Feeding Grounds, Daily Foraging Activities, and Movements of Common Terns in Southern Brazil, Determined by Radio-telemetry

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Abstract.—Fourteen Common Terns (*Sterna hirundo*) were radio-tagged on their wintering grounds at Lagoa do Peixe, Rio Grande do Sul state, southern Brazil. Aerial radio-tracking was made along 850 km from northern Rio Grande do Sul state to Montevideo, Uruguay. During 23.6 h of tracking in February 2003, we recorded 100 locations of 12 radio-tagged terns. Birds were located within a range of 165 km from the tagging area, and most locations were at sea (74 at sea *vs.* 26 roosting on the beach), due to frequent movement of the birds when feeding and most tracking during feeding periods. Each bird was located 4-14 times (mean = 8.3 locations/bird). Common Terns fed predominantly between 15-20 m isobaths (56% of at sea locations), and 10-15 m isobaths (32%), which corresponded to a maximum of 8 km offshore. Minimum distance traveled in five days of intensive tracking was 46 km, and maximum distance was 167 km. Daily movement was 19 km on average (minimum 6 km d^{-1}, maximum 49 km d^{-1}). Nine out of 12 birds were found at sea in both early morning and late afternoon periods. Eight out of 12 birds were recorded feeding at sea in consecutive periods of the day (morning and afternoon), indicating two feeding trips a day. *Received 25 November 2004, accepted 2 May 2005*

Key words.—Common Tern, *Sterna hirundo*, wintering grounds, South America, foraging, feeding ecology, radio-tracking, otolith.

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The Common Tern (*Sterna hirundo*) has been intensively studied, both in Europe and North America, and is one of the best-known seabird species. In spite of intensive fieldwork on the breeding grounds in the Northern Hemisphere and 2-3 millions birds banded, information on birds wintering in South America is scant and several gaps exist in our understanding of the Common Tern's lifecycle. Until the mid-1980s, the Atlantic Coast breeding population (sensu Austin 1953) was suspected to winter north of the Amazon river in Suriname, Guyana and Trinidad (Blokpoel *et al.* 1982, 1984, 1987). However, Harrington *et al.* (1986) and Resende and Leeuwenberg (1987) mentioned large concentrations of juveniles and adults (up to 14,000) in Lagoa do Peixe, southern Brazil. Vooren and Chiaradia (1990) estimated maximum abundance of 2,200 individuals along 60 km of Cassino Beach. New observations in southern South America were reported by Hays *et al.* (1997), who described large concentrations of Common Terns in Punta Rasa, Buenos Aires Province, Argentina, and used band recoveries to establish Argentina and southern Brazil as wintering grounds for birds older than one year. In contrast, birds of the year stay north of 27°S, primarily along the northern coast of South America. Hays *et al.* (1999) described a large concentration about 10,000 Common and Roseate Terns in northern Bahia, Brazil.

The effective conservation of a migratory species, such as the Common Tern, depends on an understanding of their annual cycle and a knowledge of their winter ecology. Investigations on feeding ecology were conducted at Punta Rasa, Argentina (Mauco *et al.* 2001), and in southern Brazil (Bugoni and Vooren 2004) using regurgitated pellets to describe the diet. As a result of plasticity in

foraging methods (Erwin 1977; Nisbet 1983; Burger and Gochfeld 1996), the Common Tern has a highly diverse diet both on wintering (Mauco *et al.* 2001; Bugoni and Vooren 2004) and breeding grounds (Lemmetyinen 1973; Erwin 1977; Safina *et al.* 1990). On their wintering grounds in Argentina, Mauco *et al.* (2001) described a diet composed of pelagic anchovies (*Engraulis anchoita* and *Anchoa marinii*), and insects. Alternatively, in southern Brazil, demersal sciaenid fish (*Paralonchurus brasiliensis* and *Micropogonias furnieri*), and insects composed the bulk of the Common Tern diet (Bugoni and Vooren 2004). On the breeding grounds, the Common Tern preys on small fish up to 150 mm long, and sometimes predominantly crustaceans or insects. Most breeding birds forage within 20 km of colonies, on fish available within 50 cm of the surface, in marine and freshwater environments (Nisbet 2002), catching them by surface plunging, i.e., a bird in flight plunges into the water using the momentum of the fall without fully submerging (Harper *et al.* 1985). Common Terns frequently forage on predatory fishes both in breeding (Safina 1990) and wintering areas (Bugoni and Vooren 2004). Bugoni and Vooren's (2004) analysis of otoliths in pellets collected at roosting sites in southern Brazil led them to suspect the birds were feeding twice a day. In this paper, using radio telemetry and aerial tracking we describe movements and daily activities of Common Terns at Lagoa do Peixe and include data confirming their suggestions.

STUDY AREA

Lagoa do Peixe (31°22'S; 51°02'W) is a coastal lagoon, 32 km long and 1.3-2.4 km wide, connected to the Atlantic Ocean by a temporary inlet. Shallow waters (mean depth of 0.5 m) and mudflats, irregularly exposed by wind action and rain, provide abundant food for staging and wintering waterbirds. Mudflats and sandbars are also important as day and night roosting sites for large flocks of seabirds and shorebirds. In order to protect this environment, the 33,400 ha Lagoa do Peixe National Park was established in 1986. This area is also part of the Western Hemisphere Shorebird Reserve Network and is a Ramsar wetland of international importance (Nascimento 1995).

Adjacent to Lagoa do Peixe, a 620 km beach extends between Torres (29°20'S; 49°44'W) and Arroio Chuí (33°45'S; 53°22'W), in the southernmost Brazilian State, Rio Grande do Sul (Fig. 1). It is a continuous sandy beach interrupted only by the Lagoa dos Patos and the Tramandaí River inlets. The beach is composed of fine quartz sand and has a low gradient (2°). During periods of heavy rainfall, a large number of ephemeral creeks break the frontal dunes, draining landward depressions (Calliari 1997a). The gently sloping continental shelf (2 m km^{-1}) has a width of 100-180 km, composed mostly of unconsolidated substrates, such as fine sand and mud (Calliari 1997b). The Uruguayan coast is similar to southern Brazil, with the exception of rocky sections across the beach. Both areas are influenced by the Subtropical Convergence, where warm waters of the Brazil Current flow southward to reach the cold waters of the Malvinas Current flowing northward. Rio da Prata and Lagoa dos Patos waters flow into the ocean, also affecting the neritic region (Castello *et al.* 1998).

METHODS

On the nights of 7-9 February 2003, fourteen Common Terns were mist-netted, radio-tagged and released in the Lagoa do Peixe inlet. Netting sites were exposed mudflats and sandbars near nocturnal roosting sites.

Common Terns were radio tagged with Very High Frequency (VHF) transmitters (Holohil Systems Ltd.), each containing a lithium battery, which lasted about three weeks, and a flexible 14 cm long whip omni-directional antenna. The transmitters were glued by the manufacturer to metal leg rings and operated at a frequency of 172.669 to 172.930 MHz, at a range up to 5 km. The transmitter and the band together weighed 1.2 g or 0.8% of the Common Tern's body mass of 145 g (Harrington *et al.* 1986). For a detailed description of a similar transmitter see Morris and Burness (1992).

Aerial monitoring for radio signals was performed using two directional 4-element Yagi antennas; one attached to each wing strut of a Cessna 206 high-winged aircraft. Flight altitude ranged from 250-600 m. The receiver (Lotek STR 1000) was programmed to scan the 14 frequencies, plus 15 frequencies of birds simultaneously tagged in Punta Rasa, Argentina. Birds encountered that had been marked in Argentina will be reported elsewhere (Hays *et al.* in prep.). When poten-

Figure 1. Study area in southern Brazil and Uruguay. Common Terns were radio-tagged in Lagoa do Peixe and tracked by aircraft from Torres to Montevideo in February 2003. Localities mentioned in the text are shown.

tial radio signals were detected the individual frequency was monitored for as long as necessary to confirm a bird's presence. The exact location of a bird was determined using a switch box to switch between the right and left antennae. A radio-tagged bird was circled (Gilmer *et al.* 1981; Mech 1983), and using a Global Positioning System (GPS) we tried to collect at least three positions around each signal to increase the accuracy of the bird's location. Signal bounce was improbable because tracking occurred over the sea or over flat coastal terrain. Sometimes, the location of individual birds or flocks was confirmed through visual observation. Aerial tracking was performed from 10-14 February and 27-28 February 2003, for a total of 23.6 h. Flights were performed in good weather (light wind and minimal cloud cover). Tracking flights usually occurred just before nautical dawn (around 05.00 h), and from 15.00 h to dusk. Overall, more time was spent searching for radio signals along the coast and ocean adjacent to Lagoa do Peixe, due to high concentration of radio-tagged birds identified there during our first flights. On 13 February, a longer trip covered the whole coast from Lagoa do Peixe to Montevideo, Uruguay, and back. On 27-28 February, the coast was surveyed between the Uruguayan border to Torres, in northern Rio Grande do Sul. Details of flight schedules are shown in Table 1 and localities mentioned are in Figure 1.

For data analysis, a Geographical Information System (GIS) was used to digitize Brazilian Navy nautical charts #2000 and #2100 and plot locations of radio-tracked birds. The digitizing procedure resulted in differences of less than 270 m in identified landmarks, with known latitudes and longitudes, and marks in the final digital map. The inferred bird location was obtained by plotting successive aircraft locations on the digital map, with the direction of the aircraft (magnetic compass) and the antenna (left/right) in which the signal was detected. Additional notes as "strong" signal, visual identification of a bird or flock, or "birds on the beach" were used to pinpoint bird locations. Multiple locations for individuals in the same day were recorded when 1) a bird was detected during different daytime periods during the same day, 2) a bird moved several kilometers from one site to another within the same flight, or 3) a bird was recorded roosting on the beach and at sea in the same daytime period. Distances and time between successive locations were used to calculate daily movements (km d^{-1}), using data from 10 to 14 February, the most intensively sampled period. Departure from roosting sites was determined from two successive locations of a given tagged bird, one on a roosting site and a second one at sea. Similarly, arrival time was determined from an at-sea record and a subsequent record of the same bird on a roosting site. Bird locations were plotted on digital maps, and distances from successive points calculated by GIS software. Values are given as mean ± standard deviation (SD).

Although transmitters were checked before birds were released, two birds were not detected during aerial tracking. These birds could have moved beyond the limits of the study area, had lost the transmitters at sea, or the transmitters failed.

RESULTS

Twelve out of 14 radio-tagged birds were detected in aerial tracking from 10 to 14 February, and only four birds tracked again two weeks later, 27-28 February. Birds were detected 8.3 ± 3.7 times (range: 4-14). In total, 100 valid locations were recorded (74 at sea and 26 on land). Birds on land were recorded roosting on the beach or roosting on sandbars and mudflats near Lagoa do Peixe inlet (Fig. 2). No birds were detected on inshore waters. At sea, locations were predominantly between 15-20 m isobaths (55%), followed by 10-15 m isobaths (32%) and 0-10 m isobaths (8%). Only three locations (4%) were detected in isobaths over 20 m, with one

Table 1. Dates, sampling periods and areas searched for radio-tagged Common Terns in southern Brazil in February 2003. Local time GMT-3.

Date	Shift	Start (h)	End (h)	Tracking period (h)	Tracking area
10 February	Morning	05.02	07.54	2.52	Lagoa do Peixe
10 February	Afternoon	15.50	18.39	2.49	Lagoa do Peixe—Lagoa dos Patos mouth—Lagoa do Peixe
11 February	Morning	09.42	10.23	0.41	Lagoa do Peixe—Lagoa dos Patos mouth
12 February	Afternoon	15.14	16.36	1.22	Lagoa dos Patos mouth—Lagoa do Peixe
13 February	Morning	05.25	06.35	1.10	Lagoa do Peixe—Lagoa dos Patos mouth
13 February	Morning	08.22	11.30	3.08	Lagoa dos Patos mouth—Montevideo
13 February	Afternoon	14.36	17.05	2.29	Montevideo—Lagoa dos Patos mouth
13 February	Afternoon	18.45	19.32	0.47	Lagoa dos Patos mouth—Lagoa do Peixe
14 February	Morning	07.30	08.03	0.33	Lagoa do Peixe
27 February	Morning	06.11	07.05	0.54	Lagoa do Peixe—Lagoa dos Patos mouth
27 February	Morning	08.31	12.02	3.31	Lagoa dos Patos mouth—Arroio Chuí—Lagoa do Peixe
27 February	Afternoon	17.05	18.32	1.27	North of Lagoa do Peixe
28 February	Morning	05.41	07.54	2.13	Lagoa do Peixe—Torres

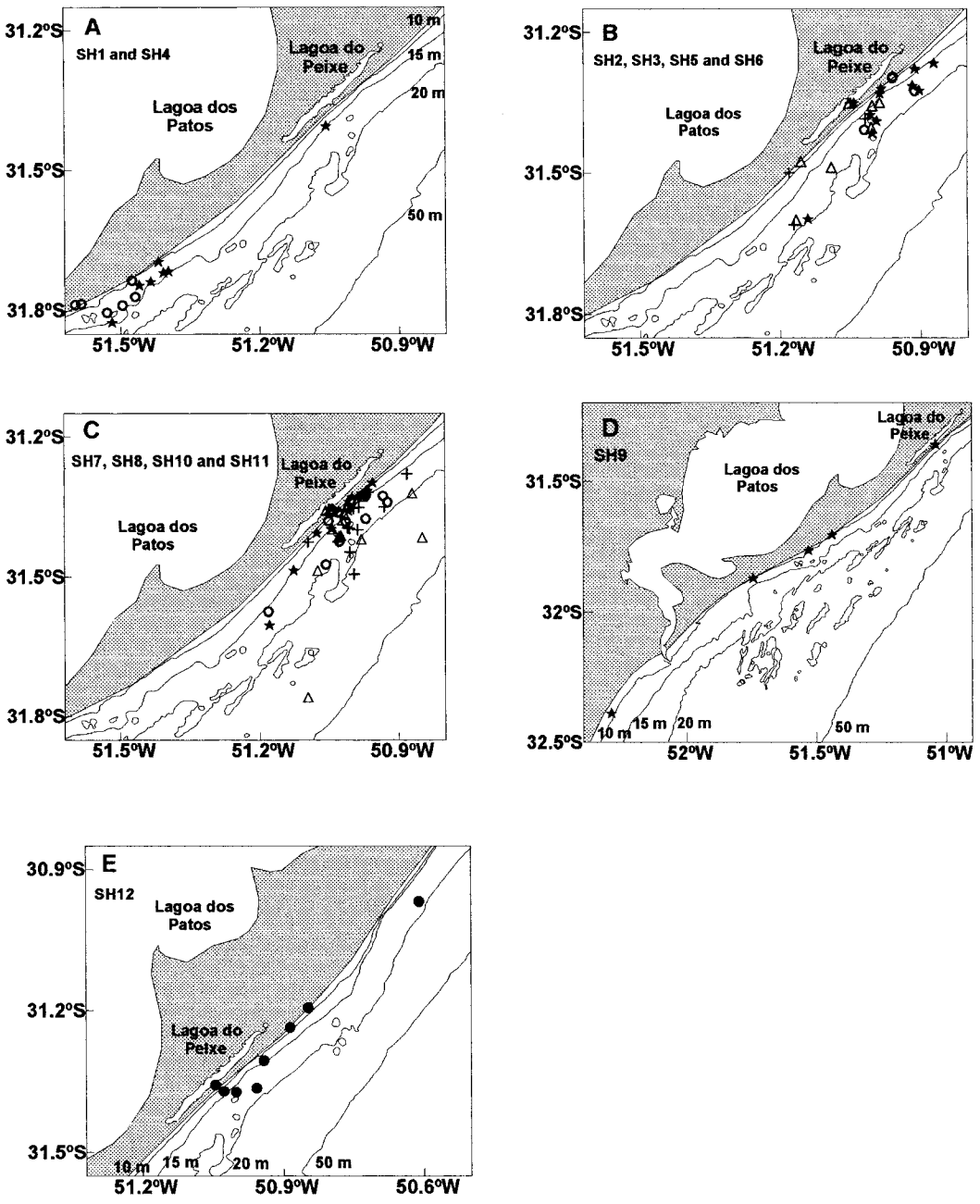

Figure 2. Locations of Common Terns tagged in Lagoa do Peixe in February 2003, determined by radio telemetry. A—Birds moved 60 km south. B and C—Birds recorded in the Lagoa do Peixe area. D—Bird recorded 165 km south. E—Bird recorded in the Lagoa do Peixe area and 60 km north. Birds are indicated by different symbols.

bird detected over water 43 m in depth. Birds we followed from the roosting areas to foraging areas as well as birds whose signals were picked up near roosting areas were all feeding in shallow water and we found no indication that foraging birds moved to deep water.

Common Tern Movements

Nine birds stayed on the coast and marine waters adjacent to Lagoa do Peixe during our 10-14 February tracking period (Fig. 2B, C, E). The other three birds moved

south; two birds (SH1 and SH4) stopped approximately 60 km south of the tagging site (Fig. 2A), been recorded there both on the beach and at sea; the other (SH9) moved 165 km south, and was recorded on Cassino Beach (32°23'S, 52°18'W) four days after tagging (Fig. 2D). Despite attempts to locate tagged Common Terns farther south (Arroio Chuí and Montevideo), and north (Torres), no birds were detected.

Distances traveled were calculated for each bird based on successive locations (Table 2). On average, birds traveled 102 ± 38 km (range: 46-167 km). These values represent a minimum estimation, since some foraging trips or movements along the coast were probably not detected. Daily movement calculated for each bird was 19 ± 9 km d^{-1} (range 6-40 km d^{-1}, N = 12 birds). Common Terns used the sandbars in Lagoa do Peixe inlet and mudflats inside the lagoon as nocturnal and diurnal roosting sites. Several places along the beach were also used for diurnal, and probably nocturnal, roosting. Repeat signals at some of the beach locations suggested fidelity by some birds to these sites, while a single detection for other birds at some of the locations suggested a more temporary association with the site (Fig. 2).

Table 2. Daily movement and minimum distance traveled by Common Terns between the tagging site in Lagoa do Peixe, southern Brazil, and subsequent locations during a 5-day period on February 2003.

Bird	Daily movement (km d^{-1})	Distance traveled (km)
SH1	12.8	96.9
SH2	6.4	45.7
SH3	11.6	64.0
SH4	16.5	91.3
SH5	25.0	139.9
SH6	18.8	105.4
SH7	20.0	102.5
SH8	29.5	150.6
SH9	40.2	166.9
SH10	22.1	113.2
SH11	17.7	90.4
SH12	10.2	52.1
N = 12 birds	19.2 ± 9.3	101.6 ± 37.6

Daily Feeding Activities

Radio-tracked Common Terns in southern Brazil were detected at sea, presumably feeding, early in the morning (06.00 h to 09.00 h) and late in the afternoon (16.00 h to 20.30 h). Birds departed for feeding grounds at dawn, usually between 05.30 h and 06.30 h. On the other hand, the pattern of departure to feeding areas in the afternoon period was not detected. Based on records of feeding birds and foraging trip duration, this likely takes place from 15.00 h to 17.00 h.

Some complete foraging trips were recorded in the morning and the afternoon (Fig. 3). Tern SH7 (Fig. 3A) was recorded roosting on a sandbar in Lagoa do Peixe inlet at 05.38 h; was detected at sea at 05.45 h; was recorded again, presumably feeding, at 06.07 h over water of 17 m depth; moved northward on the same isobath at 06.18 h, where it stayed for at least 24 minutes; and 46 minutes later (at 07.28 h) it was recorded roosting on the same sand bar in Lagoa do Peixe. This foraging trip was completed in 01.52 hours, with a minimum distance traveled of 27 km. Tern SH5 (Fig. 3B) was recorded near the beach north of Lagoa do Peixe inlet, at 15.50 h; departed southward and 7 minutes later it was recorded over water 15 m deep; at 16.39 h it was located 34 km south; and at 18.34 h it was recorded on the beach, near the departure site. The trip was 02.44 hours long and involved traveling at least 69 km.

Nine of the 12 terns were found feeding in both the morning and afternoon periods; eight out of 12 fed in consecutive periods; and seven were detected offshore twice in the same day in the morning and afternoon (Table 3). The three terns that were only observed during either the morning or afternoon were those with only one or two offshore records, suggesting that had they been detected more often they likely would have been observed feeding during both periods.

DISCUSSION

Common Terns Movement and Feeding Grounds

Radio tagged Common Terns were recorded along 230 km of coastline, both

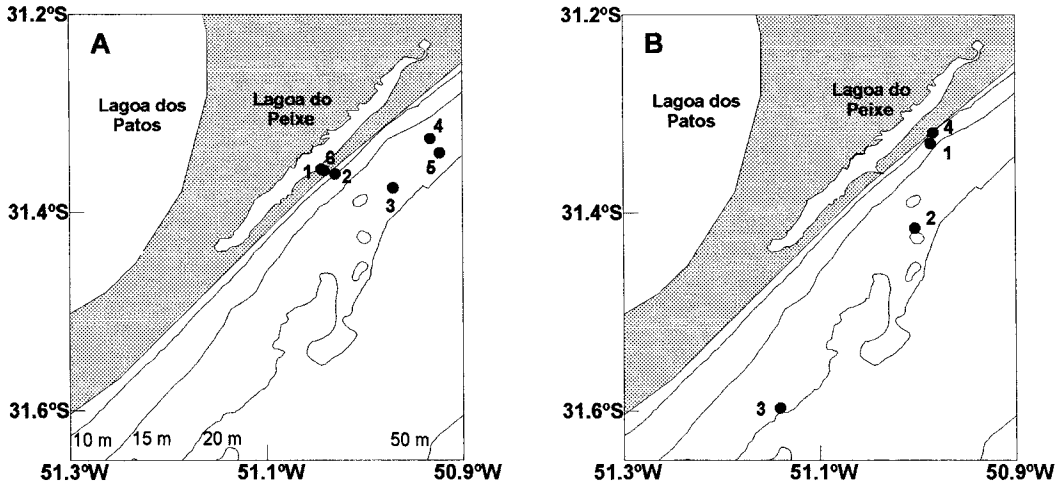

Figure 3. Foraging trips of Common Terns in February 2003 in southern Brazil, determined by radio telemetry. A—Early morning foraging trip; bird SH7. B—Afternoon foraging trip; bird SH5. Numbers indicate sequences of movement. See text for complete description of time and distances.

north and south of the tagging site in Lagoa do Peixe. Most records were close to Lagoa do Peixe because tracking took place in a five days period, just after tagging. Interestingly, some birds performed long foraging trips, feeding far (e.g., 34 km, Fig. 3B) from the Lagoa do Peixe and returning to roost in Lagoa do Peixe. On the other hand, some birds roosted on the beach adjacent to the feeding ground. The decision to stay in the same roosting and feeding place or change roosting and feeding sites many kilometers away is probably related to unpredictable food resources (Wagner and Safina 1989), which result in birds searching for prey over a large area and individuals searching in different areas.

Terns fed over waters 10-20 m depth (88% of at sea locations), corresponding to 8 km from the coast. Only three records, from two individuals, were of birds foraging over water more than 20 m depth, up to 25 km offshore. Birds did not spend long periods of time over water less than 10 m depth, which would be characteristic of foraging activity. Records from the coast to 10 m isobath probably represented birds moving between roosting and feeding grounds. These findings agree with Common Terns diet in the area (Bugoni and Vooren 2004). Common Terns prey on juvenile demersal fishes *Paralonchurus brasiliensis*, *Micropogonias furnieri*, *Cynoscion guatucupa* and *Macrodon ancylodon*, plus pelagic anchovies (Bugoni and Vooren 2004). The distribution of these juvenile fish species (from Haimovici *et al.* 1996) precludes feeding in the surf zone and further offshore (>20 m depth). Thus, both diet analysis (Bugoni and Vooren 2004) and radio telemetry (present study) gave the same result, i.e., birds feeding from the surf zone to 20 m depth contour line.

At some breeding sites in North America, the Common Tern feeds in more predictable feeding grounds, such as freshwater and near-shore habitats (Nisbet 1983; Burness *et al.* 1994). However, the marine environment is characterized by unpredictable food resources and patchy prey distribution (Erwin 1977; Nisbet 1983). During the breeding season, terns are also limited by the need to provide food to their chicks at the breeding site. During this period, birds are central-place foragers, usually feeding close to breeding sites (Duffy 1986). In southern Brazil, wintering terns are not linked to a specific roosting site, as there are long stretches of coast on which to roost close to feeding grounds (Bugoni and Vooren 2005). Thus, they are able to explore the marine environment more widely, changing foraging grounds if convenient. The ability to fly long

distances (e.g., 69 km) in a single foraging trip is an important feature of Common Tern feeding plasticity. Although there are several large freshwater lagoons very close to roosts, birds did not feed there. For unknown reasons, the ephemeral and unpredictable marine environment appears to present better feeding conditions for terns. Probably turbid estuarine waters and comparatively low calorific content of freshwater prey (Massias and Becker 1990) are important factors in the terns' choice.

Foraging trips of incubating radio-tagged Common Terns in Germany covered distances from 6 to 70 km (mean of 30 km), flying 120 km d^{-1} (Becker *et al.* 1993). These values are similar to the present study where complete foraging trips were 26.8 and 68.5 km, and birds moved minimum daily distances from 6.4 to 40.2 km. Daily movement did not account for all movements and birds were not tracked along all foraging trips, so our estimate is conservative.

Despite studies indicating adverse effects of radio tagging on terns (Massey *et al.* 1988; Sirdevan and Quinn 1997), this technique was successfully used and no adverse effect detected in Common Terns metabolism (Klaassen *et al.* 1992) and foraging efficiency (Morris and Burness 1992). Morris and Burness (1992) did not detect negative effects on the foraging efficiency of the Common Terns carrying radio-transmitters. Wells *et al.* (2003) demonstrated the levels of the glucocorticoid stress hormone of radio-tagged Dickcissels (*Spiza americana*) returned to baseline levels within 48 h. In the current study, tracking started one to three days after tagging, which allowed birds to acclimate (White and Garrott 1990). Thus, the methods used in this study are assumed to have had negligible impacts on the terns.

Daily Feeding Activities

Birds were found feeding in early morning and late in the afternoon in agreement with several other studies both in breeding (Pearson 1968; Frank and Becker 1992 and references therein) and wintering areas (Blokpoel *et al.* 1984; this study). Some birds

Table 3. At-sea records of radio-tagged Common Terns, presumably feeding, in different daytime periods during February 2003 in southern Brazil. Blank columns indicate periods not tracked.

	10 February		11 February		12 February		13 February		14 February		27 February		28 February
Birds	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning
SH1	...	X	...			X	X	...	...		...	...	...
SH2	X	...	...			...	X	...	...		...	...	...
SH3	...	X	...			...	...	X	...		...	...	...
SH4	X	...	X			X	X	X	...		X	...	...
SH5	X	X	...			...	X	X	...		...	...	...
SH6	X	X	X			...	X	X	...		...	...	...
SH7	X	X	...			...	X	X	...		...	...	X
SH8	X	...	X			X	X	X	X		...	...	X
SH9	...	X	...			...	...	...	...		...	...	...
SH10	X	X	X			...	X	...	...		...	...	...
SH11	X	X	...			...	X	...	X		...	...	...
SH12	X	...	...			...	X	X	...		...	X	...

fed twice a day (Table 3), which corroborated previous suggestions (Bugoni and Vooren 2004), and agreed with recent data on circadian rhythm and birds egesting pellets twice a day (L. Bugoni, unpubl. data). Based on data presented here, we can describe daily routines of Common Terns in southern Brazil. Birds departed synchronously to the feeding grounds in early morning, usually at dawn, after a nighttime fasting (Frank and Becker 1992). They fed close to the coast, and came back to roost at Lagoa do Peixe and Lagoa dos Patos inlet, or oceanic beaches; they roosted from mid-morning to mid-afternoon, when the meal was digested and a pellet egested (Bugoni 2001). Departure to sea for the second feeding trip was more variable, probably related to individual variation in the amount of food ingested and time spent on the morning feeding trip. After feeding, birds returned to roosting sites; birds roosting on the beach traveled to primary roosting sites at the end of the daylight period (Bugoni and Vooren 2005).

Foraging trip time was consistently longer on the wintering grounds when birds did not have chicks to feed. Courtney and Blokpoel (1980) found a mean foraging trip time during chick feeding period of 17.2 min, and birds spent from 45% (one-chick brood) to 64% (four-chick brood) of daylight period away from their nest. Similarly, Pearson (1968) found that Common Terns spent 40-94% of daylight hours feeding chicks, while mean foraging trip duration by incubation terns in German Wadden Sea ranged from 1.6 to 2.7 h for different years. There, birds spent 7.9 h a day in feeding activities (Frank and Becker 1992; Becker *et al.* 1997), which corresponded to 46% of daylight hours. In the present study, considering two trips per day, foraging trips lasting 2.5 h, and 16 h of daylight each day, an estimated 31% of daylight time was spent in feeding activities. Obtaining food in southern Brazil appears to be an easier task for Common Terns, who spent most of their time at roosts. This is in contrast with birds wintering in northern South America, where terns had difficulty finding food and emaciated birds feeding on fisheries discharge was typical (Blokpoel *et al.* 1982, 1984). However, a key difference between northern South America and southern Brazil and Argentina is that birds in the former area are mostly juveniles (Blokpoel *et al.* 1984), and in the latter they are adults (Hays *et al.* 1997).

Finally, it is important to highlight the importance of southern Brazilian coastal waters for Nearctic Common Terns during the wintering period. These coastal waters are important nurseries for several fish species, and the area up to 5.6 km from the coast is protected by Federal law and trawling is forbidden. Unfortunately, due to the precariousness of government surveillance, trawlers are frequently observed fishing inside this zone, and sometimes in the protected zone inside the Lagoa do Peixe National Park. The Lagoa do Peixe is a particularly important habitat for Common Terns and several other migratory and resident seabirds and shorebirds. It should be protected to conserve these species.

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