Western Wildlife 12:23–30 • 2025
Submitted: 14 March 2025; Accepted: 25 June 2025.

Notes

Black Skimmer (*Rynchops niger*) Nesting Success Trends Along the Eastern Shore of the San Francisco Bay, California

David L. Riensche[1,3] and Meredith L. Elliott[2]

[1]East Bay Regional Park District, 2950 Peralta Oaks Court, Oakland, California 94605
[2]Point Blue Conservation Science, 3820 Cypress Drive #11, Petaluma, California 94954
[3]Corresponding author, e-mail: driensche@ebparks.org

***Abstract.*—The Black Skimmer (*Rynchops niger*), a distinctive colonial waterbird species, is listed as a California Species of Special Concern. Factors affecting their breeding population include limited suitable open nesting habitat, human disturbance, varied food availability, predation (feral animals and gulls), extreme weather, and environmental pollutants. Typically, islet-breeding skimmers are in close proximity to nesting tern species, which provide early warning and defensive behaviors against intruders. Since 2001, the East Bay Regional Park District, California, has been working to establish and enhance a California Least Tern (*Sternula antillarum browni*) colony at Hayward Regional Shoreline located along the eastern shore of San Francisco Bay. In the efforts to assist in the recovery of this state and federally listed endangered species, it resulted in the attraction of breeding Black Skimmers to the site in 2015. For a total of eight breeding seasons between 2015 and 2024, the Black Skimmer has nested successfully, with 90% of nests hatching at least one egg; fledging success was 1.56 fledglings produced per breeding pair. During this same 10-year period, the endangered California Least Tern, and the threatened Western Snowy Plover (*Anarhynchus nivosus nivosus*), American Avocet (*Recurvirostra americana*), and Black-necked Stilt (*Himantopus mexicanus*) have also nested successfully at this location. The results presented on Black Skimmer breeding chronology, hatching, fledging success, and diet in the northern portion of the species range answers data gaps that may help inform future research, protection, and management measures for this special status bird.**

Key Words.—conservation; management; nest success; protection; fledging success; waterbirds.

Introduction

The Black Skimmer (*Rynchops niger*) is a distinctive and beautiful coastal colonial waterbird, usually seen gliding gracefully low over the water on elegant wingbeats (Fig. 1), with its iconic longer lower mandible slicing through the wet surface in search of fish. This species has an extensive distribution across coastal areas of North and Central America. Breeding colonies are observed along the North American Atlantic Coast as far north as Massachusetts and as far south as parts of Mexico (Clapp et al. 1983; Gochfeld and Burger 1994). On the Pacific Coast, the species winters from southern California south to Baja California and the Gulf of California, as well as the Pacific Coast of Central and South America (Howell and Webb 1995). In California, they typically occupy breeding colonies from mid-April through September, and occasionally into mid-October, with eggs first laid in early May and their last young fledged by late September (Gochfeld and Burger 1994; Molina 1996).

The Black Skimmer is listed as a California Species of Special Concern (Shuford and Gardali 2008) and was first observed in California in Orange County in 1962 (McCaskie and Suffel 1971). The first breeding records for this species in California occurred at the Salton Sea in 1972 (McCaskie et al. 1974) and in south San Diego Bay, San Diego County, in 1976 (Shuford and Gardali 2008). The initial east San Francisco Bay record of nesting Black Skimmers occurred at the Hayward Regional Shoreline, Alameda County, in 1994 (Bob Richmond et al., unpubl. report). The bulk of the breeding population in California can be found in coastal southern California and the Salton Sea, and while no statewide population surveys have been conducted, it is estimated that the breeding population in California ranges between 1,400 and 1,500 pairs (Shuford and Gardali 2008). Factors affecting breeding skimmers include limited suitable open nesting habitat and its continued loss as a result of erosion or vegetation growth on small islands (Molina 2004),

Figure 1. Black Skimmer (*Rynchops niger*) flying with elegant wingbeats at the Hayward Regional Shoreline (Tern Town), San Franciso Bay, California. (Photographed by David Riensche).

Figure 2. Black Skimmer (*Rynchops niger*) nest with chicks at the Hayward Regional Shoreline (Tern Town), San Franciso Bay, California. (Photographed by David Riensche).

human disturbance, varied marine food availability, predation (feral animals and gulls), extreme weather, and environmental pollutants (Coburn et al. 2001). It is projected that by 2050, this species, in the face of a changing climate, will have its habitat reduced by as much as 50% (National Audubon Society 2015). Islet-breeding skimmers typically nest in close proximity to nesting tern species that provide early warning and defense against intruders (Gochfeld and Burger 1994).

Black Skimmers are subject to many of the same conservation challenges faced by shorebirds and near shore seabirds, such as loss and degradation of nesting habitat, sea level rise, nest predation, oil pollution, and human disturbance (Hunter et al. 2001; Kushlan et al. 2002; Evers et al. 2010). The ecology, reproductive biology, and behavior of Black Skimmer populations along the Atlantic Coast and the Gulf of Mexico have been the topic of numerous studies (Erwin 1977 1979; Loftin 1982; Custer and Mitchell 1987; Quinn 1989, 1990; Burger and Gochield 1990). Information regarding the Pacific coast population nesting at the Salton Sea, a large interior saline basin in southern California, has also received research attention since the establishment of breeding in 1972 (McCaskie et al. 1974; Grant and Hogg 1976; Grant 1978; Molina 1996). Shuford and Gardali (2008) made recommendations for additional skimmer studies focusing on diet, foraging, provisioning behavior, nest attendance, reproductive success, fledgling success, juvenile survival, adult longevity, recruitment, and the degree of metapopulation mixing among breeders in California. Our research on Black Skimmers in the northern portion of their range in the San Francisco Bay, where there has been limited published records, begins to address some of those recommendations. In an effort to inform regional waterbird monitoring efforts and develop a site-specific conservation plan, we investigated the population trends, nesting phenology, reproductive success, fledgling success, and diet of a Black Skimmer colony coexisting within a California Least Tern colony on the eastern shoreline of the San Francisco Bay.

Methods

Study site.—The East Bay Regional Park District manages the nesting habitat of Black Skimmers, California Least Terns, Western Snowy Plovers, and Black Oystercatchers (*Haematopus bachmani*) at the Hayward Regional Shoreline (37°37’47’’N 122°8’46’’W) located along the eastern shore of San Francisco Bay (Riensche 2007; Riensche et al. 2012a, 2015, 2023). We conducted this study from 2015 to 2024 on Island Five (also known as Tern Town), a 0.24-ha (0.6-ac) island created from dredge materials. Vegetative cover on Tern Town has been managed (with mechanical techniques and herbicide treatments) to 5–15% over the years to minimize non-native vegetation spread and encourage state and federally listed ground-nesting bird species. A 10 × 20 m grid system was established for nest surveys and colony monitoring conducted off the island using binoculars.

Data on nest distribution, chronology of nesting, and reproductive success were collected using the Type 1 method (active monitoring inside colony by permitted biologists; Riensche 2007). In this method, monitors entered the colony to mark nests and record the number of eggs and chicks (Fig. 2). This type of intensive monitoring, conducted twice a week (0700–

1700), yields data on clutch size, hatching success, and evidence of predation. Each nest was monitored from when the first egg was laid and continued until all nest fates were determined. During each visit, the number of eggs within each nest was recorded. We assigned nest fates similar to those described in Brooks et al. (2014). The fate of each nest was defined as successful if ≥ 1 egg hatched; this was determined if recently hatched, relatively immobile chicks were observed lying within the monitored scrapes and there was a corresponding reduction in clutch size, or if a sequential decrease in the number of eggs at nests that contained a pipping egg on the previous visit was observed. Nests were recorded as failed if the nest was abandoned (i.e., eggs were cold and/or moisture was seen on the eggshell) or depredated (signs of predation such as broken eggshells and yolk stains and/or evidence of predator tracks). We used Linear Regression to look for trends in number of nests, and we used Stata 14.2 (Stata Statistical Software, College Station, Texas, USA) for statistical analyses.

Diet data were obtained by collecting fish dropped in the colony during the 2020 breeding season. Once collected, the specimens were stored in plastic bags labeled with the collection date. Next, we soaked items in water and cleaned them with a fine artist's paintbrush and then dried in a laboratory convection oven at 150° C for one hour. We gave each specimen a sample number, which was written on the specimen with a fine tip marker. We recorded the following for each specimen: (1) species or lowest taxonomic group possible; (2) total length (in mm) from the tip of the snout to the end of the caudal fin; (3) standard length (in mm) from the tip of the snout to the end of the hypural bone; (4) body depth (in mm), which was the widest part of the fish; and (5) dry weight (g; Riensche et al. 2018). We report standard length results but note that total length measurements can be inaccurate due to caudal fins being broken or chipped on dropped fish.

Results

Breeding Black Skimmers were typically on-site from the end of April through mid-September (2015 to 2024), with the exceptions of 2018 and 2021, when they did not nest (Fig. 3). We and volunteers monitored 78 nests during 403 observation intervals (i.e., one interval is the time period between nest visits) at the colony from 2015 to 2024. Observation intervals ranged from 1–5 d, although 85% of the intervals were 2–3 d. Complete nest clutches with three to four eggs (90%) were more common than clutches with one or two eggs (10%) at this location.

Of the 78 Black Skimmer nests monitored, 90% of the nests were successful. Only eight of the nests failed to produce at least one fledgling, primarily from predation, although abandonment, failure of eggs to hatch, and deterioration of the nesting substrate/scrape all contributed to nest failures as well. In most years, we observed nest initiations in May and first nests hatching in May or June (Fig. 3). Although egg-laying generally started by mid-May and continued into August, there was a well-defined peak of nest hatching from mid-June through July. Due to consistent adult pair counts, which helped to determine nesting locations, we did not detect any renesting attempts by adults at this location. Fledglings first appeared in July and continued into mid-September. Black Skimmer pairs at this site have produced a total of 220 chicks and 122 fledglings (Fig. 4), yielding a mean of 1.56 fledglings/pair. Over the last decade, the number of Black Skimmer nests have increased, although the positive trend is not significant ($F_{1,8} = 1.69$, $P = 0.229$; Fig. 5). We and volunteers collected 31 dropped fish at the nesting area, belonging to four fish families: Atherinopsidae,

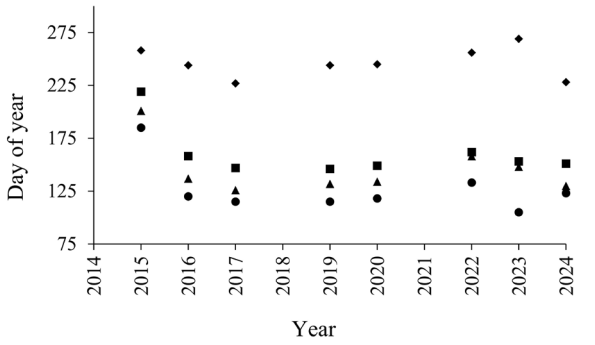

Figure 3. Black Skimmer (*Rynchops niger*) nesting chronology at the Hayward Regional Shoreline (Tern Town), San Franciso Bay, California, 2015–2024. Symbols are date first observed (circles), nest initiation date (triangles), date first nest hatched (squares), and date last observed (diamonds). Skimmers are typically at this site from the end of April through the end of August; for reference, Day of Year tick marks for non-leap years on y-axis ranges are 75 (March 16), 125 (May 5), 225 (August 13), and 275 (October 2). The skimmers did not nest at the site in 2018 and 2021.

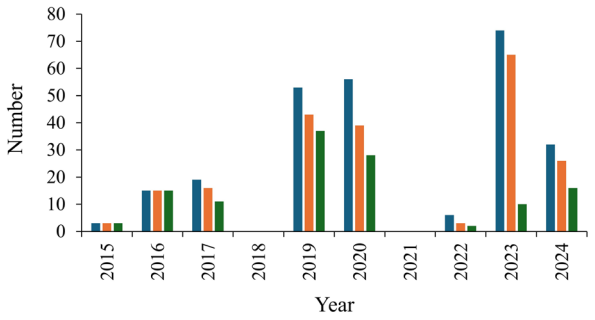

Figure 4. Black Skimmer (*Rynchops niger*) breeding success at the Hayward Regional Shoreline (Tern Town), San Franciso Bay, California from 2015 to 2024. Bars shown are numbers of eggs (blue), chicks (orange), and fledglings (green). The average nest success was 90% and fledgling per pair ratio was 1.56.

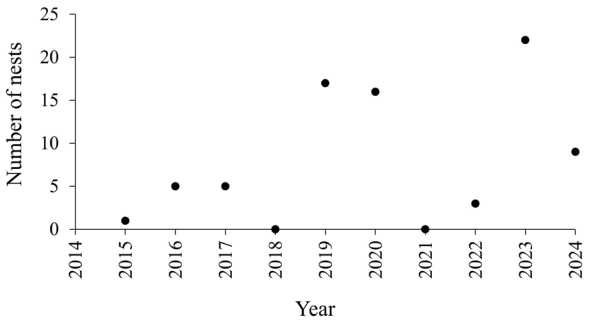

Figure 5. Black Skimmer (*Rynchops niger*) nesting trends (2015 to 2024) at Tern Town (Hayward Regional Shoreline).

Gobiidae, Cottidae, and Gasterosteidae (Table 1). Most dropped prey were atherinopsids, including Jacksmelt (*Atherinopsis californiensis*), California Grunion (*Leuresthes tenuis*), Topsmelt (*Atherinops affinis*), and Mississippi Silverside (*Menidia audens*). The mean standard length of the dropped fish was 66 mm (range of values, 33–121 mm; Table 1).

Table 1. Species composition, mean standard lengths (MSL in mm), range of values of standard lengths (RSL in mm), and numbers (n) of dropped prey collected from the Black Skimmer (*Rynchops niger*) nesting area at Tern Town, San Francisco Bay, California, in 2020.

Species	MSL	RSL	n
Atherinopsidae			
California Grunion (*Leuresthes tenuis*)	109.6	96–121	5
Mississippi Silverside (*Menidia audens*)	77		1
Jacksmelt (*Atherinopsis californiensis*)	49.7	38–62	6
Topsmelt (*Atherinops affinis*)	85.5	75–101	4
Unidentified Atherinopsid	33		1
Cottidae			
Unidentified Sculpin	45		1
Gasterosteidae			
Three-spined Stickleback (*Gasterosteus aculeatus*)	43		1
Gobiidae			
Unidentified Goby	55.9	35–81	12
Total	66.4	33–121	31

Discussion

While some natural bird populations are suffering declines, the California Black Skimmer population is increasing in numbers since the first observation in 1962 (Small 1963; Collins and Garret 1996). The first San Francisco Bay nesting record for Black Skimmer occurred in 1994 within Forster's Tern (*Sterna forsteri*) colonies in Santa Clara and Alameda County (Layne et al. 1996). This species continued to nest in small numbers in the San Francisco Bay through 2005 (Rogers et al. 2004). Previously, there were up to two dozen nesting pairs reported at the Redwood Shores in southern San Mateo County (Shuford and Gardali 2008), and surveys in the south San Francisco Bay in May 2019 recorded five Black Skimmers engaging in breeding behaviors and roosting at two island locations (Foster City/Redwood Shores and Moffett; Schacter et al. 2023). With these two exceptions, there have been limited detailed, published studies of the nesting and foraging biology of the Black Skimmer in the region.

Black Skimmers are extremely social, colonial nesting waterbirds requiring bare substrate and isolation from terrestrial predators and other disturbances. Colonies normally are established on small, constructed islands or the remote sections of eroded levees (Shuford and Gardali 2008). They characteristically nest with terns (*Sterna* spp., Gochfeld 1978) and depend on the aggressiveness of terns towards intruders (Gochfeld 1978; Erwin 1979) to thwart potential predators. Their nesting associates include Caspian Tern (*Hydroprogne caspia*), Elegant Tern (*Thalasseus elegans*), Gull-billed Tern (*Gelochelidon nilotica*), Royal Tern (*Thalasseus maximus)*, Black-necked Stilt, and American Avocet (Shuford and Gardali 2008), and in Florida, the Least Tern (*Sterna antillarum*; Kale and Maehr 1989). Tern Town meets some of these important nesting requirements for Black Skimmers by providing a low vegetated area with dredged materials (Loftin and Smith 1996) and several associate species to help defend against predators.

Adult skimmers attempt to nest every year (Gochfeld and Burger 1994) and will re-nest up to three times within a breeding season if nest failure occurs (Clapp et al. 1983; Gochfeld 1976). Colonies may fail due to predation, overwash during extreme high tides, or other factors, and skimmers may attempt renesting at different sites (Snipes and Sanders 2012). Because nest initiation within a colony is asynchronous, it is recommended that multiple visits are necessary to document maximum colony size (Brooks 2011; Gochfeld 1979). Reports of hatching success among populations of Black Skimmer in North America is highly variable (Gochfeld and Burger 1994). At the extreme southern end of California, in a 3-y study at the Salton Sea, Molina (1996) reported a highly variable hatching success rate for nests of known fate ranging from 27% in 1994 to 71% in 1993. At our location, in the extreme northern limits of the species nesting range in California, we report a 90% nest success rate, ranging from 33% (in 2022) to 100% (in 2015–2017, 2020, 2023). Successful nesting attempts at our study site have produced a total of 220 chicks, resulting in 122 fledglings. The mean 1.56 fledglings per nest obtained along the eastern shore of the San Francisco Bay are higher than those reported for breeding skimmers in Virginia at 0.40 (Erwin 1977),

New Jersey at 0.39 (Burger 1982), and South Carolina at 1.2 (Blus and Stafford 1980).

Additionally, Brooks et al. (2014) reported that Black Skimmer nest survival was positively related to clutch size, with the odds of a nest producing at least one fledgling when clutch size was large (≥ 3 eggs) being 2.7 times higher than when a clutch size was small (< 3 eggs). Dinsmore (2008) suggested the effect of clutch size on nest fledging may be related to a combination of female condition or age, location of nest within the colony, and other factors. Experienced breeders appear to have larger clutches than first-time breeders and tend to nest at the center of colonies, where they may be less vulnerable to predation or overwash (Burger and Gochfeld 1990). Clutches with three or four eggs (90%) were more frequent than clutches with one or two eggs (10%) at our location, and this may suggest the Black Skimmers at Tern Town are experienced breeders and/or the habitat is well protected from potential predators (Riensche et al. 2012b).

Skimmers typically forage at dawn and dusk (Wilson 1995) on small fish and possibly crustaceans (Leavitt 1957) by cutting or skimming the surface of the water with their lower mandible in the calm shallows of harbors, lagoons, bays, estuaries, ponds, and river channels (Shuford and Gardali 2008). Periodic monitoring of Black Skimmer diet and egg contents may help identify trends and limiting factors to elucidate possible reasons for reproductive failure (Coburn et al. 2001). Molina (1996) reported that the quantitative information of foraging behavior and diet for the Black Skimmers at the Salton Sea was missing, but that small marine fish like Ronco Croaker (*Baridiella icistia*) and tilapia (*Tilapia* sp.) were occasionally regurgitated by chicks during handling or dropped at the nest. The dropped fish at the Tern Town location is comprised of species common to estuaries and brackish water environments near this nesting site, with slightly over 50% composed of silversides (Atherinopsidae). Wilson (1995) also reported that the most abundant prey items brought to the nesting colony in Bolsa Chica, California, included members of family Atherinidae (Topsmelt, California Grunion, and Jacksmelt), all species we identified in the dropped fish at Tern Town. While we show only one year of dropped fish results here, continued collection of dropped prey may give us better insights into the diet and foraging behaviors of the Black Skimmer colony at Tern Town.

Black Skimmers, like other waterbirds, need access to suitable nesting and brood-rearing habitat (typically an island, or otherwise protected from predators), as well as adjacent foraging and roosting habitat (Erwin et al. 1993; Law and Dickman 1998). Species using coastal habitats may need to adapt and migrate to more suitable habitats to persist in the future (Parmesan 2006; Loarie et al. 2009) due to expected sea level rise. Sea level rise will adversely affect coastal waterbirds through direct mortality of nests and young (Pol et al. 2010), as well as indirectly through the loss of habitat (Hunter et al. 2015). It has been shown that climate change driven population shifts are occurring in New Jersey, where the probability of nesting Black Skimmers coexisting within Least Tern colonies increased significantly over a period of 44 y (Tattoni et al. 2020). Furthermore, Brooks et al. (2014) described that for every 10 cm increase in estimated tide height in South Carolina, the odds of Black Skimmer nesting success decreased by 33%.

The San Francisco Bay has lost much of its historic tidal wetlands, approximately 140 km2 of which were converted to commercial salt production (https://sfestuary.org/wp-content/uploads/2012/12/1Habitat_Goals.pdf). Looking toward future conservation efforts in the region, as Black Skimmers, Least Terns, and Western Snowy Plovers overlap in space and time, any single disturbance now has the potential to negatively impact more individuals and more listed species. Greater effort to understand the limiting factors that drive changes in the distribution of these special status species is critical for informing population recovery efforts in this rapidly changing world. Ultimately, upcoming conservation work focusing on comparing the population dynamics of multi-species colonies within managed ponds, nest and chick survival, and diet information will be needed to develop beneficial management strategies.

Acknowledgments.—We would like to express our sincere gratitude to the following institutions that made this work possible: U.S. Fish and Wildlife Service, Point Blue Conservation Science, San Francisco Bay Bird Observatory, East Bay Regional Park District, Regional Parks Foundation, U.S. Fish and Wildlife Service Coastal Program, Fremont Bank Foundation, Alameda Countywide Clean Water Community Stewardship Program, New United Motor Manufacturing, Orchard Supply Hardware, Johnston's and Drake's Bay Oyster Farms, Las Positas College Science Faculty, California Department of Fish and Wildlife, and California State University East Bay Faculty. Special thanks go to the following volunteers who helped maintain and monitor the site: Patrick Alvarez, Sarah Barnes, George Bloom, Kay Bloom, Emily Brownlee, Nathan Callison, Wade Carlson, Norman Chu, Maggie Clark, Hannah Crosby, Kala Crosby, Rachel Crosby, Peter Dailey, Sam Dailey, Janelle Dorcy, Sharon Dulava, Amanda Dwyer, Joel Eisler, Arthur Garibaldi, Kevin Goe, Tierra Groff, Lisa Henderson, Carin High, Howard High, Kate High, Sam High, Justin Hunter, Jeanne Jones, Michael Jones, Richard Kaufmann, Maria Kristiati, Anne Krysiak, Sara Lockett, John Mena, Ross Mitchell, Elliot Moon, Martha Morrow, Cody Newell, Caitlin Robinson-Nielsen, Robbie Parry, Brian Pinomaki, Brianna Pinomaki, Rita Pinomaki, Tyler Pinomaki, Mary Richards, Sarah

Riensche, Daniel Riensche, Nathan Riensche, Rebekah Riensche, Mark Schynert, Andrey Semyonov, Adam Shawen, Petra Shawen, Mary Stallard, Pam Thompson, Pete Thompson, Daniel Wiley, David Wiley, Jon Wiley, and Steve Wiley.

Literature Cited

Blus, L. J. and C.J. Stafford. 1980. Breeding biology and relation of pollutants to Black Skimmer and Gull-billed Terns in South Carolina. Special Scientific Report, Wildlife No. 230, U.S. Fish and Wildlife Service, Columbia, South Carolina, USA.

Brooks, G.L. 2011. Factors influencing reproductive success of near-shore seabirds in Cape Romain National Wildlife Refuge, South Carolina. M.Sc. Thesis. Clemson University, Clemson, South Carolina. 56 p.

Brooks, G.L., F.L. Sanders, P.D. Gerard, and P.G.R. Jodice. 2014. Daily survival rate for nests of Black Skimmers from a core breeding area of southeastern USA. Wilson Journal of Ornithology 126:443–450.

Burger, J., and M. Gochfeld. 1990. The Black Skimmer: social dynamics of a colonial species. Columbia University Press, New York, New York, USA.

Burger, J. 1982. The role of reproductive success in colony-site selection and abandonment in Black Skimmer (*Rynchops niger*). Auk 99:109–115.

Clapp, R.B., D. Morgan-Jacobs, and R.C. Banks. 1983. Marine birds of the Southeastern United States. FWS/OBS 83/30, U.S. Fish and Wildlife Service, Washington, D.C., USA.

Coburn, L.M, D.T. Cobb, and J.A. Gore. 2001. Managing opportunities and techniques for roof-and ground-nesting Black Skimmers. Wildlife Society Bulletin 29:342–348.

Collins, C.T., and K.L. Garret. 1996. The Black Skimmer in California: an Overview. Western Birds 27:127–135.

Custer, T.W., and C.A. Mitchell. 1987. Organochlorine contaminants and reproductive success of Black Skimmers in South Texas, 1984. Journal of Field Ornithology 58:480–489.

Dinsmore, S.J. 2008. Black Skimmer nest survival in Mississippi. Waterbirds 31:24–29.

Erwin, R.M. 1977. Black Skimmer breeding ecology and behavior. Auk 94:709–717.

Erwin, R.M. 1979. Species interaction in a mixed colony of Common Terns (*Sterna hirundo*) and Black Skimmer (*Rynchops niger*). Animal Behavior 27:1054–1062.

Erwin, R.M., G.M. Haramis, D.G. Krementz, and S.L. Funderburk. 1993. Resource protection for waterbirds in Chesapeake Bay. Environmental Management 17:613–619.

Evers, D., P. Jodice, P. Frederick, V. Byrd, W. Vermillion, J. Schmerfeld, D. Welsh, V. Varela, T. McBride, M. Seymour, and L. Carver. 2010. Work plan for estimating oiling and mortality of breeding colonial waterbirds from the Deepwater Horizon (MC252) oil spill (Bird Study #4). Deepwater Horizon Trustee Council, Fairhope, Alabama, USA. 19 p.

Grant, G., and N. Hogg. 1976. Behavior of late-nesting Black Skimmers at Salton Sea, California. Western Birds 7:73–80.

Grant, G.S. 1978. Foot-wetting and belly-soaking by incubating Gull-billed Terns and Black Skimmers. Journal of the Bombay Natural History Society 75:148–152.

Gochfeld, M. 1976. Waterbird colonies of Long Island, New York. Kingbird 26:62–80.

Gochfeld, M. 1978. Colony and nest site selection by Black Skimmer. Proceedings of the Colonial Waterbird Group 1:78–90.

Gochfeld, M. 1979. Breeding synchrony in the Black Skimmer: Colony vs subcolonies. Proceedings of the Colonial Waterbird Group 2:171–177.

Gochfeld, M. and J. Burger. 1994. Black Skimmer (*Rynchops niger*). Pp. 1–28 *in* The Birds of North America, Number 108. Poole, A. and F. Gills (Eds.). Academy of Natural Science, Philadelphia, and American Ornithologists' Union, Washington, D.C., USA.

Howell, S.N.G., and S. Webb. 1995. A Guide to the Birds of Mexico and North Central America. Oxford University Press, Oxford, U.K.

Hunter, E., N. Nibbelink, J. Alexander Clark, K. Barret, L. Mengak, R. Guy, C. Moore, and R.J. Cooper. 2015. Coastal vertebrate exposure to predicted habitat changes due to sea level rise. Environmental Management 56:1528–1537.

Hunter, W.C., L. Peoples, and J. Collazo. 2001. South Atlantic coastal plain Partners in Flight conservation plan. U.S. Fish and Wildlife Service, Atlanta Georgia, USA.

Kale, H.W., II, and D.S. Maehr. 1989. Florida's Birds: A Handbook Reference. Pineapple Press, Sarasota, Florida, USA.

Kushlan, J.A., M.J. Steinkamp, K.C. Parsons, J. Capp, M.A. Cruz, M. Coulter, I. Davidson, L. Dickson, N. Edelson, R. Elliot, et al. 2002. Waterbird conservation for the Americas: the North American Waterbird Conservation Plan. Version 1. Waterbird Conservation for the Americas, Washington, D.C., USA. 84 p.

Law, B.B., and C.R. Dickman. 1998. The use of habitat mosaics by terrestrial vertebrate fauna: implications for conservation and management. Biodiversity and Conservation 7:323–333.

Layne, V.L., R.J. Richmond and P.J. Metropulos. 1996. First nesting of Black Skimmers on San Francisco Bay. Western Birds 27:159–162.

Leavitt, B.B. 1957. Food of the Black Skimmer (*Rynchops niger*). Auk 74:394.

Loarie, S.R., P.B. Duffy, H. Hamilton, G.P. Asner, C.B. Field, and D.D. Ackerly. 2009. The velocity of climate change. Nature 462:1052–1055.

Loftin, R.W., and H.T. Smith. 1996. Black Skimmer. Pp. 571–578 *in* Rare and Endangered biota of Florida. Volume 5. Birds. Rodgers, J.A., Jr., H.W. Kale, II, and H.T. Smith (Eds.). University Press of Florida, Gainesville, Florida, USA.

Loftin, R.W. 1982. Diet of Black Skimmers and Royal Terns in northeastern Florida. Florida Field Naturalist 10:19–20.

McCaskie, G., and S. Suffell. 1971. Black Skimmer at the Salton Sea, California. Western Birds 2:69–71.

McCaskie, G., S. Liston, and W.A. Rapley. 1974. First nesting of Black Skimmers in California. Condor 76:337–338.

Molina, K.C. 1996. Population status and breeding biology of Black Skimmers at the Salton Sea, California. Western Birds 27:143–158.

Molina, K.C. 2004. Breeding larids of the Salton Sea: trends in population size and colony site occupation. Studies Avian Biology 27:92–99.

National Audubon Society. 2015. Audubon's Birds and Climate Change Report: A Primer for Practitioners. Version 1.3. National Audubon Society, New York, New York, USA.

Parmesan, C. 2006. Ecological and evolutionary responses to recent climate change. Annual Review of Ecology, Evolution, and Systematics 37:637–669.

Pol, M.V.D., B.J. Ens, D. Heg, L. Brouwer, J. Krol, M. Maier, K. Exo, K. Oosterbeek, T. Lok, C.M. Eising, and K. Koffijberg. 2010. Do changes in the frequency, magnitude and timing of extreme climate events threaten the population viability of coastal birds? Journal of Applied Ecology 47:720–730.

Quinn, J. 1989. Black Skimmer parental defense against chick predation by gulls. Animal Behavior 38:534–541.

Quinn, J. 1990. Sexual size dimorphism and parental care patterns in a monomorphic and a dimorphic larid. Auk 107:260–274

Riensche, D.L. 2007. California Least Tern habitat enhancement and nesting in the East Bay Regional Park District, California, Transactions of the Western Section of the Wildlife Society 43:62–71.

Riensche, D.L., M.L. Elliott, and S.H. Euing. 2012a. Breeding status, nesting densities and diet trends of two endangered California Least Tern colonies. Journal of Environmental Science and Engineering 1:1135–1145.

Riensche, D.L., M. L. Elliott, S.K. Riensche, and R.E. Riensche. 2018. Diet trends of two sympatric terns breeding in the San Francisco Bay. Western Wildlife 5:53–56.

Riensche, D.L., S.C. Gidre, N.A. Beadle, and S.K. Riensche. 2015. Western Snowy Plover nest site selection and oyster shell enhancement. Western Wildlife 2:38–43.

Riensche, D.L., K.L. Kitting, T.C. Groff, S. Dulava, and D.A. Bell. 2012b. California Gull predator management and reproductive success of endangered California Least Terns in the San Francisco Bay, California. Pp. 240–245 *in* Proceedings of the Twenty-fifth Vertebrate Pest Conference. Timm, R.M. (Ed.). University of California Davis, Monterey, California, USA.

Riensche, D. L., B. Pearl and S. Ramos. 2023. First successful nesting of Black Oystercatcher among endangered California Least Terns along West Coast of North America. Journal of Environmental Science and Engineering 2023:100–105.

Rogers, M.M., S.A. Glover, L.W. Cole, and S.B. Terrill. 2004. The nesting season: Middle Pacific Coast Region. North American Birds 58:595–598.

Schacter, C.R., C.A. Hartman, M.P. Herzog, S.H. Peterson, L.M. Tarjan, Y. Wang, C. Strong, R. Tertes, N. Warnock, J.T. Ackerman. 2023. Habitat use by breeding waterbirds in relation to tidal marsh restoration in the San Francisco Bay Estuary. San Francisco Estuary and Watershed Science 21(2): 1–25. https://doi.org/10.15447/sfews.2023v21iss2art2.

Shuford, W.D., and T. Gardali (Eds.). 2008. California Bird Species of Special Concern: a ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologist, Camarillo, California, and the California Department of Fish and Game, Sacramento, California.

Small, A. 1963. The fall migration. Southern Pacific Coast region. Audubon Field Notes 17:66–71.

Snipes, K.C., and F.J. Sanders. 2012. Black Skimmer (*Rynchops niger*) Breeing Trends in South Carolina. Southeastern Naturalist 11:437–446.

Tattoni, D.J., E.A. Mordecai, and M.L. Stantial. 2020. Special and Temporal Changes in Nesting Behavior of Black Skimmers (*Rynchops niger*) in New Jersey, USA, form 1976–2019. Waterbirds 43:307–313.

Wilson, J.F. 1995. Diel periodicity and dietary breadth in the Black Skimmer (*Rynchops niger*): implications for coexistence in a mixed-species colony of breeding seabirds. M.S. thesis, California State University Fullerton, California. 68 p.

David L. Riensche (shown with a rescued pre-fledge Black Skimmer) is a Certified Wildlife Biologist and Wildlife Biologist II for the East Bay Regional Park District, California, where he has worked for 37 y. For over 27 y, he has been on the faculty of the Biology Department at Las Positas College where he teaches courses in Biology, Ecology, Vertebrate Natural History, and Field Biology. David is a recipient of The National Association for Interpretation (Region 9) - Outstanding Field Naturalist Award. He holds advanced degrees in both Natural Resource Management and Environmental Education and has an undergraduate degree in Biology (Wildlife). (Photographed by David Riensche).

Meredith Elliott is a Principal Scientist in the California Current Group at Point Blue Conservation Science based in Petaluma, California. She received her B.S. in Zoology from the University of California, Davis, and her M.S. in Marine Biology from San Francisco State University, California. Meredith supervises a marine laboratory at Point Blue where she and her team investigate marine food webs through the diet analysis of marine predators and identification of krill in zooplankton samples. In addition, she is a Program Leader with ACCESS (www.accessoceans.org), a partnership among Point Blue, two National Marine Sanctuaries (Greater Farallones and Cordell Bank), and several other entities to conduct ocean research in north central California. (Photographed by Meredith Elliott).