Intercolony Movement and Survival of Caspian Terns in Southern California.

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ABSTRACT

Caspian Terns (Hydroprogne caspia) *nesting in coastal southern California regularly move among three colony sites on a year-to-year basis. We document here the first examples of intra-seasonal movements between two of these colonies. Based on bands read with spotting scopes between 2000 and 2010, apparent annual survival of adult breeding Caspian Terns was determined to be 0.82 (± 0.03 SE).*

INTRODUCTION

Many seabirds have very high annual survival rates (>0.85) and longevities in excess of 25 years. This is particularly true for the Caspian Tern (*Hydroprogne caspia*) the largest and one of the most widespread of the Sterninae. Caspian Terns occur on all continents other than Antarctica and inhabit both coastal and inland waterways for breeding and wintering (Harrison 1983, Cuthbert and Wires 1999, Wires and Cuthbert 2000).

In North America, various aspects of Caspian Tern breeding biology and demography have been studied in the Great Lakes (Ludwig 1942, Ludwig1965, Cuthbert 1985, 1988), the Columbia River (Roby et al. 1998, Suryan et al 2004), central California (Gill 1976, Gill and Mewaldt 1983) and southern California (Schew et al. 1994, Collins 2006). Recent observations of banded Caspian Terns at two of the three southern California nesting sites have provided additional information on intercolony movements and annual survival which we report here.

Study Sites - The two study sites utilized in this study were the Bolsa Chica State Ecological Reserve (Bolsa Chica, herein) in northern Orange County and undeveloped fill sites in the Port of Los Angeles (Pier 305 and Pier 400, herein) in Los Angeles County. Pier 305 was first colonized by Caspian Terns and Elegant Terns (*Thalasseus elegans*) in 2008 and is about 1.5 km northeast of a site previously used by these terns at Pier 400 (Collins 2006). Both Pier 305 and Pier 400 are 18 km northwest of Bolsa Chica (see Fig. 2 in Collins 2006). No bands were read at the third coastal southern California Caspian Tern colony in south San Diego Bay.

METHODS

From 2000 to 2010, bands on prebreeding and breeding adult Caspian Terns were read with a spotting scope in the colonies at Bolsa Chica and in the Port of Los Angeles. Effort varied in each year due to the amount of time that could be spent in the colonies. More bands were read in 2004, 2008, and 2009 when the nesting sites were vehicle accessible and bands could be read with a window mounted spotting scope without disturbing the terns. Band reading took place from late April through early August. Most bands were read on multiple occasions so that errors were minimal. A summary of the raw data is presented in Table 1.

Table 1. Summay of the sighting and resighting data for Caspian Terns in coastal southern California from 2000-2010. Table to be read as follows: In 2000, 37 adult Caspian Terns were observed of which two were first resighted in 2001, and of which four were first resighted in 2002.

		Re-observed										
Year	Number Observed	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
2000	37	2	4	3	5	0	0	1	2	0	0	17
2001	2		0	0	0	0	0	0	0	0	0	0
2002	13			1	5	0	0	0	3	0	0	9
2003	12				4	0	0	0	1	0	0	5
2004	46					1	0	2	13	3	0	19
2005	2						0	0	1	0	0	1
2006	3							1	1	0	0	2
2007	5								3	0	0	3
2008	59									25	2	27
2009	38										7	7

Using these data, we estimated annual apparent survival (φ) and detection probabilities (p) using a Cormack-Jolly-Seber model (Cormack 1964, Jolly 1965, Seber 1965) We estimate both of these parameters as either a constant or as a function of time for a model set containing four parameters. We used Akaike's information criteria, corrected for small sample size and overdisperion (QAICc) for model selection (Burnham and Anderson 2002). We used a median $\hat{c}$ test to test for over dispersion and estimate $\hat{c}$. We performed all the estimation and modeling using program MARK (White and Burnham 1999).

RESULTS

In total, 137 bands were observed on Caspian Terns. We estimated $\hat{c}$ at 1.08 and adjusted our model selection criteria and estimates accordingly. The model with the most support estimated survival as a constant and probabilities of detection as time varying (weight = 0.99). Detection ranged from 0 (in years with little to no effort) to 0.78. Apparent survival was estimated at 0.82 (± 0.03 SE).

Of the bands read in all years >80% had been placed on preflying chicks (= Local) at Bolsa Chica or Pier 400 and ranged in age from seven to 17 years. Individuals that had been banded at other sites included six banded in San Diego Bay, two in San Francisco Bay, one at the Salton Sea. Particularly interesting sightings were of two Caspian Terns banded as chicks at an ephemeral colony site on islands in the Carson Sink near Stillwater, NV, in 1999 (B. Henry, pers. com.). Four additional Caspian Terns, identified by color band combinations, were banded at East Sand Island in the lower Columbia River (Y. Suzuki, pers. com.).

In addition to the inter-year movements between southern California colonies, there were 15 cases of individual Caspian Terns moving between sites within the same nesting season. In 2008 at Bolsa Chica, 10 individuals were identified in the prebreeding or early nesting periods which were later observed nesting at Pier 305 in July or August. Prior to that, roosting Brown Pelicans (*Pelecanus occidentalis*) disturbed the nesting terns and destroyed some eggs at Bolsa Chica. The movement of the Caspian Terns to the new site at Pier 305 coincided with a large number of Elegant Terns also

moving there. In 2009, five individuals, which were identified at Pier 305 in June when many Caspian Terns were incubating eggs, were subsequently found on nests at Bolsa Chica later in the season.

DISCUSSION

As previously noted (Collins 2006), both Caspian and Elegant terns show year-to-year movements among the three breeding colony sites in southern California. Intraseasonal movements between colonies have not been documented in this area previously. In the Great Lakes, such movements were thought to be caused by colony disturbance and/or reproductive failure (Cuthbert 1985). For Caspian Terns in the Great Lakes (Ludwig 1942) and central California (Gill and Mewaldt 1983), post-fledging mortality is high, and approximately 62% of all chicks die before becoming breeders in their third year. Annual survival of after-third-year birds was substantially higher (0.89) as calculated from band recoveries. The data presented here based on bands read on breeding adults is somewhat lower (0.82) than the previous estimate but might be influenced by lower sample sizes and emigration. These high survival rates predict that some individual Caspian Terns will likely survive for many years. The oldest Caspian Tern identified in a southern California colony was 18 yr old when last seen in 2004 (Collins 2006). Thirteen of the banded Caspian Terns identified in 2008 and 2009 were 14-17 years old when last seen in 2009. In the Great Lakes, the maximum age recorded for a Caspian Tern was 26 yr and 2 mo, and four more lived a minimum of 26 yr (Cuthbert and Wires 1999, Lutmerding and Love 2010).

Caspian Terns have been established as breeders at Bolsa Chica and the Port of Los Angeles only since the mid-1980s. Since then, there has been substantial changes to the nesting sites at both locations. Pier 305 will be lost in the next few years as port facilities expand. Additional studies may help our understanding of the causes of inter-year and intra-seasonal movements of these terns and identify possible sources of disturbance in the highly human-developed environment of southern California.

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Replacement of Primaries during the Prealternate Molt of a Yellow Warbler

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ABSTRACT

We examined an adult male Yellow Warbler that had replaced all secondary coverts and six inner secondaries (s4-s9) on both wings, the innermost primary (p1) and its corresponding primary covert on the right wing, and the innermost two primaries (p1-p2) and their corresponding primary coverts on the left wing, but no rectrices during the prealternate molt. This represents the first evidence of primary replacement during the prealternate molt in Parulidae and only the fourth North American passerine species documented to replace primaries during this molt. The combination of incomplete inner-secondary and inner-primary replacement represents a novel sequence pattern for molts among birds. We suggest that the relatively extensive prealternate molt of Yellow Warbler originally evolved due to the need to replace sun-bleached feathers and that the brighter feather edging of alternate feathers in male (but not female) Yellow Warblers represents a later adaptation for sexual selection.