Diet Trends and Nesting Success of Two Sympatric Terns Breeding in the San Francisco Bay

Abstract

The California Least Tern (Sternula antillarum browni) is a migratory bird, which nests in beaches, bays and lagoons from the San Francisco Bay south to Baja California (US Fish and Wildlife 1980). The species was listed as federally endangered in 1970, and as a state endangered species in 1971 (Mexico 1976). The East Bay Regional Park District manages California Least Tern nesting habitat at the Hayward Regional Shoreline (37°37’N 122°24’W) which is located along the eastern shore of the San Francisco Bay. The East Bay Regional Park District manages 400 miles of coastline. Terns (Sterna antillarum) breed from April to July, and lay approximately 1.5 ounces (Sibley 2003). California Least Terns have an average clutch size of 2.4 (Rubinowitz 2003). Forster’s Terns are medium sized birds (image 2), averaging 13 inches in length with a wingspan of 21 inches and weighing approximately six ounces (Sibley 2003). The mean Forster’s Tern bill length is 4.10 mm (Rubinowitz 2003). Body size and bill length contribute to prey size selection. There is a slight overlap in their diets. This overlap can increase in areas where these two species share breeding habitats (Rubinowitz 2003). The size and type of prey can have a significant impact on the growth and development of the California Least Tern chicks (Riensche et al. 2012 a.). Competition for adequate prey may result in kleptoparasitism in areas where these two sympatric species breed. During the nesting season, kleptoparasitism by Forster’s Terns on California Least Terns was documented (Riensche et al. 2012 b.). We are assuming that the rate of kleptoparasitism is the same over the years. This study investigates the possible diet overlapping and its potential effects on reproductive success of these two sympatric terns breeding in the San Francisco Bay.

Introduction

The California Least Tern (Sternula antillarum browni) is a migratory bird, which nests in beaches, bays and lagoons from the San Francisco Bay south to Baja California (US Fish and Wildlife 1980). The species was listed as federally endangered in 1970, and as a state endangered species in 1971 (Mexico 1976). The East Bay Regional Park District manages California Least Tern nesting habitat at the Hayward Regional Shoreline (37°37’N 122°24’W) which is located along the eastern shore of the San Francisco Bay. The East Bay Regional Park District manages 400 miles of coastline. Terns (Sterna antillarum) breed from April to July, and lay approximately 1.5 ounces (Sibley 2003). California Least Terns have an average clutch size of 2.4 (Rubinowitz 2003). Forster’s Terns are medium sized birds (image 2), averaging 13 inches in length with a wingspan of 21 inches and weighing approximately six ounces (Sibley 2003). The mean Forster’s Tern bill length is 4.10 mm (Rubinowitz 2003). Body size and bill length contribute to prey size selection. There is a slight overlap in their diets. This overlap can increase in areas where these two species share breeding habitats (Rubinowitz 2003). The size and type of prey can have a significant impact on the growth and development of the California Least Tern chicks (Riensche et al. 2012 a.). Competition for adequate prey may result in kleptoparasitism in areas where these two sympatric species breed. During the nesting season, kleptoparasitism by Forster’s Terns on California Least Terns was documented (Riensche et al. 2012 b.). We are assuming that the rate of kleptoparasitism is the same over the years. This study investigates the possible diet overlapping and its potential effects on reproductive success of these two sympatric terns breeding in the San Francisco Bay.

Study Area

The area in which this study was conducted is located at the Hayward Regional Shoreline (37°37’), on the eastern side of the San Francisco Bay. The habitat area was established in 2001, and is 0.24 ha (0.6 ac). It was built mostly out of native materials (Riensche 2007). The colony is off limits to the public.

Methods

Diet Trends: Data on diet was obtained by collecting fish dropped in the nesting colony during the nesting season. Once collected, the specimens were stored in alcohol (70°) for 1 week to allow the collection date. Next, they were soaked in water and then blotted with a paper towel and then dried in a laboratory convection oven. The specimens were given a sample number, which was written on the specimen with a fine tip marker. The following was recorded for each sample: species or least taxonomic group possible, total length (from the tip of the snout to the end of the caudal fin); standard length (from the tip of the snout to the end of the hypural bone (mm)); body depth (to the widest part of the fish (mm)); and dry weight (g). Due to caudal fin being frequently broken, we used standard length as the measurement to test for size differences between the two tern species.

Nesting Success: Nesting and reproductive success data was collected using the Type 1 Colony Survey Method. In this method, permitted biologists entered the colony to mark nests, record the number of eggs and chicks which results in data on clutch size, hatching and fledging success.

Results

Diet Trends: A total of 109 specimens were analyzed for both years and both tern species. We collected more dropped prey from the California Least Tern colony (n=45 in 2015, n=19 in 2016) than the Forster’s Tern colony (n=39 in 2015, n=23 in 2016). A total of six different families of dropped prey were identified for both years and both tern species. The variation in dropped prey between the two species is attributed to a higher occurrence of silversides (family Atherinopsidae) with California Least Terns, and a higher occurrence of flatfishes (family Paralichthyidae) with Forster’s Terns. A Chi-square goodness-of-fit showed no significant differences in diet between the two tern species (χ² = 31.27, df=5, p<0.0001). Silversides make up 40% of the Forster’s Tern (FOTE) colonies diet, while Atherinopsidae make up 40% of the California Least Tern (CLOTE) colonies diet.

Nesting Success: During 2015 and 2016, both colonies had successful nesting seasons (Figure 4 and 5). In the respective years, the number of California Least Tern chicks hatched was 120 and 152; the number of Forster’s Tern chicks hatched was 94 and 83. Unpaired t-tests were used to compare the average hatching and fledging success of the two colonies for both years combined. The results showed no statistically significant difference in the hatching success (p=0.218) or the fledging success (p=0.074) of the colonies. Based on this evidence, and assuming that the rate of kleptoparasitism is the same over the years, there is no statistical evidence of time and energy spent by one tern species feeding on the other species. This was also supported by the fact that the California Least Tern hatched more chicks and produced more fledglings than the Forster’s Tern. Forster’s Tern is not a significant factor affecting the breeding success of the California Least Tern at this location. Other factors (e.g. predation, protection from other species nesting nearby, type of prey available and consumed) may explain the lower breeding success of the Forster’s Tern colony.

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References


Figure 1. The standard length of fish dropped by Forster’s Tern (mean=7.0 mm ± 1.7 mm s.d.) was significantly larger than fish dropped by California Least Tern (mean=5.7 mm ± 1.28 s.d.; t-test: t=-4.073, Satterthwaite’s degrees of freedom=77.4766, p<0.0001).

Figure 2. Diet differences between the two sympatric tern species. A Chi-square goodness-of-fit showed significant differences in diet between the two tern species (χ² = 31.27, df=5, p<0.0001). Silversides make up 40% of the Forster’s Tern (FOTE) colonies diet, while Atherinopsidae make up 40% of the California Least Tern (CLOTE) colonies diet.

Figure 3. California Least Tern established 71 nests (2015) and 88 nests (2016). Fledging success increased from 98% (2015) to 134% (2016).