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BEHAVIOR OF LATE-NESTING BLACK SKIMMERS AT SALTON SEA, CALIFORNIA

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The Black Skimmer *(Rynchops niger)* was first found nesting at the south end of Salton Sea, Imperial County, California in 1972 (McCaskie et al. 1974). Five nests were found in 1972, three in 1973 (McCaskie 1973), and three in 1974 (McCaskie 1974). Nesting had been suspected at the north end of the sea, but was not confirmed until 16 August 1975 when the authors, Sandra Grant and Jeanne Hogg discovered eight nests on a small barnacle-covered island in the northeast corner of the sea. Biweekly visits were made to the island and several aspects of their breeding behavior are reported here.

RESULTS

Nests. When first discovered, the 20 m x 40 m island was about 15-20 cm above water level. It is doubtful that nesting could have occurred there in June and early July (all previous egg dates of the skimmer at Salton Sea fall within this time period) as the island was probably submerged then. Evaporation exceeds irrigation effluent in late June-July and the sea level falls from then until about December. The nesting site was about 50 m southeast of the end of Grant Street drain in the Whitewater Cove area of Salton Sea, Riverside County. The unvegetated island was made primarily of Acorn Barnacle *(Balanus amphitrite)* shells with a few shells of a freshwater snail *(Helisoma sp.).* Eight nests with eggs were found on 16 August and by 30 August five more nests had been added (Table 1). On these early visits several empty scrapes were found.

The mean depth of the 13 active nests was 64 mm (range 40-90 mm) and the mean diameter was 296 mm (range 260-400 mm). No lining, other than the seashells present, was added. Nests were placed along the higher contours of the island and proximity to the nearest neighbor

Table 1. Population counts and nesting data of Black Skimmers at the north end of the Salton Sea in 1975.

	Adults	Flying Juv.	Nestlings	Scrapes with Eggs	Eggs in Scrapes	Eggs out of Scrapes	Total Eggs and Nestlings
16 Aug	37	1	0	8	14	0	14
30 Aug	39	2	0	13	38	4	42
13 Sep	48	1	8		17	10'	35
27 Sep	46	4	8[2]	I	'193'		27

1. Includes 2 eggs punctured probably by heron or gull
2. Includes 1 chick (1 day old) dead near nest
3. Includes 3 eggs punctured by skimmers

seemed haphazard; mean distance was 242 cm (range 135457 cm). The distance from the nests to the water ranged from 1 m to about 10 m.

A behavior in skimmers was observed that seems similar to the "choking behavior" illustrated by Tinbergen (1960:59, 60, 76) for the Herring Gull *(Larus argentatus)* and the Laughing Gull *(L. atricilla).* The male and female skimmers standing near a scrape often faced each other, pointed the bill nearly vertically downward and rhythmically moved the head up and down. From our observation point, we were unable to distinguish any vocalizations associated with this behavior. This behavior was observed in several pairs of skimmers, but choking was not observed in more than one pair at a time. Choking preceeded several episodes of digging by one pair of skimmers at the site of an unfinished scrape on 16 August. Skimmers formed the nest scrape by lowering the breast, raising the tail, and kicking barnacle shells outward with the feet. After several kicks the bird moved to another position within the scrape and kicked outward again. To a casual observer it might be assumed that a scrape is formed by slowly spinning around on the breast feathers but this would cause excessive abrasion of the feathers (Tomkins 1933).

Eggs. The mean clutch size of the 13 nests was 2.9 (range 1-4 eggs). Eggs found outside of scrapes (4 on 30 August; Table 1) were not included in this calculation. They may have come from some of the 13 nests, from an empty scrape, or laid inadvertently away from the bird's scrape. Preston (1962) reported a skimmer laying an egg aboard his boat while it was stranded on a bar near a nesting colony of skimmers and terns. We measured and weighed 38 eggs on 30 August. The mean length was 45.4 mm (range 40.5-50.0 mm), mean width was 34.1 mm (range 31.5-36.0 mm), and the mean weight was 26.8 g (range 22.0-32.5 g). Egg weights were not all fresh weights as 14 eggs were known to be at least 14 days old. Unfortunately, we had no means of numbering eggs and nests nor weighing eggs on our first visit. Egg dimensions agree well with those reported by Bent (1921)

Between 13 and 27 September skimmers evidently punctured three eggs with their knife-like bills (Figure 1). These eggs were outside of scrapes when found and it is not known whether nesting or non-nesting birds were responsible. Inside one punctured egg was a well-formed embryo. Eggs were displaced from nests of late-nesting skimmers in Louisiana (Chamberlain 1959), but it was not indicated whether any eggs had been punctured. Bongiorno (1968) found Laughing Gulls puncturing eggs of their own species when their nests had been displaced by a storm.

Incubation. Both sexes incubate, but much variation occurred. It was hot (34-38°C) and nest relief occurred every 3-4 minutes when we first discovered the colony on 16 August. Our initial disturbance may have caused the rapid nest relief. It was at this time that we observed "foot-wetting" (Turner and Gerhart 1971) and other cooling mechanisms (to be discussed more fully elsewhere). Three nests were watched closely on 30 August from 1543 to 1820 to determine the amount of incubation by each sex (Table 2). Tomkins (1933) and Bent (1921) felt that females did all of the incubating and Pettingill (1937) felt these chores were shared equally. Modha and Coe (1969) reported that in the African Skimmer *(Rynchops flavirostris),* the parents took turns incubating. Sexes can be determined in the field by size differences. The male appears larger both on the ground and in the air (when both sexes are

Figure 1. Punctured ***egg*** of Black Skimmer at Salton Sea, California.

Photo by G. S. Grant

Table 2. Percentage of incubation performed by each sex from 1543 to 1820 on 30 August 1975.

	Male	Female	Uncovered
Nest No. 6 (4 eggs)	6.5	86.1	7.4
Nest No. 12 (3 eggs)	38.9	53.5	7.6
Nest No. 13 (3 eggs)	19.1	71.3	9.6

present for critical comparison). The maximum interval of uncovered eggs was 3 minutes. During the heat of the day a short interval of disturbance may prove lethal for the eggs. To minimize disturbance most of our observations were made from a boat anchored offshore and examination of eggs and young was limited to early morning and late afternoon visits.

Incubating birds oriented into the wind, almost without exception, but in still air orientation with respect to other skimmers was random. From 0715 to 1100 on 27 September all skimmers were facing into a NW wind (tail to sun) regardless of whether incubating, brooding, or in a resting flock. From 1100 to 1130 no wind occurred and bird positions were random. At 1130 the wind came from the SE and all birds faced into the wind and sun. Our observation position was unchanged during this time interval. Wind flow over the feather surface facilitates heat loss by convection. Ruffled feathers and orientation into the wind were important behavioral adjustments for desert nesting Gray Gulls ***(Lams*** *modestus)* in Chile (Howell et al. 1974).

Figure 2. Some heat loss mechanisms of the Black Skimmer. Note panting; elevated crown, nape, and scapular feathers; shading of legs and feet; and slightly drooped and outward displaced wings. ***Photo by G. S. Grant***

Panting, elevated crown, nape, and scapular feathers, slightly drooped and outward displaced wings, and shading of feet and legs were frequently used heat loss mechanisms (Figure 2) of nesting skimmers in this stressful environment. Shade temperatures above 40°C and ground temperatures above 50°C are often encountered here.

Nestlings. Intense solar radiation dictates egg coverage during the egg-laying stage and asynchronous hatching would be expected. Even if the eggs were only shaded during the egg-laying stage, some development within the egg would probably occur because of the high ambient temperatures encountered here. One pair brooded three chicks and there was at least 24 hours difference in the age of each one. Tomkins (1933) also reported incubation beginning with the first egg laid and chicks hatching a day or so apart. Measurements and weights were obtained on all chicks captured. The upper and lower mandibles are about the same length at hatching and in chicks weighing up to 300 g only 1 mm difference was detected. In the largest chick (340.5 g), the lower mandible extended 3 mm beyond the upper. This individual was near fledging age. Uneven bill lengths would handicap the feeding ability of chicks, especially if the food item fell to the ground during the exchange from the parent's bill to the chick, as also suggested by Bent (1921) and Modha and Coe (1969). A rapid growth of the lower mandible occurs at fledging or shortly afterward as the bill lengths of flying juveniles that we saw appeared similar to those of the adults. We have no data on the extent of parental feeding during this intermediate stage. Feeding of the young was not observed during our visits, but discarded Sailfin Mollies *(Peocilia latipinna)* were found in some of the scrapes. Skimmers feed primarily at dusk and at night and presumably the young are not fed during the day at Salton Sea.

Four chicks were banded on 13 September and four more on 27 September with the hope of learning something about their wintering area. On 27 September we recaptured two of the previously banded chicks, but the other two could not be found. One chick and two eggs were lost to avian predators and 15 other eggs and/or young were not accounted for between 30 August and 27 September (Table 1). A chick, about one day old, that was found dead on 27 September (specimen to UCLA) had a gaping hole at the base of its neck which was probably inflicted by a heron or gull.

Skimmers were observed feeding in the Whitewater River delta region of Salton Sea as late as 13 October.

*Behavior **toward nest markers.*** Sixteen numbered, wooden tongue depressors (152 mm x 19 mm x 2 mm), with red paint applied to the top 20 mm, were placed about 15 cm from the nest scrapes on 30 August. Almost immediately some birds began actively removing these markers, and by 27 September only one marker of the original 16 remained upright. Seven others ***were*** scattered in the vicinity of nests

and one of these had been displaced over 5 m. The remaining eight were no longer present on the island. To investigate color responses we placed five variously colored tongue depressors from 15 cm to 1 m from a nest scrape (one egg and two chicks in scrape) on 13 September. Within one hour the pair (male in all the cases where sex was determined) had knocked down or flown off with all markers in the following order and approximate distance placed from the nest: black (30 cm), yellow (30 cm), green (15 cm), blue (1 m), red (65 cm). The vertical component of the marker was not the sole stimulus as they repeatedly attempted to lift markers lying flat on the ground near the nest. We attempted to duplicate this experiment on 27 September but the birds did not respond to markers placed near the nests. Adult attentions were directed toward the more mobile chicks rather than to the nest sites on this date. With our limited data it would be premature to speculate on the significance of this behavior.

DISCUSSION

Skimmers characteristically nest later than most terns and gulls on the Atlantic seaboard, with most egg dates coming from mid-May to late July (Bent 1921). The African Skimmer (Britton and Brown 1974) breeds mainly in April-May at Lake Rudolf, Kenya, but elsewhere in East Africa they breed on exposed sandbanks of rivers where egg-laying begins in June but may continue into September during the dry season (Attwell 1959). Falling water and exposure of sandbanks has been suggested as the nesting stimulus for the Black Skimmer along the Amazon River (Preston 1962). Late-nesting skimmers were studied in Louisiana where the majority of eggs did not hatch until 18 August (Chamberlain 1959). Chamberlain suggested the late nesting was probably due to a second nesting effort. At the south end of Salton Sea, Black Skimmers successfully- raised one young by mid-August 1975 (McCaskie 1975). Any nests placed in the drift or high water line are subjected to flooding by rising water levels until late June-July or by wind-driven water at any time during the summer. Skimmers nesting at the north end were probably unsuccessful in an earlier nesting attempt in 1975 along the shoreline of the sea.

Nesting success of this species might be enhanced by constructing small islands that remain above June and July water levels at both ends of the sea. Islands kept relatively clear of vegetation and at a suitable distance from land to prevent predator and human access should prove acceptable to skimmers seeking nest sites in June. Nest sites available early in the season would allow nesting relatively free of gull predation. Gull numbers increased sharply after the first week in July 1975 at the north end of the sea.

It is interesting to speculate on this sudden influx of skimmers into California. One wonders about habitat destruction in the Gulf of California, persecution by man, and change in food availability. Two breeding colonies in Sonora and several colonies in Sinaloa (Friedmann et al. 1950) are the only recorded nesting locations for northwestern Mexico. About three-fourths of the annual precipitation in Sonora and northern Sinaloa falls between June and September, mainly in July and August (Anon. 1965). The first summer record of the Black Skimmer for California occurred on 3 July 1968 (McCaskie and Suffel 1971). Perhaps unusually heavy rains destroyed skimmer nests in northwestern Mexico in 1968 and were responsible for the 1968 skimmer influx into Salton Sea. Rainfall for Guaymas, Sonora in July 1968 exceeded the mean July precipitation by a factor of 2.5 (Anon. 1965, 1968). However, June 1968 had only a trace and we do not know how much rain occurred between 1 and 3 July 1968.

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