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## Banding Studies of Elegant Terns in Southern California

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### ABSTRACT

Elegant Terns (*Sterna elegans*) breed in three colonies in coastal southern California. In winter, banded terns have been recovered from Mexico to Chile, but mostly in coastal Central America. There is some fidelity to nesting areas and exchange among the California colonies. Thus far, there is no evidence of exchange with colonies in Mexico.

### INTRODUCTION

In summer, Elegant Terns (*Sterna elegans*) are commonly encountered on the Pacific coast of North America from Baja California, Mexico, to northern California and southern Oregon (Shuford et al. 1989, A.O.U. 1998, Small 1994, Burness et al. 1999).

In El Niño (warm water) years, post-breeding movements extend northward to Washington and British Columbia, Canada (Campbell et al. 1990, Burness et al. 1999). Breeding sites are limited to three colonies in the United States, all in southern California, and two to three sites in Mexico, with the largest colony being located on Isla Rasa in the Gulf of California (Burness et al. 1999). Movements and colony locations of Elegant Terns are strongly related to the availability of their principal diet, schooling fish species, especially the northern anchovy (*Engraulis mordax*) (Schaffner 1986, Horn et al. 1996), in California.

In southern California, Elegant Terns were first found breeding in south San Diego Bay in 1959 (Gallop and Bailey 1960, Schaffner, 1986, Unitt 1984). In 1987, a second colony was established at the Bolsa Chica Ecological Reserve in Orange

County (Collins et al. 1991); and in 1998, they colonized a site at Los Angeles Harbor (K. Keane, pers. com.) In recent years the breeding population of Elegant Terns in southern California has increased and the bulk of the nesting has shifted among these three colony sites from year to year (Collins, unpub.). A banding study was initiated at Bolsa Chica in 1989 with additional banding done in San Diego and at the Port of Los Angeles. The outcome of this banding and subsequent re-encounters is summarized here.

## STUDY SITES

The principal study area has been the Bolsa Chica Ecological Reserve (Bolsa Chica, herein) in northern Orange County (Figure 1). Elegant Terns first bred here in 1987 (Collins et al. 1991) on one of two 1.7 ha (4 ac) sand islands established in 1978 as a nesting place for the endangered California Least Tern (*Sterna antillarum browni*). This site has also been utilized by other species beginning with Caspian Terns (*Sterna caspia*) in 1986 (Cuthbert and Wires 1999, Collins 2006) followed by Royal Terns (*Sterna maxima*), Forster's Terns (*Sterna forsteri*) and Black Skimmers (*Rynchops niger*). Throughout July and August 2005, up to 1,000 Elegant Terns frequented the colony site used by Black Skimmers and Forster's Terns in the Upper Newport Bay Ecological Reserve (Figure 1). This may be a prelude to their colonizing this site in the near future.

In San Diego County, about 148 km south of Bolsa Chica, Elegant Terns have nested on the dikes of the salt evaporation ponds located in southern San Diego Bay (Salt Works, herein). These ponds and dikes are now part of the South San Diego Bay Unit of the San Diego National Wildlife Refuge. Since 1998, Elegant Terns have nested in association with California Least Terns and Caspian Terns at a newly established sand-fill area of the Port of Los Angeles (Pier 400, herein), 18 km west of Bolsa Chica in Los Angeles County (Figure 1). The initial 40 ha (100-ac) dredge fill area is now nearly completely developed. The nesting terns are restricted to part of a 6 ha (15-ac) site set aside for them immediately adjacent to what is currently one of the busiest container cargo terminals on the west coast.

Although they are encountered frequently, often in noisy roosting groups, little attempt has been made

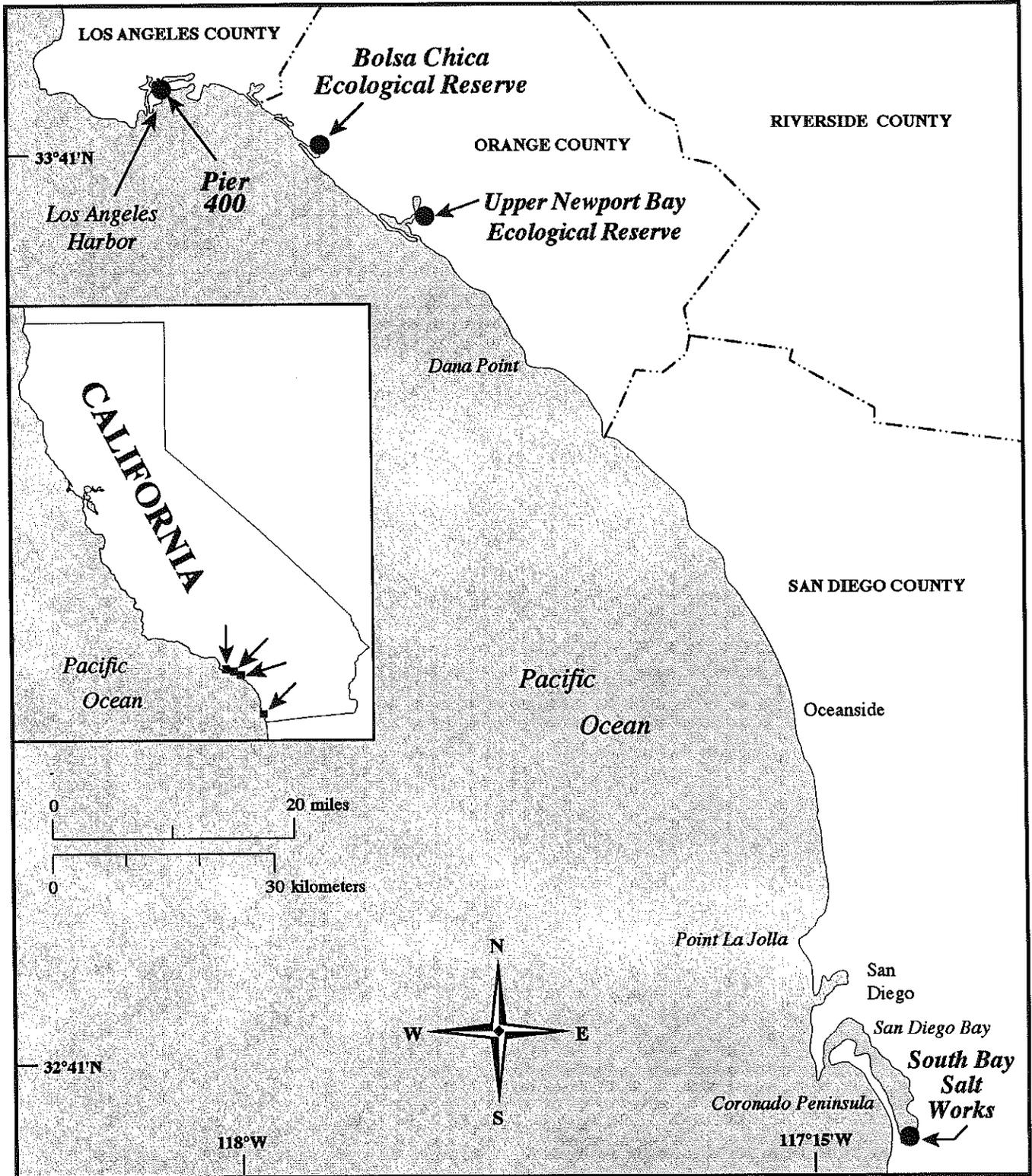
to read bands (size 3) on Elegant Terns on these occasions. This is unlike the similar studies of Caspian Terns (Collins 2006) and Royal Terns (Collins and Doherty 2006) where substantial information was obtained from band (sizes 4 and 5) read with a telescope both in and away from the breeding colonies. Nearly all of the re-encounter data presented here are from reports of Elegant Terns submitted to the USGS Bird Banding Laboratory (BBL). A few individuals were captured alive in the breeding colonies entangled in monofilament fishing line and were cut loose and released.

## METHODS

Between 1987 and 2005, a total of 16,564 pre-flying Elegant Tern chicks (HY/L) were banded with standard, size 3, numbered aluminum bands issued by the BBL. Most of the banding was done at Bolsa Chica; chicks were also banded at the Salt Works in one year, 1987, and at Pier 400 in four years between 1998 and 2003. Elegant Tern chicks congregate in a large crèche within a few days after hatching (Burness et al. 1999). Banding of large numbers of chicks was accomplished by herding the crèche into a temporary 1 m high wire fence corral where they could be captured quickly, banded and released by a team of "grabbers," "holders" and banders. In this manner, up to as many as 3000 chicks were caught, banded and released in less than two hours. The crèche quickly reformed and no apparent impacts, other than the temporary disruption during banding operations, were noted.

## RESULTS

A total of 84 Elegant Terns were re-encountered from one to nearly 12 years after initial banding. Of these, 40 were reported as found dead, 26 were reported to the BBL as found tangled in fishing line, and ten were reported as injured or caught by hand. These categories may not be mutually exclusive, as some birds found dead tangled in fishing line were simply reported as "found dead" and birds reported as injured or caught by hand also may have been partially tangled in fishing line. Two individuals were reported as having been shot (in coastal western Mexico). Two additional birds were reported to the BBL by rehabilitation centers (it was not known if they survived and were released) and



**Figure 1.** Location of the three current breeding colonies of Elegant Terns in southern California. A possible future colony site (Upper Newport Bay Ecological Reserve) is also indicated.

**Table 1. Intercolony movements of Elegant Terns among southern California colonies**

Banding Site	Recovery Site		
	Salt Works	Bolsa Chica	Pier 400
Salt Works	0	0	0
Bolsa Chica	13	27	9
Pier 400	0	2	0

four were caught in the breeding colonies, during this study, tangled in fish line and released unharmed. Sixty-three of the terns recovered (75%) were re-encountered in southern California between late March and early September, of which 49 (58%) were in breeding colonies. Only 25% of the terns were encountered outside southern California in the non-breeding or migration periods at locations ranging from coastal western Mexico to northern Chile. Although the bands on some of the older terns are noticeably worn (pers. obs.), they had not reached the point where band loss was likely to have been significant.

A total of 27 individuals banded at Bolsa Chica were also recovered there in subsequent breeding seasons. However, individuals banded at Bolsa Chica were also encountered at the Salt Works and at Pier 400 (Table 1). Two terns banded at Pier 400 were recovered at Bolsa Chica. Since few Elegant Terns have been banded at the Salt Works in recent years (none since 1987), it is not surprising that none was recovered at the northern colonies later in this study period. The actual number of individuals making inter-colony movements is perhaps misleading. Most of the current banding was done at Bolsa Chica, which would in large part account for the low re-encounter of birds from the Salt Works and Pier 400. Also, the bulk of the southern California breeding population of Elegant Terns has shifted among the three colony sites from year to year. One such shift, from Pier 400 to Bolsa Chica in 2005, was related to a single early season nocturnal predation event (presumably by an owl). In this case, 2300 nests with eggs were abandoned. Other shifts, including one from the northern colonies to the Salt Works in 2003, may have been related to localized changes in water temperatures and prey availability. Such shifts in the breeding population clearly influenced the number and location of band returns in those years.

None of the 823 Elegant Terns banded at the Salt Works between 1980 and 1982 (BBL) was encountered in this study. Similarly, no Elegant Terns banded at any of the colonies in Mexico were recovered in southern California. Conversely, no Elegant Terns banded in this study have been recovered, to date, in any of the Mexican colonies.

## DISCUSSION

Elegant Terns showed moderate fidelity to their natal colonies as indicated by the number of individuals banded at Bolsa Chica and recovered there in subsequent breeding seasons. However, when large-scale movements of the breeding population were made among the three southern California colonies, this appeared to override colony fidelity. Many banded birds, most of which were presumably banded at Bolsa Chica, were observed regularly in the nesting aggregations at Pier 400 and the Salt Works in various years.

The lack of recoveries in southern California of any Elegant Terns banded in any of the Mexican colonies and vice versa suggests that the three southern California breeding colonies form a distinct metapopulation. Accordingly, the recent population growth of Elegant Terns in southern California seems to be the result of local breeding success and recruitment of young into the breeding population. The breeding population of Elegant Terns in the three southern California colonies has increased from a few hundred pairs prior to 1986 to over 5800 pairs in 1995 and 9300 pairs in 2005 (Collins, unpub.).

Elegant Terns are largely absent from California in winter with only a few stragglers being reported in December and January (Garrett and Dunn 1981). Their numbers decrease from September to early November (Small 1994) when they depart on migration to Central and South American wintering areas. Their winter range extends from coastal Nayarit, Mexico, south to central Chile (Howell and Webb 1995, AOU 1998, Burness et al. 1999). Twenty-one of the banded Elegant Terns in this study were recovered from Sinaloa, Mexico (4) to Taital, Chile (1) including Guatemala (2), El Salvador (7) Nicaragua (1), Costa Rica (2), at sea off Panama (1), and Colombia (3). Two individuals recovered in western Mexico in July were yearlings,

which supports the earlier suggestion that some pre-breeders remain on the wintering grounds (Stiles and Skutch 1989; Howell and Web 1995, Burness et al. 1999). However, not all do so as other yearling birds (identified by plumage characteristics) have been seen in the southern California breeding colonies in midsummer (pers. obs.). Since 12 of the recoveries found were birds in coastal Central America in midwinter (December-January), it would appear that most of the Elegant Terns from southern California winter there. Four recoveries from Colombia and Chile indicate that at least some make the longer flight to South America. The concentrations of Elegant Terns in coastal Peru and Chile in winter are more likely to be from the largest breeding colony located on Isla Rasa, Mexico, where over 95% of the world population, 180,000 individuals, of this tern nests (Burness et al. 1999, Velarde et al. 2005).

It has been suggested that most migrant Elegant Terns pass through Panama far offshore (Ridgely and Gwynne 1989); the one recovery from Panama in this study was noted to be "at sea." The pelagic distribution of Elegant Terns in migration is also indicated by an individual recovered offshore in Guatemala and one individual recovered from Malpelo Island, Colombia, located 506 km off the Pacific coast west of Buenaventura. Two more individuals were recovered on the coast in Narina, Colombia, in December 1996. Four specimens collected in Parque Nacional Isla Gorgona in 1988-1992 provided the first confirmed records of Elegant Terns in Colombia (Naranjo and Franke 1997).

Bolsa Chica is currently the site of a major wetland restoration project. This will include a new ocean entrance and tidal basin as well as an enlarged area for nesting terns and skimmers. This project is scheduled for completion some time in 2006. The effects on the seabird populations nesting there remain to be seen and should be the subject of future studies.

#### ACKNOWLEDGMENTS

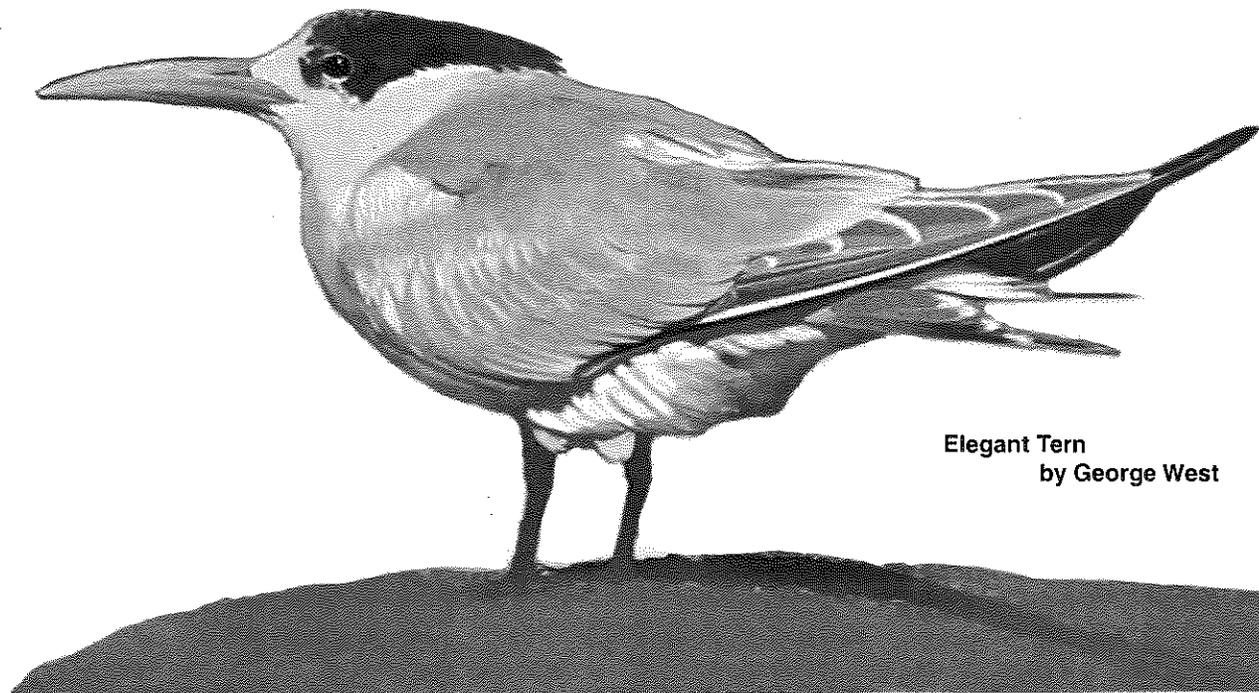
In this study, banding was conducted under BBL master bird banding permit 08707 and protocol 154 approved by the Animal Welfare Board, at California State University, Long Beach. Permission to conduct studies at Bolsa Chica State Ecological

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