

AVIFAUNA OF THE WETLANDS OF BAJA CALIFORNIA, MÉXICO: CURRENT STATUS

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Abstract. Although Baja California has not experienced loss of wetlands comparable in magnitude to that in California, some habitat changes have provoked changes in the abundance and distribution of wetland avifauna. The Osprey population has increased in the Vizcaíno wetlands, but at least three species of egrets and herons, and American Oystercatcher have declined due to human disturbance. The Elegant Tern is missing at Laguna Ojo de Liebre, but there is a new colony at Delta del Río Colorado. Several species have expanded their range into Baja California and have established breeding colonies, e.g., Little Blue Heron, Laughing Gull, Caspian, Royal, Forster's and Gull-billed terns, and Black Skimmer. Both number and variety of breeding birds have increased in Laguna San Ignacio. At least 52 species of water-associated birds breed in the several habitats of the wetlands, including five endangered or threatened species. The northernmost breeding colony of the Magnificent Frigatebird is located in Bahía Magdalena. Migratory birds use the wetlands in large numbers; the biggest concentrations of shorebirds are found in two wetlands—Laguna Ojo de Liebre and Delta del Río Colorado. The lagoons of Baja California are the primary wintering grounds for Brant. Mangroves in the southern wetlands have recently been identified as wintering habitat for passerines. Threats to the wetlands are primarily from resort and industrial developments being planned by international companies. Conservation of these vital avian habitats is a matter of concern to all ornithologists.

Key Words: México; Baja California; coastal wetlands; marsh avifauna; endangered species; distribution; conservation.

The peninsula of Baja California, México extends 1600 km south from Tijuana to Cabo San Lucas. Its diverse natural habitats include richly vegetated deserts, riparian valleys, rugged mountain ranges and the magnificent coastal wetlands whose avifauna is our subject. Long insulated from disturbance and development by lack of roads, the wetlands were also out of reach to all but the hardiest ornithologists prior to the opening of the peninsula-long highway in 1974. Post-highway changes have been gradual but inexorable and today some of the major wetlands are under threat, particularly from tourist-oriented development. However, most are still in near-pristine condition, and presumably have not experienced the changes in bird use that have characterized California's wetlands. Unfortunately, numerical baseline data are sketchy, as early ornithologists reported species' presence and breeding information, but seldom numbers.

The first checklist of the birds of Baja California appeared in 1889 (Bryant 1889), and in the 1920s Bancroft (1927a, b) and Grinnell (1928) added extensively to the

scant literature. In 1987 Wilbur compiled an annotated checklist from the literature and from reliable field observers (Wilbur 1987); his bibliography was comprehensive and allows us to concentrate on data gathered subsequently. Recently there has been an accelerated interest in documenting numbers and species in Baja California, and much of the information presented here has not been published heretofore. Scientific names of species are given in Table 1.

The first attempt at estimating numbers of birds in Baja California was in 1949 when the U.S. Fish and Wildlife Service (USFWS) added the peninsular lagoons to its aerial surveys of Mexican waterfowl (Sanders and Sanders 1981). Since 1974 the surveys have been a cooperative project with the Mexican government. Brant have received special attention and have been censused every year even when the all-México surveys were reduced to every 3rd year (U.S. Fish and Wildlife Service unpublished reports on winter waterfowl surveys of the Mexican West Coast and Baja California, 1954–1992, available from J. Voelzer, USFWS, Portland, OR).

In 1977 the Osprey population of west coast mainland México and Baja California was censused (Henny and Anderson 1979). The survey was repeated in 1992–1993 (C. Henny, pers. comm.).

The first attempt at obtaining numerical data on a marsh bird was the 1981 census of the Light-footed Clapper Rail in the two northern wetlands, Estero de Punta Banda and Bahía San Quintín (Zembal and Massey 1981). Four more censuses were done in 1986–1988 (available from R. Zembal, USFWS, 2730 Loker Ave West, Carlsbad, CA 92008).

Regular shorebird censusing of the northern estuaries was begun in 1989 as part of the Point Reyes Bird Observatory (PRBO) Pacific Flyway Project in cooperation with *pro esteros*, a bi-national, non-profit group dedicated to protection of Baja California's wetlands and Centro de Investigación Científica y de Educación Superior de Ensenada, B.C. (CICESE), a Mexican research and teaching institution. Comprehensive counts have been done 2–3 times a year at the northern estuaries since 1989 (Page et al. 1992); in 1991 and 1992 all of the other major wetlands were visited by members of the above organizations, and numbers of wintering and breeding birds documented. Additional information on Ensenada de La Paz and Isla Margarita in Bahía Magdalena has come from studies by students at Universidad Autónoma de Baja California Sur (UABCS).

In 1992 the Canadian Wildlife Service (CWS) began a Mexican Shorebird Atlas Project in conjunction with the Mexican government. Estimates of wintering shorebird numbers in western México were made by aerial survey in early 1992, the first of a 3-yr series (Morrison et al. 1992).

All of the large estuaries in Baja California host thousands of migrating and wintering shorebirds and waterfowl. They also provide breeding habitat for raptors, rails, terns, gulls, cormorants, pelicans, frigatebirds, herons, egrets, shorebirds, and several passerines.

THE WETLANDS

Figure 1 shows the locations of the major wetlands; most are complexes of marshes with connecting waterways. We will focus on the seven largest: 1) Estero de Punta Banda, 2) Bahía San Quintín complex, 3) Ojo de Liebre complex, 4) Laguna San Ignacio complex, 5) Bahía Magdalena complex, 6) Ensenada de La Paz and 7) Delta del Río Colorado.

Small saltmarshes on the west coast not dealt with here are La Salina, La Misión, San Antonio del Mar, and San Gregorio. Laguna Percebú, a 5 km long, narrow saltmarsh on the northeast coast deserves special mention as it hosts many breeding birds including Wilson's Plover and California Least Tern (see Table 1). Freshwater marshes are extremely rare on the peninsula; examples are La Lagunita Formex-Ibarra in Ensenada, La Bocana de Santo Domingo, El Rosario, San Ignacio, Estero de San José del Cabo, La Poza de Todos Santos and Mulegé. Others are without names and known only to local residents, e.g., a series of ponds several kilometers inland from Puerto Lopez Mateos.

Estero de Punta Banda

Area: 2100 ha. A description of this northernmost estuary can be found in Ibarra-Obando (1990). Thousands of shorebirds winter here, the most important numerically is the Marbled Godwit (Palacios et al. 1991). Many species of wintering waterfowl have been documented; American Wigeon is the most numerous, numbering in the thousands (E. Palacios, pers. obs.). The California Least Tern and Light-footed Clapper Rail (U.S. and México endangered species), Snowy Plover (U.S. threatened species), and Belding's Savannah Sparrow (California endangered species) breed here.

Bahía de San Quintín complex

Area: 12,060 ha. Descriptions are given in Ibarra-Obando (1990) and Palacios and Alfaro (1991). Vast eel grass beds (*Zostera*

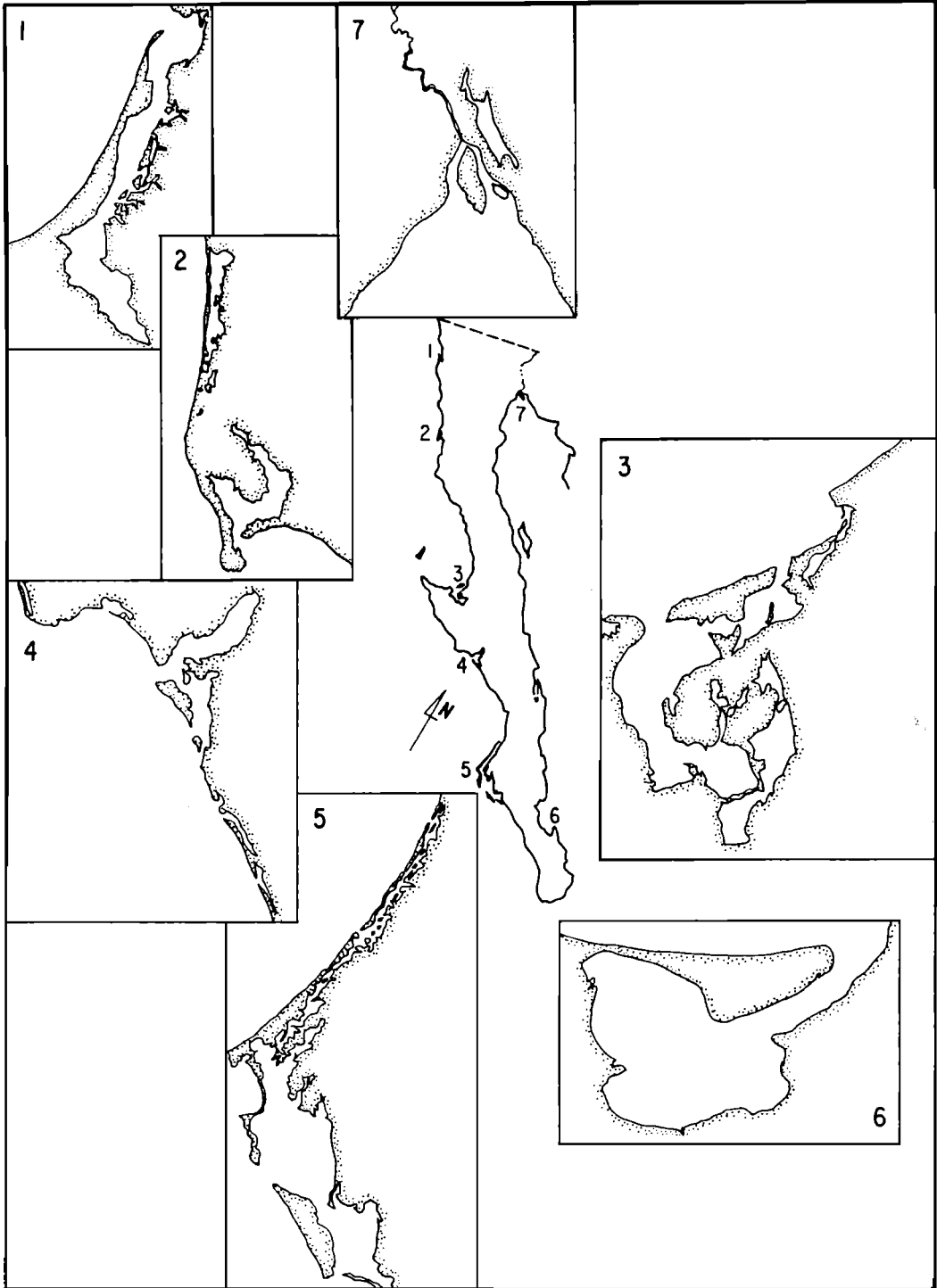


FIGURE 1. The peninsula of Baja California, México, showing locations of the major wetlands. 1) Estero de Punta Banda; 2) Bahía San Quintín complex (north to south—Laguna Figueroa, Bahía San Quintín); 3) Ojo de Liebre complex (Laguna Manuela, Guerrero Negro, Ojo de Liebre); 4) Laguna San Ignacio complex (La Bocana, El Coyote, San Ignacio, Estero el Delgadito); 5) Bahía Magdalena complex (Laguna Santo Domingo, Bahía Magdalena, Bahía Almejas); 6) Ensenada de La Paz; and 7) Delta del Río Colorado.

marina) in the channels attract >20,000 Brant in winter. On recent winter surveys up to 27,000 shorebirds have been counted on the extensive mudflats (Page et al. 1992). The above-mentioned four threatened or endangered species of birds also nest here. Salt ponds along the coast just north of the bay also attract shorebirds.

Approximately 15 km north of Bahía de San Quintín but not connected to it is Laguna Figueroa, a hypersaline flat 20 km long that lies behind very tall dunes and has no ocean outlet. After winter storms it is covered with water and attracts thousands of shorebirds, particularly Western Sandpipers (L. Stenzel, pers. comm.). The Snowy Plover, Caspian Tern, Forster's Tern, and California Least Tern have nested here (Palacios and Alfaro 1991). In 1992, however, the local community diverted three rivers to impound water in the basin, and heavy winter rains created a lake up to two meters deep, transforming shorebird habitat into waterfowl habitat. The future of this area as breeding habitat is uncertain.

Ojo de Liebre complex

Three lagoons are included in this group: Laguna Manuela (600 ha), Guerrero Negro (2100 ha), and Ojo de Liebre (36,600 ha) (Contreras 1988). All empty into Bahía Vizcaíno, all have vast areas of saltmarsh, mudflat and extensive barrier beaches. Several small islands in Laguna Ojo de Liebre provide breeding habitat for raptors and seabirds. Double-crested Cormorant, Osprey, Peregrine Falcon, American Oystercatcher, Wilson's Plover, Western Gull, California Least Tern, and several species of herons and egrets breed on Isote La Piedra; Isla Concha has breeding colonies of Double-crested Cormorant, Osprey, Western Gull, Caspian Tern, Royal Tern, and several species of herons and egrets. On the southeast side of Laguna Ojo de Liebre a huge saltworks is divided into cells, most of which are hypersaline, but several cells (close to Ocho Bombas, where sea water is pumped into the system) provide habitat for inver-

tebrates and fish and thus for birds. Caspian and Royal terns nest on an island in one of the cells; California Least Terns breed in scattered colonies around another. Snowy Plovers nest on salt pans throughout the saltworks. Thousands of Red-necked and Wilson's phalaropes are present during July and August in the saltworks close to Ocho Bombas; thousands of Eared Grebes and hundreds of Red Phalaropes are present in winter (F. Heredia, pers. comm.). Over 270,000 shorebirds (Morrison et al. 1992) and >35,000 Brant (Conant et al. 1992) winter here.

Laguna San Ignacio complex

Several small esteros lie north and south of Laguna San Ignacio, which covers approximately 28,000 ha (Contreras 1988), and lies in a NE/SW direction with the ocean entrance on the south end (Fig. 1). This lagoon complex marks the northern limit of red mangrove (*Rhizophora mangle*), which begins to replace saltmarsh as one moves south and becomes the dominant plant in Bahía Magdalena (Roberts 1989). White Ibis, Little Blue Heron and other species of wading birds nest in the mangroves. Two islands provide nesting habitat for Brown Pelican, Double-crested Cormorant, Osprey, Reddish Egret, Caspian and Royal terns, Snowy Plover, American Oystercatcher and others (Danemann and Guzmán Poo 1992; E. Palacios and L. Alfaro, pers. obs.). The bay is a major wintering site for Brant (>33,000) (Conant et al. 1992) and shorebirds (32,000) (E. Palacios, pers. obs.).

Bahía Magdalena complex

This vast complex of bays, dunes, islands and mangrove stands extends 250 km along the southwestern shore of Baja California. A series of long, narrow dune islands protects it against the sea for most of its length, with ocean openings between them. At the south end is the mountainous, 40 km long Isla Santa Margarita. A mangrove lagoon

on its protected southwest side hosts the continent's northernmost breeding colony of Magnificent Frigatebirds. Brown Pelican and Brandt's Cormorant breed on Isla Santa Margarita in large numbers (Amador 1985, Everett and Anderson 1991); in winter their populations are further augmented by migrants. Other breeding birds in Bahía Magdalena are Double-crested Cormorant, several species of heron and egret, Snowy and Wilson's Plover, American Oystercatcher, and California Least Tern. A population of the Scrub Jay is resident in the mangroves (Pitelka 1951; M. Evans and S. Howell, pers. comm.; B. W. Massey, pers. obs.).

Ensenada de La Paz

This 4500 ha shallow lagoon is connected to Bahía de La Paz by a canal. Its mudflats, mangroves and recently created dredge-fill islands provide habitat diversity. Wilson's Plover, Yellow-footed Gull, California Least Tern and several species of heron and egret breed there. Brown Pelican, White Pelican, Yellow-footed Gull and a variety of shorebirds are abundant in winter (E. Palacios, pers. obs.).

Delta del Río Colorado

Once a vast wetland, the Colorado River delta (240,000 ha) has only a remnant stream emptying into the Gulf of California as the result of dams and water diversion along the river in both U.S. and México. There are, however, extensive mudflats at the land/gulf interface, which support >163,000 wintering shorebirds, principally small "peep" sandpipers (Morrison et al. 1992) and thousands of waterfowl, especially Pintail (Kramer and Migoya 1989). Estero Río Colorado and Marismas Nacionales on the mainland are the first sites in México to be designated reserves in the Western Hemisphere Shorbird Reserve Network. Isla Montague, a low, flat and sparsely vegetated island at the mouth of the delta, provides breeding habitat for herons and seabirds, including the California Least Tern (Palacios and Mellink 1992).

AVIFAUNA

The coastal wetland avifauna of Baja California is dominated, at least numerically, by large numbers of Anseriformes, Ciconiiformes, and Charadriiformes. Only at Bahía Magdalena is the dominant avifauna Pelecaniformes. At all sites, avian populations increase considerably in winter, when large numbers of waterfowl and shorebirds congregate to feed and rest in such areas.

Table 1 is a checklist of the birds of Baja California's wetlands as of January 1993, which includes all species seen within the past five years. Sources are recent publications (Danemann and Guzmán Poo 1992; Erickson 1992; Everett and Anderson 1991; Howell and Webb 1992, 1993; Morrison et al. 1992; Page et al. 1992; Palacios and Alfaro 1991, 1992a, b; Palacios et al. 1991; Palacios and Mellink 1992) and the observations of Lucía Alfaro, Edgar Amador, Jose Angel Sánchez, Michael Evans, Salvador González, Fernando Heredia, Steve Howell, Barbara Massey, Renato Mendoza, Leopoldo Moreno, Eduardo Palacios and Lynne Stenzel.

Breeding birds are designated by an asterisk and only recently documented breeding (since 1985) is acknowledged; several species that bred historically (e.g., Virginia Rail, Sora, and Common Yellowthroat) have no recent documentation. There may also be omissions of casually-occurring species.

MIGRATORY BIRDS

Although the USFWS census of wintering waterfowl in México has included Baja California's wetlands for the past 40 years, the principal surveyors state that an aerial survey done every few years at different tide levels and under various weather conditions gives results far too variable to show statistically analyzable changes (James Voelzer, Bruce Conant, pers. comm.). While changes in waterfowl numbers may be undocumented, survey data show that most waterfowl winter in the wetlands of mainland México rather than in Baja California, with the exception of Brant (Conant et al. 1992).

TABLE 1. CHECKLIST OF BIRDS OF THE BAJA CALIFORNIA WETLANDS

Scientific name	Common name	Where found†
<i>Gavia stellata</i>	Red-throated Loon	1
<i>Gavia pacifica</i>	Pacific Loon	2, 5
<i>Gavia immer</i>	Common Loon	1-3, 5
<i>Tachybaptus dominicus*</i>	Least Grebe	10*
<i>Podilymbus podiceps*</i>	Pied-billed Grebe	1, 2, 6, 10*
<i>Podiceps auritus</i>	Horned Grebe	2
<i>Podiceps nigricollis</i>	Eared Grebe	1-8, 10
<i>Aechmophorus occidentalis</i>	Western Grebe	1-7, 10
<i>Aechmophorus clarkii</i>	Clark's Grebe	2, 3, 5, 10
<i>Fulmarus glacialis</i>	Northern Fulmar	1-3
<i>Sula dactylatra</i>	Masked Booby	5, 6
<i>Sula nebouxii</i>	Blue-footed Booby	5, 6
<i>Sula leucogaster</i>	Brown Booby	6
<i>Pelecanus erythrorhynchos</i>	White Pelican	1, 3-7
<i>Pelecanus occidentalis*</i>	Brown Pelican	1-3, 4*, 5*, 6-10
<i>Phalacrocorax auritus*</i>	Double-crested Cormorant	1, 2, (3-5)*, 6, 7, 10
<i>Phalacrocorax penicillatus*</i>	Brandt's Cormorant	1, 3, 4, 5*, 6, 7, 10
<i>Fregata magnificens*</i>	Magnificent Frigatebird	4, 5*, 6, 8, 10
<i>Botaurus lentiginosus*</i>	American Bittern	2, 4
<i>Ixobrychus exilis*</i>	Least Bittern	4, 7*
<i>Ardea herodias*</i>	Great Blue Heron	1, 2, (3-5)*, (7-9)*, 10
<i>Casmerodius albus*</i>	Great Egret	1, 2, (3-6)*, 10
<i>Egretta thula*</i>	Snowy Egret	1, 2, (3-7)*, 8-10
<i>Egretta caerulea*</i>	Little Blue Heron	1-3, 4*, 5*, 6, 10
<i>Egretta tricolor*</i>	Tricolored Heron	1, 2, (3-6)*, 8
<i>Egretta rufescens*</i>	Reddish Egret	2, (3-6)*, 8
<i>Bubulcus ibis*</i>	Cattle Egret	1, 2, 5, 6*, 7*, 10
<i>Butorides virescens*</i>	Green Heron	1, (4-7)*, 9*
<i>Nycticorax nycticorax*</i>	Black-crowned Night-Heron	1, 2, (3-7)*
<i>Nycticorax violaceus*</i>	Yellow-crowned Night-Heron	(3-6)*
<i>Eudocimus albus*</i>	White Ibis	(4-6)*
<i>Plegadis chihi</i>	White-faced Ibis	6, 10
<i>Mycteria americana</i>	Wood Stork	6
<i>Anser albifrons</i>	Greater White-fronted Goose	1-4
<i>Anser caerulescens</i>	Snow Goose	1, 2, 10
<i>Branta bernicla</i>	Brant	1-5, 8
<i>Branta canadensis</i>	Canada Goose	1
<i>Anas platyrhynchos</i>	Mallard	1-3, 6, 9, 10
<i>Anas acuta</i>	Northern Pintail	1-7, 10
<i>Anas discors</i>	Blue-winged Teal	1, 2
<i>Anas cyanoptera</i>	Cinnamon Teal	1-3, 5, 6, 9, 10
<i>Anas clypeata</i>	Northern Shoveler	1-3, 5, 6, 9, 10
<i>Anas strepera</i>	Gadwall	1-3, 5
<i>Anas americana</i>	American Wigeon	1-4, 9
<i>Aythya valisineria</i>	Canvasback	1-4
<i>Aythya americana</i>	Redhead	1-5, 10
<i>Aythya collaris</i>	Ring-necked Duck	1-4, 10
<i>Aythya marila</i>	Greater Scaup	1-4, 6, 10
<i>Aythya affinis</i>	Lesser Scaup	1-5, 6, 10
<i>Melanitta nigra</i>	Black Scoter	1, 2
<i>Melanitta perspicillata</i>	Surf Scoter	1-5
<i>Melanitta fusca</i>	White-winged Scoter	1-4
<i>Bucephala albeola</i>	Bufflehead	1-6, 10
<i>Mergus merganser</i>	Common Merganser	4, 5
<i>Mergus serrator</i>	Red-breasted Merganser	1-8, 10
<i>Oxyura jamaicensis*</i>	Ruddy Duck	1-6, 9, 10*
<i>Cathartes aura</i>	Turkey Vulture	1-10
<i>Pandion haliaetus*</i>	Osprey	1-10 (3, 4, 5, 6, 8)*
<i>Elanus leucurus</i>	White-tailed Kite	1, 2, 5
<i>Haliaeetus leucocephalus*</i>	Bald Eagle	5*
<i>Circus cyaneus</i>	Northern Harrier	1-4, 9

TABLE 1. CONTINUED

Scientific name	Common name	Where found†
<i>Buteo regalis</i>	Ferruginous Hawk	1–3
<i>Falco sparverius</i>	American Kestrel	1, 2, 5, 6, 9
<i>Falco columbarius</i>	Merlin	1, 6
<i>Falco peregrinus*</i>	Peregrine Falcon	1, 2, 3*, 4*, 5, 6, 9, 10
<i>Laterallus jamaicensis</i>	Black Rail	2
<i>Rallus longirostris*</i>	Clapper Rail	(1–9)*
<i>Rallus limicola</i>	Virginia Rail	1, 2, 4, 7
<i>Porzana carolina</i>	Sora	2, 5, 7, 10
<i>Gallinula chloropus*</i>	Common Moorhen	7*, 10*
<i>Fulica americana*</i>	American Coot	2, 3, 6, 7*, 9, 10*
<i>Pluvialis squatarola</i>	Black-bellied Plover	1–10
<i>Charadrius alexandrinus*</i>	Snowy Plover	(1–5)*, 6, 7, 9*, 10
<i>Charadrius wilsonia*</i>	Wilson's Plover	1, 2, (3–6)*, 8*, 9*, 10
<i>Charadrius semipalmatus</i>	Semi-palmated Plover	(1–10)*
<i>Charadrius vociferus*</i>	Killdeer	1–10
<i>Charadrius montanus</i>	Mountain Plover	1, 2
<i>Haemotopus palliatus*</i>	American Oystercatcher	(3–6)*
<i>Haemotopus bachmani*</i>	Black Oystercatcher	1, 2, 3*, 4*
<i>Himantopus mexicanus*</i>	Black-necked Stilt	1, 2*, 3–6, 7*, 8, 9*, 10
<i>Recurvirostra americana*</i>	American Avocet	1, 2*, 3–6, 7*, 8, 9*
<i>Tringa melanoleuca</i>	Greater Yellowlegs	1–10
<i>Tringa flavipes</i>	Lesser Yellowlegs	1–10
<i>Catoptrophorus semipalmatus</i>	Willet	1–10
<i>Heteroscelus incanus</i>	Wandering Tattler	1–6, 10
<i>Actitis macularia</i>	Spotted Sandpiper	1–6, 9, 10
<i>Numenius phaeopus</i>	Whimbrel	1–10
<i>Numenius americanus</i>	Long-billed Curlew	1–10
<i>Limosa fedoa</i>	Marbled Godwit	1–10
<i>Arenaria interpres</i>	Ruddy Turnstone	1–10
<i>Arenaria melanocephala</i>	Black Turnstone	1–5, 6, 10
<i>Calidris canutus</i>	Red Knot	1, 2, 5
<i>Calidris alba</i>	Sanderling	1–10
<i>Calidris mauri</i>	Western Sandpiper	1–10
<i>Calidris minutilla</i>	Least Sandpiper	1–10
<i>Calidris bairdii</i>	Baird's Sandpiper	3
<i>Calidris melanotos</i>	Pectoral Sandpiper	1, 2
<i>Calidris alpina</i>	Dunlin	1–10
<i>Limnodromus griseus</i>	Short-billed Dowitcher	1–10
<i>Limnodromus scolopaceus</i>	Long-billed Dowitcher	1–10
<i>Phalaropus tricolor</i>	Wilson's Phalarope	1–3
<i>Phalaropus lobatus</i>	Red-necked Phalarope	1–3
<i>Phalaropus fulicaria</i>	Red Phalarope	1–10
<i>Larus atricilla*</i>	Laughing Gull	3, 5, 6, 7*, 8, 10
<i>Larus philadelphia</i>	Bonaparte's Gull	1–6, 10
<i>Larus heermanni</i>	Heermann's Gull	1–10
<i>Larus canus</i>	Mew Gull	1
<i>Larus delawarensis</i>	Ringed-billed Gull	1–10
<i>Larus californicus</i>	California Gull	1–6, 10
<i>Larus argentatus</i>	Herring Gull	1–3, 5
<i>Larus thayeri</i>	Thayer's Gull	1–3
<i>Larus livens*</i>	Yellow-footed Gull	4, 5, 6*, 10
<i>Larus occidentalis*</i>	Western Gull	1, 2, (3–5)*
<i>Larus glaucescens</i>	Glaucous-winged Gull	1
<i>Larus hyperboreus</i>	Glaucous Gull	1, 5
<i>Xema sabini</i>	Sabine's Gull	4, 10
<i>Sterna nilotica*</i>	Gull-billed Tern	7*, 8
<i>Sterna caspia*</i>	Caspian Tern	1, (2–4)*, 5–10
<i>Sterna maxima*</i>	Royal Tern	1, 2, 3*, 4*, 5, 6, 7*, 8–10
<i>Sterna elegans*</i>	Elegant Tern	1–6, 7*, 8–10
<i>Sterna hirundo</i>	Common Tern	10
<i>Sterna forsteri*</i>	Forster's Tern	1, 2*, 3–10

TABLE 1. CONTINUED

Scientific name	Common name	Where found†
<i>Sterna antillarum</i> *	Least Tern	(1-10)*
<i>Chlidonias niger</i>	Black Tern	1, 3
<i>Rynchops niger</i> *	Black Skimmer	1-4, 6, 7*
<i>Zenaida asiatica</i> *	White-winged Dove	6*, 10
<i>Zenaida macroura</i> *	Mourning Dove	6*, 9, 10
<i>Athene cunicularia</i> *	Burrowing Owl	(1-7)*
<i>Asio flammeus</i>	Short-eared Owl	1, 2
<i>Chordeiles acutipennis</i> *	Lesser Nighthawk	6*
<i>Ceryle alcyon</i>	Belted Kingfisher	1-6, 10
<i>Eremophila alpestris</i> *	Horned Lark	(1-4)*
<i>Aphelocoma coerulescens</i> *	Scrub Jay	5*
<i>Corvus corax</i>	Common Raven	1-10
<i>Anthus rufescens</i>	American Pipit	1-4
<i>Lanius ludovicianus</i>	Loggerhead Shrike	2-6
<i>Dendroica petechia</i> *	Yellow (Mangrove) Warbler	(4-6)*
<i>Geothlypis trichas</i>	Common Yellowthroat	2, 10
<i>Geothlypis beldingi</i>	Belding's Yellowthroat	10
<i>Passerculus sandwichensis</i> *	Savannah Sparrow	(1-6)*

* Denotes recently documented breeding.

† Numbers in this column refer to the wetlands described in the section WETLANDS. Locations 1-7 are shown in Figure 1; locations 8-10 are noted in the text but not shown in the figure. 1 = Estero de Punta Banda, 2 = Bahía San Quintín complex, 3 = Laguna Ojo de Liebre complex, 4 = San Ignacio complex, 5 = Bahía Magdalena complex, 6 = Ensenada de La Paz, 7 = Delta del Río Colorado, 8 = Laguna Percebé, 9 = Small saltmarshes, 10 = freshwater ponds/marshes.

Brant receive special attention, as they winter almost exclusively on the Pacific coast of the U.S. and México. In 1952 an inventory that accounted for approximately 90% of the population showed that two-thirds of the birds were in Baja California, the rest in the U.S., mainly in the bays of California (Sanders and Sanders 1981); there were none on the Mexican mainland. In 1958 Brant were first seen in the wetlands of Sonora-Sinaloa and by 1990 represented 15% of the total in México (Conant et al. 1990). The California population declined concurrently as coastal wetlands were lost to development, and in 1990 85% of the total population was wintering in México, primarily in the Baja California lagoons. Brant numbers have shown wide fluctuations over the past 20 years, but "declines" were regularly followed by "recoveries," and in 13 of the 20 years the numbers were between 100,000 and 130,000 (USFWS winter waterfowl surveys of México).

Baja California's coastal wetlands are major wintering sites for shorebirds. Combining recent counts from three different sources, we estimate that 510,000 individuals winter in the wetlands of the peninsula

(Morrison et al. 1992; Page et al. 1992; E. Palacios, pers. obs.). The first Canadian Wildlife Service aerial survey in 1992, which covered the west coast of mainland México and Baja California, documented the importance of the peninsular wetlands for shorebirds. The combined count at Laguna Ojo de Liebre complex and Delta del Río Colorado (434,000) was more than half of the total number (800,000) seen on the survey (Morrison et al. 1992).

The mangrove stands in the southern wetlands host many wintering passerines that nest in North America. The importance of this habitat throughout México has only been recognized recently (S. Howell, pers. comm.). Species seen in the mangroves at Bahía Magdalena are Solitary Vireo, Orange-crowned Warbler, Yellow-rumped Warbler, Black-and-white Warbler, Ovenbird, Northern Waterthrush, Painted Bunting, and Black-throated Sparrow (Amador 1985; M. Evans, S. Howell, pers. obs.).

BREEDING BIRDS

Fifty two species of birds now breed in the coastal wetlands of Baja California (Table 1). Six species, previously undocu-

TABLE 2. ESTIMATED NUMBER OF PAIRS OF BIRDS BREEDING IN THE BAJA CALIFORNIA WETLANDS, 1985–1992

	Number of pairs in the wetlands						
	EPB*	BSQ	LOL	LSI	BM	ELP	DRC
Brown Pelican				1100	3000		
Double-crested Cormorant			3500	500	250		
Brandt's Cormorant					300		
Magnificent Frigatebird					20,000		
Great Blue Heron			5	12	<10	30	5
Great Egret			3	1			
Snowy Egret			20	68			100
Little Blue Heron				152	20		
Tricolored Heron			17	54		30	
Reddish Egret			50	95			
Cattle Egret						25	
Green Heron				20		10	
Black-crowned Night-Heron			50	30			20
Yellow-crowned Night-Heron				>4		>100	
White Ibis				50	20	5	
Osprey			76	146	12	3	
Bald Eagle					5		
Peregrine Falcon			6	2			
Clapper Rail	250	500					
Snowy Plover	30	>160	>190	>180	>45	1	
American Oystercatcher			28	30	20	6	
Laughing Gull							100
Yellow-footed Gull						25	
Western Gull			355	40	400		
Gull-billed Tern						200	
Caspian Tern		10	160	150			
Royal Tern			500	350			275
Elegant Tern							275
Forster's Tern		30					
California Least Tern†	90	97	>60	>30	30	150	20
Black Skimmer							250

* Abbreviations of the wetlands: EPB = Estero de Punta Banda, BSQ = Bahía San Quintín, LOL = Laguna Ojo de Liebre, LSI = Laguna San Ignacio, BM = Bahía Magdalena, ELP = Ensenada de La Paz, DRC = Delta del Río Colorado.

† California Least Terns also nested at Laguna Percebutú (46–76 prs).

mented, have well established breeding colonies: Little Blue Heron, Cattle Egret, Laughing Gull, Gull-billed Tern, Forster's Tern and Black Skimmer. Table 2 shows the number of pairs and locations of all nesting species documented since 1985. Brandt's Cormorant was formerly known to breed only on offshore islands; there are now several small colonies (50–100 pairs each) on Santa Margarita Island in Bahía Magdalena (Amador 1985; E. Palacios, pers. obs.). The range of the Elegant Tern also appears to be shifting. Early in the century a few pairs were reported nesting in Laguna Ojo de Liebre (Bancroft 1927a), but there has been no recent nesting there. A new colony has recently formed on Isla Montague in the Colorado River Delta (Palacios and Mel-

link 1993). The bird's current status in the U.S. was recently summarized (Collins et al. 1991).

Two former breeding species, Northern Harrier and Sora, have not been documented recently; the harrier probably no longer nests in Baja California (Pete Bloom, pers. comm.); the Sora is presumably still present in freshwater marshes and has been overlooked. The uncommon Black Rail was a breeding bird in Bahía San Quintín in the 1920s (Wilbur 1987), but then not documented anywhere in Baja California until recently, when two or three individuals were heard calling in Bahía San Quintín in February 1991 (Erickson 1992). One endemic species, Belding's Yellowthroat, breeds exclusively in the freshwater marshes of the

TABLE 3. HABITAT PREFERENCES OF BREEDING BIRDS IN THE BAJA CALIFORNIA WETLANDS

	Beach- salt- flats	Salt- marsh vege- tation	Fresh- water marsh veg.	Man- groves	Is- lands
Least Grebe			X		
Pied-billed Grebe			X		
Brown Pelican†					X
Double-crested Cormorant†				X	X
Brandt's Cormorant†					X
Magnificent Frigatebird†				X	X
American Bittern			X		
Least Bittern			X		
Great Blue Heron				X	X
Great Egret				X	X
Snowy Egret				X	X
Little Blue Heron				X	
Tri-colored Heron				X	X
Reddish Egret				X	X
Cattle Egret				X	
Green Heron				X	X
Black-crowned Night- Heron				X	X
Yellow-crowned Night- Heron				X	X
White Ibis				X	
Ruddy Duck			X		
Osprey					X
Bald Eagle					X
Peregrine Falcon					X
Clapper Rail		X		X	
Common Moorhen			X		
American Coot			X		
Snowy Plover	X				X
Wilson's Plover	X				X
Killdeer	X				
American Oystercatcher	X				X
Black Oystercatcher	X				X
Black-necked Stilt	X	X			
American Avocet	X	X			
Laughing Gull†		X			
Yellow-footed Gull†					
Western Gull†					X
Gull-billed Tern†					X
Caspian Tern	X				X
Royal Tern†	X				X
Elegant Tern†	X				
Forster's Tern		X			X
Least Tern	X				
Black Skimmer	X				X
White-winged Dove				X	
Mourning Dove		X			
Burrowing Owl	X				
Lesser Nighthawk		X			
Horned Lark	X				
Scrub Jay				X	
Yellow (Mangrove) Warbler				X	
Belding's Yellowthroat			X		
Savannah Sparrow		X			

† Breeds only on islands in Baja California.

peninsula from Mulegé south (Howell and Webb 1992).

Breeding habitat in Baja California's wetlands generally falls into four categories: beaches and saltflats, saltmarsh vegetation, freshwater marsh vegetation, and mangrove stands. The islands in the lagoons often have several of these habitats; and some, e.g., Isla Ballena in Laguna San Ignacio, also have scrubby desert vegetation that provides nest sites for seabirds and wading birds. While some bird species are strictly island nesters, many others nest both on islands and the mainland, wherever there is suitable habitat. Table 3 categorizes the habitat preferences of the 52 breeding species.

DISCUSSION

Although Baja California has not experienced loss of wetlands comparable in magnitude to that documented for California, some habitat changes have occurred. The most altered wetland along Baja California's Pacific coast is Laguna Ojo de Liebre, site of the world's largest saltworks (20,000 ha). The area had previously been mostly saltmarsh and salt flats subject to periodic tidal inundation (Nelson 1921). The only preconstruction numerical baseline data are found in Bancroft (1927a) who estimated numbers of some of the breeding birds. The changes between 1927 and the present are: the American Oystercatcher declined from about 150 pairs in 1926 to 30 in 1991; the small Elegant Tern colony (6 pairs) is missing; the Snowy Egret decreased from > 100 to 20 pairs; the Tricolored Heron declined from >75 to about 20 pairs; the Black-crowned Night-Heron dropped from 100 to 50 pairs. Herons and egrets that used to nest in the marshes are now found nesting only on islands, mainly due to increased human disturbance by fishermen and tourists. The populations of other breeding species have remained stable (Caspian, Royal and Least terns, Western Gull) or increased (Osprey and Double-crested Cormorant). Double-crested Cormorant numbers in Laguna Ojo de Liebre rose from 80 pairs in 1926 (Ban-

croft 1927a) to 3500 in 1984 (J. A. Sánchez, pers. comm.).

It is impossible to quantify changes in numbers of most migratory species over the past century for lack of baseline data. Some may have experienced changes due to loss of breeding grounds (e.g., Marbled Godwit and Willet); others may have shifted to Baja California when wintering habitat elsewhere was lost (Brant).

One species that has been reasonably well tracked is the Osprey, particularly in the Vizcaíno wetlands (Laguna Ojo de Liebre complex, Laguna San Ignacio complex). In 1927 Bancroft found a "dozen or more nests" restricted to the islands in the Laguna Ojo de Liebre complex (Bancroft 1927a); Kenyon (1947) visited the islands in May of 1946 and found 27 occupied nests; Jehl (1977) estimated the lagoon population at 25 pairs in 1957, 30 pairs in 1970, and 20 pairs in 1971. During the 1970s the population began to increase. In 1977 the population estimate was 27 pairs for the islands and 50 pairs for the whole complex (Henny and Anderson 1979); in 1980 Castellanos (1982) reported 71 active nests; and in 1984 Salinas-Zavala et al. (1991) reported 76 breeding pairs.

While several factors may be involved in the increase in Osprey numbers, including reduction of DDT in the environment, a major factor was a reversal in attitude by local residents. Protection of the Osprey is now an accepted fact in Guerrero Negro. Ospreys are no longer shot by fishermen, and dozens of nesting poles have been erected in the town and on islands in the lagoons. In 1992, at least 15 of these towers were in use (L. Alfaro, M. Evans, B. Massey, E. Palacios, pers. obs.).

Although tourism and commercial fishing have increased in recent years in Laguna San Ignacio, so have the number and variety of breeding birds (Danemann and Guzmán Poo 1992). Colonies of Brown Pelicans (1100 breeding pairs), Double-crested Cormorants (500 pairs), Caspian Terns (150 pairs) and Royal Terns (350 pairs) have become

established on Isla Ballena, a site of little ornithological interest early in the century (Huey 1927).

Current plans to construct the world's largest solar salt evaporation pond system at Laguna San Ignacio (J. Bremer, pers. comm.) could increase the winter population size of several shorebird species in this area, since the plan calls mainly for the flooding of usually dry playa that has limited habitat value for shorebirds.

Several species have expanded their range into Baja California. The Black Skimmer has recently established nesting colonies in southern California, and at Isla Montague in Delta del Río Colorado, so nesting is likely also in Estero de Punta Banda and Bahía San Quintín, where the bird is a year-round resident (Palacios and Alfaro 1992b). The Cattle Egret is now found along the length of the peninsula and breeds at Ensenada de la Paz (E. Palacios, pers. obs.). The Pacific coast population of Caspian Terns has increased since the mid-1960s and they have colonized new nesting sites at Lagunas Figueroa and San Ignacio (Palacios and Alfaro 1992a). The Little Blue Heron colony in Laguna San Ignacio (150 pairs) is the first breeding record of this heron in Baja California, although it may also breed in the mangroves of Bahía Magdalena and Ensenada de La Paz.

The coastal wetlands of the peninsula lie within a transition zone between temperate and tropical climates, and draw species from both. The northern breeding limits of the Magnificent Frigatebird, Tricolored Heron, Reddish Egret, Yellow-crowned Night-Heron, White Ibis, Wilson's Plover and American Oystercatcher are found in Baja California (Table 1). On the Pacific coast, none of these species breeds north of the Ojo de Liebre Lagoon complex (28th parallel). Conversely, the peninsula is the southern end of the breeding range for Bald Eagle, Snowy Plover, Black Oystercatcher, American Avocet and Forster's Tern (Table 1).

The wetlands provide a portrait of California's coastal marshes as they were before

their wholesale damage and destruction. They offer an opportunity to observe the behavior and breeding biology of water-associated birds in unaltered marsh habitat, such as the endangered Light-footed Clapper Rail and Belding's Savannah Sparrow. Equally unchanged are the islands in the lagoons that provide breeding sites for a great variety of species. The California Least Tern and Snowy Plover nest on ocean-fronting beaches and other natural habitats; in only a few instances have Least Terns been found on dredge-spoil islands or other man-made habitats in Baja California. In 1991–1992 a survey documented over 500 pairs at 28 breeding sites throughout the peninsula (E. Palacios and L. Alfaro, pers. obs.).

The recent surge of field work has filled many gaps in our knowledge, but there is still much to be learned. Shorebird censuses are continuing under the Pacific Flyway Project, and a year-long study of shorebird use of Bahía San Quintín will add data on seasonality in that important wintering and migratory ground. The use of mangroves by breeding and wintering Ciconiiformes and wintering Passeriformes needs further documentation, as does the importance of the small, scattered freshwater marshes to birds restricted to such habitat, e.g., Belding's Yellowthroat.

Conservation of natural habitat has become an increasingly important issue under the present Mexican government and cooperative programs between U.S. and Mexican wildlife agencies are expanding. Enforcement of the law, creation of reserves, and protection of endangered species are in their infancy. For example, the vast Viscaíno Biosphere Reserve extends across the peninsula and includes lagunas San Ignacio and Ojo de Liebre, but it is as yet a reserve in name only, there is neither headquarters nor personnel to implement protection.

Tourist developments have impacted some wetlands and there are new projects in the planning stage. At Estero de Punta Banda a resort development has destroyed two thirds of the barrier beach since 1987

and is encroaching on the remainder. In Bahía Magdalena, a foreign construction company has bought 80,000 ha of land with the purpose of building a hotel, golf course, marina, and other recreational facilities. Industrial development is another threat. At Bahía San Quintín exploitation of the volcanic rock from the cinder cones is under consideration by foreign investors. A phosphoric rock extraction plant and a thermoelectric plant have been constructed and are operational in Bahía Magdalena; their impacts on the bay have not been assessed.

The wetlands of Baja California are an ecological treasure of international importance. Their integrity is of concern to all ornithologists. A cooperative international effort to insure their conservation is an imperative.

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