NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

APEM

Environmental Imaging Solutions

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

Quarterly Report: March 2020 to May 2020

Equinor Wind US

APEM Ref: P00004197

Issued December 2020

Matthew Arundale, Abigail Goulding, Simon Warford, Julia Robinson Wilmott, Laura Jervis

Client:	**Scott Lundin, Dave Phillips**
Address:	**Equinor Wind US** **1 Lincoln Street** **Boston** **Massachusetts** **02111**
Project reference:	**P00004197**
Date of issue:	**December 2020**

Project Director:	**Stuart Clough**
Project Manager:	**Laura Jervis**
Key Contributors:	**Matthew Arundale, Abigail Goulding, Katie St John Glew, Simon Warford, Julia Robinson-Willmott (Normandeau Associates)**

APEM Inc.
2603 NW 13th Street
#402
Gainesville
Florida
FL 32609

Tel: (352) 559-9155

Document number of the corporation: P15000019267

Normandeau-APEM (2020). Digital Aerial Wildlife Surveys of BOEM Lease Area OCS-A 520: March 2020 to May 2020. Scientific Quarterly Report P00004197-02. Equinor Wind US, 12/01/2020, v3.0 Final, 29 pp.

Revision and Amendment Register

Version Number	Date	Section(s)	Page(s)	Summary of Changes	Approved by
1.0	10/26/20	All	All	Creation	MA / AG
1.1	11/05/20	All	All	Internal Review	LJ
2.0	11/16/20	9-10	28-29	Amendments following client review	MA / LJ
2.1	11/17/20	10	28	Adjustments for clarity	MA
3.0 Final	12/01/20	All	All	Amendments following client review	DP

Contents

List of Figures

List of Tables

1. Executive Summary

- 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 in March, April, and May 2020 using APEM Inc.'s high-resolution camera system to capture digital still imagery.

- 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 surveys are presented here.

- A total of 680 birds and 20 marine mammals were recorded in the survey area in March 2020. The most abundant group recorded was auks (n=498). This was followed by waterfowl (n=146); gulls (n=22); seals (n=15); fulmars (n=9); gannets (n=3) and porpoises (n=3); and cormorants (n=1), loons (n=1), dolphins (n=1), and unidentified marine mammals (n=1).

- A total of 1,048 birds, 39 marine mammals, and 5 sharks were recorded in the survey area for the April I survey. The most abundant group recorded was auks (n=806). This was followed by waterfowl (n=136); fulmars (n=47); gulls (n=42); seals (n=13) and porpoises (n=13); dolphins (n=11); loons (n=9); gannets (n=8); sharks (n=5); and whales (n=1) and unidentified marine mammals (n=1).

- A total of 1,298 birds, 46 marine mammals, and one shark were recorded in the survey area for the April II survey. The most abundant group recorded was loons (n=853). This was followed by auks (n=233); waterfowl (n=96); gannets (n=86); porpoises (n=34); gulls (n=23); unidentified marine mammals (n=7); terns (n=5) and seals (n=5); storm-petrels (n=2); and sharks (n=1).

- A total of 121 birds and eleven marine mammals were recorded in the survey area for the May I survey. The most abundant group recorded was terns (n=52). This was followed by loons (n=31); waterfowl (n=15), gannets (n=11), gulls (n=11), porpoises (n=7), seals (n=2), unidentified marine mammals (n=2), and fulmar (n=1).

  Roseate terns and Sterna terns were recorded during the May I survey. These are Listed Species (Federally listed or State Listed as Threatened or Endangered). Unidentified Sterna tern species have been grouped as Listed Species in order to cover the potential for the individuals to be roseate terns, which are Listed.

- A total of 122 birds were recorded in the Survey Area in May II 2020. The most abundant group recorded was shearwaters (n=105). This was followed by gulls (n=10), storm petrels (n=5) and loons (n=2).

- No turtles or rays were recorded during the March 2020, April I 2020, April II 2020, May I 2020 or May II 2020 surveys.

2. Introduction

APEM and Normandeau were contracted by Equinor Wind US (hereafter referred to as Equinor) to provide a full year of digital aerial wildlife surveys of the Massachusetts Lease Area OCS-A 0520. Surveys will be carried out on a monthly basis from December 2019 through November 2020, except for April, May, August and September, when two surveys per month shall be 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, sharks, rays, and turtles present in the Lease Area OCS-A 0520 over the course of a full year. 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 March 2020, April 2020, and May 2020 surveys.

This is the second of three quarterly progress reports to summarize the information collected following the completion of five aerial surveys of the Survey Area: March 2020, April 2020 (two surveys), and May 2020 (two surveys).

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 surveys that have not yet been undertaken or reported (July 2020 to November 2020), the currently planned provisional survey windows have been provided in Section 8.

The reports that are remaining as part of the requirements of Equinor are as follows.

- Third Quarterly Report to summarize data collected from the completed surveys: June 2020, July 2020, and August 2020 (two surveys); and
- Annual Report to provide detailed information comprising the full 16 surveys of aerial survey data collected December 2019 to November 2020 inclusive.

3. Summary of Surveys

Surveys have been undertaken for March 2020 to May 2020 inclusive, with two surveys undertaken for both April and May.

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 at a speed of approximately 120 knots. Coverage of images analyzed was calculated to be approximately 10% of the survey area, as contracted.

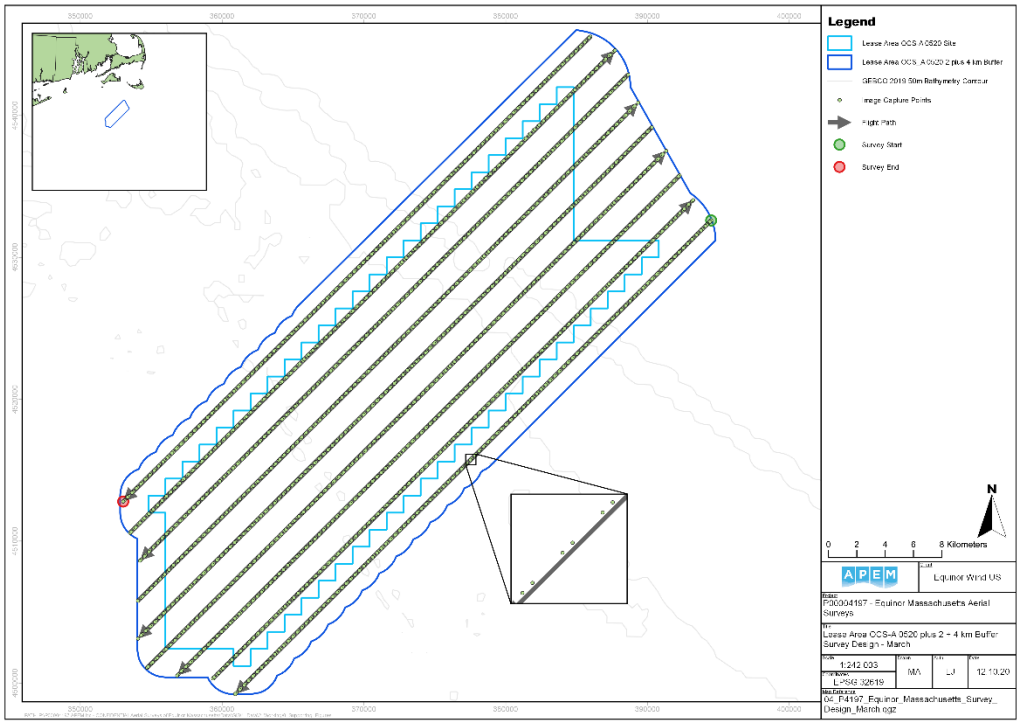

Figure 1 Flight lines and image capture points of the Survey Area for March 2020

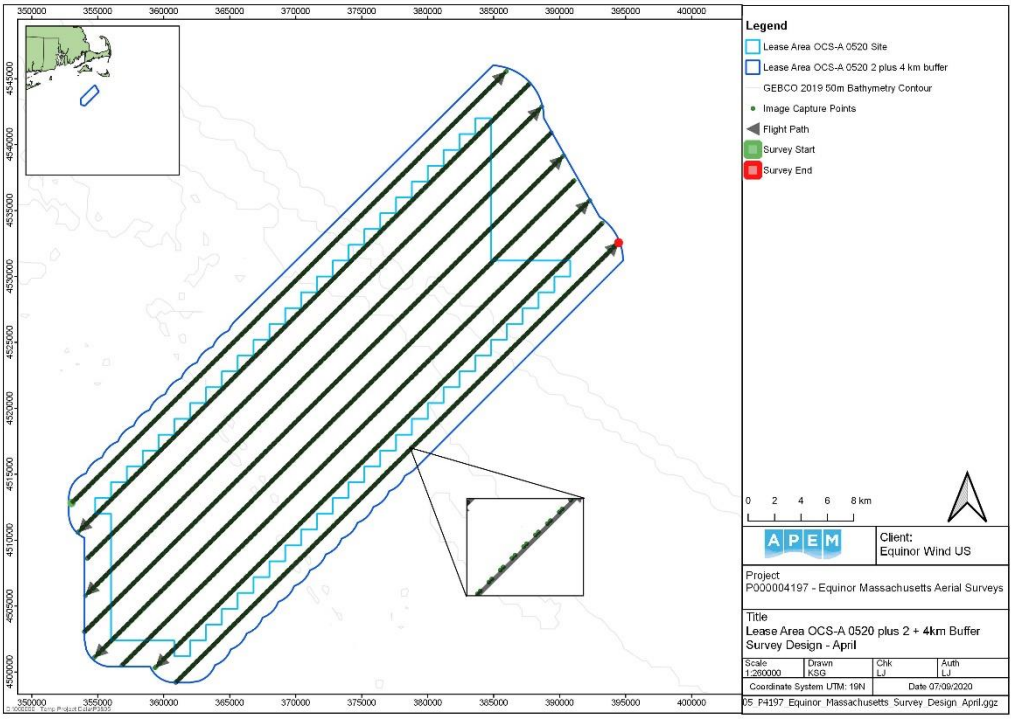

Figure 2 Flight lines and image capture points of the Survey Area for April I 2020

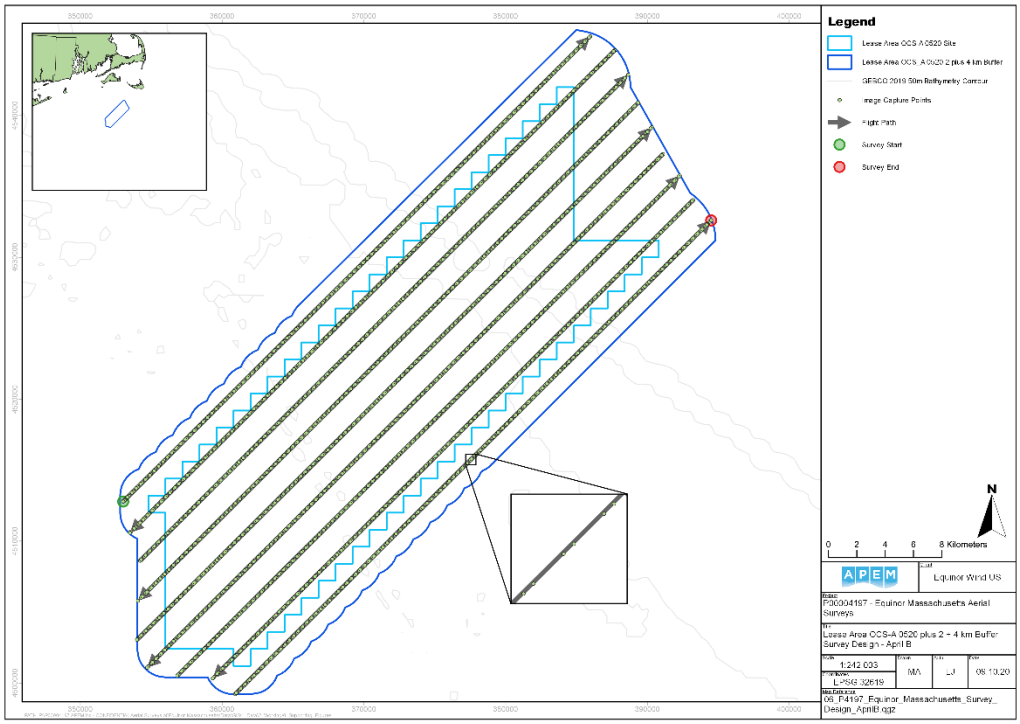

Figure 3 Flight lines and image capture points of the Survey Area for April II 2020

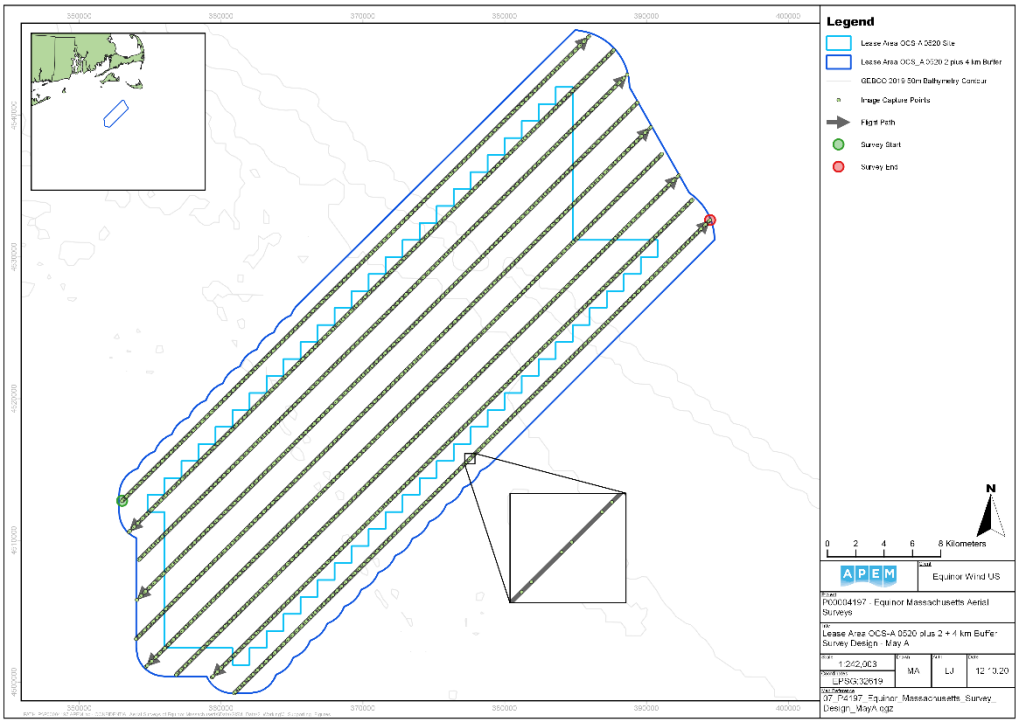

Figure 4 **Flight lines and image capture points of the Survey Area for May I 2020**

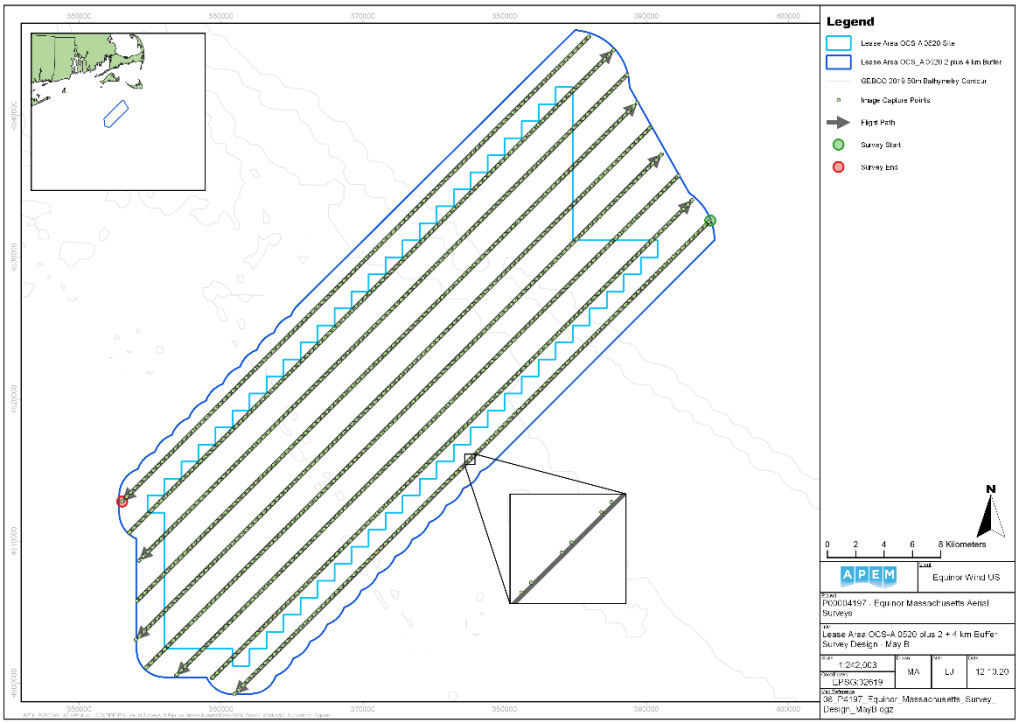

Figure 5 **Flight lines and image capture points of the Survey Area for May II 2020**

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.

Table 1 **Date and start and end time (Coordinated Universal Time; UTC) for each flight for the March 2020 to May 2020 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 04	03-08-20	1	17:31	19:33
Survey 05	04-07-20	1	13:27	15:27
Survey 06	04-25-20	1	13:56	15:51
Survey 07	05-05-20	1	14:33	16:24
Survey 08	05-31-20	1	17:47	19:42

Table 2 **Weather conditions recorded for each of the March 2020 to May 2020 surveys**

Survey	Date	Sea State	Turbidity	Wind Speed (knots) / Direction	Cloud Cover (%)	Visibility (km)	Air Temp (ºF)
Survey 04	03-08-20	2-3	1	12-20 WNW	0-5	> 10 km	38-43
Survey 05	04-07-20	2	1	25 NW	5-20	> 10 km	47-50
Survey 06	04-25-20	2	1	8 NW	5-20	> 10 km	50-51
Survey 07	05-05-20	3	1-2	25 NW	0	> 10 km	43-44
Survey 08	05-31-20	1-2	1	22-24 N	0	> 10 km	57-59

Table 3 **Image number and coverage for each of the March 2020 to May 2020 surveys**

Survey	Image Number	Coverage (%)
Survey 04	12,048	11.85
Survey 05	12,048	11.85
Survey 06	12,048	11.85
Survey 07	12,048	11.85
Survey 08	12,048	11.85

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, sharks, rays, turtles. Birds and marine fauna identified from the images were 'snagged' (i.e. located within the images) and categorised usually to species, but sometimes to the species grouping. The results of the QA are provided in Tables 4 and 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 04	11,600	1,160	5	99.57
Survey 05	11,521	1,153	4	99.65
Survey 06	11,241	1,125	12	98.93
Survey 07	11,976	1,198	9	99.25
Survey 08	11,657	1,166	7	99.40

Table 5 The number of individuals that were found during QC

Survey	Order Found by QC	Number of individuals
Survey 04	Avian	9
	Marine Mammal	1
Survey 05	Avian	4
Survey 06	Avian	10
	Fish	1
	Fish Shoal	1
Survey 07	Avian	8
	Marine Mammal	1
Survey 08	Avian	2
	Fish Shoal	4
	Buoy	1

5. Abundance and Distribution

Data reported are raw counts of animals that have not yet been subject to extrapolation for population estimates. Design-based population estimates will be provided in the annual report following the completion of the November 2020 survey.

Species scientific names are provided in Appendix 1 Species List.

5.1 Avian Abundance

For March 2020, April I 2020, April II 2020, May I 2020, and May II 2020, totals of 680, 1048, 1298, 121 and 122 birds were recorded respectively (**Table 6**). Birds mostly comprised of murres / razorbills (n=925 in total across March to May 2020) and red-throated loons (n=812) were the second most abundant species. Thereafter, the following species were recorded: Atlantic puffins (n=318), white-winged scoters (n=301), common / thick-billed murres (n=142), northern gannets (n=108), razorbills (n=86), long-tailed ducks (n=73), unidentified auk species (n=66), sooty shearwater (n=61), common loon (n=60), northern fulmar (n=57), herring gulls (n=45), great black-backed gulls (n=34), unidentified Sterna tern species (n=34), unidentified loon species (n=24), unidentified shearwater sp. (n=17), 'commic' / Forster's tern (n=15), great shearwater (n=14), Cory's shearwater (n=13), Bonaparte's gull (n=12), unidentified small gull species (n=12), unidentified scoter species (n=10), unidentified duck species (n=6), Wilson's storm petrel (n=5), common tern (n=5), roseate tern (n=3), black scoter (n=2), unidentified storm petrel (n=2), laughing gull (n=2) and lesser black-backed gull (n=2). Single individuals of surf scoter, unidentified cormorant species and black-legged kittiwake were also recorded.

Table 6 Total number of birds recorded within the Survey Area during the March 2020, April 2020, and May 2020 surveys

Group	Species	Mar-20			Apr-20 Survey I			Apr-20 Survey II				May-20 Survey I			May-20 Survey II		
		Flying	Sitting	Total	Flying	Sitting	Total	Flying	Sitting	Diving	Total	Flying	Sitting	Total	Flying	Sitting	Total
Waterfowl	Surf Scoter	-	1	**1**	-	-	**-**	-	-	-	**-**	-	-	**-**	-	-	**-**
	White-winged Scoter	3	112	**115**	8	70	**78**	4	89	-	**93**	-	15	**15**	-	-	**-**
	Black Scoter	-	-	**-**	-	2	**2**	-	-	-	**-**	-	-	**-**	-	-	**-**
	Scoter sp. – unidentified	-	-	**-**	-	10	**10**	-	-	-	**-**	-	-	**-**	-	-	**-**
	Long-tailed Duck	22	5	**27**	-	46	**46**	-	-	-	**-**	-	-	**-**	-	-	**-**
	Duck sp. – unidentified	-	3	**3**	-	-	**-**	-	3	-	**3**	-	-	**-**	-	-	**-**
Loon	Red-throated Loon	-	1	**1**	7	1	**8**	24	747	-	**771**	1	29	**30**	2	-	**2**
	Common Loon	-	-	**-**	-	-	**-**	-	58	1	**59**	-	1	**1**	-	-	**-**
	Loon sp. – unidentified	-	-	**-**	-	1	**1**	-	23	-	**23**	-	-	**-**	-	-	**-**
Storm-petrel	Wilson's Storm Petrel	-	-	**-**	-	-	**-**	-	-	-	**-**	-	-	**-**	5	-	**5**
	Storm-petrel sp. - unidentified	-	-	**-**	-	-	**-**	2	-	-	**2**	-	-	**-**	-	-	**-**
Shearwater	Great Shearwater	-	-	**-**	-	-	**-**	-	-	-	**-**	-	-	**-**	6	8	**14**
	Cory's Shearwater	-	-	**-**	-	-	**-**	-	-	-	**-**	-	-	**-**	11	2	**13**
	Sooty Shearwater	-	-	**-**	-	-	**-**	-	-	-	**-**	-	-	**-**	26	35	**61**
	Shearwater sp. - unidentified	-	-	**-**	-	-	**-**	-	-	-	**-**	-	-	**-**	1	16	**17**
Fulmar	Northern Fulmar	8	1	**9**	44	3	**47**	-	-	-	**-**	1	-	**1**	-	-	**-**
Gannet	Northern Gannet	3	-	**3**	4	4	**8**	18	68	-	**86**	7	4	**11**	-	-	**-**
Cormorant / Shag	Cormorant sp. – unidentified	-	1	**1**	-	-	**-**	-	-	-	**-**	-	-	**-**	-	-	**-**
Gull	Black-legged Kittiwake	-	-	**-**	1	-	**1**	-	-	-	**-**	-	-	**-**	-	-	**-**
	Bonaparte's Gull	-	-	**-**	6	-	**6**	4	1	-	**5**	1	-	**1**	-	-	**-**
	Laughing Gull	-	-	**-**	-	-	**-**	1	-	-	**1**	1	-	**1**	-	-	**-**
	Small Gull sp. – unidentified	-	-	**-**	-	2	**2**	2	7	-	**9**	-	-	**-**	-	1	**1**
	Great Black-backed Gull	4	6	**10**	3	4	**7**	2	5	-	**7**	5	1	**6**	1	3	**4**
	Herring Gull	7	5	**12**	5	19	**24**	1	-	-	**1**	1	2	**3**	3	2	**5**
	Lesser Black-backed Gull	-	-	**-**	1	1	**2**	-	-	-	**-**	-	-	**-**	-	-	**-**
Tern	Common Tern	-	-	**-**	-	-	**-**	-	-	-	**-**	5	-	**5**	-	-	**-**
	'Commic'[1] / Forster's Tern	-	-	**-**	-	-	**-**	5	-	-	**5**	10	-	**10**	-	-	**-**
	Roseate Tern	-	-	**-**	-	-	**-**	-	-	-	**-**	3	-	**3**	-	-	**-**
	Sterna Tern sp. - unidentified	-	-	**-**	-	-	**-**	-	-	-	**-**	-	34	**34**	-	-	**-**
Auk	Common / Thick-billed Murre	-	-	**-**	3	110	**113**	1	28	-	**29**	-	-	**-**	-	-	**-**

Group	Species	Mar-20			Apr-20 Survey I			Apr-20 Survey II				May-20 Survey I			May-20 Survey II		
		Flying	Sitting	Total	Flying	Sitting	Total	Flying	Sitting	Diving	Total	Flying	Sitting	Total	Flying	Sitting	Total
	Razorbill	-	-	**-**	1	59	**60**	-	26	-	**26**	-	-	**-**	-	-	**-**
	Murre[2] / Razorbill	25	473	**498**	3	256	**259**	1	167	-	**168**	-	-	**-**	-	-	**-**
	Atlantic Puffin	-	-	**-**	-	318	**318**	-	-	-	**-**	-	-	**-**	-	-	**-**
	Auk sp. – unidentified	-	-	**-**	-	56	**56**	-	10	-	**10**	-	-	**-**	-	-	**-**
Total Birds		**72**	**608**	**680**	**86**	**962**	**1,048**	**65**	**1,232**	**1**	**1,298**	**35**	**86**	**121**	**55**	**67**	**122**

[1]Note: 'Commic' refers to either common tern or Arctic tern. *[2]Note: Murre refers to either common murre or thick-billed murre.*

5.2 Marine Mammal and Other Marina Fauna Abundance

For March 2020, April I 2020, April II 2020, May I 2020, and May II 2020, totals of 20, 44, 47, 11 and 23 marine mammals and other marine fauna were recorded respectively (**Table 7**). Marine mammals mostly comprised of harbor porpoise (n=59 in March to May 2020). Unidentified seal sp. (n=27) was the most abundant thereafter, which was followed by common dolphin (n=18); unidentified marine mammal sp. (n=11), gray seals (n=8), basking sharks (n=6), spurdogs (n=5), common minke whale (n=4), unidentified dolphin species (n=3) and ocean sunfish (n=2). Single individuals of Atlantic swordfish and unidentified shark species were also recorded.

Table 7 Total number of marine mammals and other marine fauna recorded within the Survey Area during the March 2020, April 2020, and May 2020 surveys

Group	Species	Mar-20			Apr-20 Survey I			Apr-20 Survey II			May-20 Survey I			May-20 Survey II		
		Submerged	Surfacing	Total	Submerged	Surfacing	Total	Submerged	Surfacing	Total	Submerged	Surfacing	Total	Submerged	Surfacing	Total
Marine Mammal	Common Minke Whale	-	-	**-**	-	1	**1**	-	-	**-**	**-**	**-**	**-**	3	-	**3**
	Common Dolphin	-	-	**-**	11	-	**11**	-	-	**-**	**-**	**-**	**-**	6	1	**7**
	Dolphin sp. – unidentified	1	-	**1**	-	-	**-**	-	-	**-**	**-**	**-**	**-**	1	1	**2**
	Harbor Porpoise	3	-	**3**	10	3	**13**	30	4	**34**	6	1	**7**	1	1	**2**
	Gray Seal	1	2	**3**	-	2	**2**	1	1	**2**	1	-	**1**	-	-	**-**
	Seal sp. – unidentified	12	-	**12**	9	2	**11**	-	3	**3**	-	1	**1**	-	-	**-**
	Marine Mammal sp. – unidentified	1	-	**1**	1	-	**1**	**5**	2	**7**	2	-	**2**	-	-	**-**
Shark	Basking Shark	-	-	**-**	-	-	**-**	-	-	**-**	**-**	**-**	**-**	6	-	**6**
	Spurdog	-	-	**-**	5	-	**5**	**-**	-	**-**	**-**	**-**	**-**	-	-	**-**
	Shark sp. – unidentified	-	-	**-**	-	-	**-**	1	-	**1**	**-**	**-**	**-**	-	-	**-**
Fish	Atlantic Swordfish	-	-	**-**	-	-	**-**	-	-	**-**	**-**	**-**	**-**	1	-	**1**
	Ocean Sunfish	-	-	**-**	-	-	**-**	-	-	**-**	**-**	**-**	**-**	2	-	**2**
Total Mammals		**18**	**2**	**20**	**36**	8	**44**	**37**	**10**	**47**	**9**	**2**	**11**	**20**	**3**	**23**

5.3 Spatial Distribution

Figures 7 to 10 show the location of all birds and marine mammals recorded throughout the Survey Area during the March 2020 to May II 2020 surveys respectively.

Overall, birds and marine mammals were distributed throughout the Survey Area in March with notable densities of white-winged scoter and long-tailed ducks in the north-east, and northern fulmar in the east. Marine mammals were mostly recorded in the northern half of the survey area.

In April I, as in March, birds and marine mammals were distributed across the survey area. Waterfowl were concentrated in the north-east, with other notable concentrations including northern fulmars in the south, razorbills in the north-northwest, and a pod of common dolphins in the south-southeast.

In April II, red-throated loons were the most consistently distributed species, albeit with a greater concentration in the north and east of the survey area. White-winged scoters were heavily concentrated in the north-northwest, whilst auk species where distributed throughout the survey area, with the heaviest concentrations in the north-east, and in fewer numbers than March or April I. Marine mammals were primarily distributed in the northern half of the survey area.

In May I, the number of individuals decreased dramatically, with auks being a notable absence. As with previous surveys, white-winged scoters were located in the north of the survey area. Tern numbers rose during this survey, with concentrations towards the south of the survey area, including a large group of unidentified Sterna tern species, and three roseate tern individuals. Marine mammals were recorded in low numbers, located in all but the eastern areas.

The May II survey was notable for the presence of several shearwater species, which were most abundant group of the survey. Shearwaters were mostly concentrated in the south of the survey area. Gulls were exclusively located in the north, whilst marine megafauna was distributed across the survey area.

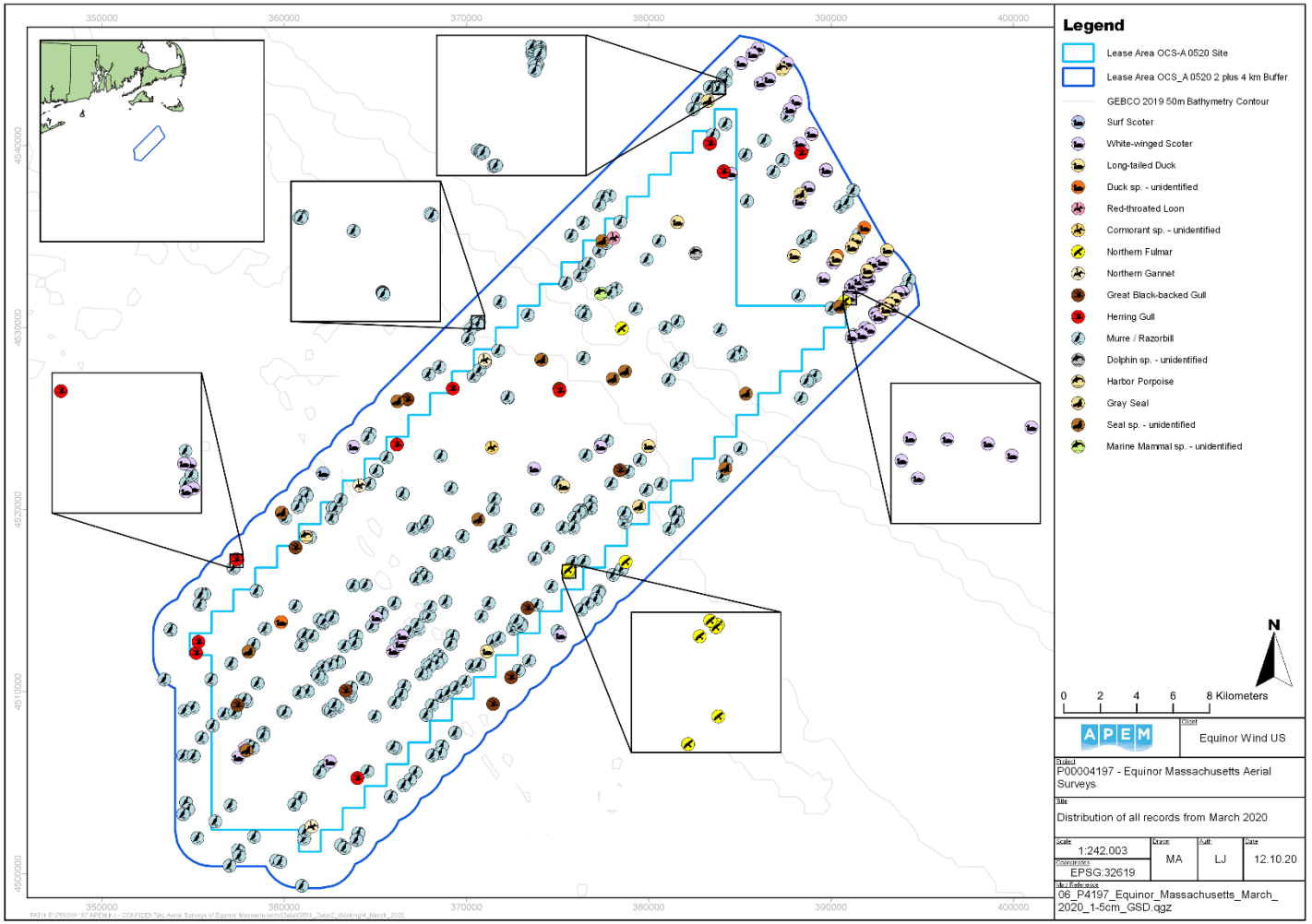

Figure 6 Distribution of all birds, marine fauna, and human artifacts recorded in March 2020

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

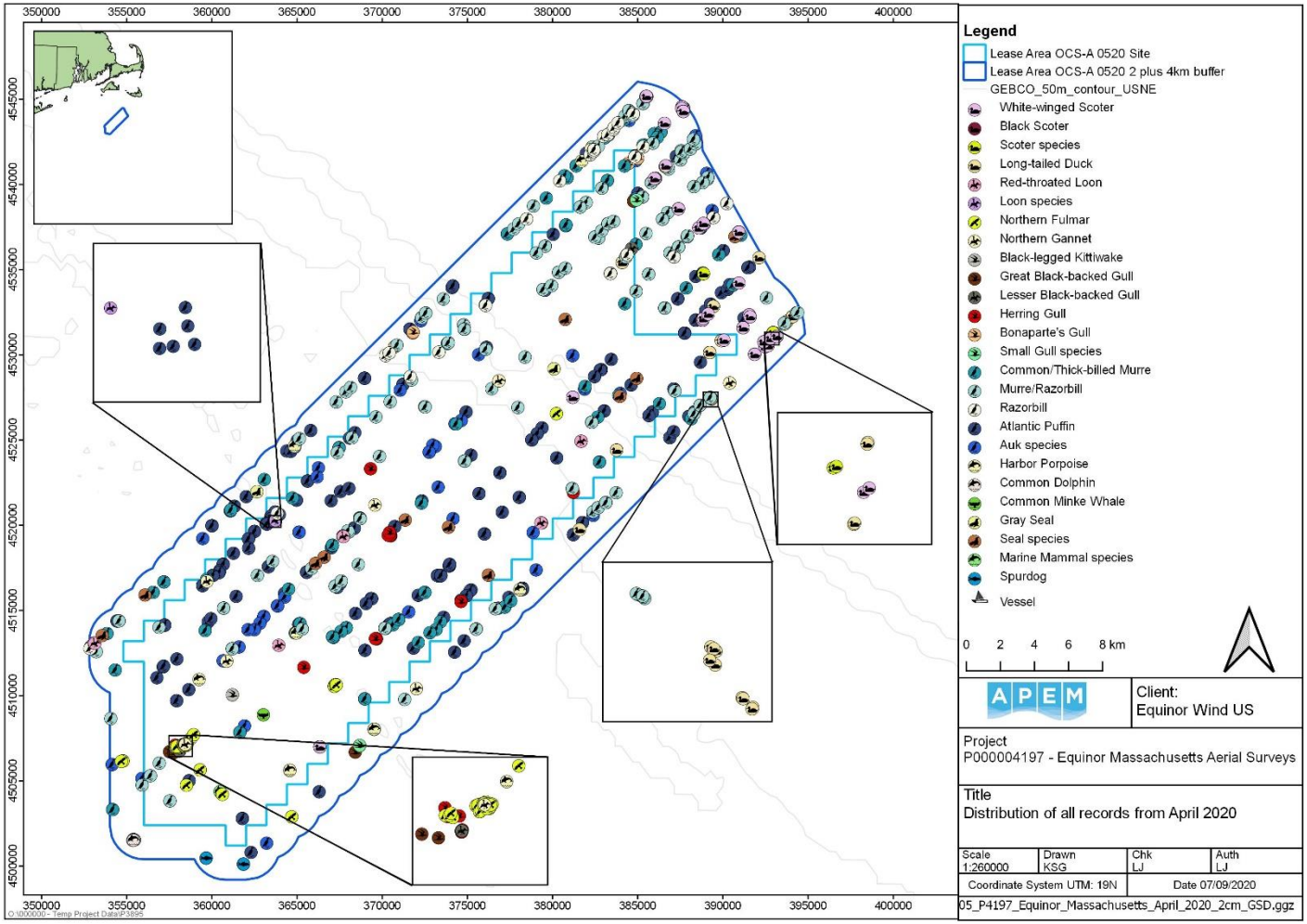

Figure 7 Distribution of all birds, marine fauna, and human artifacts recorded in April I 2020

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

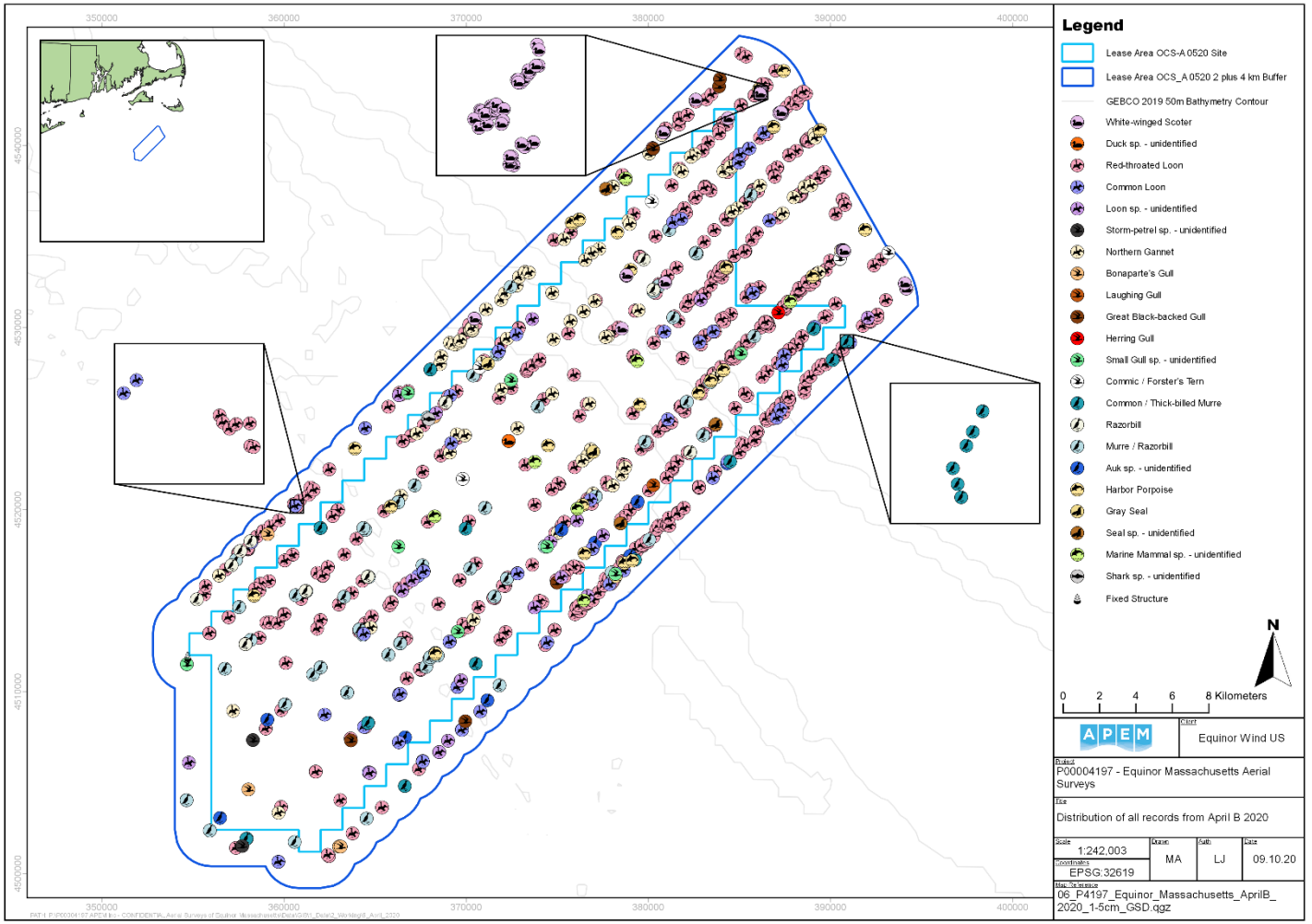

Figure 8 Distribution of all birds, marine fauna, and human artifacts recorded in the April II 2020

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

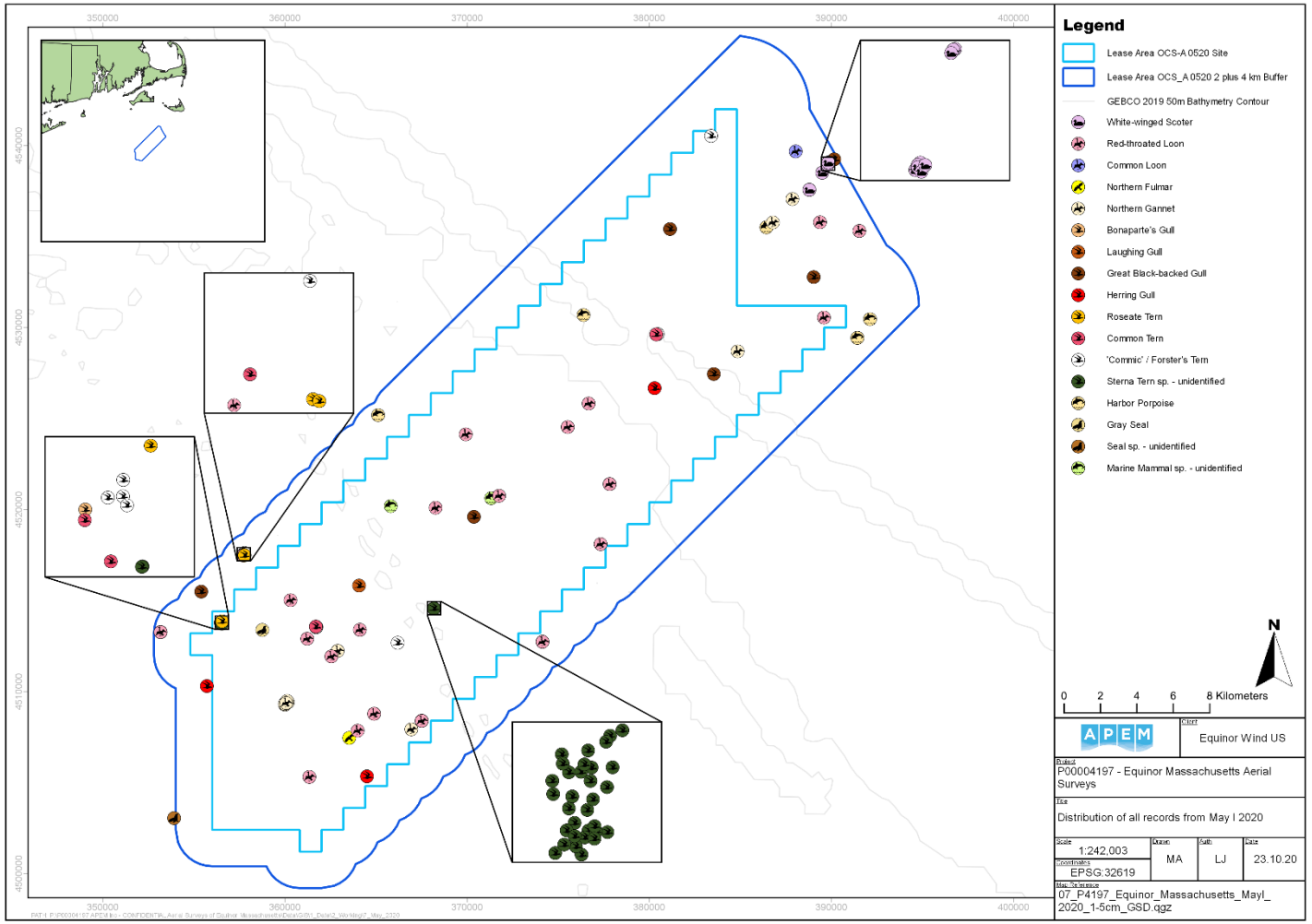

Figure 9 Distribution of all birds, marine fauna, and human artifacts recorded in the May I 2020

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

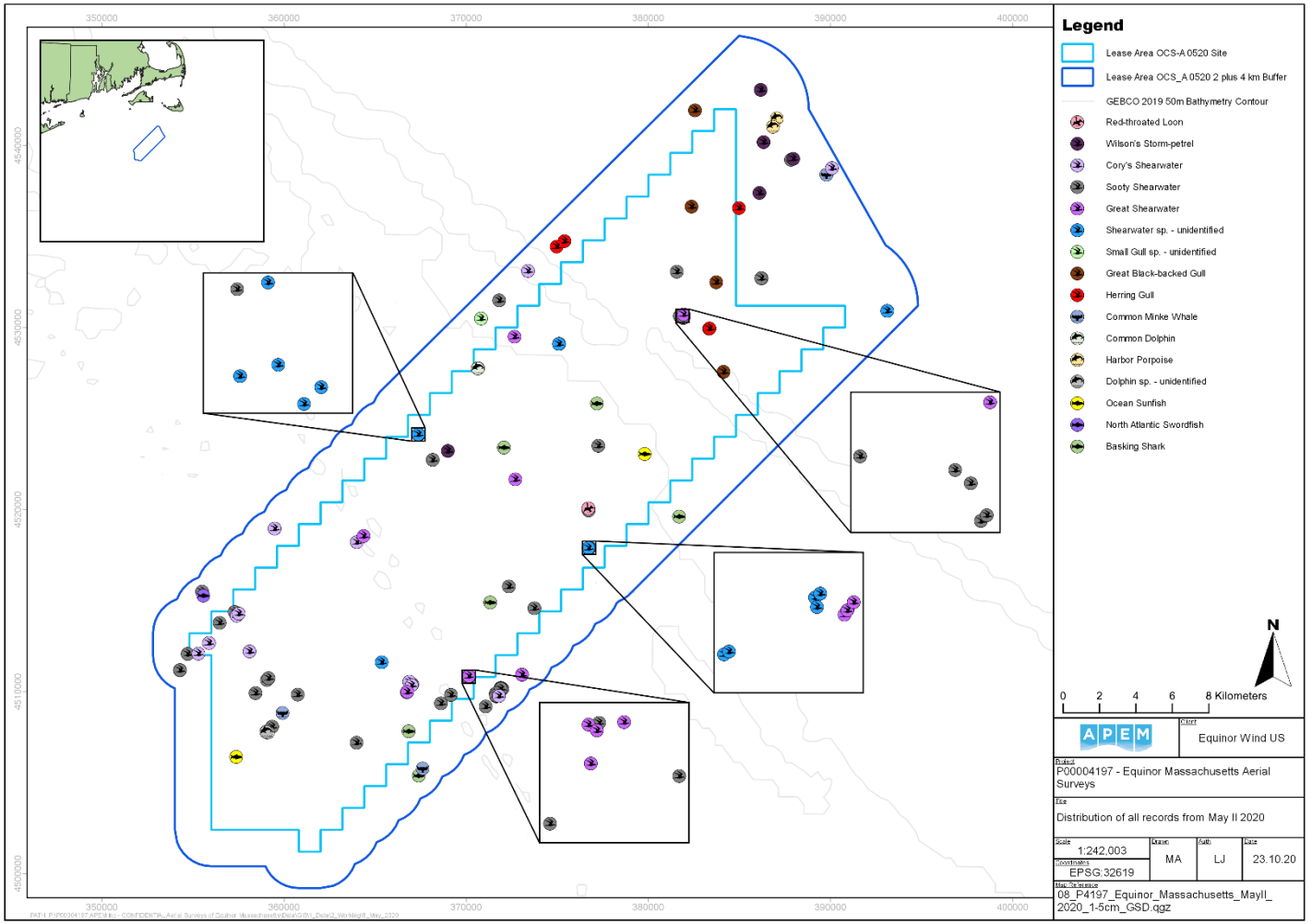

Figure 10 Distribution of all birds, marine fauna, and human artifacts recorded in the May II 2020

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

6. Species Accounts

6.1 Surf Scoter

A single, sitting surf scoter was recorded in the March 2020 survey, located in the west of the buffer.

6.2 White-winged Scoter

White-winged scoters were recorded in all surveys except May II 2020, with a total of 301 scoters recorded consisting of 15 in flight and 286 sitting on the water. Individuals tended to occur in the north-east of the Survey Area, primarily within the buffer area.

6.3 Black Scoter

Two black scoters were recorded sitting on the water in the April I 2020 survey. Both were recorded in the north-east of the buffer.

6.4 Scoter sp. – unidentified

Unidentified scoters were recorded in the April II survey, consisting of ten individuals only, all observed as sitting on the water. All ten were recorded in the north-east of the buffer area.

6.5 Long-tailed Duck

Long-tailed ducks were recorded in both the March and the April I 2020 surveys. These consisted of 22 birds flying and five birds sitting in March, and 46 birds sitting in April I. In both surveys, long-tailed ducks were primarily recorded in the north-eastern corner of the Survey Area, with several marginally further south.

6.6 Duck sp. – unidentified

A total of six unidentified duck species were recorded, with three in the March survey and three in the April II survey. All unidentified ducks were observed as sitting on the water. In March, two ducks were recorded in the north of the buffer, with one in the south of the south-west of the site, whilst in April, all three individuals were recorded in the center of the site.

6.7 Red-throated Loon

Red-throated loons were recorded in all five surveys, and consisted of a total of 34 in flight, and 778 sitting on the water. In March, the single individual was recorded in the north of the site, whilst in the April I survey, loons were distributed across the center of the site and buffer. In the April II survey, a total of 771 loons were recorded, and were loosely distributed across the Survey Area with an abundance in the north and east. In the May I survey, loons were also loosely distributed across the Survey Area, albeit in considerably fewer numbers, whilst in the May II survey, two individuals were recorded in the center of the Survey Area.

6.8 Common Loon

Common loons were recorded in the April II 2020 survey, consisting of 58 and one diving, and one on the water in May I 2020. Common loons were recorded as loosely distributed across the Survey Area.

6.9 Loon sp. – unidentified

Unidentified loon species were recorded in both April 2020 surveys. In April I, a single loon was recorded sitting on the west of the site, whilst in the April II survey, 23 loons were loosely distributed across the Survey Area with an abundance in the south-east.

6.10 Wilson's Storm Petrel

Five Wilson's storm petrels were recorded in the May II 2020 survey, all of which were recorded in flight. Four were recorded in the north of the buffer, with one in the center of the Survey Area.

6.11 Storm Petrel sp. – unidentified

Two unidentified storm petrels were recorded in the April II 2020 survey. Both were recorded in flight in the south of the Survey Area, with one within the site and one in the buffer.

6.12 Great Shearwater

Fourteen Great shearwater were recorded in the May II 2020 survey, of which six were recorded in flight and eight sitting on the water. All fourteen were recorded distributed across the center of the Survey Area, with twelve within the site and two in the buffer.

6.13 Cory's Shearwater

Thirteen Cory's shearwater were recorded in the May II survey, of which thirteen were recorded in flight and two sitting on the water. Cory's shearwater were primarily distributed in the south-west and south of the Survey Area, with two in the north in the buffer.

6.14 Sooty Shearwater

A total of 61 sooty shearwaters were recorded in the May II 2020 survey, of which 26 were recorded in flight and 35 sitting on the water. Sooty shearwaters were loosely distributed across the Survey Area, with a greater concentration in the south.

6.15 Shearwater sp. – unidentified

Unidentified shearwaters were recorded in the May II 2020 survey, with a single individual recorded in flight and 16 sitting on the water. Two individuals were recorded in the north-east of the buffer, with the rest distributed across the center of the Survey Area.

6.16 Northern Fulmar

Northern fulmars were recorded in March, the April I 2020 and May I 2020 surveys. These consisted of eight flying and one sitting in March; 44 flying and three sitting in April; and one flying in May. In March, most individuals were recorded towards the east of the Survey Area, with two towards the north. In April, the majority were recorded in the south, with one in the center of the site, whilst in May the single individual was recorded in the south of the site.

6.17 Northern Gannet

A total of 108 northern gannets were recorded across the March, both April and May I 2020 surveys. These consisted of three flying gannets in March; four flying and four sitting in April I; 18 flying and 68 sitting in April II; and seven flying and four sitting in May I. In March, two gannets were recorded in the west and one in the south of the site. In the April I survey, gannets were loosely distributed across the Survey Area, whilst In the April II survey, gannets were primarily concentrated in the north and east of the Survey Area, with a few in the south and east. In May, three were recorded in the north (two in the buffer), with the rest recorded in the south of the site.

6.18 Cormorant sp. – unidentified

A single unidentified cormorant species was recorded sitting in the center of the site in March 2020.

6.19 Black-legged Kittiwake

A single flying black-legged kittiwake was recorded in the south of the site in the April I 2020 survey.

6.20 Bonaparte's Gull

Bonaparte's gulls were recorded in both April and the May I 2020 surveys. These consisted of six flying gulls in April I; four flying and one sitting in April II; and one flying in May I. In the April I survey, three individuals were recorded in the western buffer, with the rest in the north-western corner of the Survey Area. In the April II survey, three individuals were recorded in the south (with two in the buffer), with the remaining two in the west, of which one was in the buffer. In May I, the single individual was recorded in the south-west of the site.

6.21 Laughing Gull

A single flying laughing gull was recorded in each of the second April and first May 2020 surveys. In April, the individual was recorded in the east of the site, whilst in May, it was in the southern center of the site.

6.22 Small Gull sp. – unidentified

Unidentified small gull species were recorded in both April and the May II 2020 surveys. These consisted of two sitting individuals in April I; two flying and seven sitting in April II; and a single sitting individual in May. In the April I survey, both individuals were recorded in the buffer, with one in the north and one in the south. In the April II survey, small gulls were loosely distributed across the center of the Survey Area. In May II, the single gull was recorded in the west of the buffer.

6.23 Great Black-backed Gull

Great black-backed gulls were recorded in all five surveys. These consisted of four flying and six sitting in March; three flying and four sitting in April I; two flying and five sitting in April II; five flying and one sitting in May I; and one flying and three sitting in May II 2020 survey. In March, Great black-backed gulls were loosely distributed across the southern half of the Survey Area. In the April I survey, gulls were mostly distributed across the southern

half of the Survey Area, with a single gull in the north of the site. In the April II survey, gulls were distributed in the north and south-east of the Survey Area. In the May I survey, four gulls were distributed in the north, one in the center and one in the south-west of the Survey Area, whilst in the May II survey, all four were distributed in the north of the Survey Area.

6.24 Herring Gull

Herring gulls were recorded in all five surveys. These consisted of seven flying and five sitting in March; five flying and 19 sitting in April I; one flying in April II; one flying and two sitting in May I; and three flying and two sitting in the May II 2020 survey. In March, herring gulls were distributed in the north, west and south of the Survey Area. In the April I survey, gulls were loosely distributed across the southern half of the Survey Area, whilst in the April II survey, the single gull was recorded in the north of the site. In the May I survey, two gulls were recorded in the south and one in the center of the Survey Area, whilst in the May II survey, all gulls were recorded in the north of the Survey Area.

6.25 Lesser Black-backed Gull

One flying and one sitting lesser black-backed gull were recorded in April I 2020 survey. Both were recorded within the site, with one in the north and one in the south.

6.26 Common Tern

Five common terns were recorded in flight in the May I 2020 survey. One was recorded in the center of the site, with the rest in the south-west of the Survey Area.

6.27 'Commic' / Forster's Tern

'Commic' / Forster's terns were recorded in the April II and the May I 2020 surveys, consisting of five flying terns in April II and ten flying terns in May. In April II, three terns were recorded in the north of the Survey Area (with two in the buffer), and the other two in the west of the site. In May I, two terns were recorded towards the north of the site, with eight in the south-west, of which one was recorded in the buffer.

6.28 Roseate Tern

Three flying roseate terns were recorded in the May I 2020 survey. All three were recorded in the south-west of the Survey Area, with two in the buffer. All three roseate terns were recorded flying in a generally westerly direction.

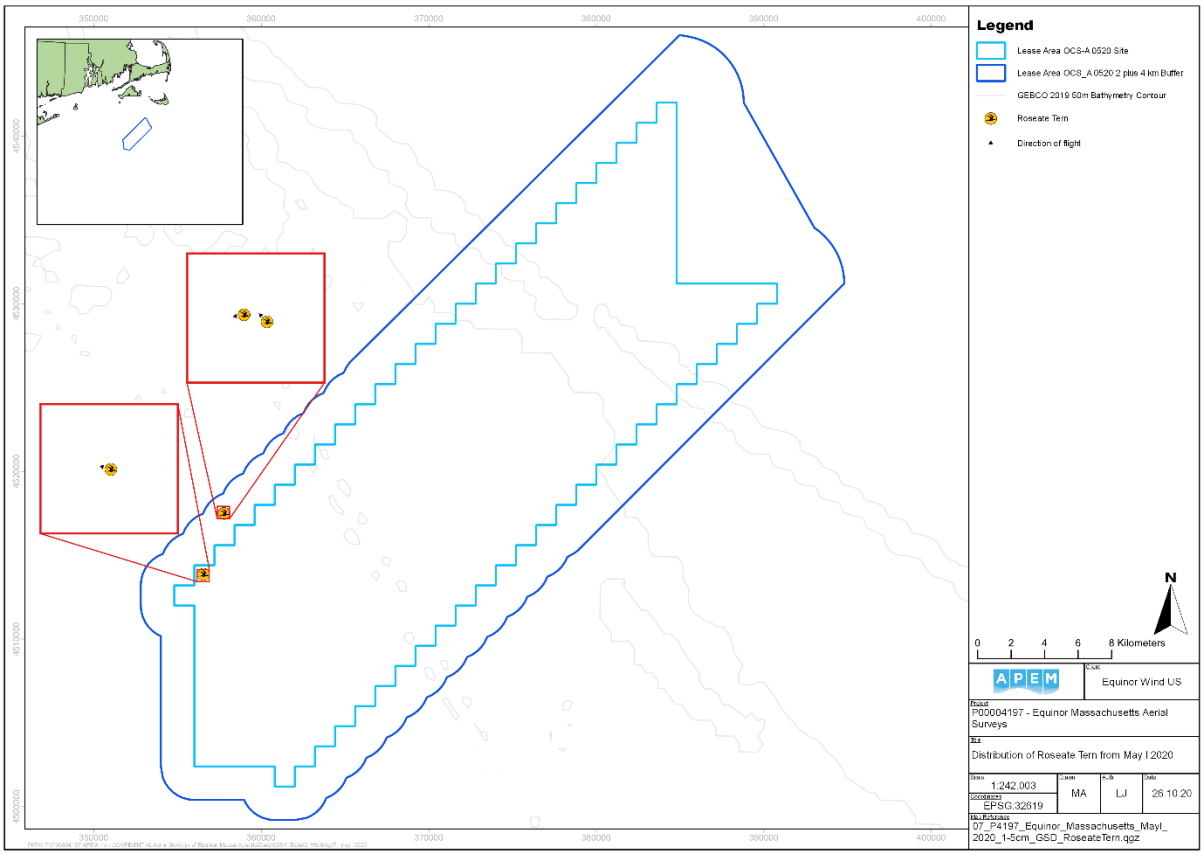

Figure 11 Distribution of roseate terns from the May I 2020 survey

6.29 Sterna Tern sp. – unidentified

A total of 34 unidentified Sterna tern species were recorded in the May I 2020 survey, all of which were recorded sitting on the water. A total of 32 of these were recorded in a group towards the south of the site, with the remaining two in the south-west of the site.

6.30 Common / Thick-billed Murre

Common / thick-billed murres were recorded in both April surveys, and consisted of 113 in April I (of which three were in flight), and 29 in April II (of which one was flying). In both April surveys, common / thick-billed murres were loosely distributed across the Survey Area.

6.31 Razorbill

Razorbills were recorded in both April surveys, and consisted of one flying and 59 sitting individuals In the April I survey, and 26 sitting individuals in April II. In the April I survey, razorbills were concentrated in the north of the Survey Area, with a few further south. In the April II survey, razorbills were recorded primarily in the south-west of the Survey Area, with a few towards the north and east.

6.32 Murre / Razorbill

Murre / razorbills were recorded in the March, and both April 2020 surveys. These consisted of 25 flying and 473 sitting in March; three flying and 256 sitting in April I; and one flying and

167 sitting in April II. In all three of these surveys, murres / razorbills were loosely distributed across the Survey Area, with a greater concentration in the north in April I.

6.33 Atlantic Puffin

Atlantic puffins were recorded in the April I 2020 survey, with a total of 318 puffins recorded, all sitting on the water. Atlantic puffins were loosely distributed across the Survey Area.

6.34 Auk sp. – unidentified

Unidentified auks were recorded in the two April surveys only, consisting of 56 sitting individuals in the first of these surveys, and ten sitting individuals in the second. In the April I survey, auks were loosely distributed across the Survey Area, whilst in the April II survey, auks were recorded in the south and east of the Survey Area.

6.35 Common Minke Whale

A single surfacing common minke whale was recorded in the south of the site during the April I 2020 survey. Three submerged common minke whales were recorded in the May II 2020 survey, of which one was recorded in the north of the buffer, and two in the south of the Survey Area.

6.36 Common Dolphin

Common dolphins were recorded in the April I and May II 2020 surveys, consisting of eleven submerged individuals in the April I survey, and six submerged and one surfacing individuals in May II. In the April I survey, all eleven dolphins were recorded in the south of the buffer, whilst in the May II survey, the dolphins were recorded in two groups; one group of five in the west of the site, and a pair in the south.

6.37 Dolphin sp. – unidentified

Unidentified dolphins were recorded in March, and the May II 2020 surveys. A single submerged dolphin was recorded in the north of the site in March, and one submerged and one surfacing individuals were recorded in the south of the site in May II.

6.38 Harbor Porpoise

Harbor porpoises were recorded in all five surveys. These consisted of three submerged porpoises in March; ten submerged and three surfacing in April I; 30 submerged and four surfacing in April II; six submerged and one surfacing in May I; and one submerged and one surfacing in May II. In March, one porpoise was recorded in the north of the buffer, and two in the south-west of the site. In the April I survey, porpoises were loosely distributed across the southern half of the Survey Area, with one in the north of the buffer, whilst in the April II survey, porpoises were loosely distributed across the Survey Area with a greater concentration in the north. In the May I survey, porpoises were primarily located in the north of the buffer, with one on the western buffer and one in the center of the site. In the May II survey, both porpoises were recorded in the north of the buffer.

6.39 Gray Seal

Gray seals were recorded in all bar the May II 2020 survey. These consisted of one submerged and two surfacing in March 2020; two surfacing in April I; one submerged and

one surfacing in April II; and one submerged in May I. In March, two seals were recorded in the north of the buffer and ne in the eats of the site. In the April I survey, one was recorded in the north of the site and one in the west of the buffer, whilst in the April II survey, both one seal was recorded in the west of the site and one in the center. In the May I survey; the single seal was recorded in the south-west of the site.

6.40 Seal sp. – unidentified

Unidentified seals were recorded in all bar the May II 2020. These consisted of twelve submerged in March 2020; nine submerged and two surfacing in April I; three surfacing in April II; and one surfacing in May I. In March, seals were loosely distributed across the Survey Area. In the April I survey, seals were also loosely distributed across the Survey Area, with a greater concentration in the center of the site. In the April II survey, two seals were recorded in the east of the site, and one in the north of the buffer. In the May I survey; a single seal was recorded outside the Survey Area.

6.41 Marine Mammal sp. – unidentified

Unidentified marine mammals were recorded in all bar the May II 2020 survey. These consisted of one submerged in March 2020; one submerged in April I; five submerged and two surfacing in April II; and two submerged in May I. In March 2020, the single individual was recorded in the north of the site. In the April I survey, the mammal was recorded in the south of the site, whilst in the April II survey, individuals were loosely distributed across the northern half of the Survey Area. In the May I survey, both individuals were recorded in the center of the site.

6.42 Basking Shark

Six submerged basking sharks were recorded in the May II 2020 survey, with individuals recorded in the center and east of the Survey Area.

6.43 Spurdog

Five submerged spurdogs were recorded in the south of the buffer in the April I 2020 survey.

6.44 Shark sp. – unidentified

A single unidentified shark species was recorded in the west of the site in the April II 2020 survey.

6.45 Atlantic Swordfish

A single submerged Atlantic swordfish was recorded in the south-western buffer in the May II 2020 survey.

6.46 Ocean Sunfish

Two submerged ocean sunfish were recorded in the May II 2020 survey. One individual was located in the east of the site, and one in the south of the site.

7. Shipping Observations

One vessel, identified as a commercial fishing vessel, was recorded in the imagery during the April I 2020 survey. No vessels were recorded in the imagery for the March 2020, April II 2020, May I 2020, or May II 2020 surveys.

No vessels were recorded visually from the aircraft during the March 2020 to May II 2020 surveys.

8. Survey Completion Dates

Table 8 provides the survey dates for the seven surveys: July to November 2020 inclusive which are awaiting data finalization. There are no plans currently to undertake further surveys.

Table 8 Survey dates for completed surveys to date

Survey Number	Survey Month	Survey Dates
Survey 09	June	June 14th
Survey 10	July	July 21st
Survey 11	August	August 20th
Survey 12		September 4th*
Survey 13	September	September 14th
Survey 14		September 24th
Survey 15	October	October 14th
Survey 16	November	November 4th

*Due to poor weather in August, the second August survey was delayed and completed at the earliest opportunity in September.

9. Summary of Results

9.1 March 2020

A total of 680 birds were recorded in the Survey Area in March 2020. The most abundant group recorded was auks (n=498). This was followed by waterfowl (n=146); gulls (n=22); fulmars (n=9); gannets (n=3); and loons (n=1) and cormorant / shags (n=1).

A total of 72 birds (11%) were recorded in flight during this survey. These consisted of murre / razorbill (n=25); long-tailed duck (n=22); northern fulmar (n=8); herring gull (n=7); great-black backed gull (n=4); white-winged scoter (n=3); and northern gannet (n=3). There were 608 birds (89%) recorded as sitting.

A total of 20 marine mammals were recorded consisting of unidentified seal sp. (n=12); harbor porpoise (n=3); gray seal (n=3); unidentified dolphin sp. (n=1); and unidentified marine mammal sp. (n=1). Of the 20 marine mammals recorded, 18 were recorded submerged, and 2 were recorded surfacing.

9.2 April I 2020

A total of 1,048 birds were recorded in the Survey Area in April I 2020. The most abundant group recorded was auks (n=806). This was followed by waterfowl (n=136); fulmars (n=47); gulls (n=42); loons (n=9); and gannets (n=8).

A total of 86 birds (8%) were recorded in flight during this survey. These consisted of northern fulmar (n=44); white-winged scoter (n=8); red-throated loon (n=7); Bonaparte's gull (n=6); herring gull (n=5); northern gannet (n=4); great black-backed gull (n=3); common / thick-billed murre (n=3); murre / razorbill (n=3); black-legged kittiwake (n=1); lesser black-backed gull (n=1); and razorbill (n=1). There were 962 birds (92%) recorded as sitting.

A total of 39 marine mammals were recorded, consisting of harbour porpoise (n=13); common dolphin (n=11); unidentified seal sp. (n=11); gray seal (n=2); common minke whale (n=1); and unidentified marine mammal sp. (n=1). Of the 39 marine mammals recorded, 31

were recorded submerged, and 8 were recorded surfacing. Five submerged sharks, consisting of spurdog (n=5), were also recorded.

9.3 April II 2020

A total of 1,298 birds were recorded in the Survey Area in April II 2020. The most abundant group recorded was loons (n=853). This was followed by auks (n=233); waterfowl (n=96); gannets (n=86); gulls (n=23); terns (n=5); and storm-petrels (n=2).

A total of 65 birds (5%) were recorded in flight during this survey. These consisted of red-throated loon (n=24); northern gannet (n=18); comic / Forster's tern (n=5); white-winged scoter (n=4); Bonaparte's gull (n=4); unidentified storm-petrel sp. (n=2); unidentified small gull sp. (n=2); great black-backed gull (n=2); laughing gull (n=1); herring gull (n=1); common / thick-billed murre (n=1); and murre / razorbill (n=1). There were 1,232 birds (94%) recorded as sitting, and one bird recorded as diving (<1%).

A total of 46 marine mammals were recorded, consisting of harbor porpoise (n=34); unidentified marine mammal sp. (n=7); unidentified seal sp. (n=3); and gray seal (n=2). Of the 46 marine mammals recorded, 36 were recorded submerged, and ten were recorded surfacing. One submerged shark, consisting of unidentified shark sp. (n=1), was also recorded.

9.4 May I 2020

A total of 121 birds were recorded in the Survey Area in May I 2020. The most abundant group recorded was terns (n=52). This was followed by loons (n=31); waterfowl (n=15), gannets (n=11), gulls (n=11) and fulmar (n=1).

A total of 35 birds (29%) were recorded in flight during this survey. These consisted of 'commic' / Forster's terns (n=10), northern gannets (n=7), great black-backed gull (n=5), common tern (n=5), roseate tern (n=3), red-throated loon (n=1), northern fulmar (n=1), Bonaparte's gull (n=1), laughing gull (n=1) and herring gull (n=1). There were 86 birds (71%) recorded as sitting.

A total of eleven marine mammals were recorded, consisting of harbor porpoise (n=7), unidentified marine mammal species (n=2), gray seal (n=1) and unidentified seal species (n=1). Of the eleven marine mammals recorded, nine were submerged, and two were recorded surfacing.

9.5 May II 2020

A total of 122 birds were recorded in the Survey Area in May II 2020. The most abundant group recorded was shearwaters (n=105). This was followed by gulls (n=10), storm petrels (n=5) and loons (n=2).

A total of 55 birds (45%) were recorded in flight during this survey. These consisted of sooty shearwater (n=26), Cory's shearwater (n=11), great shearwater (n=6), Wilson's storm petrel (n=5), herring gull (n=3), red-throated loon (n=2) and Great black-backed gull (n=1). There were 67 birds (55%) recorded as sitting.

A total of 14 marine mammals were recorded, consisting of common dolphins (n=7), common minke whale (n=3), unidentified dolphin species (n=2), and harbor porpoise (n=2). Of the fourteen marine mammals recorded, eleven were submerged, and three were recorded surfacing. Six submerged sharks, consisting of basking sharks (n=6), were also recorded.

10. Discussion

Overall, the preceding three winter surveys (December 2019, January 2020, February 2020) recorded less avian abundance than the five spring surveys (March 2020, April I 2020, April II 2020, May I 2020, May II 2020) as a result of the bimonthly approach undertaken for April and May. However, when calculating a mean for the two April and two May surveys as representative totals for each month respectively, the winter survey showed a roughly 10% greater abundance compared with spring. This is largely due to the presence of wintering white-winged scoters that were recorded in large numbers during the January survey, and although they continued to be recorded relatively consistently from February to April, their numbers remained less than the January peak. With regards to wintering birds, it is noteworthy that auk records were relatively low until February, where they remained consistent until the end of April. It would be expected that auk numbers would be highest during winter, though from the winter and spring surveys it is apparent that auks were recorded towards the end of winter and persisted up until late spring. The presence of white-winged scoters also persisted throughout this timeframe.

The spring months exhibited a higher number of species compared with the winter months, which is most notably evidenced by the appearance of shearwaters and terns compared with their absence in winter. This is in line with expectations, particularly with regards to terns, as the migration of roseate terns was the instigating factor in the decision to fly bimonthly surveys in April and May. The presence of two roseate tern breeding colonies along the Massachusetts coast, at the sites of Bird Island and Ram Island (**Figure 12**), highlights the importance of monitoring potential passage through the Survey Area, as was indeed exhibited during the first May survey.

Marine megafauna exhibited an increase in both number of individual species, and overall abundance, even when adjusting for the April and May bimonthly surveys by using the mean total. The seasonal increase in sea temperature is expected to influence the increase in presence of marine megafauna, and so it is consistent with expectations that an increase in both the number of individual species, and in the total abundance of species, was observed during the spring months.

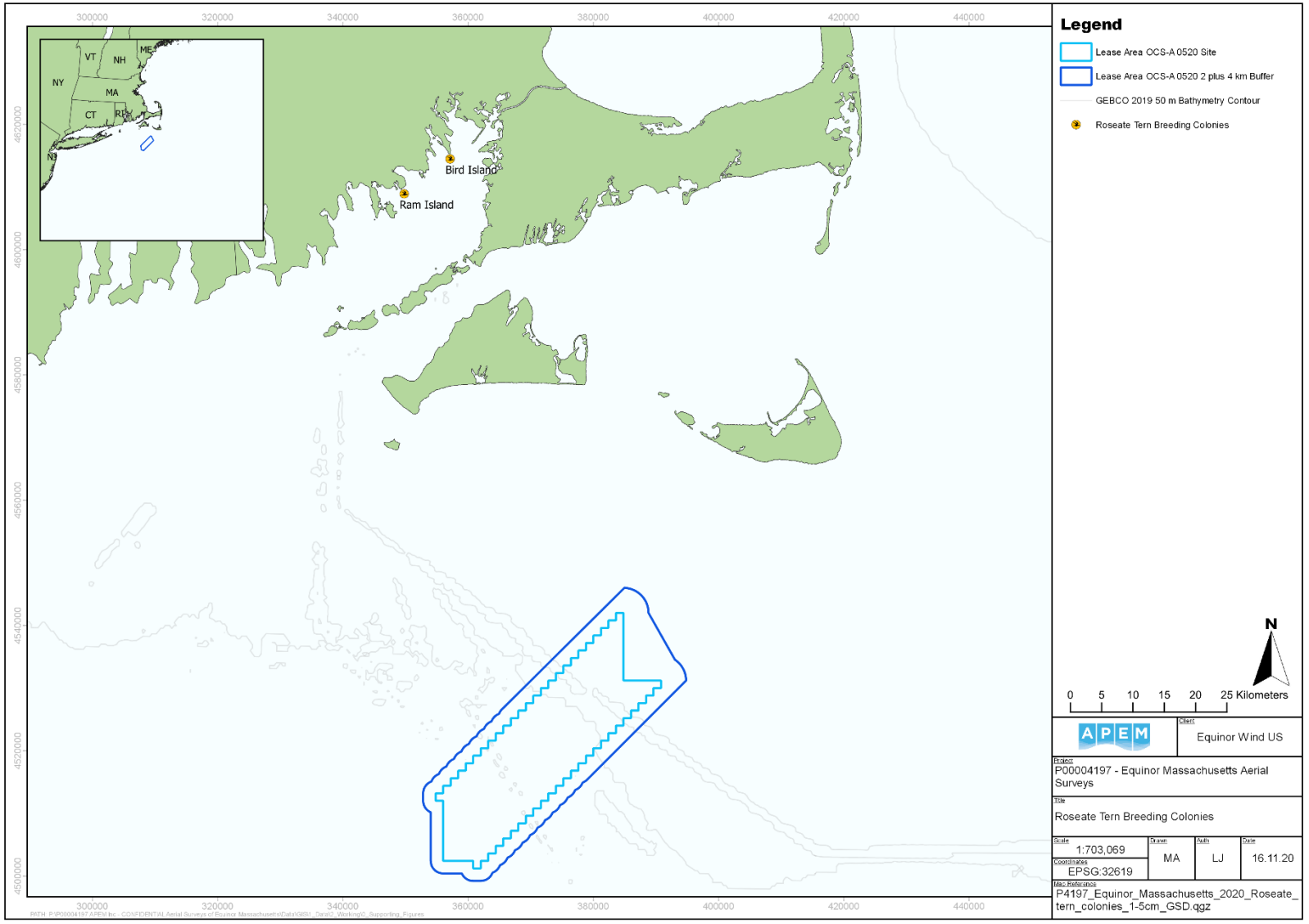

Figure 12 Massachusetts roseate tern breeding colony locations relative to Lease Area OCS-A 0520

Appendix I Species List

Common Name	Scientific Name	Family	Class
Surf Scoter	*Melanitta perspicillata*	Anatidae	Aves
White-winged Scoter	*Melanitta deglandi*	Anatidae	Aves
Black Scoter	*Melanitta americana*	Anatidae	Aves
Long-tailed Duck	*Clangula hyemalis*	Anatidae	Aves
Red-throated Loon	*Gavia stellata*	Gaviidae	Aves
Common Loon	*Gavia immer*	Gaviidae	Aves
Wilson's Storm Petrel	*Oceanites oceanicus*	Oceanitidae	Aves
Great Shearwater	*Ardenna gravis*	Procellariidae	Aves
Cory's Shearwater	*Calonectris borealis*	Procellariidae	Aves
Sooty Shearwater	*Ardenna grisea*	Procellariidae	Aves
Northern Fulmar	*Fulmarus glacialis*	Procellariidae	Aves
Northern Gannet	*Morus bassanus*	Sulidae	Aves
Black-legged Kittiwake	*Rissa tridactyla*	Laridae	Aves
Bonaparte's Gull	*Chroicocephalus philadelphia*	Laridae	Aves
Laughing Gull	*Leucophaeus atricilla*	Laridae	Aves
Great Black-backed Gull	*Larus marinus*	Laridae	Aves
Herring Gull	*Larus argentatus*	Laridae	Aves
Lesser Black-backed Gull	*Larus fuscus*	Laridae	Aves
Common Tern	*Sterna hirundo*	Laridae	Aves
Arctic Tern	*Sterna paradisaea*	Laridae	Aves
Forster's Tern	*Sterna forsteri*	Laridae	Aves
Roseate Tern	*Sterna dougallii*	Laridae	Aves
Common Murre	*Uria aalge*	Alcidae	Aves
Thick-billed Murre	*Uria lomvia*	Alcidae	Aves
Razorbill	*Alca torda*	Alcidae	Aves
Atlantic Puffin	*Fratercula arctica*	Alcidae	Aves
Common Minke Whale	*Balaenoptera acutorostrata*	Balaenopteridae	Mammalia
Common Dolphin	*Delphinus delphis*	Delphinidae	Mammalia
Harbor Porpoise	*Phocoena phocoena*	Phocoenidae	Mammalia
Gray Seal	*Halichoerus grypus*	Phocidae	Mammalia
Basking Shark	*Cetorhinus maximus*	Cetorhinidae	Chondrichthyes
Spurdog	*Squalus acanthias*	Squalidae	Chondrichthyes
Atlantic Swordfish	*Xiphias gladius*	Xiphiidae	Actinopterygii
Ocean Sunfish	*Mola mola*	Molidae	Actinopterygii