Banding Studies of Caspian Terns in Southern California

Charles T. Collins
Department of Biological Sciences
California State University
Long Beach, CA 90840
ccollins@csulb.edu

ABSTRACT

Caspian Terns currently breed at three anthropocentric sites in southern California. Observations of banded birds and band recoveries from 1986 to 2006 indicate low nesting colony philopatry and substantial inter-colony movements from year to year. Several terns banded as chicks dispersed northward to colonies in San Francisco Bay and the Columbia River. Only two immigrant individuals were identified in the southern California colonies. The oldest recovery was of an 18-year-old individual. Most of the local breeding population migrates and appears to winter in coastal western Mexico. These data closely agree with a recent regional analysis of Pacific coast colonies.

INTRODUCTION

The Caspian Tern (*Sterna caspia*) is a widespread and nearly cosmopolitan species inhabiting and breeding in both freshwater and saline environments (Harrison 1983, Cuthbert and Wires 1999). In western North America its breeding distribution has changed substantially from largely inland wetlands to coastal environments (Gill and Mewaldt 1983, Wires and Cuthbert 2000). It now breeds along the Pacific coast from Alaska to central Baja California, Mexico (Palacios and Alfaro 1992, MacCaffery et al. 1997, AOU 1998, Cuthbert and Wires 1999, Suryan et al. 2004). In coastal southern California, Caspian Terns have bred in southern San Diego Bay since at least 1941 (Unitt 1984) and more recently at Bolsa Chica Ecological Reserve and in Los Angeles Harbor (Suryan et al. 2004). A banding study was initiated at Bolsa Chica in 1986; additional chick banding was done in San Diego Bay and in Los Angeles Harbor. The outcome of these bandings and subsequent field observations are summarized here. Previous studies included Caspian Tern chick growth (Schew et al. 1994) and food habits at these colonies (Horn et al. 1996, 1998).

STUDY SITES

The principal study area has been the Bolsa Chica State Ecological Reserve (Bolsa Chica, herein) in northern Orange County (Figure 1). Caspian Terns began breeding here in 1986 on one of two four-acre (1.6 ha) sand islands established in 1978 as a nesting place for the endangered California Least Tern (*Sterna antillarum browni*). Since 1986, Bolsa Chica has also been colonized by Elegant Terns (*Sterna elegans*), Royal Terns (*Sterna maxima*), Forster's Terns (*Sterna forsteri*), and Black Skimmers (*Rynchops niger*) (Collins et al. 1991).

In San Diego County, about 148 km south of Bolsa Chica, Caspian Terns have long nested on the dikes of the salt evaporation ponds located in southern San Diego Bay (Unitt 1984) (Salt Works herein; Figure 1). These ponds and dikes are now part of the South San Diego Bay Unit of the San Diego Bay National Wildlife Refuge. Since 1996, Caspian Terns have nested in association with California Least Terns and Elegant 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 2). The initial 100-ac (40.5 ha) dredge fill area is now nearly completely developed and the nesting terns are restricted to part of a 15-ac (6.0 ha) site set aside for them immediately adjacent to what is currently one of the busiest container cargo terminals on the west coast.

METHODS

Between 1986 and 2004 a total of 1376 pre-flying Caspian Tern chicks (HY/L) were banded with standard, size 5, numbered aluminum bands issued by the USGS Bird Banding Laboratory (BBL). In two of these years single plastic bands were added to identify annual cohorts: yellow in 1993 and blue in 1994. Four of seven of these color-banded individuals observed in 2004 had retained the color band; seven of seven others seen in 2000 had lost the color band. Initially, banding was conducted as part of a general colony monitoring program at Bolsa Chica and a study of chick growth conducted there (Schew et al. 1994) and continued thereafter. An additional 134 chicks were banded at the Salt Works in 1993 and 1994 (J. Konecny, pers. com.) and 103 after 1996 at Pier 400. In total, 121 birds were re-encountered from one to 18 years after initial banding. Of these, 11 were found dead; nine of these were found in local southern California breeding colonies. One individual was shot near Culican, Sonora, Mexico. Two more were collected during a diet study in the Columbia River estuary, Oregon (Roby et al. 1998) and 107 were read with a spotting scope from one to seven times each over several years.

Additional observations of Caspian Terns were made about midway between Bolsa Chica and Pier 400 on the ocean or harbor beaches of Seal Beach in northern Orange County and Long Beach in adjacent Los Angeles County (Figure 2). Observations were made one to four times per month from November to April in most years. These visits included the reading of bands on over-wintering Caspian Terns as well as Royal Terns (Collins and Doherty 2006) and Black Skimmers (Collins, unpublished). Bands were read with a 20x-60x zoom spotting scope frequently at distances of <15 m. Errors in band reading were minimal as bands were usually re-read in the same or subsequent observation periods. A few sightings of banded terns were made at Upper Newport Bay State Ecological Preserve in central Orange County and one near Dana Point at Doheny State Beach in southern Orange County (Figure 1). These data were combined in this analysis.

Table 1. Colony fidelity and intercolony movements of Caspian Terns breeding in southern California

Banding Site	Re-encounter Site		
	Salt Works	Bolsa Chica	Pier 400
Salt Works	1	1	6
Bolsa Chica	5	29	57
Pier 400	0	1	1

RESULTS

Caspian Terns showed low fidelity to their natal colony as indicated by 28 individuals (2%) initially banded at Bolsa Chica being re-sighted there in subsequent breeding seasons. However, individuals banded at Bolsa Chica were also encountered at the Salt Works and at Pier 400 and visa versa (Table 1). The actual numbers presented of individuals making inter-colony movements are perhaps misleading. Only 134 Caspian Tern chicks were banded at the Salt Works in 1993-1994 and 103 since 1996 at Pier 400. This would largely account for the low re-encounter rate of these birds at the other colonies. The large new fill area at Pier 400 proved to be highly attractive to Caspian and Elegant terns many of which relocated there. This site was also more accessible and amenable to band reading which may account for the relatively high number of banded Caspian Terns from the other colonies recorded there. The number of breeding Caspian Terns at all three colonies varied from year to year (Suryan et al. 2004) and there was a documented interchange of breeding birds (Table 1). In addition, five individual Caspian Terns were recorded breeding at two different colonies in different years during the 1986-2004 study period. This pattern of movement is also true for Elegant Terns (Collins 2006) and Royal Terns (Collins and Doherty 2006) in southern California.

Some Caspian Terns (<1 %) have also dispersed northward and been re-encountered in the breeding season outside the southern California study area. In 2004 and 2005 three individuals were sighted at the Brooks Island colony in San Francisco Bay, one of which was seen in both years (BBL Records; K. Larson, pers. com.) and two were recovered at the largest west coast breeding colony on East Sand Island near the mouth of the Columbia River (BBL records; D. Roby, pers. com.). Long-distance northward dispersal by Caspian Terns banded in

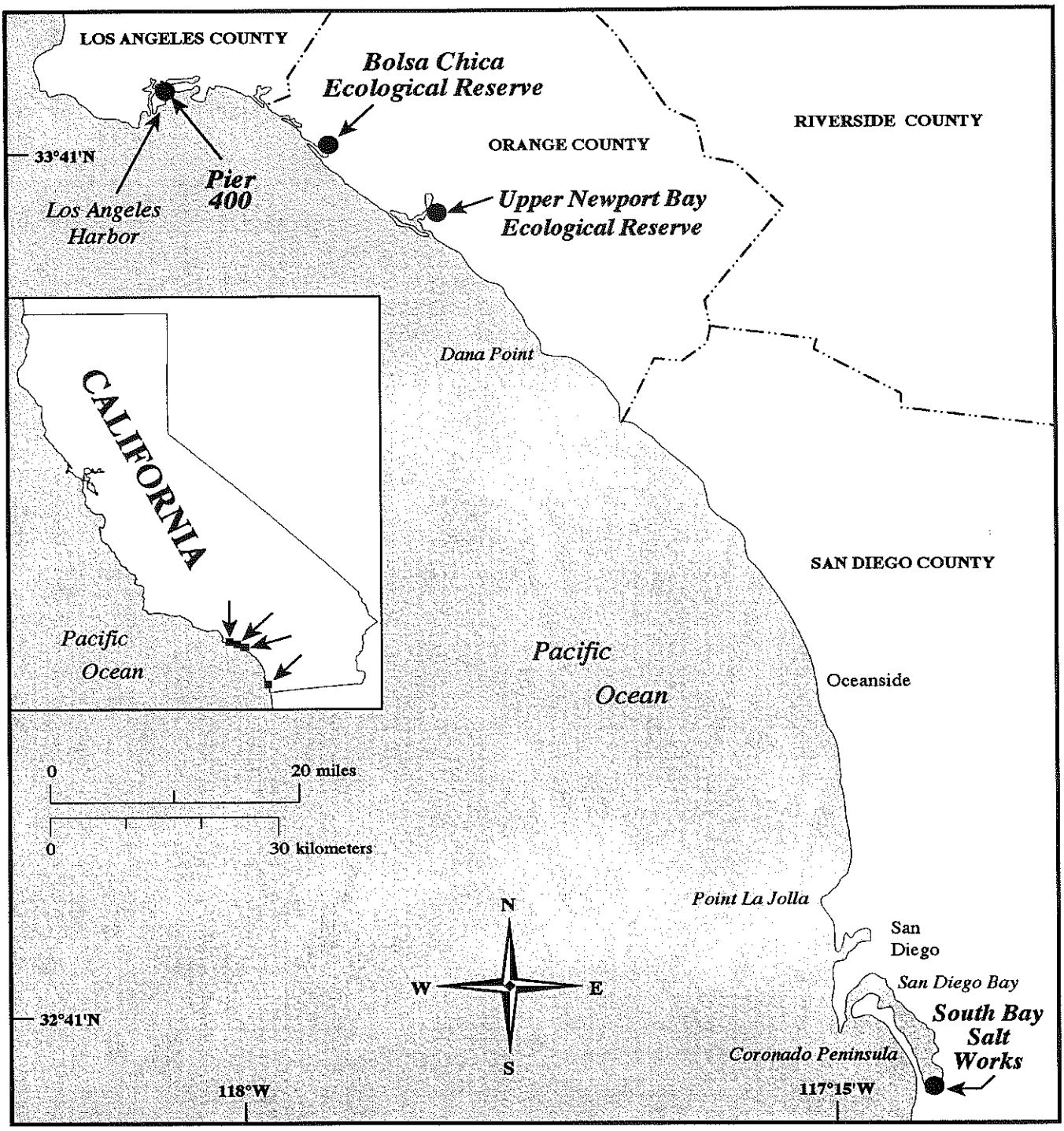

Figure 1. Study area in southern California. Breeding colonies of Caspian Terns are at Pier 400, Bolsa Chica and the Salt Works. Observations of banded birds were also made at Upper Newport Bay.

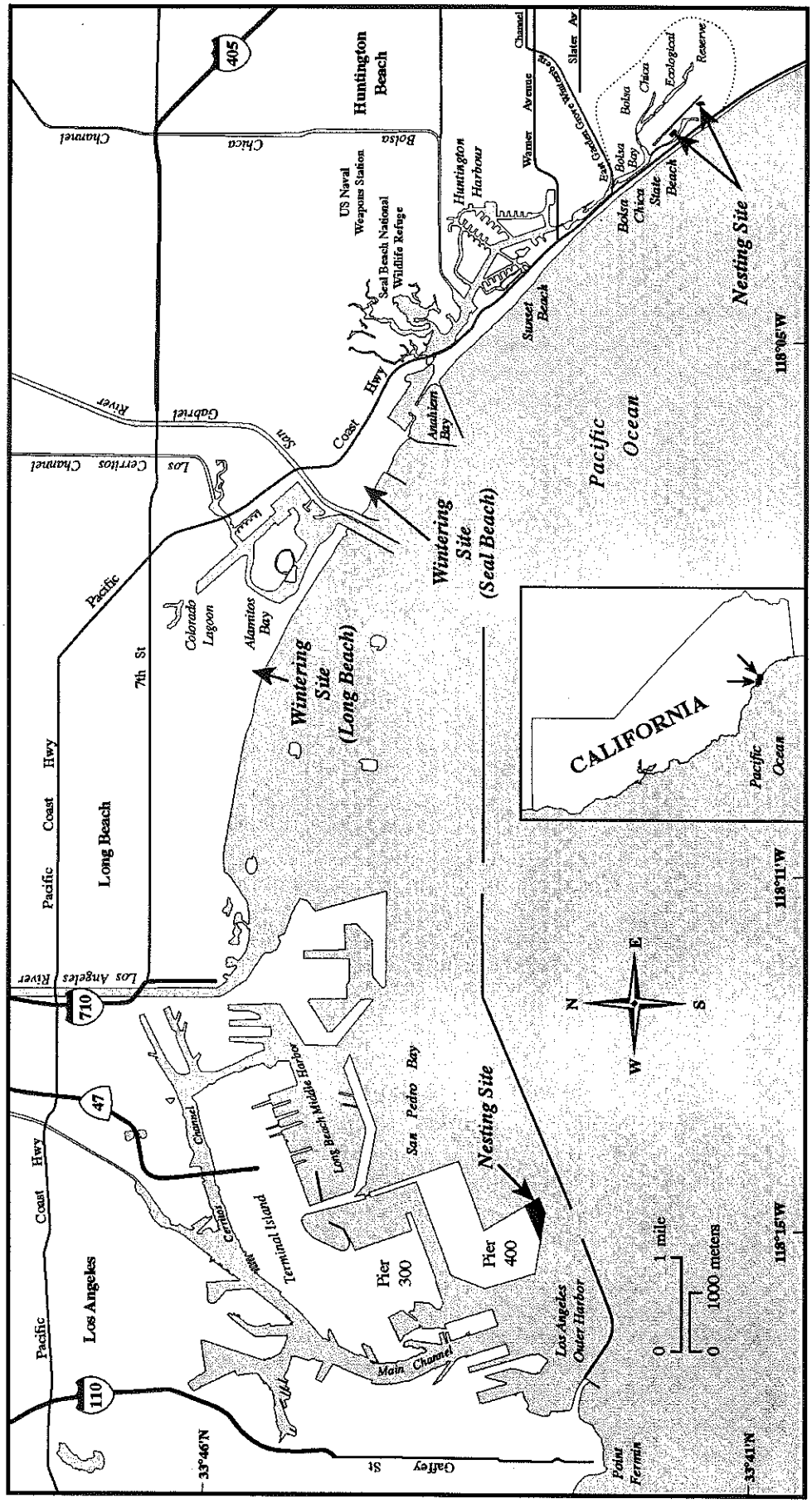

Figure 2. Northern part of the study area showing colony sites at Bolsa Chica and Pier 400 and sites of winter observations and band-reading in Seal Beach and Long Beach.

San Francisco Bay has also been recorded (Gill and Mewaldt 1979, Suryan et al. 2004).

In contrast, only two Caspian Terns from outside the three southern California colonies have been found breeding locally. The first was a bird found dead in the Bolsa Chica colony in May 1994; it had been banded as a chick (HY/L) near Lawen, Oregon, in 1984. The second exception was an individual found tending a nest in the Pier 400 colony in 2004. It appears to have been banded at a colony in south San Francisco Bay in 1999 or 2000 but details of the year and site of banding are not currently available (J. Hansen, pers. com.).

During the winter, Caspian Terns are common in small numbers in coastal southern California (Garrett and Dunn 1981, Unitt 1984, Small 1994). Over the years, a total of only 14 Caspian Terns banded at Bolsa Chica and one from Pier 400 have been encountered in winter at Seal Beach, Long Beach, Upper Newport Bay, and Dana Point. This suggests that the bulk of the local breeding population of these terns migrates south in winter. Three young Caspian Terns banded at Bolsa Chica were recovered in western Mexico. Of these, one was found at Estero Tastiota, Sonora, in October and another at Culiacan, Sinaola, in August. Both were only 1-1.5 years old (SY). The third individual was recovered at Rio Fuerte, Sonora. The recovery date was not known other than sometime during the year after it had been banded as a chick (HY/L) at Bolsa Chica. There is also one January record of a first winter (SY) Caspian Tern found dead at the Salton Sea. However, this bird may have been dead for some time and could have died while in transit to Mexico and was not over-wintering at the Salton Sea.

Only five of the many Caspian Terns color-banded in the Columbia River colonies have been observed during this study. One individual was re-sighted on several occasions at Seal Beach during the winter of 2004-2005 suggesting that it over-wintered locally. It was again seen at Seal Beach on 25 Feb 2006. The earliest post-breeding sighting of a Caspian Tern banded at the Columbia River was of an adult at Upper Newport Bay on 11 Sep 2005. The latest winter sighting was of an individual at Seal Beach on 4 Mar 2006.

The paucity of these sightings suggests that the Columbia River Caspian Terns do not regularly migrate through coastal southern California and rarely over-winter there.

In this study there were 117 annual re-encounters of banded Caspian Terns in the three southern California breeding colonies. The ages of these birds ranged from 1-18 years (Figure 3). The four one-year-old birds included a bird found dead at Bolsa Chica and another seen there on one occasion; these probably did not represent breeders. The youngest presumed breeder was three years old. The skew in the data (Figure 3) towards birds aged 6-11 years old probably is a product of more chicks being banded in the late 1980s and early 1990s and uneven band-reading efforts concentrated in the years 1997-2004. Bands on even the oldest Caspian Terns observed in this study did not appear to be excessively worn or eroded, so band loss was not considered to be significant. Elsewhere, Caspian Terns typically do not breed until they are at least three years old (Ludwig 1942, 1965, Gill and Mewaldt 1983, Cuthbert and Wires 1999). A few one- and two-year-old birds (<1 % of the population) are seen annually in Great Lakes breeding colonies (Cuthbert and Wires 1999).

DISCUSSION

These data for Caspian Terns breeding in southern California are in close agreement with the detailed population analysis of these terns in the Pacific Coast region (Suryan et al. 2004). As is also true in other parts of the region (Suryan et al. 2004), Caspian Tern numbers in southern California are increasing, possibly related to the newer anthropocentric sites (i.e., Bolsa Chica and Pier 400). Similarly, in southern California Caspian Terns showed weak nest site philopatry and readily moved among available sites as previously observed elsewhere in the region (Gill and Mewaldt 1983, Suryan et al. 2004). However, in other studies site fidelity was shown to be variable, possibly stronger at undisturbed sites and also positively associated with prior breeding success (Cuthbert 1988).

A northward dispersal or emigration of a few Caspian Terns (<1 %) was recorded in this study.

A southward immigration into southern California colonies was limited to two individuals. Thus, the southern California colonies appear to form a distinct breeding subunit or metapopulation (as suggested by Akcakaya et al. 2003) within the Pacific Coast region and also a source population for colonization of other more northerly sites.

The band recoveries from Sonora and Sinaloa suggest that the southern California breeding population may over-winter in the Gulf of California along coastal western Mexico as previously documented for Caspian Terns breeding in San Francisco Bay (Gill and Mewaldt 1979). Caspian Terns are considered to be fairly common to common transient and winter visitors to Sonora and coastal western Mexico (Howell and Webb 1995, Russell and Monson 1998).

The uneven band-reading effort in this study precluded a meaningful estimate of survival rates based on a live-recapture model for the southern California populations. Elsewhere, the highest mortality in Caspian Terns is in the first several months post-fledging (Ludwig 1942, 1965, Gill and Mewaldt 1983). Although annual survival gradually increases with age, up to 0.84-0.89 in after-third-year birds (Ludwig 1965, Suryan et al. 2004), approximately 62% of all chicks die before reaching breeding age (Ludwig 1965). The maximum age reported for Caspian Terns in the Pacific Coast region is 25 years (Suryan et al. 2004) and slightly more than 26 years elsewhere in North America (Cuthbert and Wires 1999).

The development of the port facilities at Pier 400 has recently decreased (by over 80 %) the available nesting area there for Caspian Terns. Conversely, a major habitat restoration project at Bolsa Chica (scheduled for completion in 2006) will provide substantially increased space for nesting terns. Future studies of Caspian Terns at all the southern California colonies should include a more detailed analysis of fledging rates and age-specific survival estimates. Such a program might well incorporate individually marked birds (and the use of color

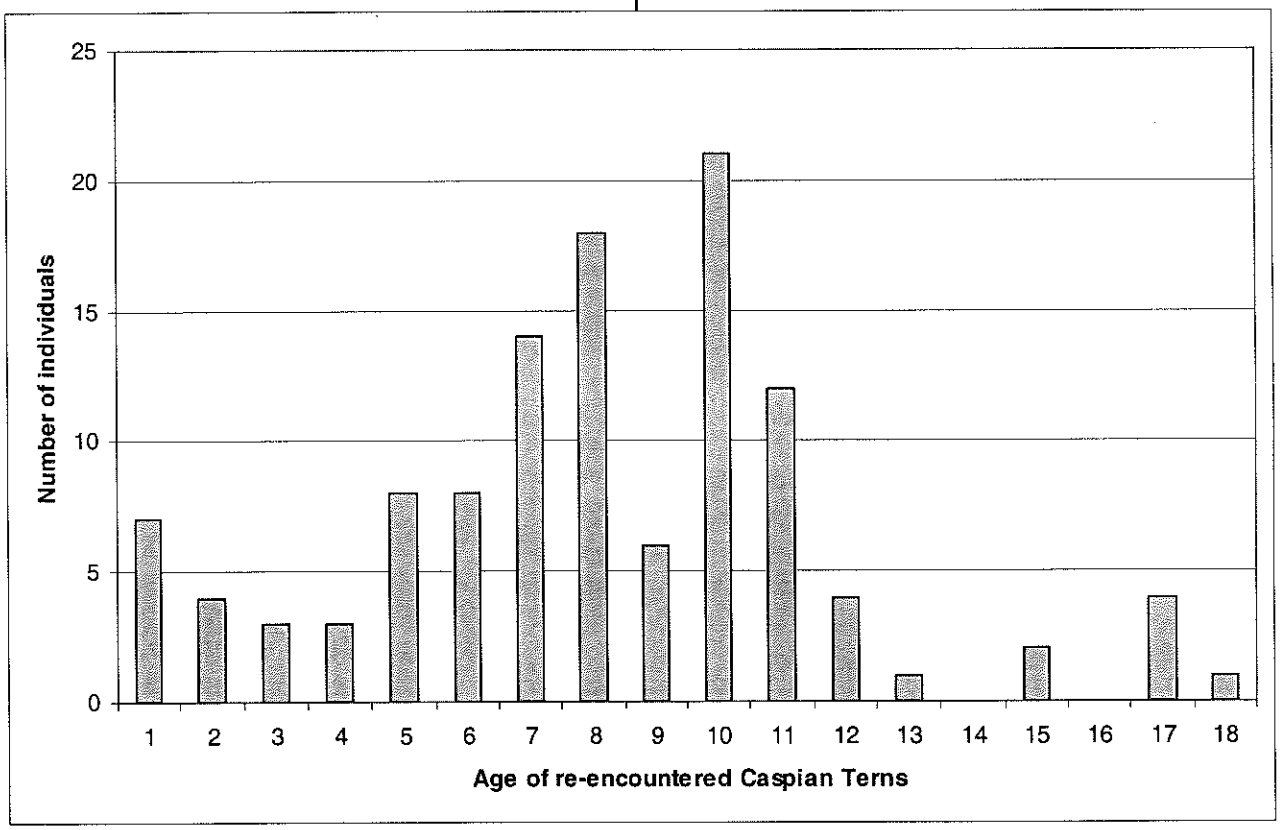

Figure 3. Age distribution of Caspian Terns banded in southern California 1985-2004 and subsequently re-encountered. Included are birds reported to the Bird Banding Laboratory and those read locally in the breeding colonies or overwintering.

bands or field-readable metal bands) to facilitate use of a live-recapture model of survival as suggested by Suryan et al. (2004) and used successfully on Royal Terns also breeding in these colonies (Collins and Doherty 2006).

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Charles T. Collins
Department of Biological Sciences
California State University
Long Beach, CA 90840
ccollins@csulb.edu

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