J. Field Ornithol., 55(4):424–434

FIELD INVESTIGATIONS OF THE BIOLOGY OF COMMON TERNS WINTERING IN TRINIDAD

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Austin (1953) recognized 3 nesting populations of Common Terns (*Sterna hirundo*) in North America: (1) the Atlantic Coast Unit, (2) the Central Unit, and (3) the Northwest Unit. The Atlantic Coast birds breed from the Gulf of St. Lawrence to the Chesapeake Bay area and winter mainly in the West Indies and on the north coast of South America from Venezuela east to the mouth of the Amazon River. In Trinidad, almost all band recoveries have been of birds banded as nestlings in Atlantic Coast colonies, with a few birds banded in the Great Lakes area (ffrench 1980). Little is known of the biology of North American Common Terns on their winter range.

During the winter of 1980–1981 we found that Common Terns at the southwest tip of Trinidad were in poor physical condition and appeared to have difficulty in obtaining food (Blokpoel et al. 1982). Somewhat similar observations were made by P. Trull in Suriname and Guyana (op. cit.), suggesting that the observed phenomena may be widespread.

During the 1981–1982 winter we returned to Trinidad for further studies. This report presents our findings on the geographic distribution, weights, ages, site tenacity, and daily activities of Common Terns during late January and early February 1982.

METHODS

Geographical distribution.—We surveyed the coastline of Trinidad (except Caroni Swamp) and its off-shore islands using a Gazelle Helicopter flying at a height of about 100 m (Fig. 1). We made 4 flights from 19–21 Jan. 1982 between 0940 and 1500. On each flight there were at least 2 observers. We also visited several coastal areas in southwest Trinidad by car on 30 Jan. and 2 Feb. to identify "white terns" observed from the air.

Study area.—The aerial survey suggested that the only accessible place for a detailed study of "small white terns" was Icacos Beach in the southwest corner of Trinidad. We chose 4-km of beach from just south of Corral Point to ca 400 m east of Icacos Village (Fig. 1, inset). The area was typical Caribbean beach with coconut palms set back from a 5–10 m width of low xerophytic herbaceous ground cover. The width of the bare sandy beach varied from 1–10 m depending on the tide. We used a covered cabana to handle captured terns and to observe tern movements. This cabana was centrally located on the beach strip and was ca 15 m from the edge of the water at high tide. There were 3 sites of fishing activities (boats pulled up on the beach, seining for bait fish) along the length of the study area. These were: "East Village," "West Village," and Icacos Village (Fig. 1, inset).

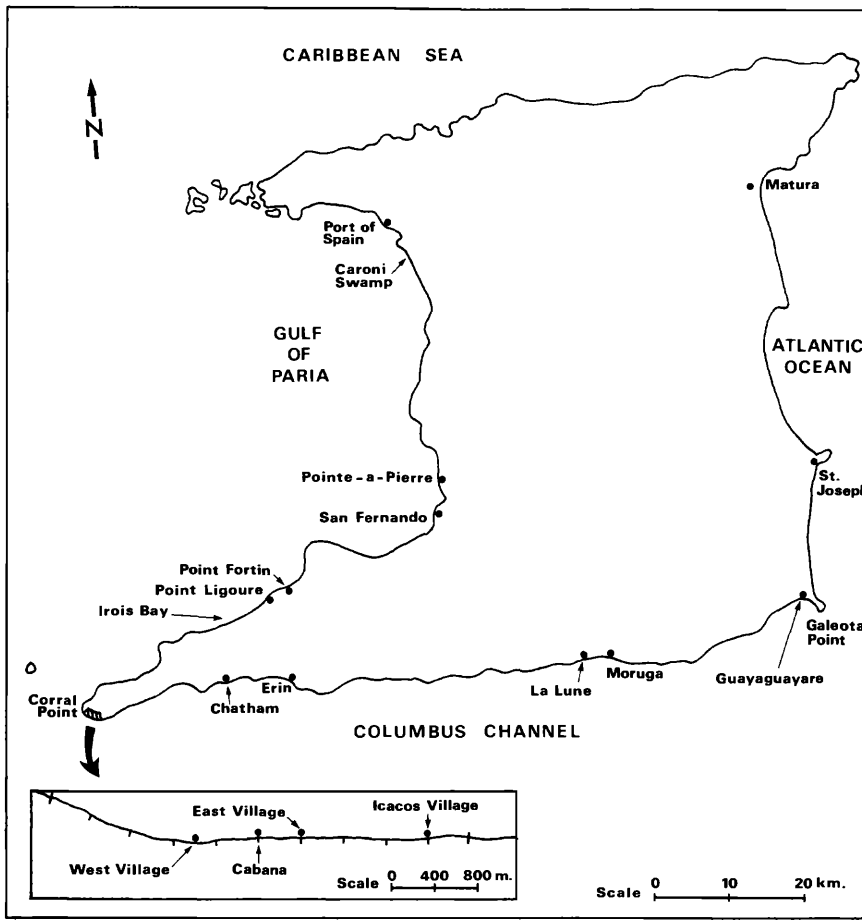

FIGURE 1. Map of Trinidad and study area (inset). See text for details of study area.

Capturing.—We captured 54 birds, 53 of which were caught using small fish as bait. Birds feeding on bait laid out on the beach were caught by hand (n = 2) or with a net (n = 1). Birds feeding on bait thrown over the side of a fishing boat anchored offshore were caught by hand (n = 11) or by hoopnet (n = 39). One weak bird was caught by hand on the beach without using bait. Captured birds were transported individually in canvas bags.

Condition and age.—To ascertain condition of the terns, we weighed captured birds using a 300-g Pesola spring balance that we calibrated daily. To estimate the age of the birds, we examined primary molt, as that is the main difference in the plumage of winter birds of different ages (Roselaar, in press). We also recorded plumage and color of bill

and feet and photographed the head (side view) and one spread wing for the first 32 birds captured.

Distribution, site tenacity, and numbers.—To observe individual birds we color-marked the first 16 of the 54 trapped birds with red (Rhodamine B) and yellow (picric acid) dye on nape and wings in different combinations. All trapped birds received a numbered aluminum band on one leg and a plastic color band on the other. Birds already banded received a color band only. Between 0900 and 1600 on each day, we walked the 4000-m study beach at least twice and noted location and number of resting birds.

Movements.—During 27 Jan.–2 Feb. 1982 we observed movements of terns passing in front of the cabana from 0600 to 1900, for a total of 49 h. A single observer, sitting in the cabana with 2 hand-counters, recorded the number of bird movements to the east and to the west past the cabana.

RESULTS

Geographical distribution in Trinidad.—Small "white terns" were seen during the air survey in only 2 areas: ca 550 birds near Point Fortin and ca 200 near Icacos Village (Fig. 1). Big "white terns" were seen at Point Fortin (ca 600 birds), near Icacos Village (fewer than 20), Chatham (45), and Galeota Point (90–100). In the Point Fortin area we saw a few birds foraging over the water, but more than 90% of the birds were resting near the end of a 2-km-long oil jetty. Ground observations (30 Jan., 1100–1200) showed 3 species present: ca 250 Royal Terns (*Sterna maxima*), 40–50 Sandwich Terns (*S. sandvicensis*), and 500–600 Common Terns. At the Icacos Point area most terns were foraging near active fishing boats, while a few were resting on the sandy beach and on inactive boats anchored offshore. Ground observations (24 Jan.–2 Feb.) showed that the small white terns were Common Terns and the large ones Royal Terns. The large terns seen during the air survey at Chatham and Galeota Point (areas that we did not visit by car) were most likely Royal Terns. At Chatham the birds were resting on an offshore jetty, and on Galeota Point they rested on docking facilities.

During a waterbird survey of the coast of Trinidad on 17 Feb. 1982, 865 small "white terns" were seen from the air: 500 off San Fernando, 315 near Corral Point, and 50 offshore from the Caroni Swamp (R. I. G. Morrison and R. K. Ross, pers. comm.).

Weights.—Weights of the 54 birds captured ranged from 78 to 123 g ($\bar{x} \pm SD = 102.6 \pm 9.5$ g). Most of the lighter birds (<100 g) were in poor physical condition with sharp sterna. The lightest bird (78 g) was caught by hand on the beach in the early evening and found dead the next morning on the site where it was released. We also found a bird weighing 94 g that had recently died in an open boat anchored offshore. Weights of birds known or judged to be in their first winter ($\bar{x} \pm SD = 101.4 \pm 9.1$ g, n = 41, Tables 1 and 2) and those of older birds ($\bar{x} \pm$

SD = 105.8 ± 10.6 g, n = 12) were not significantly different (t = 1.41, df = 50, $P > .05$).

Ages.—Of the 54 captured birds, 6 had been banded at colonies along the northeast Atlantic coast of the United States. Five had been banded as chicks (4 in 1981, 1 in 1980) and one as an adult (ASY in 1979) (Table 1). All had blackish-red or blackish-orange feet and blackish bills, often with an orange tinge at the gape. The 5 sub-adults had the typical winter head: a white forehead, black-and-white mottled crown, and a black nape extending anteriorly to the eyes. The adult had forehead, crown, and nape completely mottled.

The molt of the 10 primaries in terns is unusual in that a second wave of molt may begin before the first has been completed, resulting in 3 generations of primaries (Stresemann and Stresemann 1966). We describe the various feather generations observed in the field as follows: (1) "Old"—feathers worn, black faded to dirty brown, (2) "New"—the first generation of replacement feathers; often with a bluish hue on the black outer feathers; no or very little wear, and (3) "Very New"—the second generation of replacement feathers, observed only in P1–P3, light gray with silvery sheen.

Before estimating the ages of the 48 unbanded terns, we compared the molts of the 6 banded birds (Table 1) with published data. Juvenile birds begin to replace their primaries after the fall migration (beginning in December and ending by June–August) (Roselaar, in press). First-winter birds in late January therefore probably have their first 2 to 4 primaries "New" with the remainder still "Old." Our data for first-winter birds support Roselaar's findings. Terns in their second winter start a third series of primaries in December–February (Roselaar, op. cit.); data for our second-winter bird are again in agreement. Adult birds may molt P1 to P4 prior to migration and replace the other primaries on the wintering grounds with the molt being completed in late January to early March (Roselaar, op. cit.). Hence, adults in late January would probably have P8 or P9 to P10 as "Old" feathers, P1 to P7, P8, P9 or P10 as "New," and possibly P1 and P2 as "Very New." The data for our adult-winter bird fit this prediction except that there were only 2 generations of feathers. This lack of "Very New" primaries may have been the result of the poor condition of the bird, which weighed only 86 g.

Based on the agreement between our findings for the 6 banded birds and the study by Roselaar, we categorized the primaries for each bird according to feather generation (i.e., Very New, New, and Old) and then assigned likely ages to the various combinations of generations. Of 47 birds for which we had sufficient data, 37 (79%) were most likely first-winter birds, with the remainder second-winter or adult-winter (Table 2). Including the 6 banded birds, 41 (77%) of 53 birds for which we had sufficient data were first-winter birds. Of the other 12, at least 1 and possibly 4 were second-winter birds. In summary, the proportion of subadults among the captured birds may have been as high as 85%.

TABLE 1. Age, weight, and molt of primaries of banded Common Terns captured in Trinidad, 24 Jan.–2 Feb. 1982. L—left, R—right. See text for description of the different generations of the primaries.

Age, description	Weight (g)		Primaries
~8 mo., first winter	98	L	1 new, growing, 2 new, pin, 3 to 10 old
		R	1 and 2 absent, 3 new, 4 to 10 old
~8 mo., first winter	108	L	1 new, 2 new, growing, 3 to 10 old
		R	1 and 2 new, growing, 3 new, pin, 4 to 10 old
~8 mo., first winter	84	L	1 and 2 new, 3 new, growing, 4 to 10 old
		R	1 and 2 new, 3 new, growing, 4 to 10 old
~8 mo., first winter	105	L	1 and 2 absent, 3 new, growing, 4 to 10 old
		R	1 absent, 2 and 3 new, growing, 4 to 10 old
~20 mo., second winter	119	L	1 very new, 2 very new, pin, 3 to 6 new, 7 new, pin, 8 to 10 old
		R	1 very new, 2 very new, growing, 3 to 6 new, 7 new, pin, 8 to 10 old
≥4½ yr., adult, winter	86	L	1 to 7 new, 8 new, pin, 9 and 10 old
		R	1 to 7 new, 8 new, growing, 9 and 10 old

Distribution, site tenacity, and numbers.—Common Terns along the southwest corner of Trinidad were restricted to the area of beach within our 4000-m study site. Extensive searching on foot and by car to points up to 2 km east never resulted in terns sighted on the beach or in the air. Groups of 1–65 terns were seen on 49 occasions during the regular beach walks during 27 Jan.–2 Feb. The most common group size was 1–10 birds (n = 25 observations, 51%), with group sizes of 1–30 birds accounting for 82% of the observations. The terns preferred to rest near the 3 sites of fishing activities along the beach: West Village (with a mean of 10.1 birds per 100 m of beach), East Village ($\bar{x}$ = 8.2) and Icacos Village ($\bar{x}$ = 4.2). The mean numbers of terns per 100 m along the remainder of the beach ranged from 0 to 1.1. The observed distribution of the resting terns was significantly different from random (χ^2 = 162.2, df = 9, $P < .001$).

Each of the 16 birds captured and individually color-marked from 25–27 Jan., was resighted 1–25 times over the next 7 days ($\bar{x} \pm SD$ = 9.1 ± 6.7 sightings). This suggests that these individuals formed part of a "resident" population of terns at Icacos.

Our observations from the air and on the ground suggested that the population of Common Terns in the study area did not exceed 175–200 birds during 19 Jan.–1 Feb. Early on 2 Feb., 3 new flocks totalling some 150 birds flew in from the ocean. Later that day all terns in the study area were concentrated in one location, where 2 observers established their numbers at 320–325. On 2 Feb. we trapped 21 birds, and some of those were probably from among the 150 newly-arrived birds. The weights of those 21 birds ($\bar{x} \pm SD$ = 103.7 ± 7.6 g) were not

TABLE 2. Molts of primaries and estimated ages of 48 non-banded Common Terns captured in Trinidad, 24 Jan.–2 Feb. 1982. See text for description of feather generations.

Generations of primaries	Description of molt[a]	Estimated age	n
Old	1 to 10 old	first winter	1
Old, new	1 and 2 new, 3 to 10 old	first winter	10
Old, new	1 to 3 new, 4 to 10 old	first winter	11
Old, new	1 to 4 new, 5 to 10 old	first winter	13
Old, new	1 to 5 new, 6 to 10 old	first winter	2
Old, new	1 to 8 new, 9 and 10 old	adult	2
New	1 to 10 new	adult	1
New, very new	1 very new, 2 to 10 new	adult	2
New, very new	1 and 2 very new, 3 to 10 new	adult	2
Old, new, very new	1 very new, 2 to 7 new, 8 to 10 old	second winter or adult	1
Old, new, very new	1 very new, 2 to 9 new, 10 old	second winter or adult	1
Old, new, very new	1 and 2 very new, 3 to 6 new, 7 to 10 old	second winter or adult	1
Insufficient data	—	?	1

[a] Primaries classified as to feather generation regardless of extent of feather growth. In cases of differences between the left and right wing, the most advanced molt is used.

significantly different from the weights of the 33 birds captured earlier ($\bar{x} \pm SD = 101.4 \pm 10.5$ g; $t = 0.86$, $df = 51$, $P > 0.05$). The proportion of first-winter birds was the same for the 21 terns trapped on 2 Feb. as for those captured earlier. The molt in the first-winter birds captured on the later date was slightly advanced compared to that of the birds caught earlier. If the 21 birds captured on 2 Feb. were indeed mainly from the newly-arrived birds, the data suggest that this second group was similar in age composition and physical condition to the "resident" group.

Movements.—The numbers of birds moving east and west were variable but similar (Fig. 2). The only difference which approached significance was during the evening (1600–1900), when more birds flew west than east (Mann-Whitney U-test, $.1 > P > .05$). Numbers moving in both directions were combined for each hour within each of the 3 time blocks to establish differences in the extent of movement among them. Movement was most extensive in the morning (0600–0900) and evening, and smaller during the middle part of the day (0900–1600) (Mann-Whitney U-tests, $P \leq .02$). The high levels of movement following sunrise and before sunset were apparently related to foraging activities and to travel from and to night-time roosting areas. Preferred roosts were fishing boats anchored offshore. Just prior to darkness, the gunwhales of those unattended boats quickly became densely occupied by terns and around dawn the terns were seen to leave those boats.

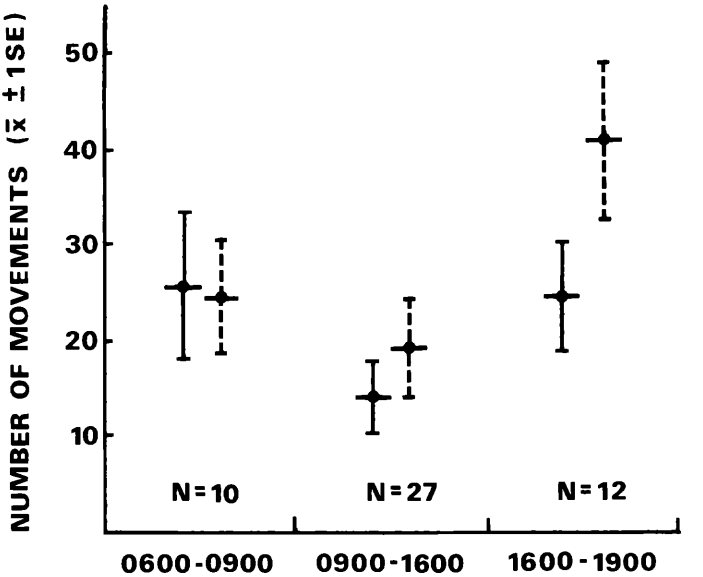

FIGURE 2. Numbers of Common Tern movements in front of the center of the study area at different time of day during 27 Jan.–2 Feb. 1982. Solid lines—birds flying from east to west; broken lines—birds flying from west to east. N = number of hours of observation.

Foraging techniques.—Just after dawn terns would begin foraging over the sea, especially at a reef off the west tip of the study area. When foraging at sea, the terns were normally widely distributed. A few times they formed frenzied feeding concentrations and then dispersed again. Other techniques of foraging were: (1) patrolling the shoreline for dead or dying fish; (2) "scrounging" when seine nets were hauled up on the shore or when fishing boats returned to unload their catch, and (3) "checking out" fishing boats out at sea (both trawlers and small open boats). During the course of the day we usually saw fewer terns foraging than in the early morning, and many birds rested on the beach (especially during mid day).

Oil pollution.—During the air survey we noticed several instances of oil leaking from the many offshore oil facilities along the southern half of the west coast, especially near Point Fortin. Many "sheets" of oil were seen along the east coast from near Matura south to St. Joseph. During visits by car to accessible locations along the north shore of the southwest tip of Trinidad, we saw substantial oil pollution on beaches at Point Ligoure and at Irois Bay (Fig. 1). At the study area we noticed several instances of oil pollution on the beach, but, because of the high tides and the strong east-to-west current in the Columbus Channel, the oil usually dispersed in less than a day. Among the Common Terns on

the beach, we noticed several with oil-stained plumage. Two terns were very badly oiled and would probably not have survived. Of the 54 captured birds, 3 had oil-stained plumage.

In April or May 1982, many oiled Common Terns were observed in the area by Mr. O. Mohammed, a fisherman at Icacos Village who had helped us with our field work. Mr. Mohammed collected 5 bands from the oiled birds. All bands had been put on Common Tern chicks at coastal colonies in New York, Maryland, Connecticut, or Rhode Island during 1981.

Avian predators.—Twice terns foraging at sea suddenly flocked together and rapidly left in response to the presence of a bird of prey high in the sky. We watched one bird of prey pursue a Common Tern over the sea about 200 m offshore. The predator stooped 3 or 4 times but the tern escaped by diving. We could not identify the raptor with certainty, but it probably was a Peregrine Falcon (*Falco peregrinus*), a species known to hunt terns in Trinidad (R. ffrench, pers. comm.). Although we saw no Common Terns killed by raptors, one of the local fishermen told us that he had seen a "hawk" kill one of the color-marked birds on the beach.

DISCUSSION

Geographic distribution in Trinidad.—The air surveys and our observations at the study area suggest that the observed distribution of the wintering terns around coastal Trinidad was determined largely by (1) availability of food, and (2) presence of adequate roosting sites. Waters surrounding Trinidad vary considerably in depth, turbidity, and productivity. The Caribbean Sea breaks with violence on the rocky shores of the north coast. During the air survey of that coast we saw no terns and no fishing boats. The Atlantic Ocean on the east coast produces pelagic conditions. We saw no terns and only one small fishing village just south of St. Joseph. In the Columbus Channel along Trinidad's south coast, there is a strong current that carries the rather murky water west into the Gulf of Paria. We saw concentrations of fishing boats at Guayaguayare, Moruga, La Lune, Erin, and in the Icacos Village area. Common Terns were present only near Icacos Village, but on 2 May 1965 "thousands" had been observed resting on offshore sandbars near Moruga (R. ffrench, pers. comm.). The Gulf of Paria has a somewhat estuarine character and is rich in fish. The relatively sheltered west coast has numerous fishing villages. We found the main concentration area of Common Terns at Point Fortin on the west coast. Similar findings were reported by Morrison and Ross during their air survey on 17 Feb. 1982.

We have noticed, both in Trinidad and at our study colonies in Canada, that Common Terns seem reluctant to enter the water. At Great Lakes colonies, we have observed terns entering the water for only 4 reasons: (1) plunge-diving, (2) bathing, (3) wetting of the breast feathers by incubating birds during hot weather, and (4) preening immediately

upon release after being trapped and handled. In Trinidad, the captured birds upon release first flew out to sea, but then returned to the beach without entering the water.

In Trinidad terns rested and roosted on offshore boats, jetties, and unused docking facilities as well as on the beach. We believe that offshore roosting sites are preferred to the beach. We also noted that at high tide, as the rising water forced the terns resting on the beach towards the band of low vegetation above the high tide line, the birds became agitated and flighty. Night-time roosting on the beach may occur when the tide is low (as we observed in 1981), but during our study there was much nocturnal activity by fishermen along the beach and we saw no roosting birds.

Physical condition and age.—Many of the terns at the study area were in poor physical condition. The weights of the captured birds ($\bar{x}$ = 102.6 g, range = 78–123, n = 54) were well below weights reported for adults nesting at Great Gull Island ($\bar{x}$ = 120.4 g, range = 103–145 g, n = 265, LeCroy and LeCroy 1974) and at Massachusetts colonies ($\bar{x}$ = 125 g, range = 106–147 g, n = 116, Nisbet 1977). We believe that we did not capture only the weakest, most starved birds. When catching birds from the boat, we would first build up a "feeding frenzy" by throwing many bait fish overboard and then making a quick swoop with the hoop net. With this procedure we believe we obtained a representative sample of the population. If the weight data for our trapped sample are a reasonable representation of the local population, many of those birds were underweight. Molting requires much energy, but we do not think that this is sufficient to explain the low weights and poor conditions that we observed in the study area. Other reasons for the observed low weights could include: poor availability of prey fish (we have no data on this topic), ingestion of oil (no data), diseases (no data), ectoparasites (most birds had parasites around the head, but their numbers did not seem excessive), reduced maneuverability due to molt (all birds were actively molting), or poor hunting skills due to young age (cf. Buckley and Buckley 1974 for Royal Terns). It may be that the last factor plays an important role. Again assuming that the trapped birds were representative of the population, up to 85% of the birds were in their first or second year and many of those subadults might have failed to develop fishing skills. Post-breeding parental care on the wintering grounds in large tern species has been documented (Ashmole and Tovar 1968). In the Common Tern, post-fledging parental care has been observed on the summer range, but not on the wintering grounds (Burger 1980). We saw no food begging in Trinidad. If the subadult birds lacked hunting skills and no adults were feeding them, they would probably have to rely on the fishermen, move elsewhere, and/or slowly starve to death.

SUMMARY

During an aerial survey of coastal Trinidad in January 1982 we saw about 750 Common Terns: 550 near an oil jetty at Point Fortin (west

coast) and 200 near Icacos Village (south coast). The distribution of terns appeared to be determined by availability of food and roosting sites. Near Icacos Village terns rested on the beach near human fishing activities and on boats anchored offshore. There we trapped 54 birds, 77% of which were in their first winter. Many birds were underweight and a few were starving. Color-marked birds indicated a site tenacity for the Icacos Beach; however a new group of terns arrived late in the study period, showing that flocks do move between areas. Birds foraged by fishing at sea, by patrolling the shore line, and by picking up fish discarded by fishermen. Poor feeding conditions and/or fishing skills, a scarcity of suitable resting and roosting areas, oil pollution, and predation by raptors combined to reduce the survival of Common Terns wintering in Trinidad.

ACKNOWLEDGMENTS

The Trinidad and Tobago Ministry of Agriculture, Lands and Food Production participated in the study. Thanks are due to B. Ramdial, Head of the Wildlife Division, as well as A. Maharaj, G. Ramdeen, R. Ramjattan, and S. Ramnath for assistance. The Department of National Security allowed us on board their helicopters during patrol flights. We thank C. Cane, of Bristol Helicopters, and acknowledge the help of O. Mohammed, a fisherman at Icacos. We thank R. ffrench, with whom we discussed the project, and Mr. and Mrs. G. Bovell, who provided field accommodation. R. I. G. Morrison and R. K. Ross, both with the Canadian Wildlife Service, allowed us to use their aerial survey data. Blokpoel had useful discussions with R. van Halewÿn, G. F. Mees, A. L. Spaans, and C. S. Roselaar. S. G. Curtis, T. C. Dauphiné, and I. C. T. Nisbet commented on the draft manuscript. The project was carried out as part of the Latin American Program of the Canadian Wildlife Service.

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Received 14 Dec. 1982; accepted 31 July 1984.