THE LITERATURE OF THE CALIFORNIA LEAST TERN

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INTRODUCTION

Once the beaches of southern California teemed with California least terns (Sterna albifrons browni). Today, numbers are so depleted that both the U.S. Bureau of Sport Fisheries and Wildlife (1973) and the California Department of Fish and Game (1972) consider these birds in danger of extinction.

This paper summarizes information contained in about 100 references to the California least tern and related subspecies. Additional records of past distribution derived from several museum collections are also included.

NOMENCLATURE

The California least tern is one of 12 recognized subspecies of the least (or little) tern (Brodkorb, 1940; Burleigh and Lowery, 1942; Peters, 1934; Van Rossem and Hachisuka, 1937), three of which inhabit the United States (American Ornithologists' Union, 1957). Although known and studied at an early date (Holterhoff, 1884, McCormick, 1899), the California least tern was not recognized as a separate subspecies until Mearns (1916) published his description of it. The five specimens used in compiling the description had been collected in southern San Diego County, Calif., in July 1894.

Burleigh and Lowery (1942) questioned the validity of this subspecies because they found the plumage characteristics used by Mearns (1916) to be highly variable and not sufficiently different from the plumages of other described races. However, geographical isolation from other races is often considered adequate justification for subspecific status, hence most authorities still recognize Sterna albifrons browni.

The least terns are occasionally assigned to the genus Sternula (e.g., in Ridgway, 1919), an action proposed to the American Ornithologists' Union (Oberholser, 1917) but never adopted by that organization or by most other ornithologists.

DESCRIPTION

Least terns are the smallest members of the subfamily Sterninae (Davis, 1968), measuring about 9 inches long with a 20-inch wingspread. Sexes look alike, being characterized by a black cap, gray wings with black wingtips, yellow legs, and a black-tipped yellow bill. Immature birds have darker plumage and a dark bill, and their white heads with dark eye stripes are often quite distinctive (K. Bender, personal communication). Full descriptions are

included in Bent (1921) and Ridgway (1919). The California least tern cannot be reliably differentiated from other races of the least tern on the basis of plumage characteristics alone (Burleigh and Lowery, 1942).

DISTRIBUTION

The California least tern is migratory, usually arriving in its breeding area during the last week of April and departing again in August (Davis, 1968; Massey, 1971; Swickard, 1971b). However, terns have been recorded in the breeding range as early as 13 March and as late as 31 October (Sibley, 1952). North of San Francisco Bay, Calif., there appears to be only one record from any season, a single immature tern seen at Humboldt Bay, Humboldt County, 27 August 1971 (DeSante and Stallcup, 1972).

The historical breeding range of this subspecies has usually been described as extending along the Pacific Coast from Moss Landing, Monterey County, Calif., to San Jose del Cabo, southern Baja California, Mexico (A.O.U., 1957; Dawson, 1924; Grinnell, 1928; Grinnell and Miller, 1944). However, least terns were nesting several miles north of Moss Landing at the mouth of the Pajaro River, Santa Cruz County, Calif., at least from 1939 (W. E. Unglish, Western Foundation of Vertebrate Zoology egg collection) to 1954 (Pray, 1954). Also, although nesting at San Francisco Bay was not confirmed until 1967 (Chandik and Baldridge, 1967), there are numerous spring and summer records for the area, so nesting may have occurred previously (Allen, 1934; Chase and Paxton, 1965; De Benedictis and Chase, 1963; Grinnell and Wythe, 1927; Sibley, 1952).

The nesting range has apparently always been widely discontinuous, with the majority of birds nesting in southern California from southern Santa Barbara County south through San Diego County. Between the city of Santa Barbara and Monterey Bay, a distance of over 200 miles, I found only one certain breeding record: July 1971, 3 nests at the mouth of the Santa Ynez River, Santa Barbara County (R. Fordice, personal communication). However, apparently reliable local sources report that least terns once nested at Morro Bay, San Luis Obispo County (B. Massey, personal communication). In Baja California, only two sites are named in the literature, Scammons Lagoon (Bancroft, 1927; Grinnell, 1928) and San Jose del Cabo (Grinnell, 1928; Lamb, 1927).

Several sets of least tern eggs collected in Sonora, Mexico, in 1930 and 1949 (and now in the collection of the Western Foundation of Vertebrate Zoology) are labeled as those of the California least tern, but this area is now considered within the breeding range of another subspecies, Sterna albifrons mexicanus (Van Rossem and Hachisuka, 1937).

Away from the Pacific coastline, there are a number of records of least terns along the California-Nevada-Arizona border (Grater, 1939; Phillips et al, 1964) and at Salton Sea, Imperial County, Calif. (McCaskie and Cardiff, 1965; McCaskie, 1971). I observed one least tern in the Colorado

River Delta, Baja California, 18 May 1972. Subspecific identity of these birds is unknown, but it seems likely they are wanderers from the mexicanus populations of the nearby Gulf of California, rather than California least terns.

The winter distribution of the California least tern is unknown. Least terns in Guatemala (Griscom, 1932) and Veracruz, Mexico (Warner and Mengel, 1951) have been assigned to this subspecies, and it has been said to migrate to Peru, but Murphy (1936) doubted this. Recent efforts to find least terns in Peru have been unsuccessful (B. Massey, personal communication). Because several races of least terns are now recognized in western Mexico and most subspecific plumage differences are only observable in breeding plumage, racial allocation of wintering birds is seldom possible without banding or marking prior to migration. From 1954 through 1971, 507 California least terns were banded on their breeding grounds but so far only 5 have been recovered. All recoveries were in the breeding areas (Massey, 1973).

Fig. 1 depicts the historic California breeding range of the California least tern and shows those areas known to have been inhabited by nesting birds since 1970. Current distribution in Baja California is unknown.

LIFE HISTORY AND HABITAT

Breeding behavior

Least terns arrive in the nesting area in small flocks of approximately 10-30 birds which congregate to fish and loaf. Some pairs may form before arrival in the nesting areas (K. Bender, personal communication), others begin to form within the group almost immediately, and active courtship may be observed within the first few days after arrival (Davis, 1968; Massey, 1971; Swickard, 1971b).

Courtship often follows a well-defined pattern, beginning with "fish flights" wherein terns fly noisily over the nesting area holding fish in their beaks. A few days later silent glides begin. Posturing and parading on the ground follows, during which the male holds a small fish in its beak as it courts the female. As the posturing ends, copulation occurs, the fish sometimes being given to the female (Davis, 1968; Hardy, 1957; Massey, 1972b; Wolk, 1954).

Nest location and construction

The least tern chooses for its nesting location an open expanse of sand, dirt, or dried mud close beside a lagoon or an estuary where food can be procured (Craig, 1971; Massey, 1971; Swickard, 1971b). Formerly, sandy ocean beaches were regularly used, but increased human activity on the beaches has made most of them uninhabitable. Recently most nesting has occurred on mud and sand flats back from the ocean or on manmade dirt fills (Craig, 1971; Longhurst, 1969).

Key to Figure 1

1. Alameda
2. Bay Farm Island-Oakland Airport
3. Bair Island
4. Coyote Hills saltponds
5. Pajaro River (Palm Beach)
6. Moss Landing (Elkhorn Slough)
7. Salinas River
8. Santa Ynez River
9. Santa Barbara
10. Summerland
11. Carpenteria
12. Ventura
13. Santa Clara River
14. Hueneme
15. Malibu
16. Venice
17. Ballona (Playa del Rey)
18. El Segundo
19. Redondo
20. Bixby Slough
21. Terminal Island
22. Alamitos Bay
23. San Gabriel River
24. Anaheim Bay (Sunset Aquatic Park)-Huntington Harbor
25. Sunset Beach
26. Bolsa Chica
27. Huntington Beach
28. Newport Beach
29. Balboa
30. Santa Margarita (Camp Pendleton)
31. Buena Vista Lagoon
32. Oceanside - Carlsbad-Agua Hedionda
33. Batiquitos Lagoon
34. San Elijo Lagoon
35. Del Mar
36. Los Penasquitos Lagoon
37. Pacific Beach
38. Mission Bay
39. San Diego Airport
40. Coronado Strand
41. National City - Chula Vista-Sweetwater River
42. Imperial Beach-South San Diego Bay
43. Tijuana River

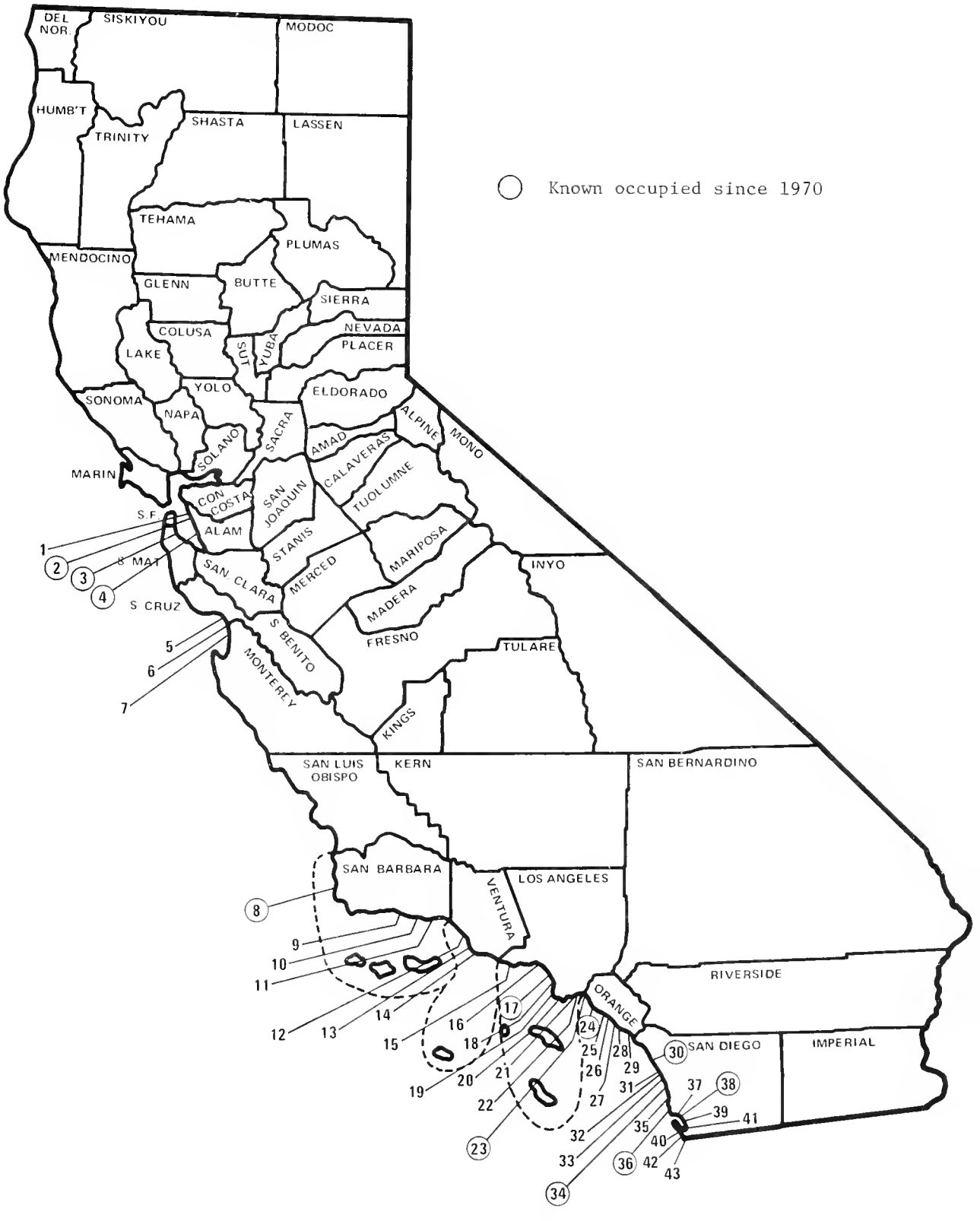

Fig. 1. California least tern nesting locations.

Least terns are colonial but do not nest in as dense concentrations as many other terns. Although nests have been found as close together as 2.5 feet (David, 1968), usual minimum distances between nests are 10-15 feet, with averages usually much greater (Hardy, 1957; Massey, 1971; Wolk, 1954). Swickard (1971b) found nest densities to be 16-18 per acre.

The nest itself is a small depression in which the eggs are deposited. In sand, it is scooped out by the bird (Davis, 1968; Massey, 1971; Swickard, 1971b), but in hard soil, it may be any kind of natural or artificial depression--for example, a dried boot track (Swickard, 1971b). Occasionally a more elaborate nest is reported, such as one found by Swickard (1971b) that was located on flat ground and completely lined with small twigs.

The eggs

Least tern eggs measure approximately 31 x 24 millimeters (1.22 x 0.944 in.), and are buffy with various brownish and purplish streaks and speckles. There appears to be little variation in basic size or color between the various subspecies (Bent, 1921; Hardy, 1957; Davis, 1968), although Bancroft (1927) felt that California least tern eggs were on the average decidedly darker and without the usual brilliance of those of the East Coast race (S. a. antillarum).

One to four eggs are laid, with two to three-egg clutches being reported most often (Anderson, 1970a; Davis, 1968; Massey, 1972b; Swickard, 1971b). Although there is considerable local variation in average number of eggs laid, there appears to be no support for Bent's (1921) statement that larger clutches are more frequent in more northerly breeding areas.

Egg laying occurs in the hours just prior to noon, with the eggs being laid on consecutive days (Davis, 1968; Massey, 1971).

The nesting season extends from approximately 15 May into early August, with the majority of nests completed by mid-June (Bent, 1921; Grinnell, 1898; Swickard, 1971b). July and August nests may be mainly renests, although Chambers (1908) believed that many terns reared more than one brood per season. No other authority considers the least tern a multiple brood species.

Incubation

Incubation, which begins with the laying of the first egg, is irregular at first but becomes steady after the clutch is completed (Davis, 1968; Massey, 1972b; Swickard, 1971b). Both parents participate, but the female takes a much greater part than the male (Davis, 1968). Although Bent (1921) recorded the incubation period as 14-16 days, authorities throughout the United States now agree that the normal incubation period is 20-25 days (Davis, 1968; Hardy, 1957; Hagar, 1937; Massey, 1972b; Swickard, 1971b). Extremes of from 17 to 28 days have been documented.

Post-hatching period

Eggs hatch on consecutive days, and the chicks are initially weak and helpless. The adults brood continuously during the first day (Davis, 1968), but by the second day the chicks are strong and make short walking trips from the nest. From the third day on, they are increasingly mobile and active (Davis, 1968; Massey, 1971).

Flight stage is reached at approximately 20 days of age, but the young birds do not become competent fishers until after they migrate from the breeding grounds. Consequently, the parents continue to feed the young even after they are strong fliers (Massey, 1971; Swickard, 1971b; Tompkins, 1959).

Nest success and young survival

Although California least tern colonies have on occasion suffered heavy losses of eggs and young to predators or unfavorable weather conditions (Craig, 1971; Pentis, 1972; Swickard, 1971b), egg hatch and nestling survival are generally high. Eighty to 90 percent hatching success was reported by both Massey (1972b) and Swickard (1971b) during the 1970-72 period. Fledging rates (number of young surviving to flight age) were estimated by Massey (1972b) as 11-26 percent in 1970 and 33-50 percent in 1971. Swickard (1971b) estimated a 50 percent fledging rate in 1971 and 33 percent rate in 1972 (Swickard, personal communication).

Infertility appears to be a minor cause of least tern egg failure. For example, Massey (1972b) found only six infertile or addled eggs out of 157 laid in her study area. Predators have been implicated in a number of egg losses, with Norway rats (Rattus norvegicus) most often named as the known or suspected predators (Craig, 1971). Dogs and gulls also destroy eggs (Chambers, 1908; Swickard, 1971b).

In the past, high tides washed away many California least tern eggs (Sechrist, 1915; Shepardson, 1909), a problem that still affects beach-nesting populations of other subspecies (Norman and Saunders, 1969). However, few California least terns now nest in situations where tide level is a factor. Summer rains sometimes cause serious loss where nests occur on soils less permeable than beach sands. For example, Swickard (1971b) found that heavy rains flooded salt flat nesting areas, and only 43 percent of the eggs in the colony hatched. On adjacent beach sands, rain water percolated through the nests, and 90 percent of the eggs hatched.

Loss of tern chicks has been attributed to sparrow hawks (Falco sparverius) (Craig, 1971), house cats (Edwards, 1919) and dogs (Pentis, 1972), to cold, wet weather (Pentis, 1972), and to dehydration and starvation (Massey, 1972b).

Longevity and breeding age

Five banded California least terns have been recovered at 5 to 15 years of age, three of them 13 years or older. This suggests a relatively long life for individuals of this species, and the fact that no banded birds under 5 years of age have been recovered on the breeding grounds suggests delayed sexual maturity (Massey, 1973).

Food and feeding habits

The California least tern obtains its food from shallow estuaries and lagoons, rather than from the ocean. Fish known to be eaten are northern anchovy (Engraulis mordax), shiner perch (Cymanogaster aggregata) and topsmelt (Atherinops affinis) (Massey, 1972b; Swickard, 1971b). The California least tern has not been observed eating anything but fish, but other subspecies are reported to feed at times on crustaceans, molluscs, sand eels, annelid worms and insects (Marples and Marples, 1934; Tompkins, 1959).

REASONS FOR DECLINE

No reliable estimates are available of original numbers of California least terns, but they once were abundant and well distributed along the southern California coast. Shepardson (1909) describes a colony of about 600 pairs at Huntington Beach, Orange County. Sechrist (1915) estimated 1000 pairs along a 3-mile stretch of beach in San Diego County. "Good sized" colonies were located in Los Angeles County (Grinnell, 1898).

Reduction in numbers was gradual. This subspecies appears to have escaped the slaughter inflicted on the East Coast populations by the millinery trade of the late 1800's (Bent, 1921; Hagar, 1937), although there were some early local losses to shooting (Holterhoff, 1884) and egg collecting (McCormick, 1899). It is doubtful these activities were widespread enough to adversely influence the population, however.

Although certain least tern colonies were still thriving in the early 1900's, others were already beginning to feel the pressure of human influence. The Pacific Coast Highway was constructed along previously undisturbed beach, and summer cottages and beach homes were built in many areas. Soon children, dogs, and cats were being blamed for disrupting tern nesting (Chambers, 1908; Edwards, 1919; Massey, 1972). Continued buildup of human use of the beaches displaced more and more colonies at the same time bay feeding areas were being developed, filled in, and polluted. By the 1940's, most terns were gone from the beaches of Orange and Los Angeles Counties (Cogswell, 1947), and they were considered sparse everywhere (Grinnell and Miller, 1944). Continuing loss of both nesting and feeding habitat and high levels of human disturbance at remaining colonies have been responsible for the continued decline to the present time (Craig, 1971).

CURRENT STATUS

Bender (1973) estimated the 1973 least tern breeding population in California to be between 623 and 763 pairs. Some birds may still breed in Baja California, but the total population there is probably quite small. Factors contributing to the decline of the least tern--loss of nesting habitat, loss of suitable feeding areas, and disturbance of nesting birds--continue to operate, and the bird's status will continue to be precarious.

Much interest in the least tern has been aroused in recent years, and this interest has resulted in some positive steps toward protection and proper management. The species now has full legal protection (California Department of Fish and Game, 1972) and has been given special protection at certain nesting locations. At Camp Pendleton, San Diego County, Marine Corps personnel have barricaded a least tern nesting site to bar military vehicles during the breeding season (Schade, 1971; Swickard, 1971a). During winter, military vehicles are used to clear vegetation and deposit sand to improve tern nesting habitat (Swickard, personal communication). In Orange County, local conservationists convinced county officials to delay building on a least tern nesting site, and to construct a barrier around the site to deter use by dune buggies and motorcycles (Anon, 1970b; Massey, 1971). In San Diego County, citizens not only persuaded the City of San Diego to temporarily defer development of a nesting area, but have also fenced the area and initiated some nesting area improvements (Pentis, 1972; Poland, 1972a). Several recent studies (Bender, 1973; Craig, 1971; Massey, 1972b; Swickard, 1971b) have contributed appreciably to the understanding of least tern biology and habitat requirements.

The problems confronting the California least tern are also influencing other subspecies. Norman and Saunders (1969) estimated only 1,600 pairs of least terns in all of Great Britain and Ireland in 1967. Nisbet (1973) noted a decline to only 950 pairs in Massachusetts, and cited evidence of a general decrease in other Atlantic Coast areas. In both studies, human disturbance is cited as the apparent chief reason for decline.

MANAGEMENT CONSIDERATIONS

The least tern can live with man, as evidenced by its ability to successfully nest near a frequently used railroad track (Chambers, 1908; Davis, 1968), in a small fenced enclosure on a public beach (Anon, 1970b; Massey, 1972b), and on manmade fill alongside coastal lagoons and estuaries (Massey, 1972b; Pentis, 1972). However, use of any site is dependent on a suitable food source nearby (a body of water containing abundant small fishes), and on protection from harassment and predation. The latter can be at least partially achieved through fencing, posting, limited predator control, and public education (Craig, 1971; Massey, 1972b). However, suitable feeding areas appear in critical short supply. Protecting those few that remain, and restoring others that no longer support adequate fish populations because of reduced tidal flow or pollution, may be the most significant management possible.

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