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Source: Waterbirds, 42(1) : 90-94

Published By: The Waterbird Society

URL: https://doi.org/10.1675/063.042.0110

The Gulf of Fonseca: an Important Central American Stopover and Wintering Site for North American Gull-billed Terns (*Gelochelidon nilotica*)

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Abstract.—North American populations of Gull-billed Terns (*Gelochelidon nilotica*) are thought to winter in low numbers throughout Central America, with highest single-site concentrations of up to 200 individuals known from the Panama Canal zone. This paper presents information on a previously unknown stopover and wintering site in southern Honduras, where up to 1,640 individuals, approximately 20% of the entire North American metapopulation, are present during the non-breeding season. This site may be of key importance to full cycle conservation of declining North American populations. Information on habitat use in the eastern Gulf of Fonseca is also included.
Received 18 June 2018, accepted 13 August 2018.

Key words.—aquaculture, *aranea*, *Gelochelidon nilotica*, Gull-billed Tern, metapopulation, salt production, seasonal wetland, stopover site, *vanrossemi*, winter distribution.

Waterbirds 42(1): 90-94, 2019

While not globally threatened, the Gull-billed Tern (*Gelochelidon nilotica*) is nevertheless considered a species of conservation concern in North America (Kushlan *et al.* 2002; U.S. Fish and Wildlife Service 2008), where populations are modest in size and thought to be in decline (Molina and Erwin 2006; Molina *et al.* 2010). Effective conservation efforts should consider a population during its full annual cycle (Hostetler *et al.* 2015; Marra *et al.* 2015); however, knowledge about the non-breeding distribution of North American populations of the Gull-billed Tern is still incomplete (Molina and Erwin 2006; Molina *et al.* 2009, 2014).

Based on a literature review (primarily using Christmas Bird Count results), Molina and Erwin (2006) concluded that the eastern North American race of the Gull-billed Tern, *G. n. aranea*, is rare to uncommon in winter along the Caribbean coast of Central America. They found it to be more common along the Panama Canal, where numbers at single sites range between one and 200 individuals. The western race, *G. n. vanrossemi*, always a small population, is believed to range south along the Pacific coast at least to Guatemala, possibly further (Molina and Erwin 2006; Molina *et al.* 2009, 2014).

Uncertainty exists regarding regional provenance of migrant and winter visitors to the Pacific coast of Central America. While *G. n. vanrossemi* was described as morphologically distinct from *G. n. aranea*—larger overall size, longer legs and more conical bill (Bancroft 1929)—these phenotypic differences are minor and show considerable overlap (Molina *et al.* 2014). Since the two subspecies are not field-identifiable, we here consider the two biogeographical populations from North America as one metapopulation.

Breeding is known from northern South America, but not from Central America (Molina and Erwin 2006; Molina *et al.* 2014). Monroe (1968) considered the species an uncommon migrant and potential winter visitor to Honduras. In March of 2013, a concentration of 35 Gull-billed Terns at salt ponds in southern Honduras was considered noteworthy (Jones and Komar 2014). Here, we present observations of a Gull-billed Tern concentration not found anywhere else in North and Central America and include information on habitat use of this species in the eastern Gulf of Fonseca.

Methods

The Gulf of Fonseca is a shallow bay on the Pacific coast of northern Central America and is shared by El Salvador, Honduras and Nicaragua. It receives the drainage of five rivers: the Goascorán that forms the border between El Salvador and Honduras; the Na-

caome and Choluteca in Honduras; and the Negro and Estero Real in Nicaragua. Land area in the Gulf of Fonseca is mostly coastal flood plains, with some volcanic elements in the form of hills, islands and peninsulas. The coastal lowlands are fairly densely populated and are characterized by agricultural use (cattle (*Bos taurus*) ranching; sugarcane (*Saccharum officinarum*) and watermelon (*Citrullus lanatus*) cultivation) and aquaculture (shrimp (*Litopenaeus vannamei*) and salt production). Between 11 March 2012 and 4 January 2018, we visited 22 sites in the Honduran Departments of Valle and Choluteca where we encountered Gull-billed Terns, for a total of 200 hr of observations. Two of these sites—Las Aguas Estuary and El Jicarito Reserve—harbored significant numbers of Gull-billed Terns and are discussed in more detail. Las Aguas Estuary (13° 05' 37.32" N, 087° 21' 45.00" W) forms the mouth of the Choluteca river, while El Jicarito Reserve (13° 07' 42.24" N, 087° 11' 58.20" W), located approximately 15 km to the east-northeast, is a seasonal wetlands complex composed of salt pannes, grassland, sedges and mangrove. Both sites are located in the Honduran Department of Choluteca (Fig. 1).

Between 31 October 2013 and 27 December 2017, we visited El Jicarito 38 times, for a total of 114 hr (mean duration of visit = 159 min, SD = 64). Las Aguas was visited seven times between 2 February 2014 and 4 January 2018 for a total of 13 hr (mean duration of visit = 117 min, SD = 19). The effort across months was not constant. All Las Aguas counts were carried out from a small fishing boat on rising tides, when the Gull-billed Terns gathered to roost on the estuary's mud banks. The Gull-billed Terns were counted using 8x binoculars and a hand clicker. Each group was counted two or three times by the same observer, to get the most accurate count possible, and individuals were carefully checked for auxiliary markers.

RESULTS

Gull-billed Terns occur throughout the Gulf of Fonseca, where they use a variety of habitats, including estuaries, seasonal wetlands, and aquaculture installations for shrimp and salt production (Table 1). They are rarely seen over open waters and are more restricted to land than the majority of locally occurring terns. Gull-billed Terns occur in most of the area in low densities. However, there are two sites in particular, Las Aguas and El Jicarito, where we have found Gull-billed Terns in regionally important numbers.

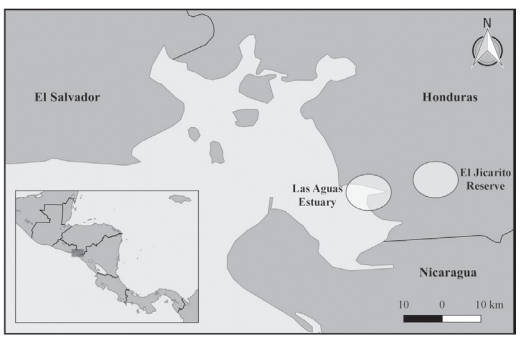

Figure 1. Principal study sites at Las Aguas Estuary and El Jicarito Reserve situated in the Gulf of Fonseca, Central America (inset).

We found Gull-billed Terns gathering to roost in large groups on mudflats at Las Aguas on rising tides on several occasions between 12 February 2016 and 4 January 2018. An earlier visit to the site under similar tidal conditions, in February 2014, did not detect the species. On 12 February 2016, we counted 840 individuals at Las Aguas. The species was recorded on all five subsequent visits: 28 January 2017 (391), 10 February 2017 (19), 6 September 2017 (370), 20 October 2017 (1,640), and 4 January 2018 (651).

At nearby El Jicarito, where the species is present from June through November, we have observed Gull-billed Terns foraging as well as roosting in shallow brackish water (Fig. 2). We have observed Gull-billed Terns throughout the Honduran part of the Gulf during all months of the year, although outside the El Jicarito and Las Aguas sites generally in much lower numbers (Fig. 3). We did not detect any individually marked birds. Other larids we have regularly observed at Las Aguas include Laughing Gull (*Leucophaeus atricilla*; maximum = 447), Caspian Tern (*Hydroprogne caspia*; maximum = 116), Royal Tern (*Thalasseus maximus*; maximum = 250) and Black Skimmer (*Rynchops niger*; maximum = 2,559), species which we have also found at El Jicarito, albeit in much lower numbers.

DISCUSSION

The entire North American breeding population (i.e., from the United States and Mexico) is estimated to be 3,610 pairs of *G. n. aranea* and 737-808 pairs of *G. n. vanrossemi*, for a combined total of 4,347-4,418 pairs

Table 1. Results of Gull-billed Tern surveys in the Honduran Gulf of Fonseca, 2012-2018. Mean ± SE are given for sites where the species was detected on multiple visits. Encounter rate is the number of visits with detection divided by total number of visits. Habitat abbreviations: AC = aquaculture (shrimp); AG = agriculture; ES = estuary; SB = sand bar; SP = salt production; SW = seasonal wetland; TF = tidal flat.

Location	Maximum	Mean ± SE	Visits	Encounter Rate	Habitat
Finca La Ostia	38	11.6 ± 4.7	66	0.1	SP
Finca Pato Azul	2		8	0.1	SP
Finca Santa Alejandra	18	6.0 ± 3.2	15	0.3	SP
Fincas Mar y Sol & Culmavic	2		7	0.1	SP
Shrimp farms near Estero El Espino	1		6	0.2	AC
Finca Las Conchas	2		6	0.2	SP
Punta Ratón	3	1.7 ± 0.7	53	0.1	SB
Finca Granjas Marinas	1		4	0.5	AC
Finca Los Puentes	29	14.0 ± 3.7	15	0.5	SP
Finca La Coquera	4		3	0.3	SP
Small channel near Guapinol	1		6	0.2	AG, AC
El Jicarito - north road	140	76.0 ± 64.0	5	0.4	SW
El Jicarito - south road	151	40.6 ± 9.4	41	0.6	SW
Punta Condega	14		9	0.1	SB
El Jicarito - lagoon	76	21.9 ± 9.1	16	0.6	SW
Estuary Guapinol	4		2	0.5	ES
Tidal flats Guapinol	6		1	1.0	TF
Finca Mujeres Unidas	3		1	1.0	AC
Las Aguas Estuary	1,640	651.8 ± 228.0	7	0.9	ES
Wetlands near El Faro	28	6.3 ± 2.9	27	0.3	SW
Along SE edge Finca Emar	1		8	0.1	SW, AC
La Berbería	40	5.6 ± 2.7	26	0.5	SW, AC

(Molina *et al.* 2010). This suggests that 10-20% of this metapopulation visits Las Aguas during the non-breeding season, rendering the site important to its conservation. While the southern bank of Las Aguas forms part of the national system of protected areas in

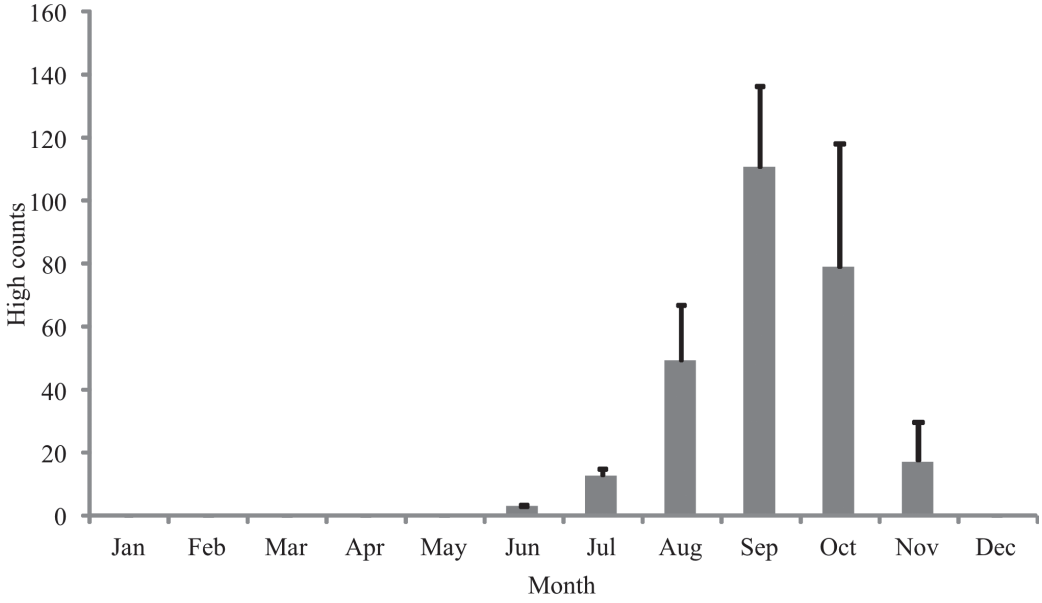

Figure 2. Mean high counts (± SE) per month of Gull-billed Terns at El Jicarito Reserve, Choluteca, Honduras, 2013-2017.

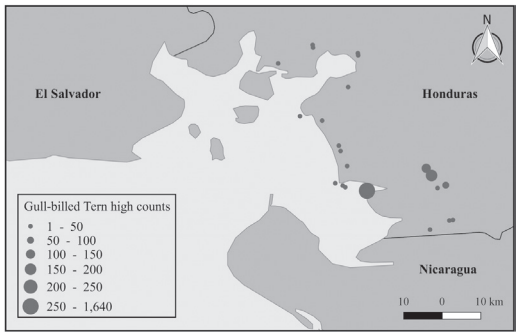

Figure 3. High counts of Gull-billed Terns in the Honduran part of the Gulf of Fonseca, 2012-2018.

Honduras, the estuary is also the mouth of one of the country's most polluted rivers, the Choluteca river (Kammerbauer and Moncada 1998). Given the close proximity of the two main sites, El Jicarito and Las Aguas, we speculate there is connectivity between them, at least during part of the year.

The temporal occurrence pattern we found at El Jicarito suggests a stopover site that is important in fall migration only (Fig. 2). However, we also found large numbers of Gull-billed Terns at Las Aguas later in the non-breeding season, specifically in January and February. The pattern we found at El Jicarito is likely reflective of seasonal hydrology changes at this site. El Jicarito is a seasonal wetland complex that provides a large surface of shallow water during the second half of the rainy season, roughly from July through September. This water gradually evaporates during the dry season, and by January/February, most of it has evaporated, leaving little suitable habitat for Gull-billed Terns in the reserve. We hypothesize that in the course of the fall, the birds stop using primary habitat provided by seasonal wetlands like El Jicarito but continue to visit secondary habitat in areas that remain with standing water, such as the extensive shrimp and salt complexes surrounding the study sites (Table 1; Fig. 3). At some shrimp farms, we have observed people dispersing the birds. Further study is needed to clarify habitat use and potential threats in the eastern Gulf of Fonseca, clearly an important site during the non-breeding season for the North American metapopulation of the Gull-billed Tern. Radio tracking studies and re-sightings of color-banded individuals could clarify subspecific provenance of these winter visitors and provide information regarding habitat use of Gull-billed Terns on this stopover and wintering site of hemispherical importance.

ACKNOWLEDGMENTS

We wish to thank two anonymous reviewers for providing helpful comments on an earlier version of this manuscript. We are grateful to Alfonso Auerbach, Katinka Domen, Jacob Drucker, Lila Fried, Oliver Komar, Robert Lambeck, Mayron Mejía, William Orellana, and Fabiola Rodríguez for field assistance. Part of the field work was carried out with support from Manomet, Inc. and the U.S. Forest Service.

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