

BREEDING WATERBIRDS OF LA PAZ BAY, BAJA CALIFORNIA SUR, MEXICO

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La Paz Bay, Baja California Sur, México, is located in the transition zone between two mayor biogeographic areas (based on fish and invertebrate distribution), the California region and the Cortez province (Briggs 1974 in Anderson 1983). These areas are characterized by patterns of climatic and latitudinal zonation that influence seabirds' distribution and breeding ranges (Anderson 1983), so data on species nesting in and near this transition zone may help clarify the factors governing these distributions. Within the bay there are nine islands and extensive mangroves, constituting the main sites used by breeding waterbirds (Figure 1).

This part of the Baja California peninsula is characterized by a semidesert climate with a mean annual temperature of 23° C (García and Mosiño 1969) and an average annual precipitation of <200 mm (Jiménez 1989). Vegetation on the islands is sparse, typified by chollas (*Opuntia* spp.), sour pitahaya (*Machaerocereus gummosus*), old-man cactus (*Lophocereus schottii*), saltbush (*Atriplex* spp.), box-thorn (*Lycium* spp.), Adam's tree (*Fouquieria diguetii*), and cardón (*Pachycereus pringlei*) (Roberts 1989).

Estuaries, surrounded by mangrove forests, cover about 25% of the coastline of La Paz Bay, mainly at its southern end (Llinas et al. 1989). Mangroves occur also on Espíritu Santo Island. There are three species of mangroves in this area: the Red (*Rizophora mangle*), the Black (*Avicennia germinans*), and, in small numbers, the White (*Laguncularia racemosa*).

The status and conservation of breeding seabirds in the Gulf of California have been reviewed by Everett and Anderson (1991) and Velarde and Anderson (1993). The waterbirds of La Paz Bay have been studied by many researchers (Mendoza 1983, Llinas 1986, Galindo 1987, Palacios 1988, Jiménez 1989, Llinas et al. 1989, Llinas and Galindo 1990, Carmona and Zárate 1992, Carmona 1993, Fernández 1993), but much of their information is unpublished. Here we compile and add to these records. This report is based on 14 years (1979–1993) of field work by the Avian Laboratory of the Universidad Autónoma de Baja California Sur, La Paz. We censused birds along the coasts of the bay monthly from 1980 to 1985. The last three years our censuses were performed twice every month during the nesting season (February–July) and extended to the west coast of Espíritu Santo Island and the whole periphery of the small islands El Gallo, La Gallina, La Lobera, La Ballena, La Gaviota, El Merito and San Rafaelito (Figure 1), where most waterbirds nest.

SPECIES ACCOUNTS

Black Storm-Petrel (*Oceanodroma melania*). This species has been nesting on La Lobera since at least 1988. There are over 150 nests, but the number is hard to

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estimate accurately because this species nests in crevices and under boulders, on cliffs, and in other difficult sites. The nesting season goes from February to June.

Least Storm-Petrel (*O. microsoma*). This species too has nested on La Lobera since at least 1988 (>200 nests). Like the Black, the Least Storm-Petrel lays one egg around mid March, and the chicks leave the nests in the beginning of June. The breeding habitat of both species of storm-petrel is the same.

Brown Pelican (*Pelecanus occidentalis*). We have nesting records since 1979. Although the colony has changed location, the Brown Pelican has nested fairly regularly on La Ballena: 1979, 800 nests; 1980, 600 nests; 1981, 70 nests; 1982, 300 nests; 1983, 250 nests; 1984, no nesting; 1985, 750 nests; 1986, 300 nests (Jiménez 1989); 1987, no nesting; 1988, 170 nests; 1989, 800 nests; 1990, 1200 nests; 1991, 1000 nests; 1992, no nesting. Occasionally, smaller colonies (5–20 nests) have nested on La Gallina and El Gallo. Eggs are laid in January and hatch in February. Fledglings leave the nests in May. Human disturbance has resulted in panicking chicks killing themselves by impaling themselves on cholla spines or falling from cliffs.

Blue-footed Booby (*Sula nebouxii*). On La Lobera, on high cliffs protected from the sun, one pair nested in March 1988, laying three eggs that never hatched. On the same island in May 1990, two pairs each laid three eggs and fledged two chicks.

Great Blue Heron (*Ardea herodias*). This species regularly breeds throughout La Paz Bay. Until 1988 it nested on La Gaviota (8–10 nests) in bushes and chollas no taller than 2 m. Since 1989 most of the nests (10–15) have been found at El Conchalito in the canopy of Red Mangroves (Table 1). Until 1992 two pairs nested on a metallic structure on San Rafaelito. Some isolated pairs nested on La Gallina and El Gallo in March 1988, and a colony of 10 pairs nested on San Gabriel in March 1988. The nests were located within the canopy of the Black Mangrove trees. In June 1993 a colony of 20 pairs nested on El Merito, on the tops of bushes. During 1992, although the species nested on El Conchalito, San Rafaelito, La Gaviota, and San Gabriel, all attempts failed. It seems that this ardeid has a wide spatial nesting niche.

Up to 10 species of herons nest in mangroves at El Conchalito (Table 1). We have recorded only the Great Blue Heron nesting elsewhere around La Paz Bay, however. At El Conchalito, the colonies are arranged largely in monospecific patches. The only exceptions were the two nests of the Great Egret, which were within the colony of Cattle Egrets.

Virginia Rail (*Rallus limicola*). We recorded one nest at El Conchalito in May 1988, in a Red Mangrove tree, very close to the tide level. In 1989 and 1993 courtship behavior was observed in the same area, but no nests were found.

American Oystercatcher (*Haematopus palliatus*). Palacios (1988) found one nest on Las Afeguas. We found single nests with eggs on La Gaviota in April 1989 and March 1990, and on San Rafaelito in 1989 and 1990.

Wilson's Plover (*Charadrius wilsonia*). Palacios (1988) recorded two nests on Las Afeguas, four nests at Chametla, and three nests at Fidepaz during 1987. We counted 25 chicks at Chametla in 1992 and eight chicks at El Conchalito in 1993.

Heermann's Gull (*Larus heermanni*). We located two nests with two and three eggs on La Ballena in April 1990. Both nests failed.

Yellow-footed Gull (*L. livens*). Since at least 1983 a colony has been settled on La Gaviota; it had 17 nests in 1989, 15 nests in 1990, 16 nests in 1991 and 14 nests in 1993. There are four more colonies in La Paz Bay, which had the following

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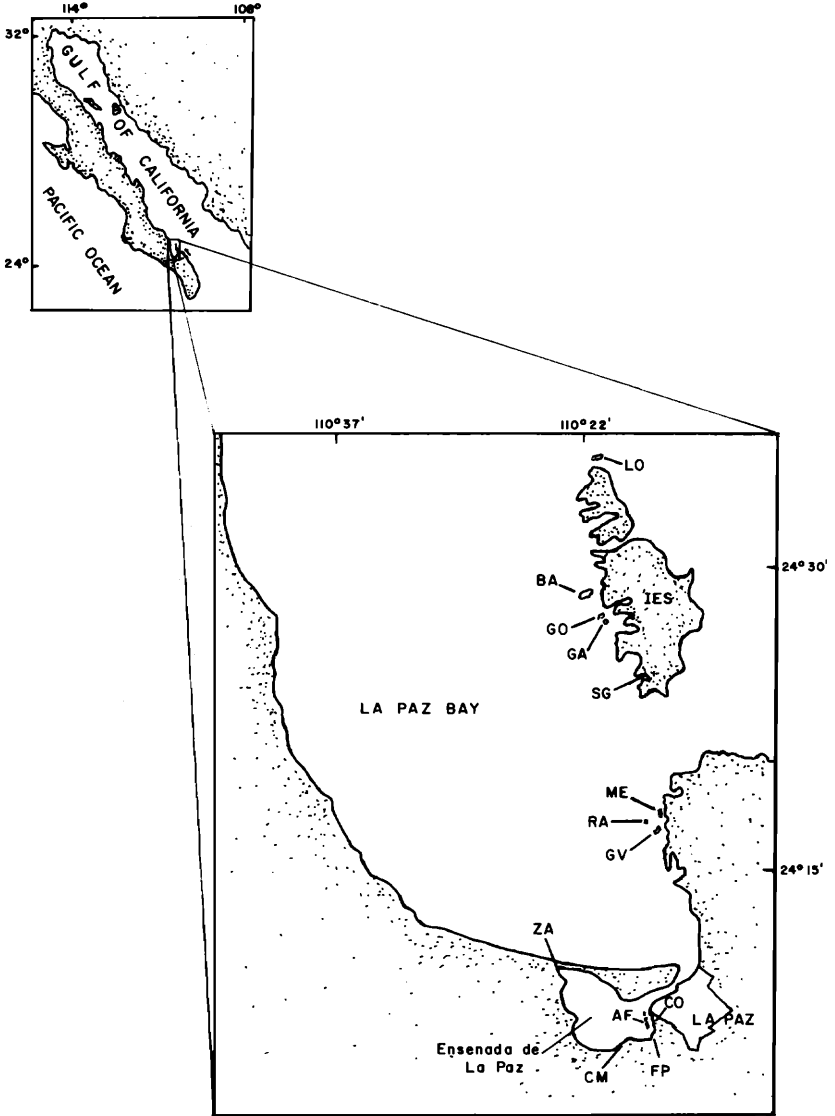


Figure 1. La Paz Bay, showing islands and other sites used by nesting waterbirds. Islands: IES, Espiritu Santo; GO, El Gallo; GA, La Gallina; LO, La Lobera; BA, La Ballena; GV, La Gaviota; ME, El Merito; RA, San Rafaelito; AF, Las Afeguas (within Ensenada de la Paz). Coastal areas: CO, El Conchalito; FP, Fidepaz; CM, Chametla; ZA, Zacatecas (within Ensenada de La Paz); SG, San Gabriel (southwest coast of Espiritu Santo Island).

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Table 1 Nesting Ardeids at El Conchalito Estuary in La Paz Bay, Baja California, 1986–1991

Species	No. nests	Nesting regularity	Nesting season (hatch–fledge)	Nesting habitat ^a
Black-crowned Night-Heron (<i>Nycticorax nycticorax</i>)	± 10	annual	April–June	RM (C)
Yellow-crowned Night-Heron (<i>Nyctanassa violacea</i>)	± 30	annual	March–May	BM (H)
Green Heron (<i>Butorides striatus</i>)	1–2	1988, 1989	May–June	BM (L)
Tricolored Heron (<i>Egretta tricolor</i>)	1	1988	May–June	BM (VH)
Little Blue Heron (<i>Egretta caerulea</i>)	1+	1988, 1993	May–June	BM (VH)
Reddish Egret (<i>Egretta rufescens</i>)	2	1988	May–June	BM (VH)
Snowy Egret (<i>Egretta thula</i>)	10–15	1988, 1989	April–June	BM (VH)
Cattle Egret ^b (<i>Bubulcus ibis</i>)	± 60	annual	April–June	BM (H)
Great Egret (<i>Casmerodius albus</i>)	2	1989	April–June	WM (VH)
Great Blue Heron ^c (<i>Ardea herodias</i>)	± 15	annual	January–June	RM (VH)

^aRM, Red Mangrove; BM, Black Mangrove; WM, White Mangrove; L, low; C, center; H, high; VH, very high.

^bIn 1993, this species moved to a location 500 m northeast.

^cThis species breeds regularly throughout La Paz Bay (see text). We estimate the entire nesting population in the bay at about 50 pairs.

numbers in 1989: La Lobera, 6 nests; La Gallina, 25 nests; El Gallo, 20 nests; La Ballena, 25 nests. We also observed 20 nests on El Merito in 1993. The eggs are laid in March, hatch about a month later, and chicks are able to fly after eight weeks (Carmona and Zárate 1992, Carmona 1993). The nests within the colonies of La Paz Bay are scattered (Carmona and Zárate 1992), as has been observed in the Yellow-footed Gull colonies of the central Gulf of California (Hand 1980, Hand et al. 1981). It seems that this scattered pattern is necessitated by thermal regulation (Hand 1980, Hand et al. 1981, Carmona 1993).

Velarde and Anderson (1993) reported 1200 nests only for Espiritu Santo Island alone, but this was a typographic error; in fact, the number should be 120 nests (D. Anderson pers. comm.).

Least Tern (*Sterna antillarum*). From 1985 to 1987 an important colony (>100 pairs) settled on Las Afeguas (Palacios 1988). Other small colonies (one to ten nests) have been found within the Ensenda de La Paz (Palacios 1988, Mendoza 1994). From 1989 to 1992 pairs tried to nest on Las Afeguas, but reproduction failed in all those years: 1989, 80–90 nests; 1990, 15–20 nests; 1991, 40–50 nests; 1992, less than 10 nests (Mendoza 1994). According to Mendoza (1994) the causes of failure

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were human disturbance, depredation, and tide inundations. This species nests from May to July.

Osprey (*Pandion haliaetus*). Ospreys have nested on Espiritu Santo Island at least since 1984, with 3 nests in 1984, 11 nests in 1985, 22 nests in 1986, and 6 nests in 1988. One nest was recorded on La Ballena in 1984 and 1985. One nest was observed along the west coast of the bay in 1985 and 1986. Even though the total number of nests in the bay has fluctuated, at least two nests have always been active.

DISCUSSION

Although the number of species of waterbirds breeding in this area is relatively high, the populations are low in comparison to those of other areas of the Gulf of California. Concomitantly, although Zeitzschel (1969) and Alvarez-Borrego (1983) reported a high productivity for the Gulf, La Paz Bay is one of the poorest areas in it (Anonymous 1988). The most abundant nesting species in the bay are the Black Storm-Petrel, Least Storm-Petrel, Brown Pelican, and Yellow-footed Gull.

Regarding the Yellow-footed Gull, Everett and Anderson (1991) reported "several" colonies of less than 100 nests on Espiritu Santo Island, whereas our observations indicate 150 nests of this species at the most for all of La Paz Bay (Carmona and Zárate 1992). Moreover, Velarde and Anderson (1993) reported both the Blue-footed (22 nests) and Brown Boobies (20 nests), we have observed only the Blue-footed Booby nesting, in numbers much smaller (maximum two pairs).

Reduced success or failure of breeding seabirds during "El Niño" conditions is well known, especially for species that feed on pelagic fish such as sardine, anchovy, and mackerel (Valdivia 1978, Schreiber and Schreiber 1984). Our data exemplify this pattern as well: Brown Pelicans failed to nest and Great Blue Herons had no success in La Paz Bay in 1992, an "El Niño" year. The numbers, species, and success of the waterbirds nesting in La Paz Bay are highly variable from year to year, however, even in years of normal oceanographic conditions. Most of the waterbird populations of La Paz Bay are marginal in comparison to population centers elsewhere in the Gulf of California, and greater variability may be expected at such marginal sites. Also, human disturbance may be a factor in this area, the most important port in Baja California Sur.

Commercial and sport fishing, tourism, and general boat traffic are widespread throughout the bay. Since the waterbird colonies are so easily accessible, better protection of them is necessary, especially because they may also serve as tourist attractions. Continued monitoring of the colonies is essential to evaluating the impact of these human activities.

It seems that the populations of nesting waterbirds in La Paz Bay have fallen. A clear example is the Least Tern, reduced to only 10 nests in 1992. The growth of the city of La Paz has also contributed to this, destroying mangroves where ardeids had nested. Some fishermen have noticed a gradual decline of Yellow-footed Gull colonies, attributing this to the human consumption of eggs. All these factors urge a management plan for the area to control human effects on populations of birds.

SUMMARY

We surveyed the breeding waterbirds of La Paz, Baja California Sur, from 1979 to 1993. We recorded nesting by 17 species and discovered previously unreported colonies of the Black and Least Storm-Petrels on Isla La Lobera (just north of Isla Partida). The most abundant species was the Brown Pelican, up to 1200 pairs of which nested on Isla La Ballena, just west of Espíritu Santo Island. Two pairs of Heermann's Gull attempted nesting in 1990 on this island, a site previously unreported for this species. A colony of Least Terns at Las Afeguas on the east side of the Ensenada de La Paz, just west of the city of La Paz, failed repeatedly, essentially because of human disturbance.

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LITERATURE CITED

- Alvarez-Borrego, S. 1983. Gulf of California, in *Estuaries and Enclosed Seas* (C. B. H. Ketchum, ed.), pp. 427-449. Elsevier, Amsterdam.
- Anderson, D. W. 1983. The seabirds, in *Island Biogeography in the Sea of Cortez* (T. J. Case and M. L. Cody, eds.), pp. 246-264. Univ. Calif. Press, Berkeley.
- Anonymous. 1988. *Islas del Golfo de California*. Secretaria de Gobernación-Univ. Nacl. Autónoma Méx., México, D.F.
- Carmona, R., and Zárate, B. 1992. Biología reproductiva de la gaviota de patas amarillas (*Larus livens*), en Isla Gaviota, B.C.S., México. *Rev. Inv. Cient.* 3(1):11-22.
- Carmona, R. 1993. Reproducción y crecimiento de dos especies de gaviota, *Larus livens* y *L. occidentalis*, anidantes en Baja California Sur. Master's thesis, Inst. Politécnico Nacl., CICIMAR, La Paz.
- Everett, W. T., and Anderson, D. W. 1991. Status and conservation of the breeding seabirds on offshore Pacific islands of Baja California and the Gulf of California. *Int. Council Bird Preserv. Tech. Publ.* 11:115-139.
- Fernández, A. G. 1993. Importancia de la marisma de Chametla, Ensenada de La Paz, B.C.S., para la migración e internación del playerito occidental (*Calidris mauri*) (Charadriiformes: Scolopacidae). Thesis, Univ. Autónoma B. C. S., La Paz.
- Galindo, J. M. 1987. Estrategias de optimización y conducta alimenticia del tildillo de Wilson (*Charadrius wilsonia*) en la Ensenada de la Paz, B.C.S., México. Thesis, Univ. Nacl. Autónoma Méx., México, D.F.
- García, E., and Mosiño, P. A. 1969. Los climas de Baja California. *Inst. Geofis. Univ. Nacl. Autónoma Méx.*, México, D.F.
- Hand, L. J. 1980. Human disturbance in Western Gull *Larus occidentalis livens* colonies and possible amplification by intraspecific predation. *Biol. Conserv.* 18:59-63.

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- Hand, L. J., Hunt, G. L., and Warner, M. 1981. Thermal stress and predation: Influences on the structure of a gull colony and possibly on breeding distributions. *Condor* 83:193-203.
- Jiménez, C. C. 1989. Hábitos alimenticios, requerimiento energético y consumo alimenticio del pelicano café en la Bahía de la Paz, B.C.S., México. Thesis, Univ. Autónoma B. C. S., La Paz.
- Linas, J. G. 1986. Feeding behavior of the Willet (*Catoptrophorus semipalmatus*) in the inlet of La Paz, B.C.S., México. Program & Abstracts of the Pacific Seabird Group, La Paz, B.C.S., 10-14 Dec., p. 36.
- Linas, J. G., and Galindo, J. J. 1990. Algunos aspectos del comportamiento alimenticio del Zarapito *Catoptrophorus semipalmatus* (Scolopacidae), en la Ensenada de La Paz, B.C.S., México. *Southwestern Nat.* 35:237-240.
- Linas, J. G., Silva, E. A., and Salgado, R. M. 1989. Avifauna costera de dos esteros de la Bahía de La Paz, Baja California Sur, México. *Inv. Mar. CICIMAR* 4(1):93-103.
- Mendoza, S. R. 1983. Identificación, distribución y densidad de la avifauna marina en los manglares: Puerto Balandra, Enfermería y Zacatecas en la Bahía de La Paz, B.C.S., México. Thesis, Univ. Autónoma B. C. S., La Paz.
- Mendoza, S. R. 1994. Anidación del gallito marino californiano (*Sterna antillarum brownii*), y manejo de una de sus áreas de reproducción en la región de La Paz, B.C.S. Master's thesis, CICIMAR, Inst. Politécnico Nacl., México.
- Palacios, E. 1988. Requerimientos y hábitos reproductivos de la golondrina marina de California (*Sterna antillarum browni* Mearns, 1916) en la Ensenada de la Paz. Thesis, Univ. Autónoma B. C. S., La Paz.
- Roberts, N. C. 1989. Baja California Plant Field Guide. Natural History Publishing Co., La Jolla, CA.
- Schreiber, R. W., and Schreiber, E. A. 1984. Central Pacific seabirds and the El Niño Southern Oscillation: 1982 to 1983 perspectives. *Science* 225:175-176.
- Valdivia, J. E. 1978. The anchoveta and El Niño. *Rapp. Réunion. Cons. Int. Explor. Mer* 173:196-202.
- Velarde, E., and Anderson D. W. 1993. Conservation and management of seabird islands in the Gulf of California: Setbacks and successes. *Int. Council Bird Preserv. Tech. Publ.* 721-767.
- Zeitzschel, B. 1969. Primary productivity in the Gulf of California. *Marine Biol.* 3:201-207.

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