Journal of Caribbean Ornithology

RESEARCH ARTICLE

Vol. 36:107–113. 2023

Insights from attempts to track movement of Black Skimmer (*Rynchops niger*) fledglings in the southern Gulf of Mexico with automated telemetry and band resighting

Kara L. Lefevre Elizabeth Forys Adam DiNuovo Adam D. Smith

Photo: Jean Hall

Birds Caribbean

Journal of Caribbean Ornithology
Research Article Vol. 36:107–113. 2023
jco.birdscaribbean.org ISSN 1544-4953 https://doi.org/10.55431/jco.2023.36.107-113
birdscaribbean.org

Insights from attempts to track movement of Black Skimmer (*Rynchops niger*) fledglings in the southern Gulf of Mexico with automated telemetry and band resighting

Kara L. Lefevre[1]*, Elizabeth Forys[2], Adam DiNuovo[3], and Adam D. Smith[4]

Associate Editor: Virginia Sanz D'Angelo

Cover Page: Tagged juvenile Black Skimmer (*Rynchops niger*) at the breeding colony on Marco Island, Florida, USA on 10 August 2018. Photographer: Jean Hall.

Published: 3 October 2023

*Corresponding author: [1]Florida Gulf Coast University, Fort Myers, FL 33965, USA; Faculty of Science, Thompson Rivers University, Kamloops, BC V2C 0C8, Canada; e-mail: klefevre@tru.ca

[2]Eckerd College, St. Petersburg, FL 33711, USA; e-mail: forysea@eckerd.edu

[3]17 Brown Street, Palmer, MA 01069, USA; e-mail: adamdinuovo@yahoo.com

[4]U.S. Fish and Wildlife Service, National Wildlife Refuge System, Southeast Inventory & Monitoring Branch, Athens, GA 30605, USA; current address: American Bird Conservancy, The Plains, VA 20198, USA; e-mail: asmith@abcbirds.org

Cite this article as:

Lefevre, K.L., E. Forys, A. DiNuovo, and A.D. Smith. 2023. Insights from attempts to track movement of Black Skimmer (*Rynchops niger*) fledglings in the southern Gulf of Mexico with automated telemetry and band resighting. Journal of Caribbean Ornithology 36:107–113. https://doi.org/10.55431/jco.2023.36.107-113

Abstract

Sound management of coastal bird populations depends on detailed knowledge of where individuals move after dispersal from their natal colonies. This study tracked the movement of Black Skimmer (*Rynchops niger niger*) chicks after they fledged from two important colonies on the Gulf of Mexico (in Pinellas and Collier counties of southern Florida, USA). A total of 35 flight-capable chicks approximately 3 weeks old were fitted with digitally-encoded VHF "nanotags" during July–August of the 2017 and 2018 breeding seasons. Chicks were followed with manual telemetry, automated tracking via the Motus Network, and systematic band resighting. Nanotags stayed attached for a mean minimum of 21 days, and chicks remained at their natal colony for a minimum of 24 days after being tagged. Only 10% of tags were deemed to be detected by Motus towers and all of those detections were dismissed as false positives. Band resightings demonstrated exchange of fledglings between colonies, with the furthest known movement being 370 km from St. Pete Beach to Key West. This paper documents inter-colony movement of skimmer chicks, shares lessons about the use of automated telemetry, and helps to frame questions for future research about regional movement patterns to support conservation of this colonial waterbird.

Keywords

breeding, Caribbean, colonial waterbird, dispersal, Florida, Motus, Rynchopinae, *Rynchops niger*

Resumen

Conocimientos obtenidos a partir de los intentos de rastrear el movimiento de volantones de *Rynchops niger* en el sur del Golfo de México con telemetría automatizada y reavistamiento de anillos • El manejo adecuado de las poblaciones de aves costeras depende del conocimiento detallado de los lugares a los que se desplazan los individuos tras la dispersión desde sus colonias de origen. En este estudio se realizó un seguimiento de los movimientos de los pichones de *Rynchops niger niger* después de que abandonaron dos colonias importantes en el Golfo de México (en los condados de Pinellas y Collier, en el sur de Florida, EE. UU.). Durante julio y agosto de las temporadas reproductivas de 2017 y 2018, un total de 35 pichones capaces de volar, de aproximadamente 3 semanas de edad, fueron equipados con "nanoetiquetas" VHF codificadas digitalmente. Los pichones fueron seguidos con telemetría manual, seguimiento automatizado a través de la red Motus y reavistamiento sistemático de anillos. Las nanoetiquetas permanecieron adheridas durante una media mínima de 21 días, y los pichones permanecieron en su colonia natal durante un mínimo de 24 días después de haber sido marcados. Sólo el 10% de las marcas fueron detectadas por las torres Motus y todas esas detecciones fueron descartadas como falsos positivos. Los reavistamientos de anillos demostraron el intercambio de volantones entre colonias, siendo el movimiento más lejano conocido de 370 km, desde St. Pete Beach hasta Cayo Hueso. Este artículo documenta el movimiento de pichones de esta especie entre colonias, comparte lecciones sobre el uso de la telemetría automatizada y ayuda a formular preguntas para futuras investigaciones sobre patrones de movimiento regional para apoyar la conservación de esta ave acuática colonial.

Palabras clave
ave acuática colonial, Caribe, cría, dispersión, Florida, Motus, Rynchopinae, *Rynchops niger*

Résumé
Aperçu des essais de suivi des déplacements de jeunes Becs-en-ciseaux noirs (*Rynchops niger*) après l'envol dans le sud du golfe du Mexique par télémétrie automatisée et lecture de bagues • Une bonne gestion des populations d'oiseaux côtiers dépend de la connaissance détaillée des lieux vers lesquels les individus se dispersent après avoir quitté leur colonie natale. Cette étude a permis le suivi des déplacements de jeunes Becs-en-ciseaux noirs (*Rynchops niger niger*) après leur envol de deux importantes colonies du golfe du Mexique (dans les comtés de Pinellas et Collier, au sud de la Floride, aux États-Unis). Au total, 35 jeunes volants, âgés d'environ 3 semaines, ont été équipés de « nanoémetteurs » VHF codés numériquement, au cours de la saison de reproduction, en juillet-août 2017 et 2018. Ils ont été suivis par télémétrie manuelle, par suivi automatisé via le réseau Motus et par relecture systématique des bagues. Les nanoémetteurs sont restés fixés au moins 21 jours en moyenne, et les jeunes sont restés dans leur colonie d'origine au moins 24 jours après avoir été marqués. Seulement 10 % des émetteurs ont été détectés par les stations Motus et toutes ces détections ont été considérées comme de faux positifs. Les lectures de bagues ont démontré l'échange de jeunes entre les colonies, le plus long déplacement connu étant de 370 km de St Pete Beach à Key West. Cet article présente des données sur les déplacements de jeunes Bec-en-ciseaux entre les colonies, partage des enseignements tirés de l'utilisation de la télémétrie automatisée, et aide à formuler des questions pour les recherches futures sur les modèles de déplacements régionaux visant à soutenir la conservation de cet oiseau d'eau colonial.

Mots clés
Caraïbes, dispersion, Floride, Motus, oiseau d'eau colonial, reproduction, Rynchopinae, *Rynchops niger*

The Black Skimmer (*Rynchops niger*) is a charismatic waterbird distributed across the Americas that attracts public attention for its unique habit of skimming for fish, the contrast of its striking orange bill and black-and-white plumage, and large, noisy breeding colonies. A significant portion of the world's populations breeds along Gulf of Mexico beaches (Burger 2018) that also support human recreation. Although the species has a wide global range with an IUCN status of Least Concern (BirdLife International 2022), it is a conservation priority in the state of Florida where it is considered "imperiled" (FWC 2013), having experienced significant population declines over the last half-century including a decrease in the total number of pairs, colony size, and productivity during that period (FWC 2011). Observational data suggest that declines are influenced by development pressures and other human activities that impact the coastal breeding habitat of skimmers (Shope 2020). Development is particularly intense on the southern Florida beaches that support the largest colonies and are also popular tourist destinations; an estimated 77% of the state's breeding population occurs in the southwest region (FWC 2020). The same area is also of broader ecological interest, with the Gulf of Mexico supporting one of the most diverse regions for North America's avifauna (Burger 2018).

Skimmers in Florida belong to the most northern of 3 subspecies, *R. niger niger*, which breeds in the USA and in Mexico and winters south to Panama (Gochfeld *et al.* 2020). While Florida breeders have typically been considered as "residents" (Burger 2018), the state is a very large area and we infer that the situation is more complex. While the range of North American skimmers is well-documented, much remains to be learned about movement dynamics of this species among areas throughout its range across the Americas. Knowledge gaps include juvenile dispersal, migration, and survival, both within and beyond Florida (Gochfeld *et al.* 2020). For example, while the species is monitored regularly in US states where it breeds (e.g., FWC 2013), little information about juveniles appears in the published literature. The Birds of the World species account summarizes that fledglings "are dependent on parents for at least 2 [weeks], probably much longer" (Gochfeld *et al.* 2020). Our observations from unpublished banding data show that chicks are flight-capable at roughly 3–4 weeks old, that a majority of fledglings move from their natal region during or soon after the first summer, and that individuals from many places mix within the state. This study therefore had two aims: (1) to investigate where Black Skimmers move after they fledge from two important breeding colonies in southern Florida, and (2) to test the use of newly-available automated telemetry for tracking dispersal in the study region. While our telemetry attempt was mainly not successful, it informs next steps in this line of research. Here we share lessons learned about our dual objectives, toward the ultimate goal of augmenting knowledge in support of management efforts that better reflect the movement biology of this species of concern.

Methods

Study Area

In Florida, Black Skimmers nest mainly on sparsely vegetated, sandy beaches along the Gulf of Mexico where they form colonies ranging from a few to hundreds of pairs (FWC 2013). This study focused on chicks that fledged from two key breeding sites on the Gulf Coast. These sites were chosen for their sizeable colonies, ease of access, and proximity to the southern extent of the documented range of the subspecies. The first study site was the colony at St. Pete Beach (27°43'15.2"N, 82°44'30.5"W) in Pinellas, the state's most densely populated county, within the Tampa Bay region. It is close to several large buildings and is disturbed frequently by beach-goers (Forys *et al.* 2022). The minimum mean colony size during the study period was ~180 pairs. Further south, the second study site, at Sand Dollar Beach on Marco Island in Collier county (25°57'40.7"N, 81°45'05.4"W), is more remote yet also subject to frequent disturbances by people and weather activity (Shope 2020). The minimum mean colony size there during the study period was

~500 pairs. Note that these sizes are minimum estimates based on our observations at the colonies, and not official population counts.

Tagging individuals

During July–August of the 2017 and 2018 breeding seasons, we deployed radio tags on a total of 35 fledgling skimmers at the breeding colonies of St. Pete Beach (*n* = 25) and Sand Dollar Beach (*n* = 10); in 2017, 1 additional rehabbed adult was tagged at Fort de Soto near St. Pete. Flight-capable chicks (~3 weeks old, mean mass 301.4 g ± 11.1 SE) were captured using hand-held nets within the breeding colony (Fair *et al.* 2010). Handling time was kept to a minimum (Streby *et al.* 2015), roughly 20 min to allow for body measurements, banding, and tagging. Chicks were outfitted with a numbered USGS metal service band and a field-readable alphanumeric colored band. By convention we use green bands to signify Florida, in coordination with other researchers who are tagging skimmers using different colors within each US state in the Black Skimmer breeding range.

In addition to bands, we affixed tiny "nanotags" compatible with the Motus Wildlife Tracking Network (motus.org; Birds Canada 2021), a continental-scale system for collaborative, automated tracking of tagged migratory animals on a single VHF (Very High Frequency) radio frequency (166.380 MHz is used in the Western Hemisphere) as they move through terrestrial and coastal environments (Taylor *et al.* 2017). Tagging followed standard procedures (Warnock and Warnock 1993, Mackenzie *et al.* 2017). While one person held a bird, a second person attached a 1.1 g radio-transmitter (model NTQBW-3-2, Lotek, Newmarket, Ontario, Canada) by applying high-strength Gorilla glue to the base of the tag, and then placing it on feathers in the middle of the bird's back. After release, each chick was observed for several minutes to ensure it could fly unhindered. All procedures were approved and permitted according to guidelines at federal (USGS Banding Office), state (FWC, Florida Fish and Wildlife Conservation Commission), and institutional (FGCU's IACUC) levels, as described in the ethics statement within the Acknowledgments section of this paper.

Tracking movements

We used a combination of automated and manual radio-telemetry to track the movement of fledglings from their natal colonies. In 2017, 13 nanotags were deployed and tracked with automated telemetry. In 2018, 23 more tags were deployed. To determine precisely when chicks departed, in the second year we also used hand-held manual telemetry (Lotek model SRX800-M2 receiver) to verify the presence of tagged chicks at the colonies until no further detections were made. Tracking visits were made every 2–3 days at St. Pete, and 1–2 times per week at the more remote Sand Dollar colony. Systematic band resighting was also incorporated into our detection database, stemming from frequent, regular surveys of breeding beaches across the region by various biologists and volunteers.

Data processing

Automated detections were downloaded from Motus in late January 2019, and the data were processed similar to previously published studies that have used Motus (Crysler *et al.* 2016). Tag identity is encoded in the duration of three rapid, consecutive pulses that form a single tag "burst" along with the precisely fixed interval between bursts; the resulting pattern of pulse lengths and burst interval is unique among tags. A detection is logged when at least two pulses of a given tag are recorded, separated by the expected burst interval. Once processed by Motus, the data include measures of signal qualities within that tag detection. False positive detections occur mainly when nearby radio communications and noise at frequencies overlapping the tags randomly emulate tag bursts separated by some multiple of the burst interval; due to their random nature, false positives typically produce "runs" (i.e., the number of bursts recorded in a detection) of two nonconsecutive bursts, or occasionally more bursts in environments with very high radio noise. We identified false detections by examining those with less than three consecutive pulses, and further evaluating burst interval, signal strength, and other signal qualities. Overall, a low number of consecutive pulses in a run is typically consistent with a false detection.

Results

The combination of manual telemetry and visual resighting showed that glued-on tags (*n* = 36) lasted an average minimum of 21.2 days (± 1.9 SE) before falling off the birds, and that chicks stayed at their natal colony for an average minimum of 24.2 days (± 1.4 SE, *n* = 35) after being tagged. While the tag status of chicks precisely at departure could not always be determined (given a time interval of up to 7 days between manual telemetry sessions), few chicks were likely to still bear a tag when they left the natal colony.

Automated tracking results yielded putative detections of ~10% of tags (4 of 36) by Motus receiving towers. These were linked to unlikely locations in the Great Lakes (Ontario, Canada and Ohio, USA) and the Canadian Maritimes (Sable Island, Nova Scotia, Canada) that are a few hundred kilometers from the northern limit of the species' breeding range in Massachusetts. Because those locations were atypical for this species, and because the signal patterns of the detections were ambiguous, they were deemed likely to be false positives. Upon further screening of signal patterns, none of those detections was considered valid.

Nonetheless we were able to discern some movement patterns from manual tracking combined with resighting of color bands (Fig. 1). Up to the end of their first calendar year (i.e., 31 December of the year of tagging), birds from St. Pete were subsequently observed at 6 different locations along the Gulf Coast, and birds from the smaller subset at Marco Island were observed at 2 of those locations. Those detection data are summarized in Table 1. The longest known movement among the cohort of 35 nano-tagged fledglings was ~370 km from St. Pete Beach to Key West.

Discussion

The attempt to use automated telemetry to track nano-tagged skimmer fledglings was not successful. The low rate of tag detection by Motus towers was not surprising, as manual telemetry showed chicks had not yet moved far from their natal colonies during the relatively short period of tag retention.

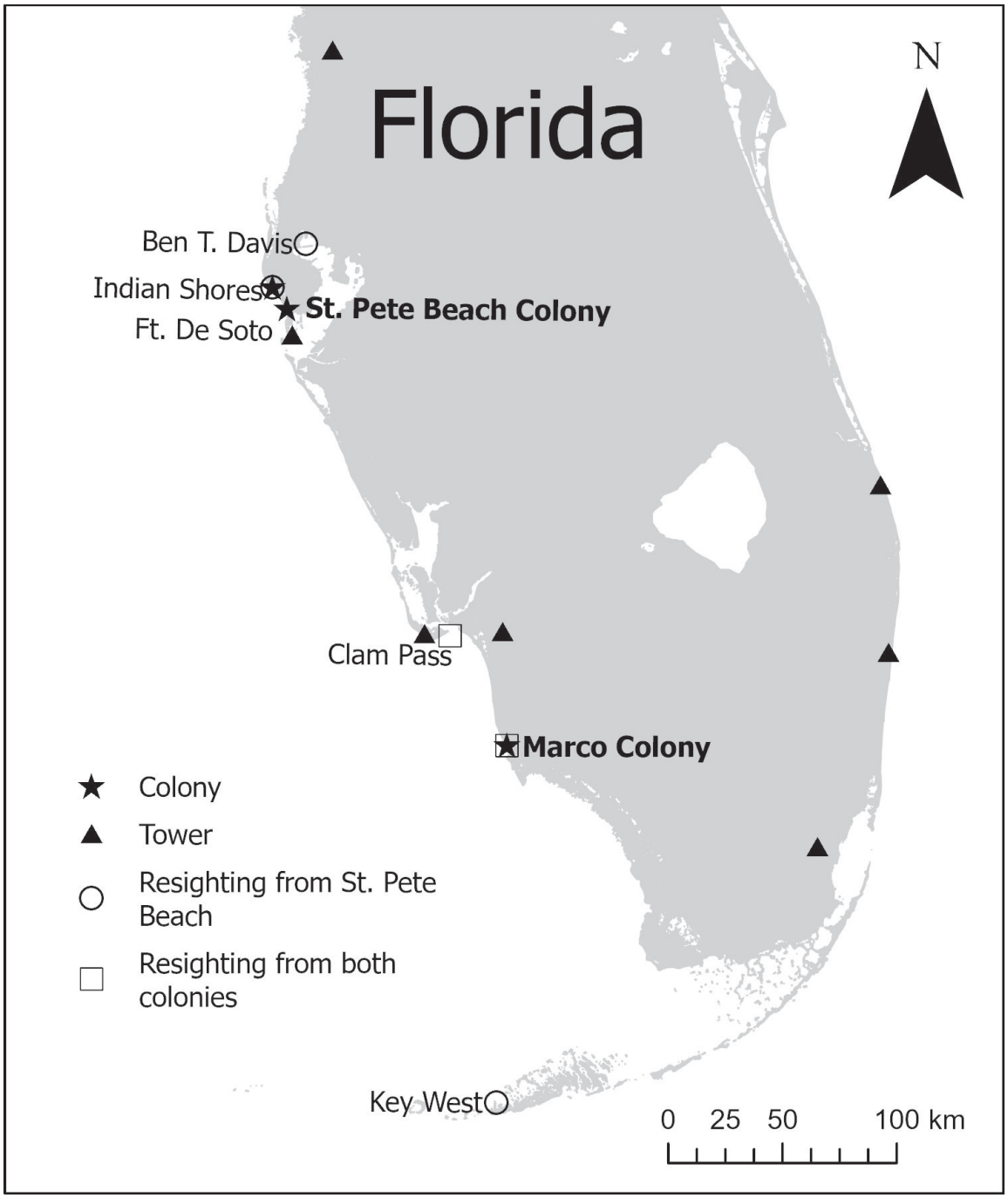

Fig. 1. Documented locations of nano-tagged Black Skimmer fledglings (*n* = 35) in southwest Florida, USA after movement from natal colonies, based on band resightings and manual tracking. Chicks were tagged at St. Pete Beach, Pinellas county or Sand Dollar Beach on Marco Island, Collier county, during the 2017 and 2018 breeding seasons. Tower locations are Motus receiving stations that were active locally during the study period (viewable at motus.org). Details of movement data are summarized in Table 1.

Additionally, there was a sparse though growing regional array of receiving towers in the immediate study area (Fig. 1), making for a low detection probability. Trapping/tagging individuals at a later stage of development might be an alternative, although in this study we were limited by permission to trap only chicks, which needed to be large enough to carry leg bands, and to use only glue as an attachment method. Practically that necessitated capturing fledglings before they left their natal colonies. Moreover, the attachment method of glue proved not to be ideal for tagging juveniles, although again it was the only permissible approach in this study. Future studies of skimmer dispersal could pursue alternate options for tagging attachment, such as the use of leg-loop harnesses where permitted.

One chick was observed near a receiving tower while still bearing its tag, yet was not detected by that station; we inferred that this likely occurred due to gaps in functionality at the station, which can happen due to intense storms and lightning that are common in the region. Another challenge was low survivorship

Table 1. Tagging and movement data for a sample of 35 nano-tagged1 Black Skimmer chicks and 1 rehabilitated adult in Florida (USA), tagged in July–August 2017 and 2018.

Sample	Band	Nanotag #	Date tagged	Colony	Location[2]
1	B33	5	19 July 2017	SPB	SPB, Marco (Motus hit in OH deemed unlikely)
2	B37	6	19 July 2017	SPB	SPB, Marco
3	B39	7	19 July 2017	SPB	SPB
4	B43	11	2 August 2017	SPB	SPB, Indian Shores
5	B45	10	2 August 2017	SPB	SPB, FDS
6	B47	15	2 August 2017	SPB	SPB (Motus hits in OH deemed unlikely)
7	B49	17	8 August 2017	FDS	unknown (rehabbed adult)
8	B50	8	19 July 2017	SPB	SPB, FDS
9	B52	13	2 August 2017	SPB	SPB
10	B53	14	2 August 2017	SPB	SPB
11	B54	16	2 August 2017	SPB	SPB
12	none	9	2 August 2017	SPB	SPB
13	none	12	2 August 2017	SPB	SPB
14	B57	329	7 August 2018	SPB	SPB
15	B59	331	7 August 2018	SPB	SPB, Caxambas Pass (near Marco)
16	B60	330	7 August 2018	SPB	SPB, Marco
17	B61	333	7 August 2018	SPB	SPB, Outback Key (near FDS)
18	B62	332	7 August 2018	SPB	SPB, Marco
19	B63	335	7 August 2018	SPB	SPB, Outback Key (near FDS), Clam Pass
20	B64	334	7 August 2018	SPB	SPB
21	B65	336	7 August 2018	SPB	SPB, Outback Key (near FDS)
22	B66	337	7 August 2018	SPB	SPB
23	B67	338	7 August 2018	SPB	SPB, Ben T. Davis
24	B68	340	7 August 2018	SPB	SPB, Clam Pass
25	B69	339	7 August 2018	SPB	SPB, FDS
26	B70	341	7 August 2018	SPB	SPB, Indian Shores, Marco, Key West
27	E08	319	31 July 2018	Marco	Marco
28	E09	321	31 July 2018	Marco	Marco (Motus hits in NS deemed unlikely)
29	E10	322	31 July 2018	Marco	Marco
30	E11	324	31 July 2018	Marco	Marco, Clam Pass
31	E23	325	10 August 2018	Marco	Marco
32	E24	326	10 August 2018	Marco	Marco
33	E25	328	10 August 2018	Marco	Marco, Clam Pass
34	105489717	320	31 July 2018	Marco	Marco
35	105489724	323	31 July 2018	Marco	Marco
36	105489765	327	10 August 2018	Marco	Marco

[1]Chicks also received green alphanumeric bands (except in a few cases when their legs were deemed too small) along with USGS metal bands. Natal colony where chicks were tagged: SPB = St. Pete Beach; Marco = Sand Dollar Beach on Marco Island; FDS = Fort de Soto Park near SPB, where one rehabbed adult was tagged (making the total sample size 36). Detections were made with a combination of manual tracking and band resighting. Locations of each chick are listed in chronological order of detection and depicted on the study area map (Fig. 1).
[2]Locations where observed through 31 December of 1st winter.

of Marco Island chicks in 2018 related to bacterial infections that chicks experienced when presumably immunocompromised during a prolonged Red Tide algal bloom (Niedringhaus *et al.* 2021). Detections that were thought to have occurred in the Great Lakes and Canadian Maritimes were rejected during data screening. Those northern locations could have been possible for this species, as skimmers are indeed "post-breeding or storm-driven wanderers" in the Maritimes region (Godfrey 1966, in Gochfeld *et al.* 2020). We also know from eBird data (e.g., 324 reports in Canada) that skimmers are blown north by

severe storms: e.g., there were many confirmed sightings of the species in Nova Scotia after Hurricane Dorian in September 2019, including one banded in New Jersey (C83 blue, eBird observation by P. Matteucci, Halifax, 21 September 2019; eBird 2022). However, based on signal pattern, those detections were deemed to be either false positives or cases of "tag aliasing", which can occur when several active tags at a station interfere with each other and appear as a completely different tag. We mention these false detections as a concrete example for other researchers embarking on the use of automated telemetry, to show why the step of data cleaning and inspection is integral to appropriate interpretation of detections.

Despite the low sample size of detections, there were some notable differences in movement patterns of the two colonies. For example, while several tagged chicks moved south from St. Pete to Marco Island, movement in the opposite direction was not observed (Table 1). Generally, chicks from St. Pete appeared to move further than the Marco chicks. We do not yet have a clear picture of causes for these potential differences, although reasons to explore include the higher intensity of human activity at St. Pete, and relative food availability in the two breeding areas.

Confirmed movement of a tagged chick from Pinellas to Key West poses the question of whether skimmers are moving from Florida even further afield to the Caribbean. For example, the shortest distance between Key West and Cuba is roughly 100 km; perhaps movements in the Caribbean are simply undetected because they are not studied. There is only scant mention of the Caribbean in published treatments of Black Skimmer life history, e.g., in terms of subspecies distribution (Gochfeld *et al.* 2020), or possible inter-island movement (Vieira *et al.* 2018). Yet eBird documents Black Skimmers throughout the Caribbean, with many existing records from Cuba, and occasional reports in Anguilla, The Bahamas, Barbados, Cayman Islands, Grenada, and Puerto Rico (eBird 2022). Outstanding questions for future research include: how common are movements across and/or southward from Florida, how common are Caribbean occurrences, and do those birds interact with Florida skimmers? It is also important to determine which of the three skimmer subspecies are occurring in Caribbean locations; northern South America is occupied by *R. n. cinerascens*, different from *R. n. niger* that occurs in North America, with mixing potentially occurring in areas between the two regions (Gochfeld *et al.* 2020).

In summary, whether Black Skimmers are strictly "resident" in Florida and whether chicks move further from southwest Florida than is currently understood remains to be determined. Over time, this will become more possible to study as the Motus Network expands across the southeast US and Caribbean (Lefevre and Smith 2020a), and with the use of other technologies such as GPS tags. Lessons learned from challenges that we faced with tag retention and the limited footprint of the receiving network will be beneficial to other researchers considering similar research. We have been encouraging new partners to become involved in the Motus Network in order to have better coverage with more receiving stations across the region for dispersal and migration research in general, because success of automated telemetry efforts depends on collaboration (Lefevre and Smith 2020b). Our future efforts will consider the use of other tracking approaches that might be more successful, including seeking permissions for a more effective attachment method such as harnesses.

Many interesting questions certainly remain to be addressed about the movement patterns of Black Skimmers across the Americas. During the current context of climate change within the Anthropocene, multiple complex factors are driving the ecology of coastal birds, both natural and human-caused; intense environmental events such as the recent impact of Hurricane Ian (September 2022) along the coast of southwest Florida serve to further underscore the importance of studying those factors. Going forward, new insights about local and possibly long-distance movement patterns will enable better protection of the habitats and resources upon which these birds rely, to facilitate effective conservation planning that includes areas beyond breeding colonies and that can also benefit coastal breeding birds generally.

Acknowledgments

We are grateful to Birds Canada and all partners in the Motus Wildlife Tracking Network who collectively support a system that benefits continental-scale migration research. Thanks to students Joshua Roach and Lina Ramirez who assisted with radio-telemetry, and to Dr. Marianne Korosy and Audubon Florida for encouragement of this project. Many students and volunteers in the Florida Shorebird Alliance contributed to fieldwork including efforts to resight bands. Telemetry equipment was funded by Eckerd College and Florida Gulf Coast University (Holmes Fund of the Whitaker Center for STEM Education); nanotags were funded by The Water School at FGCU. We honor Jean Hall's dedication to seabird conservation and generous sharing of her award-winning wildlife photography to raise awareness. Ethics statement: field procedures for handling birds were approved and permitted according to all relevant guidelines. Banding and tagging were conducted in concordance with federal and state research permits of Adam DiNuovo and Audubon Florida (Dr. Korosy: USGS banding permit #23627; FWC Scientific Collecting permit #LSSC-12-00030C). Methods were also approved by FGCU's Institutional Animal Care and Use committee (Dr. Lefevre, IACUC protocol #1617-03). Author Contributions: KLL, EF and ADN planned the study, conducted fieldwork, and compiled data. ADS analyzed the Motus data. EF created the figure. KLL drafted the manuscript and all authors contributed to completing and approving the final version.

Literature Cited

BirdLife International. 2022. Species factsheet: *Rynchops niger*. datazone.birdlife.org/species/factsheet/black-skimmer-rynchops-niger.

Birds Canada. 2021. Motus Wildlife Tracking System. Port Rowan, ON, Canada. motus.org.

Burger, J. 2018. Birdlife of the Gulf of Mexico. Texas A&M University Press, College Station, TX.

Crysler, Z.J., R.A. Ronconi, and P.D. Taylor. 2016. Differential fall migratory routes of adult and juvenile Ipswich Sparrows (*Passerculus sandwichensis princeps*). Movement Ecology 4:3.

eBird. 2022. eBird: an Online Database of Bird Distribution and Abundance. Ithaca, NY. ebird.org.

Fair, J., E. Paul, and J. Jones (eds.). 2010. Guidelines to the Use of Wild Birds in Research. Ornithological Council, Washington, DC.

Forys, E.A., S.K. Beres, A.L. McKay, and O.N. Spicer. 2022. Infanticide in highly urbanized colonies of Black Skimmers *Rynchops niger*. Marine Ornithology 50:43–47.

FWC. 2011. Biological status review report for the Black Skimmer. Florida Fish and Wildlife Conservation Commission, Tallahassee, FL.

FWC. 2013. A species action plan for four imperiled beach-nesting birds. Florida Fish and Wildlife Conservation Commission, Tallahassee, FL.

FWC. 2020. Florida Shorebird Alliance monitoring data at work. Monitoring data retrieved from the Florida Shorebird Database (FSD), 23 June 2020. Florida Fish and Wildlife Conservation Commission, Tallahassee, FL.

Gochfeld, M., J. Burger, and K.L. Lefevre. 2020. Black Skimmer (*Rynchops niger*), version 1.0. *In* Birds of the World (S.M. Billerman, ed.). Cornell Lab of Ornithology, Ithaca, NY.

Godfrey, W.E. 1966. The Birds of Canada. Bulletin of the National Museum of Canada 203, Biological Series No. 73.

Lefevre, K.L., and A.D. Smith. 2020a. The case for expanding automated telemetry efforts across the Caribbean. NAOC VII, North American Ornithological Conference, 11–15 August 2020.

Lefevre, K.L., and A.D. Smith. 2020b. Florida's strategic position for collaborative automated-telemetry tracking of avian movements across the Americas. Journal of Fish and Wildlife Management 11:369–375.

Mackenzie, S.A., D. Bell, Z. Crysler, A. Anderson, J. Smetzer, D. Hamilton, and R. Gray (eds.). 2017. Draft Report: Tagging things, an incomplete guide to affixing radio transmitters to a variety of animals. Birds Canada and Motus, Port Rowan, ON, Canada.

Niedringhaus, K.D., L.A. Shender, A. DiNuovo, L.J. Flewelling, G. Maboni, S. Sanchez, P.J. Deitschel, J. Fitzgerald, and N.M. Nemeth. 2021. Mortality in Common (*Sterna hirundo*) and Sandwich (*Thalasseus sandvicensis*) Terns associated with Bisgaard Taxon 40 infection on Marco Island, Florida, USA. Journal of Comparative Pathology 184:12–18.

Shope, K. 2020. The Relative Impact of Anthropogenic and Environmental Disturbances on a Black Skimmer Nesting Colony Within a Critical Wildlife Area on Marco Island, Florida. M.S. Thesis. Florida Gulf Coast University, Fort Myers, FL.

Streby, H.M., T.L. McAllister, S.M. Peterson, G.R. Kramer, J.A. Lehman, and D.E. Anderson. 2015. Minimizing marker mass and handling time when attaching radio-transmitters and geolocators to small songbirds. Condor 117:249–255.

Taylor, P.D., T.L. Crewe, S.A. Mackenzie, D. Lepage, Y. Aubry, Z. Crysler, G. Finney, C.M. Francis, C.G. Guglielmo, D.J. Hamilton, R.L. Holberton, P.H. Loring, G.W. Mitchell, D.R. Norris, J. Paquet, R.A. Ronconi, J. Smetzer, P.A. Smith, L.J. Welch, and B.K. Woodworth. 2017. The Motus Wildlife Tracking System: a collaborative research network to enhance the understanding of wildlife movement. Avian Conservation and Ecology 12:8.

Vieira, B.P., R.W. Furness, and R.G. Nager. 2018. What do we know about Black Skimmers? A review on its annual-cycle and life-history main events. Ardea 106:119–130.

Warnock, J., and S. Warnock. 1993. Attachment of radiotransmitters to sandpipers: review and methods. Wader Study Group Bulletin 70:28–30.