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SHORT NOTE

BREEDING OF THE SOUTH AMERICAN TERN (*STERNA HIRUNDINACEA*) ON ANCHORED BOATS IN COQUIMBO, NORTHERN CHILE

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Abstract · We report the breeding attempt of South American Terns (*Sterna hirundinacea*) on three boats in Coquimbo, northern Chile. The first breeding attempt was reported in winter 2011 where at least one chick fledged. From April to June 2015, all nests on the boats were monitored. We recorded eggs and chicks during May and early June. However, towards the end of June, no eggs or chicks were recorded in the nests, and a Chimango Caracara (*Phalcoboenus chimango*) was observed preying on chicks in one nest. In April and May 2017, breeding attempts on boats were also monitored and nests with eggs and one chick were recorded. However, at the end of May all nests were empty. This unusual nesting site for South American Terns is apparently regularly used in the area despite its virtually null breeding success.

Resumen · Reproducción del Gaviotín Sudamericano (*Sterna hirundinacea*) en botes anclados en Coquimbo, norte de Chile
Reportamos el intento de reproducción del Gaviotín Sudamericano (*Sterna hirundinacea*) sobre tres botes en Coquimbo, norte de Chile. Un primer intento de reproducción para esta zona se registró en invierno de 2011, donde al menos un pollo dejó un nido como volantón. Entre Abril y Junio de 2015 monitoreamos los nidos en los botes de manera más intensiva. Registramos huevos y pollos durante Mayo y principios de Junio. Sin embargo, a finales de Junio, no registramos huevos en los nidos y observamos un Tiuque (*Phalcoboenus chimango*) depredar sobre los pollos. En Abril y Mayo de 2017, monitoreamos otros intentos de reproducción y registramos un pollo y nidos con huevos. Sin embargo, a finales de Mayo, esos nidos estaban vacíos. Este inusual sitio de nidificación parece ser utilizado de forma recurrente por el Gaviotín Sudamericano, a pesar del aparente casi nulo éxito reproductivo.

Key words: Anchored boats · Chile · Nesting · Predation · South American Tern

INTRODUCTION

The South American Tern (*Sterna hirundinacea*) is a common resident on the coasts of South America with breeding colonies in Ecuador, Perú, and Chile on the Pacific Ocean coast, and Brazil, Argentina, and Falklands/ Malvinas Islands on the Atlantic Ocean coast (Gochfeld & Burger 1996). Breeding sites have been identified primarily on sandy beaches and rocky shores, as well as on islets or in crevices on rocky cliffs (Yorio 2005, Cursach et al. 2009). Along the Chilean coasts the South American Tern is a common resident species. It is reported in several regions of Chile with the highest abundance reports for the coast of Maule, central Chile (SAG 2012). Nesting areas have mainly been reported in southern Chile, where this species breeds during the spring–summer (Cursach et al. 2009, Reyes-Arriagada et al. 2009, Schüttler et al. 2009). On Pingüino islet (41°56'S) and Roca Huenteyao (40°32'S), ca. 50 breeding pairs have been reported (Cursach et al. 2009). The largest breeding

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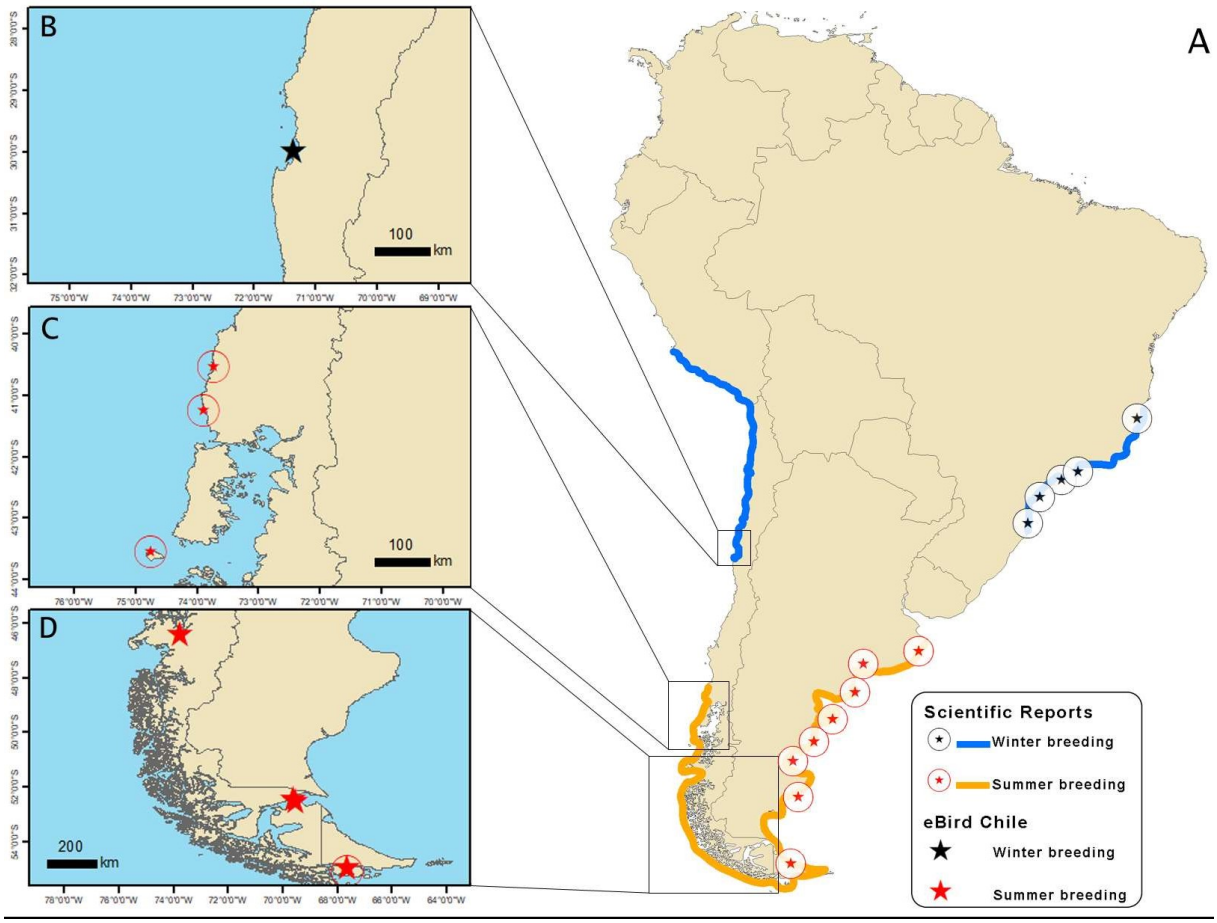

Figure 1. (A) Breeding distribution of the South American Tern (*Sterna hirundinacea)* in South America. Breeding ranges are depicted in blue (autumn–winter breeding) and orange (spring–summer breeding). The Pacific breeding range is based on Cocker (1919), and records by Zavalaga (pers. comm.), this study, Cursach et al. (2009), Reyes-Arriagada et al. (2009), and Schüttler et al. (2009). The Atlantic breeding range is based on records by Yorio (2005), Branco (2003), and Faría et al. (2010). Insets, (B–D) show details of confirmed breeding sites in Chile according to Cursach et al. (2009), Reyes-Arriagada et al. (2009), Schüttler et al. (2009), and eBird information (accessed 15 August 2016).

colony currently known in Chile is located on Isla Guafo (Chiloé, 43°33'S) with an estimated population of 1,400 birds (Reyes-Arriagada et al. 2009). The southernmost breeding colony is located on Isla Navarino (Tierra del Fuego, 54°–56°S) with approx. 90 individuals in 2006–2007 (Schüttler et al. 2009). Only three breeding sites are confirmed for the region of Magallanes in southern Chile, according to eBird (2016) (Figure 1).

Breeding site selection by seabirds is critical for their breeding success (Hamer et al. 2002). Environmental conditions, food availability and predation risk can significantly reduce the breeding success and even modify reproductive behavior, causing individuals to postpone breeding until the next season (Forbes et al. 1994, Hamer et al. 2002). It is known that terns breed on diverse substrata that include natural and artificial surfaces. For example, the Least Tern (*Sternula antillarum*) nests on beaches, dredged-material, and roofs, being substratum type a factor that significantly influences breeding success (Krogh & Schweitzer 1999). In view of the rapid global change affecting marine ecosystems, it is important to document seabird nesting on anthropogenic structures, which contributes to our understanding of the ability of seabirds to adapt to current and emerging threats or to accelerated changes in the marine environment (Callaghan et al. 2018). Here, we report breeding events of the South American Tern on anchored boats in La Herradura Bay Coquimbo in northern Chile during the Austral autumn–winter season.

METHODS

The study area is located in La Herradura Bay (29°58'S, 71°21'O), Coquimbo, Chile. In this area, the first report of a breeding attempt of the South American Tern was during winter 2011. From 2012 to 2017, South American Terns were observed in the area but nest monitoring was only carried out in 2015 and 2017. Breeding sites were visited four times in 2015 (on 4 May and on 3, 8, and 22 June) and three times in 2017 (on 27 April and on 4 and 25 May). Individuals were nesting on three boats (named Uni, Kaki, and Hirame) which are property of the Universidad Católica del Norte (Figure 2A). Boats were anchored

Figure 2. (A) Photographs of the boats used by the South American Tern, *Sterna hirundinacea*, to breed in La Herradura Bay, Coquimbo, Chile (see arrows, photo by Matías Portflitt-Toro). (B) and (C) Young chicks and fledglings during the breeding season in July and August 2011 (photo by Laurent De Vriendt), and (D), (E), and (F) chicks and adults during the breeding season in June 2015 (photo by Matías Portflitt-Toro).

between 50–70 meters from the dock located in La Herradura Bay. The boats are 8.6 m long and 2.4 m wide. At the time of this study, the boats were not in use, so the terns could use them as nesting sites. For each boat we recorded the number of breeding pairs, and the number of eggs and chicks in each nest. Monitoring was performed by two observers on board of a small rowboat.

RESULTS & DISCUSSION

In 2011, one breeding pair was recorded nesting on an anchored boat with two chicks, and at least one of them left the nest as a fledgling (Figure 2B–C). During the monitoring events of 2015 and 2017 (typically during the early afternoon, at around 14:00 h), up to eight breeding adults were observed flying over the boats (no attempts were made to quantify the total number of adults comprising the colony). The nests were located on the decks protected from wind (see Figure 2) and were mainly composed of organic materials like dried seaweeds, tree branches, dried grass, and mussel shell fragments, similar to nest material described for Brazil (Fracasso et al. 2010). In 2015, nesting began on 30 April when the boat caretaker (Freddy González pers. observ.) mentioned to us that there was one egg on the boat "Uni." Eggs, chicks, and breeding pairs were observed on 4 May, and 3 and 8 June (Table 1). During the first extensive survey on 4 May 2015 there were a total of 10 eggs, with at least 2 eggs on each boat; on that day we also observed the first young chick (between 1 and 2 weeks), indicating that egg laying must have started before 30 April 2015. On 3 June, we observed the maximum number of five chicks (at least one on each boat) but on 8 June 2015, only one chick was left. Throughout the breeding period the boat "Hirame" held the majority of nests and eggs (Table 1). On 9 June, an adult of Chimango Caracara (*Phalcoboenus chimango*) was observed preying on the chick of the boat "Uni." Finally, on 22 June we could not find any eggs or chicks. The number of active nests in 2015 was nine (four nests with two eggs, five nests with one egg, and one nest empty).

In 2017, nesting began on 27 April (Table 1) when we observed the first eggs on the boats "Kaki" and "Hotate." On 4 May, we observed the first chicks. On 25 May, no eggs or chicks were found (Table 1), and all nests were apparently abandoned. The number of active nests in 2017 was five (two nests with two eggs, and three nests with one egg or chick).

Table 1. Counts of nests, eggs, and chicks of the South American Tern (*Sterna hirundinacea*) during the breeding period of 2015 and 2017 in Coquimbo, Chile. *****In 2017, the boat "Hirame" was replaced by the boat "Hotate," which had the same dimensions as the other boats (see Methods).

Date		Boat			Total
		Uni	Kaki	Hirame*	
4 May 2015	Nests	1	1	5	7
	Eggs	2	2	6	10
	Chicks	0	0	1	1
3 Jun 2015	Nests	1	2	7	10
	Eggs	0	2	6	8
	Chicks	2	1	2	5
8 Jun 2015	Nests	1	2	7	10
	Eggs	0	0	3	3
	Chicks	0	1	0	1
22 Jun 2015	Nests	1	2	7	10
	Eggs	0	0	0	0
	Chicks	0	0	0	0
27 Apr 2017	Nests	0	1	3	4
	Eggs	0	1	1	2
	Chicks	0	0	0	0
4 May 2017	Nests	1	1	3	5
	Eggs	2	2	2	6
	Chicks	0	0	1	1
25 May 2017	Nests	0	0	0	0
	Eggs	0	0	0	0
	Chicks	0	0	0	0

As far as we know, until now there were no previous records of breeding colonies of the South American Tern for Coquimbo or other places in northern Chile. The northernmost colony for the coast of South Pacific is reported from southern Peru on the Isla Vieja (14°S, Coker 1919, C. Zavalaga pers. comm.). The South American Tern breeds in southern Chile (Cursach et al. 2009, Reyes-Arriagada et al. 2009) and southern Argentina (Scolaro et al. 1996) during the Austral summer. On the other hand, this species breeds during autumn–winter in southern Peru (Coker 1919), northern Chile (this study), and in southern Brazil (Branco 2003, see Figure 1). This breeding pattern could be explained in terms of seasonal and latitudinal effects on food availability. It is known that species that reproduce at high latitudes are restricted to climatic conditions and food availability during the short Austral summer (Costa 1991). In contrast, the permanent upwelling throughout the year in northern Chile and southern Peru (Thiel et al. 2007) allows the South American Tern to find food around their nesting colonies throughout the year. It is unclear why this species does not reproduce year-round, and this should be addressed in future studies.

The coastal islands of the Coastal System of Coquimbo provide diverse types of nesting habitat for 12 seabird species (Simeone et al. 2003, Luna-Jorquera et al. 2012). However, instead of nesting on these islands the South American Tern, breeds on boats anchored in La Herradura Bay. This could be because boats provide a better nesting substratum for terns. A comparative study conducted in the Black Tern (*Chlidonias niger*) shows that pairs nesting on artificial floating platforms had a significantly higher hatching success and nest survival than the pairs breeding on natural substrata (Shealer et al. 2006). However, at our study site the terns experienced total breeding failure (except for 2011 when at least one young fledged). While we did not determine the causes of most failures, predation by the Caracara Chimango may be one of the main reason for breeding failure (Harrison 1971). In addition, seabird eggs and chicks could be depredated by other seabirds, such as gulls, pelicans, and skuas (Thiel & Sommer 1994, Coulson 2002). Other causes of breeding failure could include boat instability due to wind or waves that causes chicks or eggs to fall off the boat, or chicks lost due to intraspecific aggression (Villanueva-Gomila et al. 2009).

In the Coastal System of Coquimbo, the use of boats instead of natural nests for breeding is an unusual event of ecological interest in the context of global climate change (Miller 2015, Callaghan et al. 2018). However, the coast of northern Chile has been relatively well studied in the last two decades, and the South American Tern has nested for at least 6 consecutive years (since 2011, see above) on the boats. Nesting on anthropogenic structures (sensu Callaghan et al. 2018) is a novel behavior for this species. In the study area, the Kelp Gull (*Larus dominicanus*) breeds on rooftops of Coquimbo city (Yorio et al. 2016), using waste disposal sites and fishing ports as feeding grounds (Ludynia et al. 2005). Novel nesting behavior has also been reported for the Grey Gull (*Leucophaeus modestus*), which normally nests inland in the Atacama Desert at distances up to 100 km from the coast (Aguilar et al. 2016), but for two consecutive years (i.e., 2017 and 2018, R. Aguilar pers. comm.) this species had bred on the coast of northern Chile. Future monitoring should confirm if the South American Terns continue breeding on boats or others novel substrata in northern Chile, and should also investigate the effect of the different types of nesting sites on the reproductive success.

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