PROCELLARIIFORMES OCCURRENCE AT THE SALTON SEA AND SONORAN DESERT

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ABSTRACT—We reviewed Sonoran Desert occurrences of Procellariiformes (albatrosses, petrels, shearwaters, and storm-petrels) through August 1996. Most occurrences (27 of 35, 77.1%) were at the Salton Sea, California. Records show a non-random seasonal distribution between late April and late September of species that occur regularly off Mexico during summer. Procellariiform records correspond with annual southerly monsoon flows through the Gulf of California, and with concomitant increases in sea surface temperatures of adjacent waters off southwestern Mexico such that a more uniform habitat is established with the Gulf of California.

RESUMEN—Revisamos la ocurrencia de Procellariiformes (álbatroses, petrels, pardelas y paiños) en el desierto de Sonora hasta agosto de 1996. La mayoría de ocurrenrias (27 del 35, 77.1%) tuvieron lugar en Salton Sea, California. Los registros muestran una distribución estacional no al azar entre fines de abril y fines de septiembre de las especies clue regularmente se encuentran en Mexico durante el verano. Los registros de Procellariiformes corresponden con el monzón anual que fluye del sur a través del Golfo de California y *con* los incrementos concomitantes de las temperaturas de la superficie del mar de aguas adyacentes al suroeste de Mexico ya que se ha establecido un habitat más uniforme con el Golfo de California.

Procellariiformes is the only avian order whose members are truly pelagic; all 93 of the world's species return to land only to breed (Harrison, 1985). Twenty-eight species of procellariiforms have been recorded in California waters, i.e., within the United States Fisheries Conservation Zone, which *is* within 320 km of the nearest point of land in California. This procellariiform richness is unequaled in any other state but Hawaii (DeSante and Pyle, 1986). In spite of their highly pelagic nature, there are 27 records of eight species of procellariiforms from the Salton Sea and surrounding deserts of southeastern California, and there are eight procellariiform records, involving at least four species, elsewhere in the Sonoran Desert.

The Salton Sea lies 130 km east of the Pacific Ocean and 190 km north-northwest of the Gulf of California in a structural basin that represents the northwestern extension of the Gulf of California. This hypersaline lake lies within the bed of historic Lake Cahuilla, "a much larger forerunner of the Salton Sea" (Norris and Norris, 1961). The topographic depression was caused by alluvium deposition by the Colorado River into the Imperial and Mexicali valleys. Lake Cahuilla, a salt or brackish lake, grew as large as 5,400 km^2 when the Colorado River flowed west into the basin (Blake, 1914, 1915). Because daytime summer temperatures average > 40" C, high evaporation rates led to the frequent desiccation of Lake Cahuilla when the Colorado River flowed to the Gulf of California (Norris and Norris, 1961). The Salton Sea was created by floodwaters of the Colorado River from 1905 to 1907 (Kennan, 191'7). The Salton Sea has since been maintained by irrigation runoff from agricultural field flooding with waters brought from the Colorado River to the Imperial Valley and the Coachella Valley via the All American Canal and Coachella Canal. It has also become regularly visited by various oceanic/coastal bird species, such as the brown pelican (*Pebmnus occidentalis*) and the yellow-footed gull (*Larus livens*), each of which occurs in the thousands.

The hypothesis that procellariiforms became "trapped" in the Gulf of California and then moved northward into the Salton Sea and sur-

rounding desert (McCaskie, 1976, 1984, 1993b; Dunn and Unitt, 1977; Rosenberg et al., 1991) suggests that procellariiform occurrences in the interior of the southwestern United States are random vagrancies. Nevertheless, this entrapment hypothesis only describes a situation; it does not explain it. How do procellariiforms reach the Salton Sea and how do they initially become "trapped" in the Gulf of California?

Procellariiform occurrences at the Salton Sea may be related to climatic and biogeographic factors, including prevailing seasonal surface wind patterns through the Gulf of California and seasonal sea surface temperatures off western mainland Mexico. Reasonable explanations for the occurrence of procellariiforms at the Salton Sea and in the Sonoran Desert include direct relationships with tropical cyclones, El Niiio-Southern Oscillation conditions, and normal summer wind circulations off western mainland Mexico and in the Gulf of California. This paper summarizes procellariiforms records for the interior of the southwestern United States and investigates these possible causal relationships.

METHODS—Records of procellariiforms from the Salton Sea, Coachella Valley, Imperial Valley, and *Lower* Colorado River Valley were obtained from Garrett and Dunn (1981), Rosenberg et al. (1991), regional reports published in *American Birds,* and papers published in *Western Birds.* These records were plotted by date of first occurrence and tabulated by year. Additional information about the validity of specific records *was* obtained by examination of specimens (five records are supported by extant specimens), California Bird Records Committee (CBRC) files at the Western Foundation of Vertebrate Zoology in Camarillo, California, and field notes and photographs from Barbara A. Carlson, Guy McCaskie, Robert L. McKernan, and Michael A. Patten. Records treated herein were considered valid (1) if they were accepted by the CBRC or (2), for records of species not reviewed by that body, if specimen evidence, photographs, or written documentation were judged by us to be sufficient to support the record's validity. These data were searched for correlations between specific procellariiform occurrences and weather data obtained from Daily *Weather Maps,* a historical summary of Mexican west coast tropical cyclones (Smith, 1986), and hurricane season summaries in the *Monthly Weather Review.*

RESULTS—The 35 procellariiform records from the Salton Sea and surrounding Sonoran Desert show a distinct seasonal pattern of occurrence from late April to late September, inclusively, with a peak in mid-July (Fig. 1). Observer coverage at the Salton Sea is uniform year-round, although coverage may be greater in winter, when temperatures are hospitable. Although the overall pattern of procellariiform records is consistent, the timing, frequency, and distribution of occurrences varies with species. Unless otherwise stated, an evaluation of *Daily Weather Maps* indicates that all occurrences were during normal spring and summer weather. There were onshore surface flows from the Pacific anticyclone to the thermal low pressure over the desert. Skies were mostly clear. Southerly winds extended from the Gulf of California into the Sonoran Desert. Upper winds of the jet stream were light. Laysan albatrosses were recorded in late spring during northwesterly winds into the Coachella and Imperial valleys.

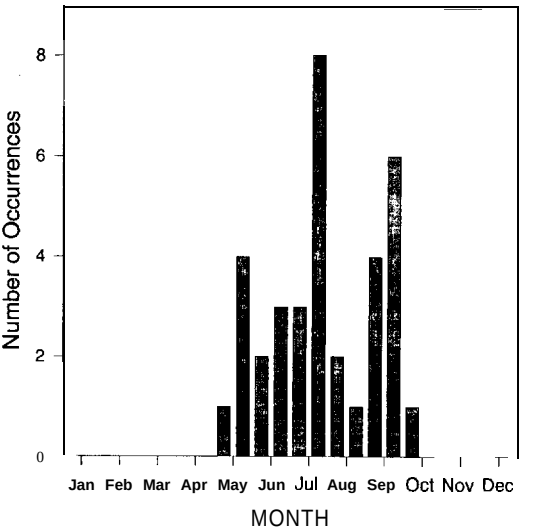

FIG. 1.--Seasonal distribution of procellariiform records for the Salton Sea and the Sonoran Desert based on first date of occurrence. Each month is divided into halves, with records plotted accordingly.

Laysan albatross (Diomedea immutabilis)—There are six records of the Laysan albatross for the Salton Sea area, one of which involves two individuals. Most records are from the first half of May. The first inland record was 5 May 1976 when a bird was seen flying west-northwest at the southern base of Morongo Pass (McCaskie, 1976; Dunn and Unitt, 1977). In

1984, a bird was seen regularly from 21 May to 20 June from Desert Shores north to the Whitewater River delta, with two birds photographed together on 9 June (McCaskie, 1984a,b). On 6 May 1985, a Laysan albatross was seen to "collide with power lines" in San Gorgonio Pass (McCaskie, 1985; uncatalogued specimen at the Natural History Museum of Los Angeles County). Another Laysan albatross hit a power line 9 May 1991 near the headquarters of the Salton Sea National Wildlife Refuge (McCaskie, 1991a) and subsequently died (San Bernardino County Museum 54388). The most recent Laysan albatross record is of one observed 2 May 1993 soaring over the Salton Sea at North Shore (McCaskie, 1993a; R. L. McKernan, in litt.).

There are two Laysan albatross records from the Lower Colorado River Valley, and a questionable report from the Anza-Borrego Desert. On 14 May 1981 a Laysan albatross was found in Yuma and another was found dead 18 July 1988 along the Gila River east of Yuma (Rosenberg et al., 1991). The other inland report of Laysan albatross comes from the southern end of Blair Valley in the Anza-Borrego Desert, where putative remains of this species were found 28 May 1982 (McCaskie, 1982). Because no remains were saved (Unitt, 1984:241), this report is not considered in our study.

Cook's *petrel* (Pterodroma cookii)-There are four records, all for July. A *Pterodroma* seen daily 24-29 July 1984 at the Whitewater River delta (McCaskie, 1984b) was believed to be *P. cookii* based on known range, but the morphologically similar Defillipe's (*P. defilippiana*) and Pycroft's petrels (*P. pycrofti*) could not be eliminated by the description, sketches, and photographs (Dunn, 1988; CBRC 1961984). Another apparent Cook's petrel was observed 10-11 July 1993 at the Whitewater River delta (McCaskie, 1993b). What was judged to be the same bird was observed 17 July 1993 off Poe Road at the southwestern corner of the Salton Sea, and 25 July-6 August 1993 at various locations around the north end of the Salton Sea (McCaskie, 1993b). Two more Cook's petrels were at the Whitewater River delta 15 July 1995, with one remaining near Corvina Beach through 23 July (McCaskie, 1995).

Wedge-tailed shearwater (Puffinus pacificus)—A dark-morph bird was photographed 31 July 1988 at the Whitewater River delta (McCaskie and Webster, 1990; CBRC 150-1988); a photograph of it was published (Anonymous, 1988). This record is one of only two for the continental United States (Pyle and McCaskie, 1992).

Buller's shearwater (Puffinus bulleri)-The only inland record for North America of this south/central Pacific species was an injured or sick bird captured 6 August 1966 at the Whitewater River delta (San Bernardino County Museum 31447). This record was the first of a procellariiform for interior southwestern North America (*Audubon Field Notes* 20:599).

Sooty shearwater (Puffinus griseus)-There are nine records from late April through mid-August, with most in June and July. The first record of this species in the Sonoran Desert was an "extremely fat" female collected 6 June 1971 along Interstate 8 about 58 km east of Yuma, Arizona (Quigley, 1973; University of Arizona 10316). All other records are for the Salton Sea and vicinity, with the first being a bird observed 14 August 1971 in northward flight from Desert Shores (McCaskie, 1971, in litt.). Sooty shearwaters were observed 16 June 1984 at various locations near the Whitewater River delta (McCaskie, 1984b), and 28 April 1989 flying across Interstate 10 near Indio (McCaskie, 1989). Sooty shearwater observations 14 July 1990 at the New River delta, 20 July 1990 at Desert Shores, 21 July 1990 at the Whitewater River delta, and 25 July 1990 near Red Hill were probably of the same individual (McCaskie, 1990). A sooty shearwater was found 6 July 1991 on a road by the New River 4 km south-southwest of Seeley (McCaskie, 1991b; San Diego Natural History Museum 47577) and another was observed 13 July 1991 flying south past Salton City (McCaskie, 1991b). Lastly, two sooty shearwaters were found dead on 24 August 1996 near Oasis (C. McGaugh, S. J. Peterson, in litt.).

Leach's *storm-petrel* (Oceanodroma leucorhoa)—Two subspecies of Leach's storm-petrel have been observed at the Salton Sea. On 15 September 1976, in the aftermath of Tropical Storm Kathleen, a dark-rumped individual believed to be *0. l. chapmani* was seen near Red Hill (McCaskie, 1977; Garrett and Dunn, 1981). A white-rumped individual (probably 0. 1. *beali*, but perhaps *0. l. willetti*) was seen irregularly from 30 June to 21 July 1984 at various

points around the Whitewater River delta (McCaskie, 1984b).

Black storm-petrel (Oceanodroma melania)—One observed 28 September 1986 at the Whitewater River delta (McCaskie, 1987) was the first inland record for North America, although a storm-petrel seen 11 September 1976 in Las Vegas was felt by the observers to be this species (Lawson, 1977).

Least dorm-petrel (Oceanodroma microsoma)-Between 500 and 1,000 least storm-petrels were observed on the Salton Sea after Tropical Storm Kathleen struck the region 10 September 1976 (McCaskie, 1977). They were first detected on 12 September 1976 at various locations around the Salton Sea. Most had departed within a week, but eight were still present on 21 October 1976 (McCaskie, 1977). The storm also brought least storm-petrels to the Colorado River Valley: two at Cottonwood Basin, Lake Mohave, 12 September; 50–70 at Las Vegas Bay, Lake Mead, 14 September, and one above Davis Dam, Lake Mohave, 17 September (Kaufman, 1977; Lawson, 1977). A least storm-petrel observed 10 July 1993 at the Whitewater River delta (McCaskie, 1993b) is the only interior record not associated with Tropical Storm Kathleen.

Other Procellariiforms—A "large storm-petrel with a dark rump and a forked tail" was observed 11 September 1976 during a football game in Las Vegas Stadium. As noted by Lawson (1977), "Though the bird appears on the University of Nevada, Las Vegas game films, the segment is too brief for positive species identification." The occurrence of this storm-petrel was clearly related to Tropical Storm Kathleen. Another storm-petrel observed 24 August 1992 in southern Arizona in the wake of Tropical Storm Lester may have been a least storm-petrel, but details are inconclusive (Rosenberg and Stejskal, 1993). A procellariiform seen in the early morning of 10 July 1993 at the Whitewater River delta was thought by the observers to be a Bulwer's petrel (*Bulweria bulwerii*; McCaskie, 1993b; CBRC 118-1993), but this sighting is supported by ambiguous details. An all-dark shearwater (*Puffinus* sp.) observed 10 July 1993 flying south past Salton City "with deep, graceful wingbeats, interspersed with occasional glides" was too distant to be identified to species (McCaskie, 1993b).

DISCUSSION—Procellariiform occurrences at the Salton Sea and in the surrounding Sonoran Desert are not seasonally random. Thus, the hypothesis that procellariiforms became "trapped" in the Gulf of California and then moved northward into the Salton Sea and vicinity (McCaskie, 1976, 1984b, 1993b; Dunn and Unitt, 1977; Rosenberg et al., 1991) is merely a phenomenological explanation. We explored the following potential causal relationships: (1) Mexican west coast tropical cyclones, (2) sea surface temperature patterns and El Nitio-Southern Oscillation conditions, and (3) normal summer wind circulations off western mainland Mexico (Sinaloa to Oaxaca) and in the Gulf of California from May/June through September.

Mexican West Coast *Tropical* Storms-Tropical cyclones form regularly in the eastern Pacific, mostly south of Mexico between June and October, with highest frequencies in July and August (Gerrish and Mayfield, 1989). The timing of cyclones coincides with the period of occurrence of procellariiforms in the Sonoran Desert, but aside from the storm-petrels associated with Hurricane Kathleen (Kaufman, 1977; McCaskie, 1977), only one procellariiform record has been directly attributed to a tropical cyclone: an unknown storm-petrel observed after Hurricane Lester on 24 August 1992 in Arizona (Rosenberg and Stejskal, 1993). This storm traced a path through the northern Gulf of California into northern Sonora by 24 August 1992, and "probably was a minimal tropical storm as far inland as Tucson, Arizona" (Lawrence and Rappaport, 1994). Hurricane Kathleen was first detected 5 September 1976 as a tropical disturbance roughly 550 km west of Acapulco (Fors, 1977). It intensified and tracked slowly north-northwest, then northward, crossing Punta Eugenia, Baja California Sur, and north-central Baja California to the Salton Sink. This cyclone retained tropical storm intensity (Fors, 1977; Smith, 1986) and produced winds of 66 knots at the Salton Sea on 10 September. In the aftermath of Kathleen, 500-1000 storm-petrels were found at six locations.

It is doubtful that the four procellariiforms first recorded on 10 July 1993 were related to Hurricane Calvin, which entered the mouth of the Gulf of California 8-9 July 1993, 1,400 km to the south (Avila and Mayfield, 1995). Oth-

erwise, there were no tropical cyclones near western Mexico during the other procellariiform occurrence dates (Smith, 1986; "Eastern North Pacific hurricane season" summaries in *Monthly Weather Review*, 1985-1995). Many tropical cyclones tracing a northwesterly path from Central America may indirectly influence procellariiform occurrence at the Salton Sea by "forcing" birds toward the mouth of the Gulf of California. However, prevailing surface winds could achieve the same effect.

El Niño-Southern Oscillation (ENSO)—Anomalous warm water appearing in the coastal and equatorial ocean waters off of Peru and Ecuador, termed the El Niño-Southern Oscillation (Rasmusson and Wallace, 1983; Philander, 1990), has devastating effects on seabirds (Ainley and Lewis, 1974; Bock and Larson, 1983; Schreiber and Schreiber, 1984; Ainley et al., 1988; Glynn, 1988). Many procellariiform species have a specific range of sea surface temperatures through which they forage and disperse (King, 1974). Above normal sea surface temperatures along western North America during ENS0 events may facilitate dispersal of warm water species northward into the Gulf of California (see Tershy et al., 1991); dispersal of cold water species would be discouraged.

If procellariiform occurrences at rhe Salton Sea are correlated with El Niño-Southern Oscillation events, two predictions can be made: (1) procellariiforms would appear inland only during El Niiio years (or in greater numbers or with higher frequencies in those years), and (2) warm water species would account for the records. Dichotomous data (Table 1) show no correlation between ENS0 events and procellariiform occurrences ($\phi = 0.11$, $P > 0.50$). Furthermore, there were no procellariiforms found inland during 1982 or 1983, the most intense ENSO event on record (Philander, 1990). Similarly, procellariiform occurrences are not strongly correlated with La Niña or "cold" events in the equatorial Pacific Ocean (ϕ = -0.17, $P > 0.30$). Hence, the second prediction likewise does not hold for cold water birds, including Buller's shearwater and Cook's petrel.

Monsoon Flows in the Gulf of California—Prevailing surface winds along the Gulf of California are predominantly from the northwest from October through April or May (Figure 2; Santamaria-del-Angel et al., 1994). These surface flows are accompanied by westerly winds of the jet stream aloft and the onshore movement of the Pacific trade wind layer across the Baja California peninsula. Beginning in May or June, the poleward retreat of the jet stream is replaced by the North American monsoon in which tropical maritime air moves northward along the Gulf of California in the southwestern deserts (Figure 2; Santamaria-del-Angel et al., 1994). Sea surface temperatures of west mainland Mexico climb sufficiently to establish an isothermal gradient from western Mexico into the mouth of the Gulf of California (Halpert and Ropelewski, 1989; Philander, 1990),

TABLE 1—Years with El Niño and La Niña events (Diaz and Kiladis, 1992; Minnich, unpubl. data) and procellariiform occurrences at the Salton Sea and in the Sonoran Desert.

Year	El Niño	La Niña	Procellariiform occurrences
1965	X		
1966			X
1967			
1968			
1969	X		
1970		X	
1971			X
1972	X		
1973		X	
1974			
1975		X	
1976	X		X
1977			
1978			
1979			
1980			
1981			X
1982	X		
1983			
1984			X
1985			X
1986	X		X
1987			
1988		X	X
1989			X
1990			X
1991	X		X
1992			X
1993	X		X
1994			
1995	x		X
1996			X

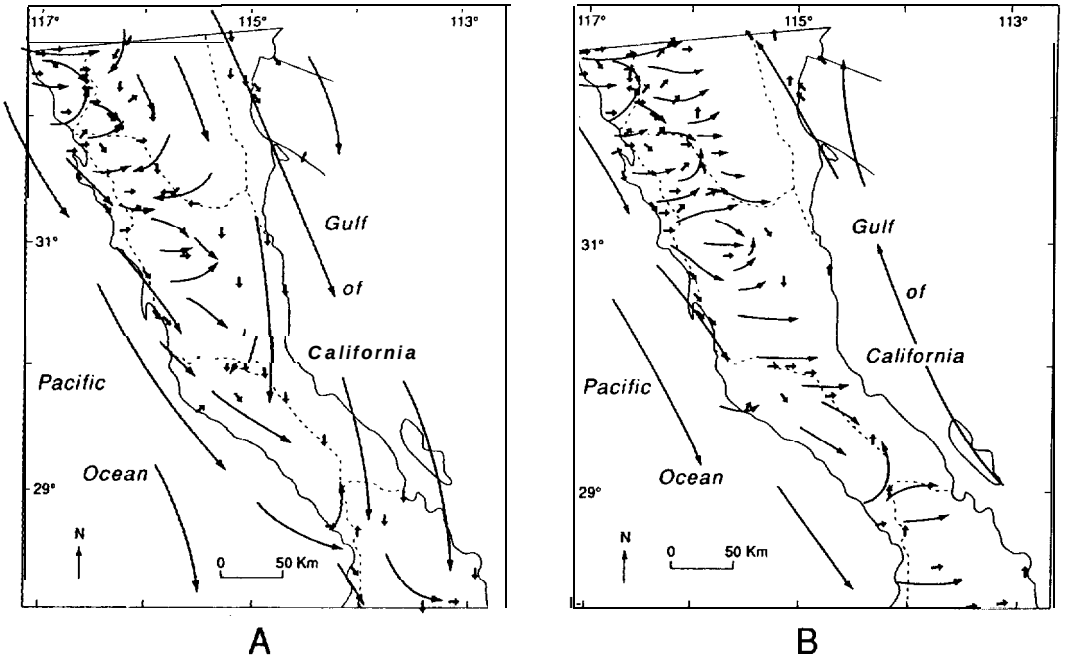

FIG. P.--Prevailing **winds in the northern Baja California peninsula in: (A)** January **and (B) July. Source:** Secretária de Agricultura y Recursos Hidráulicos, Division Hidrometrica, Ensenada, Baja California (unpubl. data).

forming an essentially contiguous habitat between western Mexico and the Gulf of California (cooler Waters extend south along the western edge of the Baja California peninsula to Jalisco, Nayarít, and southern Sinaloa from November through April, isolating the warmer water in the Gulf of California). Thus, procellariiforms normally ranging throughout waters off western mainland Mexico from May through September would find contingous habitat extending northward up the Gulf of California. As most bird species await favorable tailwinds before dispersing or migrating (Richardson, 1978; Terrill, 1991; cf. Pyle et al., 1993), steady northward surface winds during summer would facilitate procellariiform occurrence in the Gulf of California. Northward movement of "trapped" procellariiforms into the Salton Sea and Sonoran Desert would be expected for three reasons: (1) prevailing southerly surface winds of the Gulf of California extend northward to the Salton Sink and along the Colorado River; (2) because procellariiforms fly near the ocean's surface, birds straying to the southwestern deserts would tend to migrate over low-lying areas; and (3) most procellariiforms are moving in a northward direction from April through September, but in a southward direction from October through March. The Salton Sea lies below sea level and most of the Mexicali, Imperial, and Coachella valleys are less than 100 m altitude. The Salton Sink is bordered by high-elevations to the west (the Peninsular Ranges), north (the Transverse Ranges), and east (the Orocopia and Chocolate mountains), forming a natural northward extension of the Gulf of California, and thus would tend to exert **a** strong "oasis effect" on these normally sea-going birds.

Salton Sea procellariiform records are consistently of those species that are most common off western Mexico (Table 2). The black storm-petrel and least storm-petrel both nest in the Gulf of California (Anderson et al., 3976; Wilbur, 1987). The pink-footed shearwater (*Puffinus creatopus*), sooty shearwater, and black-vented shearwater (*P. opisthomelas*) are regularly seen in the Gulf of California, with the sooty shearwater appearing "sometimes in large numbers" (Wilbur, 1987). Laysan albatross records are increasing in the Gulf (New-

TABLE 2—Procellariiforms ranging at sea off western mainland Mexico from May through September. This table was compiled from information presented by King (1974), Harrison (1985, 1987), Pitman (1986), Spear et al. (1992), and Howell and Engel (1993). Species of "regular occurrence" are those whose normal range includes waters off western mainland Mexico. Species of "rare or uncertain occurrence" have been recorded in waters off western mainland Mexico only sporadically, or are on the fringe of their normal range in those waters.

Species of regular occurrence	Species of rare or uncertain occurrence
Laysan albatross (*Diomedea immutabilis*)	black-footed albatross (*Diomedea nigripes*)
Cook's petrel (*Pterodroma cookii*)	Tahiti petrel (*Pterodroma rostrata*)
pink-footed shearwater (*Puffinus creatopus*)	Juan Fernandez petrel (*Pterodroma externa*)
wedge-tailed shearwater (*Puffinus pacificus*)	dark-rumped petrel (*Pterodroma phaeopygia*)
Buller's shearwater (*Puffinus bulleri*)	Parkinson's petrel (*Procellaria parkinsoni*)
sooty shearwater (*Puffinus griseus*)	Wilson's storm-petrel (*Oceanites oceanicus*)
Townsend's shearwater (*Puffinus auricularis*)	band-rumped storm-petrel (*Oceanodroma castro*)
black-vented shearwater (*Puffninus opisthomelas*)	ashy storm-petrel (*Oceanodroma homochroa*)
Audubon's shearwater (*Puffinus lherminieri*)	Markam's storm-petrel (*Oceanodroma markhami*)
Leach's storm-petrel (*Oceanodroma leucorhoa*)	
wedge-rumped storm-petrel (*Oceanodroma tethys*)	
black storm-petrel (*Oceanodroma melania*)	
least storm-petrel (*Oceanodroma microsoma*)	

comer and Silber, 1989). The Salton Sea dark-morph wedge-tailed shearwater record is consistent with the distribution of this dimorphic species: light-morph individuals predominate in central Pacific populations, e.g. Hawaii, whereas dark-morph birds predominate in colonies on the Revillagigedo Islands off western Mexico (King, 1974). Five "species of regular occurrence" have not been recorded in the desert southwest, even though pink-footed shearwater and black-vented shearwater are regularly recorded in the Gulf of California (Wilbur, 1987). The wedge-rumped storm-petrel (*Oceanodroma tethys*) has also been recorded in the Gulf of California (Helbig, 1983). The large number of storm-petrels displaced by Tropical Storm Kathleen probably owe their occurrence to monsoon flows because these birds were most likely swept northward from their regular range in the Gulf of California rather than being transported over the Sierra Juárez (cf. Kaufman, 1977).

By contrast, none of the "species of rare or uncertain occurrence" west of Mexico (Table 2) have been recorded at the Salton Sea or in the Sonoran Desert. Offshore distributions of the black-footed albatross (Diomedea *nigripes*) and ashy storm-petrel (Oceanodroma *homochroa*) in Mexico tend to be limited to cold, upwelling seas west of Baja California. Strong habitat gradients may preclude their crossing of seas or the peninsula into the Gulf of California.

The early May Laysan albatross records, before the onset of southerly monsoons, may be partly unrelated to other procellariiform occurrences. Whereas the dispersal fate of smaller procellariiforms such as petrels, shearwaters, and, especially, storm-petrels are probably heavily influenced by tailwinds, large albatrosses are not passive fliers. Sanger (1974) discussed a sharp northward movement of this species in late April and early May in the eastern Pacific Ocean, coinciding with all Laysan albatross records for the Gulf of California (Newcomer and Silber, 1989) and with six of the eight records for the Salton Sea and Sonoran Desert. The other two records are probably attributable to monsoon flows.

SUMMARY-Highly pelagic procellariiform species at the Salton Sea and in the Sonoran Desert have occurred between late April and late September, inclusively, and involve species that nest or occur regularly off western mainland Mexico during these months. Annual development of persistent monsoon surface winds from May through September, coupled with formation of contiguous warm sea surface temperatures extending from off western mainland Mexico northward into the Gulf of

California, provides a vector for the occasional dispersal of procellariiforms into low-lying areas of the Sonoran Desert, where the Salton Sea provides the only suitable oasis. Most procellariiform occurrences do not correspond to tropical cyclones, El Niño-Southern Oscillation, or La Niiia events.

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