

THE MARINE BIRDS OF ALIJOS ROCKS, MEXICO

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Alijos Rocks (24°57'N, 115°45'W) lie 185 nautical miles almost due west of Cabo San Lazaro, off southwestern Baja California, Mexico (Figures 1-5). Their jagged, volcanic spires consist of three main stacks and numerous smaller rocks. South Rock, the largest of the group, rises 34 m above the sea; North Rock is 22 m high and Middle Rock, the smallest, is approximately 18 m high. The total top surface area of the three main pinnacles is under ¼ acre (0.1 hectare).

The only published accounts of biological surveys of Alijos Rocks come from Hanna (1926) and McLellan (1926), who spent 3 hours rowing among the rocks on 24 April 1925, and Murphy (1958) who visited the area on 9 November 1956. Since 1974 I have passed by these pinnacles five times recording bird and mammal observations while aboard research vessels. A list of survey dates and pertinent comments is given in Table 1. In addition, Bayard Brattstrom visited Alijos Rocks on 10 May and 15 November 1953, and David Au surveyed them on 7 December 1976 by helicopter from a passing research vessel.

Although Alijos Rocks maintain only small populations, the composition of the avifauna, with mixed zoogeographic affinities, is unique. It therefore seems worthwhile to update the current status of marine birds that occur there.

SPECIES ACCOUNTS

EARED GREBE (*Podiceps nigricollis*). A pair was swimming close to the rocks on 14 January 1983.

LAYSAN ALBATROSS (*Diomedea immutabilis*). There are no historical accounts of any albatrosses from Alijos Rocks. I first saw Laysan Albatrosses there on 29 February 1976, when 10 were present around the rocks, including 6 on the water between two of the larger stacks. Later that year D. Au (pers. comm.) reported one in the area on 7 December. On 15 May 1982, four were present, and when I passed near the area again on 14 January 1983 approximately 15 were soaring in the updrafts of the pinnacles or swimming on the water. Up to 12 were sitting on the water next to the ship as we drifted around the rocks on 10 April 1983, and 4, probably different birds, followed the ship several miles north of Alijos Rocks.

During the January 1983 visit to Alijos Rocks small groups of 4 to 6 albatrosses were sitting on the water facing each other, clapping their bills, and bobbing their heads up and down rapidly. They were also bowing forward, turning their wings up, and dipping their bills into the water off to the side; they appeared to lock beaks occasionally. In April 1983 bill-clapping was still common and I regularly heard a whistling whiny as the birds sat on the water near the vessel. No head-bobbing was noted at that time but some head and face allo-preening was observed. These behaviors are important components of the breeding displays of the Laysan Albatross (Rice and Kenyon 1962b). In January 1983, one (or more?) albatross flew over South Rock several times and dropped its feet as it stalled less than 0.5 m over the surface of the stack in an apparent attempt to land. Each time it averted at the last moment and was never actually seen to alight.

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Table 1. Surveys of Alijos Rocks, Mexico, by the author.

Date	Sea Temperature (°C)	Comments
16 Nov. 1974	21.1	Passed 1.5 nautical miles off east side of the rocks stopping <10 min.
29 Feb. 1976	18.7	Spent 5 hrs. in the morning drifting and fishing 0.5 nautical miles off rocks.
15 May 1982	18.5	Cruised along west side of rocks 0.5 nautical miles offshore without stopping; surveyed site with 25x, 150 mm mounted spotting binoculars.
14 Jan. 1983	20.4	Spent 50 min. circling the rocks at a distance of 0.5 nautical miles surveying with mounted spotting binoculars.
10 Apr. 1983	19.1	Drifted for 3.5 hrs. within 500 m of the rocks surveying with mounted spotting binoculars.

This species now occurs annually at Alijos Rocks for at least the duration of the breeding season (November-August in the Hawaiian Islands; Rice and Kenyon 1962b). None of the earlier expeditions to Alijos reported any species of albatross there and Sanger (1974) indicated that Laysans in the eastern Pacific range south only to about 28°N (northern Baja). Friedmann et al. (1950) reported they were "formerly fairly common" off central Baja but did not elaborate. Other records, however, show that Laysan Albatross does occur off southern Baja California, and occasionally further south, with some regularity. Perhaps this occurrence is recent.

Table 2 lists additional sightings of Laysan Albatrosses from Baja California and elsewhere in the southeast portion of its range. Dunn and Unitt (1977) reported an inland sighting north of Salton Sea, California, on 5 May 1976, and surmised that the bird had become "trapped" in the Gulf of California and continued overland in its northward migration. A Laysan found in Yuma, Arizona, on 14 May 1981, one found dead near Blaire Valley, California, on 28 May 1982, and one present at Salton Sea, California, on 21 May 1984 all probably suffered the same fate (McCaskie 1984). While these records may only reflect an increase in observer coverage, they and other data suggest that the Laysan Albatross may be expanding its range.

Historically all of the North Pacific albatrosses (including Black-footed Albatross, *D. nigripes*, and Short-tailed Albatross, *D. albatrus*) were considerably more numerous and widespread than they are now. Japanese feather hunters at the turn of the century, and then World War II military operations, depleted albatross populations and even eliminated some colonies (Rice and Kenyon 1962a). Although no albatross has been known to breed in the eastern North Pacific in recent times, albatross colonies in the central and western North Pacific were more widely distributed prior to human interference (Rice and Kenyon 1962a).

At present almost all Laysan Albatrosses breed in the Leeward Hawaiian Islands, but very small numbers have also nested in the main Hawaiian Islands including Moku Manu off Oahu and on Niihoa (Richardson 1957), and more recently on Kilauea Point, Kauai (see Pyle 1983). Hasegawa (1978) recently reported nesting on Bonin Island, Japan, which is the only modern record away from the Hawaiian chain.

The Laysan is now by far the most abundant albatross in the North Pacific, and some of the large protected colonies in the Leeward Hawaiian chain are likely at pre-

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exploitation levels and still growing (Rice and Kenyon 1962a, M. Naughton pers. comm.). If so, surplus birds may be available for colonization elsewhere in the North Pacific. This species typically nests on sandy atolls, but a few birds have bred on the tiny rocky stacks of Gardner Pinnacles in the Leeward Hawaiian Islands (Rice and Kenyon 1962a). Though there were no signs of actual nesting or even of adults roosting at Alijos Rocks in 1983, a breeding population may be established there in the near future.

BLACK-FOOTED ALBATROSS (*D. nigripes*). One, 20 nautical miles north of Alijos on 29 February 1976.

NORTHERN FULMAR (*Fulmarus glacialis*). Four all-dark fulmars scavenged around the boat as we fished just off the rocks in February 1976. In 1976 a huge influx of fulmars and Black-legged Kittiwakes occurred off the western United States, with large die-offs occurring at least as far south as southern California in February and March (Ainley 1976, Pitman pers. obs.). Fulmars normally venture as far south as Alijos only during "flight years."

Murphy (1958) collected a dark-phase fulmar on 12 December 1956 at 23°31'N, 111°22'W, which he felt was probably the southernmost record for a Northern Fulmar in any ocean. On 28 February 1976 I found a dead white-phase fulmar at 22°38'N, 115°15'W [San Diego Natural History Museum (SDNHM) 39789]. It was fairly fresh but may have drifted a considerable distance after dying. On 29 November 1983 I saw a dark-phase fulmar at 22°03'N, 114°55'W, and saw several others farther north.

Table 2. Laysan Albatross sightings off Baja California, Mexico.

Date	Position	Number	Observer
11 Apr. 1975	16°10'N 105°01'W	1	G. Friedrichsen
26 Feb. 1976	18°59'N 127°10'W	1	J. Dunn & P. Unitt (1977)
29 Feb. 1976	24°57'N 115°45'W (Alijos Rocks)	10	R. Pitman
7 Dec. 1976	24°57'N 115°45'W (Alijos Rocks)	1	D. Au
5 Jan. 1977	30°49'N 118°24'W	1	R. Pitman
4 Mar. 1979	19°00'N 111°00'W	2	D. Au
10 Mar. 1979	30°53'N 116°41'W	1	R. Pitman
4 Jan. 1980	29°53'N 118°03'W*	2	R. Pitman
18 Feb. 1980	10°33'N 113°40'W	1	G. Anderson
1 Mar. 1980	21°08'N 126°32'W	1	R. Pitman
3 Mar. 1980	26°50'N 121°54'W*	2	R. Pitman
4 Mar. 1980	30°25'N 120°13'W*	3	R. Pitman
22 Mar. 1980	28°11'N 115°59'W	1	R. Pitman
23 Mar. 1980	23°32'N 114°27'W	1	R. Pitman
2 Apr. 1981	20°28'N 110°35'W	1	J.R. Jehl, Jr.
21 Feb. 1982	24°49'N 113°12'W	1	R. Pitman
15 May 1982	24°57'N 115°45'W (Alijos Rocks)	4	R. Pitman
14 Jan. 1983	24°57'N 115°45'W (Alijos Rocks)	15	R. Pitman
7 Mar. 1983	29°39'N 117°20'W	1	G. Friedrichsen
25 Mar. 1983	16°32'N 105°43'W	1	G. Friedrichsen
29 Mar. 1983	11°22'N 109°25'W	1	J. Cotton
10 Apr. 1983	24°57'N 115°45'W (Alijos Rocks)	16	R. Pitman

*noon ship position

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COOK'S PETREL (*Pterodroma cookii*). These petrels were abundant in the vicinity on 15 May 1982. An estimated 75 were foraging in association with a school of Common Dolphins (*Delphinus* sp.) 1/2 nautical mile north of the rocks. This species was noted during every survey and is a common resident off Baja during the boreal summer (Pitman unpubl. data).

SOOTY SHEARWATER (*Puffinus griseus*). One bird, 5 nautical miles north, and two others, 1/2 nautical mile north of the rocks, on 15 May 1982.

TOWNSEND'S SHEARWATER (*P. auricularis*). Identification of this shearwater is based on a sharply demarcated black and white color pattern, conspicuous white rump patches and fluttering flight. I saw one 5 nautical miles north of the rocks on 15 May 1982, which is as far north as this species has been known to range (Jehl 1982). Seven more were seen within 20 nautical miles south of Alijos Rocks on the same date. These birds were presumably part of a northward, post-breeding dispersal from nesting colonies on the Revillagigedo Islands.

BLACK-VENTED SHEARWATER (*P. opisthomelas*). A brownish "Manx-type" shearwater seen 46 nautical miles southeast of Alijos Rocks on 8 March 1979 was probably this species; two positively identified birds were circling in the immediate area of the rocks on 10 April 1983. Identifying characters included rapid wingbeat, brown upperparts and white below with a smudgy brown chest. This species typically requires soil for excavating nest burrows (Palmer 1962), but also nests in rock crevices (Jehl pers. obs.). Conceivably a few pair may breed on the soilless rocks of Alijos.

GALAPAGOS STORM-PETREL (*Oceanodroma tethys*). Murphy (1958) collected two of these petrels on 10 November 1956 at 22°57'N, 113°34'W, "a few miles N of the isolated Alijos Rocks" (actually 175 nautical miles southeast of Alijos). In November 1974 I saw two individuals 20 nautical miles north of the rocks and four others closer in.

LEACH'S STORM-PETREL (*O. leucorhoa*). This species has been common in the area during every visit. Murphy (1958) also found them common in the vicinity in November 1956.

On 15 May 1982, I observed at least three dark-rumped, medium-sized storm-petrels fluttering about South Rock in broad daylight (about 1400). They hovered within 10-15 cm of the cliff face at a height of up to 23 m above the sea surface and were apparently investigating nest sites. I presumed they were all Leach's Storm-Petrels. On 10 April 1983 I saw an all-dark Leach's Storm-Petrel fluttering about South Rock at 0800 while another flew from the rock out to sea.

If this species does nest here, it would be the southernmost location in the North Atlantic or the Pacific, although Imber and Lovegrove (1982) have reported a case of potential breeding off New Zealand. It also appears that the normally nocturnal Leach's Storm-Petrel has taken to visiting nest sites by day at Alijos Rocks, possibly owing to a lack of avian predators. Harris (1969) found a similar situation for Galapagos Storm-Petrels breeding in the Galapagos Islands.

BLACK STORM-PETREL (*O. melania*). Eight individuals were within 40 nautical miles of the rocks in November 1974.

RED-BILLED TROPICBIRD (*Phaethon aethereus*). Apparently this species is a year-round resident; I saw it on every trip to Alijos Rocks. Hanna (1926) saw tropicbirds in April 1925 on North Rock and presumed they were breeding. Brattstrom (pers. comm.) saw three in November 1953, and Murphy (1958) found them "in abundance" and courting in November 1956, when he collected a breeding male. I have observed roosting and nesting only on South Rock and suspect it may be the only rock where they are now breeding. The current population is about seven pairs. This is the

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northernmost colony for this species in the eastern Pacific, outside the Gulf of California.

MASKED BOOBY (*Sula dactylatra*). Boobies are year-round residents. They were present on North and South rocks and were presumed breeding when Hanna (1926, McLellan 1926) and company collected an immature bird in April 1925. Brattstrom (pers. comm.) estimated 25 in May 1953 and Murphy (1958) found an unspecified number of young and adults associated with the colony in November 1956.

I estimated 30 of these boobies in February 1976 and Au (pers. comm.) reported "no more than 30" in December of that year. I estimated 30 again in May 1982 and 35 in January 1983. My largest count, however, was in April 1983, when 65 (including two large downy young) were present on North Rock and 15 (including one chick) were on South Rock. The majority of the booby activity is currently centered on North Rock, where most of the roosting and nesting take place. This rock is presumably the "easternmost of the three stacks" to which Murphy (1958) refers.

The Alijos Rocks breeding population is the northernmost in the eastern Pacific and consists of approximately 50 pairs.

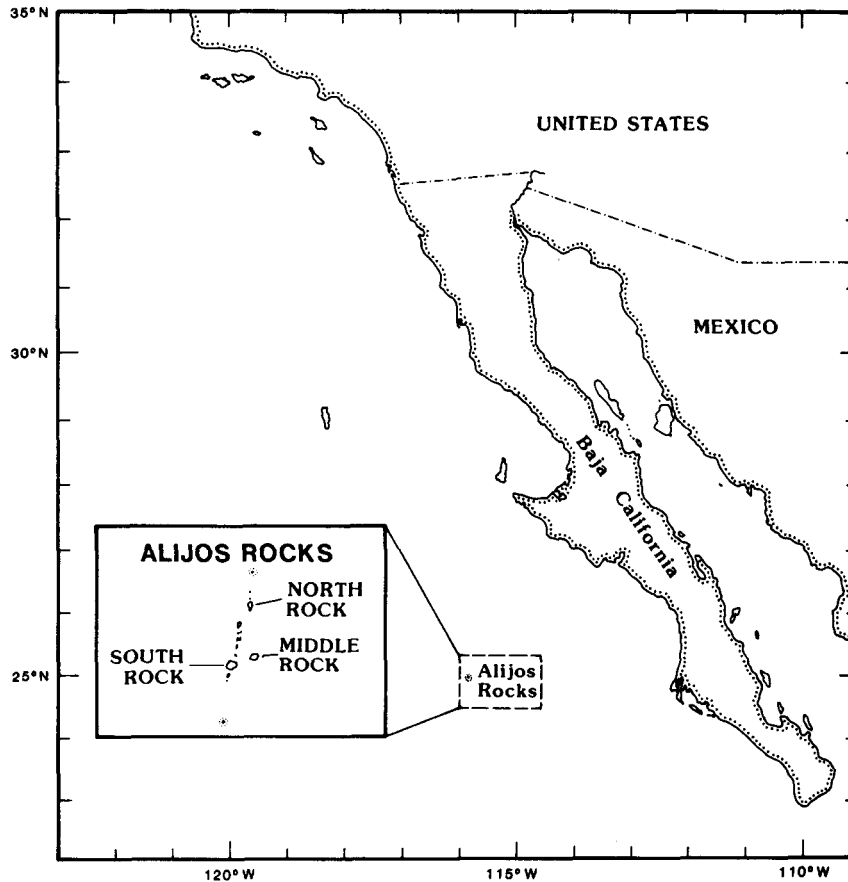


Figure 1. Alijos Rocks, Mexico, with inset showing individual rocks.

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Figure 2. A relatively calm day at Alijos Rocks showing from left to right: Middle Rock, North Rock and South Rock (April 1983).

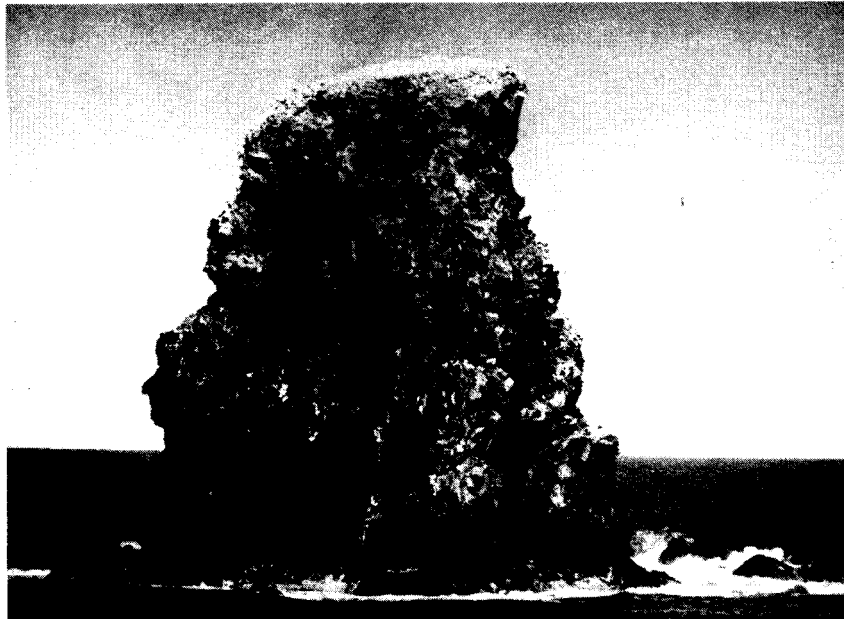


Figure 3. South Rock stands up on five legs and has daylight visible from almost any angle. Laysan Albatross can be seen flying to the right of the rock (April 1983).

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CORMORANT (*Phalacrocorax* sp.). A single, large cormorant was roosting on the cliff faces in February 1976 and again in May 1982. Brandt's Cormorant (*P. penicillatus*) seems likely.

MAGNIFICENT FRIGATEBIRD (*Fregata magnificens*). Seven Magnificent Frigatebirds were present on 14 January 1983, five females and one juvenile being identified. I saw several roosting on Middle Rock, but none elsewhere. A single adult female was soaring above the rocks on 10 April 1983, but I saw no signs of nesting.

Away from the immediate area of Alijos Rocks, I saw an adult female *magnificens* and an unidentified frigatebird 80 nautical miles to the southeast in March 1979; later I observed six individual unidentified frigatebirds (probably *magnificens*) within 75 nautical miles of the area in January 1981.

It is not clear whether frigatebirds nest at Alijos Rocks. Hanna (1926, McLellan 1926) saw none in April 1925. Brattstrom (pers. comm.) reported 12 at the rocks in November 1953 though he apparently saw none in May 1953. Murphy (1958) collected two adult males in November 1956 and identified Alijos Rocks as the northernmost breeding colony for *magnificens* along the Pacific coast, but provided no evidence for breeding. My records suggest that Magnificent Frigatebirds are regular visitors to Alijos Rocks during the non-breeding season (winter) but probably do not breed there.

CATTLE EGRET (*Bubulcus ibis*). A flock of five joined the ship for a few minutes, 10 nautical miles east of the rocks on 16 November 1974.

RED PHALAROPE (*Phalaropus fulicarius*). An estimated 20 were close to the rocks and feeding in February 1976; small numbers were in the vicinity and moving north in April 1983.

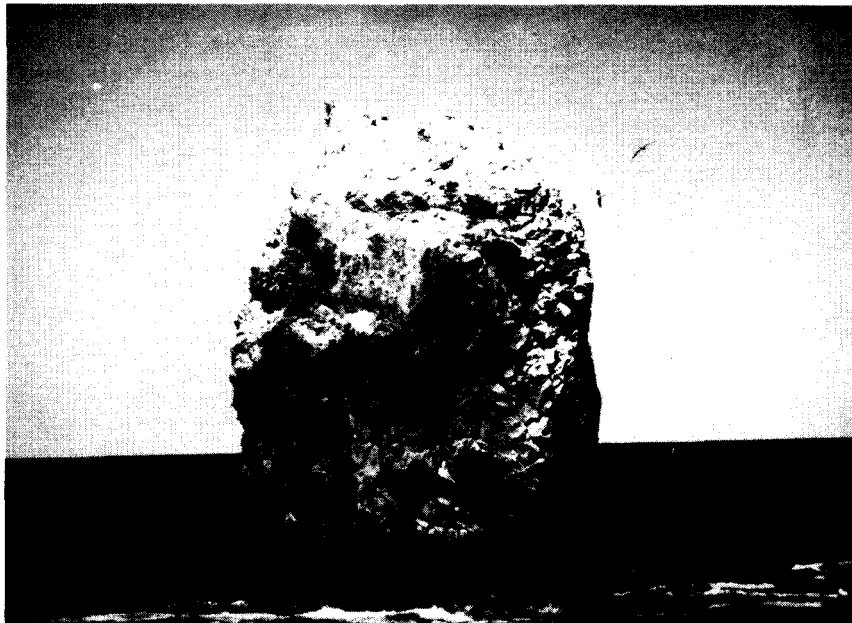


Figure 4. Masked Boobies roosting on top of North Rock and Laysan Albatross circling in the background (April 1983).

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POMARINE JAEGER (*Stercorarius pomarinus*). One was 15 nautical miles south of the rocks on 15 May 1982.

PARASITIC JAEGER (*S. parasiticus*). One was 3 nautical miles north on 14 January 1983.

HERRING GULL (*Larus argentatus*). Five (2 adults, 3 subadults) were among the gulls that stayed around the ship as we fished near the rocks in February 1976.

WESTERN GULL (*L. occidentalis*). Probably a regular visitor. One subadult was among the gulls present in February 1976; a third year bird was 20 nautical miles south of the rocks on 15 May 1982, and two adults joined the ship 35 nautical miles to the northeast on 10 April 1983.

CALIFORNIA GULL (*L. californicus*). One was with the other gulls present in February 1976.

LAUGHING GULL (*L. atricilla*). One juvenile, collected 16 November 1974, was 1.5 nautical miles from the rocks (SDNHM 39578).

BLACK-LEGGED KITTIWAKE (*Rissa tridactyla*). A minimum of 10 adults and juveniles hovered around the ship in February 1976. This is the only record for Alijos Rocks and is probably as far south as this species has been known to occur in the eastern Pacific. The winter of 1975-76 was a significant "flight year" for kittiwakes in the eastern Pacific (see also Northern Fulmar).

SOOTY TERN (*Sterna fuscata*). A summer breeder, probably absent at other seasons. I saw none on trips in November, January or February, nor did Brattstrom (pers. comm.) in November 1953 or Murphy (1958) in November 1956. McLellan (1926) and Hanna (1926) reported them on both South and East rocks in late February 1925 and collected nine. Brattstrom (pers. comm.) estimated 100 "roosting, apparently nesting" in May 1953.

On 15 May 1982 I estimated a minimum of 200 terns on top of South Rock; they were evenly spaced and probably nesting. Also, I saw four more foraging 1/2 nautical mile to the north. On 10 April 1983 approximately 10 were flying around the rocks but none was on shore. There are very few nesting colonies of Sooty Terns in the eastern Pacific, and the Alijos Rocks colony is the northernmost, with a population of about 250 individuals.

ZOOGEOGRAPHY

As is evident from some of the comments in the species accounts, Alijos Rocks is situated at the border of two very distinct oceanographic areas. Cool, southward flowing waters of the California Current meet warm tropical waters of southern Baja California at about 25°N and then veer to the southwest to form the southeast corner of the North Pacific Gyre (Wyrteki 1966).

South-central Baja is therefore an important boundary zone for tropical and cooler water species of marine birds, mammals and fishes (Hubbs 1960), as well as euphausiids (Brinton 1962) and other epipelagic organisms (McGowan 1968). Dawson (1960) sampled marine algae at Alijos Rocks and found southern records for three northern types along with "a high proportion of tropical species."

Currently four species of marine birds nest at Alijos Rocks. Leach's Storm-Petrel (a presumed breeder) nests in more temperate waters around the North Pacific basin and has its southernmost breeding station at Alijos. The

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Figure 5. Middle Rock with roosting frigatebirds; California Sea Lions (*Zalophus californianus*) are hauled out in the foreground. A group of four albatrosses is on the water at the lower left (January 1983).

Photos by the author

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remaining species (Masked Booby, Red-billed Tropicbird and Sooty Tern) all inhabit tropical or subtropical waters and have their northernmost breeding colony in the eastern Pacific at Alijos. The bird fauna of Alijos Rocks, then, also reflects the transitional nature of the local ocean environment.

On most of my visits to Alijos Rocks the thunderous splashes produced by swells slamming into the vertical pinnacles have been visible from many miles (see also Hanna 1926:28). Despite this relentless onslaught the three main spires appear to have remained largely unchanged since they were first illustrated nearly 150 years ago (Figure 6), or photographed almost 60 years ago (Hanna 1926). South Rock, severely undermined through wave action, is still precariously perched on five legs as it was in 1925 when Hanna (1926) described it. A recent fourth pinnacle, however, has not survived. Rudkin's (1956:100) reproduction of a drawing made on a French survey in 1837 (Figure 6) shows a fourth rock (second from right; also mentioned in his text, p. 94-95) that is about half the size of Middle Rock. This site no longer exists. The remaining stacks at Alijos Rocks will probably topple in time and several species of marine birds will forfeit a toehold at the edge of their ranges in the eastern Pacific.

SUMMARY

The breeding marine avifauna of Alijos Rocks, Mexico (24°57'N, 115°45'W), currently consists of Leach's Storm-Petrel (a presumed breeder; probably a few pairs), Red-billed Tropicbird (14 birds), Masked Booby (100), and Sooty Tern (250). Magnificent Frigatebird is a regular winter visitor but probably does not breed. Laysan Albatross is currently an annual visitor to Alijos Rocks during its winter breeding season, and may start to nest there in the near future.

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LITERATURE CITED

- Ainley, D.G. 1976. Seabirds. A spectacular seabird die-off in 1976: a beach survey report. Pt. Reyes Bird Obs. Newsletter 39:4-5.
- Brinton, E. 1962. The distribution of Pacific euphausiids. Bull. Scripps Instit. Oceanogr. 8:51-270.
- Dawson, E.Y. 1960. A review of the ecology, distribution and affinities of the benthic flora. Pp. 93-100 in Symposium on the biogeography of Baja California and adjacent seas. Part II. Marine Biotas. Syst. Zool. 9.
- Dunn, J. & P. Unitt. 1977. A Laysan Albatross in interior southern California. West. Birds 8:27-28.



Figure 6. Alijos Rocks from an 1837 engraving; notice the birds hovering above the pinnacles (from Abel Du Petit-Thouars' *Voyage of the Venus*, courtesy Glen Dawson).

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- Friedmann, H., L. Griscom & R.T. Moore. 1950. Distributional checklist of the birds of Mexico. Part I. Pac. Coast Avif. 29.
- Hanna, G.D. 1926. Expedition to the Revillagigedo Islands, Mexico, in 1925. I. General Report. Proc. California Acad. Sci., 4th Ser., 15:1-113.
- Harris, M.P. 1969. The biology of storm-petrels in the Galapagos Islands. Proc. California Acad. Sci., 4th Ser., 37:95-166.
- Hasegawa, H. 1978. The Laysan Albatross breeding in the Ogasawara Islands. Pac. Seabird Group Bull. 5:16-17.
- Hubbs, C.L. 1960. The marine vertebrates of the outer coast. Pp. 134-147 in Symposium on the biogeography of Baja California and adjacent seas. Part II. Marine Biotas. Syst. Zool. 9.
- Imber, M.J. & T.G. Lovegrove. 1982. Leach's Storm-Petrel (*Oceanodroma leucorhoa*) prospecting for nest sites on the Chatham Islands. Notornis 29:101-108.
- Jehl, J.R., Jr. 1982. The biology and taxonomy of Townsend's Shearwater. Le Gerfaut 72:121-135.
- McCaskie, G. 1984. Southern Pacific coast region. Am. Birds 38:957-958.
- McGowan, J.A. 1968. The thecostomata and gymnostomata of California. The Veliger. Supplement to 3:103.
- McLellan, M.E. 1926. Expedition to the Revillagigedo Islands, Mexico, in 1925. VI. The birds and mammals. Proc. California Acad. Sci., 4th Ser., 15:279-322.
- Murphy, R.C. 1958. The vertebrates of SCOPE, November 7-December 16, 1956. USDI Fish & Wildl. Serv., Spec. Sci. Rep., Fish. No. 279.
- Palmer, R.S., ed. 1962. Handbook of North American birds, Vol. I. Yale Univ. Press, New Haven, CT.
- Pyle, R.L. 1983. Hawaiian Islands region. Am. Birds 37:1028-1029.
- Rice, D.W. & K.W. Kenyon. 1962a. Breeding distribution, history and populations of North Pacific albatrosses. Auk 79:365-386.
- Rice, D.W. & K.W. Kenyon. 1962b. Breeding cycles and behavior of Laysan and Black-footed albatrosses. Auk 79:517-567.
- Richardson, F. 1957. The breeding cycles of Hawaiian sea birds. Bernice P. Bishop Mus. Bull. 218:1-41.
- Rudkin, C.N. (Transl.). 1956. Voyage of the Venus: sojourn in California. G. Dawson, Los Angeles.
- Sanger, G.A. 1974. Laysan Albatross (*Diomedea immutabilis*). In Pelagic studies of seabirds in the central and eastern Pacific Ocean. Contrib. Zool. No. 158:129-153.
- Wyrski, K. 1966. Oceanography of the eastern equatorial Pacific Ocean. Oceanogr. Mar. Biol. Ann. Rev. 4:33-68.

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