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MASS USA

VINEYARD WIND

Draft
Construction and Operations Plan

Volume III
Appendices

Vineyard Wind Project

October 22, 2018

Submitted by
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Submitted to
Bureau of Ocean Energy Management
45600 Woodland Road
Sterling, Virginia 20166

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In Association with:

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C2Wind
Capitol Air Space Group
Clarendon Hill Consulting
Ecology and Environment
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JASCO Applied Sciences
Morgan, Lewis & Bockius LLP
Public Archaeology Laboratory, Inc.
RPS
Saratoga Associates
Swanson Environmental Associates
Wood Thilsted Partners Ltd
WSP

October 22, 2018

Appendix III-N

Frequency of Activation of an Aircraft Detection Lighting System (ADLS) Report

Vineyard Wind Project

Vineyard Wind LLC

Outer Continental Shelf: North Atlantic Planning Area (OCS-A-501)

An analysis of historical air traffic operations to determine the frequency of activation of an Aircraft Detection Lighting System (ADLS)

April 6, 2018

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Summary

Capitol Airspace conducted an air traffic flow analysis for the Vineyard wind project located approximately 15 nautical miles south of Martha's Vineyard Airport (MVY) and 16 nautical miles southwest of Nantucket Memorial Airport (ACK) (purple area, ***Figure 1***). The purpose for this study was to identify the number of historical aviation operations that would likely activate obstruction lights controlled by an Aircraft Detection Lighting System (ADLS).

An ADLS utilizes radar surveillance systems to track aircraft transiting in proximity to the wind project. If an aircraft flies within a predetermined range of the wind project, the ADLS system activates the turbine field's obstruction lights. Once the aircraft has departed the area, the lights are deactivated by the system. This effectively provides nighttime conspicuity on an "as-needed" basis and potentially reduces the amount of time that the obstruction lights will be illuminated. Depending on the volume of nighttime flights transiting a given wind project, the use of an ADLS could result in a significant reduction in the amount of time obstruction lights are needed.

Historical air traffic data indicates that obstruction lights controlled by an ADLS would have been activated for a total of 3 hours and 49 minutes over a one year period. Considering the local sunrise and sunset times, obstruction lights controlled by an ADLS would be activated less than 0.1% of the time that traditional obstruction lights would be active.

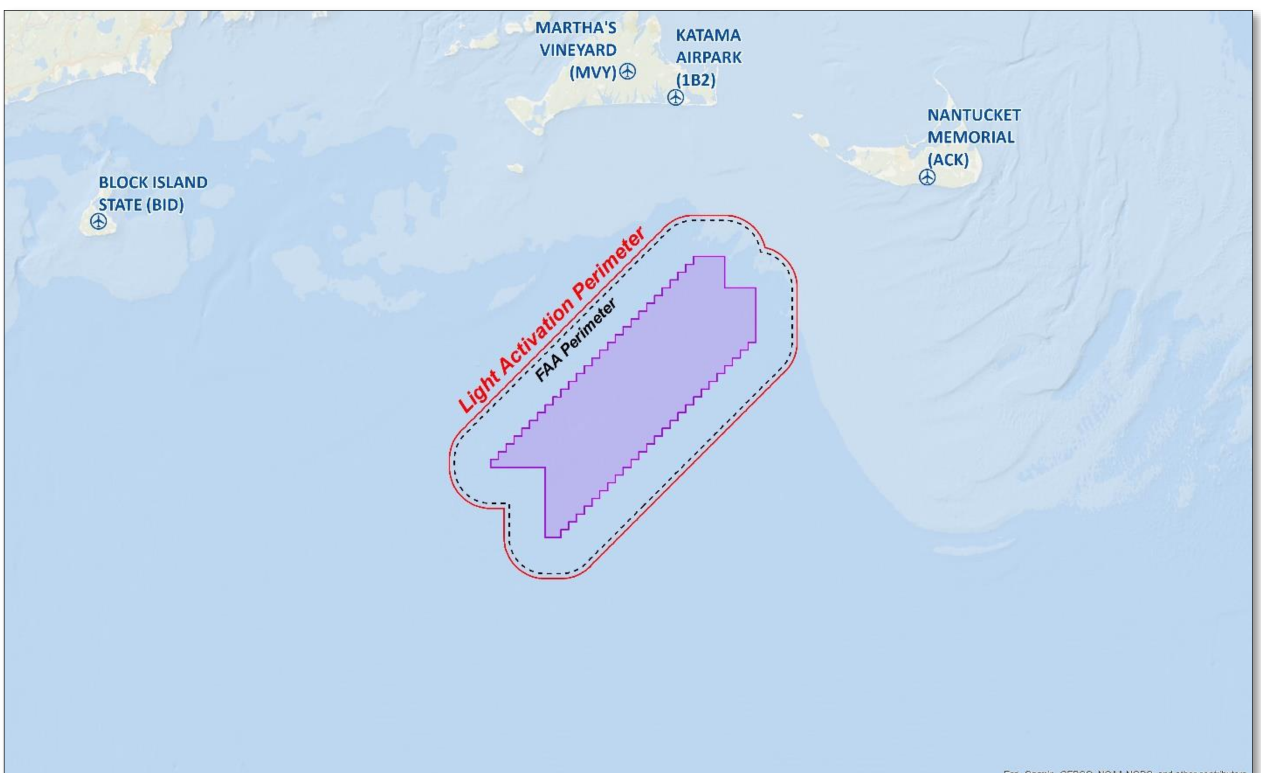

Figure 1: Public-use (blue) airports in proximity to the Vineyard wind project

Methodology

Capitol Airspace analyzed FAA National Offload Program (NOP) radar returns in proximity to the Vineyard wind project for the period between October 1, 2016 and September 30, 2017. FAA NOP data only includes secondary radar returns which are created if the identified aircraft is equipped with a transponder. Aircraft operations without an active transponder were not captured as part of this dataset. Within 40 nautical miles of the wind project, the NOP data contained 30,304,025 different radar returns from seven different air traffic control (ATC) facilities. In addition to unique flight and radar track identifiers, each radar return contained: latitude, longitude, altitude, date, and time information.

The following process was used to determine the frequency of nighttime aviation operations transiting in proximity to the Vineyard wind project:

1. **Parse and Import Radar Data –** Original data was provided in compressed comma separated value (CSV) text format. Each CSV file contains one day of radar return data. Each CSV file was uncompressed, combined, and imported into a geographic information system.

2. **Determine Accuracy of Radar Data –** Radar return data was analyzed to confirm accuracy in time and location.

3. **Define Three Dimensional Light Activation Perimeter –** In accordance with FAA Advisory Circular 70/7460-1L, lights controlled by an ADLS must be activated and illuminated prior to an aircraft reaching 3 nautical miles from, and 1,000 feet above, any wind turbine. In order to account for varying radar systems as well as aircraft speeds and decent rates, Capitol Airspace utilized a 3.42 nautical mile buffer and 3,500 feet above mean sea level (red, ***Figure 2***).

4. **Calculate Sunrise and Sunset –** Sunrise and sunset data was calculated for each day of the year. This data was derived through a public *application programming interface (API)* and validated through comparison to the *United States Naval Oceanography Portal*.

5. **Select Nighttime Radar Returns –** Since traditional obstruction lights can rely on ambient light sensors to identify darkness, nighttime was considered to occur between 30 minutes prior to sunset until 30 minutes after sunrise. This represents the time during which traditional obstruction lights would likely be activated. All radar returns occurring within the light activation perimeter and during this period were evaluated.

6. **Remove Time Overlap –** To remove the duration of overlap occurring when more than one flight transits the light activation perimeter at the same time, each flight was compared to every other nighttime flight. If flight times overlapped, the duration of overlap was removed from the total time that obstruction lights would be activated.

Results

FAA NOP data indicates that as many as 9,257 different radar tracks had at least one radar return within the light activation perimeter (red, *Figure 2*). However, the vast majority of these flights occurred during daytime. Using local sunrise and sunset times, Capitol Airspace determined that 318 radar tracks had at least one radar return within the light activation perimeter during the nighttime period when traditional obstruction lights would likely be activated.

Each of the 318 radar tracks (*Figure 3* & *Figure 4*) was further evaluated to determine the amount of time it remained within the light activation perimeter. Multiple aircraft could transit the light activation perimeter at the same time and, if counted separately, would artificially inflate the light duration. As a result, each track's duration was compared to every other track to determine the amount of track overlap. This overlap was removed from the results.

Removing track overlap resulted in a maximum of 235 on/off cycles with 3 hours and 49 minutes of light activation time over a one year period.[1] Considering that this area observes 4,304 hours of nighttime each year, this equates to ADLS controlled lights being activated less than 0.1% of the time that traditional obstruction lights would be active. For reference, the typical duration of light activation time during each month is provided in *Table 1*.

	January	February	March	April	May	June	July	August	September	October	November	December
Minutes Activated	5	4	3	2	33	16	46	32	12	41	32	3

Table 1: Typical duration, in minutes, of light activation time during each month

Lastly, if an ADLS system loses track of an aircraft, the FAA guidance requires that a 30 minute timer should be initiated to keep the lights activated while the aircraft can clear the wind project area. Since the application of ADLS requires site specific radar surveillance systems that will be focused on the project area, Capitol Airspace does not anticipate a likelihood of dropped tracks.

Please contact ***Joe Anderson*** at (703)-256-2485 with any questions regarding the findings of this analysis.

[1] The FAA requires that ADLS controlled lights are activated and illuminated prior to an aircraft reaching 3 nautical miles from, and 1,000 feet above, any wind turbine. Capitol Airspace determined that aircraft were within this volume of airspace during nighttime for a maximum of 42 minutes over a one year period.

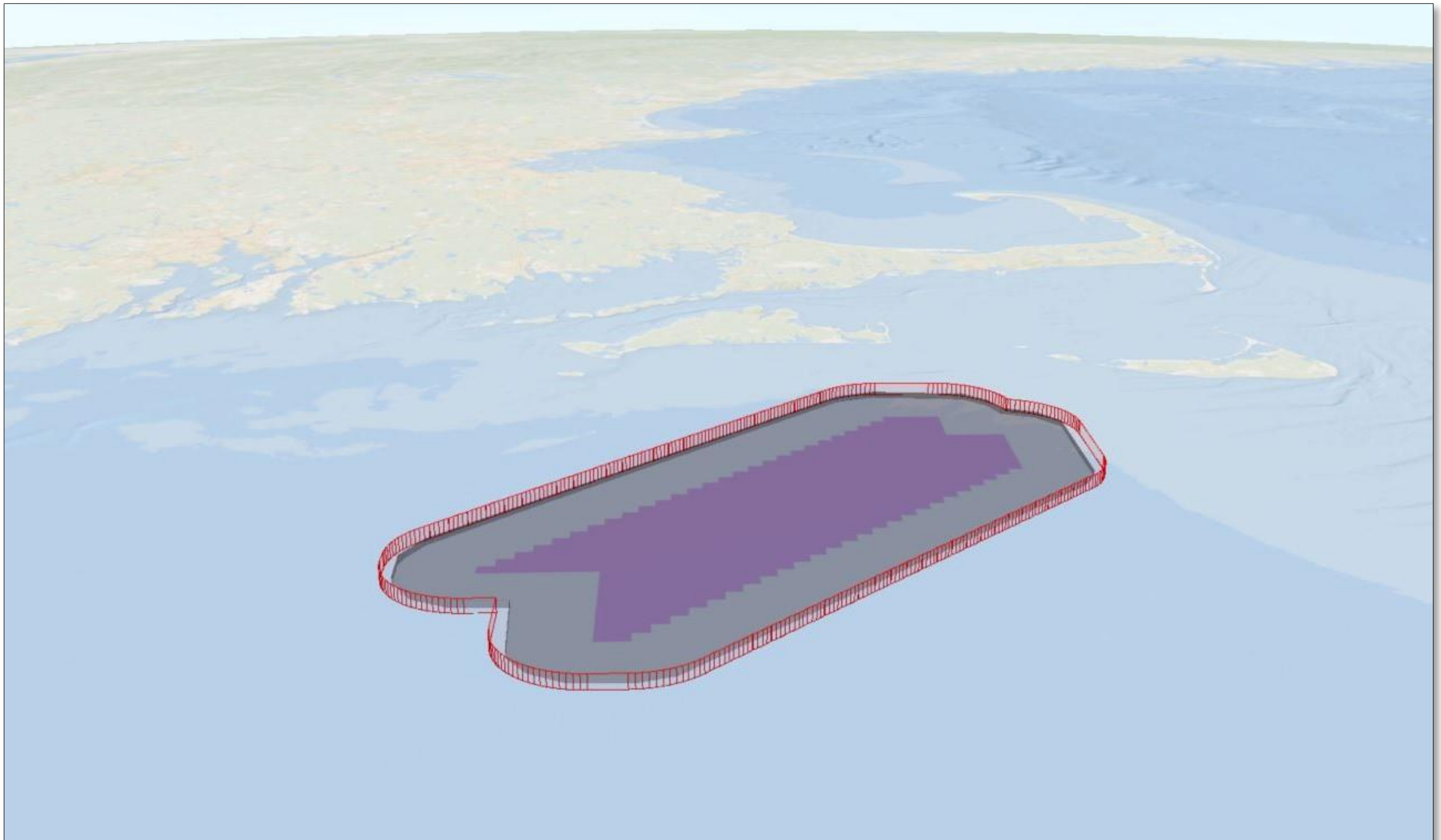

Figure 2: FAA Perimeter (black) and Light Activation Area (red)

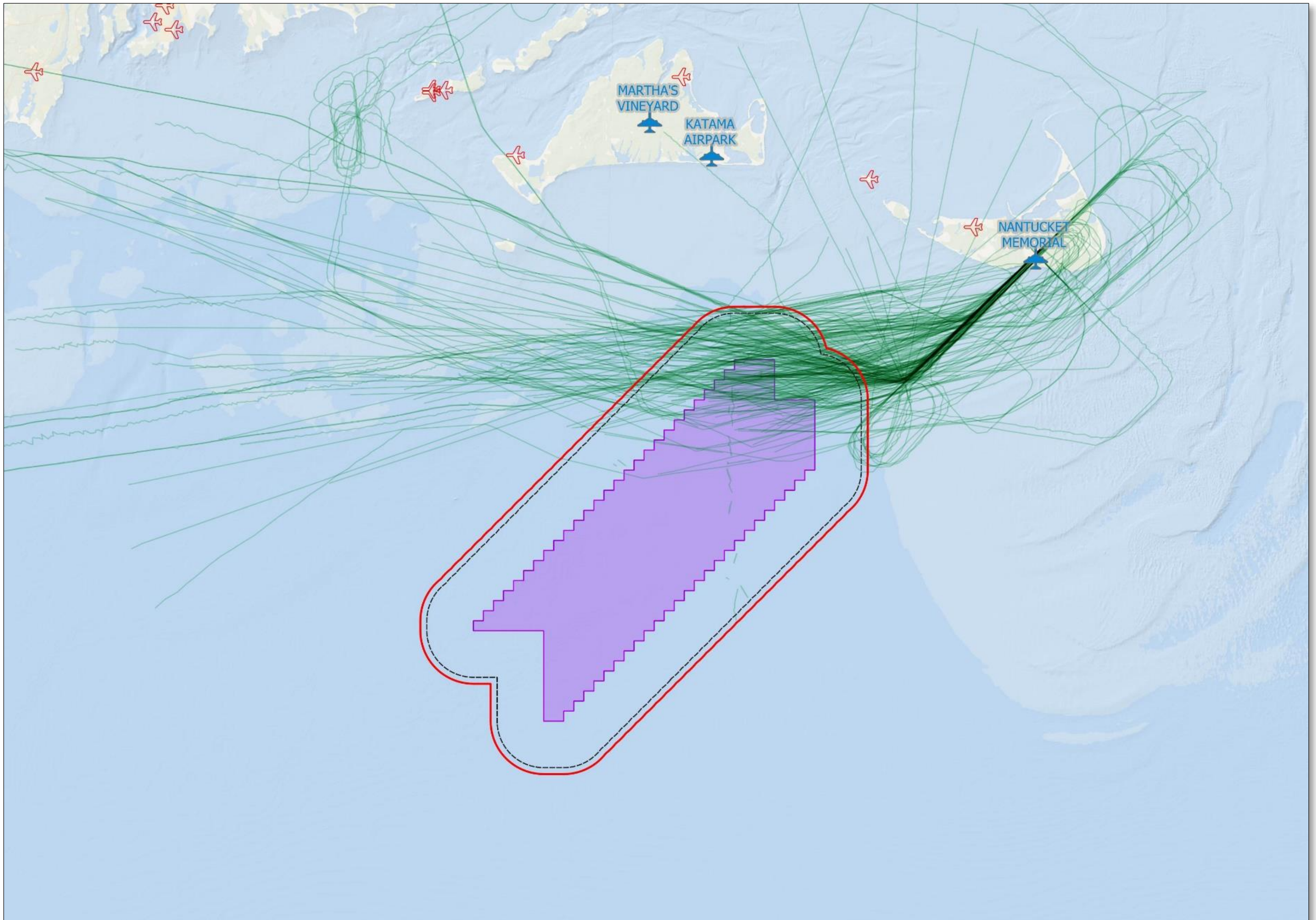

Figure 3: Resulting flight tracks with at least one radar return in Light Activation Perimeter (red) during nighttime

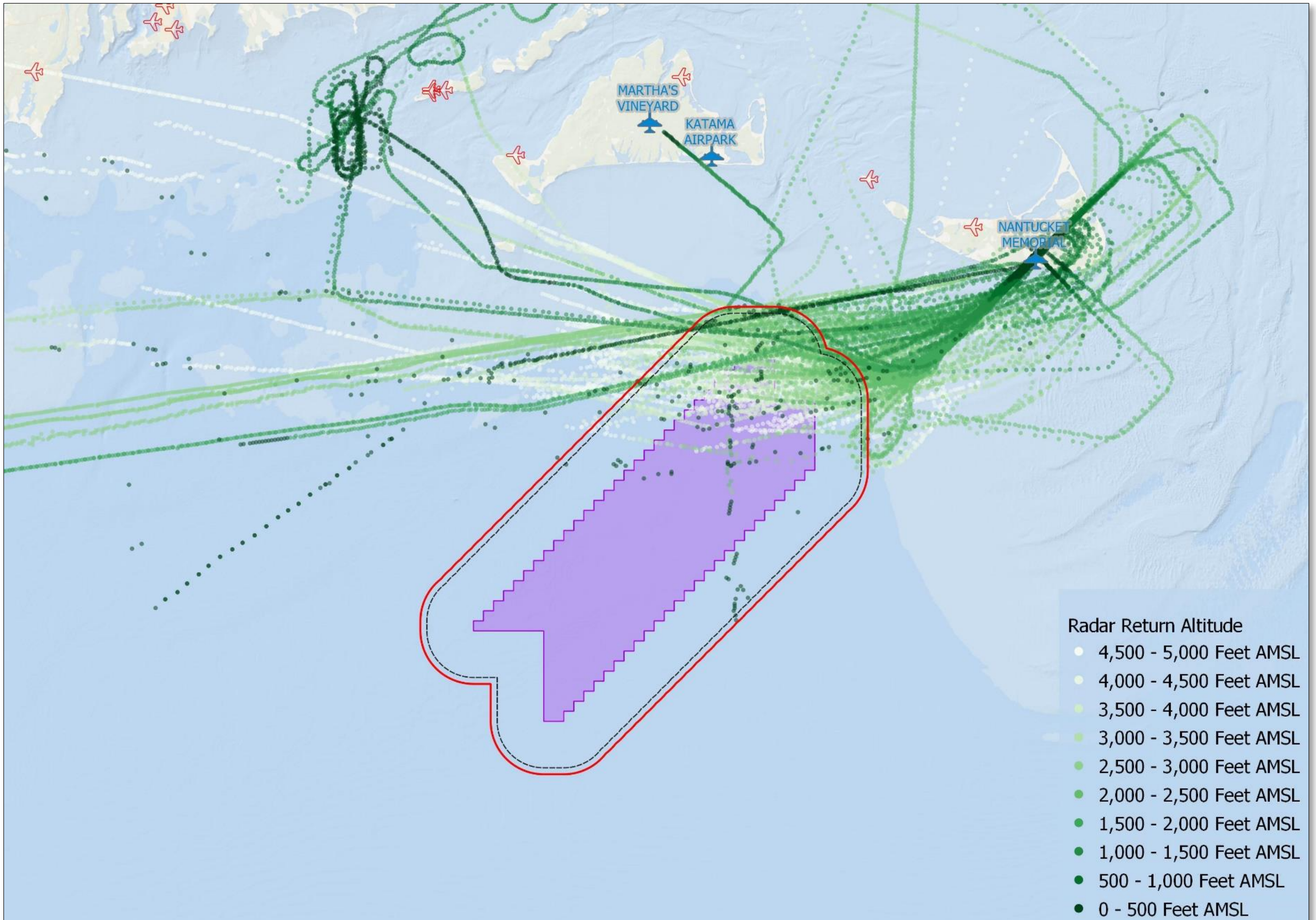

Figure 4: Resulting radar returns associated with nighttime flight tracks

Appendix III-O

Vineyard Wind Spring Tern Survey

Vineyard Wind Spring Tern Survey

June 2018

Submitted to:

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Summary

The Biodiversity Research Institute (BRI) conducted four offshore boat-based avian surveys during April and May of 2018 in the Vineyard Wind "Wind Development Area" (WDA). The surveys used standardized avian at-sea survey methods, but were specifically aimed at detecting Roseate Terns (*Sterna dougallii*) in the WDA during their spring migration.

The surveys followed the Bureau of Ocean Energy Management (BOEM) Avian Survey Guidelines, were conducted on the *MV Islander*, and observers used SeaScribe for recording survey data. Overall, 16 species of birds were identified in the WDA, with another 13 unidentified categories used. The most common species observed were White-winged Scoter (*Melanitta deglandi*), Northern Gannet (*Morus bassanus*; Figure 1), and Razorbill (*Alca torda*). No Roseate Terns were observed in the WDA, but a few were observed opportunistically during transit to and from the WDA close to Martha's Vineyard.

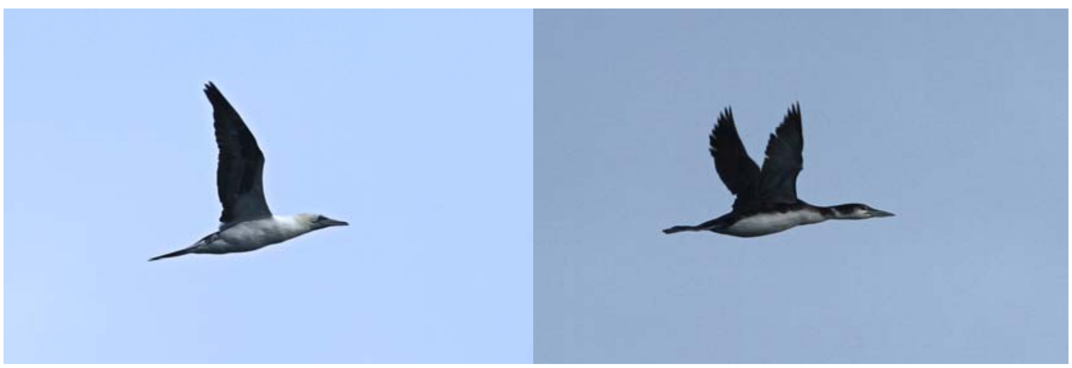

Figure 1: A Northern Gannet (left) and Common Loon (right) observed during the Vineyard Wind surveys.

1 Study Overview and Methods

1.1 Study overview

The Biodiversity Research Institute (BRI) conducted four offshore boat-based avian surveys during April (22nd & 28th) and May (6th & 10th) of 2018 in the Vineyard Wind "Wind Development Area" (WDA). The surveys were designed to detect Roseate Terns (*Sterna dougallii*) foraging in or transiting through the WDA during spring migration. The survey design followed the Bureau of Ocean Energy's (BOEM's) Avian Guidelines[1], and surveys were conducted in suitable viewing conditions (sea state 2-4 on the Beaufort Scale).

BRI conducted the surveys on the *MV Islander* (Figure 2). This vessel is owned and operated by Patriot Party Boats, Inc., and was piloted by Capt. Joe Deprisio for the surveys. On each one-day survey, the boat departed from the Falmouth Inner Harbor dock, in the Town of Falmouth, MA, at 0500 hrs. Time on the water was around 12 hours each day, including approximately 6 hours of survey time within the WDA. A team of two experienced at-sea avian observers used SeaScribe for recording survey data throughout the surveys. The surveys covered 10.3% of the WDA, including a 1 nautical mile buffer, with a total transect length of just over 100 km (Figure 3).

Figure 2: The survey vessel, the MV Islander.

[1] https://www.boem.gov/Avian-Survey-Guidelines/

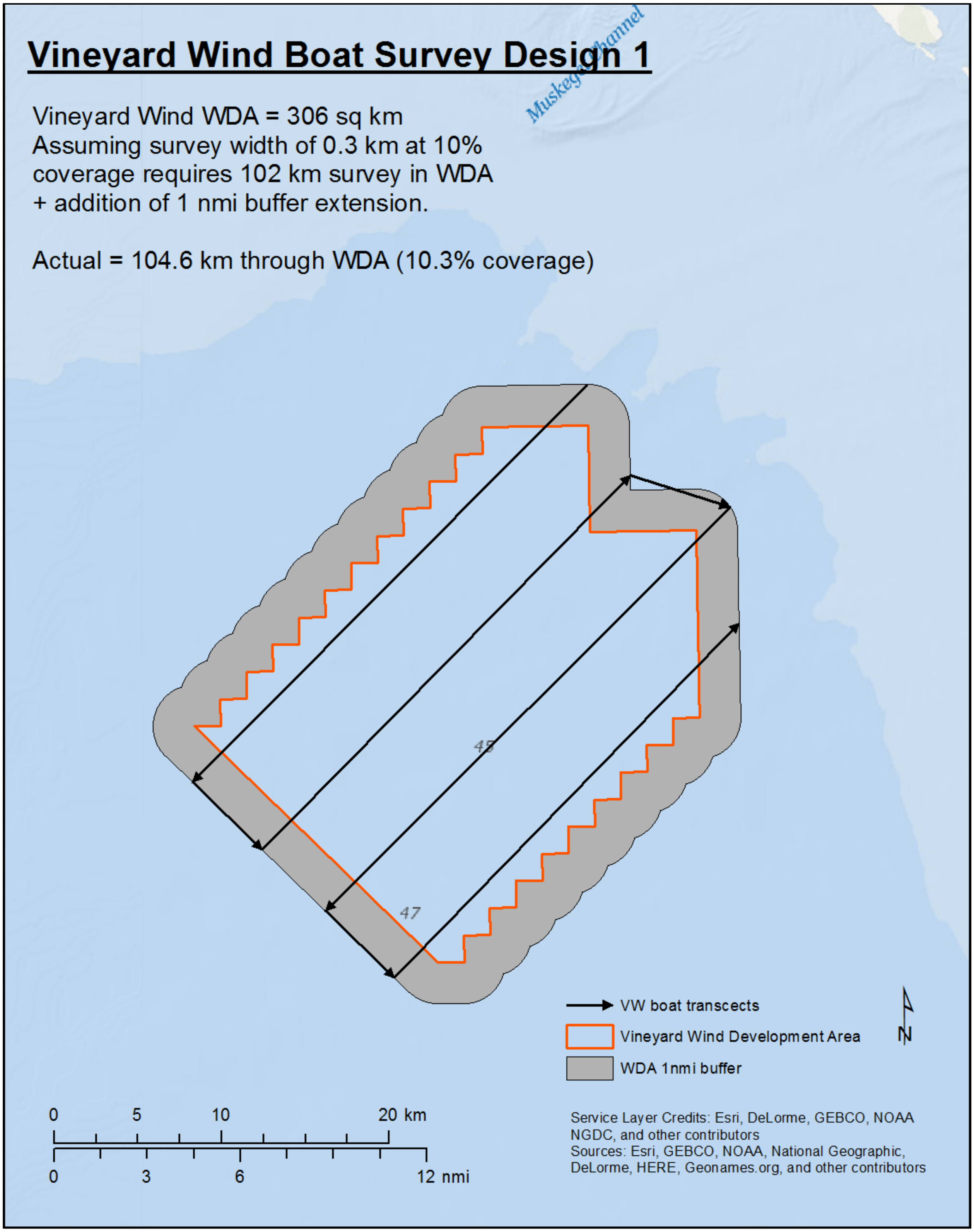

Figure 3: The transect layout and coverage area of the Vineyard Wind surveys.

1.2 Observation Protocols

The surveys were conducted from the main deck of the *MV Islander*. Observers had a clear view in a bow to beam arc off one side of the vessel. While on transect, one surveyor (the primary observer) continuously scanned horizontally and vertically for birds (using the naked eye or binoculars). The second surveyor (the recorder) entered all observations into SeaScribe using a tablet computer. Locations, date, and time were automatically recorded by SeaScribe several times per minute and observations were individually georeferenced. At the beginning of each survey, the recorder entered data on sea state (Beaufort Scale, Appendix I), transect number, observer's initials, visibility, survey ID, station, and platform, changing each throughout the survey, as needed. Observers also recorded sea state and visibility every 15–30 minutes, prompted by SeaScribe. Data fields are detailed in Table 1 and species codes are described in Appendix II.

Surveys were conducted on one side of the vessel and used distance sampling. Observers used the side of the boat with the best viewing conditions (least glare) and swapped sides as needed during the day to optimize viewing conditions. Observers recorded all birds sighted (species and number), and the distance (m) and angle (°) to each at first sighting, within a 90° arc between the bow and the port or starboard beam. Radial distance was estimated from the observer to the animal or the center of the group of animals, and the estimate was based on the first observed instance. Distance estimates were calibrated between observers and were estimated to the nearest tens of meters for birds closer to the boat, and to the nearest 20 or 50 m for birds farther from the boat. For birds observed in flight, the vertical flight height above the water at first sighting was estimated to the nearest meter along with their general direction of movement. Details of bird plumages (which provide information on age) and specific behaviors were recorded whenever possible, following codes provided in SeaScribe. The behavior and direction of movement were also recorded based on when the bird or group was first spotted.

While in transit to and from the survey area, surveyors carried out casual observations for terns and other species during daylight hours.

Table 1: Data fields, descriptions and examples for each field. Fields in bold are entered by the recorder when entering a record for a sighting. Fields in bold and italics are entered by the recorder at the start of the survey and changed when necessary (i.e. sea state changes, observers switch).

Field	Description	Example	Type
Species	Use four letter species code (See Appendix I for details). As you type, a drop down menu will appear, which you can choose from. Or choose from 'Quick Species', which populates with most commonly entered species. Appendix I also includes codes for boats and other items of interest.	HERG	Open or drop-down
Count	Number of animals seen. Type directly in box, or, for quick entry choose 1.	2	Open
Distance	Estimate the radial distance to the animal or the center of the group of animals. Type directly in box. Estimate based on the first instance you see the animal. Distance estimate is rounded to the nearest 50 or 100 m, unless the animal is within 50 meters of the boat and a more accurate estimate is possible.	100	Open
Degree	Estimate the animal's location in degrees from the bow of the boat. The bow of the ship is 0°, one quarter around towards the starboard is 90°, directly off the stern is 180°, and three quarters around off of port is 270°. Estimate is based on the first instance that you see the animal, and is rounded to the nearest 10°.	350	Open
Behavior	Choose the term best describing animal's behavior. Use drop down menu, or choose from Quick list.	FLYING	Drop-down
Direction	Optional - Select direction of movement from drop-down menu. Not applicable for birds that are milling, feeding, or sitting, or for other animals that are stationary.	N	Drop-down
Age	Optional - Adult, Immature, Juvenile. Choose from drop-down menu.	Ad	Drop-down
Plumage	Optional - Describe the bird's phase or molt. Choose from drop-down menu.	Breeding	Drop-down
Sex	Optional - Choose from drop-down menu	M	Drop-down
Linked with…	Optional - Connect observations.		Drop-down
Comment	Optional - Any additional comments about the sighting.	with GBBG	Open
Flight height	Estimate vertical height above the water in meters.	30	Open
Observer	Choose from drop-down menu. Enter details prior to survey.	name	Drop-down
Position	Side of the vessel from which observations are made. Choose from drop-down menu.	Port	Drop-down
Beaufort	Approximate description of the current sea state using the Beaufort Scale (see Appendix I). Update as necessary. Choose from drop-down menu.	3	Drop-down
Visibility	Visibility. Update as the visibility changes. Choose from drop-down menu.	3-5 km	

2 Results

2.1 Overall

Weather conditions varied by survey, and within surveys, but, overall, were appropriate for avian surveys at sea (up to sea state 4, with good to excellent visibility), following BOEM avian survey guidelines. Total transect length varied slightly between surveys (112–118 km). Over the course of the four surveys, BRI surveyors recorded 447 observations, including 1,014 birds (Table 2). Among these, 16 species were identified as present in the WDA and 13 unidentified species/group categories were recorded (Table 2). No Roseate Terns were observed in the WDA. For all surveys combined, the most common species observed were White-winged Scoter (*Melanitta deglandi*), Northern Gannet (*Morus bassanus*), and Razorbill (*Alca torda*; Table 2), in that order. For all species observed within the WDA, the mean flight height was 11.99 m (± 14.72 m) with a range of 1–75 m.

2.2 Tern Observations

In total, 18 Common Terns (*Sterna hirundo*) and 5 unidentified terns were observed widely across the survey area (WDA and buffer; Table 3; Figure 4). No Roseate Terns were observed within or near the WDA. The mean tern flight height was 11.6 m (± 6.07 m) with a range of 1–30 m.

While in transit to and from the WDA, opportunistic observations of terns were recorded. A few Roseate Terns were observed inshore, in addition to other tern species observed within and adjacent to Nantucket Sound – a total of 565 terns on the Horseshoe Shoal and in Muskeget Channel over all four trips. This included 4 Roseate Terns, 73 Common Terns, and 488 unidentified terns (Table 3; Figure 5).

Table 2: The number of observations, count of birds, and count per km for each survey, and the number of observations and count for all surveys combined, for all species observed on survey and each of the unidentified species/groups (in alphabetical order).

	Survey 1			Survey 2			Survey 3			Survey 4			All Surveys Combined	
Common Name	# obs	count	/km	# obs	count	/km	# obs	count	/km	# obs	count	/km	# obs	count
Atlantic Puffin	0	0	0.00	8	11	0.10	1	1	0.01	9	15	0.13	18	27
Bonaparte's Gull	0	0	0.00	0	0	0.00	3	19	0.17	0	0	0.00	3	19
Common Loon	4	6	0.05	1	1	0.01	3	3	0.03	2	2	0.02	10	12
Common Murre	1	3	0.03	2	2	0.02	1	1	0.01	0	0	0.00	4	6
Common Tern	0	0	0.00	1	1	0.01	3	11	0.10	5	6	0.05	9	18
Great Black-backed Gull	3	5	0.04	0	0	0.00	9	9	0.08	14	17	0.15	26	31
Herring Gull	9	17	0.14	5	15	0.13	14	19	0.17	26	26	0.23	54	77
Laughing Gull	0	0	0.00	0	0	0.00	2	6	0.05	0	0	0.00	2	6
Long-tailed Duck	6	19	0.16	0	0	0.00	1	2	0.02	0	0	0.00	7	21
Northern Gannet	29	59	0.50	15	20	0.18	73	112	0.97	19	20	0.18	136	211
Razorbill	42	105	0.89	8	22	0.19	6	7	0.06	0	0	0.00	56	134
Red-throated Loon	5	8	0.07	1	1	0.01	0	0	0.00	0	0	0.00	6	9
Rose-breasted Grosbeak	0	0	0.00	1	1	0.01	0	0	0.00	0	0	0.00	1	1
Sooty Shearwater	0	0	0.00	0	0	0.00	1	2	0.02	10	15	0.13	11	17
White-winged Scoter	34	223	1.89	3	10	0.09	0	0	0.00	0	0	0.00	37	233
Wilson's Storm-petrel	0	0	0.00	3	5	0.04	0	0	0.00	0	0	0.00	3	5
Unidentified auk	9	35	0.30	0	0	0.00	2	2	0.02	0	0	0.00	11	37
Unidentified bird	1	1	0.01	1	2	0.02	2	2	0.02	0	0	0.00	4	5
Unidentified duck, goose, or swan	1	3	0.03	0	0	0.00	0	0	0.00	0	0	0.00	1	3
Unidentified gull	0	0	0.00	1	1	0.01	3	4	0.03	11	16	0.14	15	21
Unidentified large auk	0	0	0.00	6	6	0.05	7	8	0.07	0	0	0.00	13	14
Unidentified large gull	0	0	0.00	0	0	0.00	1	1	0.01	0	0	0.00	1	1
Unidentified loon	2	2	0.02	1	1	0.01	0	0	0.00	2	2	0.02	5	5
Unidentified murre	1	1	0.01	0	0	0.00	0	0	0.00	0	0	0.00	1	1
Unidentified phalarope	0	0	0.00	0	0	0.00	0	0	0.00	1	15	0.13	1	15
Unidentified scoter	5	67	0.57	0	0	0.00	0	0	0.00	0	0	0.00	5	67
Unidentified shorebird	0	0	0.00	0	0	0.00	2	11	0.10	0	0	0.00	2	11
Unidentified small auk	0	0	0.00	2	2	0.02	0	0	0.00	0	0	0.00	2	2
Unidentified tern	0	0	0.00	0	0	0.00	1	3	0.03	2	2	0.02	3	5
Totals	152	554	4.69	59	101	0.89	135	223	1.94	101	136	1.21	447	1014

Note: Large auk = Razorbill or Common/Thick-billed Murre, Small auk = Atlantic Puffin or Dovekie.

Table 3: The number of tern observations, count of terns, and count per km for each transit period, and the number of observations and count for all transits combined.

Common Name	Transit period 1			Transit period 2			Transit period 3			Transit period 4			All Transits Combined	
	# obs	count	/km	# obs	count	/km	# obs	count	/km	# obs	count	/km	# obs	count
Common Tern	0	0	.	2	4	0.04	12	35	0.30	14	34	0.36	28	73
Roseate Tern	0	0	.	0	0	.	2	3	0.03	1	1	0.01	3	4
Unidentified tern	0	0	.	7	89	0.97	25	334	2.86	17	65	0.68	49	488
Total	0	0	.	9	93	1.01	39	372	3.19	32	100	1.05	80	565

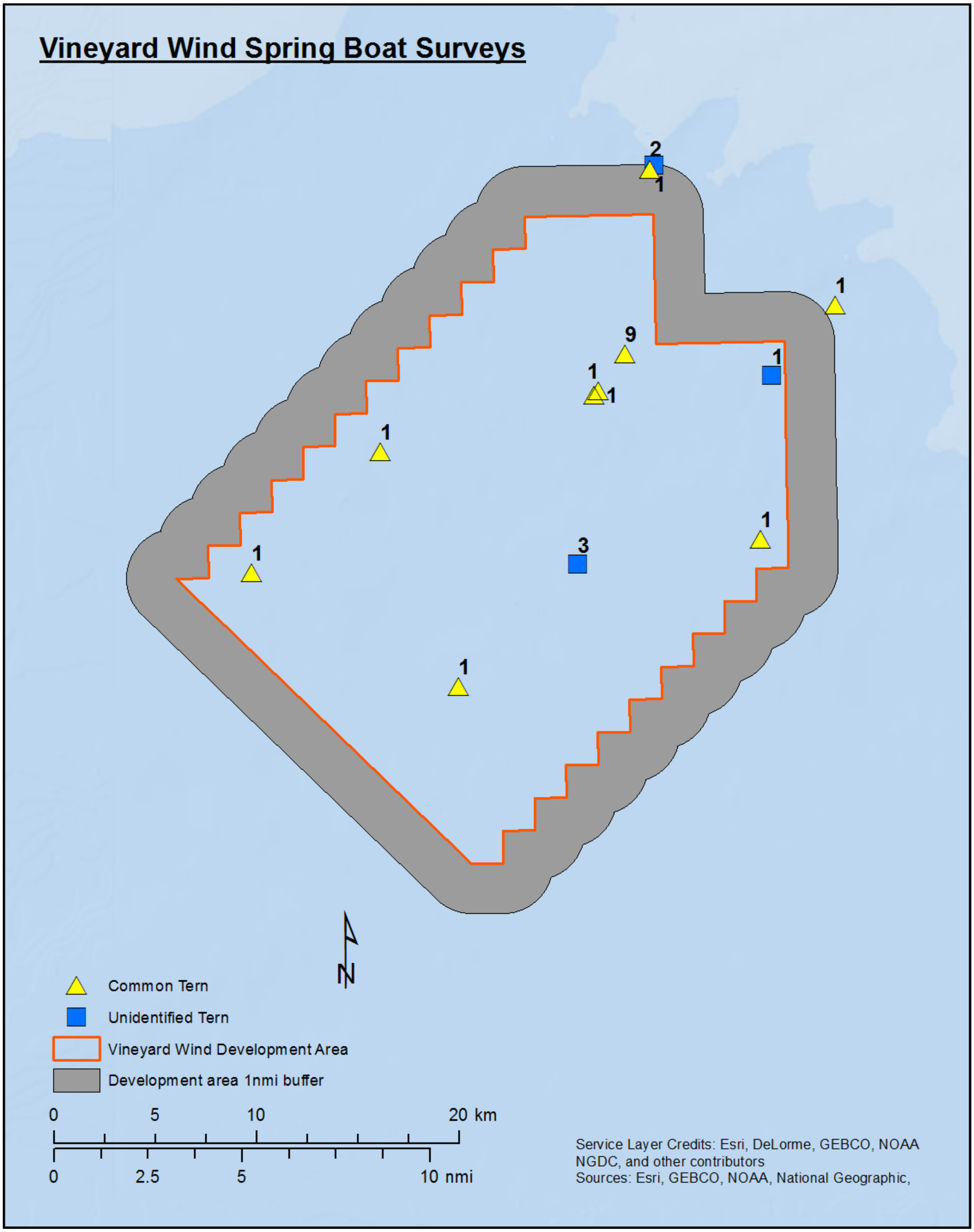

Figure 4: Locations of all terns observations within the Wind Development Area and survey buffer, with the number of individuals sighted at each observation, all surveys combined.

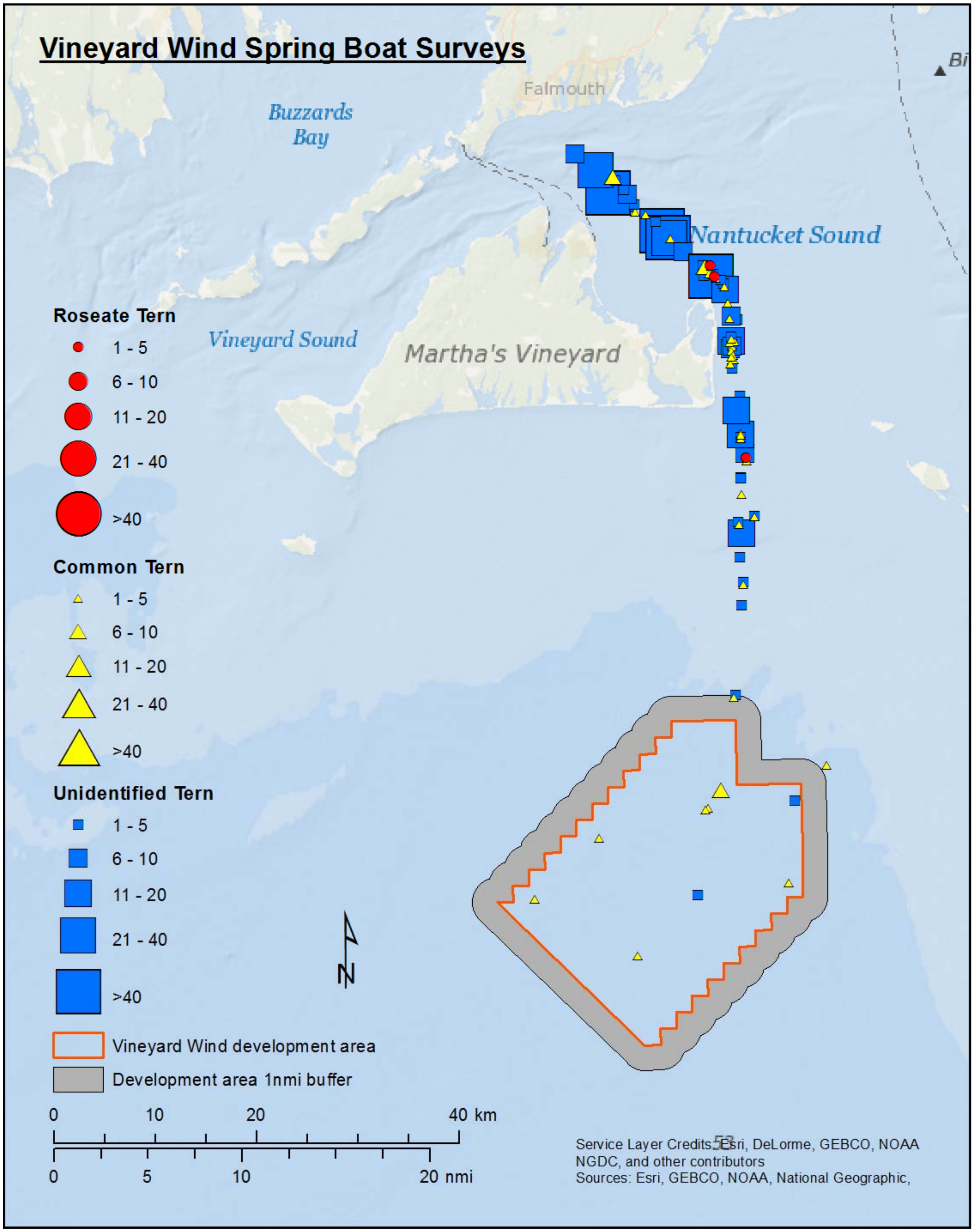

Figure 5: All terns observed during the surveys, and in transit to and from the Wind Development Area, all trips combined.