

## THE DISTRIBUTION AND STATUS OF ROYAL TERNS ON THE PACIFIC COAST OF SOUTHERN CALIFORNIA AND BAJA CALIFORNIA, MEXICO

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*Abstract.* In the early part of the 1900s non-breeding Royal Terns (*Thalasseus maximus*) were commonly found on the California coast, particularly in winter. By the 1950s their numbers had declined, along with populations of the Pacific sardine (*Sardinops sagax*). Today they are resident on the southern California coast and have bred there since 1959. The current breeding population is nearly 140 pairs and slowly increasing. On the Pacific coast of Baja California, Mexico, Royal Terns are also permanent residents and have bred in coastal wetlands since at least 1926. The recent breeding population in the Laguna San Ignacio and Laguna Ojo de Liebre wetland systems is between 1,300 and 3,500 pairs. Continued protection of colony sites from human disturbance and terrestrial predators, particularly in southern California, seem to be the most important factors for the continued increase in Royal Tern populations in this portion of their extensive range.

*Key Words:* Baja California, breeding distribution, California, Mexico, population size, *Thalasseus maximus*.

### DISTRIBUCIÓN Y STATUS DE LA GOLONDRINA MARINA REAL EN LA COSTA DEL PACIFICO DEL SUR DE CALIFORNIA Y BAJA CALIFORNIA, MEXICO

*Resumen.* A principios de los 1900s, los individuos no reproductivos de golondrinas marinas reales (*Thalasseus maximus*) eran comunes en la costa de California, particularmente en invierno. Hacia los 1950s sus números habían disminuido, junto con las poblaciones de la sardina Monterrey (*Sardinops sagax*). Ahora son residentes en la costa del sur de California y han anidado ahí desde 1959. La población reproductiva actual es 140 parejas pero esta aumentando gradualmente. En la costa del Pacífico de la península de Baja California, México, las golondrinas marinas reales también son residentes permanentes y se reproducen en lagunas costeras desde por lo menos 1926. La población reproductiva actual en los complejos lagunares de Laguna Ojo de Liebre y Laguna San Ignacio es de alrededor de 1,300-3,500 parejas. La protección continua de las colonias contra el disturbio humano y los depredadores terrestres, especialmente en el sur de California, parecen ser los factores más importantes para el aumento continuo de las poblaciones de la golondrina marina real en esta porción de su extenso intervalo de distribución.

The Royal Tern (*Thalasseus maximus*) is one of the most widespread of the seven species of crested terns. It is a common summer resident on the Atlantic and Gulf coasts of North America and resident in the Gulf of California and also breeds in coastal west Africa (Buckley and Buckley 2002). Royal Terns nest in dense clusters at colony sites (Buckley and Buckley 1977) in coastal locations where they forage on schooling fish in the marine environment (Buckley and Buckley 1972, 1974, 2002; Erwin 1977). Colony sizes range from only a few individuals intermixed with Sandwich (*Thalasseus sanduicensis*) or Elegant Terns (*Thalasseus elegans*) to colonies of 17,000 pairs (Buckley and Buckley 2002, Velarde et al. 2005, Mellink et al. 2007). Overall population trends are poorly known, with declines in some areas (Buckley and Buckley 2002). On a world-wide basis its population status is considered to be of moderate concern (Kushlan et al. 2002). Here we

review the history, current status, diet, and conservation of Royal Terns in the California Current system of southern California and the west coast of the Baja California peninsula. The status of Royal Terns in the Gulf of California has been reviewed elsewhere (Velarde et al. 2005, Mellink et al. 2007) and is not part of this analysis.

#### ROYAL TERNS IN BAJA CALIFORNIA

In Baja California, Royal Terns have long been considered to be fairly common to common on both coasts of the peninsula (Grinnell 1928, Wilbur 1987). The first documentation of their breeding on the Pacific side was in 1926 (Bancroft 1927a) at Scammons Lagoon (hereafter Laguna Ojo de Liebre) and again there in 1927 (Bancroft 1927b). Although records exist of Royal Terns along the coast of Baja California from Cabo San Lucas north to the Coronados

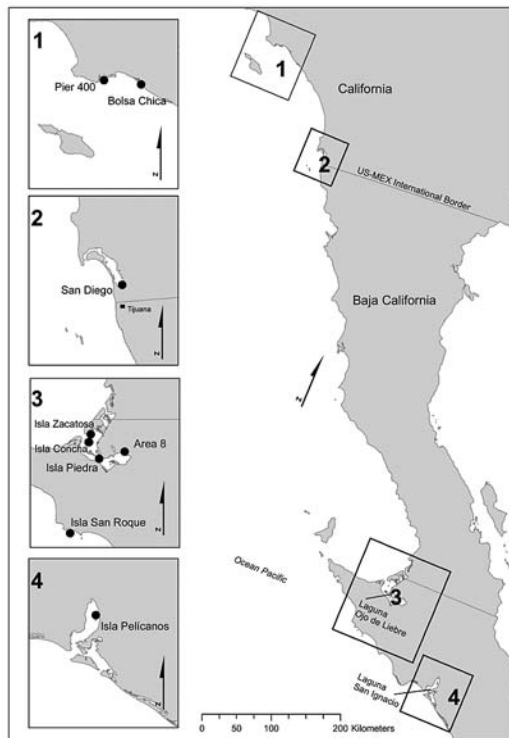


FIGURE 1. Locations of breeding colonies of Royal Terns on the Pacific coast of southern California and Baja California, Mexico.

Islands near the California border, in nearly all seasons (Grinnell 1928, Wilbur 1987), no further mention of breeding was made until 1946, when they were again reported breeding at Laguna Ojo de Liebre (Kenyon 1947).

In the early 1990s, Royal Terns were reported to be present in several coastal estuaries of Baja California and breeding in both the Laguna Ojo de Liebre and Laguna San Ignacio complexes (Massey and Palacios 1994). In Laguna Ojo de Liebre, Royal Terns have nested at four sites (Fig. 1). The oldest colony, on Isla Concha, first mentioned by Bancroft (1927a), has been utilized, perhaps regularly, up to 2007 (Table 1). Kenyon's report of 150 nests included terns nesting on both Isla Concha and on nearby Isla Zacatosa (K. W. Kenyon, unpubl. data). No Royal Tern nests were found on Isla Piedra in 1998 (Castellanos et al. 2001). However, by 2002 all Royal Terns had shifted their nesting from Isla Concha 16 km south to Isla Piedra with 1,845–3,500 nests having been reported between 2002 and 2005 with an estimated 1300 in 2007 (Table 1).

A fourth nesting site is on an islet in area 8 of the Guerrero Negro saltworks (Fig. 1). Royal

Terns were first reported nesting at this site in 1992 (Massey and Palacios 1994). It has been utilized regularly from 2003–2007 (Table 1). Since 1998 the number of Royal Terns breeding at the several sites in Laguna Ojo de Liebre has averaged 2,406 pairs (range 1,330–3,500).

In Laguna San Ignacio (Fig. 1), up to 350 pairs of Royal Terns have nested on Isla Pelicanos in recent years (Table 1). None were observed there in 1989 (Danemann and Guzman 1992) but 350 pairs were found nesting there in 1992 (Massey and Palacios 1994), 100 pairs (60 on nests) in 1998 (D. W. Anderson, unpubl. data), at least 200 pairs (150 on nests) in 1999 (D. W. Anderson, unpubl. data), and ca. 350 in 2004 (R. Mayoral, pers. comm.). Caspian Terns (*Hydroprogne caspia*) first colonized this site in the mid-1980s and were joined by Royal Terns in 1992. The earlier report of Royal Terns nesting there (Everett and Anderson 1991) was based on a misidentification of the nesting Caspian Terns (Palacios and Mellink 1993). No terns of either species were found nesting at this site in 2006 (G. Danemann, pers. comm.) with predation by coyotes (*Canis latrans*) thought to be the cause of desertion.

The nest site in Laguna San Ignacio is on an island largely divided into two sections by a tidal channel. This has been alternatively referred to as a single island, Isla Ballena (Danemann and Guzman 1992) or Islas Pelicano (Tejas et al. 1991). It has also been considered as two separate islands, Islas Ballenas, on some maps of the area (Crumpton 1991, 1997; Automobile Club of Southern California 1998, Baja Almanac Publishers 2003), in which case the northern of the two islands has also been called Isla Garzas and the southern island, the site of the Caspian and Royal Tern colonies, Isla Pelicanos (Crumpton 1991). We prefer the latter terminology and have adopted it here (Table 1).

Bancroft (1927a) also stated that Royal Terns were breeders on [Isla] San Roque and other islands to the south of Laguna Ojo de Liebre. No other documentation was presented. This report was subsequently mentioned, without further elaboration, by Grinnell (1928), Wilbur (1987) and Everett and Anderson (1991). Royal Terns have not bred on Isla San Roque for many years (Wolf 2002) presumably due to predation by feral cats (*Felis catus*). The recent eradication of these cats from Isla San Roque (Wolf et al. 2006) may encourage Royal Terns to again breed on this island.

In Baja California, it is hard to detect any trends in Royal Tern numbers because the reporting has been, until recent years, rather uneven with large information gaps in important time

TABLE 1. NUMBER OF NESTING PAIRS OF ROYAL TERNS AT BAJA CALIFORNIA, MEXICO, COLONIES. SEE TEXT FOR DESCRIPTION OF COLONY SITES.

Site	Year	Number of pairs	Source <sup>a</sup>
Laguna Ojo de Liebre			
Isla Concha (27°49'48"N, 114°14'06"W)			
	1926	present	1
	1927	present	2
	1946	150	3
	1980	400	4
	1992	400	5
	1998	2,762	4
	2007	30	16
Isla Piedra (27°42'18"N, 114°19'06"W)			
	2002	3,500	6
	2003	2,500	7
	2004	2,500	8
	2005	1,845	9
	2007	1,300	16
Guerrero Negro, area 8 (27°42'18"N, 113°58'07"W)			
	1975	0	10
	1992	100	5
	1996	99	11
	2002	0	6
	2003	42	7
	2004	400	8
	2005	135	9
	2007	100	16
Laguna San Ignacio			
Isla Pelicanos (26°55'N, 113°09'W)			
	1989	0	12
	1992	350	5
	1998	100	13
	1999	200	13
	2004	ca 350	14
	2006	0	15
	2007	20	16

<sup>a</sup> 1—Bancroft (1927a); 2—Bancroft (1927b); 3—Kenyon (1947, unpubl. data); 4—Castellanos et al. (2001); 5—Massey and Palacios (1994); 6—E. Palacios, E. Amador, and M. García (unpubl. data); 7—E. Palacios and E. Mellink (unpubl. data); 8—E. Amador (pers. comm.); 9—E. Palacios, E. Amador, and M. García (unpubl. data); 10—M. Evans (pers. comm.); 11—Danemann and Carmona (2000); 12—Danemann and Guzman (1992); 13—D. W. Anderson (pers. comm.); 14—R. Mayoral (pers. comm.); 15—G. Danemann (pers. comm.); 16—E. Palacios (pers. obs.).

periods. The number of Royal Terns breeding in Laguna Ojo de Liebre had increased in recent years but decreased in 2007. They colonized Laguna San Ignacio in 1992, but were extirpated from Isla San Roque and suffered breeding failure at Laguna San Ignacio in 2006.

#### ROYAL TERNS IN SOUTHERN CALIFORNIA

Royal Tern populations in California were substantially larger in the past, particularly in winter, when they ranged north to Tomales Bay, Marin County (Grinnell and Miller 1944). In the early part of the 1900s Royal Terns were the commonest large tern in coastal southern California (Unitt 1984) but this was followed by a sharp decline in their numbers, particularly after 1950 (Cogswell 1977); they are now rare in northern California (Stallcup 1990, Small 1994, Roberson 2002) and no breeding records exist for Royal Terns in northern California.

In southern California Royal Terns are commonly found in small numbers during the winter along the coast and throughout the Channel Islands (Howell 1917, Garrett and Dunn 1981, Small 1994) but are less common during the summer (Howell 1917, Unitt 1984, 2004. Wilbur (1987) suggested that there was a northward movement from further south in Baja California in the fall and winter although no direct evidence supports this. Royal Terns were first reported breeding in southern California in 1959 in south San Diego Bay (Gallop and Bailey 1960, Unitt 1984) but not subsequently until 1980 and 1982 at the same location (Schaffner 1985, Unitt 2004).

More recently, Royal Terns have also nested within the large clusters of Elegant Terns in the colonies at the Bolsa Chica State Ecological Reserve in Orange County beginning in 1988 (Collins et al. 1991) and Pier 400 in the Port of Los Angeles, Los Angeles County beginning in

1998 (K. Keane, pers. comm.). Since 1988, Royal Terns have bred annually at one or more of the following three man-made nesting sites (Fig. 1). In San Diego, Royal, Elegant, and Caspian Terns nest on the dikes of the salt evaporation ponds located in southern San Diego Bay. At Bolsa Chica they occupy one of two 1.7 ha sand islands established in 1978 as a nesting place for the endangered California Least Tern (*Sternula antillarum browni*; Collins et al. 1991). The Pier 400 site is one part of a newly established 40 ha sand-fill area of the Port of Los Angeles most of which is now fully developed as one of the busiest container cargo terminals on the west coast. The number of pairs of Royal Terns nesting at these sites has increased from <10 during 1988–1990 to >60 in 2005 and about 140 in 2007 (Table 2). This appears to be related largely to a high adult survival rate (>95%, Collins and Doherty 2006).

#### INTERCOLONY MOVEMENT

The Royal Terns of the Pacific coast of Mexico (including Baja California) and southern California have been included in a single geographical region (Buckley and Buckley 2002) but the interaction between more distant nesting sites in the Gulf of California and those on the Pacific coast has not been examined. As also true for Elegant Terns (Collins 2006) substantial year to year movement of Royal Terns occurs among the three southern California colonies as indicated by band sightings (Collins and Doherty, 2006). However, to date, no Royal Terns banded as chicks in southern California have been recovered in any of the colonies in either Baja California or the Gulf of California. The converse is also true. One color-banded Royal Tern, banded in Santa Maria Bay, Sinaloa,

Mexico in 2003, was observed and the band read, in Seal Beach, Orange County, California on 13 March 2005 among a newly arrived group of migrant Elegant Terns (C. T. Collins, unpubl. data); it was not seen subsequently at a local breeding colony.

Movement between colonies in Mexico and the colonies in southern California seems to be minimal based on existing data. This suggests that the Royal Terns in southern California form a distinct, albeit small, metapopulation separate from those in coastal western Baja California and the Gulf of California. The amount of interchange between colonies in the Gulf of California and colonies on the Pacific coast of Baja California is currently unknown.

#### NESTING ASSOCIATES OF ROYAL TERNS

It may be more than coincidental that in all of the Pacific coast colonies Royal and Elegant Terns are nesting in association with Caspian Terns (Bancroft 1927a; Unitt 1984, 2004; Collins et al. 1991, Massey and Palacios 1994, K. Keane, pers. comm.). Schaffner (1985) suggested that the less aggressive crested terns, including both Royal and Elegant Terns, require the presence of other more aggressive larids, such as Caspian Terns, for protection from potential predators. The colonization by Royal Terns of several of the sites considered here (Guerrero Negro area 8, Isla Pelicanos, San Diego, Bolsa Chica and Pier 400) was similarly preceded by the utilization of these sites by Caspian Terns. Thus, on the Pacific coast, prior establishment of a Caspian Tern colony may be both a social attraction and an anti-predator prerequisite for Royal and Elegant Terns to utilize new breeding sites. Other examples of such nesting associations would include Black Skimmers (*Rynchops niger*) nesting among the more aggressive Common Terns (*Sterna hirundo*) on the Atlantic coast as previously suggested by Erwin (1979).

#### FOOD AND FORAGING

The food of Royal Terns is predominantly fish, augmented by crustaceans, particularly shrimp (Buckley and Buckley 2002). Most foraging is in nearshore ocean waters with minimal utilization of bays, estuaries and tidal lagoons. The exact species composition of fish taken varies extensively from colony to colony (Buckley and Buckley 2002). In California, the mid-century decline of Royal Terns seemed to coincide with the decline in their major prey item, the Pacific sardine (*Sardinops sagax*; MacCall 1979, Schaffner 1985). Although sardine populations are now slowly increasing, currently the

TABLE 2. NUMBER OF NESTING PAIRS OF ROYAL TERNS IN SOUTHERN CALIFORNIA COLONIES. SEE TEXT FOR DESCRIPTION OF COLONY SITES.<sup>a</sup>

Year	San Diego	Bolsa Chica	Pier 400
1997	2	12	0
1998	0	0	17
1999	36	8	0
2000	2	0	0
2001	3	18	1
2002	1–3	1	5
2003	28–31	3	5
2004	38	2	10
2005	52	11	0
2006	35	ca 15	0
2007	109	30	0

<sup>a</sup> San Diego – R. Patton (pers. comm.); Bolsa Chica – C. T. Collins (unpubl. data); Pier 400 – C. T. Collins and K. Keane (unpubl. data). Coordinates: San Diego – 32°35'56"N, 117°06'02"W; Bolsa Chica – 33°41'44"N, 118°02'46"W; Pier 400 – 33°43'06"N, 118°14'52"W.

principal food item of both Royal and Elegant Terns foraging in the coastal waters is the northern anchovy (*Engraulis mordax*; Horn et al. 1994, 1996). The availability of this fish in the colder California Current waters can be greatly reduced by the warm-water incursions of recurring El Niño events. This in turn, would expectably have short-term impacts on the nesting success and population recruitment of Royal Terns in both southern California and Baja California. Several studies have documented such El Niño impacts on a variety of other seabirds in the California current system (Massey et al. 1992, Anderson et al. 1999, Hyrenbach and Veit 2003).

#### CONSERVATION CONCERNS

The availability of secure nesting areas is an important component of conservation programs for a number of nesting seabirds on the Pacific coast of southern California and Baja California. On the Atlantic coast, human intrusions and terrestrial predators are significant causes of breeding failures in Royal Terns (Buckley and Buckley 2002). All current Royal Tern colonies in Baja California are on sites inside a protected area, the El Vizcaino Biosphere Reserve which will limit, to some extent, human intrusions. Isla Concha, Isla Piedra, and Isla Pelicanos are naturally occurring island sites in core areas of the reserve. The islet in area 8 at Guerrero Negro is also a natural site, although located within a hypersaline cell of the saltworks. Normal environmental changes (e.g., wind and wave erosion of sand and shell nesting islands such as Isla Concha) may cause abandonment of some sites and colonization of new ones, such as Isla Piedra, within this wetland system. Predation may also play a role and seems to have recently caused the failure of the terns nesting in Laguna San Ignacio. Isla Piedra is also accessible to land predators, especially coyotes. In the late 1970s and early 1980s, coyotes frequently invaded Islas Piedra and Alambre and caused the abandonment of large waterbird colonies (Castellanos et al. 2001). Royal Terns were, at that time, still nesting on Isla Concha and were not impacted. Currently, no active management activities exist, including terrestrial predator control, which would benefit nesting egrets, gulls and terns at these sites in the reserve.

In southern California, two of the three Royal Tern nesting sites are in state or federally protected areas. Bolsa Chica is a state ecological reserve and the salt pond dikes in south San Diego Bay are part of the South San Diego Bay

Unit of the San Diego National Wildlife Refuge. Only at Pier 400 is a nesting site in jeopardy. The portion of this site utilized by the larger terns is immediately adjacent to a 6 ha area being managed for the endangered California Least Tern. In 2005 a nocturnal predation event at Pier 400 caused the Royal, Elegant, and Caspian Terns starting to nest there (eggs had been laid) to immediately abandon the site and largely relocate to Bolsa Chica. After its abandonment in 2005 much weedy vegetation grew up on the Pier 400 site. In 2006 and 2007 this site was not cleared of vegetation as had been done prior to previous nesting seasons. As result none of these larger terns nested there (K. Keane, pers. comm.). This portion of the Pier 400 site may soon be used for Port of Los Angeles activities and thus become permanently unavailable for future Royal Tern nesting. The adjacent portion utilized by California Least Terns will, however, remain as a protected and managed nesting site.

An extensive renovation of the Bolsa Chica wetlands, completed in 2006, included a new tidal basin and ocean entrance as well as an enlarged area for nesting terns and Black Skimmers. The degree of utilization of this new nesting area, as well as the increased foraging zone immediately adjacent to it, remains to be seen.

Despite its extensive geographic range, many populations of Royal Terns remain conspicuously unstudied (Buckley and Buckley 2002). The available data for the overall Atlantic coast populations suggest that the number of breeding pairs there is holding constant although a 33% decline occurred in North Carolina during 1988-1990 (Buckley and Buckley 2002). Smaller populations and those near the periphery of the species' range, as those examined here, would likely be more sensitive to environmental changes as indicated by range contraction or expansion. They would also be prone to larger inter-annual fluctuations in colony size and a greater risk of local extirpation. However, the current protection afforded Royal Tern nesting sites in both southern California and Baja California bodes well for further increases in these two populations in the near future.

#### ACKNOWLEDGMENTS

We are indebted to the many field observers and colony monitors who have provided data on colony sizes: E. Amador, D. W. Anderson, G. Danemann, M. U. Evans, R. Mayoral and R. Patton. Permission to conduct studies at Bolsa Chica State Ecological Reserve was granted by

the California Department of Fish and Game. Kathy Keane and the Port of Los Angeles made observations at Pier 400 possible. We thank the two reviewers who provided helpful comments

on the organization and content of the manuscript. Our particular thanks to Jose M. Beltran for producing Figure 1.