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**Year 2 Digital Aerial Wildlife Survey of BOEM Lease Area OCS-A
520**

Quarterly Report: July 2021 to October 2021

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1. Executive Summary

- Year 2 digital aerial wildlife surveys of the Bureau of Ocean Energy Management (BOEM) Lease Area Outer Continental Shelf – Atlantic (OCS-A) 0520, off the Massachusetts coast were conducted from March to October 2021 using APEM Inc.'s high-resolution camera system to capture digital still imagery. This report covers July to October. Images collected have been analyzed by APEM Inc. (hereafter referred to as APEM) and quality assured by Normandeau Associates (hereafter referred to as Normandeau). Raw counts of all species and incidental observations recorded during the July to October surveys are presented here. March to June is covered by the Spring Report.
- A total of 212 birds, six marine mammals, 26 large bony fish, and 62 sharks were recorded in the Survey Area for the July 2021 survey. The most abundant avian group recorded was storm petrels (n=124). This was followed by shearwaters (n=78), gulls (n=9), and unidentified birds (n=1). Additionally, sharks (n=62), large bony fish (n=26), dolphins (n=5), and unidentified marine mammals (n=1) were also recorded.
A scalloped hammerhead shark was recorded during the July survey. This is an ESA Listed Species (Federally Listed as Endangered).
- A total of 39 birds, one turtle, three large bony fish, and 12 sharks were recorded in the Survey Area for the August I 2021 survey. The most abundant avian group recorded was shearwaters (n=35). This was followed by storm petrels (n=2), and gulls (n=1) and skuas (n=1). Additionally, sharks (n=12), large bony fish (n=3), and turtles (n=1) were also recorded.
A leatherback turtle was recorded during the August I survey. This is an ESA Listed Species (Federally and Massachusetts State Listed as Endangered).
- A total of 229 birds, six marine mammals, one turtle, 12 large bony fish, and 92 sharks were recorded in the Survey Area for the August II 2021 survey. The most abundant avian group recorded was storm petrels (n=93). This was followed by shearwaters (n=80), shorebirds (n=40), gulls (n=13), and terns (n=3). Additionally, sharks (n=92), large bony fish (n=12), dolphins (n=5), seals (n=1), and turtles (n=1) were also recorded.
A leatherback turtle and a scalloped hammerhead shark were recorded during the August II survey. These are ESA Listed species (Federally Listed as Endangered, and Federally and Massachusetts State Listed as Endangered respectively).
- A total of 14 birds, 97 marine mammals, two turtles, 4 large bony fish were recorded in the Survey Area for the September I 2021 survey. The most abundant avian group recorded was shorebirds (n=6). This was followed by shearwaters (n=3), gannets (n=2), and gulls (n=1), storm-petrels (n=1), and unidentified birds (n=1). Additionally, dolphins (n=97), sharks (n=16), large bony fish (n=4), and turtles (n=2) were also recorded.
Loggerhead and Kemp's ridley turtles were recorded during the September I survey. These are ESA Listed Species (Federally Listed as Threatened or Endangered and Massachusetts State Listed as Threatened, and Federally and Massachusetts State Listed as Endangered respectively).
- A total of 16 birds, three marine mammals, 24 large bony fish, and five sharks were recorded in the Survey Area for the September II 2021 survey. The most abundant avian group recorded was gulls (n=11). This was followed by shearwaters (n=3), auks (n=1), and unidentified birds (n=1). Additionally, large bony fish (n=24), sharks (n=5), and dolphins (n=3) were also recorded.

- A total of 30 birds, 136 marine mammals, eight turtles, four large bony fish, and five sharks were recorded in the Survey Area for the October 2021 survey. The most abundant avian group recorded was gulls (n=29). This was followed by shearwaters (n=1) only. Additionally, dolphins (n=133), turtles (n=8), sharks (n=5), large bony fish (n=4), porpoises (n=2), and seals (n=1) were also recorded.

A leatherback turtle was recorded during the October survey. This is an ESA Listed Species (Federally and Massachusetts State Listed as Endangered).

- No rays were recorded during the July 2021, August I 2021, August II 2021, September I 2021, September II 2021, or October 2021 surveys.

2. Introduction

APEM and Normandeau were contracted by Equinor Wind US (hereafter referred to as Equinor) to provide combined spring through fall digital aerial wildlife surveys of the Massachusetts Lease Area OCS-A 0520. This will comprise the second year of surveys following the initial Year 1 surveys undertaken from March 2020 to November 2020. Surveys were carried out on a monthly basis from March 2021 through October 2021, except for April, May, August and September, when two surveys per month were carried out in order to coincide with potential use of the area by roseate tern (*Sterna dougallii*).

The aims and objectives of the work are to assess the abundance and distribution of birds, marine mammals, turtles, sharks, and rays present in the Lease Area OCS-A 0520 over the course of spring through fall. The surveys will provide the baseline information required for conducting impact assessments and are consistent with the survey guidelines for providing avian, marine mammal, and sea turtle information for renewable energy development on the OCS (BOEM 2017 and 2019).

The Survey Area referred to herein is comprised of the Lease Area OCS-A 0520, plus a 2 km (c. 1 NM) buffer surrounding it with an approximately 4 km (c. 2 NM) buffer towards the northeast end.

Images were captured using a grid-based survey design with a 1.5 cm ground sampling distance (GSD). Images were analyzed by APEM and quality assurance (QA) was undertaken by Normandeau. This report describes the results of the July 2021, August 2021, September 2021, and October 2021 surveys.

This is the second of two progress reports (Spring and Fall) and summarizes the information collected following the completion of six aerial surveys of the Survey Area: July 2021, August 2021 (two surveys), September 2021 (two surveys), and October 2021.

The following information is provided in Section 3:

- The number of surveys conducted to date; and
- The dates, start and end times, and weather conditions.

The following information is provided in Section 4, 5, and 6:

- The number of bird species / taxonomic groupings;
- Maps showing the locations of birds and actual survey route; and
- The status of data processing, error checking, and analysis.

Shipping information recorded visually from the aircraft or captured in the imagery has been provided in Section 7.

For all surveys undertaken for the purposes of these reports (March 2021 to October 2021), the survey dates have been provided in Section 8.

3. Summary of Surveys

Surveys have been undertaken for July 2021 to October 2021 inclusive, with two surveys undertaken for both August and September.

Data collected were 1.5 cm GSD digital still images using a GPS-linked bespoke flight management system to ensure the tracks were flown with a high degree of accuracy.

The digital aerial survey captured images along 15 lines spaced approximately 1.9 km across-track and 0.5 km along-track between image nodes within the Survey Area, at an altitude of approximately 1,350 ft and a speed of approximately 120 knots. Each node had a footprint of 0.491km by 0.11km equating to 0.05401km² (Figure 1). Coverage of images analyzed was calculated to be approximately 10% of the Survey Area, as contracted.

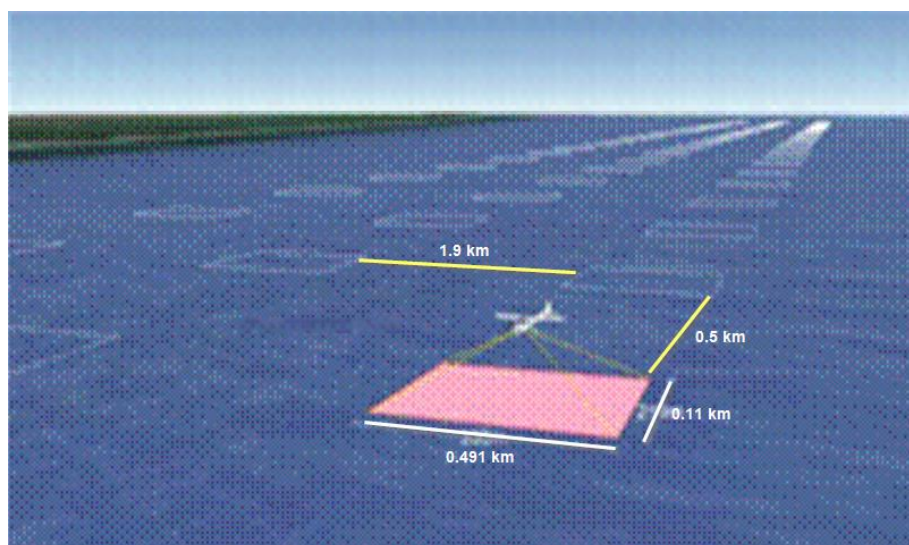


Figure 1 Indicative transect and node distances and node footprint

Flight lines and image capture points for the July 2021 to October 2021 surveys are presented in Figures 2 to 7.

Note: For some surveys, image capture points may not align precisely with the indicative flight path due to lateral aircraft movement, predominantly as a result of crosswinds. Any deviations encountered were within expected tolerances for flight paths.

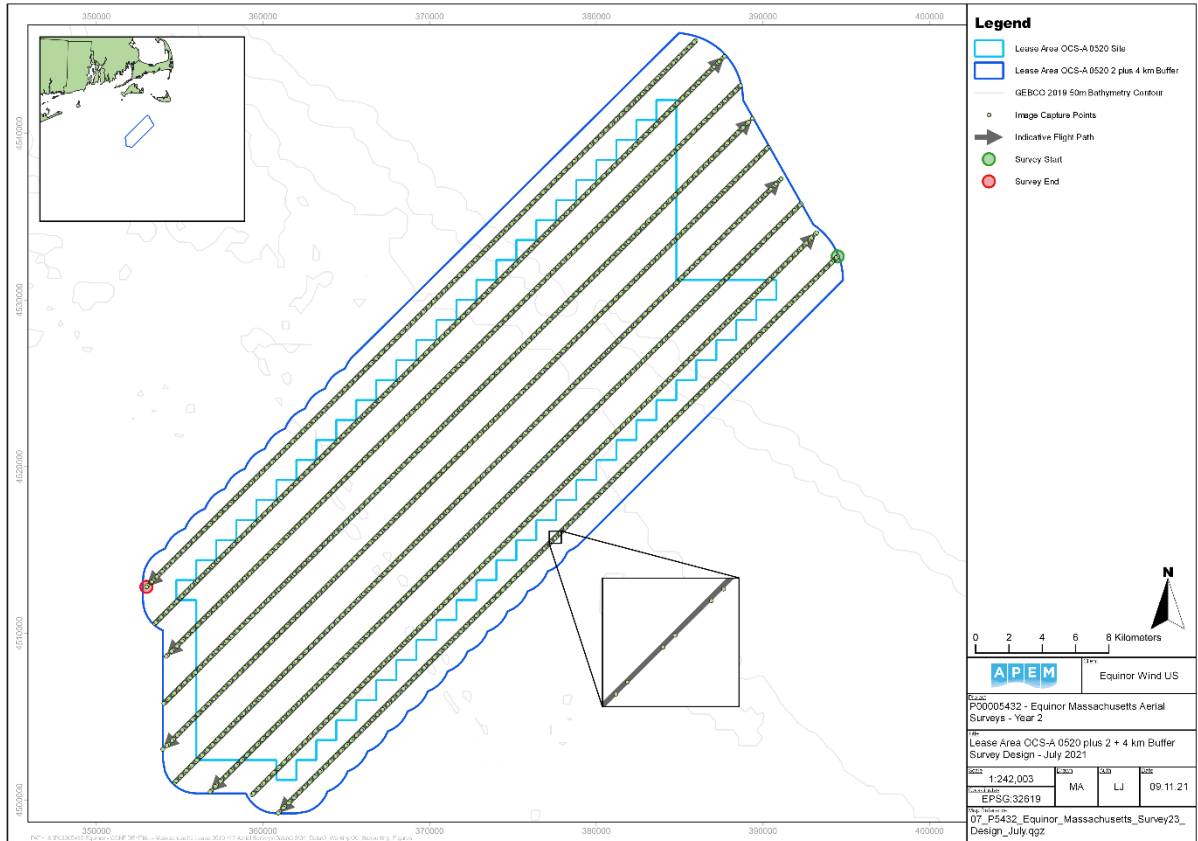


Figure 2 Indicative flight lines and image capture points of the Survey Area for July 2021

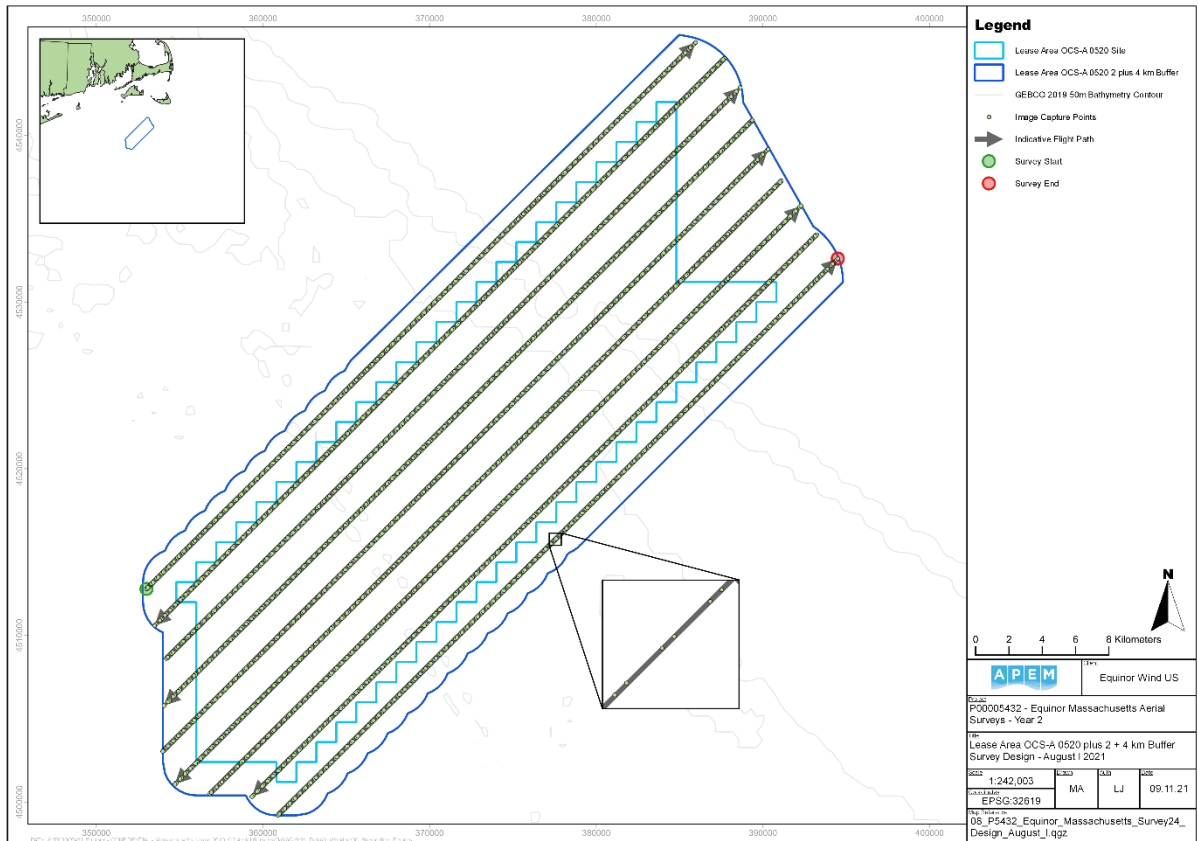


Figure 3 Indicative flight lines and image capture points of the Survey Area for August 1 2021

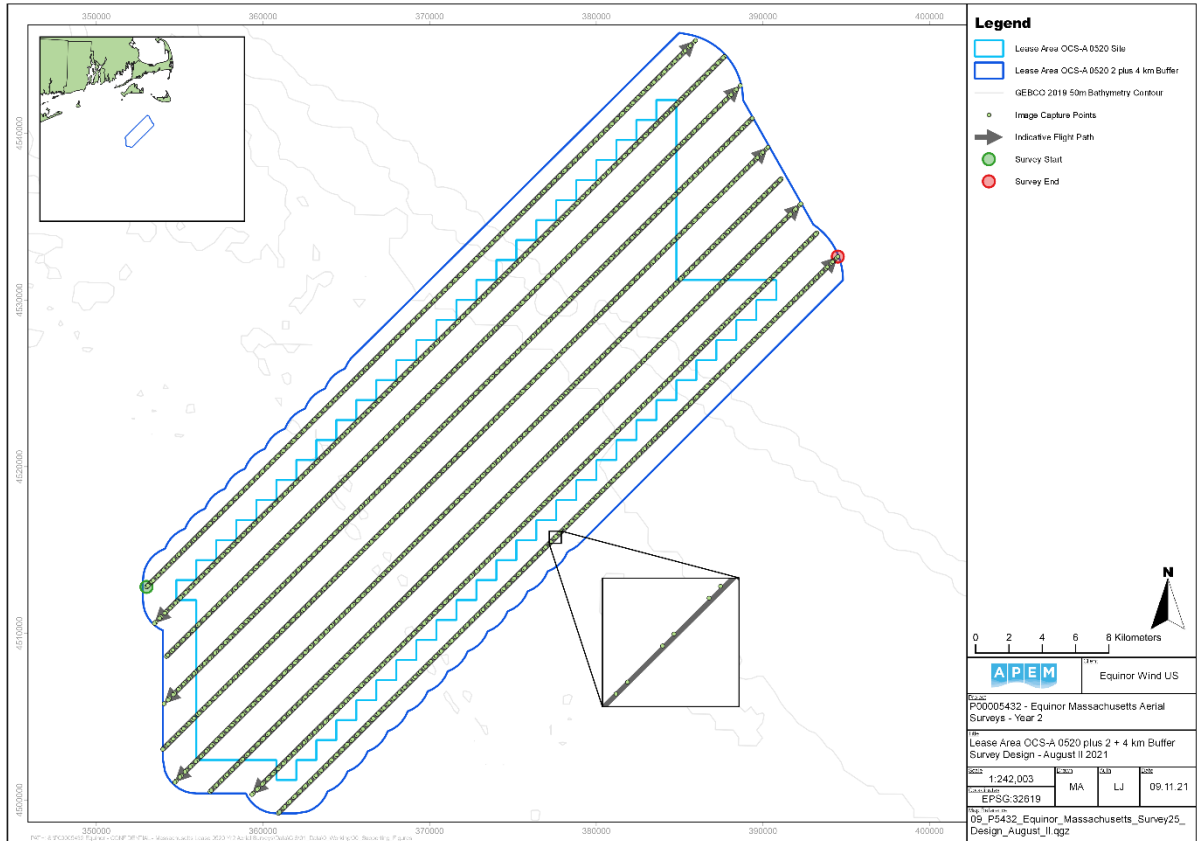


Figure 4 Indicative flight lines and image capture points of the Survey Area for August II 2021

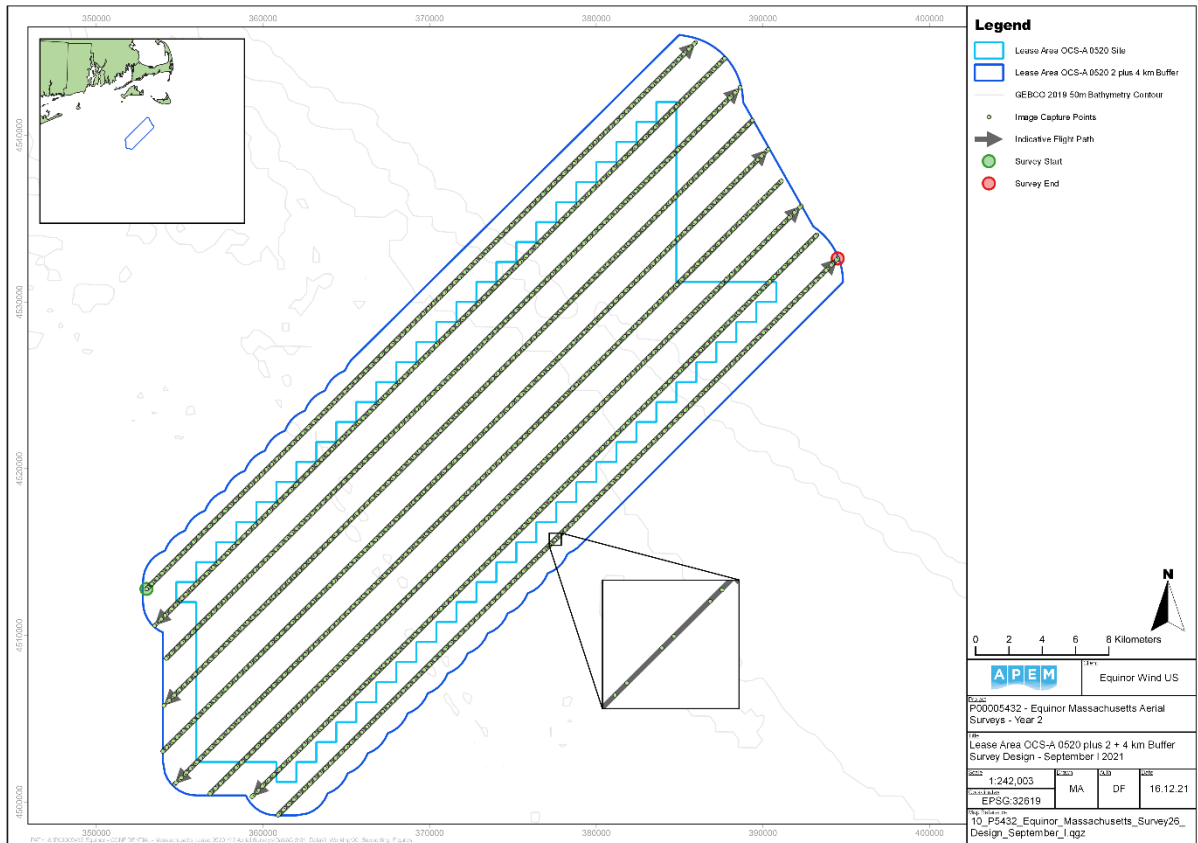


Figure 5 Indicative flight lines and image capture points of the Survey Area for September I 2021

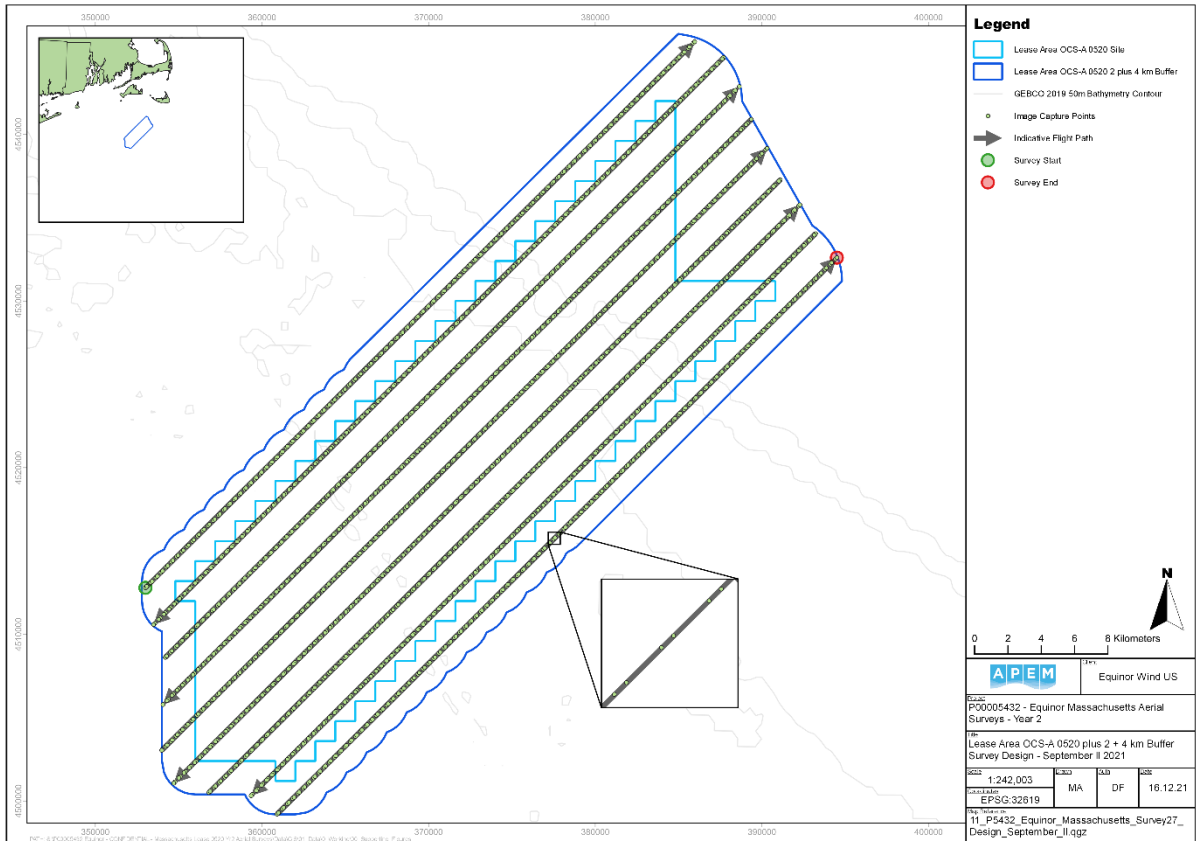


Figure 6 Indicative flight lines and image capture points of the Survey Area for September II 2021

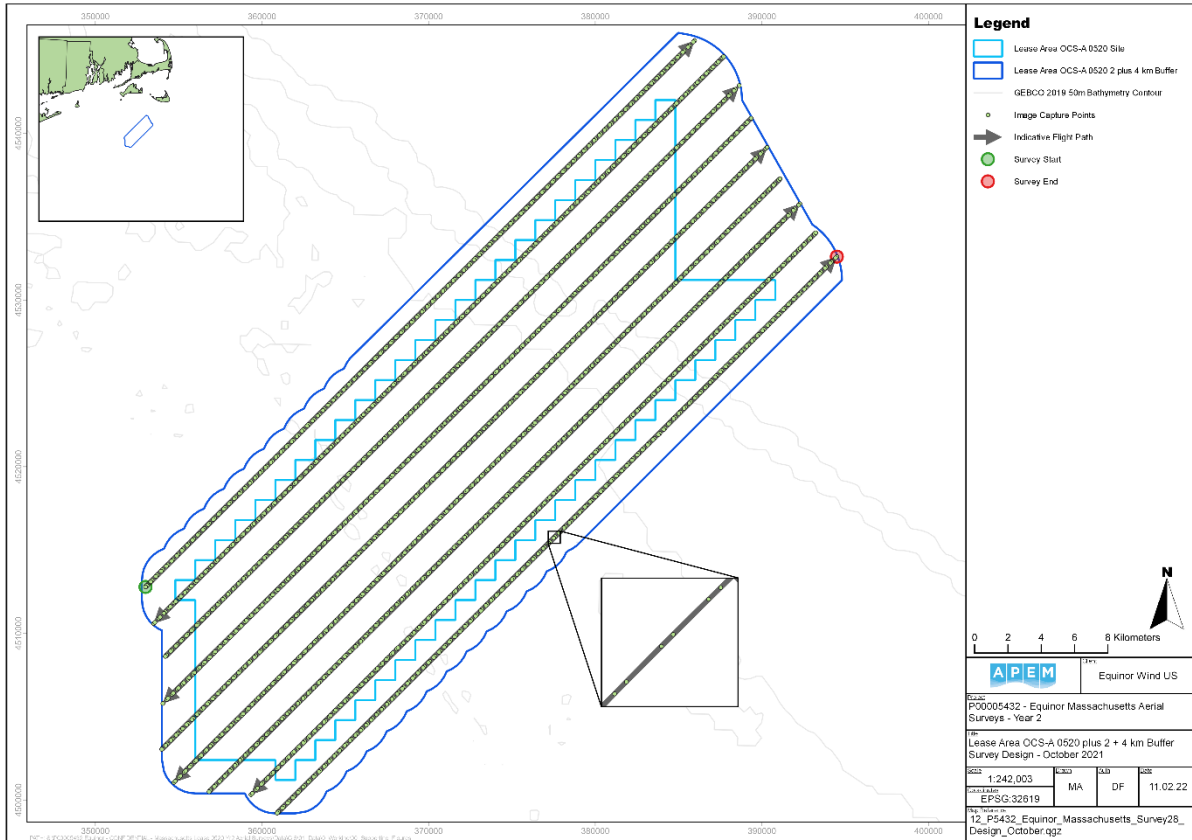


Figure 7 Indicative flight lines and image capture points of the Survey Area for October 2021

No health and safety issues were reported during the surveys.

The date and start and end times of the surveys are provided in **Table 1**, and a summary of the weather conditions that were recorded are provided in **Table 2**. Total numbers of images per survey with associated coverage percentages are provided in **Table 3**.
¹ Sea State: 0 = Calm (Glassy); 1 = Calm (Rippled); 2 = Smooth; 3 = Slight

² Turbidity: 0 = Clear; 1 = Slightly Turbid; 2 = Moderately Turbid; 3 = Highly Turbid

³ Cloud Cover: 0% = Clear; 1-10% = Few; 11-50% = Scattered; 51-95% = Broken; 96-100% = Overcast

Table 3.

Table 1 Date, and start and end time (Coordinated Universal Time; UTC) for each flight for the July 2021 to October 2021 surveys. Times were determined based upon the suitability of weather conditions and sun angles for surveying

Survey	Date	Flight Number	UTC Start Time (HH:MM)	UTC End Time (HH:MM)
Survey 23	07-27-21	1	14:08	16:25
Survey 24	08-06-21	1	17:29	19:40
Survey 25	08-17-21	1	17:42	19:40
Survey 26	09-07-21	1	17:03	19:07
Survey 27	09-20-21	1	18:27	20:55
Survey 28	10-14-21	1	17:29	19:36

Table 2 Weather conditions recorded for each of the July 2021 to October 2021 surveys

Survey	Date	Sea State ³ (Beaufort Scale)	Turbidity ²	Wind Speed (knots) / Direction	Cloud Cover (%) ³	Visibility (km)	Air Temp (°F)
Survey 23	07-27-21	1	0	5 N	0	> 10	77 – 79
Survey 24	08-06-21	2	1	15 WSW	0	> 10	75
Survey 25	08-17-21	1	0	10 SW	10 – 40	> 10	70
Survey 26	09-07-21	1	0	10 – 15 W	0 – 5	> 10	65 – 69
Survey 27	09-20-21	1	0	10 ENE	5 – 20	> 10	61 – 63
Survey 28	10-14-21	1	0	10 NW	5	> 10	65

¹ Sea State: 0 = Calm (Glassy); 1 = Calm (Rippled); 2 = Smooth; 3 = Slight

² Turbidity: 0 = Clear; 1 = Slightly Turbid; 2 = Moderately Turbid; 3 = Highly Turbid

³ Cloud Cover: 0% = Clear; 1-10% = Few; 11-50% = Scattered; 51-95% = Broken; 96-100% = Overcast

Table 3 Image number and coverage for each of the July 2021 to October 2021 surveys

Survey	Image Number	Coverage (%)
Survey 23	12,048	11.76
Survey 24	12,048	11.76
Survey 25	12,048	11.76
Survey 26	12,048	11.76
Survey 27	12,048	11.76
Survey 28	12,048	11.76

4. Quality Control Results

APEM analyzed the images to enumerate birds to species level, and to enumerate any other non-avian marine fauna. Normandeau provided QA of the data to check for missed animals in 10% of images recorded as empty and quality assured 20% of the bird species identification undertaken by APEM (and 100% of Listed species). Normandeau identified 100% of the species of non-avian marine fauna including marine mammals, turtles, fish, sharks, and rays. Birds and marine fauna identified from the images were 'snagged' (i.e., located within the images) and categorized usually to species, but sometimes to the species grouping. The results of the QA are provided in **Table 4** and **Table 5**. The agreement exceeded 99% for all surveys.

Table 4 The number of blank images, the number of blank images that went to QC, and the results of the QC

Survey	Blank Images	Blank Images QC'd	Image Number QC'd Not Blank	Agreement (%)
Survey 23	11,852	1,186	2	99.98
Survey 24	11,996	1,200	1	99.99
Survey 25	11,839	1,184	12	99.90
Survey 26	12,010	1,201	4	99.97
Survey 27	12,006	1,201	2	99.98
Survey 28	11,990	1,199	3	99.97

Table 5 The number of individuals that were found during QC

Survey	Order Found by QC	Number of individuals	Species
Survey 23	Avian	1	Red-throated loon
	Shark	1	Blue shark
Survey 24	Shark	1	Blue shark
Survey 25	Avian	16	Unidentified storm petrel species
		1	Unidentified large shearwater species
	Large Bony Fish	1	Unidentified large bony fish
	Shark	1	Blue shark
1		Unidentified shark species	
Survey 26	Avian	1	Unidentified storm petrel species
		1	Great black-backed gull
		1	Cory's shearwater
	Marine Mammal	1	Unidentified marine mammal species
Survey 27	Avian	1	Great black-backed Gull
	Shark	1	Tiger shark
Survey 28	Marine Mammal	1	Unidentified but possible seal species
	Large Bony Fish	2	Unidentified large bony fish

5. Abundance and Distribution

Data reported are raw counts of animals that have not been subject to extrapolation for population estimates. When identifying targets in the imagery, we take a precautionary stance by only identifying to the species level when we are confident. Any target we are not confident to the species level is then identified to the appropriate group level for example “large gull species”, “shearwater species”, or “marine mammal species”. Reasons for lack of confidence can be due to image quality, target on the periphery of the images distorting measurements, and difficulty identifying immature targets, Species scientific names are provided in Appendix 1 Species List.

5.1 Avian Abundance

For the July 2021, August I 2021, August II 2021, September I 2021, September II 2021, and October 2021 surveys, totals of 212, 39, 229, 14, 16, and 30 birds were recorded respectively (Table 6). Birds mostly comprised of storm petrel species (n=220 in total across July to September I 2021) and Cory’s shearwater (n=111) were the second most abundant species. Thereafter, the following species were recorded: great shearwater (n=69), red / red-necked phalarope (n=40), herring gull (n=39), large shearwater species (n=12), large gull species (n=9), great black-backed gull (n=8), red phalarope (n=6), lesser black-backed gull (n=5), unclassified shearwater species (n=4), ‘commic’ / Forster’s tern (n=3), small shearwater species (n=3), unidentified bird species (n=3), laughing gull (n=2), and northern gannet (n=2). Single individuals of great skua, murre / razorbill, unclassified gull species, and sooty shearwater were also recorded.

Table 6 Total number of birds recorded within the Survey Area during the July 2021, August I and II 2021, September I and II 2021, and October 2021 surveys

Group	Species	Jul-21			Aug-21 Survey I			Aug-21 Survey II			Sep-21 Survey I			Sep-21 Survey II			Oct-21		
		Flying	Sitting	Total	Flying	Sitting	Total	Flying	Sitting	Total	Flying	Sitting	Total	Flying	Sitting	Total	Flying	Sitting	Total
Shorebird	Red Phalarope	-	-	-	-	-	-	-	-	-	0	6	6	-	-	-	-	-	-
	Red / Red-necked Phalarope	-	-	-	-	-	-	0	40	40	-	-	-	-	-	-	-	-	-
Skua	Great Skua	-	-	-	1	0	1	-	-	-	-	-	-	-	-	-	-	-	-
Auk	Murre ¹ / Razorbill	-	-	-	-	-	-	-	-	-	-	-	-	0	1	1	-	-	-
Gull	Laughing Gull	-	-	-	-	-	-	1	0	1	-	-	-	-	-	-	1	0	1
	Herring Gull	1	5	6	1	0	1	5	2	7	-	-	-	4	3	7	4	14	18
	Lesser Black-backed Gull	-	-	-	-	-	-	1	1	2	-	-	-	-	-	-	1	2	3
	Great Black-backed Gull	3	0	3	-	-	-	-	-	-	-	-	-	3	0	3	1	1	2
	Large Gull species ²	-	-	-	-	-	-	0	2	2	0	1	1	0	1	1	0	5	5
Gull species ³	-	-	-	-	-	-	0	1	1	-	-	-	-	-	-	-	-	-	
Tern	‘Commic’ ⁴ / Forster’s Tern	-	-	-	-	-	-	3	0	3	-	-	-	-	-	-	-	-	-
Storm Petrel	Storm Petrel species	124	0	124	2	0	2	93	0	93	1	0	1	-	-	-	-	-	-
Shearwater	Cory’s Shearwater	22	35	57	13	5	18	7	26	33	1	2	3	-	-	-	-	-	-
	Great Shearwater	6	8	14	12	1	13	19	20	39	-	-	-	3	0	3	-	-	-
	Sooty Shearwater	0	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Small Shearwater species ⁵	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	1	0	1
	Large Shearwater species ⁶	0	1	1	1	2	3	0	8	8	-	-	-	-	-	-	-	-	-
Shearwater species ⁷	0	3	3	0	1	1	-	-	-	-	-	-	-	-	-	-	-	-	
Gannet	Northern Gannet	-	-	-	-	-	-	-	-	-	0	2	2	-	-	-	-	-	-
Unid. Avian	Unidentified Bird species	0	1	1	-	-	-	-	-	-	1	0	1	0	1	1	-	-	-
Total Birds		157	55	212	30	9	39	129	100	229	3	11	14	10	6	16	8	22	30

¹Note: Murre refers to either common murre or thick-billed murre.

²Note: Large Gull Species includes: Herring Gull (Larus smithsonianus), Great Black-backed Gull (Larus marinus), Lesser Black-backed Gull (Larus fuscus) & scarcer species (winter): Glaucous Gull (Larus hyperboreus), Iceland Gull (Larus glaucoides)

³Note: Gull Species includes: those species in the Large Gull Species & Bonaparte’s Gull (Chroicocephalus Philadelphia), Black-legged Kittiwake (Rissa tridactyla), Ring-billed Gull (Larus delawarensis), Laughing Gull (Leucophaeus atricilla), Little Gull (Hydrocoleus minutus)

⁴Note: ‘Commic’ refers to either common tern or Arctic tern.

⁵Note: Small Shearwater Species includes: Manx Shearwater (Puffinus puffinus) & Audubon’s Shearwater (Puffinus lherminieri)

⁶Note: Large Shearwater Species includes: Sooty Shearwater (Ardenna griseus), Great Shearwater (Ardenna gravis), Cory’s Shearwater (Calonectris borealis)

⁷Note: Shearwater Species includes: Both the small and large shearwater species listed above

5.2 Marine Mammal and Other Marina Fauna Abundance

For the July 2021, August I 2021, August II 2021, September I 2021, September II 2021, and October 2021 surveys, totals of 94, 16, 111, 119, 32, and 153 marine mammals and other marine fauna were recorded respectively (Table 7). Marine mammals mostly comprised of common dolphin (n=225 in July 2021, and August II to October 2021). Unidentified dolphin species (n=15) was the most abundant thereafter, which was followed by common bottlenose dolphin (n=3), harbor porpoise (n=2), and unidentified seal species (n=2). Single individuals of unidentified marine mammal species were also recorded. Twelve turtles were recorded consisting of leatherback turtle (n=10), loggerhead turtle (n=1), and Kemp’s ridley turtle (n=1). Additionally, 73 large bony fish were recorded, consisting of ocean sunfish (n=31), unidentified billfish species (n=19), unidentified tuna species (n=13), unidentified sunfish species (n=4), Atlantic bluefin tuna (n=3), mahi-mahi (n=2), and sharptail sunfish (n=1), and 192 sharks were recorded, consisting of unidentified shark species (n=83), blue shark (n=34), unidentified Carcharhinidae shark species (n=30), white shark (n=10), sandbar shark (n=8), unidentified hammerhead shark (n=8), common thresher shark (n=4), dusky shark (n=4), shortfin mako (n=3), scalloped hammerhead shark (n=3), tiger shark (n=2), silky shark (n=1), basking shark (n=1), and whale shark (n=1).

Table 7 Total number of marine mammals and other marine fauna recorded within the Survey Area during the July 2021, August I and II 2021, September I and II 2021, and October 2021 surveys

Group	Species	Jul-21			Aug-21 Survey I			Aug-21 Survey II			Sep-21 Survey I			Sep-21 Survey II			Oct-21		
		Submerged	Surfacing	Total	Submerged	Surfacing	Total	Submerged	Surfacing	Total	Submerged	Surfacing	Total	Submerged	Surfacing	Total	Submerged	Surfacing	Total
Turtle	Loggerhead Turtle	-	-	-	-	-	-	-	-	-	1	0	1	-	-	-	-	-	-
	Kemp’s Ridley Turtle	-	-	-	-	-	-	-	-	-	1	0	1	-	-	-	-	-	-
	Leatherback Turtle	-	-	-	0	1	1	0	1	1	-	-	-	-	-	-	5	3	8
Marine Mammal	Seal species	-	-	-	-	-	-	0	1	1	-	-	-	-	-	-	1	0	1
	Common Dolphin	1	1	2	-	-	-	2	0	2	95	0	95	2	1	3	123	0	123
	Common Bottlenose Dolphin	-	-	-	-	-	-	3	0	3	-	-	-	-	-	-	-	-	-
	Dolphin species	3	0	3	-	-	-	-	-	-	2	0	2	-	-	-	10	0	10
	Harbor Porpoise	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0	2
	Marine Mammal species	1	0	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Large Bony Fish	Mahi-mahi	-	-	-	-	-	-	1	0	1	1	0	1	-	-	-	-	-	-
	Ocean Sunfish	0	1	1	3	0	3	3	0	3	2	0	2	19	0	19	3	0	3
	Sharptail Sunfish	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0	1
	Sunfish species	3	0	3	-	-	-	-	-	-	-	-	-	1	0	1	-	-	-
	Atlantic Bluefin Tuna	-	-	-	-	-	-	3	0	3	-	-	-	-	-	-	-	-	-
	Tuna species	5	0	5	-	-	-	4	0	4	-	-	-	4	0	4	-	-	-
	Billfish species	17	0	17	-	-	-	1	0	1	1	0	1	-	-	-	-	-	-
Shark	Common Thresher Shark	3	0	3	-	-	-	1	0	1	-	-	-	-	-	-	-	-	-
	Silky Shark	-	-	-	-	-	-	1	0	1	-	-	-	-	-	-	-	-	-
	Dusky Shark	1	0	1	-	-	-	3	0	3	-	-	-	-	-	-	-	-	-
	Sandbar Shark	2	0	2	1	0	1	5	0	5	-	-	-	-	-	-	-	-	-
	Tiger Shark	-	-	-	-	-	-	1	0	1	-	-	-	1	0	1	-	-	-
	Blue Shark	18	0	18	1	0	1	7	0	7	5	0	5	1	0	1	2	0	2
	Carcharhinidae Shark species	7	0	7	4	0	4	16	0	16	2	0	2	-	-	-	1	0	1
	Basking Shark	1	0	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	White Shark	3	0	3	-	-	-	4	0	4	2	0	2	1	0	1	-	-	-
	Shortfin Mako	2	0	2	-	-	-	1	0	1	-	-	-	-	-	-	-	-	-
	Whale Shark	1	0	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Scalloped Hammerhead	1	0	1	-	-	-	1	0	1	1	0	1	-	-	-	-	-	-

	Hammerhead Shark species	2	0	2	2	0	2	4	0	4	-	-	-	-	-	-	-	-	-
	Shark species	21	0	21	4	0	4	48	0	48	6	0	6	2	0	2	2	0	2
Total Marine Megafauna		92	2	<u>94</u>	15	1	<u>16</u>	109	2	<u>111</u>	119	0	<u>119</u>	31	1	<u>32</u>	150	3	<u>153</u>

5.3 Spatial Distribution

Figures 8 to 13 show the location of all birds and marine mammals recorded throughout the Survey Area during the July 2021 to October 2021 surveys respectively.

Overall, birds and marine mammals were distributed across the majority of the Survey Area in July with notable concentrations of birds evident in the north, as well as the center to west of the Survey Area. Storm petrel species occurred in distinct densities in the north-northwest, and in the south. Shearwaters, particularly Cory's shearwaters, were predominantly distributed in the north of the 4 km buffer, with much sparser and looser distribution elsewhere. Marine mammals and other marine fauna showed little overall trends for distribution, though sharks tended to be more densely concentrated around the center of the Survey Area (**Figure 8**).

In the August I survey, birds were distributed more sparsely across the Survey Area compared with July, though Cory's shearwaters continued to remain predominantly in the north of the 4 km buffer. No marine mammals were recorded in the survey, and all other marine megafauna were recorded in loose, unassociated distribution (**Figure 9**).

For the August II survey, bird distribution was much more numerous in the north-northeastern half of the Survey Area compared with the south-southwest. Cory's shearwaters were once again found predominantly in the north of the 4 km buffer, whilst great shearwaters were also found in the north of the 4 km buffer but with the majority located further south towards the center of the Survey Area. Storm petrels exhibited predominant distribution in the east to northeast of the Survey Area, occurring in both large and small densities, and red / red-necked phalaropes all occurred in a distinct column of five small groups in the northeast of the Survey Area. Marine mammals and other marine megafauna were loosely distributed across the Survey Area, though unidentified sharks and Carcharhinidae sharks were predominantly located in the east of the 4 km buffer (**Figure 10**).

In the September I survey, birds were loosely distributed and considerably sparser than in the August II survey. Marine mammals were exclusively located in the southwest of the 4 km buffer, whilst other marine megafauna were loosely distributed across the Survey Area (**Figure 11**).

For the September II survey, bird distribution was similarly loose to September I, though the majority were located in the north-northeastern half of the Survey Area. Marine mammals and other marine megafauna were also loosely distributed, with ocean sunfish distributed in greater numbers towards the northeast (**Figure 12**).

In the October survey, bird distribution continued to be loose with no overall distinguishable patterns exhibited. All leatherback turtles were loosely distributed in the north-northeastern half of the Survey Area, whilst marine mammals were almost exclusively located in one large group in the northeast-center of the Survey Area. All other marine megafauna were loosely distributed across the Survey Area (**Figure 13**).

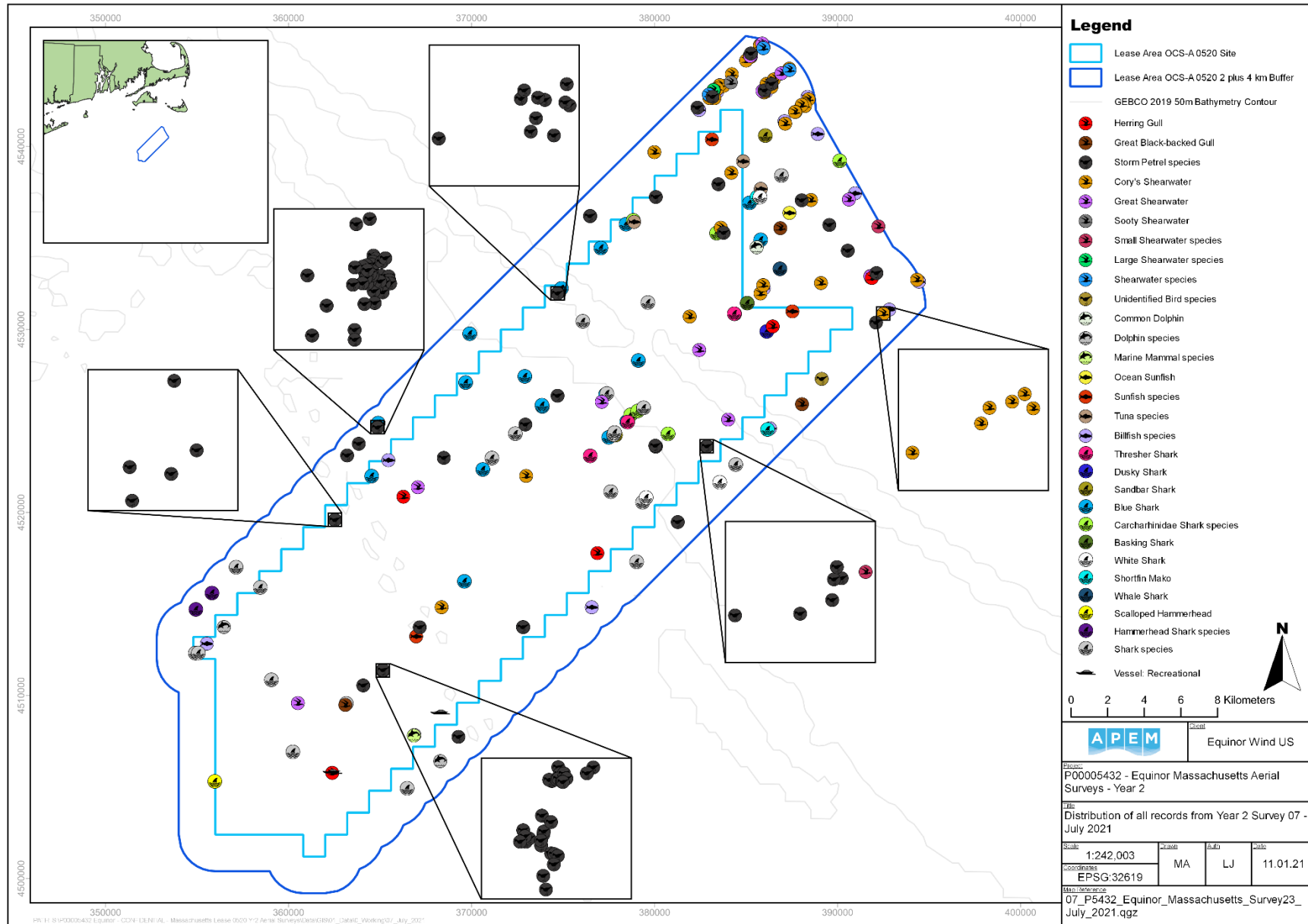


Figure 8 Distribution of all birds, other marine fauna, and human artifacts recorded in July 2021

Note: Individuals may appear to overlap if they are in close proximity to each other.

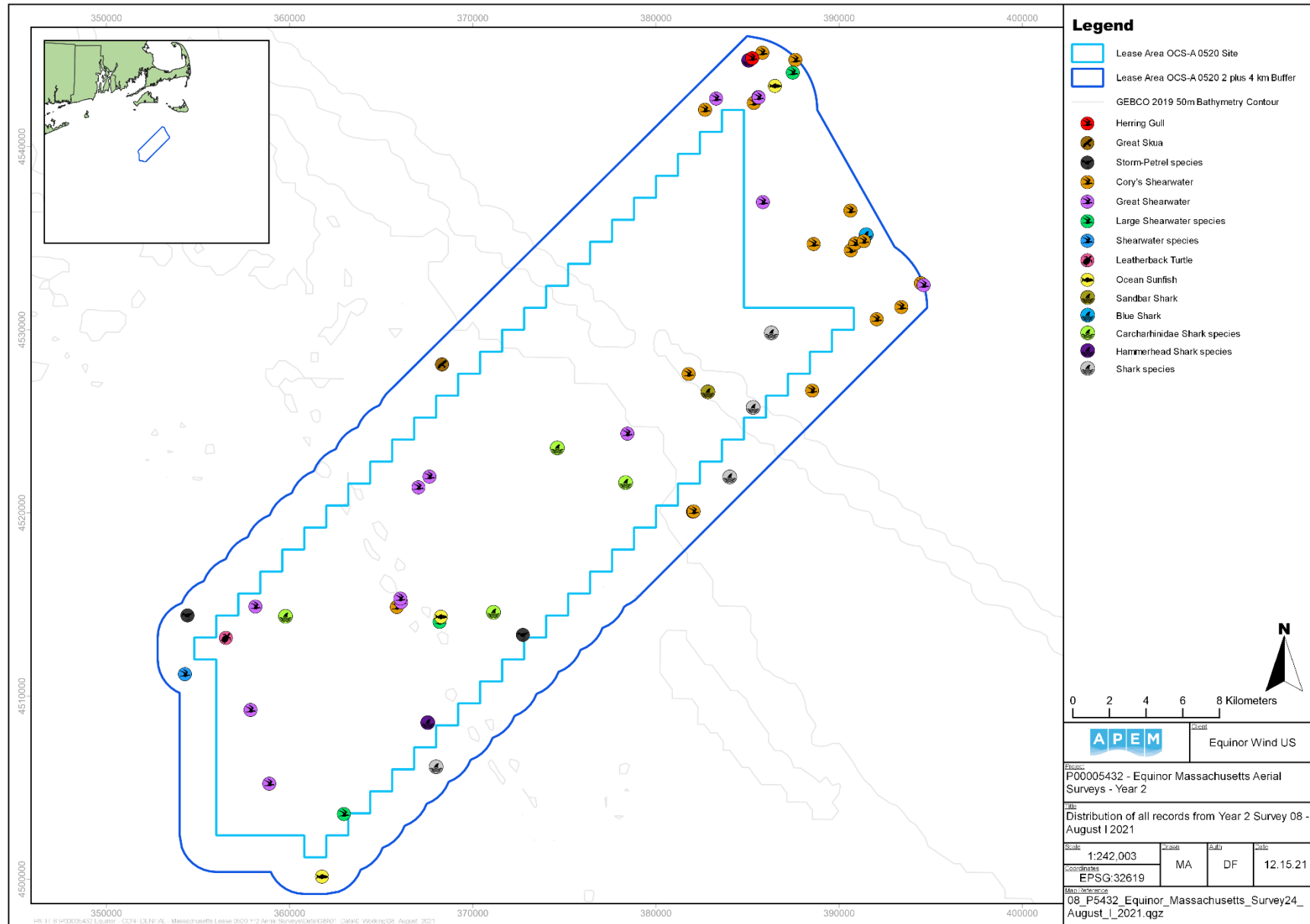


Figure 9 Distribution of all birds and other marine fauna recorded in August 1 2021

Note: Individuals may appear to overlap if they are in close proximity to each other.

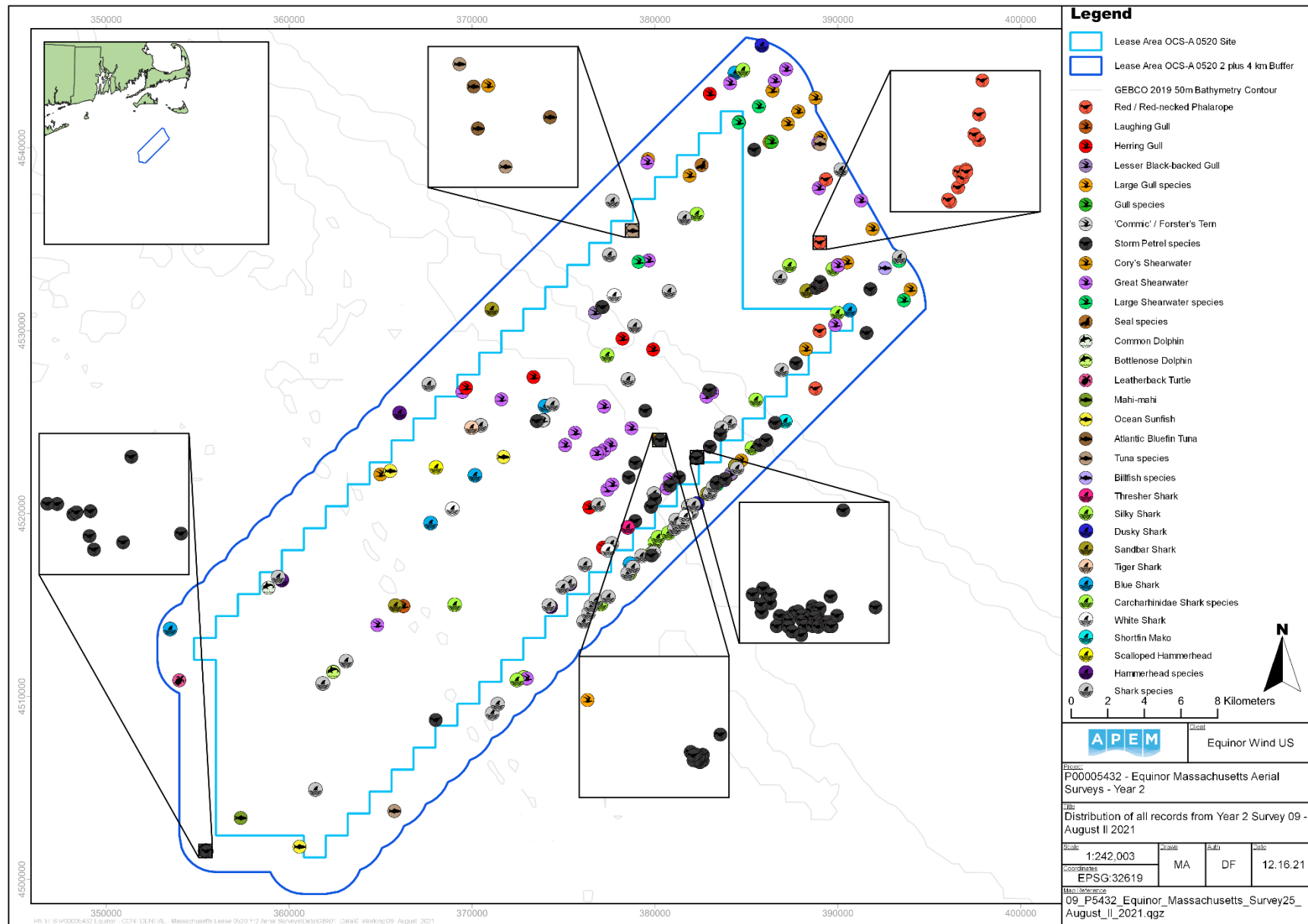


Figure 10 Distribution of all birds and other marine fauna recorded in August II 2021

Note: Individuals may appear to overlap if they are in close proximity to each other.

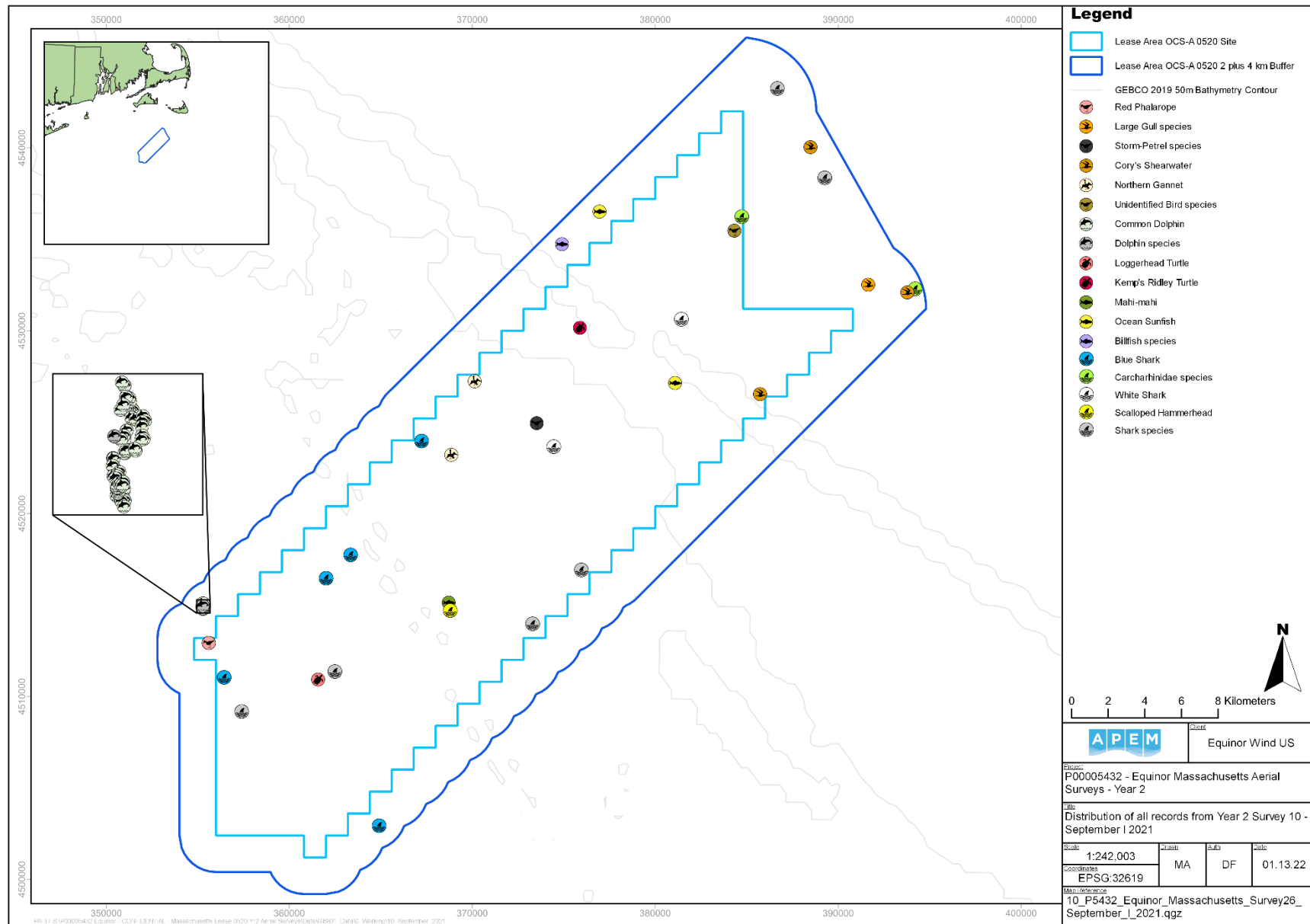


Figure 11 Distribution of all birds and other marine fauna recorded in September I 2021

Note: Individuals may appear to overlap if they are in close proximity to each other.

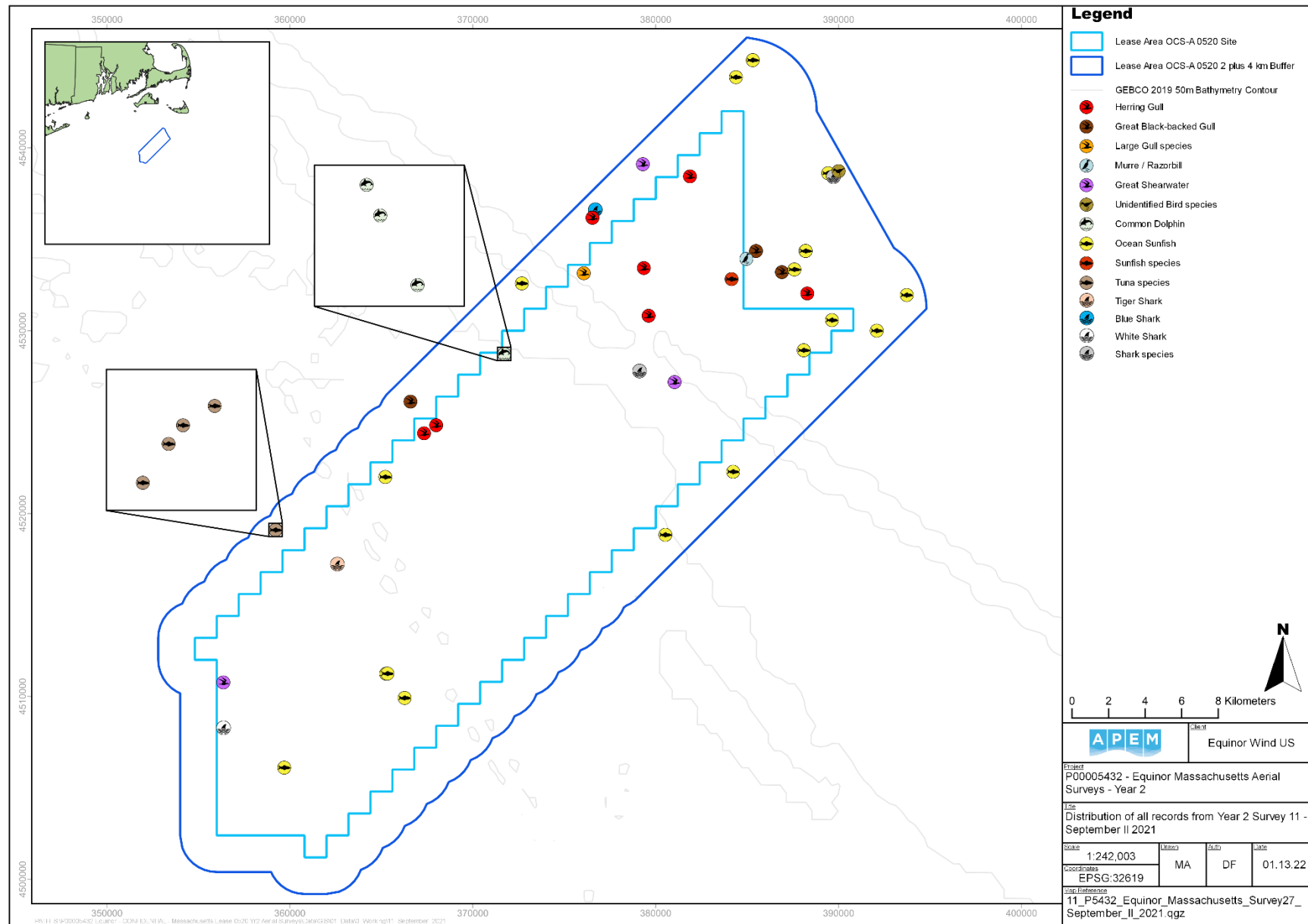


Figure 12 Distribution of all birds and other marine fauna recorded in September 11 2021

Note: Individuals may appear to overlap if they are in close proximity to each other.

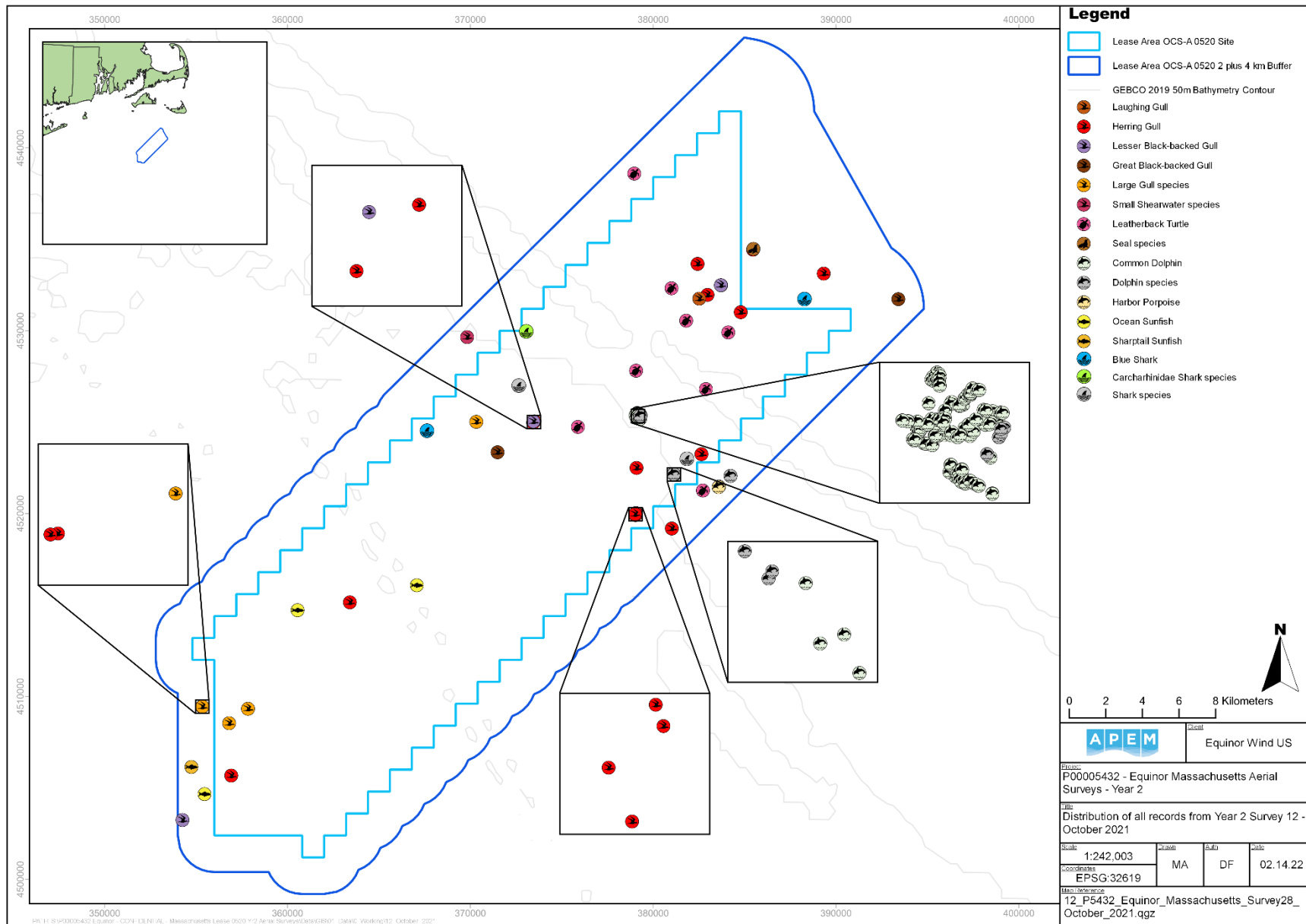


Figure 13 Distribution of all birds and other marine fauna recorded in October 2021

Note: Individuals may appear to overlap if they are in close proximity to each other.

6. Species Accounts

6.1 Red Phalarope

Red phalaropes were recorded in the September I 2021 survey only. These consisted of six birds sitting on the water surface. For the September I survey, all red phalaropes were located in the southwestern extent of the site.

6.2 Red / Red-necked Phalarope

Red / red-necked phalaropes were recorded in the August II 2021 survey only, with a total of 40 phalaropes recorded all sitting on the water surface. All individuals occurred in a distinct column of five groups in the northeast of the Survey Area.

6.3 Great Skua

A single great skua was recorded in the August I 2021 survey, consisting of one flying individual located in the west of the buffer.

6.4 Murre / Razorbill

A single murre / razorbill was recorded in the September II 2021 survey, consisting of one individual sitting on the water surface in the north-northeast of the buffer.

6.5 Laughing Gull

Laughing gulls were recorded in the August II, and October 2021 surveys only, consisting of two flying birds, one located in the southwest of the site for the August II survey and one located in the northeast for the October survey.

6.6 Herring Gull

Herring gulls were recorded in the July, August I and II, September II, and October 2021 surveys. These consisted of one flying bird and five sitting on the water surface in the July survey, one flying in the August I survey, five flying and one sitting in the August II survey, four flying and three sitting in the September II survey, and four flying and 14 sitting in the October survey. For the majority of surveys, herring gulls were loosely distributed in the northern half of the Survey Area, save for July and October which featured small numbers of herring gulls in the south as well.

6.7 Lesser Black-backed Gull

Lesser black-backed gulls were recorded in the August II and October 2021 surveys only, consisting of one flying and one sitting birds in the August II survey, and one flying and two sitting birds in the October survey. Both gulls in the August II survey were located in the northern half of the survey area, whilst for October they were loosely distributed in the north, center, and south of the Survey Area.

6.8 Great Black-backed Gull

Great black-backed gulls were recorded in the July, September II, and October 2021 surveys. These consisted of three flying gulls for the July survey, three flying gulls for the September II survey, and one flying and one sitting for the October survey. For the July and September II surveys, two gulls were located in the north and one was located in the south of the Survey Area, and two gulls were located in the north and one was located in the west respectively. For the October survey, one gull was located in the northeast of the buffer, and one was located in the center of the site.

6.9 Large Gull species – unidentified

Unidentified large gulls were recorded in the August II, September I and II, and October 2021 surveys. These consisted of two gulls sitting on the water surface in the August II survey, one sitting gull in both the September I and II surveys, and five sitting gulls in October. For the August II, September I, and September II surveys, all unidentified large gulls were located in the northern half of the Survey Area. For the October survey, unidentified large gulls were located primarily in the southwest of the Survey Area with one individual also in the center of the site, and one in the north of the site.

6.10 Gull species – unclassified

Unclassified gulls were recorded in the August II 2021 survey only, consisting of one sitting individual located in the north of the buffer.

6.11 ‘Commic’ / Forster’s Tern

‘Commic’ / Forster’s terns were recorded in the August II 2021 survey only, consisting of three flying individuals located in the center of the site.

6.12 Storm Petrel species – unidentified

Unidentified storm petrels were recorded in the July, August I and II, and September I 2021 surveys. These consisted of 124 storm petrels sitting on the water surface in July, two sitting in the August I survey, 93 sitting in the August II survey, and one sitting in the September I survey. For the July survey, storm petrels were distributed across the extent of the Survey Area, with dense concentrations of storm petrels evident in the west of the buffer and in the south of the site. For the August I survey, storm petrels were loosely distributed in the southern half of the Survey Area, and for August II, storm petrels were predominantly located in the east of the Survey Area, both loosely and in dense groups, with the remainder loosely distributed to the northeast and south.

6.13 Cory’s Shearwater

Cory’s shearwaters were recorded in the July, August I and II, and September I 2021 surveys. These consisted of 22 flying shearwaters and 35 sitting on the water surface in July, 13 flying and five sitting in August I, seven flying and 26 sitting in August II, and one flying and two sitting in the September I survey. Cory’s shearwaters were predominantly distributed in the

north to northeast of the buffer for all surveys in which they were present, with occasional loose distribution further to the south of the site.

6.14 Great Shearwater

Great shearwaters were recorded in the July, August I and II, and September II 2021 surveys. These consisted of six flying and eight sitting shearwaters in July, 12 flying and one sitting in August I, 19 flying and 20 sitting in August II, and three flying in the September II survey. Great shearwaters were predominantly distributed in the north of the buffer for the July survey with looser distribution through to the south of the Survey Area. For the August I survey, shearwaters were loosely distributed across the Survey Area, and for the August II survey, shearwaters were predominantly distributed in the center to east of the Survey Area with looser distribution in the north and south. The three great shearwaters in the September II survey were located in the north, center, and southwest of the Survey Area.

6.15 Sooty Shearwater

A single sitting sooty shearwater was recorded in the July 2021 survey, located in the north of the buffer.

6.16 Small Shearwater species – unidentified

Unidentified small shearwaters were recorded in the July and October 2021 surveys only, consisting of one flying and one sitting individual in the July survey, and one flying individual in the October survey. For the July survey, one small shearwater was located in the northeast of the buffer and one in the northeast of the site, and for the October survey, one shearwater was located in the northwest of the buffer.

6.17 Large Shearwater species – unidentified

Unidentified large shearwaters were recorded in the July, and August I and II 2021 surveys. These consisted of one sitting shearwater in the July survey, one flying and two sitting in the August I survey, and eight sitting in the August II survey. For the July survey, the single large shearwater was located in the north of the buffer, and for the August I survey, a large shearwater was located in the north of the buffer, in the south of the center of the site, and in the south of the site. For the August II survey, large shearwaters were loosely distributed from the north across to the east of the Survey Area.

6.18 Shearwater species – unclassified

Unclassified shearwaters were recorded in the July and August I 2021 surveys only, consisting of three sitting shearwaters in July, and one sitting shearwater in the August I survey. For July, all three unclassified shearwaters were located in the north of the buffer, and for the August I survey, the single shearwater was located in the southwest of the buffer.

6.19 Northern Gannet

Northern gannets were recorded in the September I 2021 survey only, consisting of two sitting gannets located in the west of the site.

6.20 Unidentified Bird species – unidentified

Unidentified birds were recorded in the July, and September I and II 2021 surveys, consisting of one sitting individual in July, one flying individual in the September I survey, and one sitting individual in the September II survey.

6.21 Loggerhead Turtle

A single loggerhead turtle was recorded in the September I 2021 survey, consisting of one submerged turtle located in the southwest of the site.

6.22 Kemp's Ridley Turtle

A single Kemp's ridley turtle was recorded in the September I 2021 survey, consisting of one submerged turtle located in the north-northwest of the site.

6.23 Leatherback Turtle

Leatherback turtles were recorded in the August I and II, and October 2021 surveys. These consisted of one surfacing turtle in the August I survey, one surfacing in the August II survey, and five submerged and three surfacing in the October survey. For the August I survey, the single leatherback turtle was located in the southwest of the site, and for the August II survey, the single leatherback turtle was located in the southwest of the buffer. For the October survey, leatherback turtles were loosely distributed across the northern half of the Survey Area, predominantly in the site.

6.24 Seal species – unidentified

Unidentified seals were recorded in the August II and October 2021 surveys only, consisting of one surfacing seal in the north of the site for August II, and one surfacing seal in the north of the buffer for October.

6.25 Common Dolphin

Common dolphins were recorded in the July, August II, September I and II, and October 2021 surveys. These consisted of one submerged dolphin and one surfacing in the July survey, two submerged in the August II survey, 95 submerged in the September I survey, one submerged and one surfacing in the September II survey, and 123 submerged dolphins in the October survey. For the July survey, both common dolphins were located in the north of the buffer, and for the August II survey, both dolphins were located in the southwest of the site. For the September I survey, all common dolphins were located in one dense group in the southwest of the buffer, and for the September II survey, all three common dolphins were located in the west of the site. For the October survey, almost all common dolphins were recorded in one

dense group in the east-northeast of the site and the remainder were located in a small group also in the east-northeast.

6.26 Common Bottlenose Dolphin

Common bottlenose dolphins were recorded in the August II 2021 survey only, consisting of three submerged dolphins located together in the south of the site.

6.27 Dolphin species – unidentified

Unidentified dolphins were recorded in the July, September I, and October 2021 surveys. These consisted of three submerged dolphins in the July survey, two submerged in the September I survey, and ten submerged in the October survey. For the July survey, all three unidentified dolphins were located in the south of the Survey Area, and for September I, the two dolphins were located in the southwest of the buffer. For the October survey, unidentified dolphins were all located in the east-northeast of the Survey Area.

6.28 Harbor Porpoise

Harbor porpoises were recorded in the October 2021 survey only, consisting of two submerged porpoises located in the east-northeast of the buffer.

6.29 Marine Mammal species – unidentified

A single unidentified marine mammal was recorded in the July survey, consisting of one submerged individual located in the south of the site.

6.30 Mahi-mahi

Mahi-mahi were recorded in the August II and September I 2021 surveys only, consisting of one submerged individual in the August II survey, and one submerged individual in the September I survey. For the August II survey, the single mahi-mahi was located in the south of the site, and for the September I survey, the single mahi-mahi was located in the southwest center of the site.

6.31 Ocean Sunfish

Ocean sunfish were recorded in the July, August I and II, September I and II, and October 2021 surveys. These consisted of one submerged ocean sunfish in the July survey, three submerged fish in both the August I and II survey, two submerged fish in the September I survey, 19 submerged fish in the September II survey, and three submerged fish in the October survey. For the July survey, the single ocean sunfish was located in the north-northeast of the buffer, and for the August I and II, September I and II, and October surveys, ocean sunfish were loosely distributed across the extent of the Survey Area.

6.32 Sharptail Sunfish

A single sharptail sunfish was recorded in the October 2021 survey, located in the southwest of the 10 km buffer.

6.33 Sunfish species – unidentified

Unidentified sunfish species were recorded in the July and September II surveys only, consisting of three submerged sunfish in July, and one submerged sunfish in the September II survey. For the July survey, two sunfish were located in the north and northeast of the site, and one was located in the south of the site, and for the September II survey, the single sunfish was located in the north-northeast of the site.

6.34 Atlantic Bluefin Tuna

Atlantic bluefin tuna were recorded in the August II survey only, consisting of three submerged tuna located in the north of the site.

6.35 Tuna species – unidentified

Unidentified tuna were recorded in the July, August II, and September II 2021 surveys. These consisted of five submerged tuna in the July survey, four submerged tuna in the August II survey, and four submerged in the September II survey. For the July survey, all unidentified tuna were loosely distributed in the north of the Survey Area, and for the August II survey, tuna were predominantly distributed in the north of the Survey Area, with one individual in the south of the buffer. For the September II survey, all unidentified tuna were located in the west of the buffer.

6.36 Billfish species – unidentified

Unidentified billfish were recorded in the July, August II, and September I 2021 surveys. These consisted of 17 submerged billfish in the July survey, and one submerged billfish in both the August II and September I surveys. For the July survey, unidentified billfish were predominantly distributed in the north-northeast of the buffer with looser distribution across the Survey Area thereafter. For the August II survey, the single billfish was located in the northeast of the buffer, and for the September I survey the single billfish was located in the northwest of the buffer.

6.37 Common Thresher Shark

Common thresher sharks were recorded in the July and August II 2021 surveys only. These consisted of three submerged thresher sharks in the July survey, and one submerged thresher shark in the August II survey. For the July survey, all three thresher sharks were located from the center to the northeast of the site, and for the August II survey, the single common thresher shark was located in the east of the site.

6.38 Silky Shark

A single silky shark was recorded in the August II survey, consisting of one submerged individual located in the south-southeast of the buffer.

6.39 Dusky Shark

Dusky sharks were recorded in the July and August II surveys only, consisting of one submerged dusky shark in the July survey, and three submerged sharks in the August II survey. For the July survey, the single dusky shark was located in the northeast of the site, and for the August II survey, two sharks were located in the east of the buffer, and one was located in the north of the buffer.

6.40 Sandbar Shark

Sandbar sharks were recorded in the July, August I, and August II 2021 surveys. These consisted of two submerged sandbar sharks in the July survey, one submerged shark in the August I survey, and five submerged sharks in the August II survey. For the July survey, one sandbar shark was located northeast of the center of the site, and one was located in the north of the buffer. For the August I survey, the single shark was located in the northeast of the site, and for the August II survey, sandbar sharks were loosely distributed across the Survey Area, predominantly in the buffer.

6.41 Tiger Shark

Tiger sharks were recorded in the August II and September II 2021 surveys only, consisting of one submerged tiger shark in the west of the site for the August II survey, and one submerged tiger shark in the west-southwest of the site for the September II survey.

6.42 Blue Shark

Blue sharks were recorded in all six of the fall 2021 surveys. These consisted of 18 submerged blue sharks in the July survey, one submerged shark in the August I survey, seven submerged sharks in the August II survey, five submerged sharks in the September I survey, one submerged shark in the September II survey, and two submerged sharks in the October survey. For the July survey, blue sharks were located around the center to northwest and north of the Survey Area. For the August I survey, the single blue shark was located in the northeast of the buffer and for the August II survey, blue sharks were loosely distributed across the Survey Area. For the September I survey, blue sharks were loosely distributed across the southern half of the Survey Area, and for the September II survey, the single blue shark was located in the north of the buffer. For the October survey, one blue shark was located in the west of the site, and one was located in the northeast of the buffer.

6.43 Carcharhinidae Shark species – unidentified

Unidentified Carcharhinidae shark species were recorded in the July, August I, and October 2021 surveys. These consisted of seven submerged sharks in the July survey, four submerged sharks in the August I survey, and one submerged shark in the October survey. For the July survey, unidentified Carcharhinidae sharks were loosely distributed in the northern half of the

Survey Area. For the August I survey, sharks were located in the center to southwest of the site, and for the August II survey, sharks were loosely distributed from the north to the southeast of the Survey Area, predominantly in the buffer. For the September I survey, one shark was located in the north of the site, and one was located in the northeast of the buffer, and for the October survey, one shark was located in the northeast of the buffer.

6.44 Basking Shark

A single submerged basking shark was recorded in the July survey, located in the northeast of the buffer.

6.45 White Shark

White sharks were recorded in the July, August II, September I, and September II 2021 surveys. These consisted of three submerged sharks in July, four submerged sharks in the August II survey, two submerged sharks in the September I survey, and one submerged shark in the September II survey. For the July survey, two white sharks were located in the east of the Survey Area, and one was located in the north of the buffer, and for the August II survey, white sharks were loosely distributed around the center of the Survey Area. For the September I survey, one white shark was located in the center of the site, and one white shark was located in the north-northeast of the buffer, and for the September II survey, the single white shark was located in the southwest of the site.

6.46 Shortfin Mako

Shortfin makos were recorded in the July and August II 2021 surveys only, consisting of two submerged shortfin makos in the July survey, and one submerged mako in the August II survey. For the July survey, one shortfin mako was located in the north of the buffer, and one was located in the northeast of the buffer. For the August II survey the shortfin mako was located in the northeast of the buffer.

6.47 Whale Shark

A single whale shark was recorded in the July survey, consisting of one submerged whale shark located in the north-northeast of the buffer.

6.48 Scalloped Hammerhead

Scalloped hammerheads were recorded in the July, August II, and September I surveys. These consisted of one submerged scalloped hammerhead in the southwest of the buffer, one submerged hammerhead located in the west of the site, and one hammerhead located to the southwest of the center of the site.

6.49 Hammerhead Shark species – unidentified

Unidentified hammerhead sharks were recorded in the July, August I, and August II 2021 surveys. These consisted of two submerged sharks in the July survey, two submerged sharks in the August I survey, and four submerged sharks in the August II survey. For the July survey,

both unidentified hammerhead sharks were located in the southwest of the buffer, and for the August I survey, one hammerhead was located in the north of the buffer, and one was located in the south of the site. For the August II survey, two hammerheads were located in the east of the site, and one hammerhead was located in the west of the site and one in the west of the buffer.

6.50 Shark species – unidentified

Unidentified sharks were recorded in all six of the fall 2021 surveys. These consisted of 21 submerged unidentified sharks in the July survey, four submerged sharks were recorded in the August I survey, 48 submerged sharks were recorded in the August II survey, six submerged sharks were recorded in the September I survey, two submerged sharks were recorded in the September II survey, and two submerged sharks were recorded in the October survey. For all surveys, unidentified sharks were loosely distributed across the extent of the Survey Area, though for the August II survey, the majority of sharks were located in the east of the buffer.

7. Vessel Observations

Two vessels, identified as recreational vessels, were recorded in the imagery during the July 2021 survey. No vessels were recorded in the imagery for the August I 2021, August II 2021, September I 2021, September II 2021, or October 2021 surveys.

One vessel identified as a supply vessel was recorded visually from the aircraft during the September II 2021 survey. No vessels were recorded visually from the aircraft from the July 2021, August I 2021, August II 2021, September I 2021, or October 2021 surveys.

8. Survey Completion Dates

Table 8 provides the survey dates for all completed surveys to date: March to October 2021 inclusive, the latter half of which are awaiting data finalization.

Table 8 Survey dates for completed surveys to date

Survey Number	Survey Month	Survey Dates
Survey 17	March	March 3 rd
Survey 18	April	April 2 nd
Survey 19		April 18 th
Survey 20	May	May 9 th
Survey 21		May 16 th
Survey 22	June	June 2 nd
Survey 23	July	July 27 th
Survey 24	August	August 6 th
Survey 25		August 17 th
Survey 26	September	September 7 th
Survey 27		September 20 th
Survey 28	October	October 14 th

9. Summary of Results

9.1 July 2021

A total of 212 birds were recorded in the Survey Area in the July 2021 survey. The most abundant group recorded was storm petrels (n=124). This was followed by shearwaters (n=78), gulls (n=9), and unidentified bird species (n=1).

A total of 157 birds (74%) were recorded in flight during this survey. These consisted of storm petrel species (n=124), Cory's shearwater (n=22), great shearwater (n=6), great black-backed gull (n=3), herring gull (n=1), and small shearwater species (n=1). There were 55 birds (26%) recorded as sitting.

A total of six marine mammals were recorded, consisting of unidentified dolphin species (n=2), common dolphin (n=2), and unidentified marine mammal species (n=1). Of the six marine mammals recorded, five were recorded as submerged, and one was recorded as surfacing. Additionally, 26 large bony fish were recorded, consisting of unidentified billfish species (n=17), unidentified tuna species (n=5), unidentified sunfish species (n=3), and ocean sunfish (n=1), and 62 sharks were recorded, consisting of unidentified shark species (n=21), blue shark (n=18), unidentified Carcharhinidae shark species (n=7), common thresher shark (n=3), white shark (n=3), sandbar shark (n=2), shortfin mako (n=2), unidentified hammerhead shark species (n=2), dusky shark (n=1), basking shark (n=1), whale shark (n=1), and scalloped hammerhead shark (n=1).

9.2 August I 2021

A total of 39 birds were recorded in the Survey Area in the August I 2021 survey. The most abundant group recorded was shearwaters (n=35). This was followed by storm petrels (n=2), gulls (n=1), and skuas (n=1).

A total of 30 birds (77%) were recorded in flight during this survey. These consisted of Cory's shearwater (n=13), great shearwater (n=12), storm petrel species (n=2), herring gull (n=1), great skua (n=1), and large shearwater species (n=1). There were 9 birds (23%) recorded as sitting.

One turtle was recorded, consisting of leatherback turtle (n=1), and a total of three large bony fish were recorded, consisting of ocean sunfish (n=3) only. Additionally, a total of twelve sharks were recorded, consisting of unidentified Carcharhinidae shark species (n=4), unidentified shark species (n=4), unidentified hammerhead shark species (n=2), sandbar shark (n=1), and blue shark (n=1). No marine mammals were recorded during the August I survey.

9.3 August II 2021

A total of 229 birds were recorded in the Survey Area in the August II 2021 survey. The most abundant group recorded was storm petrels (n=93). This was followed by shearwaters (n=80), shorebirds (n=40), gulls (n=13), and terns (n=3).

A total of 129 birds (56%) were recorded in flight during this survey. These consisted of storm petrel species (n=93), great shearwater (n=19), Cory's shearwater (n=7), herring gull (n=5), 'commic' / Forster's tern (n=3), laughing gull (n=1), and lesser black-backed gull (n=1). There were 100 birds (44%) recorded as sitting.

A total of six marine mammals were recorded, consisting of common bottlenose dolphin (n=3), common dolphin (n=2), and unidentified seal species (n=1). Of the six marine mammals recorded, five were recorded submerged, and one was recorded surfacing.

9.4 September I 2021

A total of 14 birds were recorded in the Survey Area in the September I 2021 survey. The most abundant group recorded was shorebirds (n=6). This was followed by shearwaters (n=3), gannets (n=2), gulls (n=1), storm petrels (n=1), and unidentified birds (n=1).

A total of three birds (79%) were recorded in flight during this survey. These consisted of Cory's shearwater (n=1), storm petrel species (n=1), and unidentified bird species (n=1). There were 11 birds (21%) recorded as sitting.

A total of 97 marine mammals were recorded, consisting of common dolphin (n=95), and unidentified dolphin species (n=2). Of the 97 marine mammals recorded, all 97 were submerged. Additionally, two turtles were recorded, consisting of loggerhead turtle (n=1), and Kemp's ridley turtle (n=1), and four large bony fish were recorded, consisting of ocean sunfish (n=2), mahi-mahi (n=1), and unidentified billfish species (n=1). A further 16 sharks were also recorded, consisting of unidentified shark species (n=6), blue shark (n=5), unidentified Carcharhinidae shark species (n=2), white shark (n=2), and scalloped hammerhead shark (n=1).

9.5 September II 2021

A total of 16 birds were recorded in the Survey Area in the September II 2021 survey. The most abundant group recorded was gulls (n=11). This was followed by shearwaters (n=3), auks (n=1), and unidentified birds (n=1).

A total of 10 birds (62%) were recorded in flight during this survey. These consisted of herring gull (n=4), great black-backed gull (n=3), and great shearwater (n=3). There were six birds (38%) recorded as sitting.

A total of three marine mammals were recorded, consisting of common dolphin (n=3) only. Of the three marine mammals recorded, two were submerged, and one was recorded surfacing. Additionally, 24 large bony fish were recorded, consisting of ocean sunfish (n=19), unidentified tuna species (n=4), and unidentified sunfish species (n=1), and five sharks, consisting of unidentified shark species (n=2), tiger shark (n=1), blue shark (n=1), and white shark (n=1) were also recorded.

9.6 October 2021

A total of 30 birds were recorded in the Survey Area in the October 2021 survey. The most abundant group recorded was gulls (n=29). This was followed by shearwaters (n=1).

A total of eight birds (27%) were recorded in flight during this survey. These consisted of herring gull (n=4), laughing gull (n=1), great black-backed gull (n=1), lesser black-backed gull (n=1), and small shearwater species (n=1). There were 22 birds (73%) recorded as sitting.

A total of 136 marine mammals were recorded, consisting of common dolphin (n=123), unidentified dolphin species (n=10), harbor porpoise (n=2), and unidentified seal species (n=1). Of the 136 marine mammals recorded, all were submerged. Additionally, eight turtles were recorded, consisting of leatherback turtle (n=8), and four large bony fish were recorded, consisting of ocean sunfish (n=3), and sharptail sunfish (n=1). A further five sharks were recorded, consisting of blue shark (n=2), unidentified shark species (n=2), and unidentified Carcharhinidae shark species (n=1).

10. Discussion

For the purposes of this report, a direct comparison has been made between the year one results for July to October 2020 and the results from the corresponding surveys for the second year (July to October 2021).

Overall, the year two fall surveys (July 2021, August I and II 2021, September I and II 2021, and October 2021) recorded marginally less avian numbers in total when compared with the equivalent year one surveys (July 2020, August I and II 2020, September I and II 2020, and October 2020), with a total of 540 recorded for the year two surveys compared with the 561 recorded for the year one surveys. Of the six survey months, only two featured a greater total for the second year, and the remaining four featured greater totals from the first year. Seven species groups exhibited greater numbers during the year one surveys, consisting of waterfowl (2020 n=3; 2021 n=0), skuas (2020 n=3; 2021 n=1), gulls (2020 n=167; 2021 n=64), fulmars (2020 n=3; 2021 n=0), shearwaters (2020 n=335; 2021 n=200), gannets (2020 n=3; 2021 n=2), and passerines (2020 n=22; 2021 n=0), whilst four species groups exhibited greater numbers during the year two surveys, consisting of shorebirds (2020 n=13; 2021 n=46), auks (2020 n=0; 2021 n=1), storm petrels (2020 n=9; 2021 n=220), and unidentified birds (2020 n=0; 2021 n=3). Terns exhibited equal numbers between both years. Waterfowl were only recorded in the year one surveys, with a total of three records from the October I 2020 survey, alongside fulmars (n=3) from the September I 2020 survey, and passerines (n=22) from the September II (n=1) and October (n=21) 2020 surveys. Auks were only recorded in the year two surveys, with a total of one record from the September II 2021 survey, alongside unidentified birds (n=3), from the July (n=1), September I (n=1), and September II (n=1) 2021 surveys.

The most notable differences apparent between the two years of spring surveys were exhibited by storm petrels, gulls, shearwaters, and to a lesser extent shorebirds. A total of nine storm petrels were recorded in the year one surveys compared with the 220 recorded for the year two surveys, with the majority occurring in the July II (n=124), and August II (n=93) 2021 surveys. Gulls also exhibited a noticeable difference in numbers between the two years, though to a lesser degree than storm petrels, with 167 gulls recorded in the year one surveys, and 64 gulls recorded in the year two surveys. As with gulls, shearwaters exhibited a similar ratio in the difference in totals recorded between the year one and year two surveys, with 335 shearwaters recorded in the year one surveys, and 200 recorded in the year two surveys. Whilst shorebirds more than doubled in number from the year one surveys (n=13) to the year two surveys (n=46), a smaller overall total of shorebirds, such as the ESA threatened species of red knot and piping plover was recorded when compared to the three previous species groups and so the ratio by which it changed was less notable between the two years.

An equal number of terns were recorded between the year one (n=3) and year two (n=3) surveys, though a difference in the months recorded was apparent. Two terns were recorded in the August I 2020 survey and one tern was recorded in the October I 2020 survey for year one, and all three terns were recorded in the August II 2021 survey for year two. This is in line with expectations, as the migration of roseate terns was the instigating factor in the decision to fly bimonthly surveys in August and September. Despite no terns being recorded in September, the presence of a tern in the October survey in year one shows the value in capturing a broad dataset. The presence of two roseate tern breeding colonies along the Massachusetts coast, at the sites of Bird Island and Ram Island (**Figure 14**), highlights the importance of monitoring potential passage through the Survey Area. No roseate terns were identified during the year two Fall surveys, though during the year one surveys, a single unidentified *Sterna* tern was recorded which has the possibility to have been a roseate tern, though this would only be considered as a particularly cautious proposal. Overall, the majority

of terns recorded between the two fall survey years were composed of common, Arctic, or Forster's terns (n=5).

Other avian observations include the presence of scoters (n=3) and fulmars (n=3) in the year one surveys, compared with their absence in the year two surveys, with the opposite true of auks which were only recorded in the year two surveys (n=1). Additionally, migratory passerines (n=22) were recorded during the year one surveys, with no such activity recorded during the year two surveys, though the presence of passerines is not a commonly expected occurrence during offshore aerial surveying. Likewise unidentified birds were recorded in one survey year only, namely the year two surveys. The year has no influence on the image quality and ability to identify the targets, rather it is due to a combination of targets being on the image periphery along with odd positioning of the bird (for example splashing or heavy banking in flight distorting the image). These factors combined made it difficult to confidently identify three targets to a particular grouping.

Unlike with birds, marine mammals were recorded in greater numbers during the year two surveys (n=248) compared with the year one surveys (n=23), with the same also being the case for turtles (2020 n=2; 2021 n=12). Large bony fish, sharks, and rays, all exhibited greater numbers in the year one surveys though (n=433, n=216, and n=1 respectively), when compared with the year two surveys (n=73, n=192, and n=0). For marine mammals, a considerable increase in common dolphin records, particularly in the September I 2021 (n=95) and October 2021 (n=123) surveys, resulted in the noticeable difference in marine mammal numbers between the survey years. A large number of unidentified tuna (n=243) recorded in the August II 2020 survey similarly accounted for the considerable difference between the total large bony fish recorded in the year one surveys compared with the year two surveys. For sharks and rays, the total numbers between survey years were more similar than those of marine mammals and large bony fish, and though whilst turtles did exhibit greater numbers in the year two surveys, the proportion of increase was less extensive than that offered by marine mammals and large bony fish.

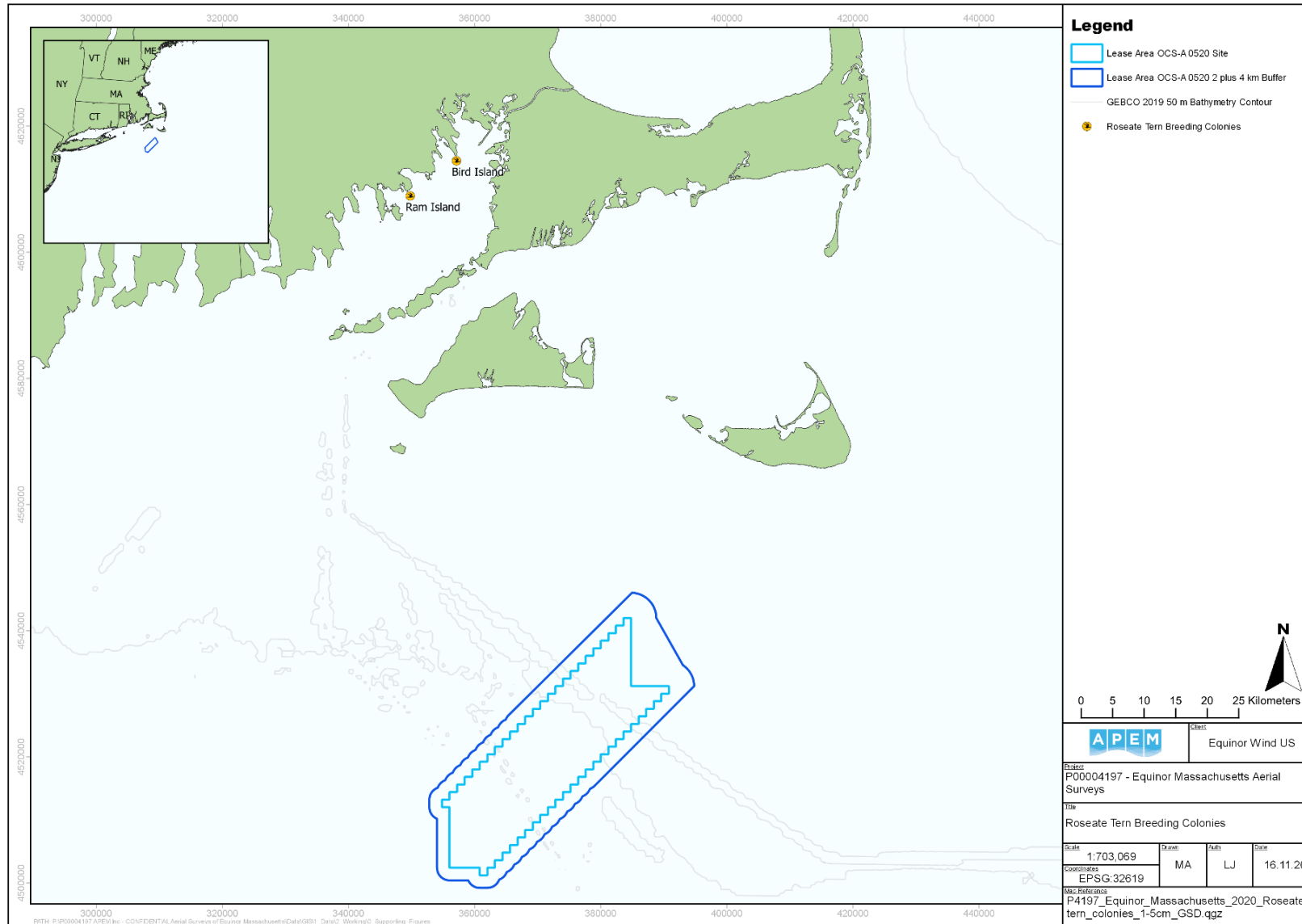


Figure 14 Massachusetts roseate tern breeding colony locations relative to Lease Area OCS-A 0520

Appendix I Species List

Common Name	Scientific Name	Family	Class
Red-necked Phalarope	<i>Phalaropus lobatus</i>	Scolopacidae	Aves
Red Phalarope	<i>Phalaropus fulicarius</i>	Scolopacidae	Aves
Great Skua	<i>Stercorarius skua</i>	Stercorariidae	Aves
Common Murre	<i>Uria aalge</i>	Alcidae	Aves
Thick-billed Murre	<i>Uria lomvia</i>	Alcidae	Aves
Razorbill	<i>Alca torda</i>	Alcidae	Aves
Laughing Gull	<i>Leucophaeus atricilla</i>	Laridae	Aves
Herring Gull	<i>Larus argentatus</i>	Laridae	Aves
Lesser Black-backed Gull	<i>Larus fuscus</i>	Laridae	Aves
Great Black-backed Gull	<i>Larus marinus</i>	Laridae	Aves
Large Gull species	<i>Larus spp.</i>	Laridae	Aves
Gull species	-	Laridae	Aves
Common Tern	<i>Sterna hirundo</i>	Laridae	Aves
Arctic Tern	<i>Sterna paradisaea</i>	Laridae	Aves
Forster's Tern	<i>Sterna forsteri</i>	Laridae	Aves
Storm Petrel species – unidentified	-	Hydrobatidae / Oceanitidae	Aves
Cory's Shearwater	<i>Calonectris borealis</i>	Procellariidae	Aves
Great Shearwater	<i>Ardenna gravis</i>	Procellariidae	Aves
Sooty Shearwater	<i>Ardenna grisea</i>	Procellariidae	Aves
Small Shearwater species – unidentified	-	Procellariidae	Aves
Large Shearwater species – unidentified	-	Procellariidae	Aves
Shearwater species – unidentified	-	Procellariidae	Aves
Northern Gannet	<i>Morus bassanus</i>	Sulidae	Aves
Bird species – unidentified	-	-	Aves
Loggerhead Turtle	<i>Caretta caretta</i>	Cheloniidae	Reptilia
Kemp's Ridley Turtle	<i>Lepidochelys kempi</i>	Cheloniidae	Reptilia
Leatherback Turtle	<i>Dermochelys coriacea</i>	Dermochelyidae	Reptilia
Seal species – unidentified	-	Phocidae	Mammalia
Common Dolphin	<i>Delphinus delphis</i>	Delphinidae	Mammalia
Common Bottlenose Dolphin	<i>Tursiops truncatus</i>	Delphinidae	Mammalia
Dolphin species – unidentified	-	Delphinidae	Mammalia
Harbor Porpoise	<i>Phocoena phocoena</i>	Phocoenidae	Mammalia
Marine Mammal species – unidentified	-	-	Mammalia
Mahi-mahi	<i>Coryphaena hippurus</i>	Coryphaenidae	Actinopterygii
Ocean Sunfish	<i>Mola mola</i>	Molidae	Actinopterygii
Sharptail Sunfish	<i>Masturus lanceolatus</i>	Molidae	Actinopterygii
Atlantic Bluefin Tuna	<i>Thunnus thynnus</i>	Scombridae	Actinopterygii
Tuna species – unidentified	-	Scombridae	Actinopterygii
Billfish species – unidentified	-	-	Actinopterygii
Common Thresher Shark	<i>Alopias vulpinus</i>	Alopiidae	Chondrichthyes
Silky Shark	<i>Carcharhinus falciformis</i>	Carcharhinidae	Chondrichthyes
Dusky Shark	<i>Carcharhinus obscurus</i>	Carcharhinidae	Chondrichthyes
Sandbar Shark	<i>Carcharhinus plumbeus</i>	Carcharhinidae	Chondrichthyes
Tiger Shark	<i>Galeocerdo cuvier</i>	Carcharhinidae	Chondrichthyes
Blue Shark	<i>Prionace glauca</i>	Carcharhinidae	Chondrichthyes
Carcharhinidae Shark species – unidentified	-	Carcharhinidae	Chondrichthyes
Basking Shark	<i>Cetorhinus maximus</i>	Cetorhinidae	Chondrichthyes
White Shark	<i>Carcharodon carcharias</i>	Lamnidae	Chondrichthyes
Shortfin Mako	<i>Isurus oxyrinchus</i>	Lamnidae	Chondrichthyes
Whale Shark	<i>Rhincodon typus</i>	Rhincodontidae	Chondrichthyes
Scalloped Hammerhead Shark	<i>Sphyrna lewini</i>	Sphyrnidae	Chondrichthyes
Hammerhead Shark species – unidentified	<i>Sphyrna spp.</i>	Sphyrnidae	Chondrichthyes
Shark species – unidentified	-	-	Chondrichthyes