

Appendix II-F3

Red Knot Satellite Tagging Study Memorandum

**TRACKING OF RED KNOTS ON THE U.S. ATLANTIC COAST:
A preliminary report on tag deployments by Atlantic Shores**

December 2021

Report to:

Environmental Design and Research
217 Montgomery Street
Syracuse, NY 13202

and

Atlantic Shores Offshore Wind, LLC
1 Beacon Street
Boston, MA 02108

Report from:

Biodiversity Research Institute
276 Canco Road
Portland, ME 04103



SUMMARY

- Atlantic Shores Offshore Wind, LLC (Atlantic Shores) is currently funding a multi-year study of the northbound and southbound migratory patterns of Red Knots using GPS satellite tags deployed on birds staging in New Jersey. The project was initiated in 2020, in collaboration with Wildlife Restoration Partnerships (WRP), the U.S. Fish and Wildlife Service (USFWS) and Normandeau Associates, and continued in 2021 with WRP, USFWS and NJ Audubon.
- To date, a total of 60 tags have been deployed on Red Knots in New Jersey (29 in 2020, 31 in 2021). In 2020, 11 of the tags deployed returned data, while in 2021, 29 of the tags deployed returned data.
- Of the 11 individuals with tags that provided data in 2020, one was recorded flying through the Wind Turbine Area at an altitude of 1,886 ft (575 m). The straight-line flight paths of 6 other birds suggests they may have flown through or near to the Wind Turbine Area.
- Overall, the altitude of individual birds varied during their offshore migratory flights, ranging from under 66 ft (20 m) to over 9,843 ft (3000 m), suggesting that Red Knots adjust their flight height in response to wind and weather, or other factors.
- A more detailed report on the 2021 data will be provided in the spring of 2022.

1. BACKGROUND

The Red Knot (*Calidris canutus*) is a medium-sized shorebird with one of the longest migrations in the world, undertaking non-stop flights of up to 5,000 mi (~8,000 km) on their annual travels (Baker *et al.* 2020). Red Knots breed in the Canadian High Arctic, and migrate to wintering grounds in the southeastern U.S., Caribbean, Mexico, Brazil, and Argentina (Baker *et al.* 2020). On their migrations, they stop over at a few key sites along the U.S. Atlantic coast, including coastal New Jersey, to renew depleted energy reserves (Burger *et al.* 2011). Population status is thought to be strongly influenced by adult survival and recruitment rates, as well as food availability on stopover sites, and conditions on the breeding grounds (Baker *et al.* 2020).



The Atlantic flyway subspecies (*C. c. rufa*) is listed as *Threatened* under the Endangered Species Act (ESA), primarily because this population decreased by approximately 70% from 1981 to 2012, to less than 30,000 individuals (Burger *et al.* 2011, Baker *et al.* 2020). This population of Red Knots has two distinct migratory strategies: long- and short-distance migrants. On their southbound migrations in the fall, the long-distance migrants are generally expected to fly directly offshore from coastal New Jersey, taking direct, multi-day offshore flights to wintering areas in South America, while the short-distance migrants are expected to fly down the Atlantic coast in a series of short hops to winter on the southeast U.S. coast or the Caribbean.

The Red Knot is present in New Jersey only during spring and fall migratory periods. This study is being carried out in the fall, when the migration period is July-October.¹ A Motus study tracked Red Knots tagged in James Bay and the Mingan Islands in Canada, and in Massachusetts and New Jersey (Loring *et al.* 2018). The receiver network was primarily land-based with some coastal coverage and limited offshore coverage. Out of 388 birds tagged, three birds (one tagged in Massachusetts and two tagged in New Jersey) were estimated to cross the New Jersey Wind Energy Area² (Loring *et al.* 2018). These flights were initiated during fair weather conditions, with clear skies and little to no precipitation (Loring *et al.* 2018).

To improve the understanding of the migratory patterns of Red Knots on the Atlantic coast, Atlantic Shores Offshore Wind, LLC (Atlantic Shores) is currently funding a multi-year study using Argos satellite tags with GPS sensors deployed on southbound birds staging in New Jersey that have the potential to fly through Atlantic Shores Wind Turbine Area (WTA). The project was initiated in 2020, in collaboration with Wildlife Restoration Partnerships (WRP), the U.S. Fish and Wildlife Service (USFWS) and Normandeau Associates and continued in 2021 with WRP, USFWS and NJ Audubon. To date, a total of 60 tags have been deployed on Red Knots (29 in 2020, 31 in 2021). Here, we take a first look at tracking data from tags deployed in 2020. The tags deployed in 2021 are currently returning locational data the results of which will be provided in the spring of 2022.

¹ In 2022 there is a northbound migrant component of the study

² NJ WEA is comprised of the Atlantic Shores Lease Areas OCS-A 0499 and OCS-A 0549 as well as Lease Area OCS-A 0498)

2. METHODS

Red Knots were tracked during their fall migration using small satellite transmitters with GPS receivers (PinPoint Argos-75 GPS Transmitters³ from Lotek Wireless, Ontario, Canada). Each transmitter weighed 0.15 oz (4.1 g), <3% of the average body mass of tagged Red Knots (6.03 oz [171 g]; see Appendix A), and each had a 2 in (5 cm) GPS antenna and 9 in (23 cm) Argos antenna.



These transmitters were designed to collect 60 GPS locations and altitude estimates on a customized schedule, and the estimated accuracy of positions is typically within 33 ft (10 m) for 2-D location estimates, and within 66 ft (20 m) for altitude estimates. The tags deployed in 2020 were programmed to collect five locations per day for 12 days (starting on day of tagging) and timed to optimize data collection during periods when migratory departure was most likely to occur (18:00–22:00 hrs). Location data is relayed via the Argos satellite system (<https://www.argos-system.org/>).

All field work to capture and tag Red Knots was conducted under the direction of Dr. Larry Niles of WRP. Captures occurred at Brigantine Natural Area (39°26'35"N, 74°19'45"W) in coastal New Jersey, on the 13th, 22nd, and 24th of August, 2020, and were timed to maximize the number of transmitters deployed on long-distance Red Knots likely to depart from the Atlantic coast by mid-September. Red Knots were captured using cannon nets, and birds were removed immediately from the net and placed in secure storage boxes. All birds were weighed, and other morphometric data was collected from Red Knots captured on August 13th, using standard protocols (see Appendix A). Red Knots were banded with one standard USFWS metal band and a light-green leg flag with a field-readable black alpha-numeric code. Dr. Niles selected birds for tagging based on their molt and weight, which together suggest when birds will depart on migration. After clipping a small area of feathers from the bird's back, the satellite tags were attached by gluing them to the feather stubble and skin with a cyanoacrylate gel adhesive – a standard method for tag attachment.

In this preliminary assessment of the data, we simply mapped actual point locations provided by the satellite tags and assumed a straight flight line between points. Erroneous outlying points, well beyond the realms of possibility for daily migratory movements, were removed manually prior to final mapping and tabulation.

³ <https://www.lotek.com/wp-content/uploads/2017/10/PinPoint-GPS-Argos-for-birds-Spec-Sheet.pdf>

3. RESULTS / DISCUSSION

Of the 29 tags deployed in 2020, 18 tags failed to record data due to a software error. Of the remaining 11 tags, all 11 provided reliable location data for some period, and 6 of them also provided altitudinal information.

When departing on migration, most of the tagged Red Knots (10 of 11) flew directly offshore from New Jersey, heading generally southeast (Figure 1). On the estimated departure days, daily average wind speeds ranged from 2.5–11.8 mph (4-19 kph), and the sustained wind direction ranged from 050–300 degrees (NE–NW; see Appendix A). Of the tagged birds heading directly offshore, two tags stopped providing data along the way for unknown reasons – the other 8 made landfall 3-6 days later in South America, scattered from western Venezuela east to northern Brazil (Figure 1). The remaining tagged bird initially made its way south down the Atlantic coast, pausing briefly in North Carolina, before heading offshore from there, arriving in Cuba just 2 days later (Figure 1).

The altitude data provided by 6 of the satellite tags indicates that Red Knots climbed to a range of flight heights on their departure and alternated their flight heights along the entirety of their migration routes, from under 66 ft (20 m) to over 9,843 ft (3000 m) (Figure 2). Individuals may have adjusted their flight heights for a number of reasons, including responding to changing winds and/or other weather conditions, or traversing island topography (Figure 2).

Only one bird (204371) was confirmed by a data point to have flown through the WTA (Figure 3). At that location, the satellite transmitter recorded an altitude of 1,886 ft (575 m; Figure 3), well above the full range of the Project's potential rotor swept zone (RSZ; 75–1,047 ft [23–319 m]). The straight-line connections drawn between points suggest another 3 tagged Red Knots may have flown directly through the WTA, with two birds possibly passing close by to the north, and one just to the south (Figure 3). The other 4 tagged Red Knots appear to have flown down the coast, or stayed closer to it, thereby missing the WTA altogether.

A further 31 satellite tags were deployed on Red Knots in New Jersey in 2021 prior to their offshore migrations. Of these, 29 delivered locational data, and a report on Red Knot movements will be provided in the spring of 2022.

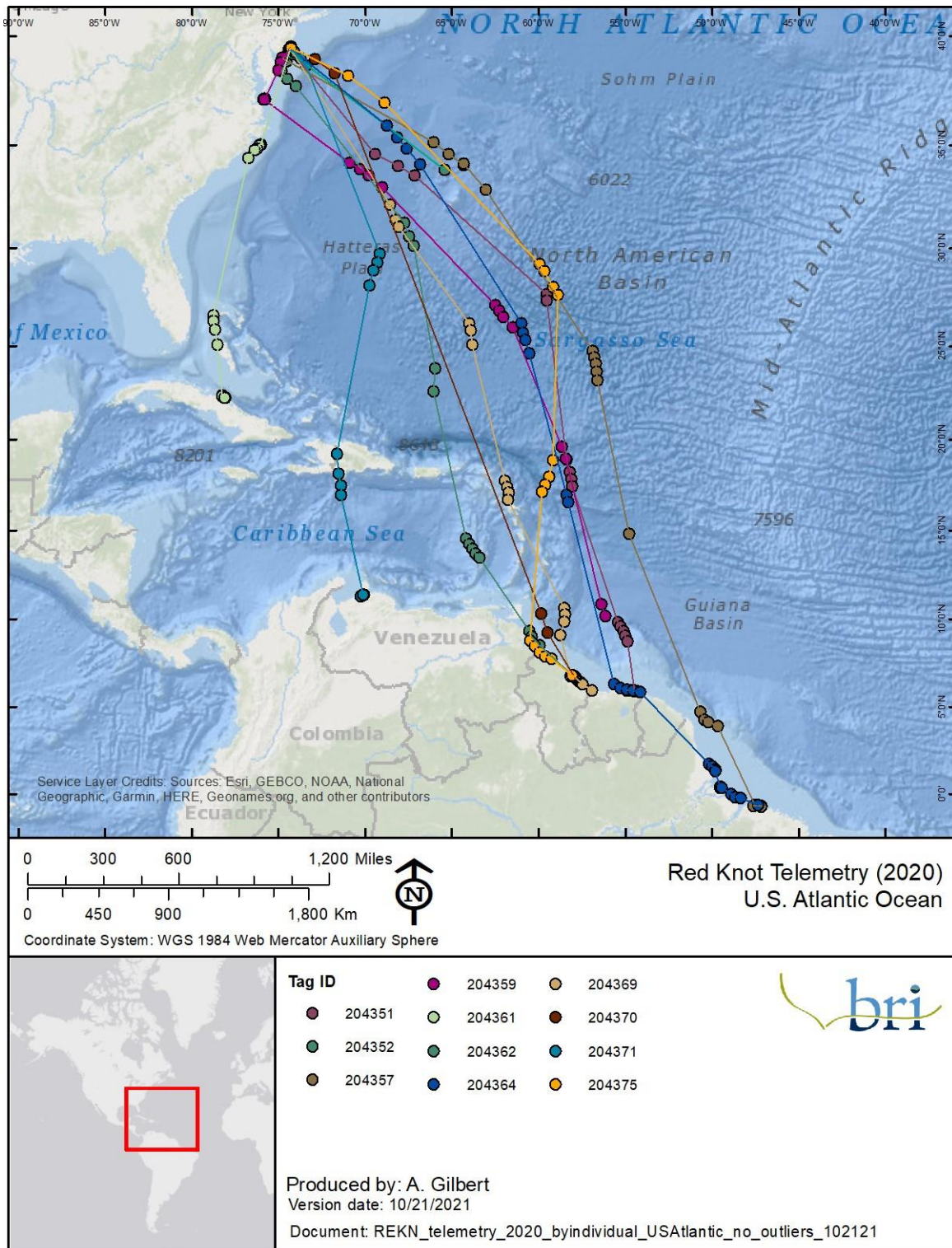


Figure 1. Full migration tracks of 11 Red Knots tagged at Brigantine, NJ, in 2020, with all data points indicated and connected by straight lines.

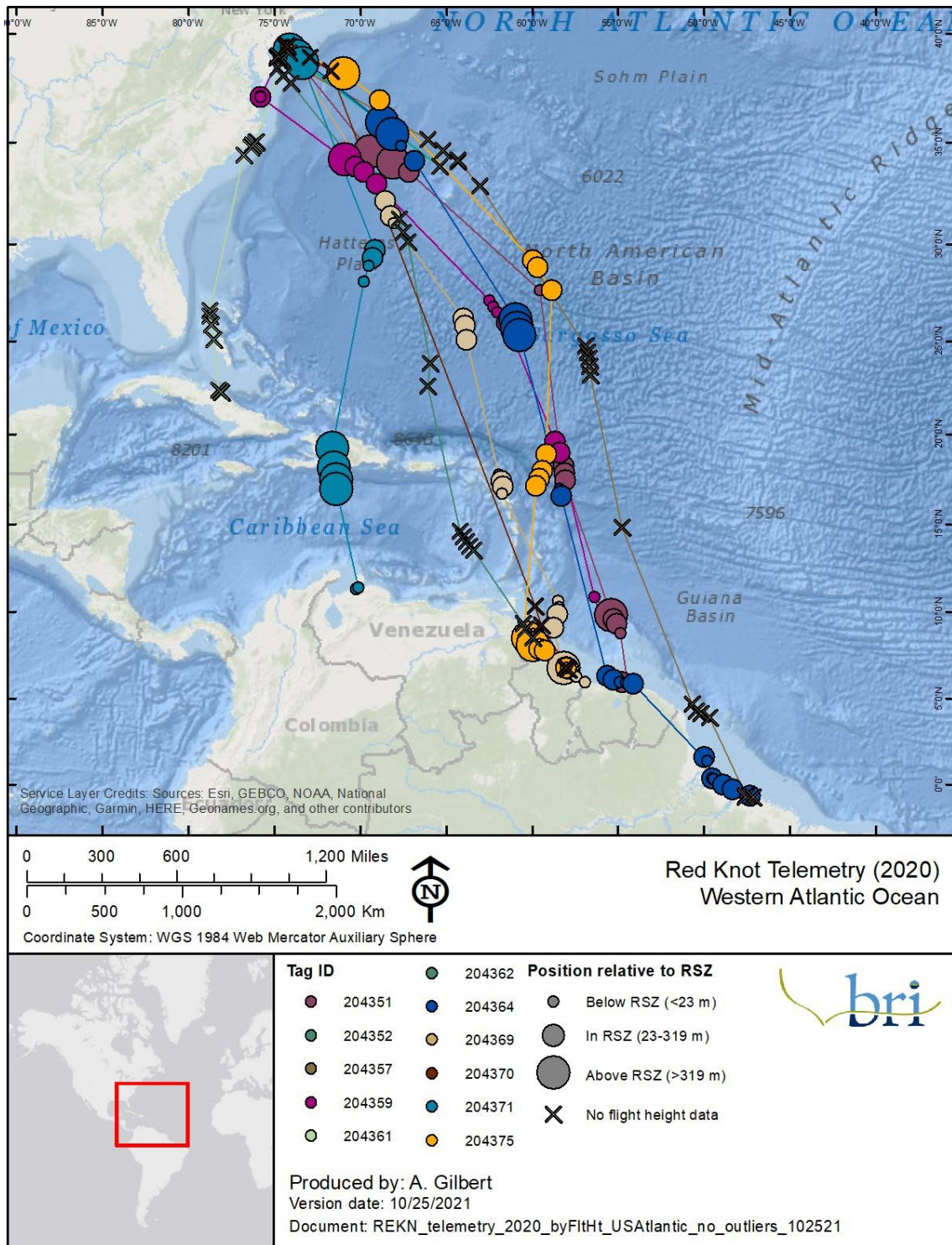


Figure 2. Full migration tracks of 11 Red Knots tagged at Brigantine, NJ, in 2020, with all data points indicated and connected by straight lines. For the 6 tags that returned altitudinal data, each point is assigned to a flight height category (below, within, or above the full range of the Project’s potential Rotor Swept Zone) indicated by point size.

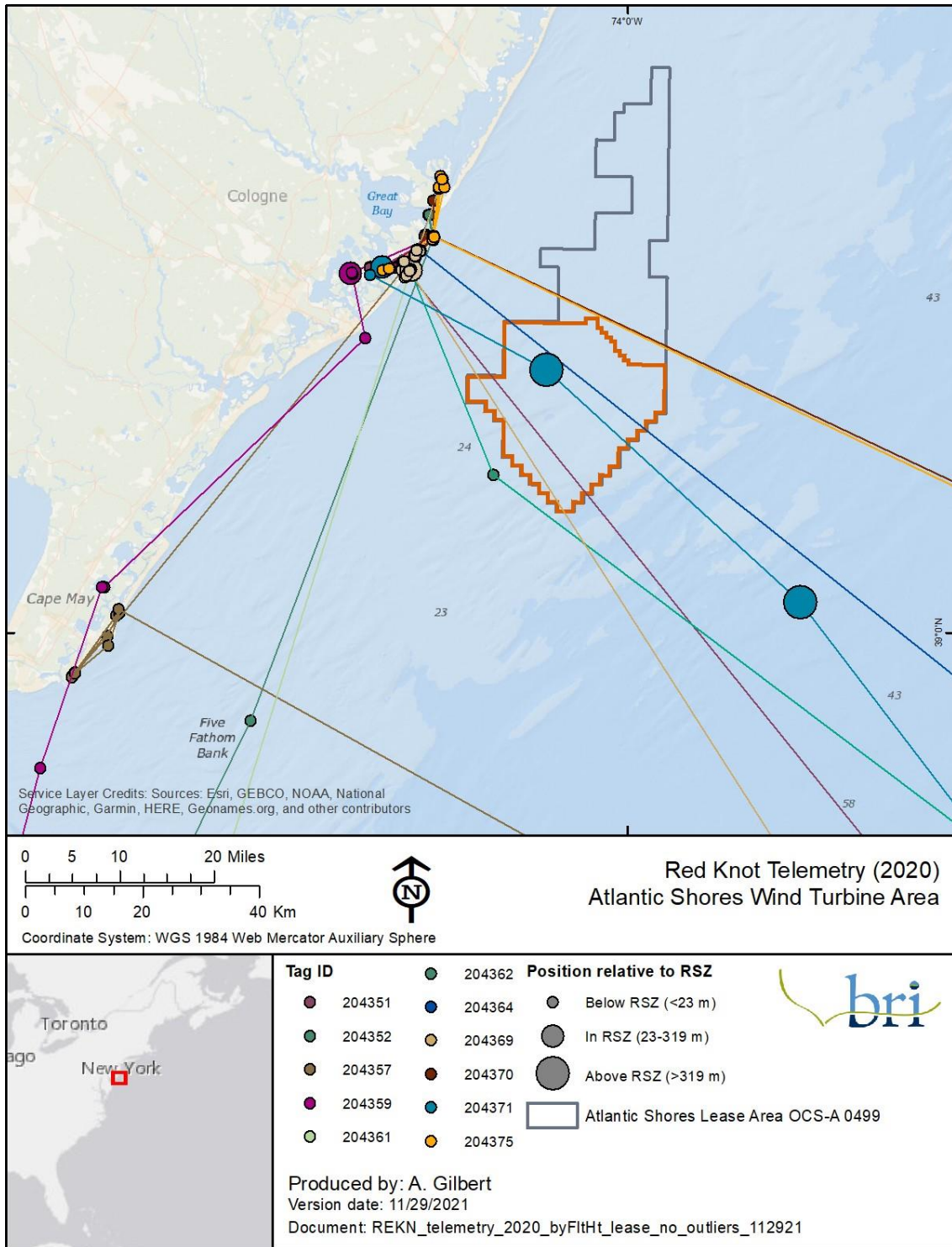


Figure 3: Movements of 11 Red Knots tagged at Brigantine, NJ, in 2020, as they depart on migration, in relation to the Atlantic Shores Lease Area and Wind Turbine Area. All data points are connected by straight lines, and each point for which there is altitudinal data is assigned to a flight height category (below, within, or above the full range of the Project’s potential Rotor Swept Zone) indicated by point size.

4. REFERENCES

- Baker, A., P. Gonzalez, R.I.G. Morrison, and B.A. Harrington. 2020. Red Knot (*Calidris canutus*), version 1.0. In Birds of the World (S.M. Billerman, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA.
<https://doi.org/10.2173/bow.redkno.01>
- Burger, J., C. Gordon, J. Lawrence, J. Newman, G. Forcey, & L. Vlietstra. 2011. Risk evaluation for federally listed (Roseate Tern, Piping Plover) or candidate (Red Knot) bird species in offshore waters: A first step for managing the potential impacts of wind facility development on the Atlantic Outer Continental Shelf. *Renewable Energy* 36: 338–351.
- Loring, P.H., J.D. McLaren, P.A. Smith, L.J. Niles, S.L. Koch, H.F. Goyert, & H. Bai. 2018. Tracking Movements of Threatened Migratory *rufa* Red Knots in U.S. Atlantic Outer Continental Shelf Waters. OCS Study BOEM 2018-046. US Department of the Interior, Bureau of Ocean Energy Management, Sterling (VA) 145 pp. OCS Study BOEM 2018-046. U.S. Department of the Interior, Bureau of Ocean Energy Management, Sterling, VA. 145 pp.

APPENDIX A:

Additional summary information on Red Knots tagged in NJ in 2020 by Atlantic Shores.

Table 1. Mass and measurements of satellite-tagged Red Knots captured at Brigantine, New Jersey, in August, 2020.

Measurement	<i>n</i>	Minimum	Maximum	Mean
Mass (g)	29	158	211	171.1
Culmen (mm)	5	33.6	37.1	35.6
Head and bill (mm)	5	64.1	67.2	65.8
Wing (mm)	5	166.0	179.0	171.8

Table 2. Altitude estimates over the course of tag deployment for 6 Red Knots satellite-tagged at Brigantine, New Jersey, in August, 2020.

Tag Code Number	No of days tracked	No of altitude estimates	Minimum (m)*	Maximum (m)	Mean (m)
204351	17	70	-5	383	23.3
204359	18	71	-12	475	17.1
204364	15	65	-32	3,047	184.7
204369	17	72	-3	490	19.0
204371	18	78	-10	3,178	174.1
204375	17	75	-3	360	33.7

*Negative altitude estimates are a result of error in the estimate and the position relative to the water surface (i.e. can be below 0 due to tide and waves)

Table 3. Estimated dates of departure, daily weather conditions on the days of departure, as well as estimated dates and locations of first landfall, and end locations for Red Knots satellite-tagged at Brigantine, New Jersey, in August, 2020.

Tag code number	Date of departure	Average wind speed (kph)*	Sustained wind direction*		Date of first landfall	Location of landfall	End location
			deg	dir			
204362	Aug 14	13.7	050	NE	.	.	.
204361	Aug 16	18.8	070	ENE	Aug 19	Cuba	Cuba
204370	Aug 18	5.6	300	NW	Aug 23	Guyana	Guyana
204352	Aug 19	5.1	280	W	Aug 22	Venezuela	Guyana
204371	Aug 23	3.9	180	S	Aug 25	Venezuela	Venezuela
204364	Aug 24	9.5	260	W	Aug 27	Suriname	Brazil
204357					Aug 28	Brazil	Brazil
204375	Aug 25	17.5	280	W	Aug 28	Venezuela	Guyana
204369	Aug 30	11.9	300	NW	Sept 03	Guyana	Guyana
204351						Suriname	Suriname
204359	Sept 04	11.1	260	W	.	.	.

*Weather data for the Atlantic City International Airport, NJ, from NOAA's Climate Data Online Archive (<https://www.ncdc.noaa.gov/cdo-web/>)