958) reported "many [Black-vented Shearwaters] seen feeding . . . about 40 miles off Punta San Telmo, southeast of Manzanillo" on 13 November 1956. R. G. B. Brown (unpubl.) reported two individuals off Oaxaca on 16 April 1981. The southernmost specimen that I am aware of (SDNHM 38461) was taken off Guerrero by J. R. Jehl, Jr. on 6 April 1973 at 17° 25' N, 101° 17' W. Jehl (1974) reported "two brownish birds (*opisthomelas?*) in the southern part of the Gulf of Tehuantepec" on 10 April 1973. Murphy (1952) reported on supposed Black-vented Shearwaters taken off Cabo Blanco, Costa Rica. These were misidentified, as he eventually realized; the specimens, now in AMNH, are Wedge-tailed Shearwaters (*P. pacificus*) (Slud 1964). Bourne and Dixon (1975) reported sightings of 288 *opisthomelas* on 21 January 1971 off El Salvador. This and reports of sightings between Hawaii and the Galapagos Islands (King and Pyle 1957) are interesting but more likely pertain to either race of *P. auricularis* (Pitman 1986).

There are sightings and photographs (Figure 3) but no specimens of this species from the Sea of Cortez. Helbig (1983) reported three birds between Topolobampo and La Paz on 4 June 1980. Jehl (1974) recorded three "probable" *opisthomelas* near Isla Cerralvo on 29 March 1973. In March 1887, M. A. Frazar saw "a large number of medium sized, white-breasted and dark-backed shearwaters" between Islas Carmen and Monserrat and near Isla Espiritu Santo that were "probably" this species (Brewster 1902). Farther north, near Isla Tiburon, D. R. Dickey (in van Rossem 1945) reported shearwaters in June 1928 that were "very probably" but "not certainly" this species. In late December 1931 van Rossem (1933, 1945) noted about a dozen Black-vented Shearwaters between Isla San Pedro Nolasco and Bahia Kino. Between 1983 and 1986 D. Breese, B. Tershy, and C. Strong (pers. comm.) recorded many sightings of Black-vented Shearwaters near Bahia de Los Angeles. These recent sightings suggest this species occurs regularly in the Sea of Cortez.

FEEDING

Little is known of this aspect of the biology of the Black-vented Shearwater. Rollo H. Beck (field notes, MVZ) reported sardines (*Sardinops* sp.) in the stomachs of specimens he collected in Monterey Bay in December 1910. Stephens (1921) reported Black-vented Shearwaters feeding on sardines near Islas Los Coronados. Anthony (1896) says herring (*Clupea* sp.) and other small fish are the main diet, with bait or refuse being ignored. In my experience, the birds are not ship-followers and are not attracted to any type of chum. They have been observed feeding "just outside the breakers" at Laguna San Ignacio (Huey 1927). North of Isla San Martin at Cabo Colnett, Anthony (1896) observed them plunging after prey in the foamy crests of breaking surf, although this is apparently quite unusual. A flock of nearly 12,000 birds (the largest flock reported in many years) was seen off La Jolla, California, in November 1979 feeding on a vast school of spawning squid (Unitt 1984).

MOLT AND PLUMAGES

According to Anthony (1896), Black-vented Shearwaters undergo a complete molt from July to August and a "more or less" complete molt of head and body feathers in January and February. Loomis (1918), after examining 139 specimens, concluded that the birds undergo a protracted postnuptial molt with great variation in timing among individuals. He also suggests the species may have a second downy plumage, as is well known in the closely related Manx Shearwater (Lockley 1942), but such a plumage is so far unconfirmed for the Black-vented. Figure 4 shows a downy young bird on Isla Natividad photographed on 7 July 1987.

Loomis (1918) believed birds with extensive gray mottling on the underparts were "apparently immature." This has not been verified. The "melanistic" specimen (MVZ 18691) pictured by Loomis (1918, plate 15) is actually a typical Short-tailed Shearwater (*P. tenuirostris*) (pers. obs.). This specimen was collected by the experienced Rollo H. Beck at Monterey Bay on 19 December 1910 and tentatively identified by him as a Christmas Shearwater (*P. nativitatis*) (field notes MVZ). The reason Loomis reidentified the specimen as *opisthomelas* is unknown. Leucism and partial albinism, which have been reported for other species of *Puffinus* (Mackrill and Yesou 1988), are so far unrecorded for *opisthomelas*.



Figure 4. Downy young *Puffinus opisthomelas*.

Photo by W. T. Everett

IDENTIFICATION

Jehl (1982) compared characters of *Puffinus* species normally found in the eastern tropical and temperate Pacific. Since *P. puffinus* of the North Atlantic is a possible wanderer, it is worth pointing out that it is similar to *P. auricularis* (both subspecies) in general appearance. Manx Shearwaters can even show the conspicuous white flanks typical of both races of *auricularis* (Hoskins et al. 1979) and also present on the Fluttering (*P. gavia*) and Hutton's (*P. huttoni*) Shearwaters of the southern hemisphere (Jehl 1982). The dark vent of *opisthomelas* may be the most reliable field mark. Observers should pay particular attention to face and underwing patterns, since these characters are poorly known but may be useful (G. McCaskie, pers. comm.). The complexity of this situation is illustrated by Figure 5, which shows a range of variation in ventral coloration within *opisthomelas*, and Figure 6, which compares *opisthomelas*, *gavia*, and *huttoni*.

Because many measurements and characters in this complex of species overlap, and there are plumage changes resulting from feather wear and also much individual variation, great care should be taken in identification of species out of their known range. Clear photographs are helpful, but present knowledge suggests that only specimens can document extralimital records adequately. Specimens should be prepared with one wing extended to allow examination of the underwing.

DISCUSSION

Clearly, much remains to be learned about this interesting and little-studied species. It is probable that unknown colonies exist on Isla Guadalupe (Jehl and Everett 1985). The current status and abundance of breeding birds on Islas San Benito and Isla Natividad also needs elucidation. Little is known of the voice of the Black-vented Shearwater. Information on behavior, breeding biology, and feeding ecology may provide details useful in settling the still unresolved question of systematic relationships of this and other similar species of the genus *Puffinus*.

Finally, there may be conservation problems for this species. Feral cats were already destroying birds on Isla Guadalupe in 1892 (Anthony 1896), and by 1922 feral cats were established on all known breeding islands (Anthony 1925). Since that time, all visitors to Isla Natividad have reported widespread predation by cats (Bancroft 1927, Banks 1964, Jehl 1973b, 1984, DeLong and Crossin unpubl., Karl Kenyon unpubl.). During my visit in July 1987 I saw no live feral cats, but dried scats were abundant. Dogs, kept as pets in the fishing village at Natividad, occasionally enter the colony and attempt to excavate burrows. The extent of predation deserves further study. In recent years, monofilament gill netting has increased substantially along the coast of Baja California. Nothing is known of the impact on Black-vented Shearwaters of this potentially devastating method of fishing.

In the early 1890s Anthony (1896) observed off Baja California a flock of Black-vented Shearwaters consisting of not less than 50,000 birds. Grinnell (1897) recorded "immense numbers" of these birds in the San Pedro Channel in May 1897. Enormous flocks such as these are no longer seen. In addition

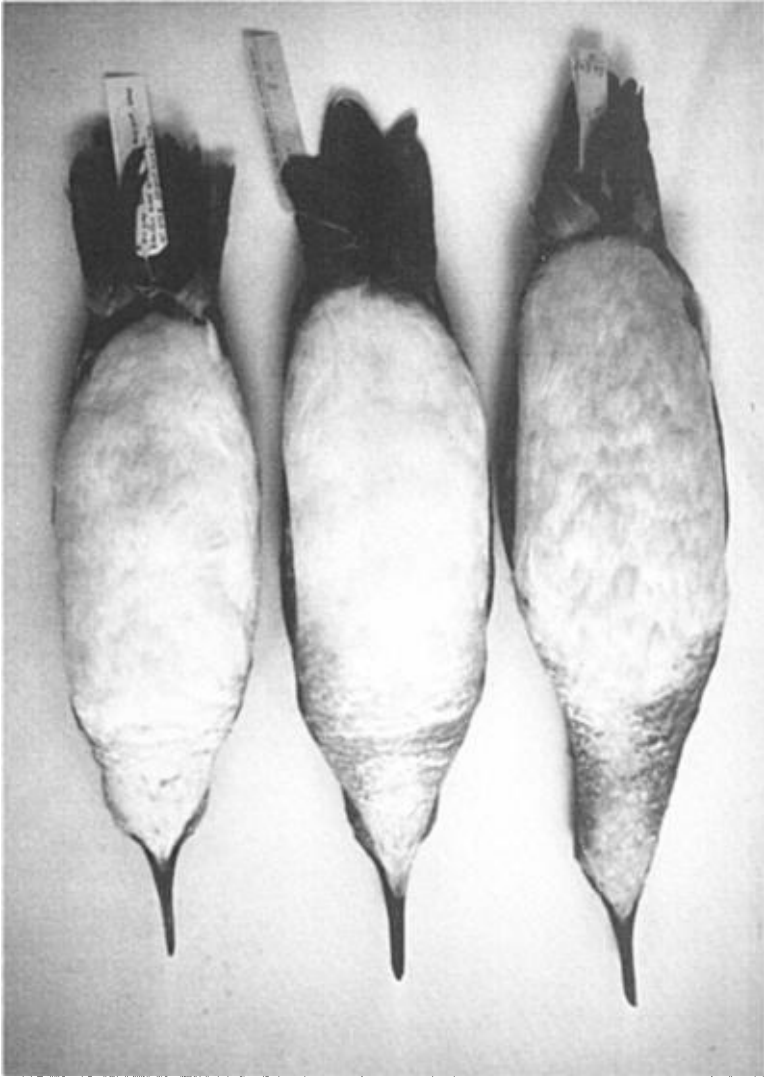


Figure 5. Specimens of *Puffinus opisthomelas*, showing range of individual variation.



Figure 6. *Puffinus gavia* (top), *P. huttoni* (center), and *P. opishomelas* (bottom).

to predation, overfishing for anchovies and sardines in both the U.S. and Mexico could have contributed to an apparent decline in abundance.

SUMMARY

On the basis of specimen collections, available literature, and personal observations, the Black-vented Shearwater is known to nest only at Isla Guadalupe, Islas San Benito, and Isla Natividad, off the west coast of Baja California, Mexico. Birds occupy the breeding grounds at least six months of the year. The northernmost documented occurrence is in British Columbia, Canada, the southernmost, off Guerrero, Mexico. The species' diet includes squid and small fish. Its molt is complex and not well known. Specimens are essential for documentation of extralimital occurrences of this and other related species. Monitoring of breeding colonies is recommended to assess or prevent a population decline.

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