The latest revision date of Appendix Q to the Empire Offshore Wind COP is May 2022. This appendix was not revised as part of the November 2023 submittal; therefore, the date on the Appendix Q cover sheet remains as May 2022.

Empire Offshore Wind: Empire Wind Project (EW 1 and EW 2)
Construction and Operations Plan

APPENDIX Q

Avian Impact Assessment for the Proposed Empire Offshore Wind: Empire Wind Project (EW 1 and EW 2)

Prepared for
equinor

TETRA TECH

MAY 2022

Avian Impact Assessment for the Proposed Empire Offshore Wind: Empire Wind Project (EW 1 and EW 2) in the New York Bight

– Lease Area OCS-A-0512 –

Prepared by:

Biodiversity Research Institute

276 Canco Road, Portland, ME 04103

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Executive Summary

Empire Offshore Wind LLC (Empire) proposes to construct and operate an offshore wind farm located in the designated Renewable Energy Lease Area OCS-A 0512 (Lease Area). The Lease Area covers approximately 79,350 acres (ac; 32,112 hectares [ha]) and is located approximately 14 statute miles (mi) (12 nautical miles [nm], 22 kilometers [km]) south of Long Island, New York and 19.5 mi (16.9 nm, 31.4 km) east of Long Branch, New Jersey. The Lease Area was awarded through the Bureau of Ocean Energy Management (BOEM) competitive renewable energy lease auction of the Wind Energy Area (WEA) offshore of New York.

Empire proposes to develop the Lease Area in two wind farms, known as Empire Wind 1 (EW 1) and Empire Wind 2 (EW 2) (both in New York; collectively referred to hereafter as the Project). Both EW 1 and EW 2 are covered in the Construction and Operations Plan (COP).

Empire initiated an assessment of potential effects on birds from the onshore and offshore components of the Project. The goal of the assessment is to provide a detailed analysis of the bird species that may be exposed to Project activities, and to describe potential impacts to those species. This assessment was developed to meet the information requirements for a COP for Outer Continental Shelf renewable energy activities on a commercial lease, as required by 30 CFR Part 585, as well as to provide information to meet the requirements of the Outer Continental Shelf Lands Act (OCSLA), National Environmental Policy Act (NEPA), and other applicable laws and regulations.

This assessment evaluates baseline conditions for birds in the onshore and offshore portions of the Project by documenting what species are likely to occur in the Project Area, based on the best available data. It then evaluates the risk of impact of Project construction, operations and decommissioning activities to those species likely to occur based on their habitat requirements, behavior, seasonal use of the Project area, and potential sensitivity to each Project activity.

Overall, offshore activities occurring in the Lease Area are unlikely to affect the populations of migratory, coastal, or marine birds. While some non-marine birds have the potential to fly through the Lease Area, this area is far enough offshore as to be beyond the range of most breeding terrestrial or coastal bird species. Falcons and songbirds may pass through the Lease Area, but this will be limited to migration. Approximately 12 groups of marine birds are known to use the marine environment off of New York; of these, migratory terns were the most likely species to occur in the Lease Area but are generally thought to fly below the rotor-swept zone. Marine and coastal birds listed under the Endangered Species Act (roseate tern, piping plover, and red knot) are only expected to fly through the Lease Area during migration in limited numbers and their likelihood of occurrence is considered minimal to low. Eagles are not expected in the Lease Area because these species are rarely detected offshore.

Onshore Project related activities are expected to largely avoid potential impacts to birds because nearly all development will be co-located with existing areas of development. At export cable landfall sites, potential impacts to the shoreline habitats will be avoided by using horizontal directional drilling, and potential impacts to shoreline nesting birds will be avoided by constructing in these areas outside the nesting period where nesting birds are identified prior to construction.

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List of Acronyms and Abbreviations

AC	alternating current
BGEPA	Bald and Golden Eagle Protection Act
BOEM	Bureau of Ocean Energy Management
CFR	Code of Federal Regulations
COP	Construction and Operations Plan
CSV	comma-separated value
EBS	Ecological Baseline Studies
EIS	Environmental Impact Statement
ESA	Endangered Species Act
EW	Empire Wind
FAA	Federal Aviation Administration
ft	feet
ha	hectare
HDD	horizontal direction drilling
JSON	JavaScript Object Notation
km	kilometer
kW	kilowatt
m	meter
MBTA	Migratory Bird Treaty Act
MDAT	Marine-life Data and Analysis Team
mi	miles
MLLW	Mean Lower Low Water
MMS	Minerals Management Service
MW	megawatt
NEPA	National Environmental Policy Act
NE RPB	Northeast Regional Planning Body
NCCOS	National Centers for Coastal Ocean Science
nm	nautical mile
NOAA	National Oceanic and Atmospheric Administration
NYSDEC	New York State Department of Environmental Conservation
OCS	Outer Continental Shelf
POI	Point of Interconnection
RSZ	rotor swept zone
SGCN	Species of Greatest Conservation Need
USFWS	United States Fish and Wildlife Service
UTM	Universal Transverse Mercator
WEA	Wind Energy Area
WTG	Wind Turbine Generator

1 Part I: Introduction

1.1 Project Description

Empire Offshore Wind LLC (Empire) proposes to construct and operate an offshore wind farm located in the designated Renewable Energy Lease Area OCS-A 0512 (Lease Area). The Lease Area covers approximately 79,350 acres (ac; 32,112 hectares [ha]) and is located approximately 14 statute miles (mi) (12 nautical miles [nm], 22 kilometers [km]) south of Long Island, New York and 19.5 mi (16.9 nm, 31.4 km) east of Long Branch, New Jersey. Water depths within the Lease Area range from 85 to 141 ft (26 to 43 m) below mean lower low water (MLLW) with seafloor gradients of less than 1°.

Empire proposes to develop the Lease Area in two wind farms, known as Empire Wind 1 (EW 1) and Empire Wind 2 (EW 2) (both in New York; collectively referred to hereafter as the Project) (Figure 1-1). Both EW 1 and EW 2 are covered in the Construction and Operations Plan (COP).

The Project consists of three major development components: the offshore wind farm/turbine array located within the Lease Area, the submarine export cable siting corridor, and the onshore construction corridor, where the permanent onshore export and interconnection cables, onshore substations, and the O&M Base will be located (Figure 1-1). Each is described as follows:

<u>Offshore Wind Farm/Turbine Array</u>: The offshore wind farm/turbine array will be located within the Lease Area. This component includes the wind turbines, interarray cables, offshore substation(s), and submarine export cables. The maximum sized wind turbine in the PDE is based on models that are anticipated to be commercially available within the proposed development timescale of the Project. The make, model, and generating capacity of the wind turbine will be selected during the procurement process and is expected to be the most technologically advanced and efficient model available at that time (see Table 1-1 and Figure 1-2 for dimensions). The minimum spacing between wind turbine generators will be no less than 0.65 nm (1.2 km).

<u>Submarine Export Cable Siting Corridor</u>: The submarine export cable siting corridor encompasses the submarine export cables from the offshore substations to the export cable landfall. The submarine export cable siting corridor includes the actual width of the corridor for cable installation and additional area that will be temporary disturbed during installation activities.

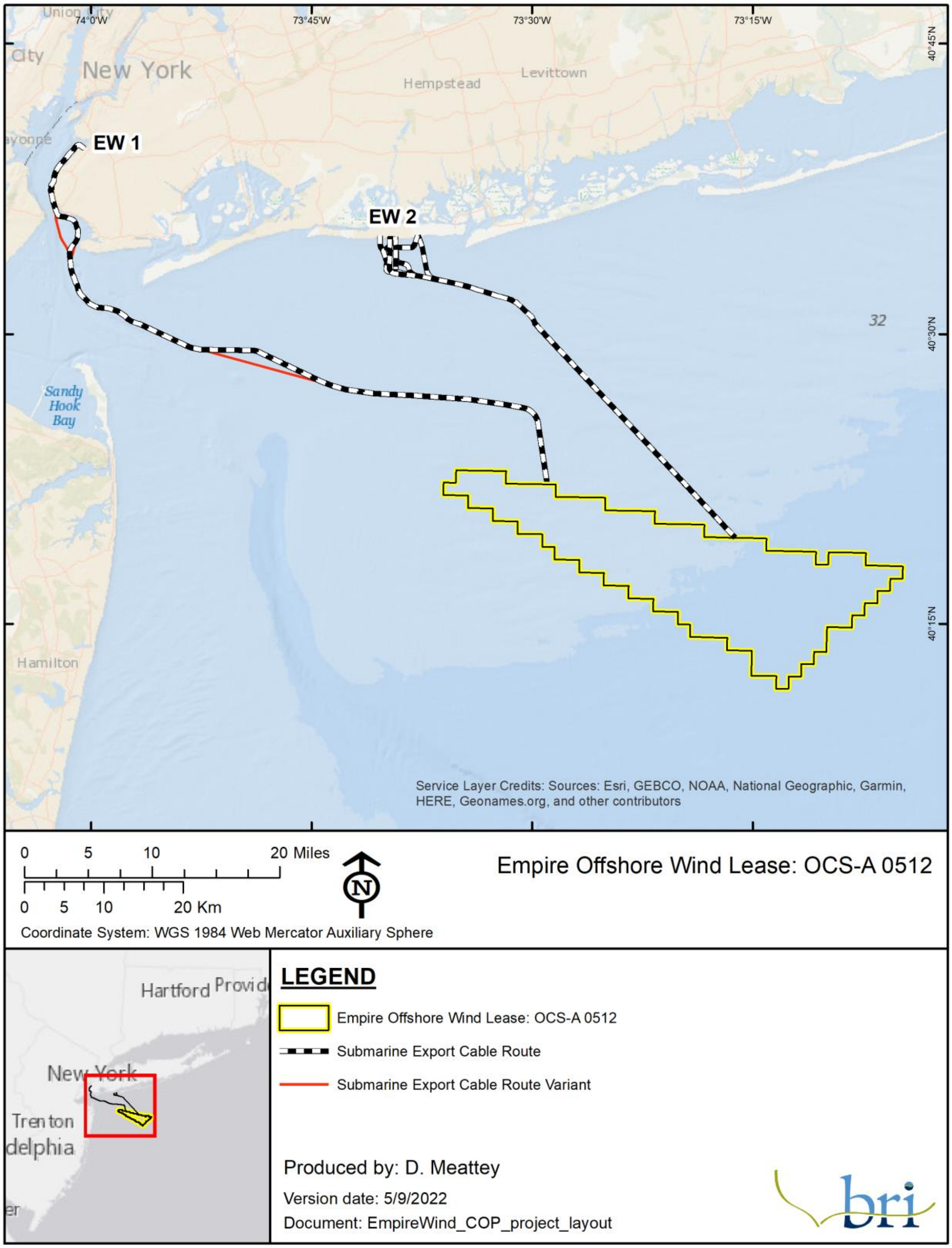

Figure 1-1. Overview of the Lease Area, including the Submarine Export Cable Routes.

Table 1-1: Summary of wind turbine maximum PDE parameters

Parameter	EW 1	EW 2
Approximate Total Number	57	90
Hub Height above HAT	525 ft (160 m)	
Upper Blade Tip above HAT	951 ft (290 m)	
Lower Blade Tip above HAT	85 ft (26 m)[1]	
Rotor Diameter	853 ft (260 m)	
[1] For this parameter, the minimum value represents the maximum PDE value.		

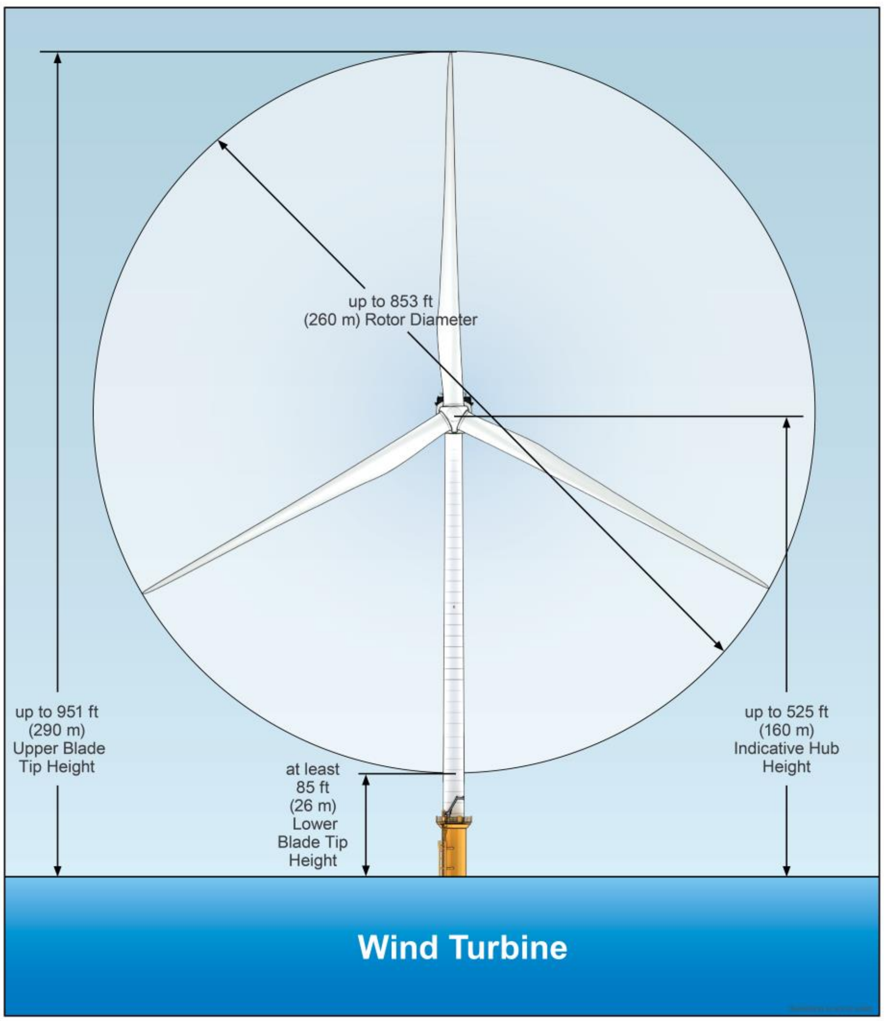

Figure 1-2: Representative Wind Turbine.

Permanent onshore electrical infrastructure: The onshore construction corridor, where the permanent onshore electrical infrastructure will be located, will contain onshore export cables, onshore substations, interconnection cables, the O&M Base, and the POIs. The onshore construction corridor includes the actual width of the corridor for cable infrastructure and additional area required for construction that will require temporary easement. Onshore construction activities will be focused on two locations: Brooklyn (EW 1) and Long Beach and Hempstead (EW 2) in New York. Proposed onshore export and interconnection cable routes (e.g., transmission lines) will be co-located with existing developed areas (e.g., roads, parking lots) and will terminate at existing substation locations.

1.2 Study Areas

For the purposes of this risk assessment, the Project is discussed from the perspective of the onshore and offshore portions of the Project, each of which present very different habitats and risk considerations to birds.

Offshore Study Area: The offshore portion of the Project includes the Lease Area where turbines, interarray cables, and two offshore substations are proposed. The Project also includes installation, operations and decommissioning of the submarine export cables that extend to land within the submarine export cable siting corridor; however, these are not expected to cause impacts to birds (Epsilon Associates Inc. 2018) because the disturbance will be short-term and will be limited to a small area directly around the cable. For this reason, this assessment places primary focus on the offshore development within the Lease Area and onshore (above high tide line) components of the Project.

Onshore Study Area: The onshore portion of the Project includes onshore (above high tide line) components of the Project. These are planned for development within up to three proposed cable corridors for the two wind farms being developed as part of the Project: one for the EW 1 interconnection cable corridor, located in Brooklyn, Kings County, NY, and up to two for the EW 2 onshore export and interconnection cable corridor located in Long Beach, Hempstead, and Oceanside, Nassau County, NY. The EW 1 export cable will make landfall via open-cut trench along a heavily developed canal. The EW 2 onshore export and interconnection cable route will make landfall via trenchless installation such as horizontal directional drill (HDD) under Long Beach and/or Lido Beach and follow existing roads from the barrier islands onto the onshore substation. The O&M Base will also be located in Brooklyn[1].

[1] While the O&M Base will serve both EW 1 and EW 2, the base will be located at SBMT, adjacent to the EW 1 onshore substation, and will therefore be included within the EW 1 Onshore Study Area for the purposes of this analysis.

2 Part II: Birds – Offshore

2.1 Methods

Using a risk assessment framework, the potential effects associated with the construction and operations of the proposed offshore wind developments were evaluated. The framework uses a weight-of-evidence approach and combines evaluations of both **exposure** (i.e., likelihood of occurrence in the Offshore Study Area), and behavioral **vulnerability** within the context of the literature to establish potential risk (Figure 2-1). The following Methods sections describe the analytical methods and criteria used to assess bird species exposure to the offshore portion of the Project, the criteria used to assess vulnerability to impact-producing factors, and the how the exposure and vulnerability assessments were combined to assess potential impacts to avian populations or individuals. Recognizing that there is uncertainty in any risk assessment, impacts were determined by considering the likelihood that the viability of the resource would be affected by the anticipated impact. For non-listed species, the assessment provides information for the BOEM to make their impact determination at a population level, as has been done for recent assessments of Wind Energy Areas (WEA) (BOEM 2016b). For federally listed species, this assessment provides information on an individual level (for ESA protected species) to evaluate risk of take.

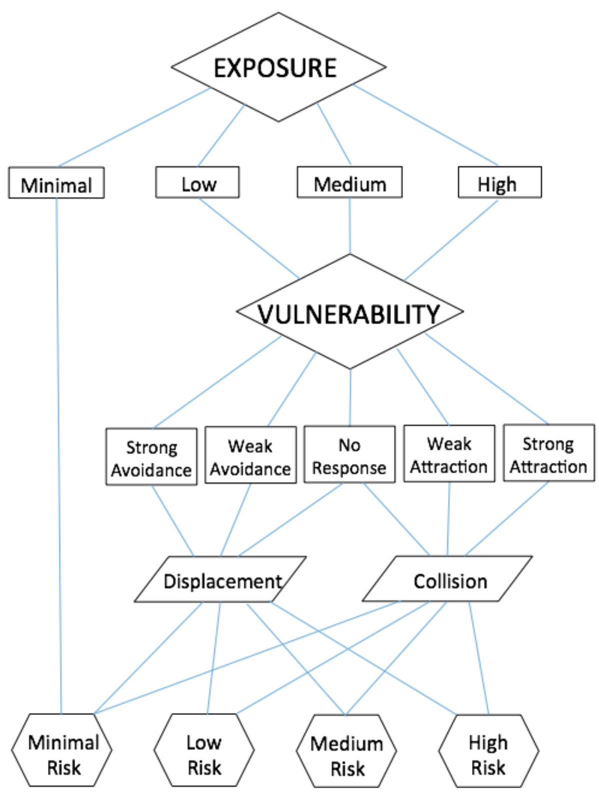

Figure 2-1: Risk assessment framework. First exposure was assessed, second behavioral vulnerability to project hazards (i.e., impact-producing factors) was assessed, and then, using a weight of evidence approach, the final risk of population level impact or individual level impact (ESA protected species) was evaluated.

2.1.1 Exposure Assessment

Exposure was evaluated for the Offshore Study Area based on digital aerial surveys conducted by APEM (a European environmental consultant which specializes in aerial surveys) for NYSERDA and Empire, as well as individual tracking data for species of special interest, and regional distribution models (Winship et al. 2018). For all birds, exposure was considered both in the context of the proportion of the population predicted to be exposed to the Lease Area as well as absolute numbers of individuals. Due to gaps in knowledge on the relationship between the number of turbines and risk, this assessment analyzes the exposure of birds to the total area of development rather than to a specific number of turbines.

The following sections introduce the data sources used in the analysis, the methods used to map species exposure, methods used to assign an exposure metric, methods to aggregate scores to year and taxonomic group, and interpretation of exposure scores. Quantitative information was used to evaluate exposure for species documented during site-specific surveys; whereas, species accounts and the literature were used to qualitatively evaluate exposure for birds with no available site-specific data.

2.1.1.1.1 Exposure Assessment Data Sources and Coverage

To assess the proportion of marine bird populations exposed to the Lease Area, four primary data sources were used to evaluate local and regional marine bird use: (1) NYSERDA regional digital aerial surveys, (2) NYSERDA New York Wind Energy Area (WEA) specific digital aerial surveys, (3) Empire Lease Area specific digital aerial surveys, and (4) version 2 of the Marine-life Data and Analysis Team (MDAT) marine bird relative density and distribution models (Curtice et al. 2016). The digital aerial surveys provide local coverage of both the Lease Area and surrounding waters. The MDAT models are modeled abundance data providing a large regional context for the Lease Area but are built from offshore survey data collected from 1978–2016. Note that the NYSERDA digital aerial survey data were not used in the MDAT modeling methodology. Each of these primary sources is described in more detail below, along with additional data sources (referred to as secondary sources) that inform the avian impact assessment. Data collected during these surveys are in general agreement with BOEM guidelines and the goals detailed above and described below.

2.1.1.1.1.1 NYSERDA Digital Aerial Surveys: New York Offshore Planning Area and Wind Energy Area

Quarterly digital aerial surveys were conducted coastally and further offshore throughout the New York Offshore Planning Area (OPA) by APEM. The OPA is inclusive of the New York Wind Energy Area (WEA), now Empire's Lease Area OCS-A 0512. Twelve surveys were conducted from Summer 2016 to Spring 2019 (Table 2-1). Note at the time of this risk assessment only data through Summer 2018 was processed and available for the exposure analysis. Surveys were conducted within the OPA as well as the NY WEA, which included a 2.5 mi (4 km) buffer. The survey within the WEA used a "checkerboard" sampling approach while the surveys across the

OPA used a strip transect method (Figure 2-2; Normandeau Associates Inc. 2019). Each survey collected images covering at least 7% of the OPA and 10% of the WEA.

Two different camera systems were used for the surveys. The Shearwater II camera system was used during the Summer 2016 survey, and the new Shearwater III camera system was used for all subsequent surveys. Both systems collected data at 0.6-inch (1.5 cm) ground sampling distance (GSD) and both surveys used a Piper Aztec twin engine aircraft. In addition, during the Summer 2016 survey of the OPA, data were collected at 0.3-inch (0.75 cm) GSD on near shore sample lines, which were flown at the lower altitude of approximately (500 ft [152 m]) to accommodate restrictions imposed in controlled airspace around the John F. Kennedy Airport. Flight altitude for the remaining survey lines of the Summer survey was at 1,020 ft (311 m), and data were captured at 1,360 ft (415 m) for all of the subsequent surveys. Daily survey time maximized crew hours and avoided mid-day when glare/glint was most prevalent. Surveys were conducted when sea state (Beaufort Scale) was ≥ 4 or less (Normandeau Associates Inc. 2019).

Table 2-1: Season, Month, Survey Dates, Days to Complete for each Survey Period. Note at the time of this risk assessment only data through Summer 2018 was processed.

Season	Reference Month	Date Started	Date Completed	Days to Complete
Summer 2016	August 2016	26 Jul 2016	9 Aug 2016	13
Fall 2016	November 2016	5 Nov 2016	27 Nov 2016	10
Winter 2016-2017	March 2017	6 Mar 2017	3 Apr 2017	10
Spring 2017	May 2017	4 May 2017	21 May 2017	9
Summer 2017	August 2017	6 Aug 2017	21 Aug 2017	8
Fall 2017	November 2017	9 Nov 2017	27 Nov 2017	8
Winter 2017-2018	February 2018	18 Feb 2018	1 Mar 2018	6
Spring 2018	April 2018	21 Apr 2018	26 Apr 2018	5
Summer 2018	July 2018	29 Jul 2018	16 Aug 2018	8
Fall 2018	November 2018	11 Nov 2018	7 Dec 2018	12
Winter 2018-2019	February 2019	3 Feb 2019	17 Feb 2019	8
Spring 2019	April 2019	27 Apr 2019	7 May 2019	5

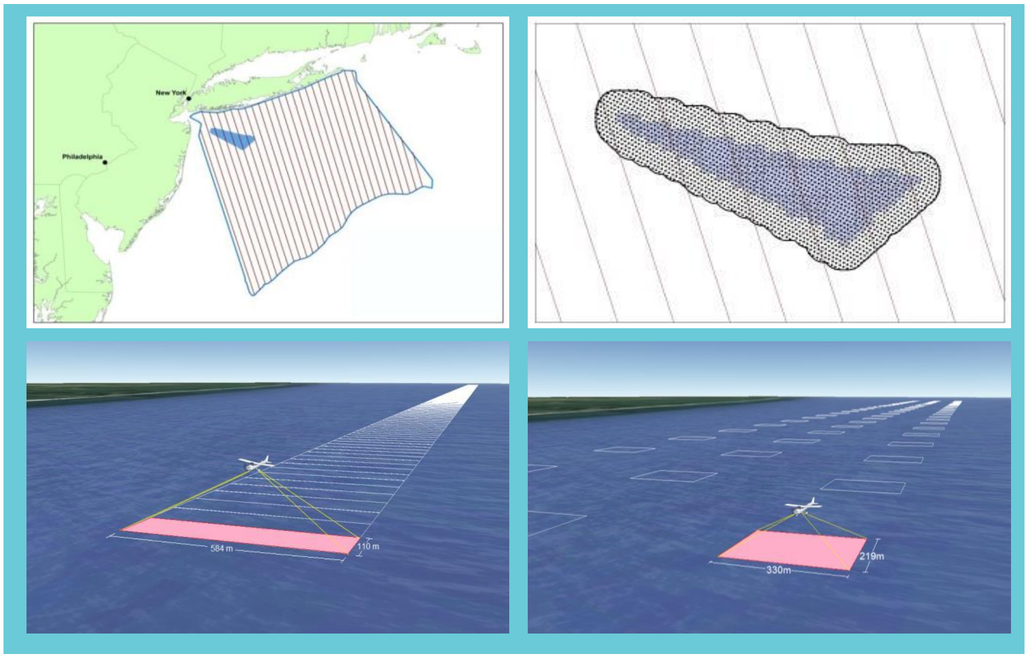

Figure 2-2: NYSERDA avian digital aerial surveys conducted in the OPA and WEA from 2016-2019 (Normandeau Associates Inc. 2016). Surveys conducted offshore in the OPA follow a transect pattern of sequential images forming a continuous set of imagery along the flight path spaced evenly as transect lines running approximately north-south (top and bottom left illustrations). Within the WEA (Lease Area) survey effort was denser and followed a grid ("checkerboard") pattern where images were spaced out evenly across the survey area (top and bottom right illustrations). A number OPA transect lines also crossed the WEA as illustrated at top right.

Identification of birds listed as "Endangered" or "Threatened" by the state or under the ESA were flagged. A minimum of 20% of all birds identified were reviewed by a second taxonomic expert, and taxonomic agreement had to meet a minimum of 90% concurrence. Failure to reach this would trigger a review of 100% of identifications made by the initial taxonomist. The 20% review included quality control review of 100% of ESA and State-listed species, and for endangered species a 100% agreement had to be reached on identifications. Additional experts in the species concerned were called in to arbitrate identifications when concurrence could not be reached (Normandeau Associates Inc. 2019).

2.1.1.1.1.2 Empire Digital Aerial Surveys: Lease Area

Following the methods described for the NYSERDA digital aerial surveys, APEM also conducted 12 monthly surveys of the Lease Area plus a 2.5 mi (4 km) buffer. The surveys were conducted from November 2017 to October 2018 and images were captured along 28 lines spaced ~0.5 mi (0.8 km) across-track and ~0.4 mi (0.6 km) along-track within the survey area (Figure 2-3; Normandeau Associates Inc. 2019).

Birds not identified to species level were identified to a broader taxonomic level (e.g., unidentified tern). Due to the large numbers of birds not identified to species (approximately 1/3 of the 74,000 observations), the exposure/risk assessment was also conducted across the following broad taxonomic groupings: dabblers, geese, and swans; coastal diving ducks; sea ducks; grebes; shorebirds; phalaropes; skuas and jaegers; auks; small gulls; medium gulls; large gulls; all gulls; small terns; medium terns; large terns; all terns; loons; storm-petrels; shearwaters and petrels; gannet; cormorants; pelicans; herons and egrets; raptors; passerines; and all birds. Groupings such as "all terns" (for example), consist of all species and higher taxonomic groupings within the specified group (i.e. the broader grouping "all terns" encompasses the more refined taxonomic groups of small, medium, and large terns). Grouping species in this manner maximized the data for analysis but came at the expense of species level analysis. For example, all unidentified scoter identifications were used along with all scoters identified to species in the sea duck group for analyzing exposure of sea ducks.

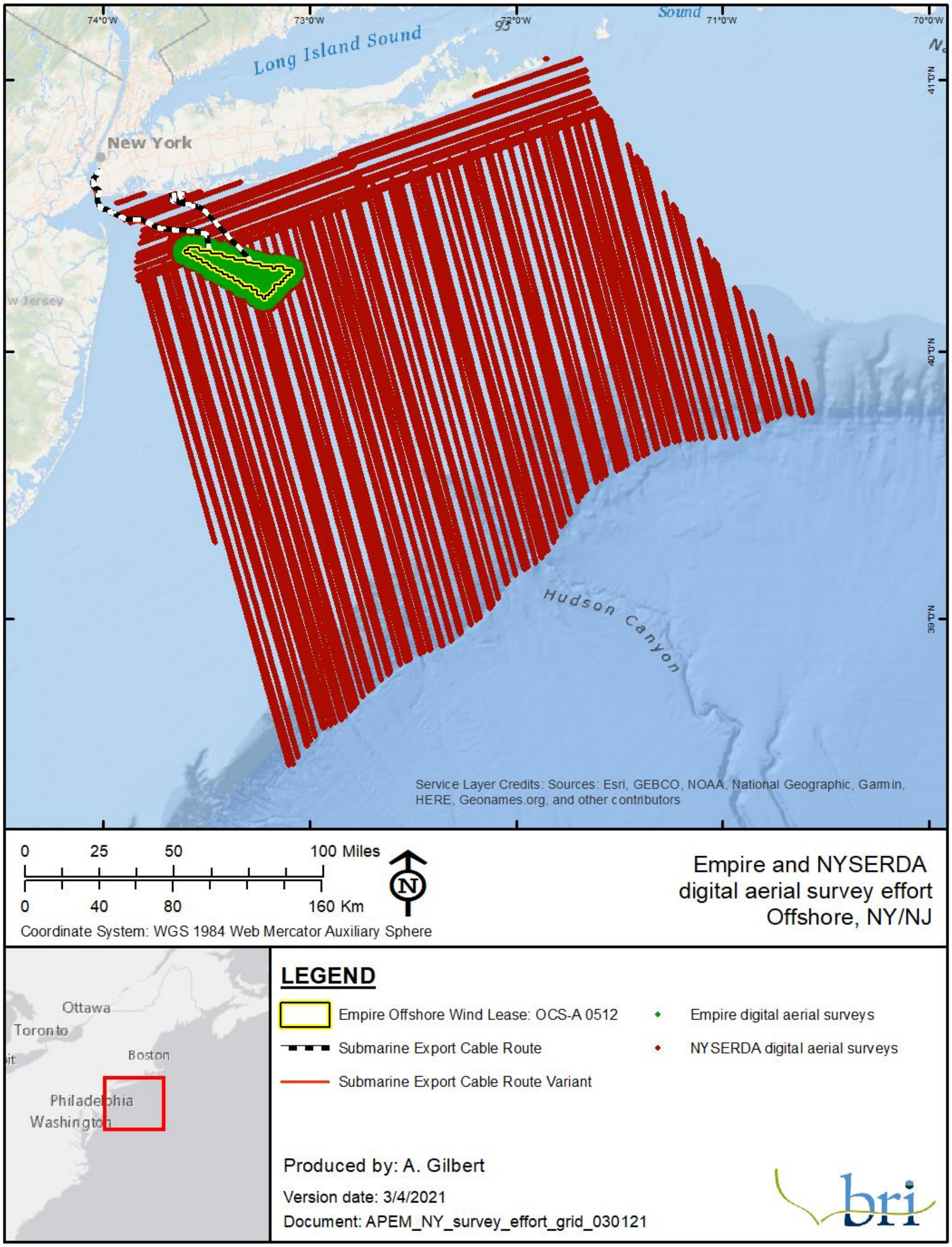

Figure 2-3: Flight lines and image capture points of the digital aerial survey in Lease Area and across the New York Offshore Planning Area.

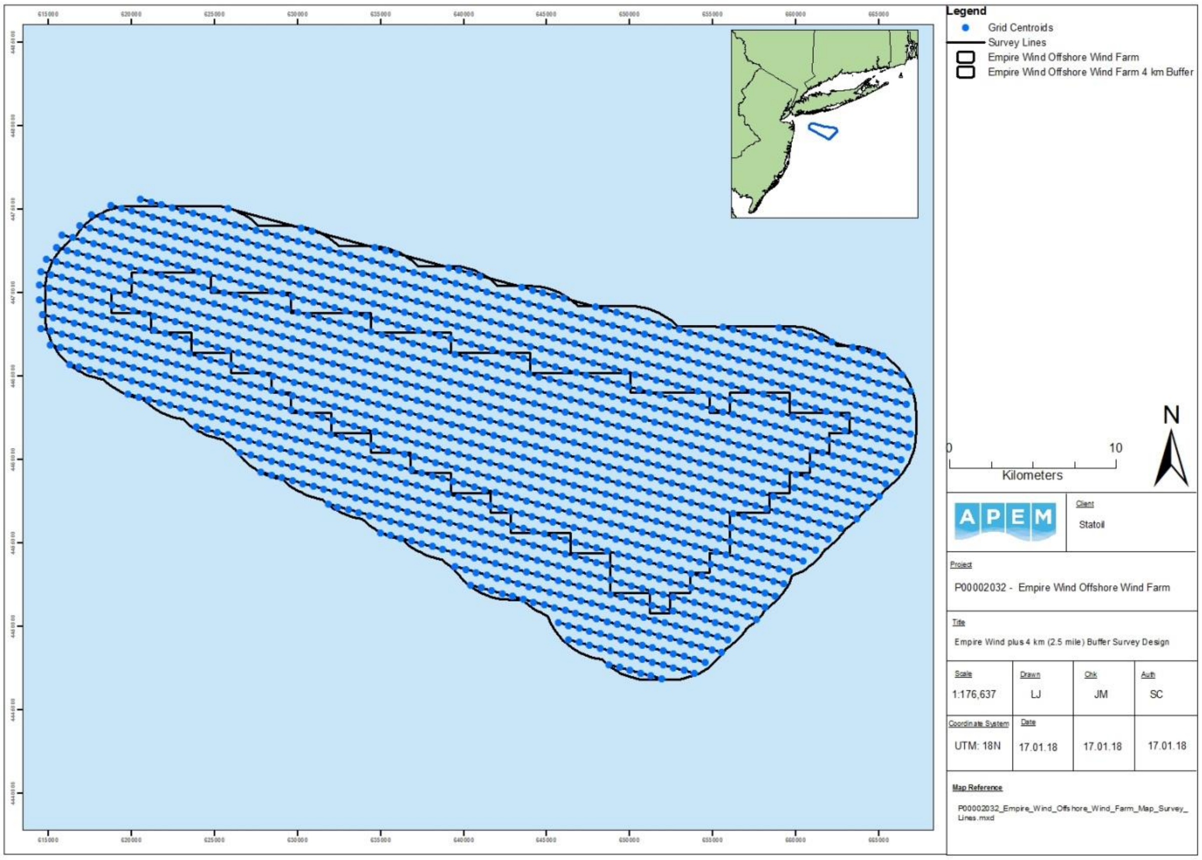

Figure 2-4: Flight lines and image capture points of the aerial digital still imagery at the Lease Area plus 2.5 mile (4 km) buffer (Normandeau Associates Inc. 2019).

The digital aerial surveys data were collected in a standardized, comprehensive way, and the data are fairly recent, so they describe recent distribution patterns in the Lease Area and surrounding areas. However, these surveys covered a fairly small area relative to the Northwest Atlantic distribution of most marine bird species, and the limited number of surveys conducted in each season means that individual observations (or lack of observations, for rare species) may in some cases carry substantial weight in determining seasonal exposure. Likewise, lack of observations of a particular species does not mean that it does not occur. These aerial surveys also produced "unidentified" observations (e.g., "unknown large gull" or "unknown small tern") which prove difficult for evaluating species-specific exposures.

2.1.1.1.1.3 The MDAT Marine Bird Abundance and Occurrence Models (Version 2)

Marine-Life Data and Analysis Team (MDAT) bird models have been developed to describe regional-scale patterns of abundance (Curtice et al. 2016, Winship et al. 2018). Updates to these models (Version 2) are available directly from Duke University's Marine Geospatial Ecology Lab

MDAT model web page[2]. The MDAT analysis integrated survey data (1978–2016) from the Atlantic Offshore Seabird Dataset Catalog[3] with a range of environmental variables to produce long-term average annual and seasonal models (Figure 2-5). Version 2 relative abundance and distribution models were produced for 47 avian species using U.S. Atlantic waters from Florida to Maine, and thus provide an excellent regional context for local relative densities estimated from digital aerial surveys. These models were developed to support marine spatial planning in the Atlantic and can be used to support renewable energy risk assessment.

In order to analyze MDAT models at the taxonomic group level, individual species models were first combined into taxonomic group models. Modeled density is long-term average relative density and so aggregating species into group models required normalizing model output and then combining. The recommendation for normalization is to divide the relative density values by the sum total relative density value, normalizing the data to between 0 and 1 (Winship et al. 2018). Normalization for all species-season MDAT models was performed prior to combining into taxonomic groups. Taxonomic group MDAT models were created from the list of species within a defined taxonomic group, if that species was present in the APEM NY surveys, providing evidence that the species occurs in the local area. Species present within each group are listed in the map captions for each taxonomic group-season combination in each taxonomic group-specific discussion.

The MDAT models, are based on data collected at much larger geographic and temporal scales than the digital aerial surveys. These data were also collected using a range of survey methods. The larger geographic scale is helpful for determining the importance of the Lease Area to marine birds relative to other available locations in the Northwest Atlantic and is thus essential for determining overall exposure. However, because these models are based on survey data from decades of surveys and long-term climatological averages of dynamic covariates; these models may no longer accurately reflect current distribution patterns. Model outputs that incorporate environmental covariates to predict distributions across a broad spatial scale may also vary in the accuracy of those predictions at a local scale.

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[2] http://seamap.env.duke.edu/models/mdat/

[3] https://coast.noaa.gov/digitalcoast/data/atloffshoreseabird.html

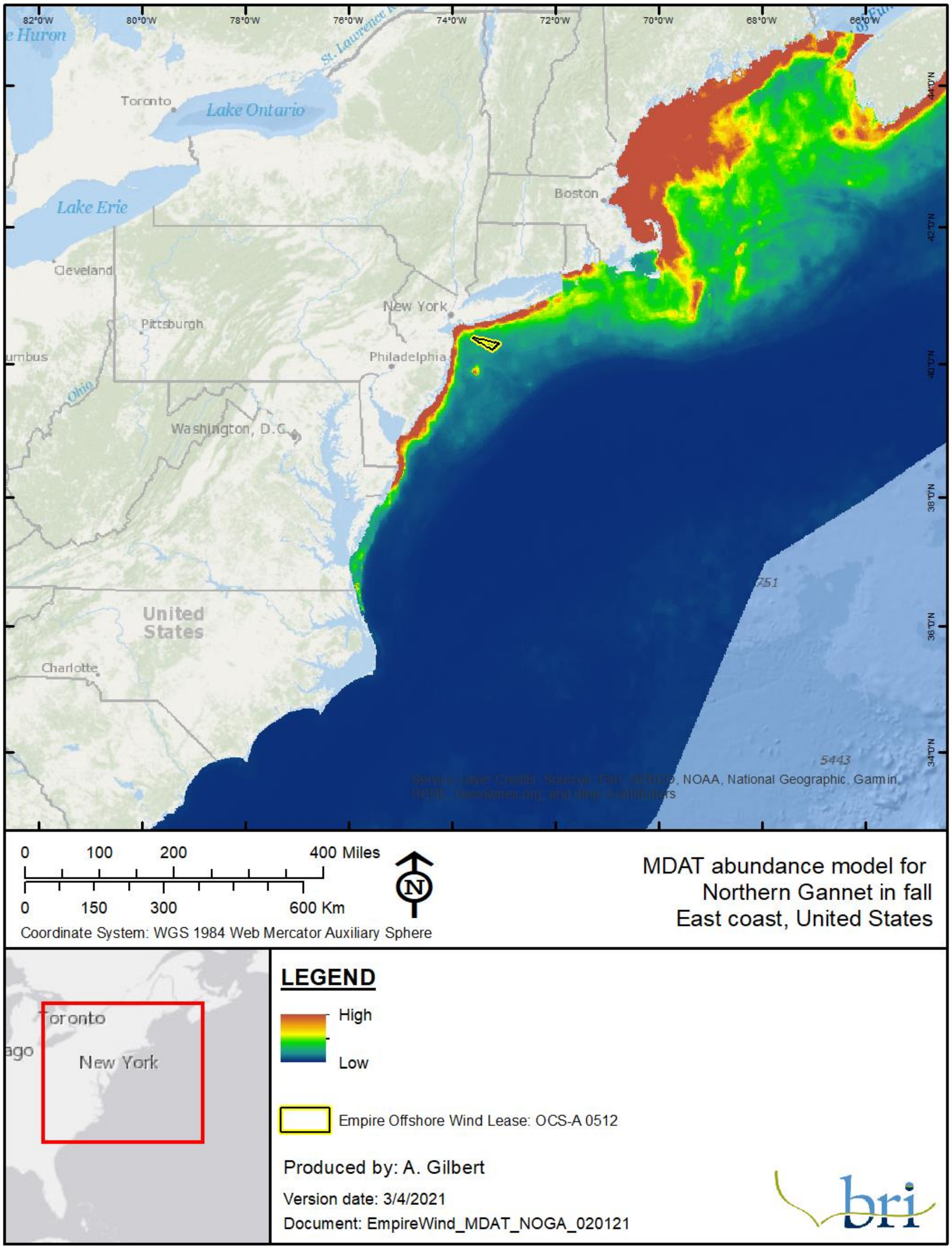

Figure 2-5: Example Marine-life Data and Analysis Team (MDAT) abundance model for Northern Gannet in fall

2.1.1.1.1.4 Secondary Data Sources

2.1.1.1.1.4.1 Northwest Atlantic Seabird Catalog

The Northwest Atlantic Seabird Catalog is the comprehensive database for the majority of offshore and coastal seabird surveys conducted in the Atlantic waters of the U.S. from Maine to Florida. The Seabird Catalog database contains records from 1938-2017, having more than 180 datasets and >700,000 observation records along with associated effort information (K. Coleman, Pers. Comm.). The database is currently being managed by Arliss Winship at National Oceanic and Atmospheric Administration (NOAA). With BOEM's approval, NOAA provided the database to BRI to make queries for this assessment. All relevant data from the Catalog were mapped to determine the occurrence of rare species within the Lease Area.

2.1.1.1.1.4.2 Mid-Atlantic Diving Bird Tracking Study

A satellite telemetry tracking study in the mid-Atlantic was developed and supported by BOEM and the USFWS with objectives aimed at determining fine scale use and movement patterns of three species of marine diving birds during migration and winter (Spiegel et al. 2017). These species – the red-throated loon (*Gavia stellata*), surf scoter (*Melanitta perspicillata*), and northern gannet (*Morus bassana*) – are all considered species of conservation concern and exhibit various traits that make them vulnerable to offshore wind development. Nearly 400 individuals were tracked using satellite transmitters over the course of five years (2012–2016), including some tagged surf scoters as part of the Atlantic and Great Lakes Sea Duck Migration Study by Sea Duck Joint Venture partners[4]. Results provide a better understanding of how these diving birds use offshore areas of the mid-Atlantic Outer Continental Shelf and beyond.

2.1.1.1.1.4.3 Migrant Raptor Studies

To facilitate research efforts on migrant raptors (i.e., migration routes, stopover sites, space use relative to Wind Energy Areas, wintering/summer range, origins, contaminant exposure), BRI has deployed satellite transmitters on fall migrating raptors at three different raptor migration research stations along the north Atlantic coast (DeSorbo et al. 2012, 2018c, 2018a). Research stations include Block Island, Rhode Island (The Block Island Raptor Research Station: Peregrines n = 3 adult females, n = 18 hatching year females, n = 17 hatching year peregrines; Merlins - 3 adult females, and 13 hatching year females [DeSorbo et al. 2018c]), Monhegan Island, Maine (n = 2 hatching year female peregrine falcons), and Cutler, Maine (n = 1 adult female).

Satellite-tagged peregrines and merlins provided information on fall migration routes along the Atlantic flyway. Positional data was filtered to remove poor quality locations using the Douglas Argos Filtering tool (Douglas et al. 2012) available online on the Movebank data repository[5] where these data are stored and processed. A request for data use was made to Chris DeSorbo,

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[4] https://seaduckjv.org/science-resources/atlantic-and-great-lakes-sea-duck-migration-study/

[5] https://www.movebank.org/

Raptor Program Director at Biodiversity Research Institute, who provided permission to utilize the results of the migrant raptor studies.

2.1.1.1.1.4.4 Tracking movements of vulnerable terns and shorebirds in the Northwest Atlantic using nanotags

Since 2013, BOEM and the USFWS have supported a study using nanotags and an array of automated VHF telemetry stations to track the movements of vulnerable terns and shorebirds. The study was designed to assess the degree to which these species use offshore federal waters during breeding, pre-migratory staging periods, and on their migrations. In a pilot study in 2013, they attached nanotags to common terns (*Sterna hirundo*) and American oystercatchers (*Haematopus palliatus*) and set up eight automated sentry stations (Loring et al. 2017). Having proved the methods successful, the study was expanded to 16 automated stations in 2014, and from 2015-2017, tagging efforts included ESA-listed piping plovers (*Charadrius melodus*) and roseate terns (*Sterna dougallii*). This study provided new information on the offshore movements and flight altitudes for these species gathered from a total of 33 automated telemetry stations, including areas of Massachusetts, New York, New Jersey, Delaware, and Virginia (Loring et al. 2019).

2.1.1.1.1.4.5 Tracking movements of rufa red knots in U.S. Atlantic Outer Continental Shelf Waters

Building from a previous tracking study, *rufa* red knots (*Calidris canutus rufa*) were fitted with digital VHF transmitters during their 2016 southbound migration at stopover locations in both Canada and along the U.S. Atlantic coast. Individuals were tracked utilizing radio telemetry stations within the study area that extended from Cape Cod, Massachusetts to Back Bay, Virginia. Modeling techniques were developed to describe the frequency and offshore movements over Federal waters and specific WEAs within the study area. The primary study objectives were to: develop models related to offshore movements for *rufa* red knots; assess the exposure to each WEA during southbound migration; and examine WEA exposure and migratory departure movements in relation to various meteorological conditions (Loring et al. 2018).

2.1.1.1.1.4.6 Sea Duck Tracking Studies

The Atlantic and Great Lakes Sea Duck Migration Study, a multi-partner collaboration, was initiated by the Sea Duck Joint Venture (SDJV) in 2009 with the goals of: 1) fully describing full annual cycle migration patterns for four species of sea ducks (surf scoter, black scoter, white-winged scoter, and long-tailed duck); 2) mapping local movements and estimating length-of-stay during winter for individual radio-marked ducks in areas proposed for placement of wind turbines, 3) identifying near-shore and offshore habitats of high significance to sea ducks to help inform habitat conservation efforts, and 4) estimating rates of annual site fidelity to wintering areas, breeding areas, and molting areas for all four focal species in the Atlantic flyway. To date, over 500 transmitters have been deployed in the United States and Canada by various project partners including Biodiversity Research Institute, Canadian Wildlife Service, USGS Patuxent Wildlife Research Center, University of Rhode Island, Rhode Island Department of Environmental

Management, USFWS, Sea Duck Joint Venture, and the University of Montreal. These collective studies have led to increased understanding of annual cycle dynamics of sea ducks, as well as potential interactions with and impacts from offshore wind energy development (Loring et al. 2014, SDJV 2015, Meattey et al. 2018, 2019).

Additionally, BOEM and USFWS partnered with the SDJV during 2012-2016 to deploy transmitters in surf scoters as part of a satellite telemetry tracking study in the mid-Atlantic, with objectives aimed at determining fine scale use and movement patterns of three species of marine diving birds during migration and winter (Spiegel et al. 2017).

2.1.1.1.2 Exposure Mapping

Maps were developed to display local and regional context for exposure assessments. A three-part map was created for each taxa-season combination that includes MDAT and/or APEM New York surveys data (see Part V). Any taxa-season combination which did not at least have either MDAT model or APEM New York surveys data (i.e., blank maps) were left out of the final map set. An example map for shearwater and petrel group in spring is provided below to aid in discussion (Figure 2-6).

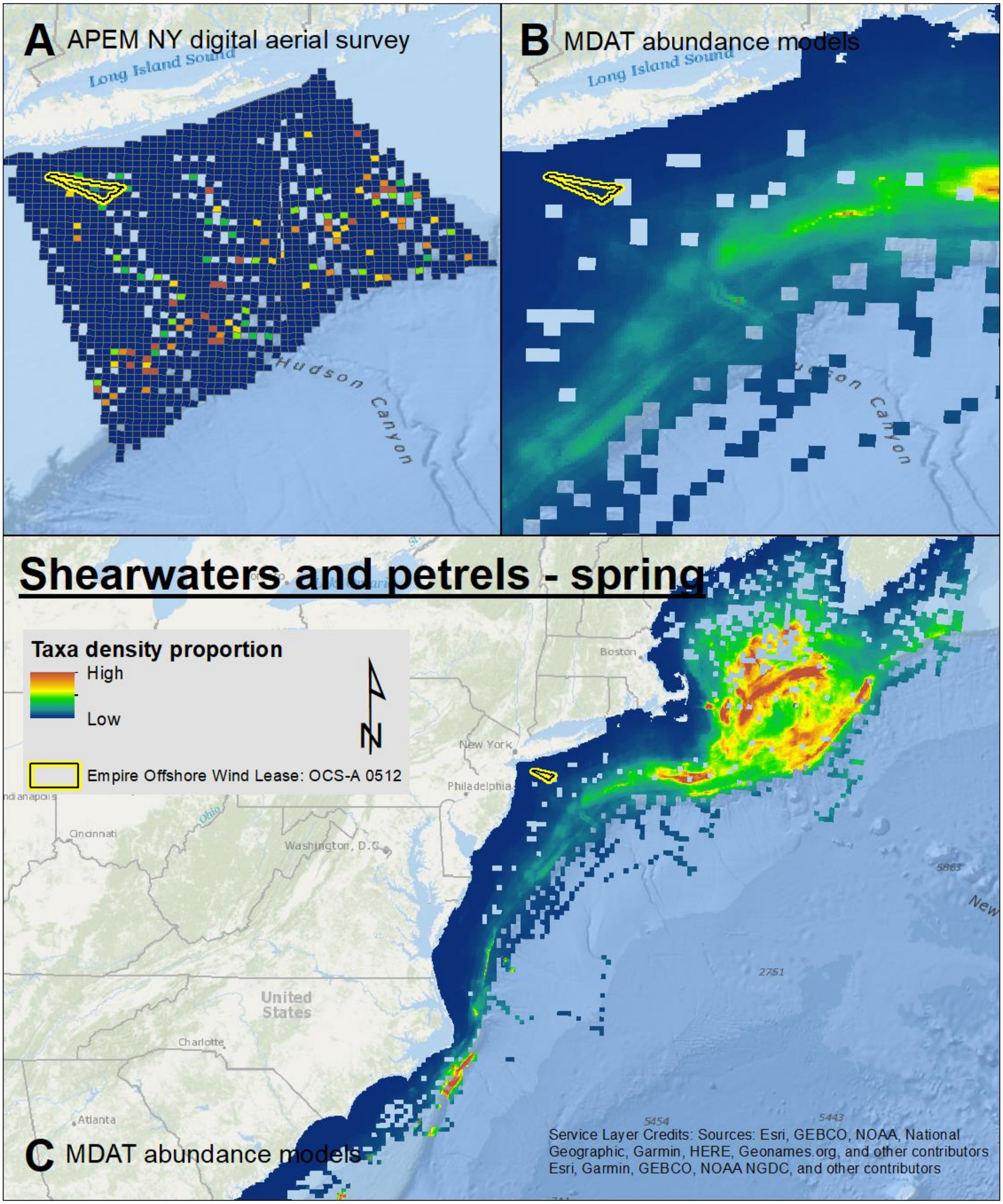

Figure 2-6: Example taxa group map of relative density proportions locally and regionally. Panel (A) presents the APEM data as proportions of total effort-corrected counts. Panels B and C include data from MDAT models presented at different scales: the APEM New York surveys and the entire northwest Atlantic.

The first map panel (A) presents the APEM data as proportions of total effort-corrected counts. The proportion of the total effort-corrected counts (total counts per square kilometer of survey area) was calculated for each BOEM designated Outer Continental Shelf (OCS)[6] Lease Block[7], across all surveys in a given season. This method was useful as it scaled all effort-corrected count data from 0-1 to standardize data visualizations among taxonomic groups. Exposure was ranked from low-to-high for each taxonomic group based on weighted quantiles of these count proportions. Quantiles were weighted by the count proportions because data were skewed towards zero. OCS Lease Blocks with zero counts were always the lowest, and blocks with more than one observation were divided into 4 weighted quantiles.

The next two map panels (B and C) include data from MDAT models presented at different scales; Panel B shows the modeled densities in the same area as the APEM New York surveys, while Panel C shows the density output over the entire northwest Atlantic. Density data are scaled in a similar way to the APEM New York data, so that the low-high designation for density is similar for both datasets. However, there are no true zeroes in the model outputs, and thus no special category for them in the MDAT data. All MDAT models were masked to remove areas of zero effort within a season. These zero-effort areas do have density estimates, but generally are of low confidence, so they were excluded from mapping and analysis to reduce anomalies in predicted taxonomic group densities and to strengthen the analysis. Additionally, while the color scale for the MDAT data is approximately matched to that used for the APEM New York data, the values that underlie them are different (the MDAT data are symbolized using an ArcMap default color scale, which uses standard deviations from the mean to determine the color scale rather than quantiles). Maps should be viewed in a broadly relative way between local and regional assessments and even across taxonomic groups.

2.1.1.1.3 Exposure Assessment Metrics

To assess bird exposure at the local (i.e., New York OPA) and regional scales (i.e., U.S. Atlantic waters), the Lease Area was compared to other similarly sized areas in each dataset for each season and taxonomic group. Using the MDAT data, masked to remove zero-effort predicted cells, the predicted seasonal density surface for a given taxonomic group was aggregated into a series of rectangles that were approximately the same size as the Lease Area, and the mean density estimate of each rectangle was calculated. This process compiled a dataset of density

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[6] Outer Continental Shelf (OCS) is defined by the Department of the Interior (https://www.bsee.gov/newsroom/library/glossary) as "All submerged lands seaward and outside the area of lands beneath navigable waters. Lands beneath navigable waters are interpreted as extending from the coastline 3 nautical miles into the Atlantic Ocean, the Pacific Ocean, the Arctic Ocean, and the Gulf of Mexico excluding the coastal waters off Texas and western Florida. Lands beneath navigable waters are interpreted as extending from the coastline 3 marine leagues into the Gulf of Mexico off Texas and western Florida."

[7] OCS Lease Blocks are defined (https://catalog.data.gov/dataset/outer-continental-shelf-lease-blocks-atlantic-region-nad83) as "small geographic areas within an Official Protraction Diagram (OPD) for leasing and administrative purposes. These blocks have been clipped along the Submerged Lands Act (SLA) boundary and along the Continental Shelf Boundaries. Additional details are available from: https://www.boem.gov/BOEM-Newsroom/Library/Publications/1999/99-0006-pdf.aspx"

estimates for all species surveyed, for areas the same size as the Lease Area. The 25th, 50th, and 75th weighted quantiles of this dataset were calculated, and the quantile into which the density estimate for the Lease Area fell for a given taxonomic group and season combination was identified. Quantiles were weighted by using the proportion of the total density across the entire modeled area that each sample represented. Thus, quantile breaks represent proportions of the total seabird density rather than proportions of the raw data. A categorical score was assigned to the Lease Area for each season-species: 0 (Minimal) was assigned when the density estimate for the Lease Area was in the bottom 25%; 1 (Low) when it was between 25% and 50%; 2 (Medium) when it was between 50% and 75%; and 3 (High) when it was in the top quartile (>75%).

A similar process was used to categorize each taxonomic group-season combination using the APEM data set. The mean relative density for the Lease Area (a collection of 20 partial or full OCS Lease Blocks) was calculated. To compare the Lease Area to other locations with the OPA, the nearest 19 OCS Lease Blocks to each OCS Lease Block surveyed in the OPA in each season (winter, n = 228; spring, n = 240; summer, n = 224; and fall, n = 224) were identified and the relative density of each 20 OCS Lease Block groups was calculated. Thus, a dataset of relative densities for all possible Lease Area sized OCS Lease Block groups was generated within the OPA using the APEM data. This data set was used to assign scores to all taxonomic group-season combinations, based on the same quartile categories described for the MDAT models above. If a score for a taxonomic group-season combination was not available using the APEM data (local assessment), and because the avian surveys made every effort to survey all species, then the local assessment score was assigned a 0 since no animals were sighted for that taxonomic group-season combination.

2.1.1.1.4 Species Exposure Scoring

To determine the relative exposure for a given taxonomic group and season in the Lease Area compared to all other areas, the MDAT quartile score and APEM quartile score were added together to create a final exposure metric that ranged from 0 to 6. The density information at both spatial scales was equally weighed, and thus represent both the local and regional importance of the Lease Area to a given taxonomic group during a given season. However, if a taxonomic group-season combination was not available for the MDAT regional assessment, then the score from the local assessment (APEM surveys) was accepted as the best available information for that taxonomic group-season, and it was scaled to range from 0 to 6 (e.g., essentially doubled to match the final combined score).

The final exposure score was categorized as Minimal (a combined score of 0), Low (combined score of 1-2), Medium (combined score of 3-4), or High (combined score of 5-6; Table 2-2). In general terms, taxonomic group-season combinations labeled as 'Minimal' had low densities at both the local and regional scales. 'Low' exposure was assessed for taxonomic groups with below-average densities at both spatial scales, or above-average density at one of the two scales and low density at the other scale. 'Medium' exposure describes several different combinations of densities; one or both scales must be at least above-average density, but this category can also include taxonomic group-season combinations where density was high for one scale and low for another. ‘High’ exposure is when both scales are high density, or one is high and the other is above average. Both local and regional exposure scores were viewed as equal in importance in the assessment of exposure.

Table 2-2: Definitions of exposure levels developed for each taxonomic group and season. The listed scores represent the exposure scores from the local APEM survey data and the regional MDAT on the left and right, respectively.

Exposure Level	Definition	Scores
Minimal	Lease Area densities at both local and regional scales are below the 25th percentile.	0, 0
Low	Lease Area local and/or regional density is between the 25th and 50th percentiles.	1, 1
	OR	
	Lease Area local density is between the 50th and 75th percentiles and regional density is below the 25th percentile, or vice versa.	2, 0
Medium	Lease Area local or regional density is between the 50th and 75th percentiles.	2, 2
	OR	
	Lease Area local density is between the 50th and 75th percentiles and regional density between the 25th and 50th percentiles, or vice versa.	2, 1
	OR	
	Lease Area local density is greater than the 75th percentile and regional density is below the 25th percentile, or vice versa.	3, 0
	OR	
	Lease Area local density is greater than the 75th percentile of all densities and regional density is between the 25th and 50th percentiles of all densities (or vice versa).	3, 1
High	Lease Area densities at both local and regional scales are above the 75th percentile.	3, 3
	OR	
	Local densities are greater than the 75th percentile and regional densities are between the 50th and 75th percentiles, or vice versa.	3, 2

2.1.1.1.5 Aggregated Annual Exposure Scores

To understand the total exposure across the annual cycle for each taxonomic group, all the seasonal scores were summed to obtain an annual score from 0–12. These annual scores were mapped to exposure categories of Minimal (0–2), Low (3–5), Medium (6–8), and High (9–12). The annual exposure category for a taxonomic group represents the seasonally-integrated risk across the annual cycle.

Finally, because these scores are all relative to seasonal distribution, estimates of count density were provided within the Lease Area and over the entire survey area for each species from the APEM survey data. Uncommon taxonomic groups with few detections in the Lease Area may be somewhat over-rated for exposure using this method, while common taxonomic groups with relatively few detections in the Lease Area may be effectively under-rated in terms of total exposure to the Project. Density estimates per square kilometer are presented to provide context for the exposure scores.

2.1.1.1.6 Interpreting Exposure Scores

The final exposure scores for each taxonomic group and season, as well as the aggregated annual scores, should be interpreted as a measure of the relative importance of the Lease Area for a taxonomic group, as compared to other surveyed areas in the region and in the northwest Atlantic. It does not indicate the absolute number of individuals likely to be exposed. Rather, the exposure score attempts to provide regional and population-level context for each taxon.

A High exposure score indicates that the observed and predicted densities of the taxonomic group in the Lease Area were high relative to densities of that taxonomic group in other surveyed areas. Conversely, a Low or Minimal exposure score means that the taxonomic group was predicted to occur at lower densities in the Lease Area than in other locations. A Minimal exposure score should not be interpreted to mean there are no individuals of that taxonomic group in the Lease Area. In fact, common taxonomic groups may receive a Minimal exposure score even if there are still substantial numbers of individuals in the Lease Area, so long as their predicted densities *outside* are comparatively higher. This quantitative annual exposure score was then considered with additional species-specific information, along with expert opinion, to place each taxonomic group within a final exposure category (described below in section 2.1.1.1.7).

2.1.1.1.7 Exposure Categories

The quantitative assessment of exposure (described above), other locally available data, existing literature, and species accounts were utilized to develop a final qualitative exposure determination. Final exposure level categories used in this assessment are described in Table 2-3.

Table 2-3. Assessment criteria used for assigning species to final exposure levels.

Final Exposure Level	Definition
Minimal	Minimal seasonal exposure scores in all seasons or minimal score in all but 1 season AND/OR Based upon the literature—and, if available, other locally available tracking or survey data—little to no evidence of use (e.g., no record in project area) of the offshore environment for breeding, wintering, or staging, and low predicted use during migration
Low	Low exposure scores in 2 or more seasons, or Medium exposure score in 1 season AND/OR Based upon the literature—and, if available, other locally available tracking or survey data— low evidence of use of the Lease Area or offshore environment during any season
Medium	Medium exposure scores in 2 or more seasons, or High exposure score in 1 season AND/OR Based upon the literature—and, if available, other locally available tracking or survey data—moderate evidence of the Lease Area or use of the offshore environment during any season
High	High exposure scores in 2 or more seasons AND/OR Based upon the literature—and, if available, other locally available tracking or survey data—high evidence of use of the Lease Area or offshore environment, and the offshore environment is primary habitat during any season

2.1.2 Vulnerability Framework

Hazards (i.e., impact-producing factors) are defined as the changes to the environment caused by Project activities during each offshore wind development phase (BOEM] 2012, Goodale and Milman 2016). For birds, the primary impact-producing factors for the offshore component of the Project are above water and include vessels, lighting, wind turbines, and sub-substations (Table 2-4). Below water Project activities, including but not limited to foundation and cable installation, are not expected to be a long-term hazard for birds (BOEM 2018) and are not discussed in detail. Low probability events, such as spills, are not discussed. In addition to the exposure to the wind project, the behavior of each species of bird will influence its vulnerability.

Table 2-4: Potential effects on birds from offshore activities and the Project phases for which they are assessed.

Impact-Producing Factor(s)	Potential Effect	Description	Construction & Decommissioning*	Operations
Vessels, lighting, wind turbines, sub-stations	Collision	Mortality and injury caused by collision with Project structures	✓	✓
Vessels, noise from pile-driving, wind turbines, sub-stations, human activity	Displacement (Temporary)	Temporary disturbance by Project activities resulting in effective habitat loss	✓	
Wind turbines, sub-stations	Displacement (Permanent)	Permanent avoidance and/or displacement from habitat		✓
*Effects of decommissioning are expected to be less than or equal to construction activities.				

Researchers in Europe and the U.S. have assessed the vulnerability of birds to offshore wind farms and general disturbance by combining ordinal scores across a range of key variables (Furness et al. 2013, Willmott et al. 2013, Wade et al. 2016, Kelsey et al. 2018, Fliessbach et al. 2019). The purpose of these indices was to prioritize species in environmental assessments (Desholm 2009), and provide a relative rank of vulnerability (Willmott et al. 2013). Importantly, the past assessments and the one conducted here, are intended to support decision-making by ranking the relative likelihood that a species will be sensitive to offshore wind farms but should not be interpreted as an absolute determination that there will or will not be collision mortality or habitat loss. In addition, for many species there remains significant uncertainty (see discussion below) on critical inputs into vulnerability score (e.g., avoidance rates). Therefore, the results should be interpreted as a guide to species that have a higher likelihood of risk and be used to prioritize the species that should be the focus of post-construction monitoring.

The existing vulnerability methods assess individual-level vulnerability to collision and displacement independently, then incorporate population-level vulnerability to develop a final *species-specific* vulnerability score. These past efforts provide useful rankings across a region but are not designed to assess the vulnerability of birds to a particular wind farm or certain turbine designs. Collision risk models (e.g., Band 2012) do estimate site-specific mortality, but are substantially influenced by assumptions about avoidance rates (Chamberlain et al. 2006) and do not assess vulnerability to displacement. Thus, there is a need to develop a *project-specific* vulnerability score for each species that is inclusive of both collision and displacement and has fewer assumptions.

The scoring process in this assessment builds from the existing methods, incorporates the specifications of the maximum sized wind turbine being considered by the Project, utilizes local bird conservation status, and limits the vulnerability score to the species observed in the local surveys. The results from this scoring method may differ for some species from the qualitative determinations made in other COP assessments. For species, or species group, for which inputs are lacking, the literature is used to qualitatively determine a vulnerability ranking using the criteria in Table 2-5. Below is a description of the scoring approach.

Table 2-5. Assessment criteria used for assigning species to each behavioral vulnerability level.

Behavioral Vulnerability Level	Definition
Minimal	0-0.25 ranking for collision or displacement risk in vulnerability scoring AND/OR No evidence of collisions or displacement in the literature. Unlikely to fly within the rotor-swept zone (RSZ).
Low	0.26-0.5 ranking for collision or displacement risk in vulnerability scoring AND/OR Little evidence of collisions or displacement in the literature. Rarely flies within the RSZ.
Medium	0.51-0.75 ranking for collision or displacement risk in vulnerability scoring AND/OR Evidence of collisions or displacement in the literature. Occasionally flies within the RSZ.
High	0.76-1.0 ranking for collision or displacement risk in vulnerability scoring AND/OR Significant evidence of collisions or displacement in the literature. Regularly flies within the RSZ.

2.1.2.1.1 Population Vulnerability (PV)

There are many factors that contribute to how sensitive a population is to mortality or habitat loss related to the presence of a wind farm; these include vital rates, existing population trends, and relative abundance of birds in (Goodale and Stenhouse 2016). In this avian risk assessment, the relative abundance of birds is accounted for by the exposure analysis described above. The vulnerability assessment creates a population vulnerability score by using Partners in Flight (PiF) “continental combined score” (CCSmax), a local “state status” (SSmax), and adult survival score (AS; Equation 1). Survival is included as an independent variable that is not accounted for in the CCSmax. This approach is based upon methods used by Kelsey et al. (2018) and Fliessbach et al. (2019).

Each factor included in this assessment (CCSmax, SSmax, and AS) is weighted equally and receives a categorical score of 1–5 (Table 2-6). The final population level vulnerability scores are rescaled to a 0–1 scale, divided into quartiles, and are then translated into four final vulnerability categories (Table 2-5). Since using quartiles creates hard cut-off points and there is uncertainty present in all inputs (see discussion on uncertainty below), using only scores can potentially misrepresent vulnerability (e.g., a 0.545 PV score leading to a 'medium' category). To account for these issues, the scores are considered along with information in existing literature. If there is evidence in the literature that conflicts with the vulnerability score, then the score will be appropriately adjusted (up or down) according to documented empirical evidence. For example, if a PV score was assessed as low, but a paper indicated an increasing population, the score would be adjusted up to include a range of low–medium.

$$PV = CCSmax + SSmax + AS \qquad \text{Equation 1}$$

Specifics for each factor in PV are as follows:

- *CCSmax* is included in scoring because it integrates various factors PiF uses to indicate global population health. It represents the maximum value for breeding and non-breeding birds developed by PiF, and combines the scores for population size, distribution, global threat status, and population trend (Panjabi et al. 2019). The CCSmax score from PiF was rescaled to a 1-5 scale to achieve consistent scoring among factors.

- *SSmax* is included in scoring to account for local conservation status, which is not included in the CCSmax. Local conservations status is generally determined independently by states and accounts for the local population size, population trends, and stressors on a species within a particular state. It was developed following methods by Adams et al. (2016) in which the State conservation status for the relevant adjacent states is placed within five categories (1 = no ranking, to 5 = endangered), and then, for each species, the maximum state ranking is selected.

- *AS* is included in the scoring because species with higher adult survival rates are more sensitive to increases in adult mortality (Desholm 2009, Adams et al. 2016). The five categories are based upon those used in several vulnerability assessments (Willmott et al. 2013, Kelsey et al. 2018, Fliessbach et al. 2019), and the species-specific values were used from Willmott et al. (2013).

Table 2-6. Data sources and scoring of factors used in the vulnerability assessment

Vulnerability Component	Factor	Definition and Source	Scoring
Population Vulnerability (PV)	*CCSmax*	Partners in Flight continental combined score: http://pif.birdconservancy.org/ACAD/Database.aspx	1 = Minor population sensitivity 2 = Low population sensitivity 3 = Medium population sensitivity 4 = High population sensitivity 5 = Very-High population sensitivity
	SSmax	State status from states adjacent to project; Adams et al. 2016	1 = No Ranking* 2 = State/Federal Special Concern 3 = State/Federal Threatened 4 = State/Federal Endangered 5 = State & Federal End and/or Thr

Vulnerability Component	Factor	Definition and Source	Scoring
	AS	Adult survival score: scores and categories taken from Willmott et al. 2013	1 = <0.75 2 = 0.75 to 0.80 3 = >0.80 to 0.85 4 = >0.85 to 0.90 5 = >0.90
Collision Vulnerability (CV)	*RSZt*	Turbine-specific percentage of flight heights in rotor swept zone (RSZ). Flight heights modeled from NW Seabird Catalog. Categories from Kelsey et al. 2018	1 = < 5% in RSZ 3 = 5–20% in RSZ 5 = > 20% in RSZ
	MAc	Avoidance rates and scoring categories from Willmott et al. 2013 and Kelsey et al. 2018	1 = >40% avoidance 2 = 30 to 40% avoidance 3 = 18 to 29% avoidance 4 = 6 to 17% avoidance 5 = 0 to 5% avoidance
	NFA & DFA	Nocturnal Flight Activity (NFA) and Diurnal Flight Activity (DFA). NFA scores were taken from Willmot et al. 2013; DFA was calculated using locally available aerial surveys that records if birds are sitting or flying.	1 = 0–20% 2 = 21–40% 3 = 41–60% 4 = 61–80% 5 = 81–100%
Displacement Vulnerability (DV)	*MAd*	Macro-avoidance rates that would decrease collision risk from Willmott et al. 2013 and Kelsey et al. 2018	1 = 0–5% avoidance 2 = 6–17% avoidance 3 = 18–29% avoidance 4 = 30–40% avoidance 5 = > 40% avoidance
	HF	The degree to which a species is considered a habitat generalist (i.e., can forage in a variety of habitats) or a specialist (i.e., requires specific habitat and prey type). HF score and categories taken from Willmott et al. 2013	0 = species does not forage in the Atlantic Outer Continental Shelf 1 = species uses a wide range of habitats over a large area and usually has a wide range of prey available to them 2 to 4 = grades of behavior between scores 1 and 5 5 = species with habitat- and prey-specific requirements that do not have much flexibility in diving-depth or choice of prey species

*Note actual definitions for state conservation ranking may be adjusted to follow individual state language

2.1.2.1.2 Collision Vulnerability (CV)

Collision vulnerability assessments can include a variety of factors including nocturnal flight activity, diurnal flight activity, avoidance, proportion of time within the rotor swept zone (RSZ), maneuverability in flight, and percentage of time flying (Furness et al. 2013, Willmott et al. 2013, Kelsey et al. 2018). The assessment process conducted here follows Kelsey et al. (2018) and includes proportion of time within the RSZ (RSZt), a measure of avoidance (MAc), and flight activity (NFA and DFA; Equation 2). Each factor was weighted equally and given a categorical score of 1–5 (Table 2-6). The final collision vulnerability scores were rescaled to a 0–1 scale, divided into quartiles, and then translated into four final vulnerability categories (Table 2-5). As described in the PV section, the score is then considered along with information available in existing literature; if there is sufficient evidence to deviate from the quantitative score, a CV categorical range is assigned for each species.

$$CV = RSZt + MAc + (NFA + DFA)/2 \qquad \text{Equation 2}$$

Specifics for each factor in CV are as follows:

- RSZt is included in the score to account for the probability that a bird may fly through the RSZ. Flight height data was selected from the Northwest Atlantic Seabird Catalog. Flight heights in the Catalog calculated from digital aerial survey methods were excluded because the methods have not been validated (Thaxter et al. 2015). The APEM flight height data was not used due to uncertainty about local variations in bird size and therefore reference lengths which feed into the calculation to generate flight height (Clough pers. comm. Nov. 13, 2019). Three additional boat-based datasets were excluded because there was low confidence in the data (collect by citizen science efforts and not QA/QCed) or estimated flight heights only included part of the air space below 300 m.

  Many of the boat-based datasets provided flight heights as categorical ranges for which the mid value of the range in meters were determined, as well as the lower and upper bounds of the category. Upper bounds that were given as >X ft (or m) were capped at 300 meters to estimate upper bounds. A few datasets provided exact flight height estimates which resulted in upper and lower ranges being the same as the mid value. A total of 100 randomized datasets were generated per species using the uniform distribution to select possible flight height values between lower and upper flight height bounds. Similar to methods from Johnston et al. (2014), flight heights were modeled using a smooth spline of the square root of the binned counts in 15-meter bins. The integration of the smooth spline model count within each 1 m increment was calculated and the mean and standard deviation of all 100 models were calculated across all 1 m increments. The proportion of animals within each RSZ zone was estimated by summing the 1 m count integrations and dividing by the total estimate count of animals across the RSZ zone for the maximum PDE parameters, then values were converted to a 1-5 scale based upon the categories used by Kelsey et al. (2018; Table 2-6). The analysis was conducted in R Version 3.5.0.[8] Of note, there are several important uncertainties in flight

[8] R Core Team (2018). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/

height estimates: flight heights from boats can be skewed lower; flight heights are generally recorded during daylight and in fair weather; and flight heights may change when turbines are present. These flight height data do not consider flight heights for nocturnal migrants.

- MAc is included in the score to account for macro-avoidance rates that would decrease collision risk. Macro-avoidance is defined as a bird's ability to change course to avoid the entire wind farm area (Kelsey et al. 2018), versus meso-avoidance (avoiding individual turbines), and micro-avoidance (avoiding turbine blades; Skov et al. 2018). The scores used in the assessment were based on Willmott et al. (2013), who conducted a literature review to determine known macro-avoidance rates and then converted them to a 1–5 score based upon the categories in Table 2-6. The MAc indicates that this factor is used in the CV versus the MAd, which was used in the DV score (described below). For the assessment conducted here, Willmott et al. (2013) avoidance rates were updated to reflect the most recent empirical studies (Krijgsveld et al. 2011, Cook et al. 2012, 2018; Vanermen et al. 2015, Skov et al. 2018), and indexes (Garthe and Hüppop 2004, Furness et al. 2013, Bradbury et al. 2014, Adams et al. 2016, Wade et al. 2016, Kelsey et al. 2018). For the empirical studies, the average avoidance was used when a range was provided in a paper. For the indices, the scores were converted to a continuous value using the median of a scores range; only one value was entered for related indices (e.g., Adams et al. 2016 and Kelsey et al. 2018). When multiple values were available for a species, the mean value was calculated. For some species, averaging the avoidance rates across both the empirical studies and indices led to some studies being counted multiple times. Indices were included to capture how the authors interpreted the avoidance studies and determined avoidance rates for species where data was not available. There are several important uncertainties in determining avoidances rates: the studies were all conducted in Europe; the studies were conducted at wind farms with turbines much smaller than are proposed for the Project; the methods used to record avoidance rates varied and included surveys, radar, and observers; the analytical methods used to estimate avoidance rates also varied significantly between studies; and the avoidance rate for species where empirical data is not available were assumed to be similar to closely-related species.

- NFA and DFA include scores of estimate percentage of time spent flying at night (NFA) and during the day (DFA) based upon the assumption that more time spent flying would increase collision risk. The NFA scores were taken directly from the scores, based upon literature review, from Willmott et al. 2013. The DFA score were calculated from the APEM data that categorized if a bird was sitting or flying for each bird observation. Per Kelsey et al. 2018 the NFA and DFA scores were equally weighted and averaged.

2.1.2.1.3 Displacement Vulnerability (DV)

Rankings of displacement vulnerability account for two factors: 1) disturbance from ship/helicopter traffic and the wind farm structures (MAd); and 2) habitat flexibility (HF; Furness et al. 2013, Kelsey et al. 2018). This assessment combines these two factors, weights them equally, and categorizes them from 1–5 (Equation 3; Table 2-6). Note: While Furness et al. (2013) down-weighed the DV score by dividing by 10 (they assumed displacement would have lower impacts on the population), the assessment conducted here maintains the two scores on the same scale. Empirical studies indicate that for some species, particularly sea ducks, that avoidance behavior may change through time and that several years after projects have been built some individuals may forage within the wind farm. The taxonomic specific text indicates if there is evidence that displacement may be partially temporary. The final displacement vulnerability scores are rescaled to a 0–1 scale, divided into quartiles, and translated into four final vulnerability categories (Table 2-5). As described in the PV section, the score is then considered along with the literature; if there is sufficient evidence to deviate from the quantitative score, a DV categorical range is assigned for each species.

$$DV = MAd + HF \qquad \text{Equation 3}$$

Specifics for each factor in DV are as follows:

- *MAd* is included to account for behavioral responses from birds that lead to macro-avoidance of wind farms, and that have the potential to cause effective habitat loss if the birds are permanently displaced (Fox et al. 2006a). The MAd scores used in the assessment were based on Willmott et al. 2013, but updated to reflect the most recent empirical studies (Krijgsveld et al. 2011, Cook et al. 2012, 2018; Vanermen et al. 2015, Skov et al. 2018), and indexes (Garthe and Hüppop 2004, Furness et al. 2013, Bradbury et al. 2014, Adams et al. 2016, Wade et al. 2016, Kelsey et al. 2018). See MAc above for further details. The scores are the same as the MAc scores described above, but, following methods from Kelsey et al. (2018), are inverted so that a high avoidance rate (> 40%) is scored as a 5. Since the > 40% cutoff is a low threshold, many species can receive a high 5 score; there is a large range within this high category that includes species documented to have moderate avoidance rates (e.g., terns) and species with near complete avoidance (e.g., loons).

- *HF* accounts for the degree to which a species is considered a habitat generalist (i.e., can forage in a variety of habitats) or a specialist (i.e., requires specific habitat and prey type). The assumption is that generalists are less likely to be affected by displacement, whereas specialists are more likely to be affected (Kelsey et al. 2018). The values for HF used in this assessment were taken from Willmott et al. (2013). Note that Willmott et al. (2013) used a 1–5 scale plus a “0” to indicate that a species does not forage in the Atlantic Outer Continental Shelf.

2.1.3 <u>Final Risk Determination</u>

The CV, DV, and PV calculations are all used to make a final evaluation on population level risk. First the CV and DV categories are combined with the exposure assessment to develop a preliminary risk determination (Table 2-7). Rather than multiplying the CV and DV by PV score, as is done in some vulnerability assessments (Furness et al. 2013), the PV score is used to adjust the risk score up or down based upon the following rules: "minimal" = adjustment down in risk; "low to medium" = no adjustment; and "high" = adjusted up. In the case of a risk range (e.g., low - medium), an adjustment down would eliminate the high of the range and an adjustment up would eliminate the low end of the range. This approach down weights the influence of PV in the risk assessment to account for the broad uncertainty in understanding population dynamics. For listed species, the final determination is on the individual level and uses a weight of evidence approach to assign a categorical likelihood that an individual would either collide or be displaced by the wind turbines.

Table 2-7: Final risk evaluation matrix. CV = collision vulnerability; DV = displacement vulnerability, and PV = population vulnerability. An initial risk determination is made based upon vulnerability and exposure, and then the PV score is used to either keep the score the same, adjust the score up or down, or with a risk range eliminate the lower or upper portion of the range.

	Vulnerability (CV & DV)				
Exposure	*Minimal*	*Low*	*Medium*	*High*	*PV*
Minimal	Minimal	Minimal	Minimal	Minimal	
Low	Minimal	Low	Low	Low	
Medium	Minimal	Low	Medium	Medium	
High	Minimal	Low	Medium	High	
PV					

2.1.4 Uncertainty

Uncertainty is recognized in this assessment for both exposure and vulnerability. Given the natural variability of ecosystems and recognized knowledge gaps, assessing how anthropogenic actions will affect the environment inherently involves a degree of uncertainty (Walker et al. 2003). Broadly defined, uncertainty is incomplete information about a subject (Masden et al. 2015) or a deviation from absolute determinism (Walker et al. 2003). In the risk assessment conducted here, uncertainty is broadly recognized as a factor in the process, and is accounted for by including, based upon the best available data, a range for the exposure, vulnerability, and population scores when appropriate.

For offshore wind avian assessments, uncertainty primarily arises from two sources: predictions of bird use of the Project area and the region (i.e., exposure); and our understanding of how birds interact with turbines (i.e., vulnerability). While uncertainty will always be present in any assessment of offshore wind, and acquiring data on bird movements during hours of darkness and in poor weather is difficult, overall knowledge on bird use of the marine environment has improved substantially in recent years through local survey efforts (e.g., APEM surveys), revised regional modeling efforts (i.e., MDAT models), and individual tracking studies (e.g., falcons, terns, piping plover, red knot, diving birds). For many species, multiple data sources may be available to make an exposure assessment, such as survey and individual tracking data. If the data sources show differing patterns in use of the wind farm area, then a range of exposure is provided (e.g., minimal–low) to account for all available data and to capture knowledge gaps and general uncertainty about bird movements.

Similarly, knowledge has been increasing on the vulnerability of birds to offshore wind facilities in Europe (e.g., Skov et al. 2018). Vulnerability assessments have either incorporated uncertainty into the scoring process to calculate a range of ranks (Willmott et al. 2013, Kelsey et al. 2018), or have developed separate stand-alone tables (Wade et al. 2016). In order to keep the scoring process as simple as possible, this assessment does not directly include uncertainty in the scoring, but rather uses the uncertainty assessment conducted by Wade et al. (2016) as a reference (Table 2-8) and references all available literature. Like exposure, if there is evidence in the literature, or from other data sources, that conflicts with the vulnerability score, the score will be adjusted up or down, as appropriate, to include a range that extends into the next category. This approach accounts for knowledge gaps and general uncertainty about vulnerability.

Table 2-8 From Wade et al. (2016): "Uncertainty inherent in data underlying the generation of four vulnerability factors for 38 seabird species. Uncertainty Scores equate to five Uncertainty Categories with greater scores indicating lower uncertainty: very high (score 1), high (score 2), moderate (score 3), low (score 4) and very low uncertainty (score 5). These categories and scores are on an ordinal scale where the numerical values have no significance beyond allowing a ranking to be established. Species rankings and scores were generated relative to data considered in each of the four vulnerability factors."

Species	Uncertainty Level: % of time at altitudes overlapping with turbine blades	Uncertainty Score	Uncertainty Level: Displacement caused by structures	Uncertainty Score	Uncertainty Level: Displacement caused by vessels and/or helicopters	Uncertainty Score	Uncertainty Level: Use of tidal races	Uncertainty Score	Overall Uncertainty Score (max 20)
European storm-petrel	Very high	1	Very high	1	High	2	Very high	1	5
Leach's storm-petrel	Very high	1	Very high	1	High	2	Very high	1	5
Sooty shearwater	Very high	1	Very high	1	High	2	Very high	1	5
Arctic skua	Moderate	3	Very high	1	Very high	1	Very high	1	6
Common goldeneye	Very high	1	Very high	1	High	2	High	2	6
Greater scaup	Very high	1	Very high	1	High	2	High	2	6
Manx shearwater	High	2	Very high	1	High	2	Very high	1	6
Slavonian grebe	Very high	1	High	2	High	2	Very high	1	6
White-tailed eagle	Very high	1	High	2	High	2	Very high	1	6
Great-crested grebe	High	2	High	2	High	2	Very high	1	7
Long-tailed duck	Very high	1	High	2	High	2	High	2	7
Roseate tern	Very high	1	High	2	High	2	High	2	7
Great skua	Moderate	3	High	2	High	2	Very high	1	8
Little tern	Very high	1	Moderate	3	Very high	1	Moderate	3	8
Velvet scoter	High	2	Very high	1	Moderate	3	High	2	8
Black-headed gull	Moderate	3	Moderate	3	High	2	Very high	1	9
Northern fulmar	Low	4	High	2	High	2	Very high	1	9
Arctic tern	Moderate	3	Moderate	3	High	2	High	2	10
Great northern diver	High	2	High	2	Very high	1	Very low	5	10
Little auk	Very high	1	Low	4	Low	4	Very high	1	10
Black-throated diver	High	2	Moderate	3	High	2	Low	4	11
Common gull	Low	4	Low	4	High	2	Very high	1	11
Common eider	Moderate	3	Moderate	3	Moderate	3	Moderate	3	12
Sandwich tern	Low	4	Low	4	High	2	High	2	12
Black guillemot	Very high	1	High	2	Very low	5	Very low	5	13
European shag	High	2	Low	4	High	2	Very low	5	13
Great black-backed gull	Low	4	Very low	5	Moderate	3	Very high	1	13
Great cormorant	Moderate	3	Very low	5	High	2	Moderate	3	13
Black-legged kittiwake	Very low	5	Very low	5	High	2	High	2	14
Common tern	Very low	5	Low	4	High	2	Moderate	3	14
Herring gull	Very low	5	Very low	5	Moderate	3	Very high	1	14
Lesser black-backed gull	Very low	5	Very low	5	Moderate	3	Very high	1	14
Northern gannet	Very low	5	Very low	5	High	2	High	2	14
Red-throated diver	Low	4	Low	4	High	2	Low	4	14
Common scoter	Low	4	Very low	5	Low	4	High	2	15
Atlantic puffin	Moderate	3	Moderate	3	Very low	5	Very low	5	16
Razorbill	Low	4	Very low	5	Very low	5	Low	4	18
Common guillemot	Low	4	Very low	5	Very low	5	Very low	5	19

2.2 Results

2.2.1 Overview

The assessment, below, includes the following for each species group: a description of the spatiotemporal context of exposure, exposure assessment, relative behavioral vulnerability assessment including flight height data, and a final risk determination. Marine birds are further divided into family groups. Species listed under the Bald and Golden Eagle Protection Act and the ESA are assessed individually within their respective sections. A summary table is provided at the end of the assessment.

2.2.1.1 Exposure

Based on a review of the USFWS IPaC system and other data sources, three species listed under the federal ESA are present in the region and have potential to occur within the offshore portion of the project: piping plover, red knot, and roseate tern (Table 2-9). Piping plovers nest along New Jersey and New York beaches, and will also migrate (spring and fall) through the region to and from northern breeding sites. Red knots pass through the region during migration in transit to far northern breeding sites. Roseate terns also fly through the mid-Atlantic on their way north to breeding sites in New York and New England.

Table 2-9. Bird species potentially exposed to the offshore components of the Project identified through USFWS IPaC database (https://ecos.fws.gov/ipac/), New York State Energy Research and Development Authority (NYSERDA) and site-specific baseline studies. E=endangered; T=threatened

Taxonomic Group	Species	IPaC		NY Listed	Federally Listed
Dabblers, geese, and swans					
American black duck	*Anas rubripes*				
Canada goose	*Branta canadensis*				
Gadwall	*Mareca strepera*				
Mallard	*Anas platyrhynchos*				
Tundra swan	*Cygnus columbianus*				
Coastal diving ducks					
Bufflehead	*Bucephala albeola*				
Common goldeneye	*Bucephala clangula*				
Lesser scaup	*Aythya affinis*				
Sea ducks					
Black scoter	*Melanitta americana*	x			
Common eider	*Somateria mollissima*	x			
Long-tailed duck	*Clangula hyemalis*	x			
Red-breasted merganser	*Mergus serrator*	x			
Surf scoter	*Melanitta perspicillata*	x			
White-winged scoter	*Melanitta fusca*	x			
Grebes					
Horned grebe	*Podiceps auritus*				

Taxonomic Group	Species	IPaC		NY Listed	Federally Listed
Shorebirds					
Black-bellied plover	*Pluvialis squatarola*				
Semipalmated plover	*Charadrius semipalmatus*				
Phalaropes					
Red phalarope	*Phalaropus fulicarius*	x			
Red-necked phalarope	*Phalaropus lobatus*				
Skuas and jaegers					
Great skua	*Stercorarius skua*				
Parasitic jaeger	*Stercorarius parasiticus*	x			
Pomarine jaeger	*Stercorarius pomarinus*	x			
South polar skua	*Stercorarius maccormicki*	x			
Auks					
Atlantic puffin	*Fratercula arctica*	x			
Black guillemot	*Cepphus grylle*				
Common murre	*Uria aalge*	x			
Dovekie	*Alle alle*	x			
Razorbill	*Alca torda*	x			
Small gulls					
Bonaparte's gull	*Chroicocephalus philadelphia*	x			
Little gull	*Hydrocoloeus minutus*				
Medium gulls					
Black-legged kittiwake	*Rissa tridactyla*	x			
Laughing gull	*Leucophaeus atricilla*				
Ring-billed gull	*Larus delawarensis*	x			
Large gulls					
Great black-backed gull	*Larus marinus*	x			
Glaucous gull	*Larus hyperboreus*				
Herring gull	*Larus argentatus*	x			
Iceland gull	*Larus glaucoides*				
Lesser black-backed gull	*Larus fuscus*				
Small terns					
Black tern	*Chlidonias niger*			E	
Least tern	*Sternula antillarum*	x		T	
Medium terns					
Common tern	*Sterna hirundo*	x		T	
Forster's tern	*Sterna forsteri*				
Roseate tern	*Sterna dougallii*	x		E	E
Royal tern	*Thalasseus maximus*	x			
Loons					
Common loon	*Gavia immer*	x			
Red-throated loon	*Gavia stellata*	x			
Storm-petrels					
Leach's storm-petrel	*Oceanodroma leucorhoa*	x			
Wilson's storm-petrel	*Oceanites oceanicus*	x			

Taxonomic Group	Species	IPaC		NY Listed	Federally Listed
Shearwaters and petrels					
Audubon's shearwater	*Puffinus lherminieri*				
Black-capped petrel	*Pterodroma hasitata*				
Cory's shearwater	*Calonectris diomedea*	x			
Great shearwater	*Ardenna gravis*	x			
Manx shearwater	*Puffinus puffinus*	x			
Northern fulmar	*Fulmarus glacialis*				
Sooty shearwater	*Ardenna grisea*				
Gannet and booby					
Northern gannet	*Morus bassanus*	x			
Cormorants					
Double-crested cormorant	*Phalacrocorax auritus*	x			
Pelicans					
Brown pelican	*Pelecanus occidentalis*	x			
Heron and egrets					
Great blue heron	*Ardea herodias*				
Raptors					
Osprey	*Pandion haliaetus*				
Passerines					
Common nighthawk	*Chordeiles minor*				

Overall, the MDAT models indicate avian abundance is greater closer to shore than in the Lease Area and predict an area of high bird abundance in the west-central portion of the Lease Area (Figure 2-7) most likely as a result of high predicted abundance of common murre in the winter (Figure 2-8). Greater detail on auk exposure is discussed in section 2.2.8.7 (p. 115).

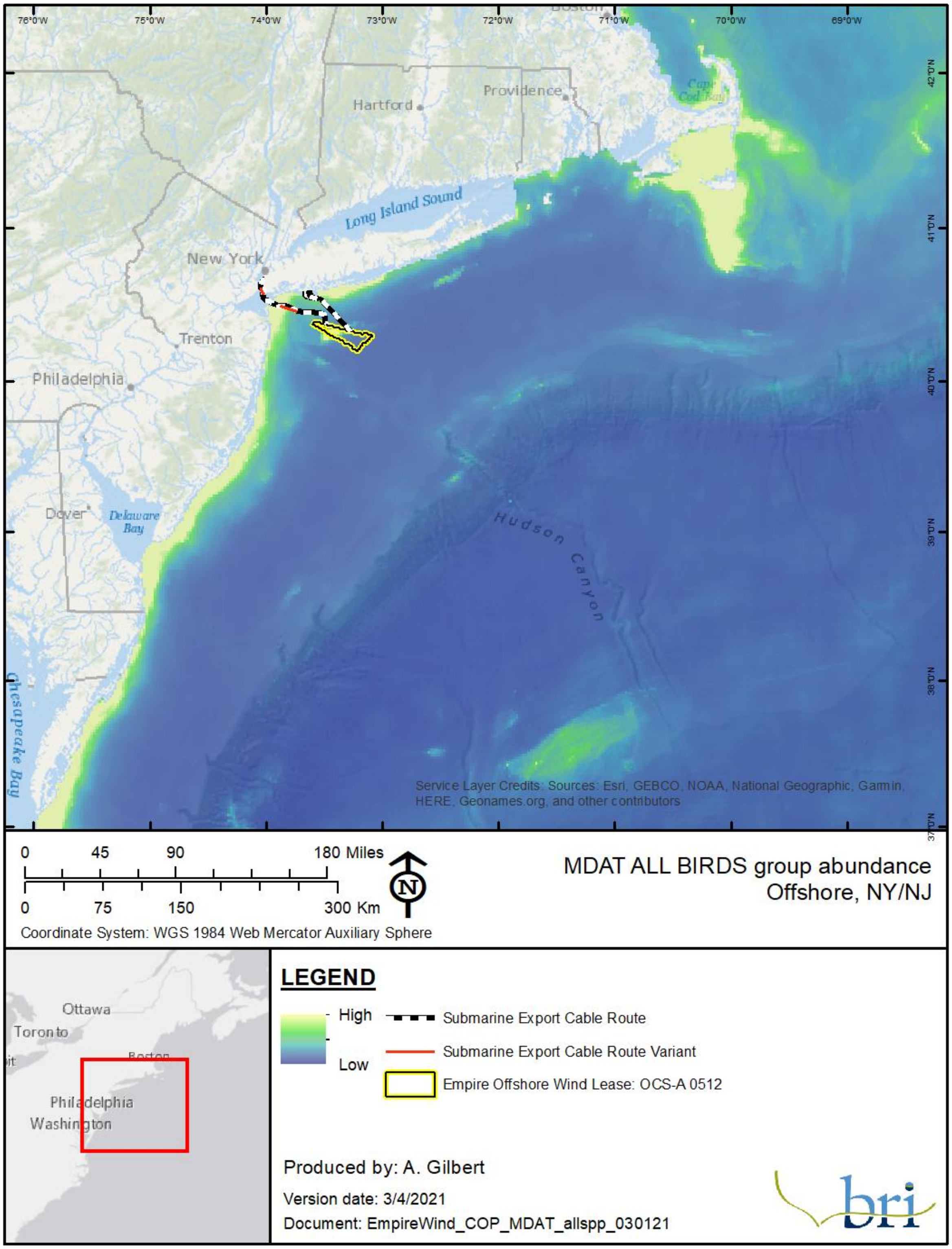

Figure 2-7: Bird abundance estimates from the MDAT models.

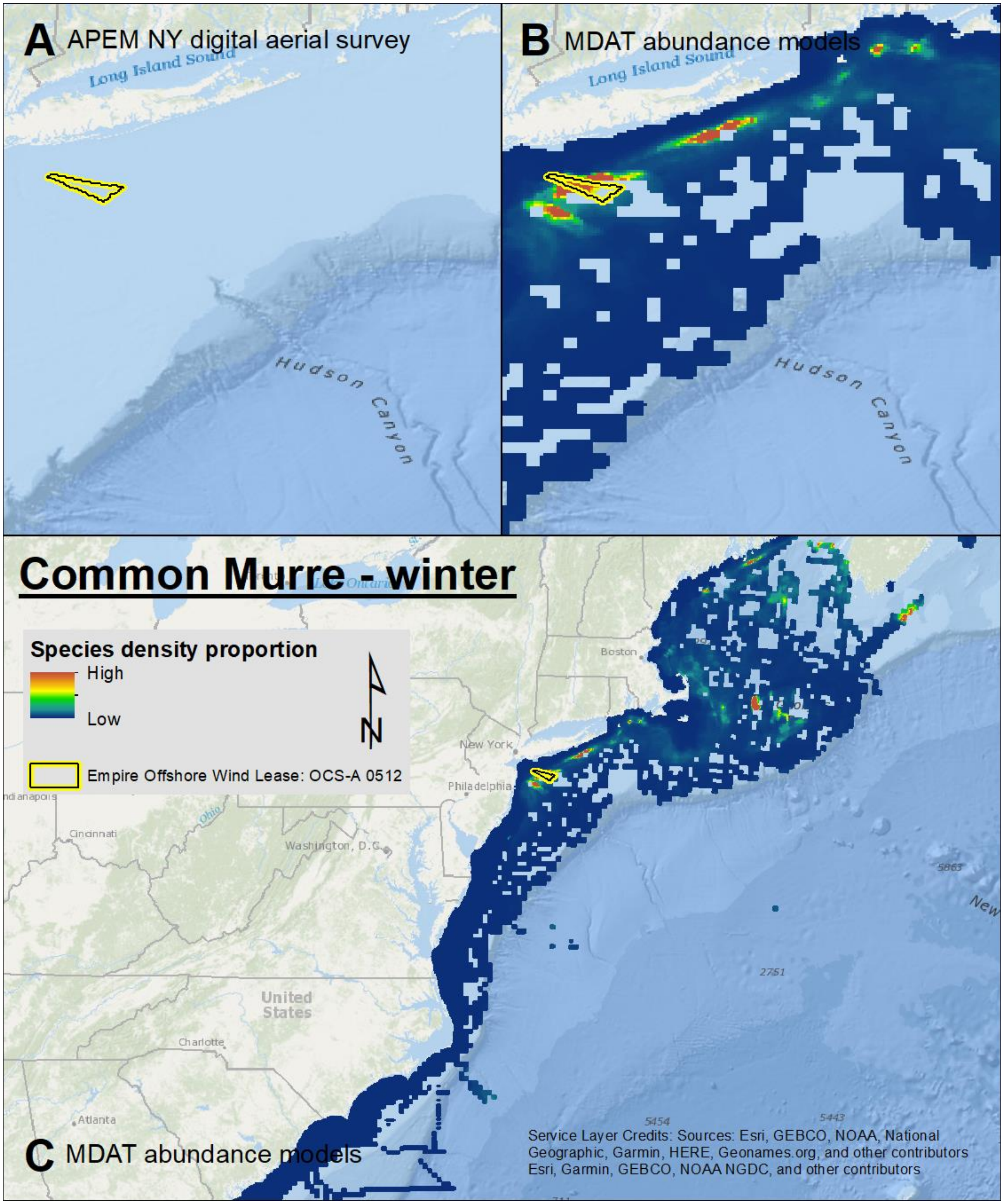

Figure 2-8: Common Murre winter abundance.

2.2.2 Shorebirds

2.2.2.1 Spatiotemporal Context

Shorebirds are coastal breeders and foragers and generally avoid straying out over deep waters during breeding. Few shorebird species breed locally on the U.S. Atlantic coast; most shorebirds that pass through the region are northern or Arctic breeders that migrate along the U.S. east coast on their way to and from wintering areas in the Caribbean islands, or Central or South America. Of the shorebirds, only the two phalaropes (Red Phalarope and Red-necked Phalarope) are generally considered marine species (Rubega et al. 2000, Tracy et al. 2002). Very little is known regarding the migratory movements of these species, although they are known to travel well offshore. Two shorebird species are federally protected under the ESA – the piping plover and the red knot – and these are addressed in detail below. Shorebirds of conservation concern identified in the USFWS IPaC database are listed in Table 2-10.

Table 2-10: Shorebirds of conservation concern in New York, and their federal status (E = Endangered; T = Threatened, identified in the IPaC database for the Lease Area.

Common Name	Scientific Name	NY Status	Federal Status
Red knot	*Calidris canutus rufa*	T	T
Piping plover	*Charadrius melodus*	E	T

2.2.2.2 Exposure Assessment

Exposure was assessed using species accounts and APEM survey data. Spatial and temporal exposure to construction and operations is considered to be "minimal" because shorebirds received minimal exposure scores in all seasons, and there were few shorebirds observed offshore during all seasons (Figure 2-9). A recent tracking study conducted in inland Canada indicates that shorebirds need 1.2-8.7 mi (2-14 km) to climb above a 541 ft (165 m) turbine (Howell et al. 2019). Since the closest portion of the Lease Area is 12-17 nm (22-31 km) from the coast, most migrating shorebirds are likely above 1,000 ft (304 m) at the time that they reach the Lease Area. Due to the minimal exposure, a vulnerability and risk assessment was not conducted for non-ESA shorebird species.

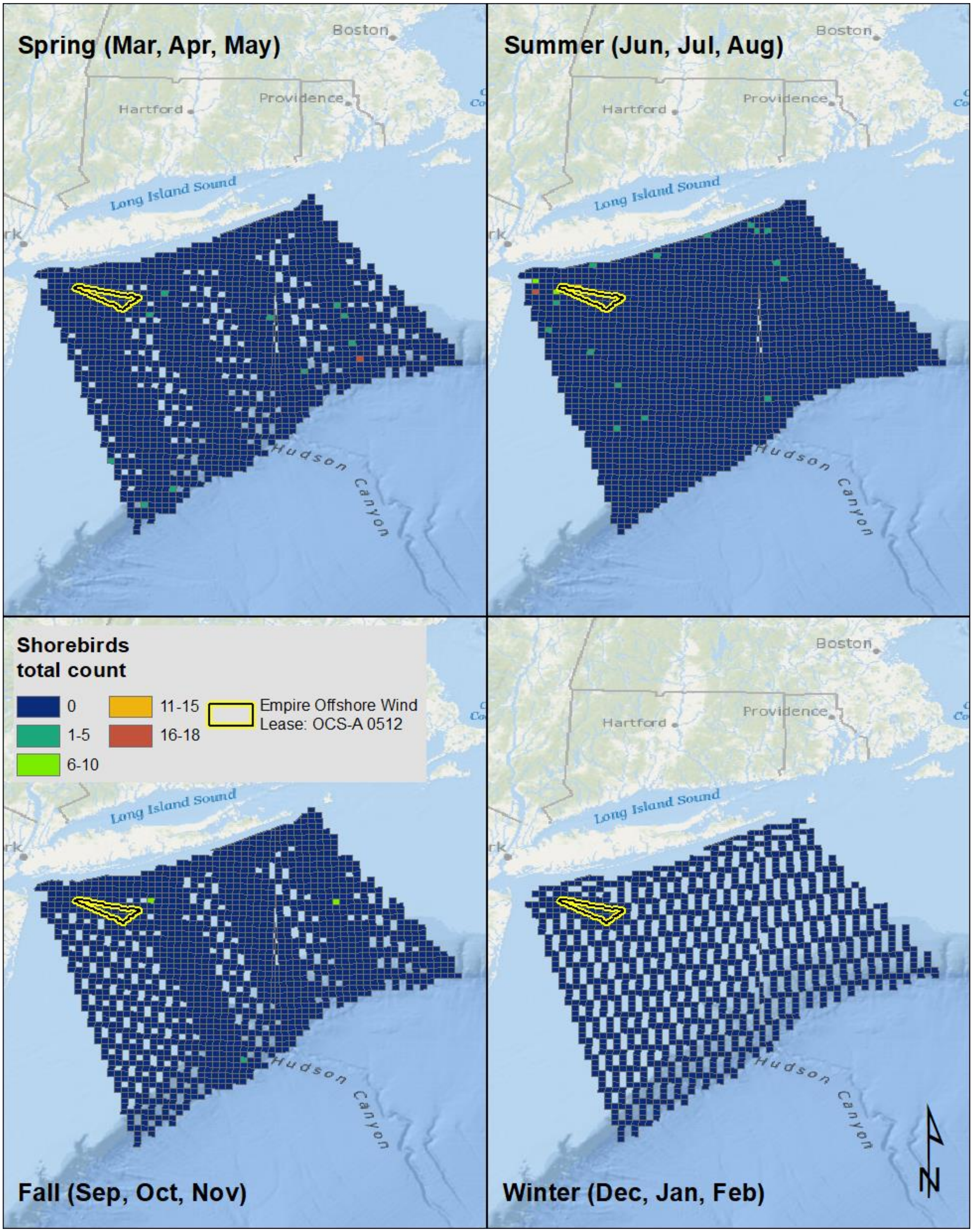

Figure 2-9: Shorebirds observed, by season, during the APEM surveys. The species positively identified were Black-bellied plover and Semipalmated plover, none of which were observed in the Lease Area.

2.2.2.3 Endangered Shorebird Species

2.2.2.3.1 Piping Plover

2.2.2.3.1.1 Spatiotemporal context

The piping plover is a small shorebird that nests on beaches and wetlands along the Atlantic coast of North America, the Great Lakes, and in the Midwestern plains (Elliott-Smith and Haig 2004). The species winters in the coastal southeastern U.S. and Caribbean (Elliott-Smith and Haig 2004, USFWS 2009, BOEM 2014). Due to a number of threats, the Atlantic subspecies (*C. m. melodus*) is listed as threatened under the ESA[9], and is heavily managed on the breeding grounds to promote population recovery (Elliott-Smith and Haig 2004). The winter range of the species is imperfectly understood, particularly for U.S. Atlantic breeders and for wintering locations outside the U.S., but the Atlantic subpopulation appears to primarily winter along the southern Atlantic coast and the Gulf coast of Florida (Elliott-Smith and Haig 2004, USFWS2009, Burger et al. 2011).

Piping plovers are present in New Jersey and New York during spring and fall migratory periods, and during the breeding season (USFWS 2019). Piping plovers are listed as Endangered in New York. In New York, piping plovers breed on Long Island's beaches (Queens to the Hamptons), in the eastern bays, and in the harbors of northern Suffolk County (NYSDEC 2019). They breed above the high tide line along the coast, primarily on sand beaches (USFWS 2019). Piping plovers breed up and down the coast of New Jersey with highest nesting numbers in northern Monmouth County, particularly Sandy Hook NRA (Heiser and Davis 2019). Non-migratory movements in May–August appear to be exclusively coastal (Burger et al. 2011). Flight heights during this period occur in the immediate vicinity of the coastline (miles away from proposed turbine arrays) and are generally at low elevations (well below RSZ elevations; Burger et al. 2011).

Piping plovers make nonstop long-distance migratory flights (Normandeau Associates Inc. 2011), or offshore migratory "hops" between coastal areas (Loring et al. 2017). As such, at least some individuals of this species likely traverse the Lease Area because the birds favor short direct ocean crossings rather than following coastal routes (Figure 2-10; Loring et al. 2019). Migration occurs primarily during nocturnal periods, with the average takeoff time appearing to be around 5–6 pm (Loring et al. 2017, 2019).

2.2.2.3.1.2 Exposure Assessment

Exposure was assessed using species accounts and the results of individual tracking studies. Due to their proximity to shore during breeding, Piping Plover exposure to the Project is limited to migration. (NOTE: for this section, exposure was considered only for the offshore component of the Lease Area. Exposure for the onshore portion of the Project is discussed in Part IV). A recent nanotag study tracked migrating piping plovers captured in Massachusetts and Rhode Island

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[9] https://www.fws.gov/northeast/pipingplover/

from 2015-2017. The study estimated that one of the tracked birds (*n* = 102), which was tagged in Rhode Island, may have been exposed to the Lease Area (Figure 2-10). The exposure estimates are considered a minimum estimate because of lost tags and incomplete coverage of the offshore environment by land-based receivers. In addition, probability densities developed from the tracking data indicated primarily low to limited high use of the western portion of the Lease Area (Loring et al. 2019). There were no records in the Northwest Atlantic Seabird Catalog of piping plovers in the vicinity of the Lease Area (Figure 2-11). Overall, there is no habitat for the species in the Lease Area, and the expected exposure to individuals of this species is limited to migration. Since tracking data suggests that exposure is more likely at the offshore edge of the Lease Area, exposure is considered “low”.

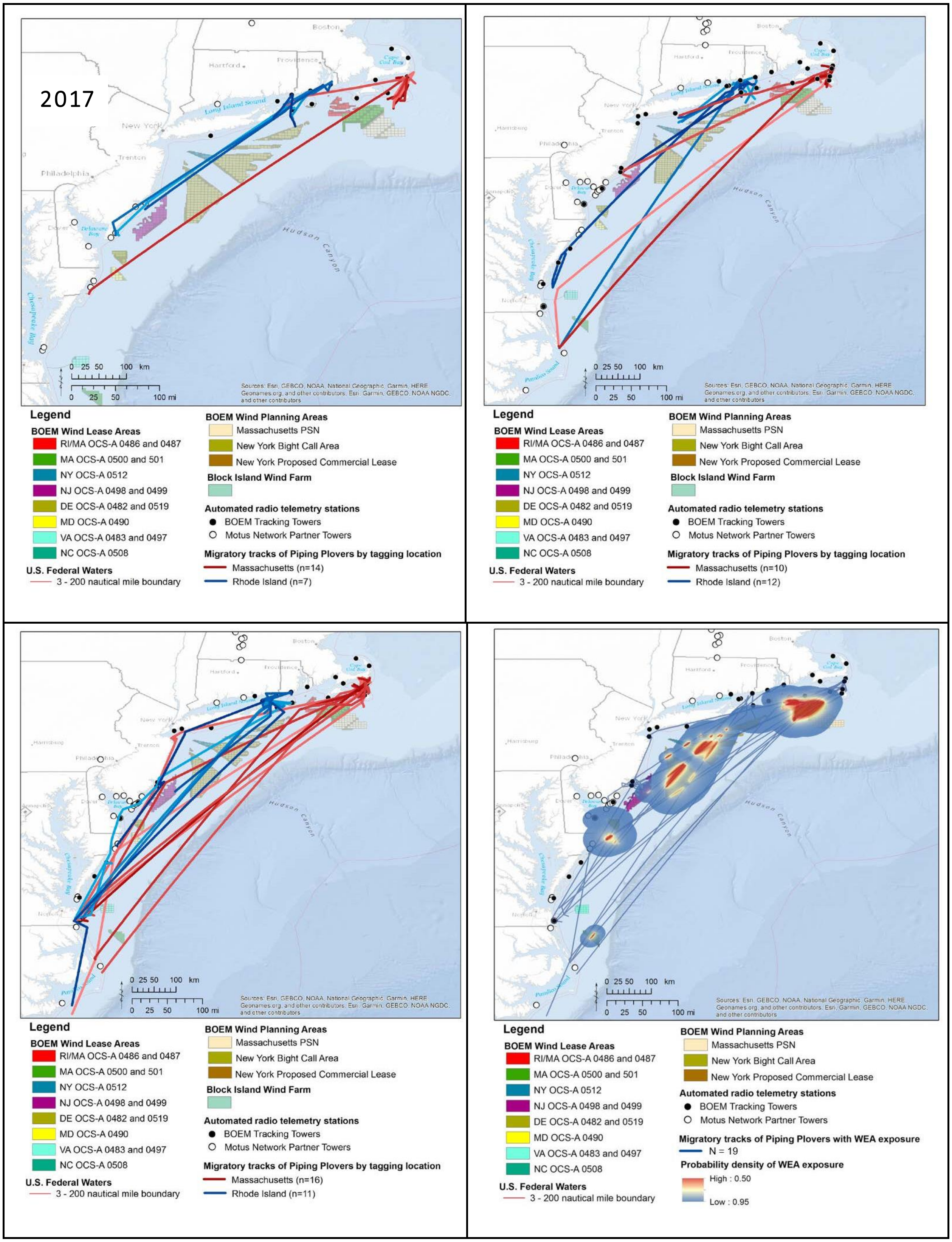

Figure 2-10: Modeled migratory track by year of piping plovers with nanotags and composite probability density across Wind Energy Areas for all years of the study (Loring et al. 2019).

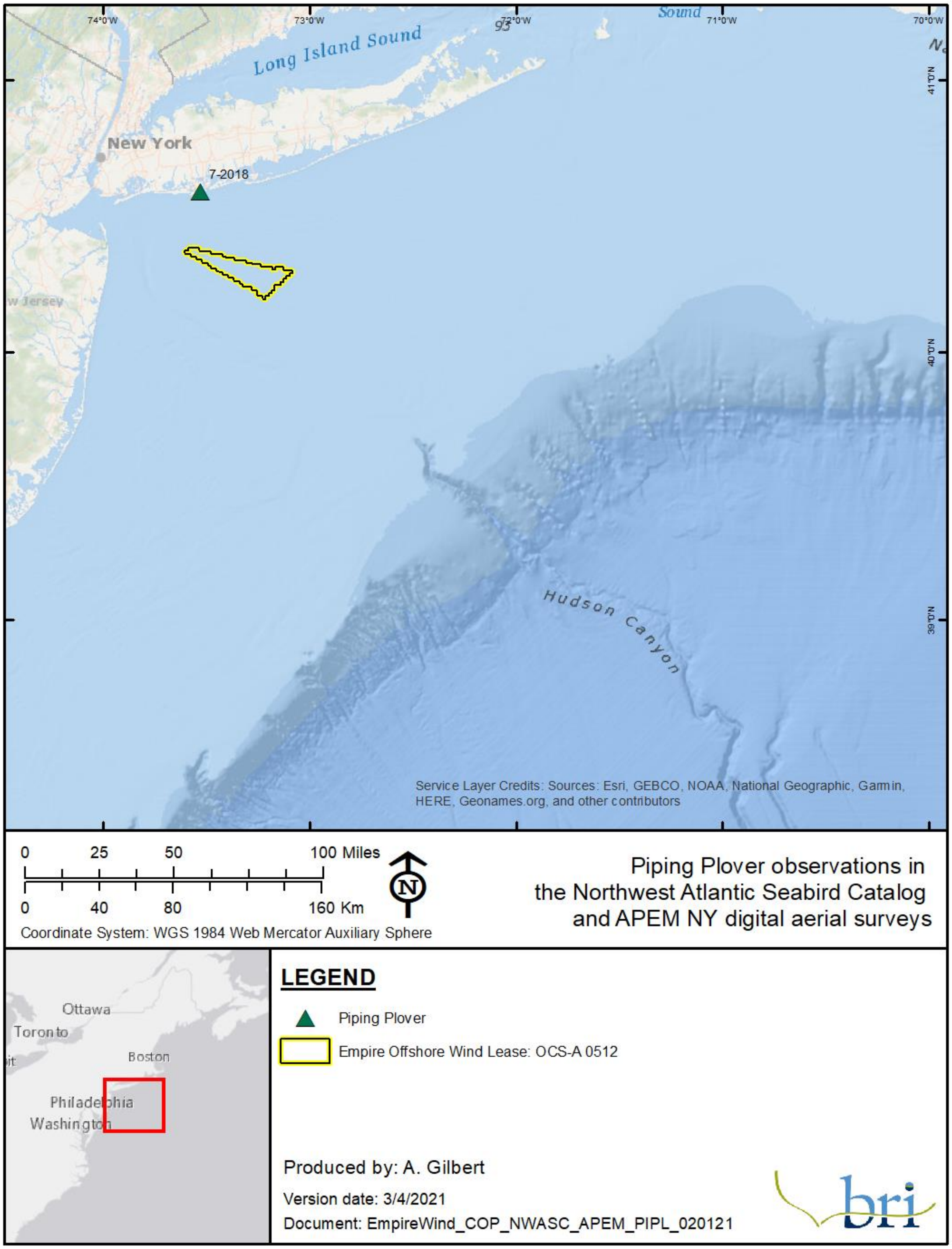

Figure 2-11: Piping plover observations in the Northwest Atlantic Seabird Catalog

2.2.2.3.1.3 Relative Behavioral Vulnerability Assessment

The migratory flight height of piping plovers tagged with nanotags were generally above the RSZ (820 ft; 250 m), with 15.2% of birds flying through the RSZ in Wind Energy Areas (Loring et al. 2019). Offshore radar studies have recorded shorebirds flying at 3,000 to 6,500 ft (1,000 to 2,000 m; Rachardson 1976, Willaims and Williams 1990 *in* Loring et al. 2019), while nearshore radar studies have recorded lower flight heights of 330 ft (100 m). Flight heights can vary with weather; during times of poor visibility the birds may fly lower within the RSZ (Dirksen et al. 2000 *in* Loring et al. 2019). Since the birds generally migrate at flight heights above the RSZ, potential exposure to collisions with turbines, construction equipment, or other structures is reduced. They also have good visual acuity and maneuverability in the air (Burger et al. 2011), and there is no evidence to suggest that they are particularly vulnerable to collisions. The Final Vineyard Wind 1 Biological Assessment prepared by BOEM for USFWS estimated that piping plover mortality from collision would be zero and that the likelihood of collision fatalities would be "insignificant and discountable" (BOEM Office of Renewable Energy Programs 2019). For these reasons, piping plovers have "minimal" to "low" vulnerability to collision with Project structures.

While there is little data on displacement for this species, avoidance behavior is not likely to lead to habitat loss offshore; thus, piping plovers are considered to have "minimal" vulnerability to displacement during turbine construction, and are unlikely to be significantly affected by offshore Project activities, including boat traffic, unless that boat traffic occurs very near beaches or intertidal feeding areas.

Table 2-11: Summary of piping plover vulnerability.

Effect	Description	Evidence from literature	
		Construction	Operations
Collision	Mortality and injury caused by collision with Project structures	Minimal - Low	Minimal - Low
Displacement (Temporary)	Temporary disturbance by Project activities resulting in effective habitat loss	Minimal	Minimal
Displacement (Permanent)	Permanent avoidance and/or displacement from habitat	Minimal	Minimal

2.2.2.3.1.4 Risk

The exposure of piping plovers to the Lease Area will be limited to migration, they have low vulnerability to collision, and there is no evidence of vulnerability to displacement; for these reasons, individual level impacts during construction and operations are expected to be "minimal" to "low". While these birds are Federally and state listed, they received a medium (0.67) population vulnerability score because they have a low (1) rank in adult survival. Therefore, the final risk score was not adjusted.

2.2.2.3.2 Red Knot

2.2.2.3.2.1 Spatiotemporal context

The red knot (*Calidris canutus*) is a medium-sized shorebird with one of the longest migrations in the world, undertaking non-stop flights of up to 5,000 mi (8,000 km) on their circumpolar travels (Baker et al. 2013). The Atlantic flyway subspecies (*C. c. rufa*) is listed as threatened under the ESA, primarily because this population decreased by approximately 70% from 1981 to 2012, to less than 30,000 individuals (Burger et al. 2011, Baker et al. 2013)[10]. Red knot is listed as Threatened in New York. This species breeds in the High Arctic, wintering in the southeastern U.S. and Caribbean, Northern Brazil, and Tierra del Fuego–Argentina (Baker et al. 2013). These populations share several key migration stopover areas along the U.S. Atlantic coast, particularly in Delaware Bay and coastal islands of Virginia (Burger et al. 2011). Population status is thought to be strongly influenced by adult survival and recruitment rates, as well as food availability on stopover sites, and conditions on the breeding grounds (Baker et al. 2013).

Red knots would be present in the Lease Area only during migratory periods (BOEM2016b, Loring et al. 2018). The fall migration period is generally July-October, but birds may pass through as late as November (Loring et al. 2018). Migration routes appear to be highly diverse, with some individuals flying out over the open ocean from the northeastern U.S. directly to stopover/wintering sites in the Caribbean and South America, while others make the ocean "jump" from farther south, or follow the U.S. Atlantic coast for the duration of migration (Baker et al. 2013). Of the birds that winter on the southeast U.S. coast and/or the Caribbean (considered short-distance migrants), a small proportion may pass through the Lease Area during migration, and are thus at higher likelihood of exposure than the segment of the population wintering in South America, for example, that set out further north and make longer migrations flights (Loring et al. 2018). While at stopover locations, red knots make local movements (e.g., commuting flights between foraging locations related to tidal changes), but are thought to remain within 3 mi (5 km) of shore (Burger et al. 2011).

2.2.2.3.2.2 Exposure Assessment

Exposure was assessed using species accounts and individual tracking data. Red knot exposure to the Lease Area is limited to migration. The Northwest Atlantic Seabird Catalog did not have any records of red knots in the vicinity of the Lease Area. In the telemetry study, one bird tagged in the Mingan Islands, Canada ($n = 245$) was detected crossing the Lease Area in mid-November (Figure 2-12; Loring et al. 2018). Migration flights are generally undertaken at night, but in fair weather conditions, which may reduce risk of collision (Loring et al. 2018). Overall, there is no habitat for the species in the Lease Area, and the expected exposure to individuals of this species is "minimal" to "low".

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[10] https://www.fws.gov/verobeach/StatusoftheSpecies.html

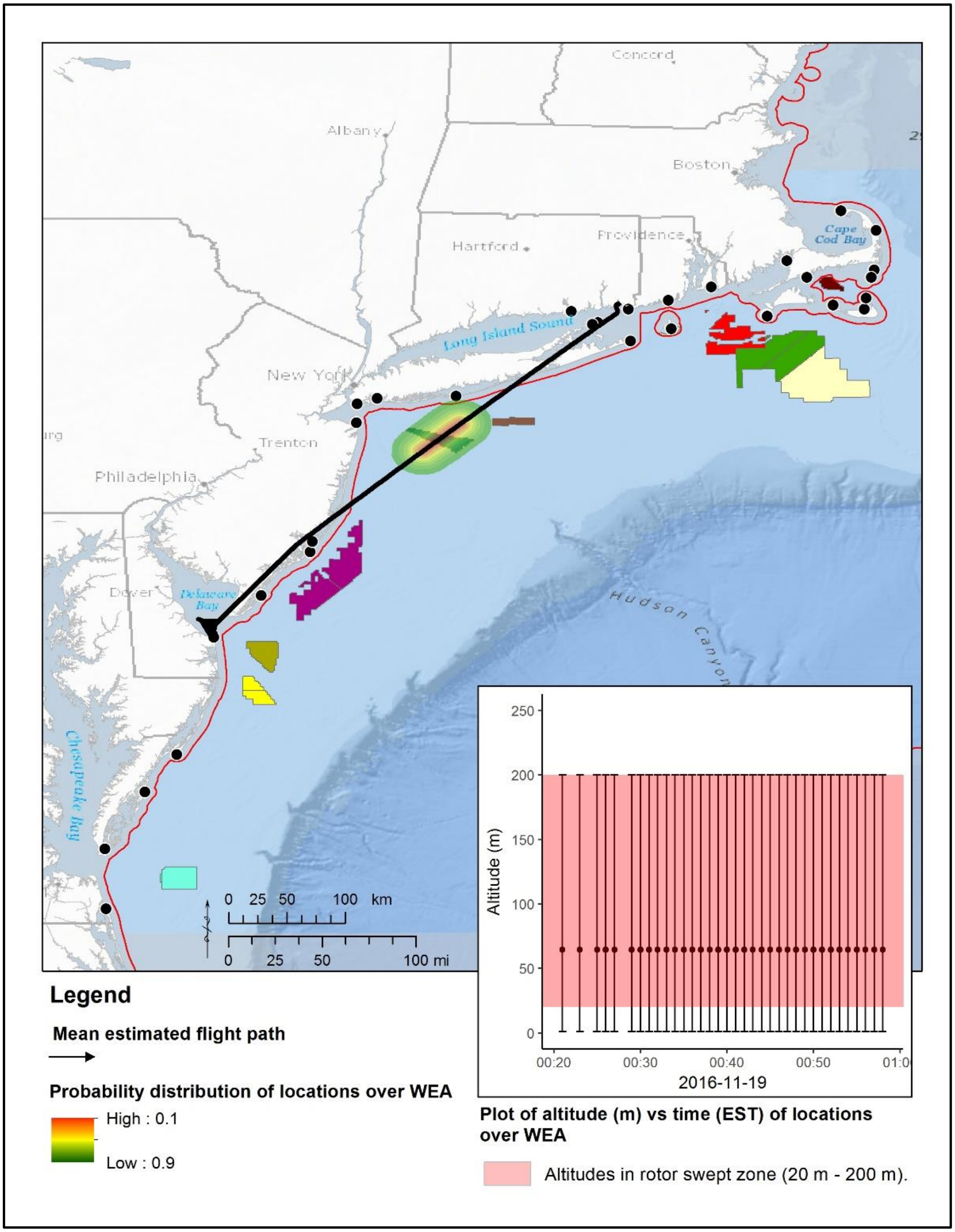


Figure 2-12: Estimated flight path of a red knot tracked with nanotags that was estimated to have passed through Empire's Lease Area on 11/19/2016. Black dots represent BOEM telemetry stations. Probability bands illustrate spatial error around locations during potential exposure to BOEM Lease Area NY OCS-A 0512 (Loring et al. 2018).

2.2.2.3.2.3 Relative Behavioral Vulnerability Assessment

During long-distance flights, red knots are generally considered to migrate at flight heights well above the RSZ (Burger et al. 2012), reducing exposure to collisions with turbines, construction equipment, or other structures. Flight heights during long-distance migrations are thought to normally be 3,000–10,000 ft (1,000–3,000 m), except during takeoff and landing at terrestrial locations (Burger et al. 2011); however, red knots likely adjust their altitude to take advantage of local weather conditions, including flying at lower altitudes in headwinds (Baker et al. 2013), or during periods of poor weather and high winds (Burger et al. 2011). Flight heights during migration are thought to be well above the RSZ for the group of red knots that are long-distance migrants, but there is potential for exposure to collision for shorter-distance migrants that may traverse the Project vicinity within the RSZ, particularly during the fall (Loring et al. 2018). During shorter coastal migration flights, red knots are more likely to fly within the RSZ (Loring et al. 2018), but they have good visual acuity and maneuverability in the air, and there is no evidence to suggest that they are particularly vulnerable to collisions. The Final Vineyard Wind 1 Biological Assessment prepared by BOEM for USFWS estimated that red knot mortality from collision would be zero and that the likelihood of collision fatalities would be "insignificant and discountable" (BOEM Office of Renewable Energy Programs 2019). For these reasons, red knots have "low" vulnerability to collision with construction equipment or turbines.

While there is little data on displacement for this species, avoidance behavior offshore is not likely to lead to habitat loss; thus, red knots are considered to have "minimal" vulnerability to displacement during turbine construction and are unlikely to be significantly affected by Project activities, including boat traffic, unless that boat traffic occurs very near beaches or stopover feeding areas.

Table 2-12: Summary of red knot vulnerability.

Effect	Description	Evidence from literature	
		Construction	Operations
Collision	Mortality and injury caused by collision with Project structures	Low	Low
Displacement (Temporary)	Temporary disturbance by Project activities resulting in effective habitat loss	Minimal	Minimal
Displacement (Permanent)	Permanent avoidance and/or displacement from habitat	Minimal	Minimal

2.2.2.3.2.4 Risk

Given that red knot exposure will be limited to migration and that these birds have low vulnerability to collision and minimal-low displacement vulnerability, individual level impacts during construction and operations are expected to be "minimal" - "low". While the birds are federally and state listed, they received a "medium" population vulnerability score (0.67) because of low score (2) in adult survival and a medium (3) CCS max score. Therefore, the final risk score was not adjusted.

2.2.3 Wading Birds

2.2.3.1 Spatiotemporal Context

Most long-legged wading birds (such as herons and egrets, etc.) breed and migrate in coastal and inland areas. Like the smaller shorebirds, wading birds are coastal breeders and foragers and generally avoid straying out over deep waters (Kushlan and Hafner 2000). Most long-legged waders breeding along the U.S. Atlantic coast migrate south to the Gulf coast, the Caribbean islands, or Central or South America, thus they are capable of crossing large areas of ocean and may traverse the Lease Area during spring and fall migration periods. The IPaC database did not indicate any wading birds in the Lease Area or adjacent waters.

2.2.3.2 Exposure Assessment

Exposure was assessed using species accounts and APEM survey data. Exposure to construction and operations is considered to be "minimal" because wading birds spend a majority of the year in freshwater aquatic systems and near-shore marine systems; furthermore, the APEM surveys showed no wading bird records within the Lease Area. In addition, there were few observations of species within this group offshore during all seasons (Figure 2-13). Due to the assessment of minimal exposure, a vulnerability and risk assessment was not conducted.

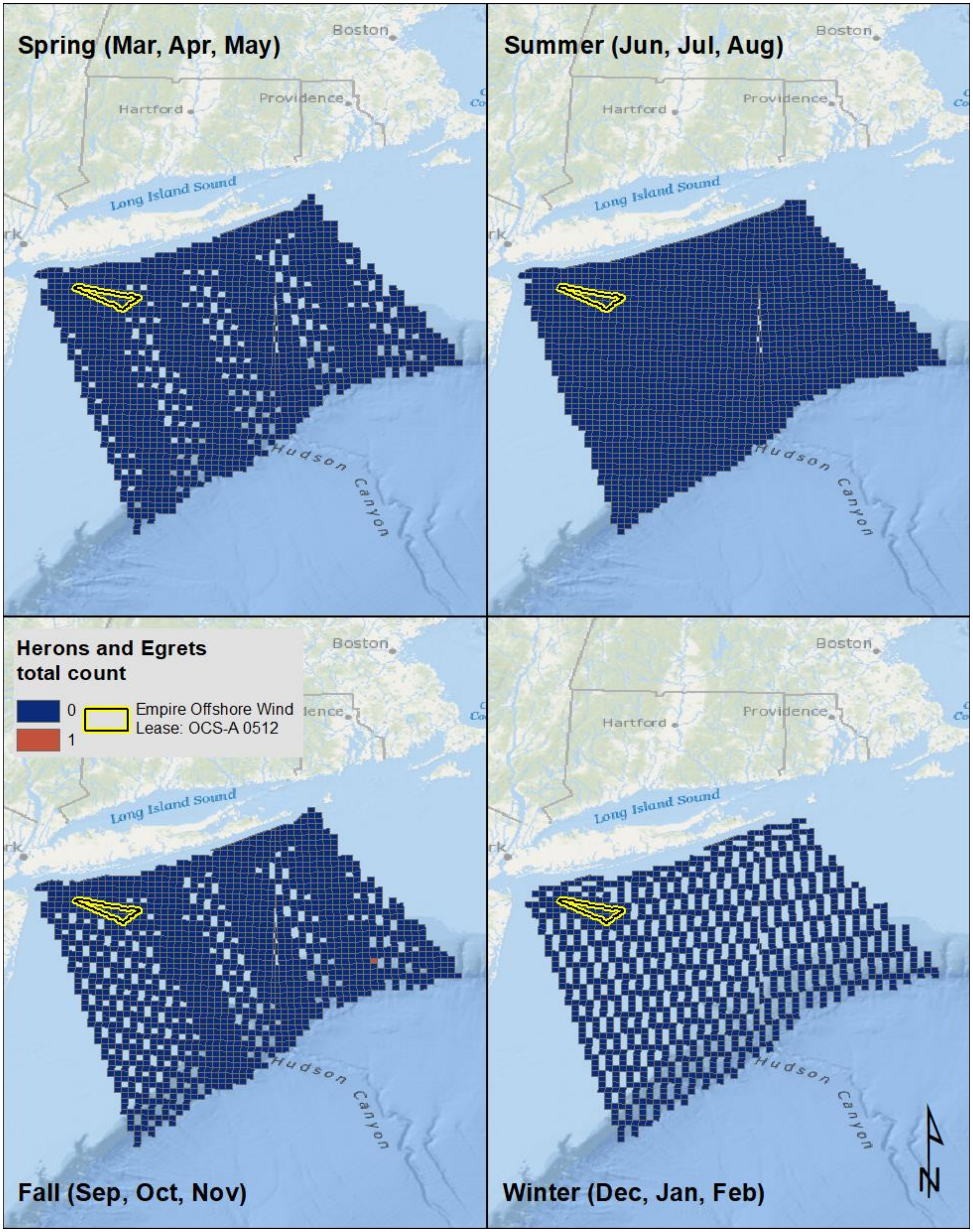


Figure 2-13: Herons and egrets observed, by season, during the APEM surveys. Only a small number of great blue herons were observed offshore, and none were observed within the Lease Area.

2.2.4 Raptors

2.2.4.1 Spatiotemporal Context

Limited data exists documenting the use of offshore habitats by diurnal and nocturnal raptors in North America. The degree to which raptors might occur offshore will be dictated in large part by their morphology and flight strategy (i.e., flapping vs. soaring), which influences species' ability or willingness to cross large expanses of open water where thermal formation is poor (Kerlinger 1985). Interactions between raptors and offshore structures are likely to be predominantly limited to migration. Of the raptors in eastern North America, the eagles, *Buteo* hawks, and large *Accipiter* hawks (i.e., northern goshawks) are rarely observed offshore (DeSorbo et al. 2012, 2018c). Sharp-shinned Hawks, Cooper's hawks, northern harriers, American kestrels, and osprey have all been observed at offshore islands regularly during migration, but generally in low numbers (DeSorbo et al. 2012, 2018c). Of the common owl species, the larger species (barred owl and great-horned owl) are generally considered to avoid the offshore environment. Northern saw-whet owls have been documented at coastal islands in Maine and Rhode Island during migration (DeSorbo et al. 2012), and these owls winter in the mid-Atlantic (Rasmussen et al. 2008). Long-eared owls also migrate along the coast and winters in the mid-Atlantic (Marks et al. 1994).

Among raptors, falcons are the most likely to be encountered in offshore settings (Cochran 1985, DeSorbo et al. 2012, 2018c). Merlins are the most abundant diurnal raptor observed at offshore islands during fall migration (DeSorbo et al. 2012, 2018c). Peregrine falcons fly hundreds of kilometers offshore during migration, and have been observed on vessels and oil drilling platforms considerable distances from shore (Voous 1961, McGrady et al. 2006, Johnson et al. 2011, DeSorbo et al. 2015). Recent individual tracking studies in the eastern U.S. indicate that migrating peregrine falcons (predominantly hatching year birds), likely originating from breeding areas in the Canadian Arctic and Greenland, commonly used offshore habitats during fall migration (DeSorbo et al. 2015, 2018c), while breeding adults from New Hampshire either used inland migration routes or were non-migratory (DeSorbo et al. 2018b). While the IPaC database did not indicate any raptors in the Lease Area or adjacent waters, satellite telemetry data indicates that falcons fly offshore in the region during migration (Figure 2-15). Bald eagles and golden eagles are federally protected under the Bald and Golden Eagle Protection Act and are addressed separately in detail below.

2.2.4.2 Exposure Assessment

Exposure for raptors was assessed using species accounts, APEM survey data, and individual tracking data. The only raptor observed in the APEM surveys was osprey, which occurred near the northwest portion of the Lease Area. For osprey, the exposure analysis determined minimal exposure to construction and operations activities (Figure 2-14). However, individual tracking data and species accounts indicate that falcons are the primary species of raptor that will be exposed to the Lease Area. Therefore, the exposure level was adjusted up to "low" for falcons because individual tracking data indicates they may pass through offshore waters in New York (Figure 2-15), and there is the potential that falcons could be exposed to the Lease Area. Falcons may be attracted to turbines as offshore perching and hunting sites, which may increase temporal exposure during migration.

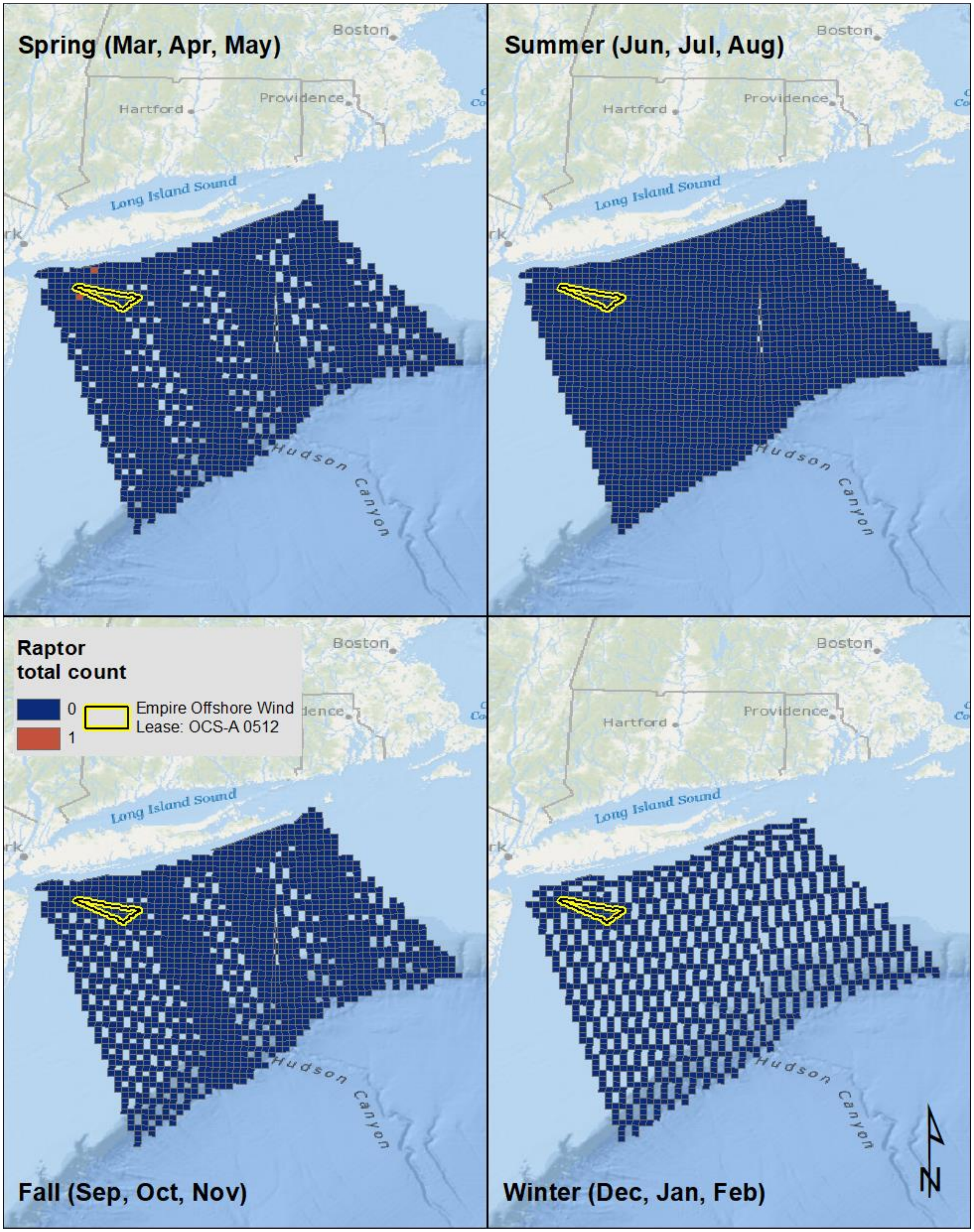


Figure 2-14: Raptors observed, by season, during the APEM surveys. Only Osprey were detected.

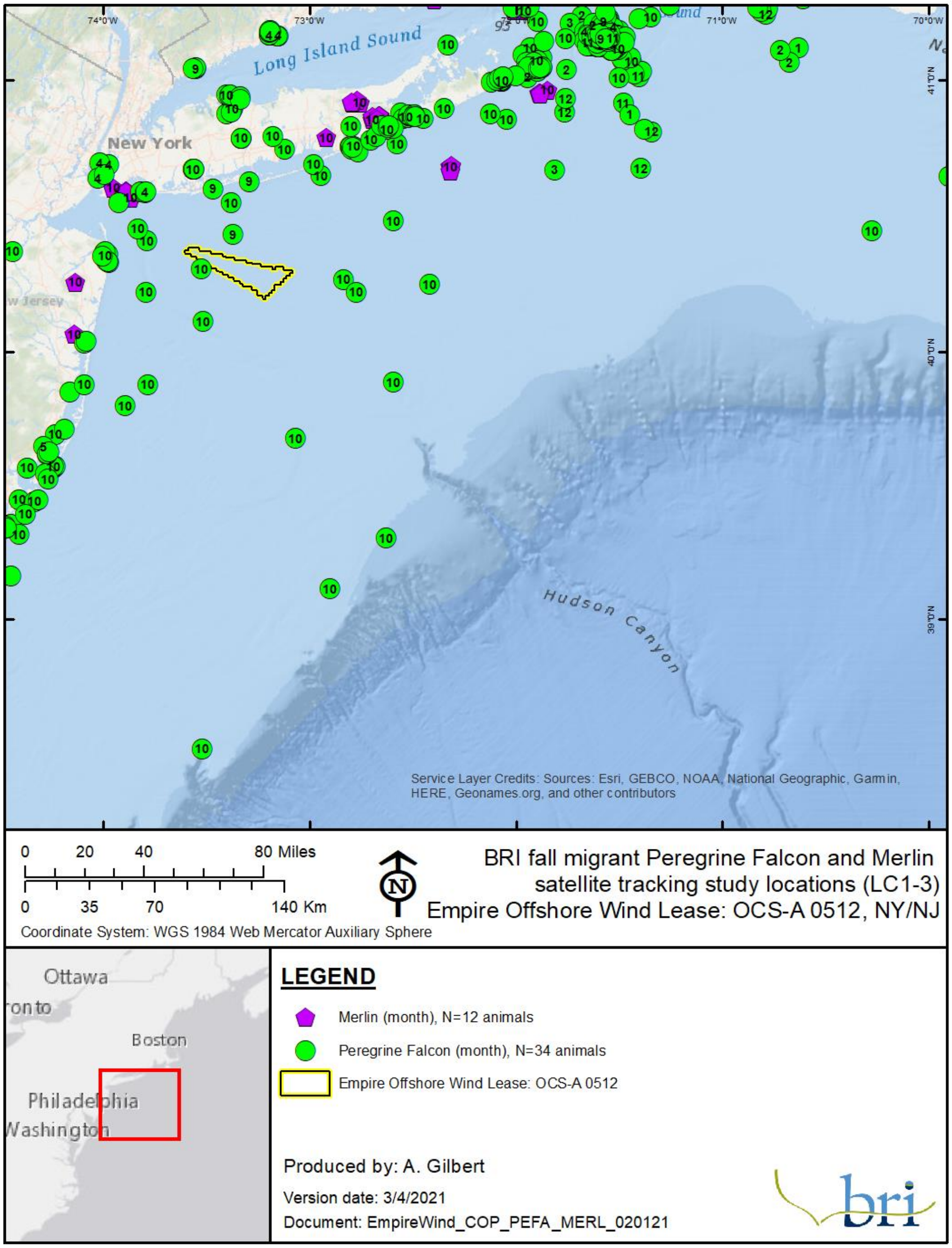


Figure 2-15: Location estimates from satellite transmitters instrumented to peregrine falcons and merlins tracked from three raptor research stations along the Atlantic coast, 2010 – 2018. Research stations include Block Island, Rhode Island (The Block Island Raptor Research Station; Peregrines: n = 3 adult females, n = 18 hatching year females, n = 17 hatching year peregrines. Merlins: 3 adult females, and 13 hatching year females; DeSorbo et al. 2018c), Monhegan Island, Maine (n = 2 HY female peregrine falcons) and Cutler, Maine (n = 1 adult female Merlin). The number shown in points represents the month in which the location estimate was fixed.

2.2.4.3 *Relative Behavioral Vulnerability Assessment*

Raptors are commonly attracted to high perches for resting, roosting or to survey for potential prey. A radar and laser rangefinder study found evidence indicating that multiple migrating raptor species were attracted to offshore wind turbines in Denmark (Skov et al. 2016) and falcons were observed regularly hunting and perching at an offshore wind farm in the Netherlands (Krijgsveld et al. 2011). Peregrine falcons and Kestrels have been observed landing on the platform deck of offshore wind turbines (Hill et al. 2014, Skov et al. 2016); however, peregrine falcon mortalities have not been documented at European offshore wind developments. Jensen et al. (2014) considered peregrine falcons to have low collision risk vulnerability at the proposed Horns Rev 3 wind development based on visual observations and radar data collated from two nearby existing wind farms. There are accounts of peregrine falcon mortalities associated with terrestrial-based wind turbines in Europe (Meek et al. 1993, Hötker et al. 2006, Dürr 2011) and one in New Jersey (Mizrahi et al. 2009). Breeding adults and several young peregrine falcons were killed after colliding with a three-turbine terrestrial wind energy facility located close their urban nest site in Massachusetts (T. French, MassWildlife, pers. comm. March 7, 2018). Carcasses were not detected in post-construction mortality studies at several projects with falcon activity (Hein et al. 2013, Bull et al. 2013, DiGaudio and Geupel 2014). American kestrel carcasses have been found in post-construction monitoring of much smaller terrestrial turbines (1.8 MW) in Washington State (Erickson et al. 2008), but American kestrel mortality has been demonstrated to decrease as turbine size increases (Smallwood 2013). Evidence of nocturnal soaring, perching and feeding under lighted structures in terrestrial and offshore settings has been noted in peregrine falcons (Cochran, 1975; Johnson et al., 2011; Kettel et al., 2016; Voous, 1961), and these behaviors increase the exposure risk in this species. However, observations of raptors at the Anholt Offshore Wind Farm in the Baltic Sea (20 km from the coast) indicate avoidance behavior (13-59% of birds observed depending on the species). This suggests wind farms have the potential to cause a barrier for migrants in some locations, but avoidance behavior may also may reduce collision risk; the percentage of merlins and kestrels showing macro/meso avoidance behavior was 14/36% and 46/50%, respectively (Jacobsen et al. 2019).

Based on the above evidence, falcon vulnerability to collision during construction and operations is considered to be "low" to "medium" (Table 2-13), and vulnerability to displacement is "minimal" to "low". Since there is little data available on raptor response during construction, the behavioral vulnerability is considered the same for each development phase.

Table 2-13: Summary of raptor vulnerability.

Effect	Description	Evidence from literature	
		Construction	Operations
Collision	Mortality and injury caused by collision with Project structures	Low - Medium	Low - Medium
Displacement (Temporary)	Temporary disturbance by Project activities resulting in effective habitat loss	Minimal - Low	Minimal - Low
Displacement (Permanent)	Permanent avoidance and/or displacement from habitat	Minimal - Low	Minimal - Low

2.2.4.4 *Risk Analysis*

Risk of potential impacts to non-falcon raptor populations is considered minimal due to minimal exposure. Population level impacts to falcons is considered "minimal" to "low" because falcons have low exposure and low to medium vulnerability. For this species group, a population vulnerability assessment was not conducted. However, considerable uncertainty exists about what the proportion of migrating falcons, particularly peregrine falcons, might be attracted to offshore wind energy projects for perching, roosting and foraging, and the extent to which individuals might avoid turbines or collide with them.

2.2.5 Eagles listed under the Bald and Golden Eagle Protection Act

2.2.5.1 *Spatiotemporal Context*

Both bald eagles and golden eagles are federally protected under the Bald and Golden Eagle Protection Act (BGEPA). The bald eagle (*Haliaeetus leucocephalus*) is broadly distributed across North America. This species generally nests and perches in association with water (lakes, rivers, bays) in both freshwater and marine habitats, often remaining within roughly 1,640 ft (500 m) of the shoreline (Buehler 2000).

The golden eagle (*Aquila chrysaetos*) is generally associated with open habitats, particularly in the western U.S., but satellite-tracked individuals wintering in the eastern U.S. have also been documented to heavily utilize forested regions (Katzner et al. 2012) and golden eagles are generally not expected offshore. Golden eagles commonly winter in the southern Appalachians and are regularly observed in the mid-Atlantic U.S., spanning coastal plain habitat in Virginia, Delaware, North Carolina, South Carolina, and other southeastern states.

The general morphology of both bald eagles and golden eagles dissuades long-distance movements in offshore settings (Kerlinger 1985). These two species generally rely upon thermal formation, which develop poorly over the open ocean, during long-distance movements.

Bald eagles are present year-round in New Jersey and New York. In New Jersey, nesting is concentrated on the edge of Delaware Bay ([NJDEP] New Jersey Department of Environmental Protection 2017); in New York, eagle territories are primary located inland, and in 2010 no territories were identified on Long Island (Nye 2010). In a study evaluating the space use of bald eagles captured in Chesapeake Bay, the coast of New Jersey was associated with moderate levels of use and the coast of New York had low to moderate levels of use (Mojica et al. 2016). Bald eagles were rarely observed in mid-Atlantic offshore surveys (all observations <3.7 mi [6 km] from shore [Williams et al. 2015b]), and only one bald eagle was observed in the APEM surveys; this individual was close to shore (Figure 2-16) and none were documented in the Lease Area.

2.2.5.2 *Exposure*

Exposure was assessed using species accounts, tracking studies, and knowledge of eagle wing morphology. Golden eagle exposure to the Lease Area is expected to be "minimal" due to their limited distribution in the eastern U.S., and reliance on terrestrial habitats. Bald eagle exposure to the Lease Area is also expected to be "minimal" because the Lease Area is not located along any likely or known bald eagle migration route, and they tend not to fly over large waterbodies. The APEM surveys only contained one bald eagle observation, which was close to shore (Figure 2-16).

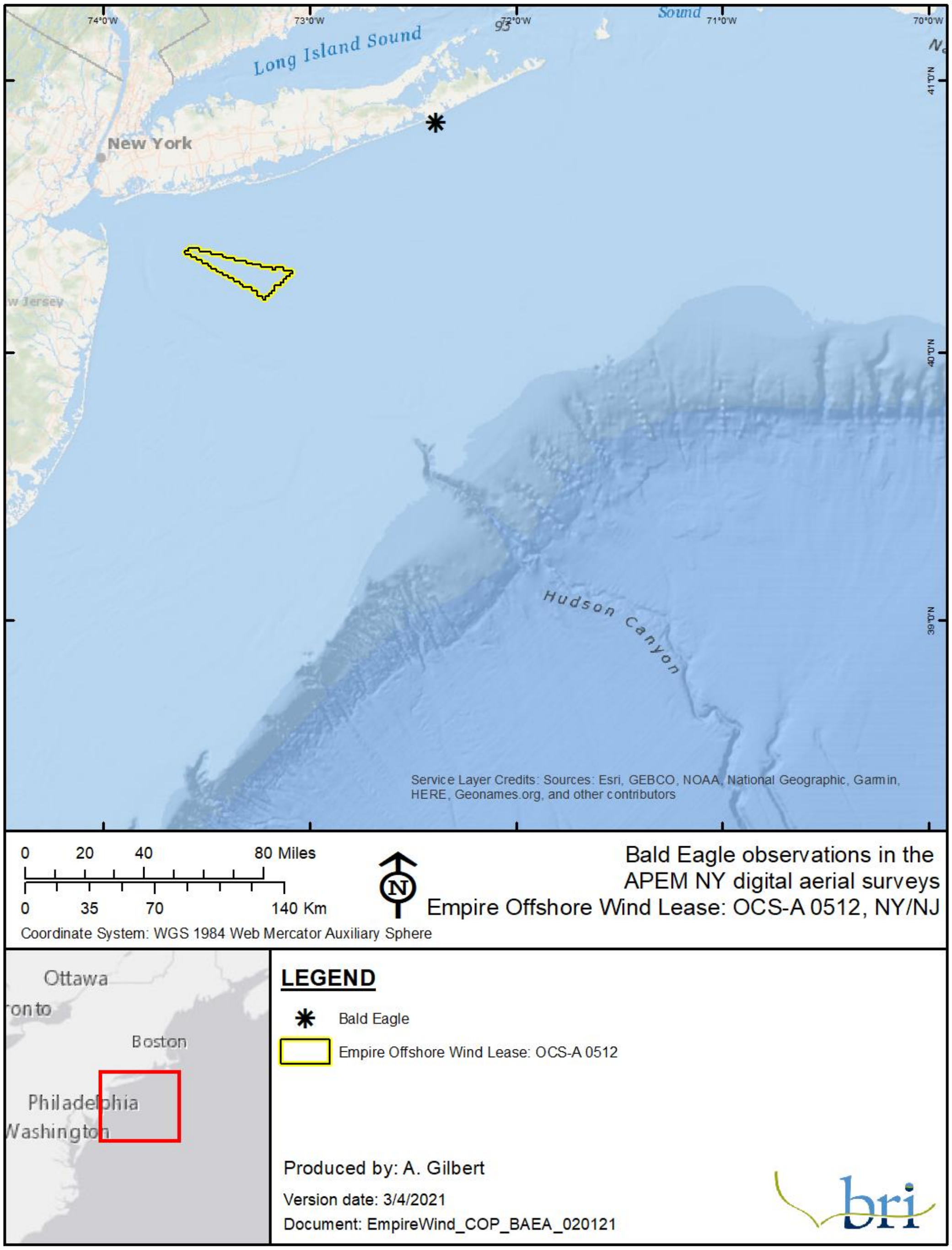


Figure 2-16: Bald eagle observations in the APEM surveys.

2.2.5.3 Relative Behavioral Vulnerability Assessment

Although there is little research on eagle interactions with offshore developments, eagles are expected to have "minimal" vulnerability to collision and displacement to offshore wind farms. Bald eagles and golden eagles are not expected to forage over the Lease Area or use the area during migration.

2.2.5.4 Risk

Since exposure is expected to be minimal for both eagle species, the individual level impacts during construction and operations are expected to be "minimal". A population vulnerability assessment was not done for eagles because they have minimal exposure and vulnerability and no mortality or displacement is anticipated.

2.2.6 Songbirds

2.2.6.1 Spatiotemporal Context

Songbirds almost exclusively use terrestrial, freshwater, and coastal habitats and do not use the offshore marine system except during migration. Many North American breeding songbirds migrate to the tropical regions. On their migrations, neotropical migrants generally travel at night and at high altitudes where favorable winds can aid them along their trip.

Songbirds regularly cross large bodies of water (Bruderer and Lietchi 1999, Gauthreaux and Belser 1999), and there is some evidence that species migrate over the northern Atlantic (Adams et al. 2015). Some birds may briefly fly over the water while others, like the blackpoll warbler (*Setophaga striata*), can migrate over vast expanses of ocean (Faaborg et al. 2010, DeLuca et al. 2015).

Landbird migration may occur across broad geographic areas, rather than in narrow "flyways" as have been described for some waterbirds (Faaborg et al. 2010). Evidence for a variety of species suggests that overwater migration in the Atlantic is much more common in fall (than in spring), when the frequency of overwater flights increases perhaps due to consistent tailwinds (e.g., see Morris et al. 1994, Hatch et al. 2013, Adams et al. 2015, DeLuca et al. 2015).

The blackpoll warbler is the species that is most likely to fly offshore during migration (Faaborg et al. 2010, DeLuca et al. 2015). Migrating songbirds have been detected at or in the vicinity of smaller offshore wind developments in Europe (Kahlert et al. 2004, Krijgsveld et al. 2011, Pettersson and Fågelvind 2011) and may have greater passage rates during the middle of the night (Huppop and Hilgerloh 2012). While the IPaC database did not indicate any songbirds in the Lease Area or adjacent waters, evidence from the literature indicates some songbirds migrate offshore in New York.

2.2.6.2 *Exposure Assessment*

Exposure for songbirds was assessed using species accounts, APEM survey data, and literature. Exposure to construction and operations is considered to be “minimal” to “low” because songbirds have limited spatial and temporal exposure, they do not use the offshore marine system as habitat, and there is little evidence of songbird use of the Lease Area outside of the migratory periods. While not designed specifically to detect small songbirds, the APEM surveys had few detections of passerines (Figure 2-17).

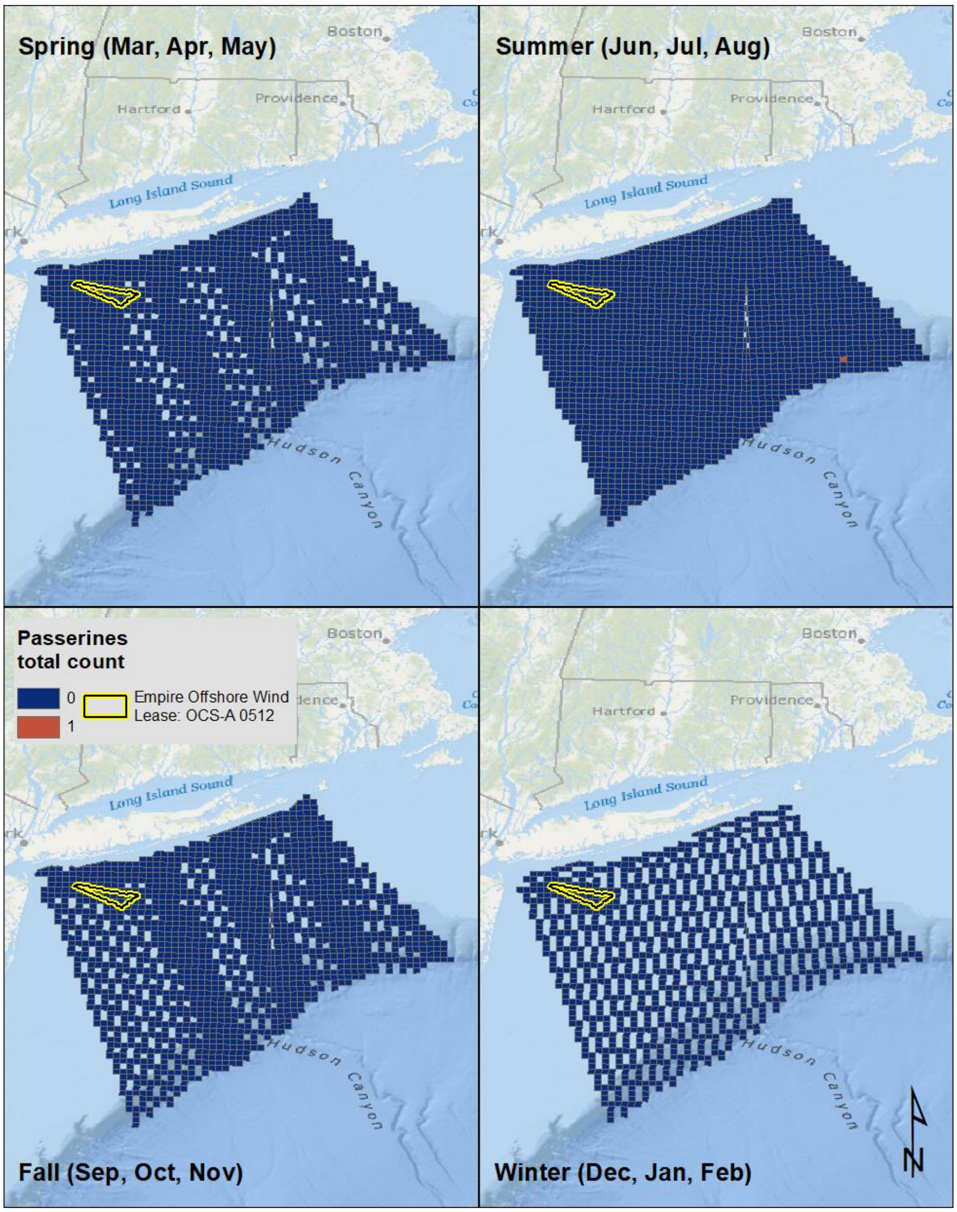


Figure 2-17: Songbirds (passerines) observed, by season, during the APEM surveys. While these surveys are not optimized to detect songbirds, one common nighthawk was detected outside the Lease Area.

2.2.6.3 *Relative Behavioral Vulnerability Assessment*

If exposed to offshore wind turbines, some songbirds may be vulnerable to collision. In some instances, songbirds may be able to avoid colliding with offshore wind turbines (Petersen et al. 2006), but they are known to collide with illuminated terrestrial and marine structures (Fox et al. 2006b). Movement during low visibility periods creates the highest collision risk conditions with lit offshore structures (Hüppop et al. 2006) and vessels. While terrestrial avian fatality rates range from 3–5 birds per MW per year ([AWWI] American Wind Wildlife Institute 2016), direct comparisons between mortality rates recorded at terrestrial and offshore wind developments should be made with caution because collisions with offshore wind turbines could be lower either due to differing behaviors or lower exposure (NYSERDA 2015). At Nysted, Denmark, in 2,400 hours of monitoring with an infrared video camera, only one collision of an unidentified small bird was detected (Petersen et al. 2006). At the Thanet Offshore Wind Farm, thermal imaging did not detect any songbird collisions (Skov et al. 2018).

Songbirds typically migrate at heights between 295–1,969 ft (90–600 m; NYSERDA 2010), but can fly lower during inclement weather or when there are headwinds. Since there were few detections of songbirds in the APEM survey, local flight height data was not available. However, there are some data available from boat baseline surveys conducted in New Jersey. While the sample size is low (*n* = 333), flight heights recorded during the New Jersey survey show that songbirds generally fly below the RSZ during the day ([NJDEP] New Jersey Department of Environmental Protection 2010). In a study in Sweden, nocturnal migrating songbirds flew on average at 1,083 ft (330 m) above the ocean during the fall and 1,736 ft (529 m) during the spring (Pettersson 2005).

Based upon the above evidence, the risk to songbirds is limited to collision with wind turbines, and songbird vulnerability to collision during construction and operations is considered to be “low” to “medium” (Table 2-14).

Table 2-14: Summary of songbird vulnerability.

Effect	Description	Evidence from literature	
		Construction	Operations
Collision	Mortality and injury caused by collision with Project structures	Low - Medium	Low - Medium
Displacement (Temporary)	Temporary disturbance by Project activities resulting in effective habitat loss	Minimal	Minimal
Displacement (Permanent)	Permanent avoidance and/or displacement from habitat	Minimal	Minimal

2.2.6.4 *Risk Analysis*

This analysis suggests that the potential population-level impacts to songbirds is “low” because, while these birds have low to medium vulnerability to collision, they have minimal to low exposure, both spatially and temporally. Despite this recognized vulnerability, and for overall context, the mortality of songbirds from all terrestrial wind turbines in the U.S. and Canada combined is predicted to have only a small effect on passerine populations (Erickson et al. 2014).

2.2.7 Coastal Waterbirds

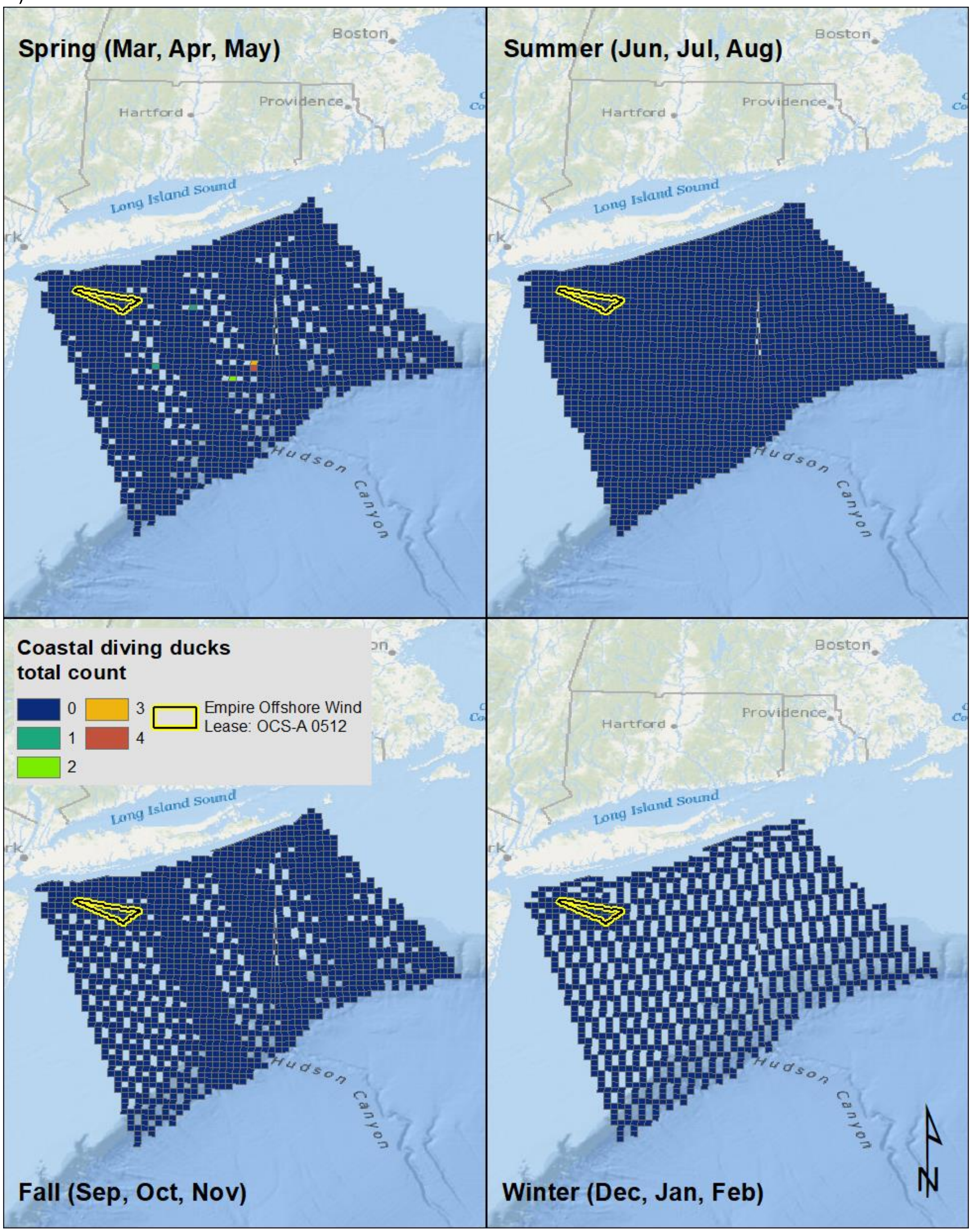
2.2.7.1 Spatiotemporal Context

Coastal waterbirds use terrestrial or coastal wetland habitats and rarely use the marine offshore environment. This group includes aquatic species that are not captured in other groupings, such as grebes and waterfowl, that are generally restricted to freshwater, or that use saltmarshes, beaches, and other strictly coastal habitats. Waterfowl comprises a broad group of geese and ducks, most of which spend much of the year in terrestrial or coastal wetland habitats (Baldassarre and Bolen 2006). The diving ducks generally winter on open freshwater, as well as brackish or saltwater. Species that regularly winter on saltwater, including mergansers, scaup, and goldeneyes, usually restrict their distributions to shallow, very nearshore waters (Owen and Black 1990). A subset of the diving ducks, however, have an exceptionally strong affinity for saltwater, either year-round or outside of the breeding season; these species are known as the “sea ducks” and are described in detail in Section 3.10 Marine Birds. The IPaC database did not indicate any coastal waterbirds in the Lease Area or adjacent waters.

2.2.7.2 Exposure Assessment

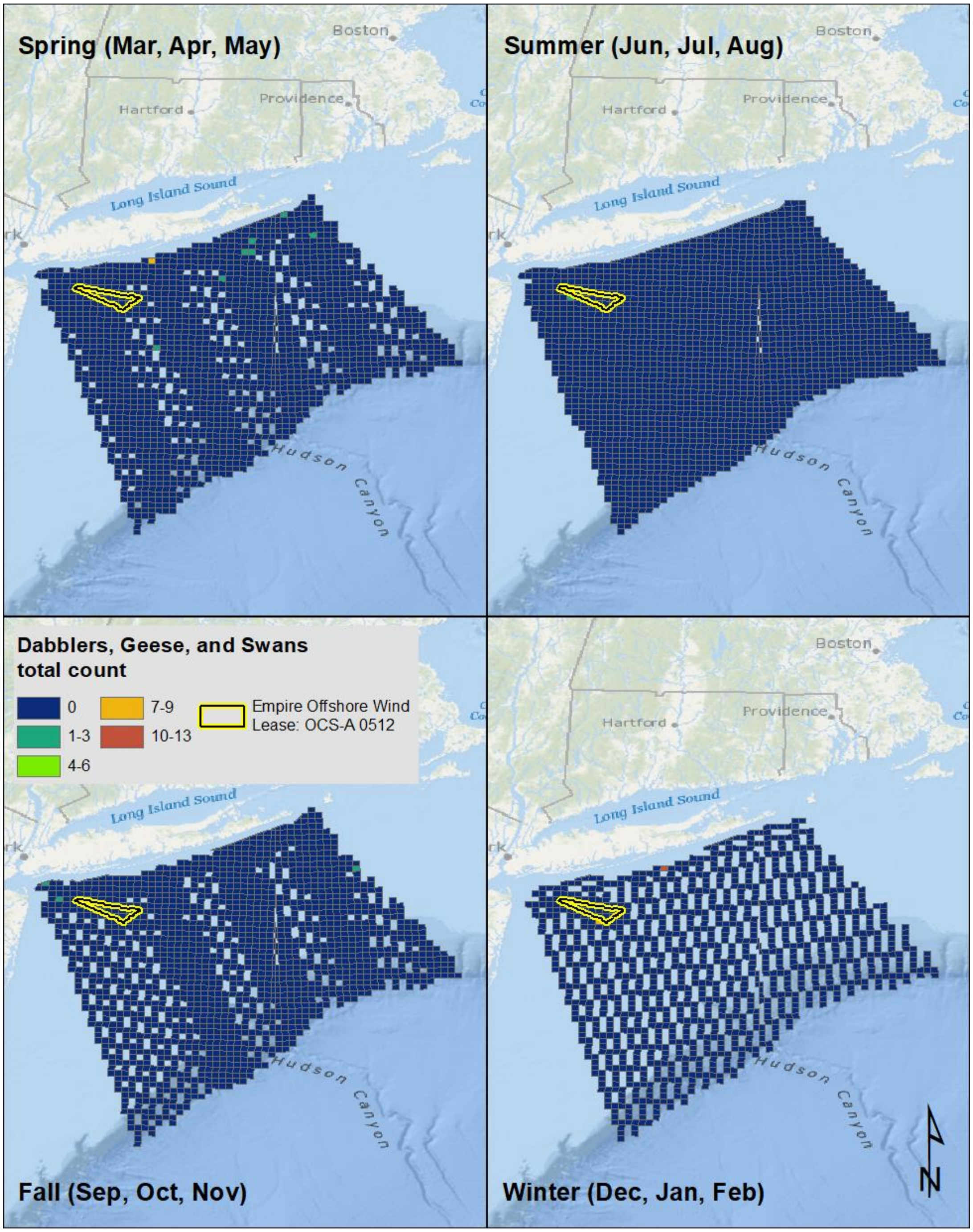
Exposure for coastal waterbirds was assessed using species accounts, APEM survey data, and literature. Exposure is considered to be “minimal” because most coastal waterfowl spend a majority of the year in freshwater aquatic systems and near-shore marine systems, and there is little to no use of the Lease Area during any season (Figure 2-18). With one exception, all species received minimal scores during all seasons; the one high score represents a flock of migratory black ducks). No skimmers were observed offshore during the APEM offshore surveys. Due to the minimal exposure rating, a vulnerability and risk assessment was not conducted.

a)



Spring (Mar, Apr, May)
Summer (Jun, Jul, Aug)
Fall (Sep, Oct, Nov)
Winter (Dec, Jan, Feb)
Coastal diving ducks total count
0
1
2
3
4
Empire Offshore Wind Lease: OCS-A 0512
Boston
Hartford
Providence
Long Island Sound
Hudson Canyon
N

b)


Spring (Mar, Apr, May)
Summer (Jun, Jul, Aug)
Fall (Sep, Oct, Nov)
Winter (Dec, Jan, Feb)
Boston
Hartford
Providence
Long Island Sound
Hudson Canyon
Dabblers, Geese, and Swans
total count
0
1-3
4-6
7-9
10-13
Empire Offshore Wind
Lease: OCS-A 0512
N

c)

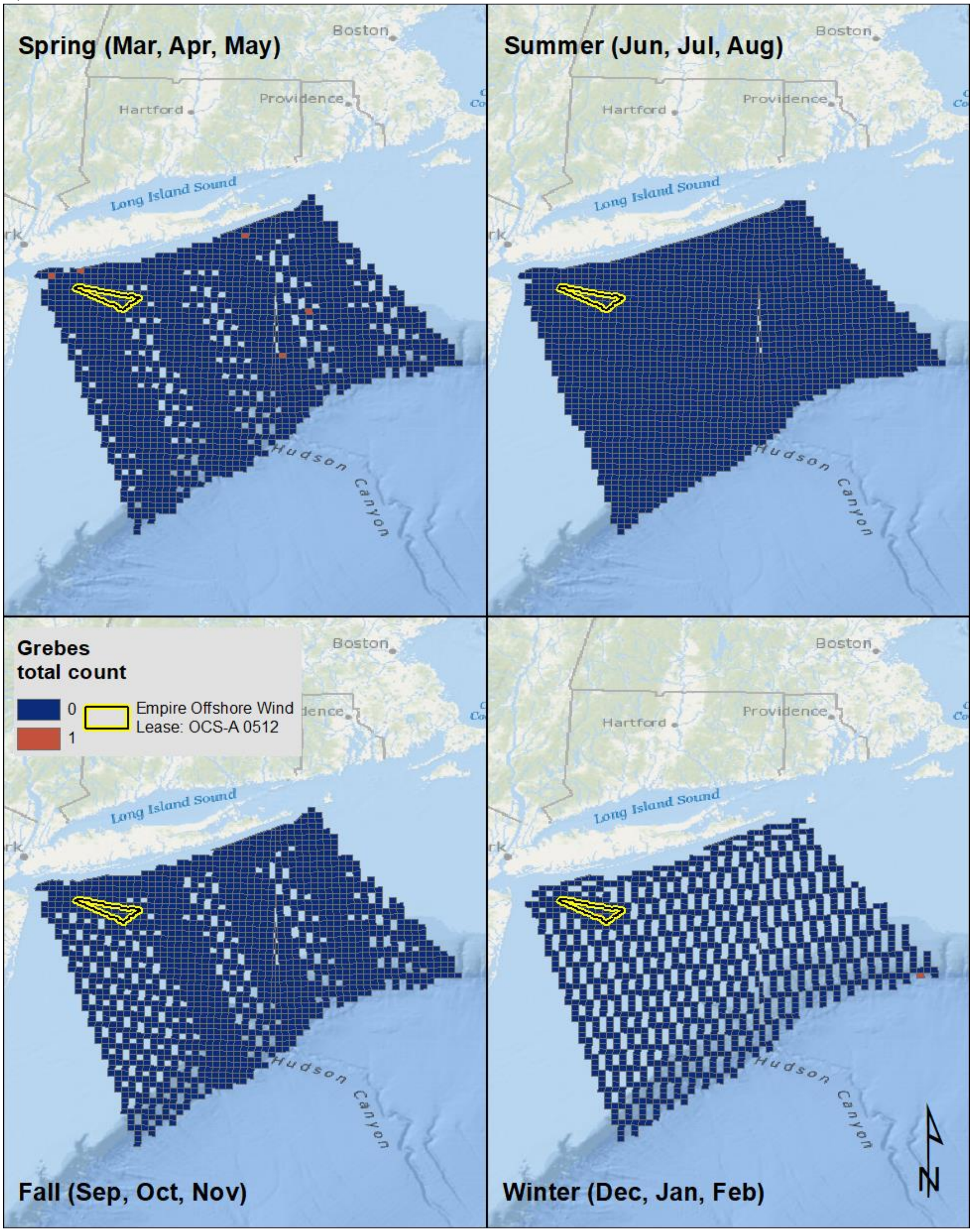


Figure 2-18 (a-c): Coastal ducks, geese, and grebes observed, by season, during the APEM surveys. For dabblers the one high represents a flock of migratory black ducks; the three species in coastal diving group were bufflehead, common goldeneye, and lesser scaup; horned grebe was the one species identified in the grebe group.

2.2.8 Marine birds

Marine bird distributions are generally more pelagic and widespread than coastal birds. A total of 83 marine bird species are known to regularly occur off the eastern seaboard of the U.S. (Nisbet et al. 2013). Many of these marine bird species use the Lease Area during multiple time periods, either seasonally or year-round, including loons, storm-petrels and shearwaters, gannets, gulls, terns, and auks. The IPaC database indicated that roseate tern (listed under the ESA) and one species of concern, red-throated loon, may be present in the Lease Area and adjacent waters.

In the following sections, the assessments for major taxonomic groups of marine birds is reviewed, including discussion of their exposure (summarized in Table 2-15), their densities inside and outside of the Lease Area (summarized in Table 2-16), and their vulnerability (summarized in Table 2-17). At the end of this offshore section,

Table 2-36 provides the species-specific densities by season as a supplement.

Table 2-15: Annual exposure scores for each marine bird taxonomic group in the APEM and MDAT data sets. Species specific scores are detailed in the individual taxonomic group sections.

Taxonomic Group	Winter	Spring	Summer	Fall	Annual Score
Sea ducks	low	minimal	minimal	low	3
Skuas and jaegers	minimal	minimal	low	minimal	1
Auks	low	minimal	minimal	minimal	1
Gulls	low	low	minimal	low	3
Terns	minimal	high	minimal	minimal	5
Loons	low	low	medium[2]	low	10
Storm-petrels	minimal	minimal	minimal	minimal	0
Shearwaters and petrels	minimal	minimal	minimal	minimal	0
Gannet and booby	low	low	low	low	5
Cormorants	minimal	minimal	low	low	2
Pelicans	minimal	minimal	minimal	minimal	0

[1]Minimal = 0–2, Low = 3–5, Medium = 6–8, and High = 9–12.

[2]Due to low sample size and other evidence this score was reduced to "minimal" to "low". See loon section for details.

Table 2-16: Annual mean species densities (total count/sq. km) within the Lease Area and the APEM NYSERDA and Empire digital aerial survey area within the Atlantic OCS. At the end of the offshore bird assessment species-specific densities by season are provided as a suppliment.

Taxonomic Grouping	Species	Mean annual densities (total count/sq. km) in Lease Area	Mean annual densities (total count/sq. km) in the APEM NYSERDA and Empire digital aerial survey area
Sea ducks	Black scoter	0.070	0.026
	Common eider	0	<0.001
	Long-tailed duck	0.002	<0.001
	Red-breasted merganser	0	<0.001
	Surf scoter	0.009	0.012
	White-winged scoter	0	0.017
	Unidentified scoter	0.008	0.184
Skuas and jaegers	Great skua	0	0
	Parasitic jaeger	0	<0.001
	Pomarine jaeger	0	<0.001
	South polar skua	0	0
	Unidentified skua	0	<0.001
Auks	Atlantic puffin	0.002	0.090
	Black guillemot	0	<0.001
	Common murre	0	<0.001
	Dovekie	<0.001	0.051
	Razorbill	0	0.080
	Unidentified alcid	0.356	0.172
	Unidentified murre	0	0.004
Small gulls	Bonaparte's gull	0.193	0.067
	Little gull	0	<0.001
	Unidentified small gull	0.016	0.021
Medium gulls	Black-legged kittiwake	0.057	0.016
	Laughing gull	0	0.004
	Ring-billed gull	0.001	0.014
Large gulls	Great black-backed gull	0.018	0.102
	Glaucous gull	0	0
	Herring gull	0.057	0.329
	Iceland gull	0	<0.001
	Lesser black-backed gull	0.019	0.005
	Unidentified large gull	0	0.005
All gulls	Unidentified gull	0	<0.001
Small terns	Black tern	0	<0.001
	Least tern	0.006	0.005
Medium terns	Common tern	0.041	0.018
	Forster's tern	0	0
	Roseate tern	0	<0.001
	Royal tern	0	<0.001
All terns	Unidentified tern	0.101	0.035
Loons	Common loon	0.118	0.040

Taxonomic Grouping	Species	Mean annual densities (total count/sq. km) in Lease Area	Mean annual densities (total count/sq. km) in the APEM NYSERDA and Empire digital aerial survey area
	Red-throated loon	0.068	0.025
	Unidentified loon	0	<0.001
Storm-petrels	Band-rumped storm-petrel	0	0
	Leach's storm-petrel	0	<0.001
	Unidentified storm-petrel	0.006	0.115
	White-faced storm-petrel	0	0
	Wilson's storm-petrel	0	0.066
Shearwaters and petrels	Audubon's shearwater	0	<0.001
	Black-capped petrel	0	0.002
	Cory's shearwater	0.038	0.048
	Great shearwater	0.012	0.026
	Manx shearwater	0	<0.001
	Northern fulmar	0.001	0.024
	Sooty shearwater	0.007	0.003
	Trindade petrel	0	0
	Unidentified petrel	0.002	<0.001
	Unidentified large shearwater	0.011	0.029
	Unidentified small shearwater (Audubon's, Manx, or little)	0.002	0.004
Gannets and boobies	Northern gannet	0.273	0.304
Cormorants	Double-crested cormorant	0	0.001
	Unidentified cormorant	0.006	0.005
Pelicans	Brown pelican	0	0

Table 2-17: Summary of taxonomic group-level vulnerability scores. In the group sections below, vulnerability scores for each species within a group are detailed.

Taxonomic Group	Collision Vulnerability	Displacement Vulnerability	Population Vulnerability
Sea ducks	low	high	low
Phalaropes	low	medium	low
Skuas and jaegers	medium	low	low
Auks	minimal	high	low
Large gulls	medium	medium	low
Medium gulls	medium	medium	low
Small gulls	low	medium	low
Terns	low	medium	medium
Loons	low	high	medium
Storm-petrels	low	medium	low
Shearwaters and petrels	low	medium	medium
Gannets	low	medium	low
Cormorants	medium	low	minimal
Pelicans	medium	medium	low

2.2.8.1 Loons

2.2.8.1.1 Spatiotemporal Context

Common loons and red-throated loons breed in areas that are associated with inland freshwater during the summer, but both species are known to use the Atlantic Outer Continental Shelf during winter, with migration periods in the spring and fall. Analysis of satellite-tracked red-throated loons, captured and tagged in the mid-Atlantic area, found their winter distributions to be largely inshore of the Lease Area, although they did overlap with the Lease Area somewhat during their migration periods, particularly in spring (Gray et al. 2016). In the mid-Atlantic, common loons generally show a broader and more dispersed distribution in winter than red-throated loons (Williams et al. 2015a). As expected, based on the summer breeding habitat of loons, the APEM surveys and MDAT models show lower use of the Lease Area by loons in the summer than other seasons.

2.2.8.1.2 Exposure Assessment

Exposure for loons was assessed using species accounts, tracking data, APEM survey data, and MDAT models. Exposure to construction and operations is considered to be “minimal” to “low” because loons may pass through the Lease Area during spring and fall migration, are estimated to have “low” relative exposure during the winter (Table 2-18). Summer originally received a “medium” relative exposure score, but that was lowered to minimal – low for the reasons described below. Since red-throated loons migrated to inland lakes to breed, density estimates indicate close to no use of the Lease Area during the summer. Similarly, common loon density was lower during the summer/spring than the other months because adults migrate to inland lakes to breed. The medium exposure score during the summer is the result of a several observations of loons, likely juvenile common loons, in the Lease Area, but few observations in the adjacent areas. This leads to an inflated summer exposure score when a majority of the population is inland. Therefore, given overall low loon densities in summer, we have discounted this exposure estimate to minimal – low to reduce the weight of only a few individual sightings on this overall score. Red-throated loons had similar counts within the Lease Area compared to the entire APEM survey area, while common loon counts were higher in the Lease Area (Table 2-16). In addition, tracking data indicate that red-throated loons largely pass through the area only during spring migration (Figure 2-19).

Table 2-18: Seasonal exposure rankings for the loons group.

Taxonomic Group	Season	Local Rank	Regional Rank	Total Rank	Exposure Score
Loons	Winter	1	1	2	low
	Spring	1	1	2	low
	Summer	3	1	4	min.- low*
	Fall	1	1	2	low

*The summer score was inflated (see text) and reduced from medium, to minimal – low

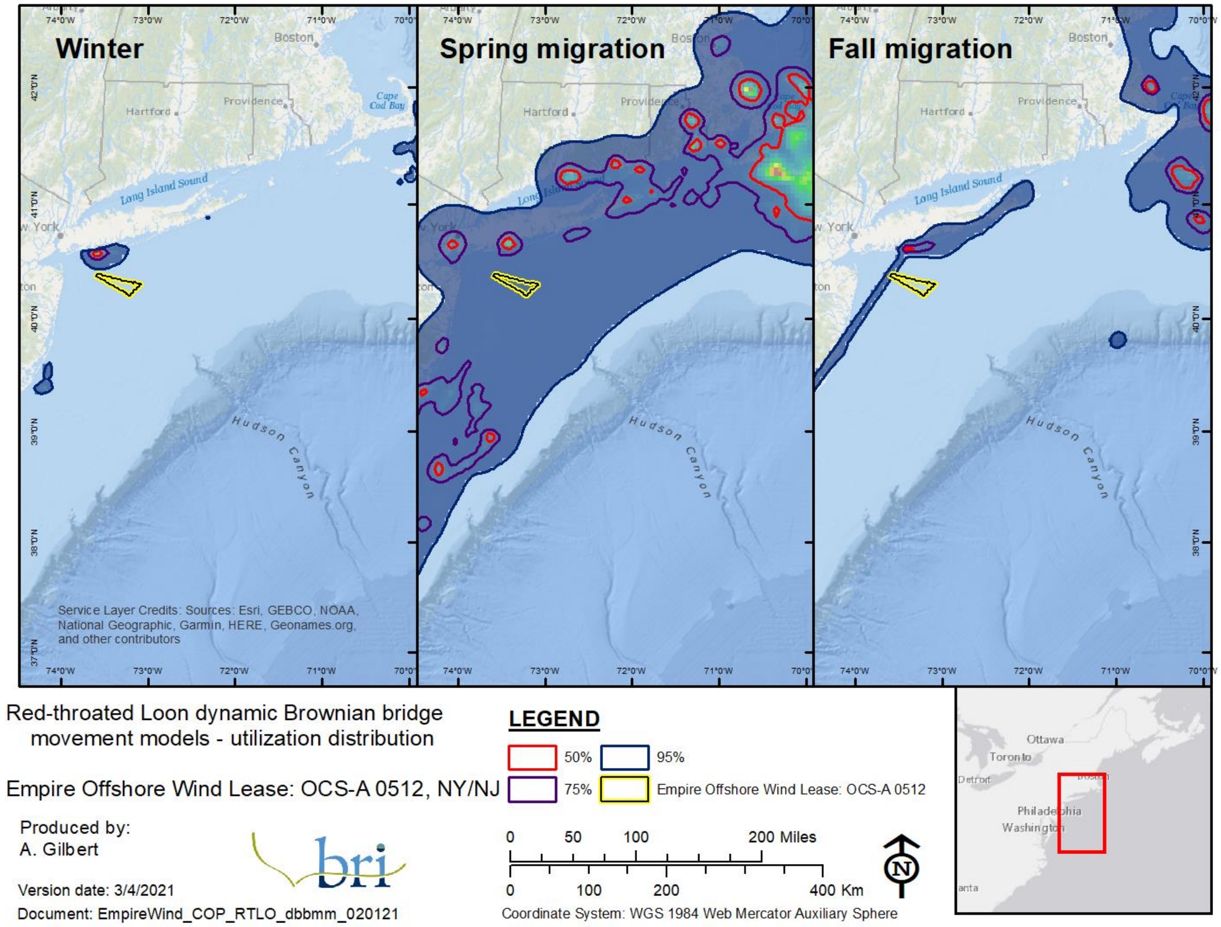


Figure 2-19: Dynamic Brownian bridge movement models for red-throated loons (n = 46, 46, 31 [winter, spring, fall]) that were tracked with satellite transmitters. Utilization contour levels (50%, 75%, 95%) were calculated for the mean utilization distribution (UD) surface; a probability density surface showing the relative use of an area by the population of animals in this study over the period of study. The contours represent the percentage of the use area across the UD surface and represent various levels of use from 50% (core use) to 95% (home range). The models indicate the birds stay close to shore in the winter and during fall migration but may pass through the Wind Farm Array during spring migration.

2.2.8.1.3 Relative Behavioral Vulnerability Assessment

Loons are consistently identified as being vulnerable to displacement (Garthe and Hüppop 2004, Furness et al. 2013, MMO 2018). Red-throated loons have been documented to avoid offshore wind developments, which can lead to displacement (Dierschke et al. 2016). In addition to displacement caused by wind turbine arrays, Red-throated loons have also been shown to be negatively affected by increased boat traffic associated with construction and maintenance (Mendel et al. 2019). This high vulnerability of displacement, coupled with extensive use of the East Coast during migration and wintering increases the potential for cumulative habitat loss for loons (Goodale et al. 2019). However, there is some evidence that Red-throated Loons may return to wind farm areas after construction has been completed (APEM 2016). While data is lacking (there are few common loons present at European wind farms), common loons are expected to have a similar avoidance response.

Based upon the above evidence, the risk to loons is primarily displacement from wind developments during construction and operations. From the literature, displacement vulnerability is considered to be "high" for loons because they are known to display a strong avoidance to offshore wind developments; the displacement score (DV) is "high" for both species (Table 2-19). There is little evidence in the literature that loons are vulnerable to collision, although they have the potential to fly through the lower portion of the RSZ (during the day loons fly approximately 7-21% within the RSZ depending on species) if they do not avoid the wind farm; thus, the loons received a "low" collision risk score (Figure 2-20). Based upon the literature, a lower range is added to collision vulnerability because the birds have such a high avoidance response.

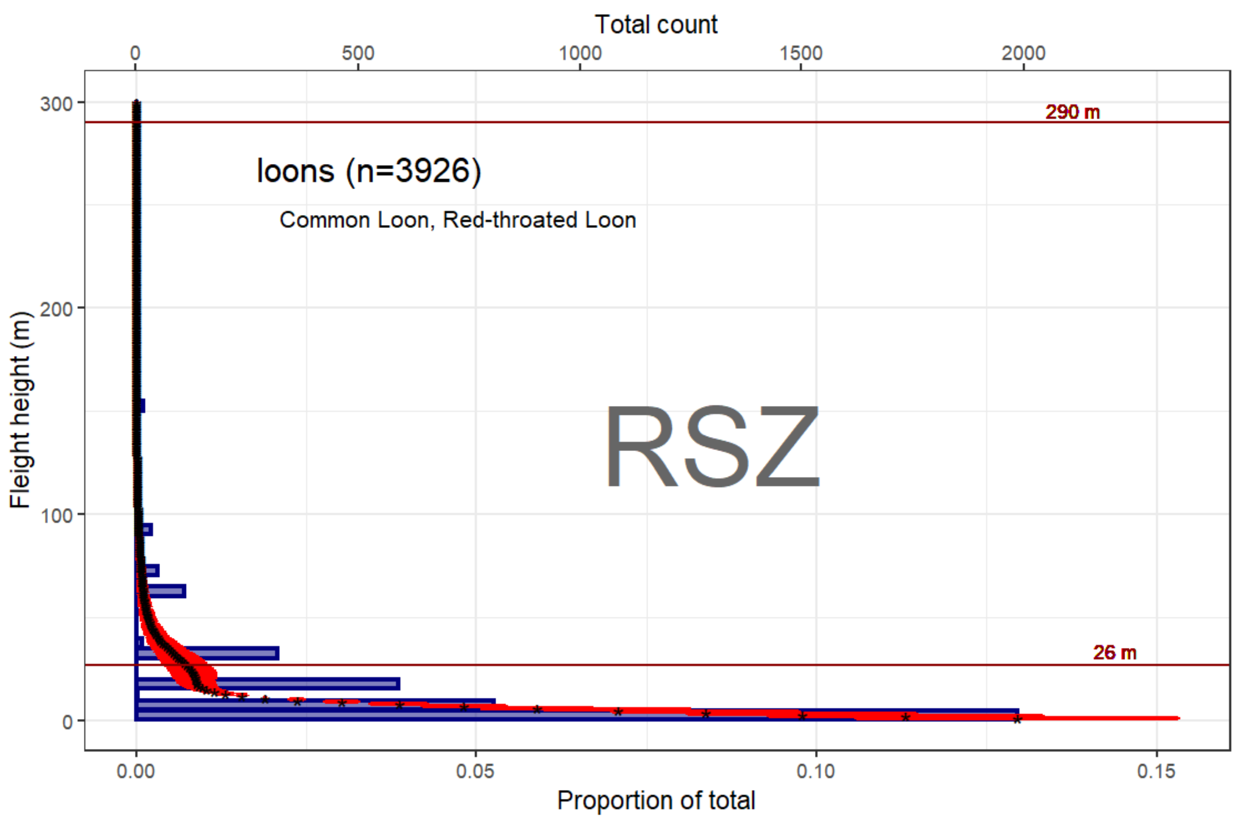


Figure 2-20: Flight heights of loons (m) derived from the Northwest Atlantic Seabird Catalog, showing the actual number of birds in 5 m intervals (blue bars), and the modeled average flight height in 1 m intervals (asterisk) and the standard deviation (red lines), in relation to the upper and lower limits of the Rotor Swept Zone (RSZ) for the maximum sized wind turbine considered for the Project.

Table 2-19: Summary of loon vulnerability. CV = collision vulnerability; DV = displacement vulnerability; PV = population vulnerability. Based upon the literature, collision vulnerability was adjusted to include a lower range limit (green).

Species	CV	DV	PV
Red-throated loon	minimal-low (0.4)	high (0.9)	low (0.47)
Common loon	minimal-low (0.47)	high (0.8)	medium (0.6)

2.2.8.1.4 Risk Analysis

This analysis suggests that the potential impacts to loon populations is "minimal" to "low" because, overall, these birds are considered to have "minimal" to "low" exposure, both spatially and temporally, and a high vulnerability to displacement due to strong avoidance. However, there is uncertainty about how displacement will affect individual fitness (e.g., changes in energy expenditure due to avoidance) and effective methodologies for assessing population-level displacement effects are lacking (Mendel et al. 2019). In addition, there is uncertainty about how displacement from the wind farm would reduce foraging opportunities because birds may move to foraging areas adjacent to the wind farm. Overall, habitat loss due to displacement as a result of a single project is unlikely to impact population trends (Fox and Petersen 2019) because of the relatively small size of the Project area in relation to available foraging habitat. Loons do have the potential to fly through the lower portion of the RSZ, but their strong avoidance behavior most likely significantly reduces their collision vulnerability to minimal levels. Since loons have a low to medium population vulnerability score, the final risk score was not adjusted.

2.2.8.2 Sea Ducks

2.2.8.2.1 Spatiotemporal Context

Sea ducks include common eider, scoters, and long-tailed ducks, all of which are northern or Arctic breeders that use the Atlantic Outer Continental Shelf heavily in winter. Most sea ducks forage on mussels and/or other benthic invertebrates, and generally winter in shallow inshore waters or out over large offshore shoals where they can access prey. Sea ducks tracked with satellite transmitters remained largely inshore of the Lease Area, with the exception of surf scoter and black scoter during spring migration (Figure 2-21 to Figure 2-24).

2.2.8.2.2 Exposure Assessment

Exposure was assessed using species accounts, tracking data, APEM survey data, and MDAT models. Exposure is considered to be "minimal" to "low" because sea duck annual exposure score was generally minimal to low (

Table 2-20), the average counts of sea duck within the Lease Area were generally the same as the APEM survey area (Table 2-16), and the literature indicates that sea duck exposure will be primarily limited to migration or travel between wintering sites.

Table 2-20: Seasonal exposure rankings for the sea duck group.

Taxonomic Group	Season	Local Rank	Regional Rank	Total Rank	Exposure Score
Sea ducks	Winter	0	1	1	low
	Spring	0	0	0	minimal
	Summer	0	·	0	minimal
	Fall	1	1	2	low

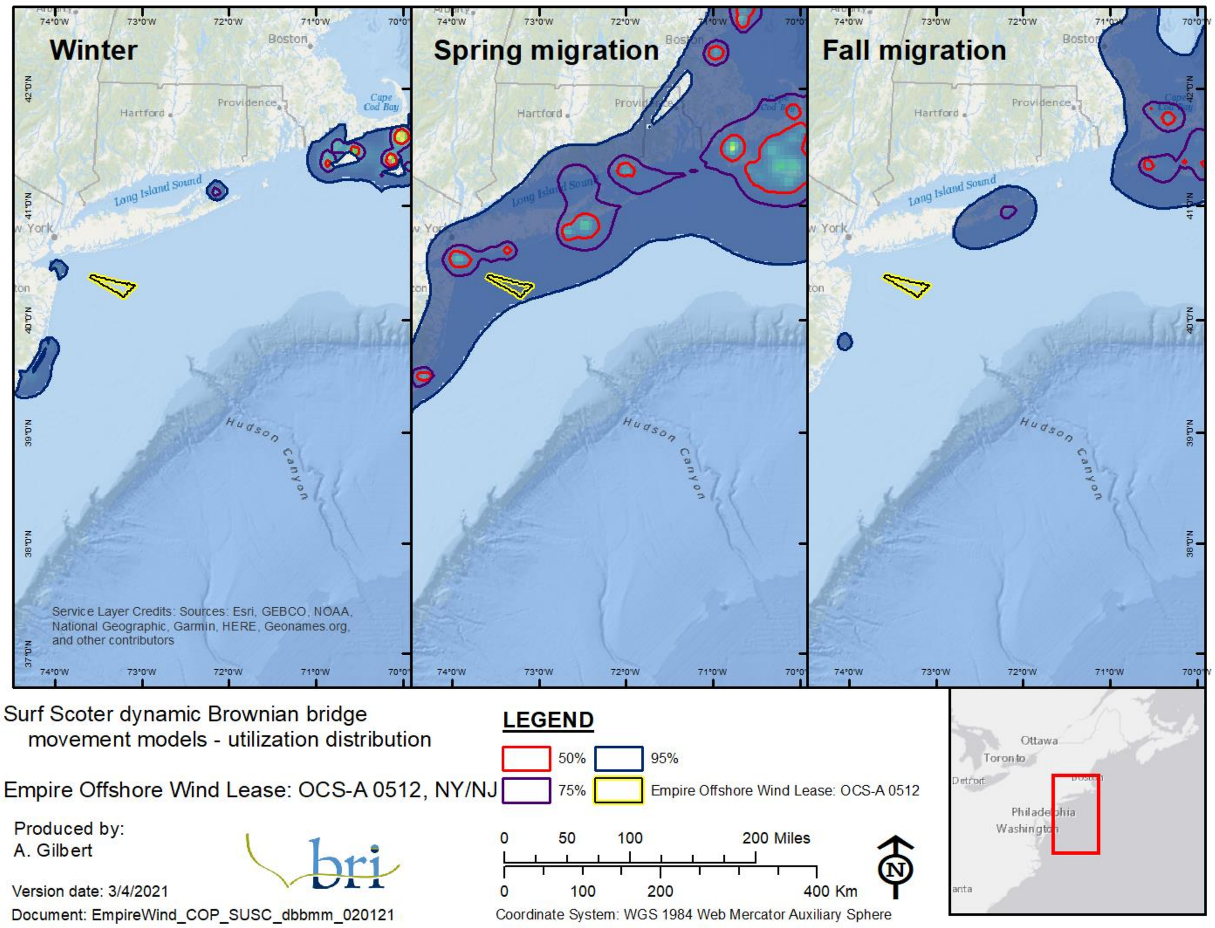


Figure 2-21: Dynamic Brownian bridge movement models for surf scoter (n = 78, 87, 83 [winter, spring, fall]) that were tracked with satellite transmitters. Utilization contour levels (50%, 75%, 95%) were calculated for the mean utilization distribution (UD) surface; a probability density surface showing the relative use of an area by the population of animals in this study over the period of study. The contours represent the percentage of the use area across the UD surface and represent various levels of use from 50% (core use) to 95% (home range). The models indicate the birds are not in the vicinity of the Lease Area or during fall migration but may pass near Lease Area during spring migration. Data provided by BOEM: see section 2.1.1.1.1.4.2 (p. 27).

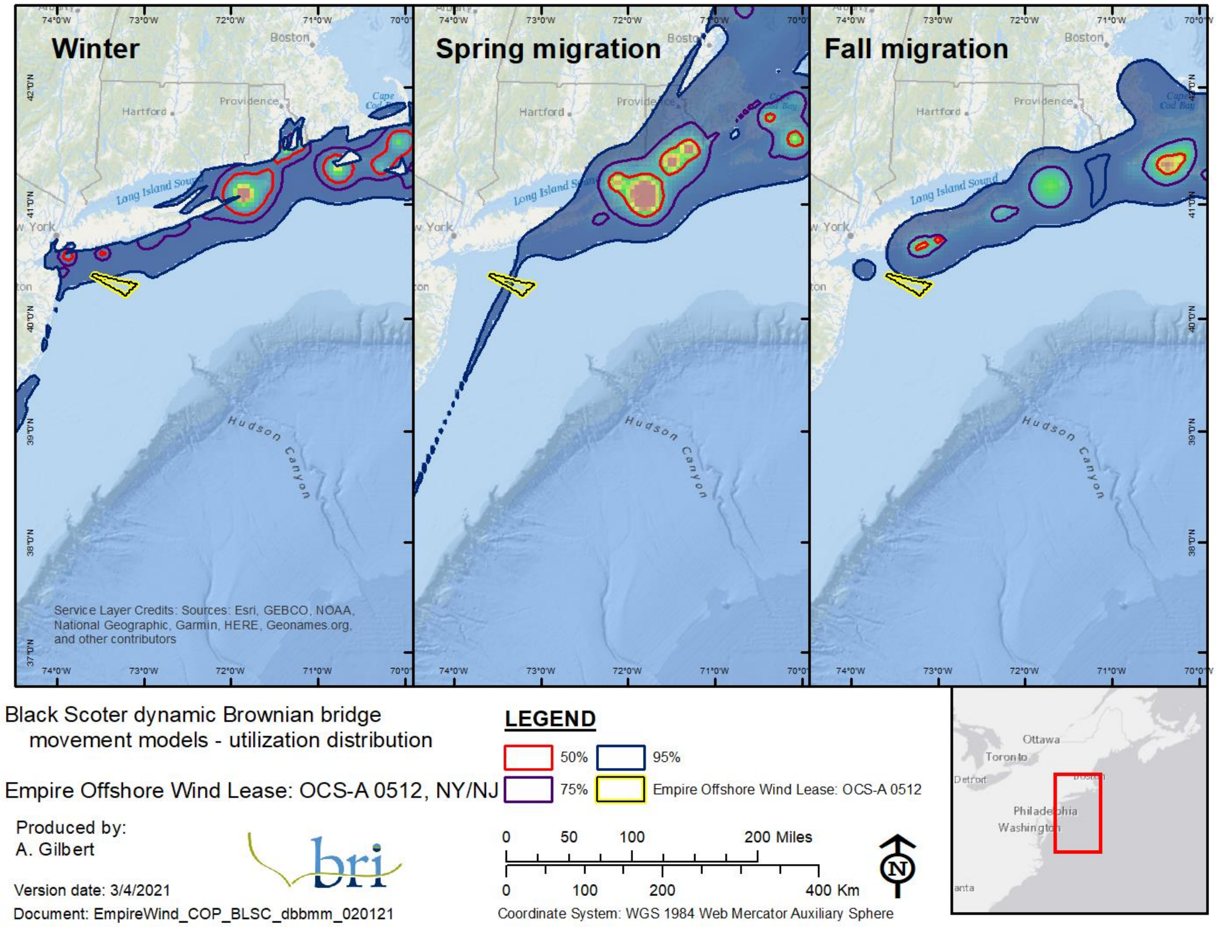


Figure 2-22: Dynamic Brownian bridge movement models for black scoter (n = 61, 76, 80 [winter, spring, fall]) that were tracked with satellite transmitters. Utilization contour levels (50%, 75%, 95%) were calculated for the mean utilization distribution (UD) surface; a probability density surface showing the relative use of an area by the population of animals in this study over the period of study. The contours represent the percentage of the use area across the UD surface and represent various levels of use from 50% (core use) to 95% (home range). The models indicate the birds stay close to shore in the winter and during fall migration but may pass though the Lease Area during spring migration. Data provided by multiple sea duck researchers: see section 2.1.1.1.1.4.6 (p. 28).

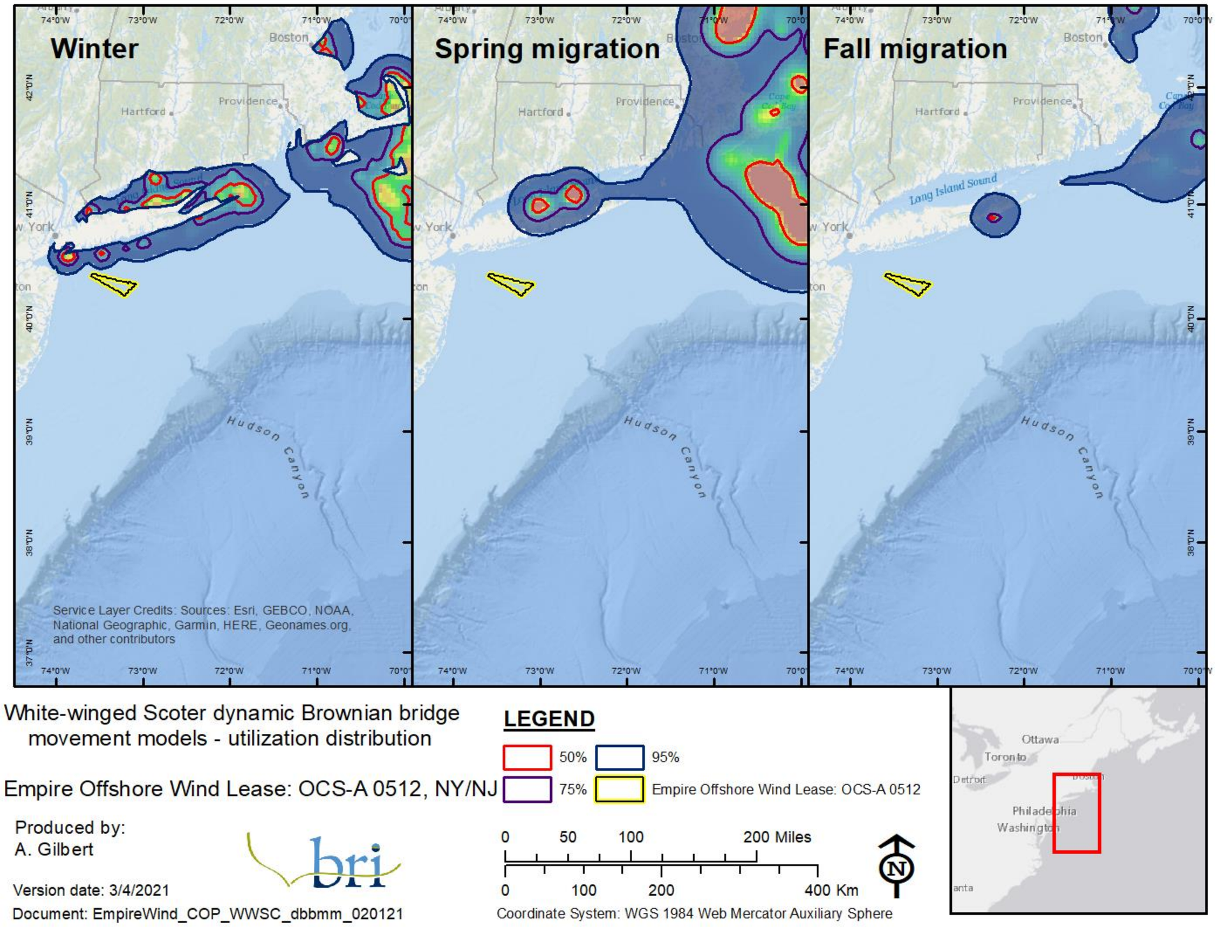


Figure 2-23: Dynamic Brownian bridge movement models for white-winged scoter (n = 66, 45, 62 [winter, spring, fall]) that were tracked with satellite transmitters. Utilization contour levels (50%, 75%, 95%) were calculated for the mean utilization distribution (UD) surface; a probability density surface showing the relative use of an area by the population of animals in this study over the period of study. The contours represent the percentage of the use area across the UD surface and represent various levels of use from 50% (core use) to 95% (home range). The models indicate the birds are not concentrated near the Lease Area. Data provided by multiple sea duck researchers: see section 2.1.1.1.1.4.6 (p. 28).

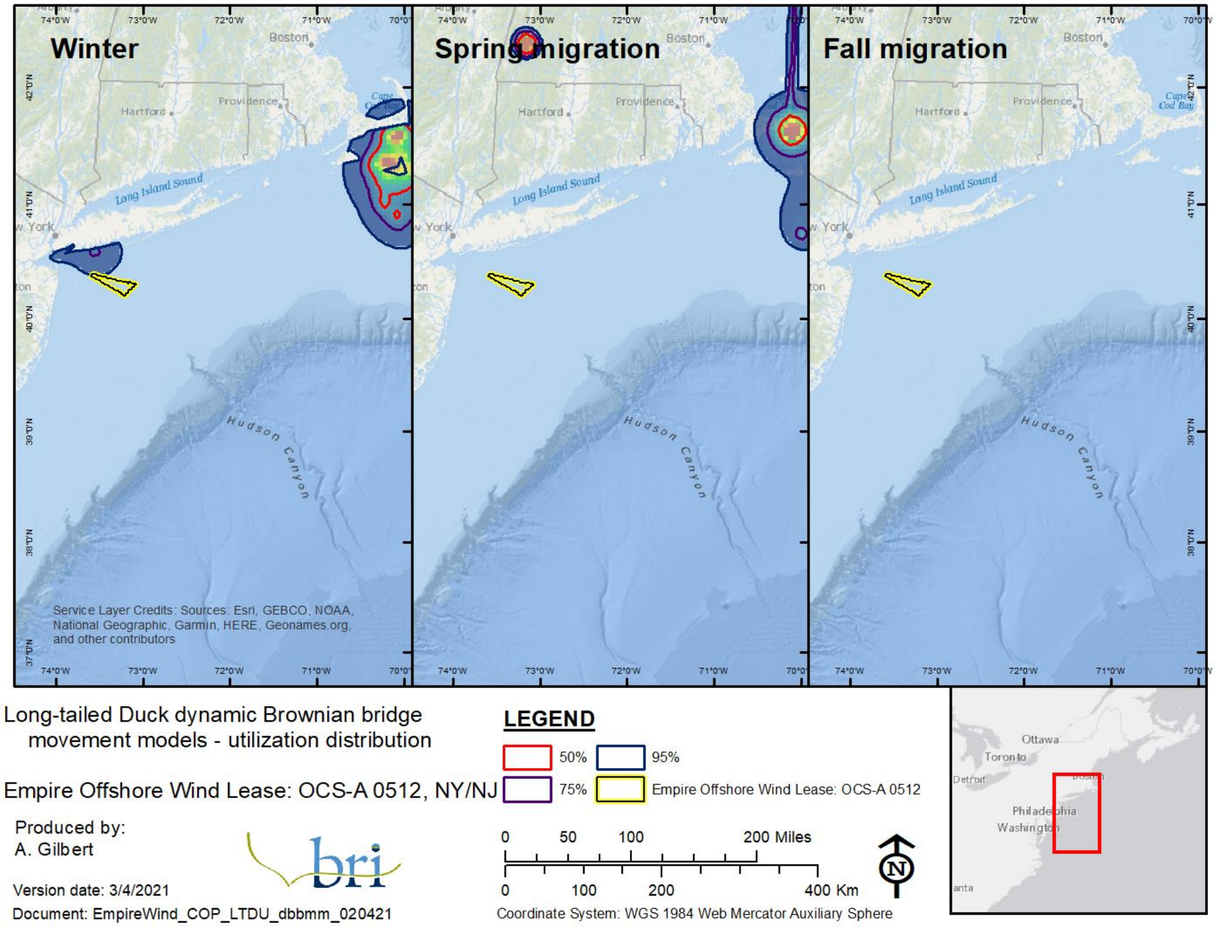


Figure 2-24: Dynamic Brownian bridge movement models for long-tailed duck (n = 49, 60, 37 [winter, spring, fall]) that were tracked with satellite transmitters. Utilization contour levels (50%, 75%, 95%) were calculated for the mean utilization distribution (UD) surface; a probability density surface showing the relative use of an area by the population of animals in this study over the period of study. The contours represent the percentage of the use area across the UD surface and represent various levels of use from 50% (core use) to 95% (home range). The models indicate the birds are not concentrated near the Lease Area. Data provided by multiple sea duck researchers: see section 2.1.1.1.1.4.6 (p. 28).

2.2.8.2.3 Relative Behavioral Vulnerability Assessment

Sea ducks, particularly scoters, have been identified as being vulnerable to displacement (MMO 2018), although ultimately, this has been shown to be temporary for some species. Sea ducks are generally not considered vulnerable to collision (Furness et al. 2013), remaining primarily below the RSZ (during the day sea ducks were estimated to fly 0-14% of the time within the RSZ depending on species; Figure 2-25). Avoidance behavior has been documented for black scoter, common eider (Desholm and Kahlert 2005, Larsen and Guillemette 2007), and greater scaup (Dirksen and van der Winden 1998 *in* Langston 2013). Avoidance behavior of wind projects can lead to permanent or semi-permanent displacement, resulting in effective habitat loss (Petersen and Fox 2007, Percival 2010, Langston 2013). The high vulnerability of displacement, coupled with extensive use of the East Coast during migration and wintering increases the potential for cumulative habitat loss for sea ducks (Goodale et al. 2019). However, for some species this displacement may cease several years after construction as food resources, behavioral responses, or other factors change (Petersen and Fox 2007, Leonhard et al. 2013).

Based upon the above evidence, the risk to sea ducks is primarily displacement from offshore wind developments. From the literature, sea duck vulnerability to temporary displacement is considered to be “medium” to “high” during construction and initial operations because sea ducks are known to display a strong avoidance to offshore wind developments; the displacement score was also “medium” to “high” (Table 2-21). However, since there is evidence of birds returning to wind farms once they become operational, vulnerability to permanent displacement will vary by species and a lower range is added to displacement vulnerability. Since sea ducks generally fly below the RSZ and have strong avoidance behavior, collision vulnerability is “low” (Figure 2-20).

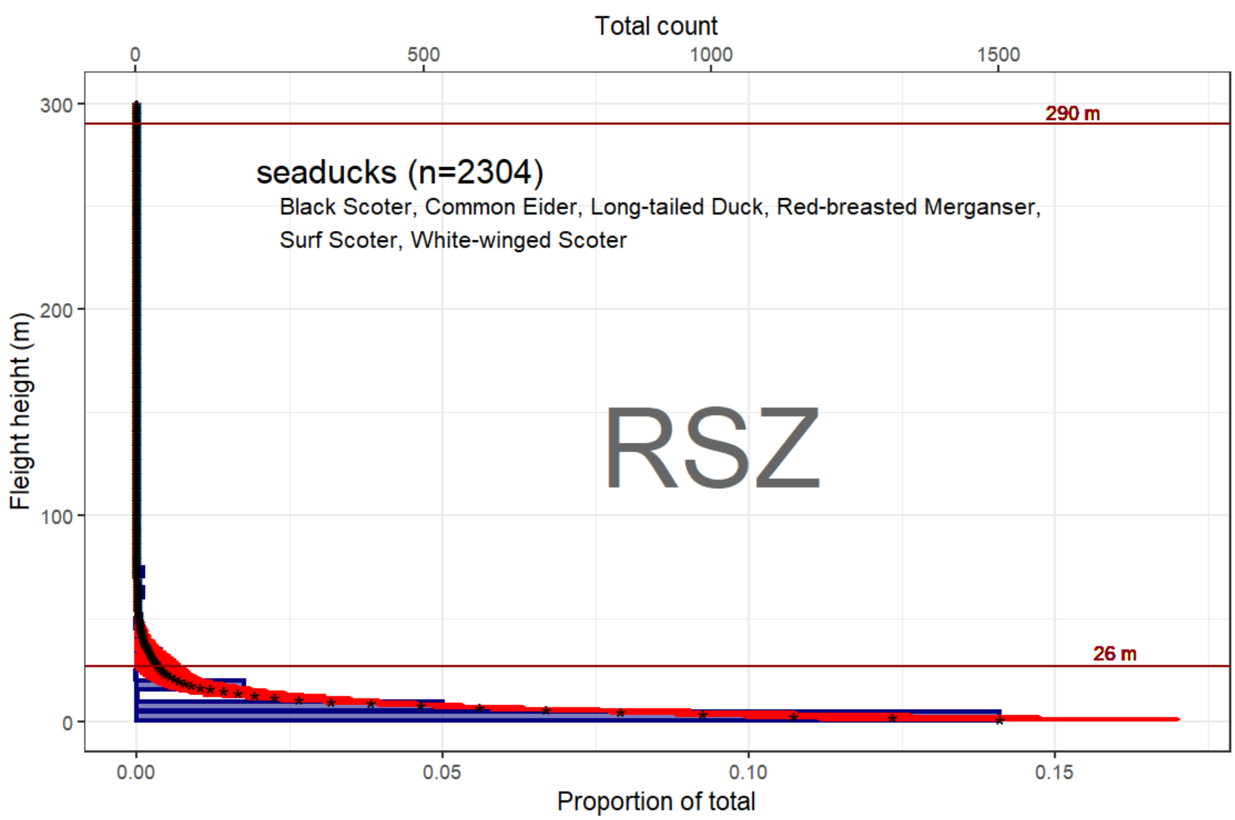


Figure 2-25: Flight heights of sea ducks (m) derived from the Northwest Atlantic Seabird Catalog, showing the actual number of birds in 5 m intervals (blue bars), and the modeled average flight height in 1 m intervals (asterisk) and the standard deviation (red lines), in relation to the upper and lower limits of the Rotor Swept Zone (RSZ) for the maximum sized wind turbine considered for the Project.

Table 2-21: Summary of sea duck vulnerability. CV = collision vulnerability; DV = displacement vulnerability; PV = population vulnerability. Based upon the literature, displacement vulnerability was adjusted to include a lower range limit (green) to account for macro avoidance rates potentially decreasing with time.

Species	CV	DV	PV
Common eider	low (0.27)	medium-high (0.9)	low (0.47)
Long-tailed duck	low (0.37)	medium-high (0.9)	low (0.27)
Black scoter	low (0.37)	medium-high (0.9)	low (0.4)
Surf scoter	low (0.33)	medium-high (0.9)	medium (0.53)
White-winged scoter	low (0.33)	medium-high (0.8)	medium (0.53)
Red-breasted merganser	low (0.4)	low-medium (0.5)	low (0.27)

2.2.8.2.4 Risk Analysis

This analysis suggests that the potential impacts to sea duck populations is “minimal” to “low” because, while the birds have medium to high vulnerability to displacement due to avoidance behaviors, overall these birds have minimal to low exposure, both spatially and temporally. In addition, displacement from individual wind farms is unlikely to affect populations because relatively few individuals are affected (Fox and Petersen 2019). Since sea ducks were assessed to have a low to medium population vulnerability score, the final risk score was not adjusted.

2.2.8.3 Petrels, Shearwaters, and Storm-Petrels

2.2.8.3.1 Spatiotemporal Context

Petrels, shearwaters, and storm-petrels that breed in the southern hemisphere visit the northern hemisphere during the austral winter (boreal summer) in vast numbers. These species use the U.S. Atlantic Outer Continental Shelf region so heavily that, in terms of sheer numbers, they easily outnumber the locally breeding species and year-round residents at this time of year (Nisbet et al. 2013). Several of these species (e.g., Cory’s shearwater, Wilson’s storm-petrel) are found in high densities across the broader region, concentrating beyond the outer continental shelf and the Gulf of Maine as shown in the MDAT avian abundance models (Winship et al. 2018).

2.2.8.3.2 Exposure Assessment

Exposure was assessed using species accounts, APEM survey data, and MDAT models. Overall, exposure is considered to be “minimal” (Table 2-22) because, while the petrel group is commonly observed throughout the region during the summer months, they are typically found much further offshore than the Lease Area (see maps in Part IV). For this reason, the annual exposure score is “minimal”.

Table 2-22: Seasonal exposure rankings for the shearwaters, petrels, and storm-petrels.

Taxonomic Group	Season	Local Rank	Regional Rank	Total Rank	Exposure Score
Storm-petrels	Winter	0	·	0	minimal
	Spring	0	0	0	minimal
	Summer	0	0	0	minimal
	Fall	0	0	0	minimal
Shearwaters and petrels	Winter	0	0	0	minimal
	Spring	0	0	0	minimal
	Summer	0	0	0	minimal
	Fall	0	0	0	minimal

2.2.8.3.3 Relative Behavioral Vulnerability Assessment

Petrels, shearwaters, and storm-petrels rank at the bottom of displacement vulnerability assessments (Furness et al. 2013), and the flight height data indicates the birds have limited exposure to the RSZ (birds flew < 0.01% of the time within the RSZ, Figure 2-26). Species within this group forage on bioluminescent aquatic prey and are instinctively attracted to artificial light sources (Imber 1975, Montevecchi 2006). This may be particularly true during periods of poor visibility, when collision risk is likely to be highest. There is little data, however, on avian behavior in the marine environment during such periods, as surveys are limited to good weather during daylight hours. Existing studies indicate that light-induced mass mortality events are primarily a land-based issue that involves juvenile birds, specifically fledging birds leaving their colonies at night (Le Corre et al. 2002, Rodríguez et al. 2014, 2015, 2017). Response to intermittent LED lights, which are the type likely to be used at offshore wind farms, is largely unknown. However, population-level effects related to this type of lighting are not expected. The collision vulnerability (CV) score is "low" for this group (Table 2-23). Displacement has not been well studied for this taxonomic group, but Furness et al. (2013) ranked species in this group as having the lowest displacement rank. A study at Egmond aan Zee, Netherlands, found that 50% (n = 10) of tubenosed species passed through the wind farm, which results in the birds receiving a displacement vulnerability score of 5 and thus a "medium" vulnerability (Table 2-23). Wade et al. (2016) described uncertainty on displacement vulnerability for these species as "very high". Based upon the evidence in the literate, and identified uncertainty, a lower range has been added to the displacement vulnerability determination (Table 2-23).

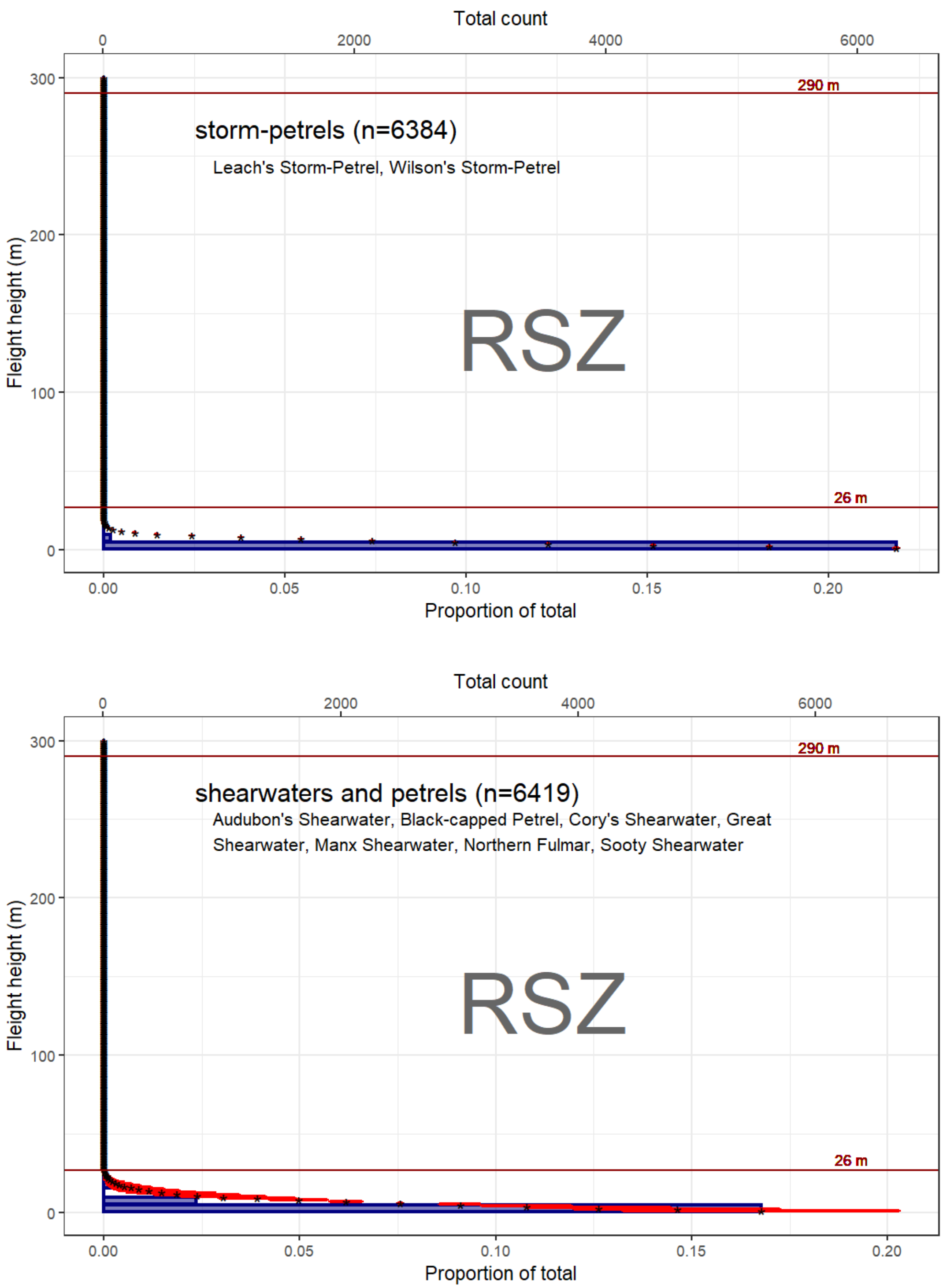


Figure 2-26: Flight heights of shearwaters, petrels, and storm-petrels (m) derived from the Northwest Atlantic Seabird Catalog, showing the actual number of birds in 5 m intervals (blue bars), and the modeled average flight height in 1 m intervals (asterisk) and the standard deviation (red lines), in relation to the upper and lower limits of the Rotor Swept Zone (RSZ) for the maximum sized wind turbine considered for the Project.

Table 2-23: Summary of petrel, shearwater, and storm-petrel vulnerability. CV = collision vulnerability; DV = displacement vulnerability; PV = population vulnerability. Based upon the literature, displacement vulnerability was adjusted to include a lower range limit (green).

Taxonomic Group	Species	CV	DV	PV
Shearwaters and petrels	Audubon's shearwater	low (0.3)	low-medium (0.6)	medium (0.73)
	Black-capped petrel	low (0.47)	low-medium (0.6)	medium (0.67)
	Cory's shearwater	low (0.33)	low-medium (0.6)	medium (0.6)
	Great shearwater	low (0.33)	low-medium (0.6)	medium (0.67)
	Manx shearwater	low (0.4)	low-medium (0.6)	medium (0.53)
	Sooty shearwater	low (0.33)	low-medium (0.6)	medium (0.53)
	Northern fulmar	low (0.4)	low-medium (0.6)	low (0.47)
Storm-petrels	Leach's storm-petrel	low (0.43)	low-medium (0.6)	low (0.47)
	Wilson's storm-petrel	low (0.43)	low-medium (0.6)	low (0.4)

2.2.8.3.4 Risk Analysis

This analysis suggests that the potential population level impacts to the petrel group is "minimal" because, overall, these birds have minimal spatial exposure. Since the petrel group had a low to medium population vulnerability score, the final risk score was not adjusted. Due to the listing status of black-capped petrel, this species is individually assessed below.

2.2.8.3.5 Candidate Petrel Species

2.2.8.3.5.1 Black-capped Petrel

The black-capped petrel (*Pterodroma hasitata*) is a pelagic seabird that breeds in small colonies on remote forested mountainsides of Caribbean islands, although breeding is now thought to be mostly restricted to the islands of Hispaniola (Haiti and the Dominican Republic) and possibly Cuba (Simons et al. 2013). During their breeding season (Jan-Jun), black-capped petrels travel long distances to forage over the deeper waters (200–2,000 m) of the southwestern North Atlantic, the Caribbean basin, and the southern Gulf of Mexico (Simons et al. 2013). Outside the breeding season, they regularly spend time in U.S. waters, along the shelf edge of the South Atlantic Bight, commonly as far north as Cape Hatteras and occasionally beyond (Jodice et al. 2015)

The small, declining global population, likely less than 2,000 breeding pairs, has been listed as *Endangered* on the IUCN Red List since 1994 (BirdLife International 2018) and is currently proposed for federal listing as *Threatened* in the U.S. (USFWS 2018a) due to its heavy use of the Gulf Stream within U.S. waters (USFWS 2018b) The black-capped petrel was pushed to the edge of extinction in the late 1800s due to hunting and harvest for food (Simons et al. 2013). Predation of adults and eggs by invasive mammals, and breeding habitat loss and degradation remain major threats to their existence; in addition, the effects of climate change on the biology of the species and its prey are largely unknown (Goetz et al. 2012). An increase in the frequency and intensity of hurricanes is expected to drastically increase mortality in breeding black-capped petrels (Hass et al. 2012). Given the small size of the breeding population, the species' resiliency (the ability to withstand normal environmental variation and stochastic disturbances over time) is considered to be low (USFWS 2018a).

2.2.8.3.5.2 Exposure Assessment

Exposure for black-capped petrel is considered "minimal" because they are extremely uncommon in areas not directly influenced by the warmer waters of the Gulf Stream (Haney 1987), and thought to be found in coastal waters of the U.S. only as a result of tropical storms (Lee 2000). The Northwest Atlantic Seabird Catalog contains ~5000 individual observations of black-capped petrels at sea (1979-2006; Figure 2-28; O'Connell et al. 2009, Simons et al. 2013), none of which are found in shelf waters north of Virginia. Recent satellite tracking of a few birds, however, suggests possibly greater use of shelf waters than previously known, especially in the South Atlantic Bight (Jodice et al. 2015). The closest sightings are from northern New York waters, where five observations were reported in 2016 (Figure 2-35 in Section 3.10.7.5 Endangered Tern Species). Recent tracking of black-capped petrels with satellite transmitters confirms that the birds are primarily using areas beyond the shelf break (Atlantic Seabirds 2019; Figure 2-27).

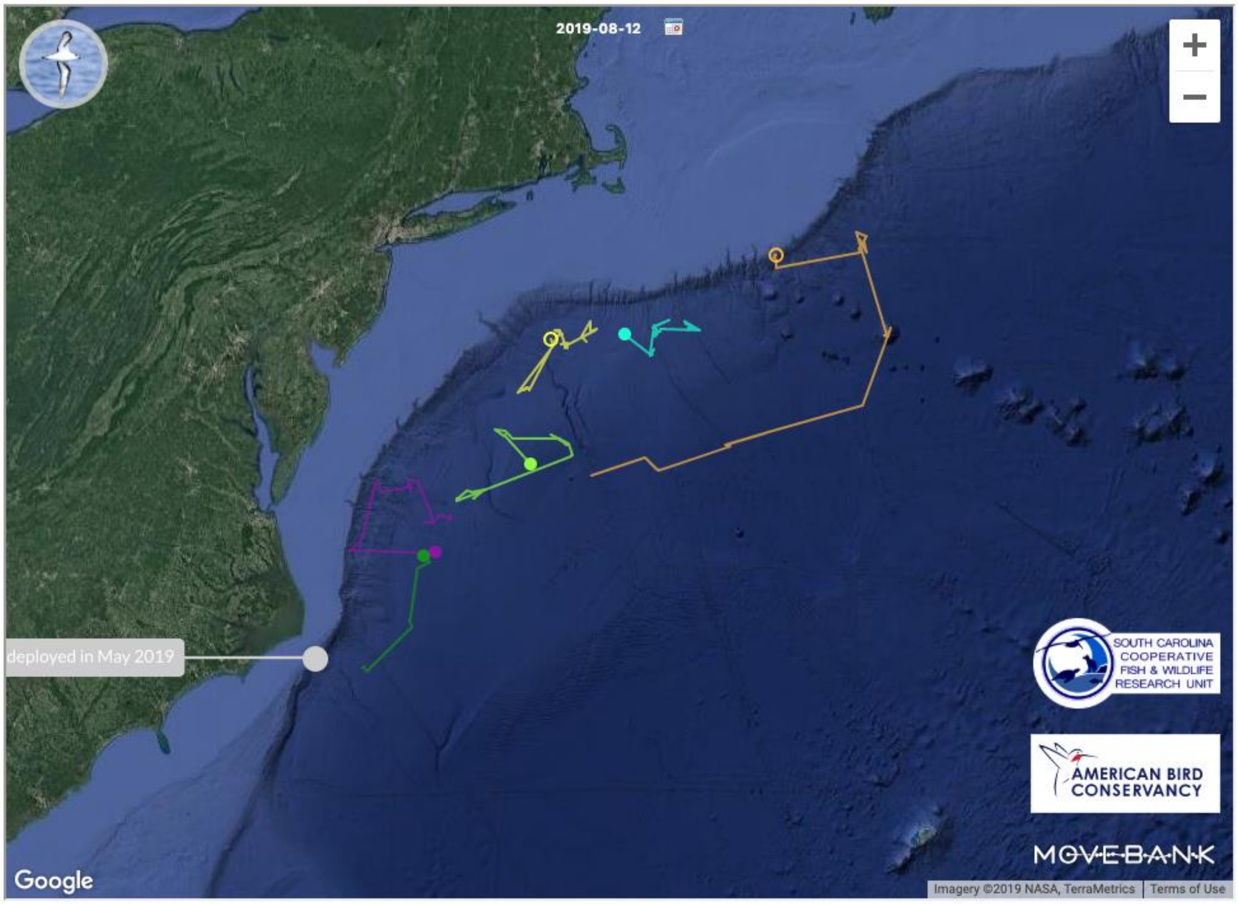


Figure 2-27: Track lines of black-capped petrels tagged with satellite transmitters (Atlantic Seabirds 2019).

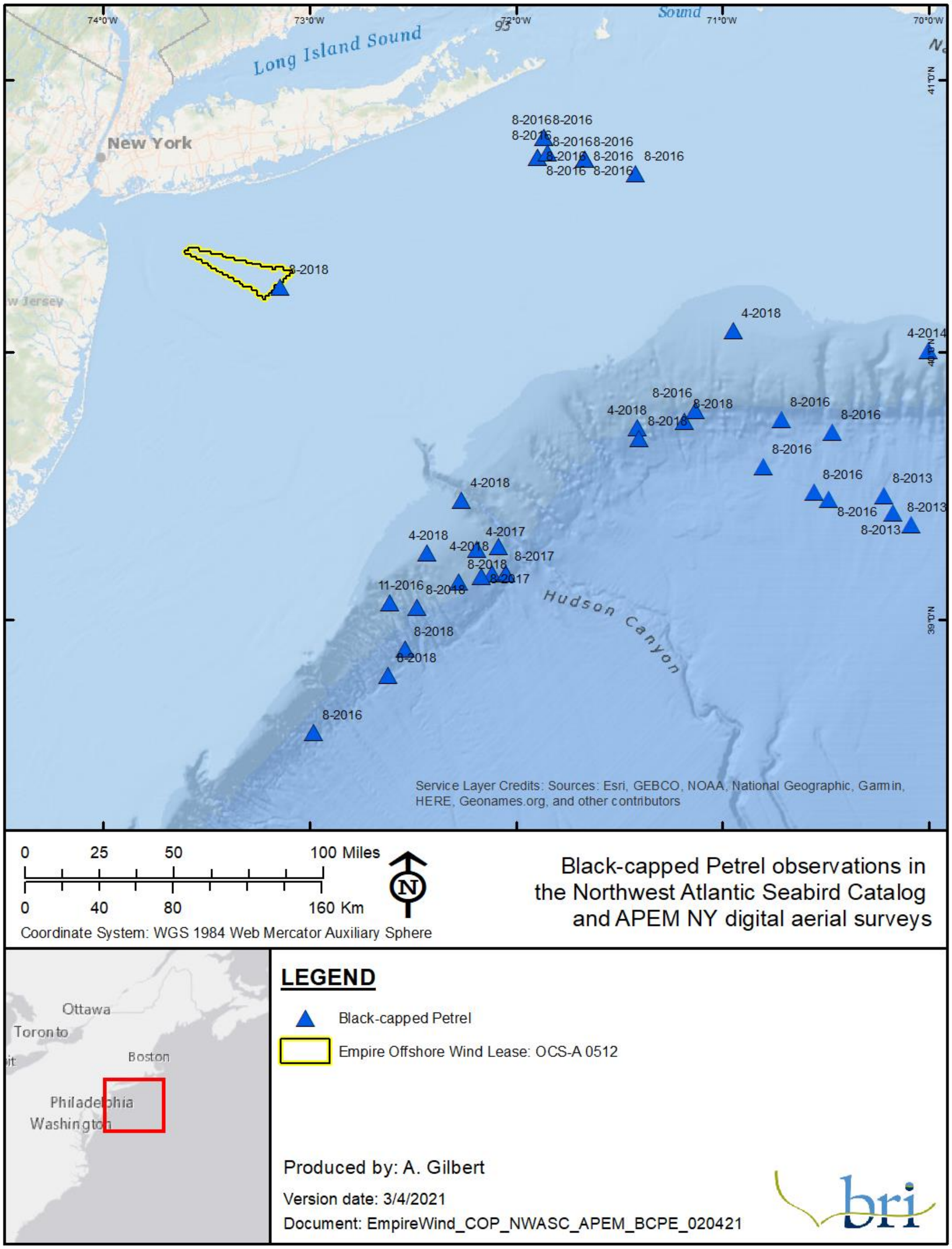


Figure 2-28: Black-capped petrel observations in the Northwest Atlantic Seabird Catalog

2.2.8.3.5.3 Relative Behavioral Vulnerability Assessment

Like most petrels, this species is attracted to lights, and is known to collide with lighted telecommunication towers on breeding islands (Goetz et al. 2012). This behavior could make black-capped petrels vulnerable to collision with lighted offshore vessels and structures. Despite some concern about the potential effects of wind farms on black-capped petrels at sea, the highly pelagic nature of this species and its near absence from continental shelf waters of the southeastern U.S., led Simons et al. (2013) to conclude it unlikely that wind farms will be detrimental to this species. Because of a lack of data, a vulnerability score was not developed for this species, but the vulnerability range for the other petrel species is used as a proxy.

2.2.8.3.5.4 Risk Analysis

This analysis suggests that the potential impacts to black-capped petrels is "minimal" because, overall, these birds have minimal spatial and temporal exposure. Since black-capped petrels are not state listed, they have a "medium" population vulnerability score; as such, the final risk score was not adjusted.

2.2.8.4 Gannets, Cormorants, and Pelicans

Only one brown pelican was detected during the APEM survey. Since pelicans are rare in the area, and New Jersey is at the northern extent of their range, they will not be discussed in detail. Northern gannets and cormorants are addressed separately below, due to the potential vulnerability of northern gannets highlighted in European studies.

2.2.8.4.1 Gannets

2.2.8.4.1.1 Spatiotemporal Context

Northern gannets (*Morus bassanus*) use the U.S. Atlantic Outer Continental Shelf (Atlantic OCS) during winter and migration. They breed in southeastern Canada and winter along the mid-Atlantic region and the Gulf of Mexico. Based on analysis of satellite-tracked northern gannets captured and tagged in the mid-Atlantic region, these birds show a preference for shallow, productive waters and are mostly found inshore of the mid-Atlantic wind energy areas in winter (Stenhouse et al. 2017). Northern gannets are opportunistic foragers, capable of long-distance oceanic movements, and generally migrate on a broad front, all of which may increase their exposure to offshore wind facilities compared with species that are truly restricted to inshore habitats (Stenhouse et al. 2017).

2.2.8.4.1.2 Exposure Assessment

Exposure was assessed using species accounts, tracking data, APEM survey data, and MDAT models. Exposure is considered to be "low" for gannets because the annual exposure score is low (Table 2-24) and average counts of northern gannets within the Lease Area was similar to the entire APEM survey area (Table 2-16). However, individual tracking data indicates that the Lease Area is within a portion of the 50% core use area (i.e., high use areas) during fall migration (Figure 2-29).

Table 2-24: Seasonal exposure rankings for northern gannets.

Taxonomic Group	Season	Local Rank	Regional Rank	Total Rank	Exposure Score
Northern gannet	Winter	0	1	1	low
	Spring	0	1	1	low
	Summer	2	0	2	low
	Fall	1	0	1	low

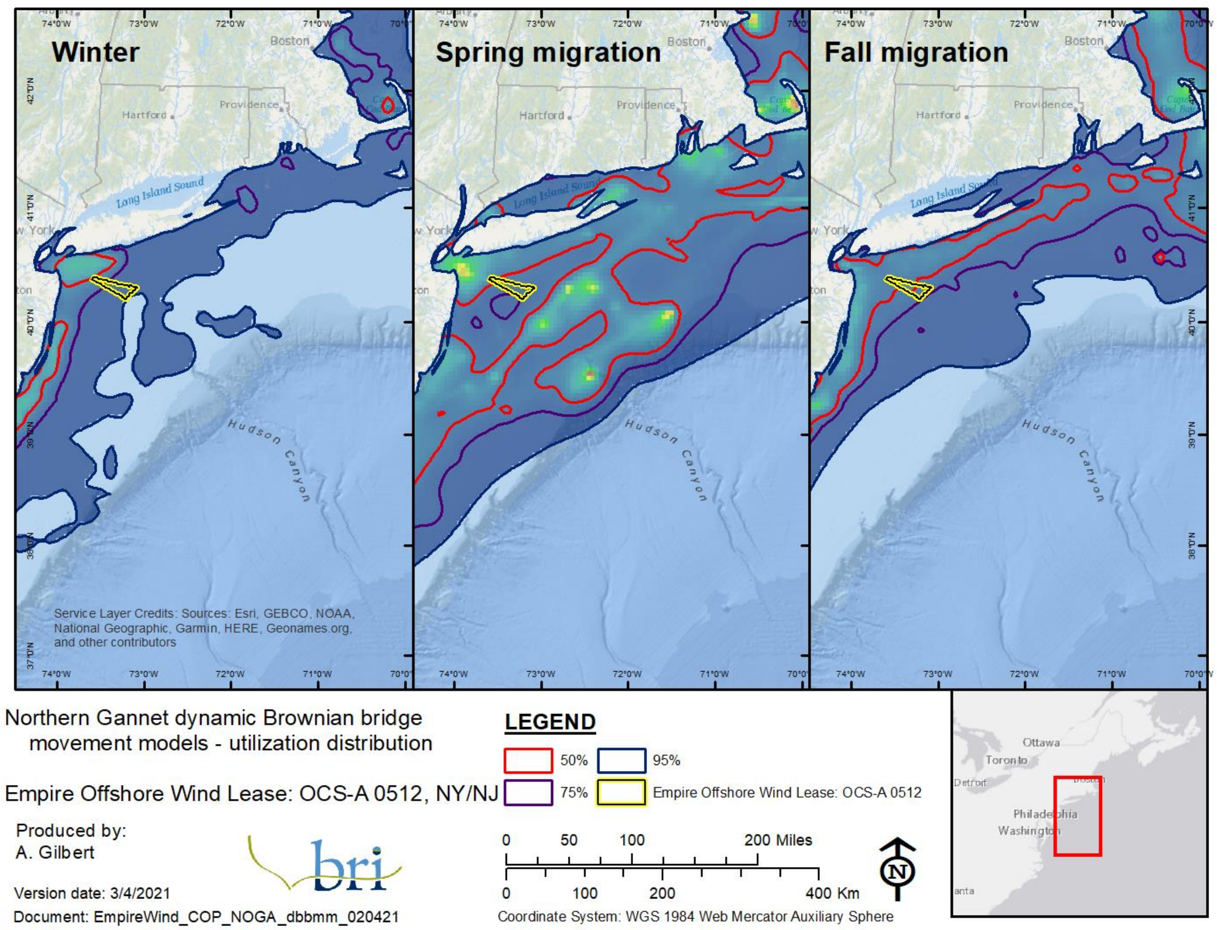


Figure 2-29: Dynamic Brownian bridge movement models for northern gannets (n = 34, 35, 36 [winter, spring, fall]) that were tracked with satellite transmitters. Utilization contour levels (50%, 75%, 95%) were calculated for the mean utilization distribution (UD) surface; a probability density surface showing the relative use of an area by the population of animals in this study over the period of study. The contours represent the percentage of the use area across the UD surface and represent various levels of use from 50% (core use) to 95% (home range). The models indicate the Lease Area is used by gannets during the winter, spring, and fall.

2.2.8.4.1.3 Relative Behavioral Vulnerability Assessment

The northern gannet is identified as being vulnerable to both displacement and collision. Gannets are considered to be vulnerable to displacement from habitat because studies indicate gannets avoid offshore wind developments (Krijgsveld et al. 2011, Cook et al. 2012, Hartman et al. 2012, Vanermen et al. 2015, Dierschke et al. 2016, Garthe et al. 2017). Satellite tracking studies indicate near complete avoidance of active wind developments by gannets (Garthe et al. 2017) and avoidance rates are estimated to be 64–84% (macro) and a 99.1% (total) rate (Krijgsveld et al. 2011, Cook et al. 2012, Vanermen et al. 2015, Skov et al. 2018). However, there is little information suggesting avoidance behavior leads to permanent displacement. Since gannets feed on highly mobile surface-fish and follow their prey throughout the outer continental shelf (Mowbray 2002), avoidance of the Lease Area is unlikely to lead to habitat loss. When gannets enter a wind development, they may also be vulnerable to collision because they have the potential to fly within the RSZ (Furness et al. 2013, Garthe et al. 2014, Cleasby et al. 2015). When gannets enter an offshore wind development they fly in the RSZ 9.6% of the time (Cook et al. 2012) and models indicate that the proportion of birds at risk height is 0.07 (Johnston et al. 2014). Flight height data from the Northwest Atlantic Seabird Catalog shows during the day that the birds are flying within the RSZ approximately 18% of the time (Figure 2-30).

Based upon the above evidence, the risk of offshore developments to northern gannets is collision and displacement. The vulnerability of northern gannet to collision is considered to be “low” during construction and operations; the collision vulnerability (CV) score was low. Recent studies indicate strong avoidance behavior (Garthe et al. 2017), which will likely reduce collision risk. Vulnerability to displacement is considered “medium” because Northern Gannets are known to avoid offshore wind developments (Table 2-25).

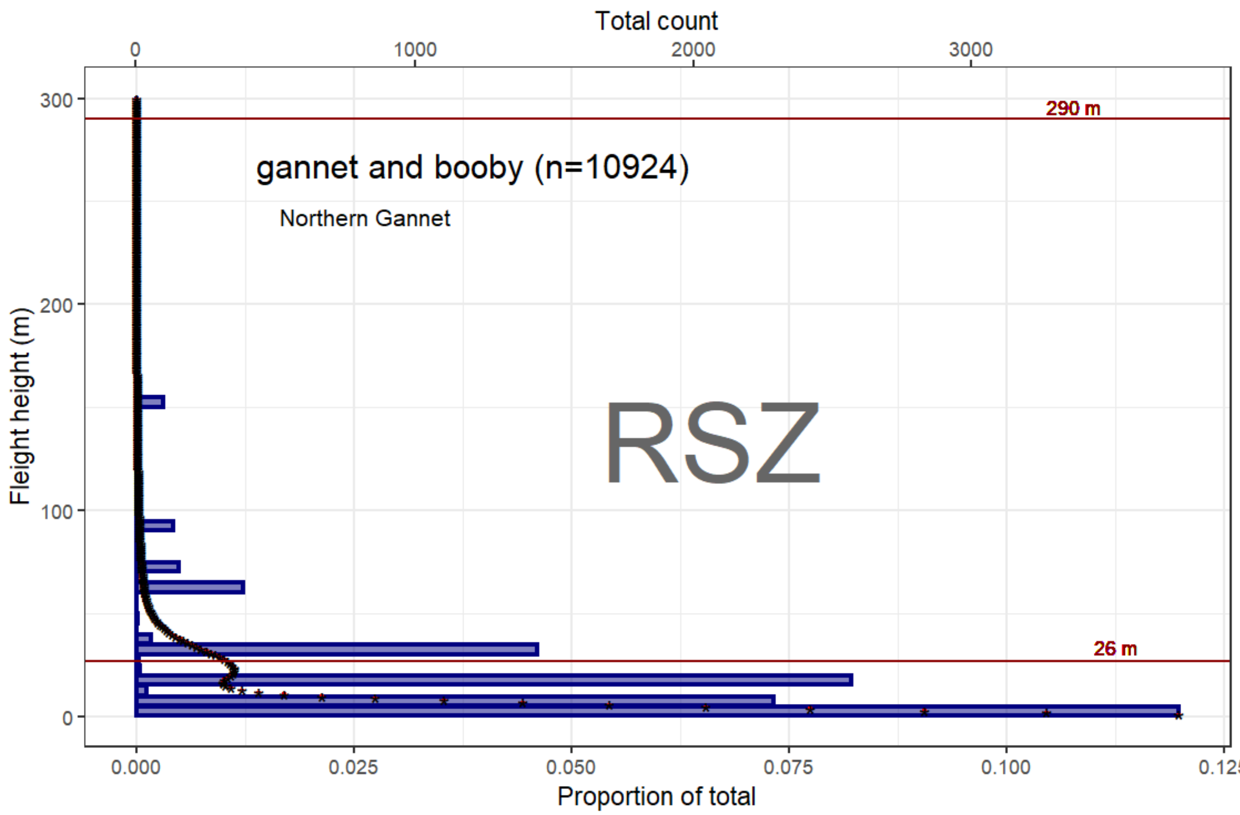


Figure 2-30: Flight heights of northern gannet (m) derived from the Northwest Atlantic Seabird Catalog, showing the actual number of birds in 5 m intervals (blue bars), and the modeled average flight height in 1 m intervals (asterisk) and the standard deviation (red lines), in relation to the upper and lower limits of the Rotor Swept Zone (RSZ) for the maximum sized wind turbine considered for the Project.

Table 2-25: Summary of gannet vulnerability. CV = collision vulnerability; DV = displacement vulnerability; PV = population vulnerability.

Species	CV	DV	PV
Northern gannet	low (0.4)	medium (0.6)	low (0.47)

2.2.8.4.1.4 Risk Analysis

This analysis suggests that the potential impacts to the northern gannet population is "low" because, overall, these birds have low exposure, both spatially and temporally, and low to medium vulnerability. However, there is uncertainty about how displacement will affect individual fitness (e.g., will it increase energy expenditure due to avoidance). In addition, while there is uncertainty about how displacement from the wind farm could reduce foraging opportunities, birds may move to foraging areas adjacent to the wind farm and displacement from individual wind farms is unlikely to affect populations (Fox and Petersen 2019). Since the northern gannet has a "low" population vulnerability score, the final risk score was not adjusted.

2.2.8.4.2 Cormorants

2.2.8.4.2.1 Spatiotemporal Context

Double-crested cormorant (*Phalacrocorax auratus*) is the most likely species of cormorant to be exposed to the Lease Area. While great cormorants (*P. carbo*) could possibly pass through the Lease Area during the non-breeding season, they are likely to remain in coastal waters (Hatch et al. 2000); no great cormorants were identified during the APEM surveys. Double-crested cormorants tend to forage and roost close to shore. The regional MDAT abundance models show that cormorants are concentrated close to shore and are not commonly encountered offshore. This aligns with the literature, which indicates these birds rarely use the offshore environment (Dorr et al. 2014).

2.2.8.4.2.2 Exposure Assessment

Exposure was assessed using species accounts, APEM survey data, and MDAT models. Exposure is considered to be "minimal" to "low" for cormorants (Table 2-26) because the exposure score is minimal to low, and few cormorants were observed within the Lease Area during the APEM surveys (Table 2-26).

Table 2-26: Seasonal exposure rankings for the cormorant group.

Taxonomic Group	Season	Local Rank	Regional Rank	Total Rank	Exposure Score
Cormorants	Winter	0	·	0	minimal
	Spring	0	0	0	minimal
	Summer	0	1	1	low
	Fall	0	1	1	low

2.2.8.4.2.3 Relative Behavioral Vulnerability Assessment

Cormorants have been documented to be attracted to wind turbines (Krijgsveld et al. 2011, Lindeboom et al. 2011), may fly through the RSZ (birds flew 34% of the time within the RSZ; Figure 2-31), rank in the middle of collision vulnerability assessments (Furness et al. 2013), and received a "medium" collision vulnerability score (Table 2-27). Based upon the evidence, the risk to cormorants is from collision; there is little evidence to suggest they will be displaced by offshore wind farms and cormorants received a "low" displacement vulnerability score (Table 2-27).

Table 2-27: Summary of cormorant vulnerability. CV = collision vulnerability; DV = displacement vulnerability; PV = population vulnerability.

Species	CV	DV	PV
Double-crested cormorant	medium (0.73)	low (0.4)	minimal (0.13)

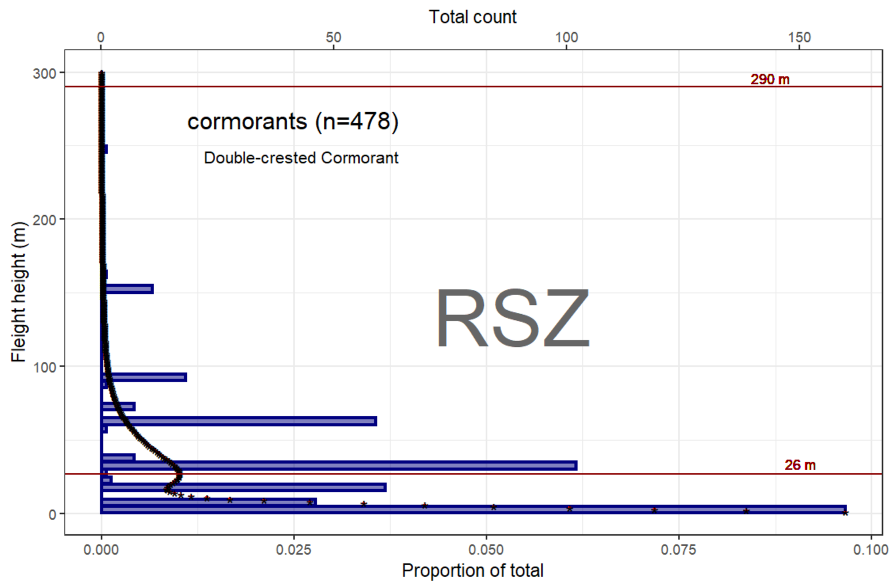


Figure 2-31: Flight heights of double-crested cormorant (m) derived from the Northwest Atlantic Seabird Catalog, showing the actual number of birds in 5 m intervals (blue bars), and the modeled average flight height in 1 m intervals (asterisk) and the standard deviation (red lines), in relation to the upper and lower limits of the Rotor Swept Zone (RSZ) for the maximum sized wind turbine considered for the Project.

2.2.8.4.2.4 Risk Analysis

This analysis suggests that the potential impacts to cormorant is “minimal” to “low” because these birds have low exposure, both spatially and temporally. Since the double-crested cormorant had a “minimal” population vulnerability score, the final risk score was adjusted down to a final “minimal” score.

2.2.8.5 Gulls, Skuas, and Jaegers

2.2.8.5.1 Spatiotemporal Context

There are 14 species of gulls, skuas, and jaegers that could be exposed to the Project, which were observed in the APEM surveys. There are multiple gull species that could potentially pass through the Lease Area. The regional MDAT abundance models show that these birds have a wide distribution ranging from near shore (gulls) to offshore (jaegers). Herring gulls (*Larus argentatus*) and great black-backed gulls (*L. marinus*) are resident in the region year-round, and are found further offshore outside of the breeding season (Winship et al. 2018). The jaegers are all Arctic breeders that regularly migrate through the western North Atlantic region. Parasitic jaegers (*Stercorarius parasiticus*) are often observed closer to shore during migration than the others species (Wiley and Lee 1999) and great skuas (*S. skua*) may pass along the Atlantic OCS outside the breeding season.

2.2.8.5.2 Exposure Assessment

Exposure was assessed using species accounts, APEM survey data, and MDAT models. Exposure is considered to be "minimal" to "low" depending upon the species (Table 2-28). Herring gulls and black-legged kittiwakes (*Rissa tridactyla*) were the only species with "medium" exposure, which was in the spring. With the exception of herring gull, which was lower in the Lease Area, the average counts for gulls within the Lease Area were similar to those in the APEM survey area (Table 2-16).

Table 2-28: Seasonal exposure rankings for gull, skuas, and jaegers.

Taxonomic Group	Season	Local Rank	Regional Rank	Total Rank	Exposure Score
Gulls	Winter	0	1	1	low
	Spring	0	1	1	low
	Summer	0	0	0	minimal
	Fall	1	0	1	low
Skuas and jaegers	Winter	0	·	0	minimal
	Spring	0	0	0	minimal
	Summer	0	1	1	low
	Fall	0	0	0	minimal

2.2.8.5.3 Relative Behavioral Vulnerability Assessment

Jaegers and gulls are considered to be vulnerable to collision but not displacement. Jaegers and gulls rank "low" in vulnerability to displacement assessments (Furness et al. 2013) and there is no evidence in the literature that they are displaced from offshore wind developments (Krijgsveld et al. 2011, Lindeboom et al. 2011). Little is known about how jaegers will respond to offshore wind turbines, but the birds generally fly below the potential RSZ (0–10 m above the sea surface) although could fly higher during kleptoparasitic chases (Wiley and Lee 1999). Gulls ranks at the top of collision vulnerability assessments because they can fly within the RSZ (Johnston et al. 2014), have been document to be attracted to turbines (Vanermen et al. 2015), and individual birds have been documented to collide with turbines (Skov et al. 2018). The flight height of gulls, skuas, and jaegers in the Northwest Atlantic Seabird Catalog indicated that birds in this group fly within the RSZ 3-25% of the time depending on species (Figure 2-32). While the collision risk is thought to be greater for gulls, total avoidance rates are estimated to be 98% (Cook et al. 2012). At European offshore wind developments gulls have been documented to be attracted to wind turbines, which may be due to attraction to increased boat traffic, new food resources, or new loafing habitat (i.e., perching areas; Fox et al. 2006, Vanermen et al. 2015), but interaction with offshore wind developments varies by season (Thaxter et al. 2015). Recent research suggests that some gull species may not exhibit macro-avoidance of wind farms, but will preferentially fly between turbines, suggesting meso-avoidance that would reduce overall collision risk (Thaxter et al. 2018). The collision vulnerability (CV) scores for these groups were "low" – "medium," with "medium" being the most common score. The displacement vulnerability score for all species was "low"- "medium" (Table 2-29).

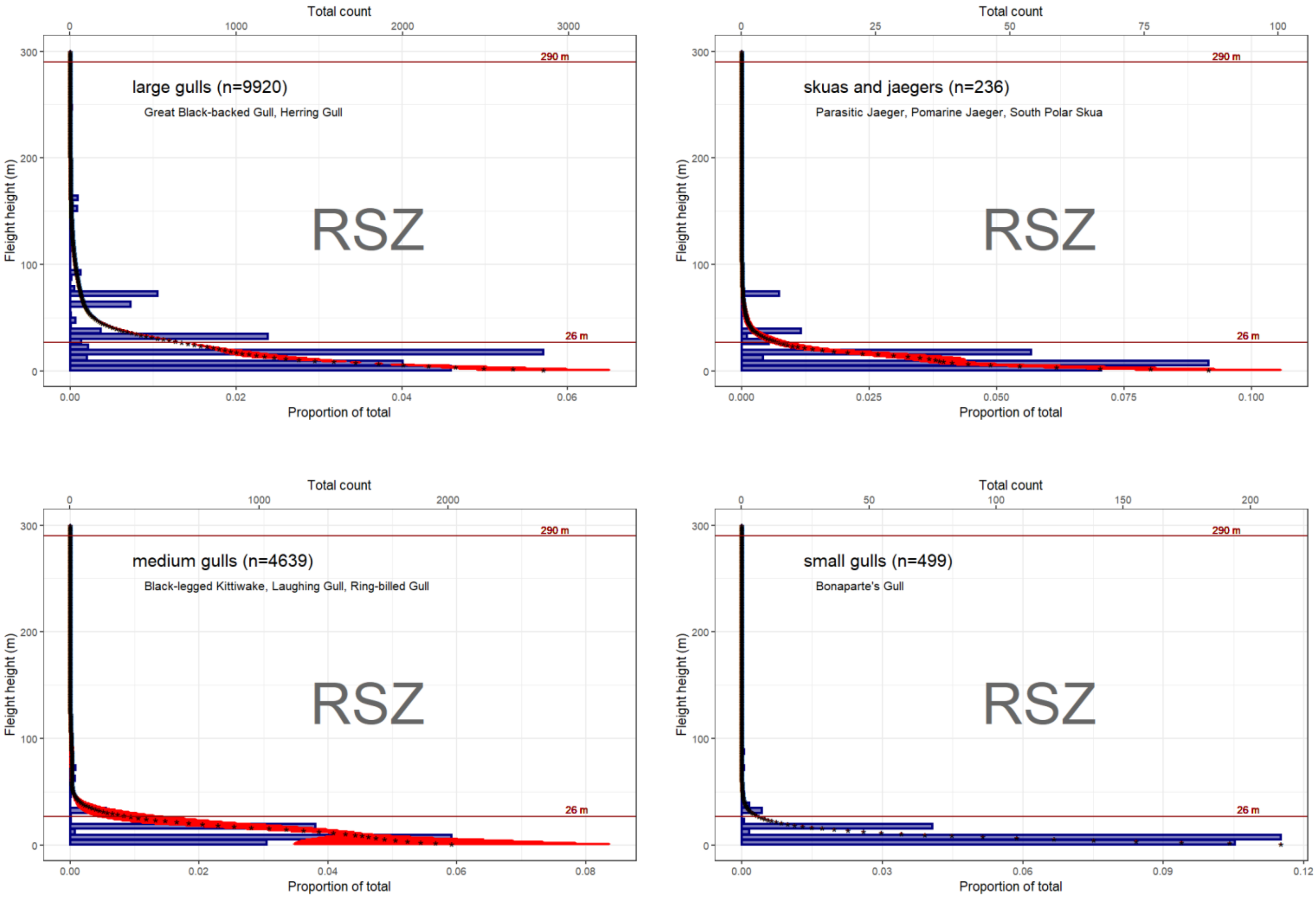


Figure 2-32: Flight heights of skuas, jaegers, and gulls (m) derived from the Northwest Atlantic Seabird Catalog, showing the actual number of birds in 5 m intervals (blue bars), and the modeled average flight height in 1 m intervals (asterisk) and the standard deviation (red lines), in relation to the upper and lower limits of the Rotor Swept Zone (RSZ) for the maximum sized wind turbine considered for the Project.

Table 2-29: Summary of gull, skua, and jaeger vulnerability. CV = collision vulnerability; DV = displacement vulnerability; PV = population vulnerability.

Taxonomic Groups	Species	CV	DV	PV
Gulls	Laughing gull	medium (0.53)	medium (0.5)	low (0.4)
	Great black-backed gull	medium (0.57)	medium (0.7)	minimal (0.2)
	Black-legged kittiwake	medium (0.57)	medium (0.6)	low (0.33)
	Herring gull	medium (0.63)	medium (0.5)	medium (0.53)
	Bonaparte's gull	low (0.43)	medium (0.5)	low (0.33)
	Ring-billed gull	medium (0.6)	low (0.3)	low (0.33)
Skuas and jaegers	Parasitic jaeger	medium (0.73)	low (0.3)	low (0.4)
	Pomarine jaeger	medium (0.73)	low (0.3)	low (0.4)
	South Polar Skua	medium (0.73)	low (0.3)	medium (0.53)

2.2.8.5.4 Risk Analysis

This analysis suggests that potential impacts to gull populations is "minimal" to "low" depending on the species. Only herring gull and black-legged kittiwake receive a "medium" exposure score during the spring, while the other species have "minimal" – "low" exposure scores. Overall these birds have low to medium exposure and medium vulnerability to collision, but recent research does suggests that they may exhibit meso-avoidance, and resident gull populations in the region are not considered of conservation concern (Good 1998, Pollet et al. 2012, Burger 2015, Nisbet et al. 2017). Since the gulls, jaegers, and skuas had a "minimal" to "medium" population vulnerability scores, the final risk score was not adjusted. Great-black backed gulls did have a "minimal" population vulnerability score, so the final risk level for this species is reduced to "minimal".

2.2.8.6 Terns

2.2.8.6.1 Spatiotemporal Context

Black tern (*Chlidonias niger*), least tern (*Sternula antillarum*), common tern (*Sterna hirundo*), forster's tern (*Sterna forsteri*), roseate tern, and royal tern (*Thalasseus maximus*) were observed in APEM surveys. Terns generally restrict themselves to coastal waters during breeding, although they may pass through the Lease Area during migration.

New York Department of Environmental Conservation lists roseate tern and black tern as "Endangered"; and common tern and least tern as "Threatened." Because roseate terns are listed at both state and federally levels, this species is addressed in detail below.

Table 2-30: Listing status of terns.

Taxonomic Group	Species		NY Listed	Federally Listed
Black tern	*Chlidonias niger*		E	
Least tern	*Sternula antillarum*		T	
Common tern	*Sterna hirundo*		T	
Forster's tern	*Sterna forsteri*			
Roseate tern	*Sterna dougallii*		E	E
Royal tern	*Thalasseus maximus*			

2.2.8.6.2 Exposure Assessment

Exposure was assessed using species accounts, APEM survey data, and MDAT models. A recent study used nanotags to track common terns tagged in New York and Massachusetts. While the movement models are not representative of the entire breeding and posting period for many individuals due to incomplete spatial coverage of the receiving stations and tag loss, 2 of the 257 birds tracked were detected to pass through the Lease Area (Loring et al. 2019). Of the detected individuals, one bird was tagged on Great Gull Island, NY and one was tagged in Buzzards Bay, MA. Exposure is considered to be "minimal" to "medium" because the annual exposure score for terns as a group was "low", and seasonally "minimal" in three seasons and "high" in one season (Table 2-31) and the average counts within the Lease Area were lower than the APEM survey area (Table 2-16). Within the tern group, common terns and unknown terns received medium exposure scores in the spring leading to an overall "high" exposure score for the tern group during spring. All other species within the tern group received "minimal" to "low" exposure scores. Overall, tern exposure is probably highest for migrating common terns in the spring because many of the unknown terns are likely to be common terns.

Table 2-31: Seasonal exposure rankings for tern.

Taxonomic Group	Season	Local Rank	Regional Rank	Total Rank	Exposure Score
Terns	Winter	0	·	0	minimal
	Spring	2	3	5	high
	Summer	0	0	0	minimal
	Fall	0	0	0	minimal

2.2.8.6.3 Behavioral Vulnerability Assessment

Terns are generally considered to be more vulnerable to collisions than displacement. Terns rank in the middle of collision vulnerability assessments (Garthe and Hüppop 2004, Furness et al. 2013), fly 2.8–12.7% of the time at rotor swept height of turbines smaller than those being used by the Project (66-492 [20-150 m]), have a 30–69.5% macro avoidance rate (Cook et al. 2012), and have been demonstrated to avoid rotating turbines (Vlietstra 2007). Tern flight heights recorded in the Northwest Atlantic Seabird Catalog indicate that during the day terns fly within the RSZ of the turbines being considered by the project 2-10% of the time (Figure 2-33). A recent nanotag study estimated that common terns primarily flew below the RSZ (<82 ft [25 m]) and that the frequency of common terns flying offshore within the RSZ (82–820 ft [25–250 m]) ranged from 0.9–9.8 % (Loring et al. 2019). While the nanotag flight height estimated birds flying below 164 ft (50 m), radar and observational studies provide evidence that terns in some instances can initiate migration at higher altitudes of 3,000–10,000 ft (1,000–3,000 m; Loring et al. 2019)). The probability of tern mortality as a result of collision with wind turbines is predicted to decline as the distance between the colony and the turbine/s increases (Cranmer et al. 2017). Common terns and roseate terns tended to avoid the airspace around a 660 kW turbine (Massachusetts Maritime Academy in the U.S.) when the turbine was rotating and usually avoided the RSZ (Vlietstra 2007). This finding is corroborated by mortality monitoring of small to medium turbines (200 and 600 kW) in Europe, where mortality rates rapidly declined with distance from the colony (Everaert et al. 2007). Most observed tern mortalities in Europe have occurred at turbines <98 ft (30 m) from nests (Burger et al. 2011). Furthermore, the Final Vineyard Wind 1 Biological Assessment prepared by BOEM for USFWS estimated that roseate tern mortality from collision would be zero and that the likelihood of collision fatalities would be “insignificant and discountable” (BOEM Office of Renewable Energy Programs 2019).

The collision vulnerability (CV) score for terns ranges from “low” to “medium” depending upon the species; the displacement score ranges from “medium” to “high” depending on the species. Terns fall into the high (5) category for macro avoidance because of a 69.5% avoidance rate determined at Horns Rev (Cook et al. 2012), which had small 2 MW turbines (Petersen et al. 2006), and Willmott et al. (2013) categorized tern avoidance as greater than 40%. Wade et al. (2016) determined for roseate tern “Very high” and “High” uncertainty for flight heights and displacement. A lower range was added to the DV score for the following reasons: terns receive a low disturbance score in Wade et al. (2016); terns were determined to have a 30% macro avoidance of turbines at Egmond aan Zee (Cook et al. 2012); terns have high uncertainty scores; and displacement in terns has not been well studied (Table 2-32). Overall, based upon the above evidence, the risk to terns is more likely to be collision with wind turbines than displacement.

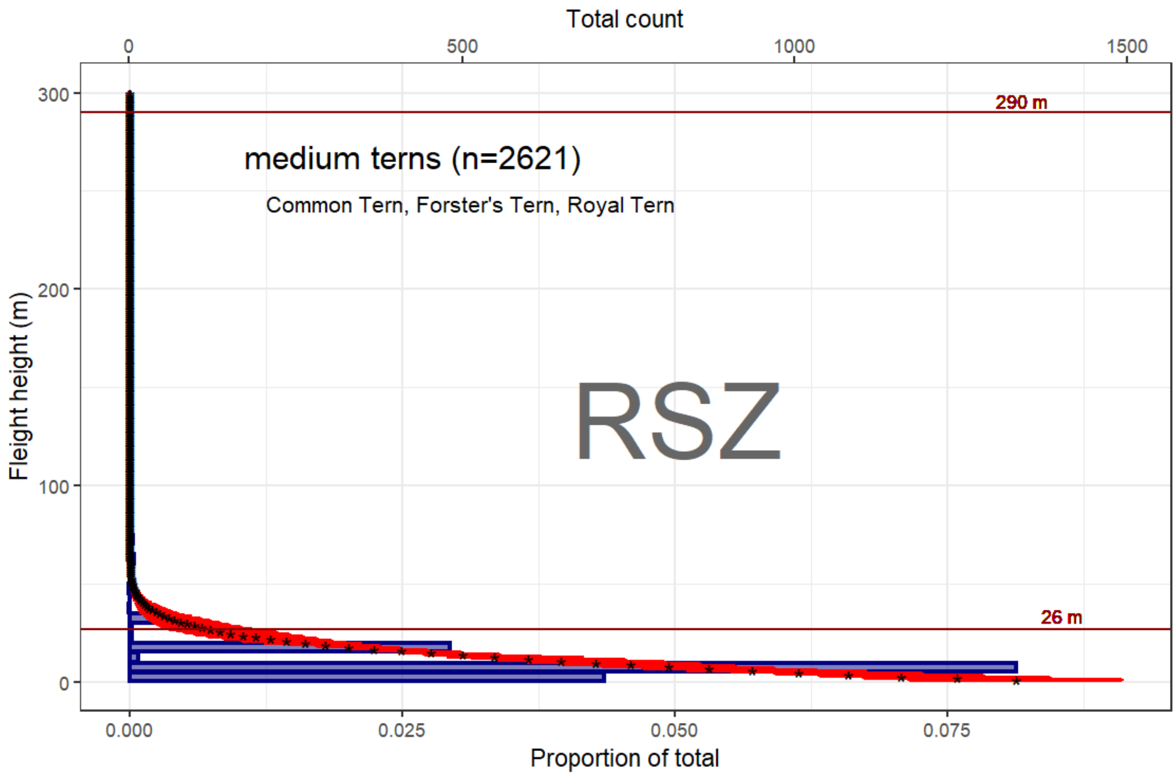


Figure 2-33: Flight heights of terns (m) derived from the Northwest Atlantic Seabird Catalog, showing the actual number of birds in 5 m intervals (blue bars), and the modeled average flight height in 1 m intervals (asterisk) and the standard deviation (red lines), in relation to the upper and lower limits of the Rotor Swept Zone (RSZ) for the maximum sized wind turbine considered for the Project.

Table 2-32: Summary of tern vulnerability. CV = collision vulnerability; DV = displacement vulnerability; PV = population vulnerability. Based upon the literature on terns, collision and displacement vulnerability was adjusted to include a lower range limit (green).

Species	CV	DV	PV
Forster's tern	medium (0.6)	low-medium (0.5)	low (0.4)
Royal tern	medium (0.57)	low-medium (0.5)	medium (0.53)
Common tern	low (0.33)	medium-high (0.8)	medium (0.67)

2.2.8.6.4 Risk Analysis

This analysis suggests that the risk of potential effects to tern populations is "minimal" to "medium", depending upon the species, because these birds have minimal to high exposure (depending on the season), both spatially and temporally. Exposure was highest for terns, likely common terns, during spring migration, but was minimal in all other seasons. The terns (excluding roseate tern) had a "low" to "medium" population vulnerability score, and the final risk score was not adjusted.

2.2.8.6.5 Federally Endangered Tern Species

2.2.8.6.5.1 Roseate Tern

2.2.8.6.5.2 Spatiotemporal context

The roseate tern is a small seabird that breeds colonially on coastal islands. The northwest Atlantic Ocean population has been federally listed as Endangered under the ESA since 1987. Roseate tern is listed as Endangered in New York. This population breeds in the northeastern United States and Atlantic Canada, and winters in South America, primarily eastern Brazil (USFWS 2010, Nisbet et al. 2014). Declines have been largely attributed to low productivity, partially related to predators, habitat loss and degradation, and adult survival rates, which are unusually low for a tern species (USFWS 2010). Over 90% of remaining individuals breed at just three colony locations in Massachusetts (Bird, Ram, and Penikese Islands in Buzzards Bay) and one colony in New York (Great Gull Island, near the entrance to Long Island Sound; (Nisbet et al. 2014, Loring et al. 2017).

Roseate terns generally migrate through the mid-Atlantic and arrive at their northwest Atlantic breeding colonies in late April to late May, with nesting occurring between roughly mid-May and late July. During breeding, roseate terns generally stay within about 10 km of the colony, though they may travel 30–50 km from the colony while provisioning chicks (USFWS 2010, Burger et al. 2011, Nisbet et al. 2014, Loring et al. 2017). Following the breeding season, adult and hatch year roseate terns move to post-breeding coastal staging areas from approximately late July to mid-September (USFWS2010). Foraging activity during the staging period is known to occur up to 16 km from the coast, though most foraging activity occurs much closer to shore (Burger et al. 2011).

Roseate tern migration routes are poorly understood, but they appear to migrate primarily well offshore (Nisbet 1984, USFWS 2010, Burger et al. 2011, Mostello et al. 2014, Nisbet et al. 2014). During migration periods, few roseate terns are predicted to occur within the Lease Area according to the MDAT models (Winship et al. 2018) and supported by the APEM surveys, Northwest Atlantic Seabird Catalog data, and satellite telemetry studies (Loring et al. 2019). The regional MDAT models show that roseate terns are generally concentrated closer to shore during spring migration and have low exposure in New Jersey and New York offshore waters during the summer and fall. The APEM surveys had 16 observations of roseate terns in one spring survey, but they were well offshore and to the east of the Lease Area (Figure 2-34). The Northwest Atlantic Seabird Catalog has historical observations of roseate terns in the region, but not within the Lease Area (Figure 2-35). A recent roseate terns nanotag tracking study (Figure 2-36) estimated that none of the tracked birds flew through the Lease Area (Loring et al. 2019).

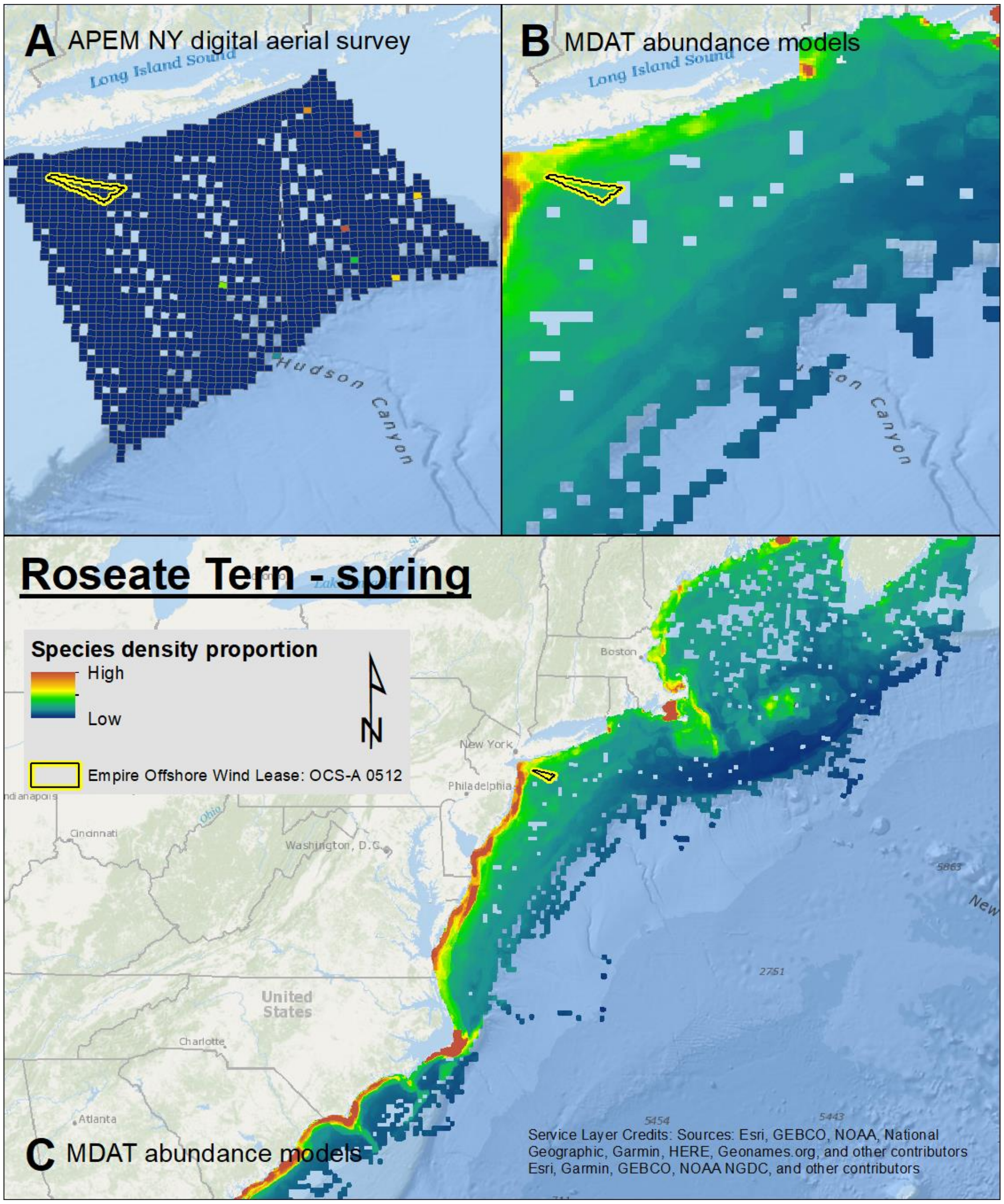


Figure 2-34: Spring roseate tern density proportions in the APEM NY (NYSERDA and Empire) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source.

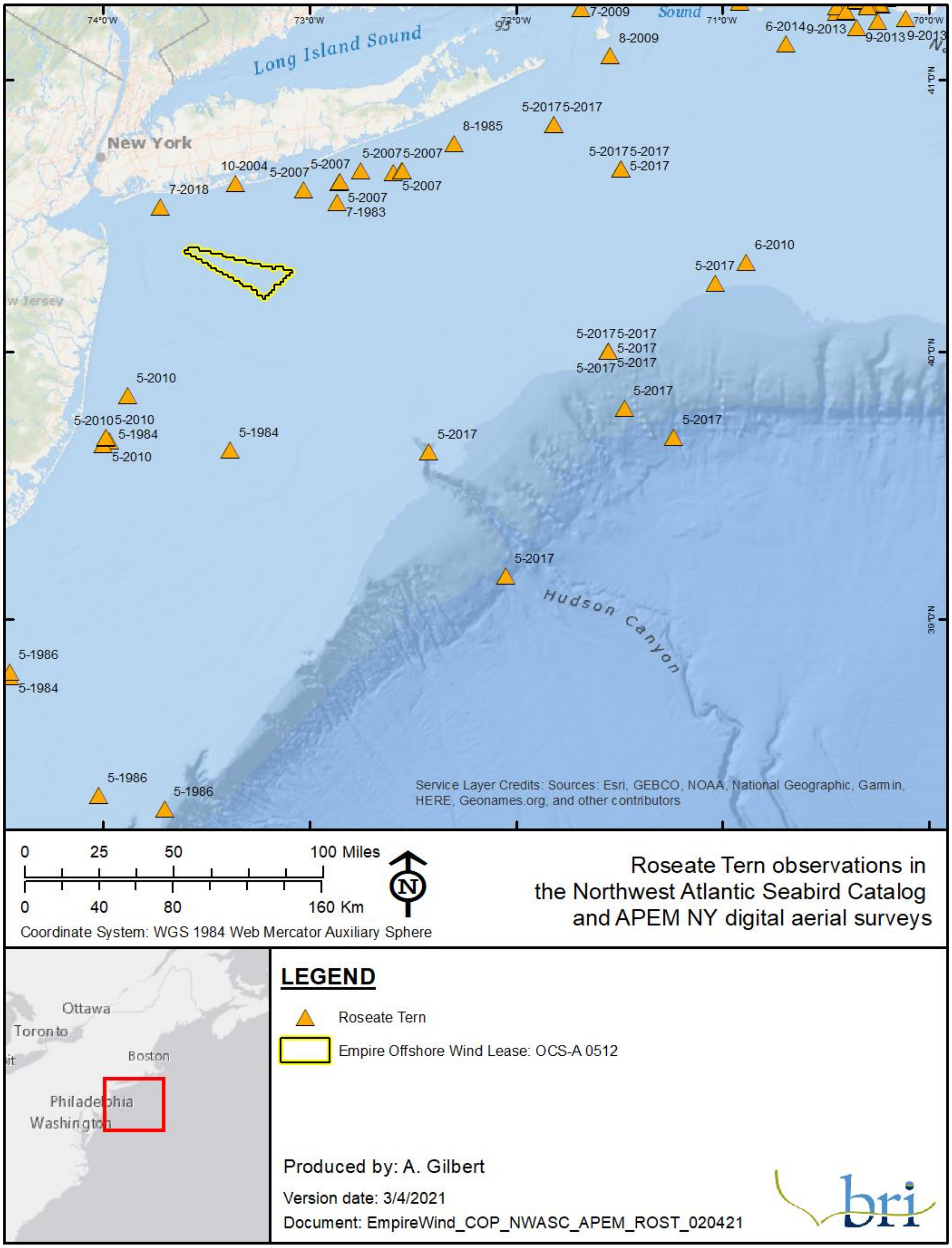


Figure 2-35: Roseate tern observations in the Northwest Atlantic Seabird Catalog.

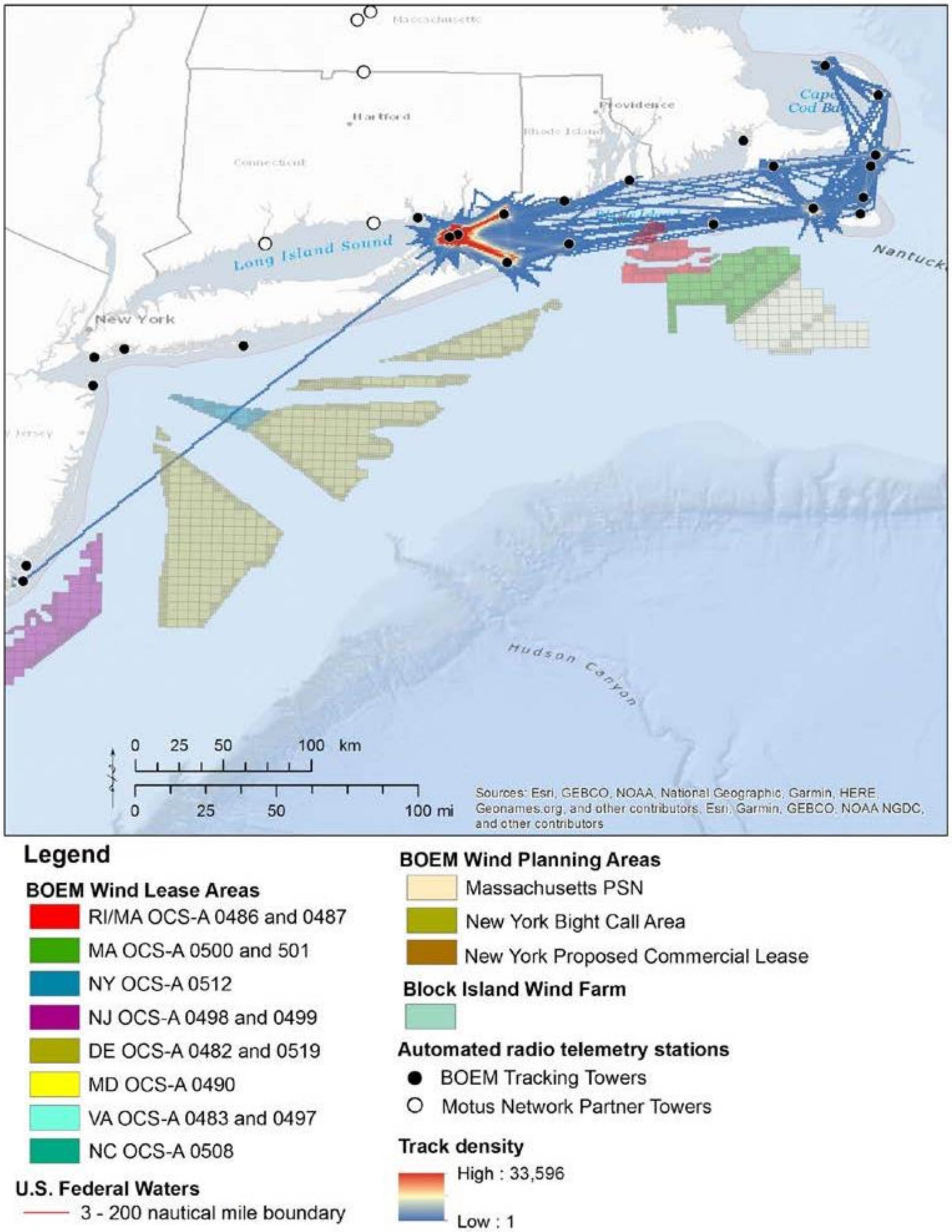


Figure 2-36: Track densities of roseate terns (n=90) tracked with nanotags from Great Gull Island (map of birds from Buzzard Bay did not include Empire's Lease Area) during the breeding and post-breeding period from 2015-2017 (Loring et al. 2019). While the estimated track of one bird passed through the Lease Area, Loring et al (2019) did not estimate a roseate tern exposure event in the Lease area.

2.2.8.6.5.3 Exposure

Exposure for roseate terns was assessed using species accounts, tracking studies, APEM survey data, and MDAT models. The available information on foraging habits, and travel activity between foraging and roosting/breeding sites, all indicate minimal exposure of roseate terns to the Lease Area during breeding or staging. Roseate terns have not been confirmed in the Lease Area. Within the Lease Area, an analysis of unknown tern observations in the APEM surveys indicate that ~2 of unknown terns were potentially roseate terns[11].

A recent study used nanotags to track roseate terns tagged in New York and Massachusetts. While the movement models are not representative of the entire breeding and posting period for many individuals due to incomplete spatial coverage of the receiving stations and tag loss, none of the tracked birds (*n*=145) were estimated to pass through the Lease Area (Loring et al. 2019), although one track line did pass through the Lease Area. Since there were not nanotag receivers within the Lease Area, the exact path the bird was flying in the vicinity of the Lease Area is uncertain. Overall, roseate terns display limited spatial and temporal exposure to the Lease Area, and the expected exposure of roseate terns to the Lease Area is "minimal" to "low" and is limited to migration.

2.2.8.6.5.4 Relative Behavioral Vulnerability Assessment

Terns rank in the middle of collision vulnerability assessments (Furness et al. 2013), fly less than 13% of the time at rotor swept height of smaller offshore wind turbines (66–492 ft [20–150 m]; Cook et al. 2012), and avoid rotating blades of small (660 kW) turbines (Vlietstra 2007). Terns have also been documented to lower their flight altitude when approaching a wind development to avoid the RSZ (Krijgsveld et al. 2011). A two-year study of an onshore turbine in Buzzard's Bay, Massachusetts found no tern mortalities, though common terns regularly flew within 50 m of the turbine (Vlietstra 2007). Terns may detect turbine blades during operations, both visually and acoustically and have been observed to avoid flying between turbine rotors while they are in motion (Vlietstra 2007, [MMS] Minerals Management Service 2008).

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[11] To determine if unknown tern observations in the APEM NY digital aerial surveys were potentially roseate terns, the following analysis was conducted:

Step 1: The proportion of roseate terns to all identified terns was calculated in the APEM NY digital aerial surveys OPA area (0.0247).

Step 2: The proportions from step 1 were applied to the count of unidentified terns (UNTE/UNMT) in the OPA (0.0247 * 1039 UNTE/UNMT = 25.6 ROST), assuming the same proportions in unknown data apply across the entire OPA. This proportion was then used for the lease area (0.0247 * 98 UNTE/UNMT = 2.42 ROST) with the same assumptions.

Result: This returns an estimate of 2.42 additional roseate terns that could have occurred in the Lease Area based on the APEM NY digital aerial data.

Tern flight height during foraging is typically low, and European studies of related tern species at turbines that are smaller than those being considered by Empire, have suggested that approximately 4–10 % of birds may fly at rotor height (66–492 ft [20–150 m asl]) during local flights (Jongbloed 2016). Estimates of tern flight height from surveys in the Nantucket Sound area suggested that 95% of common/roseate terns flew below the RSZ ([MMS] Minerals Management Service 2008). A recent nanotag study estimated that terns primarily flew below the RSZ (<82 ft [25 m]) and that roseate terns flying offshore only occasionally flew within the lower portion of the RSZ (federal waters, 6.4%; Wind Energy Areas, 0%; Figure 2-37; Loring et al. 2019). There were too few roseate tern observations in the Northwest Atlantic Seabird Catalog to estimate flight heights, but during the day common terns are estimated to fly within the RSZ approximately 1% of time. The altitude at which roseate terns migrate far offshore is still being researched, but is thought to be higher than foraging altitudes or nearshore flight altitudes (likely hundreds to thousands of meters; Perkins et al. 2004, [MMS] Minerals Management Service 2008). Furthermore, the Final Vineyard Wind 1 Biological Assessment prepared by BOEM for USFWS estimated that roseate tern mortality from collision would be zero and that the likelihood of collision fatalities would be "insignificant and discountable" ([BOEM] Bureau of Ocean Energy Management Office of Renewable Energy Programs 2019).

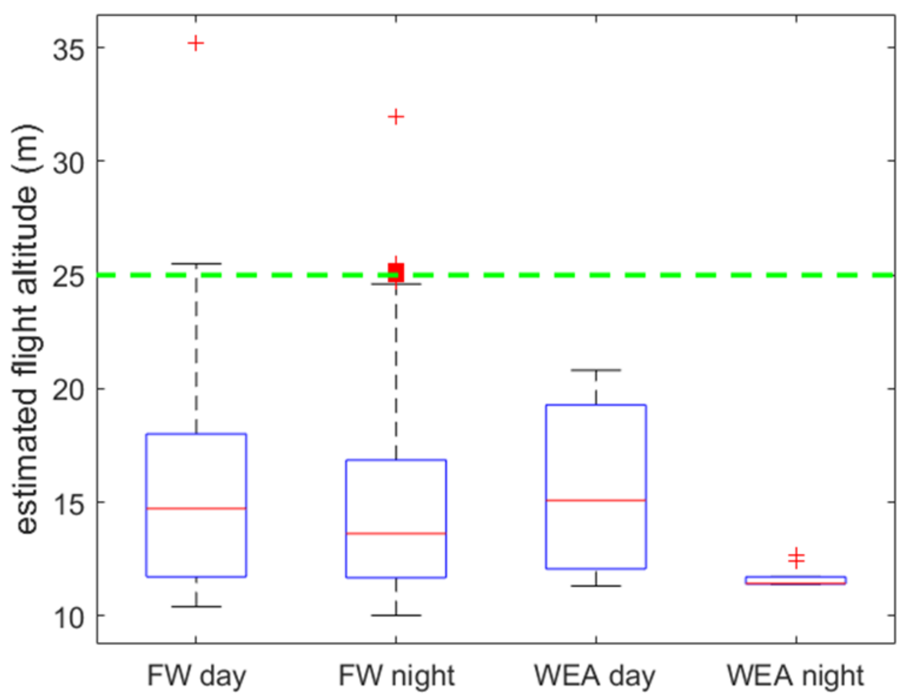

Figure 2-37: Model-estimated flight altitude ranges (m) of roseate terns. During exposure to Federal waters (FW) and Wind Energy Areas (WEAs) during day and night. The green-dashed line represents the lower limit of the RSZ (25 m). Taken from Loring et al. (2019).

Since there is little data on roseate tern flight height and proportion of time flying, common tern was used as a surrogate. Common tern received a CV score of "low"; and a DV score of "medium" to "high" (Table 2-32; see tern discussion above for further details). A lower range was added to the displacement scores because the estimates of tern avoidance are primary based upon two studies of wind farms with small turbines (2 MW; see section 2.2.8.6). In addition, Wade et al. (2016) determined for roseate tern "Very high" and "High" uncertainty for flight heights and displacement. Roseate tern collision vulnerability may even be lower than these scores, because the modeled boat survey and nanotag data indicated terns generally fly below the RSZ and potentially avoid rotating turbines.

2.2.8.6.5.5 Risk

This analysis suggests that the potential impacts to individual roseate terns from collision is "minimal" to "low", because these birds have minimal to low exposure, both spatially and temporally. However, since roseate terns have a high population vulnerability score, the final risk score was adjusted up to "low".

2.2.8.7 Auks

2.2.8.7.1 Spatiotemporal Context

The auk species present in the region of the proposed Project are generally northern or Arctic-breeders that winter along the U.S. Atlantic OCS. The annual abundance and distribution of auks along the eastern seaboard in winter is erratic, and is dependent upon broad climatic conditions and the availability of prey (Gaston and Jones 1998). In winters with prolonged harsh weather, which may prevent foraging for extended periods, these generally pelagic species often move inshore, or are driven considerably further south than usual. The MDAT abundance models show that auks are concentrated offshore and south of Nova Scotia (see maps in Part V).

2.2.8.7.2 Exposure Assessment

Exposure was assessed using species accounts, APEM survey data, and MDAT models. Exposure is considered to be "minimal" to "low" because annual exposure scores for auks ranged from "minimal" to "low"; counts of unidentified auks were higher within the Lease Area than the entire APEM survey area (Table 2-16).

Table 2-33: Seasonal exposure rankings for auks.

Taxonomic Group	Season	Local Rank	Regional Rank	Total Rank	Exposure Score
Auks	Winter	1	0	1	low
	Spring	0	0	0	minimal
	Summer	0	·	0	minimal
	Fall	0	0	0	minimal

2.2.8.7.3 Relative Behavioral Vulnerability Assessment

Auks are considered to be vulnerable to displacement but not collision. Due to sensitivity to disturbance from boat traffic and a high habitat specialization, many auks rank high in displacement vulnerability assessments (Furness et al. 2013, Dierschke et al. 2016, Wade et al. 2016). Studies in Europe have documented varying levels of displacement with rates ranging from no apparent displacement to 70% (Ørsted 2018). Auks have a 45–68% macro-avoidance rate and a 99.2% total avoidance rate (Cook et al. 2012). For turbines smaller (66-492 ft [20-150 m]) than are being considered by the Project, Atlantic Puffins are estimated to fly 0.1% of the time at RSZ, Razorbills 0.4%, common murres 0.01%, and storm-petrels 2% (Cook et al. 2012). Common murres decrease in abundance in the area of offshore wind developments by 71%, and Razorbills by 64% (Vanermen et al. 2015). Auk flight heights from the Northwest Atlantic Seabird Catalog indicate the birds during the day are flying within the RSZ <0.01% of the time (Figure 2-38). The collision vulnerability (CV) for all species was defined as "minimal"; the displacement vulnerability (DV) score ranged from "medium" to "high" depending on the species (Table 2-34).

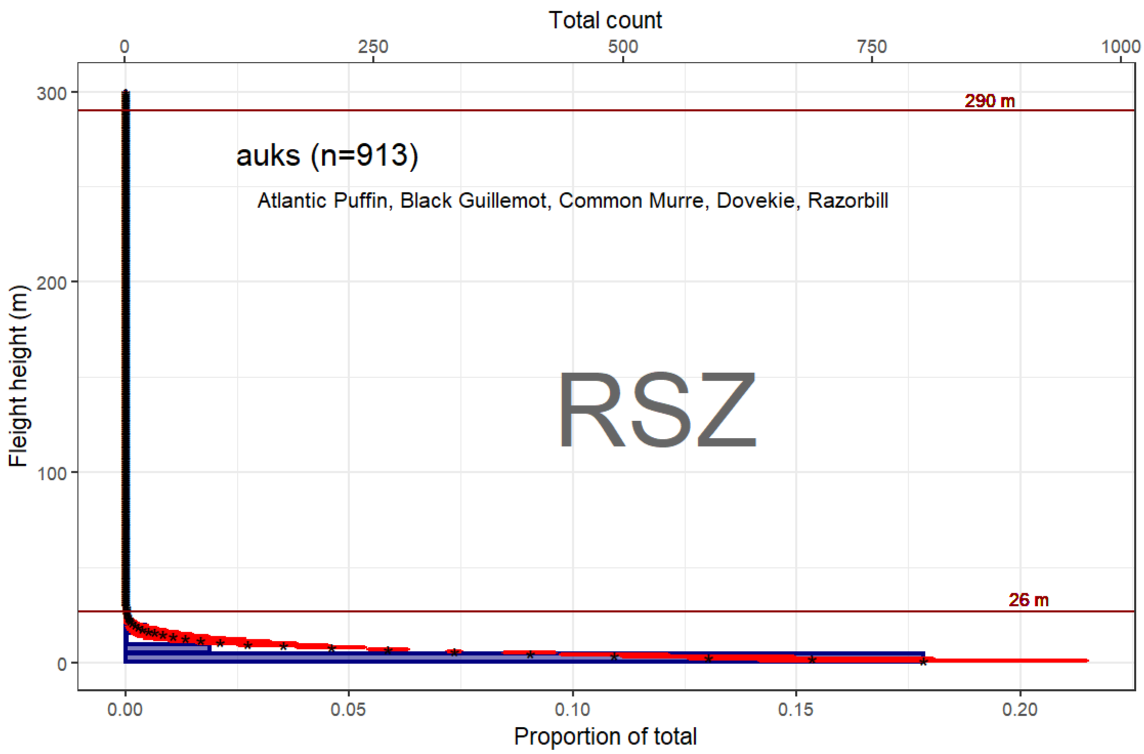

Figure 2-38: Flight heights of auks (m) derived from the Northwest Atlantic Seabird Catalog, showing the actual number of birds in 5 m intervals (blue bars), and the modeled average flight height in 1 m intervals (asterisk) and the standard deviation (red lines), in relation to the upper and lower limits of the Rotor Swept Zone (RSZ) for the maximum sized wind turbine considered for the Project.

Table 2-34: Summary of auk vulnerability.

Species	CV	DV	PV
Atlantic puffin	minimal (0.2)	high (0.8)	medium (0.53)
Black guillemot	minimal (0.2)	high (0.9)	low (0.4)
Common murre	minimal (0.23)	high (0.8)	low (0.4)
Dovekie	minimal (0.2)	medium (0.7)	low (0.4)
Razorbill	minimal (0.2)	high (0.8)	medium (0.6)

2.2.8.7.4 Risk Analysis

This analysis suggests that potential impacts to auk populations is "minimal" to "low" because, the birds have minimal to low exposure temporally and spatially.

2.2.9 Mitigation and Monitoring

In general, exposure of bird populations to wind turbine generators has been avoided by siting the Project's wind turbines offshore, in a wind energy area designated by BOEM. To minimize or mitigate the potential for bird strikes and habitat loss, the Project will use best practices identified in the *Guidelines for Information Requirements for a Renewable Energy Construction and Operations Plan* (BOEM 2016a) and the Standard Operating Conditions for Birds detailed in section B.6 in the *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New York Revised Environmental Assessment* ([BOEM] Bureau of Ocean Energy Management 2016). Standard Operating conditions include providing BOEM and USFWS and an annual report that documents any dead birds or bats found on structures, or during surveys, construction, operations, and decommissioning. Empire also intends to construct and operate the Project in compliance with BOEM guidelines, Federal Aviation Administration (FAA) and United States Coast Guard (USCG) requirements for lighting while, to the extent practical, using lighting technology that minimize attraction of birds. Furthermore, Empire will develop an avian post-construction monitoring plan.

2.3 Summary and Conclusions

This offshore avian assessment considered the potential impacts on birds during construction and operations within Empire's Lease Area. Any exposure of birds to construction activities is considered temporary (Fox and Petersen 2019), and is unlikely to affect individuals or populations. While some level of collision mortality or displacement may occur, the impacts will be short-term.

Overall, construction and operations activities occurring in the Lease Area are not expected to affect populations of coastal or marine birds (Table 2-35). The Lease Area is generally far enough offshore as to be beyond the range of most breeding terrestrial or coastal bird species. Coastal birds that may forage in the Lease Area occasionally, visit the area sporadically, or pass through on their spring and/or fall migrations, include shorebirds (e.g., sandpipers, plovers), waterbirds (e.g., grebes), waterfowl (e.g., scoters, mergansers), wading birds (e.g., herons, egrets), raptors (e.g., falcons, eagles), and songbirds (e.g., warblers, sparrows). Overall, with the exception of migratory falcons and songbirds, coastal birds are considered to have minimal exposure to the Lease Area. Falcons, primarily peregrine falcons, may be exposed to the Lease Area during migration. However, considerable uncertainty exists about what proportion of migrating peregrine falcons might be attracted to offshore wind energy projects for perching, roosting, and foraging, and the extent to which individuals might avoid turbines or collide with them. Some migratory songbirds may also be exposed to the Lease Area during fall migration, but population level impacts are unlikely because exposure of the population to the Lease Area is expected to be minimal to low and limited to migration.

Of the marine birds, terns are the only species that received a “medium” (high end of the range) exposure assessment. The terns will be most exposed during spring migration. Generally, terns are thought to fly below the RSZ, but do have some vulnerability to collision when they are not avoiding turbines. Loons also initially received a “medium” score during the summer, but this was reduced to “minimum” to “low” because the exposure score was driven by a low sample size in the summer when most individual are breeding on inland lakes. Local density estimates showed very low to no density during the summer. For these reasons, overall loon exposure is considered minimal to low. Loons are documented to avoid wind farms, but displacement from the Lease Area is unlikely to affect population trends because of the relatively small size of the Lease Area in relation to available foraging habitat.

Federally listed species that were also assessed included the golden eagle, bald eagle, red knot, piping plover, and roseate tern, as well as the black-capped petrel which is a candidate species. The Project is not expected to affect listed species populations. Eagle exposure to the Lease Area is considered “minimal” because these species are rarely detected in the offshore environment. Red knots and piping plovers have the potential to be exposed only during migration and vulnerability to collision is considered “minimal” to “low” because shorebirds generally fly substantially above the RSZ during long distance migrations. Black-capped petrel exposure and overall risk is considered “minimal” because the birds are primarily found on the shelf break. Roseate tern exposure is considered to be “minimal” to “low” because roseate terns have not been detected in the Lease Area, are rare in New York offshore waters, and would only potentially pass through the Lease Area during migration.

Table 2-35: Overall summary of the assessment of potential effects on birds. Categories that are adjusted up due to high population vulnerability are highlighted in orange and those that were adjusted down are highlighted in green. Vulnerability ranges reflect species ranges within a taxonomic group.

Group	Exposure	Relative Vulnerability to				Collision Risk	Displacement Risk
		Collision	Displacement		Population		
			Temporary	Permanent			
Shorebirds	min.	.	.	.	.	.	.
Piping plover	low	min. – low	min.	min.	med.	min.-low	min.
Red knot	min.- low	low	min.	min.	med.	min.-low	min.
Wading birds	min.	.	.	.	.	.	.
Raptors (falcons)[1]	low	low-med.	min.-low	min.-low	.	low	min.-low
Eagles	min.	min.	min.	min.	.	min.	min.
Songbirds	min.– low	low-med.	min.	min.		min.-low	min.
Coastal waterbirds	min.	.	.	.	.	.	.
Marine birds							
Loons	min.-low	min.- low	high	high	low-med.	min.-low	min.-low
Sea ducks	min.-low	low	high	med.	low-med.	min.-low	min.-low
Shearwaters, petrels & storm-petrels	min.	low	low-med.	low-med.	low-med.	min.	min.
Black-capped petrel	min.	low	low-med.	low-med.	med.	min.	min.
Gannets, cormorants							
Northern gannet	low	low	med.	med.	low	low	low
Double-crested cormorant	min.-low	med.	low	low	min.	min.	min.
Gulls, jaegers & skuas	min.- low.	low-med.	low- med.	low- med.	low-med.	min.- low.	min.- low.
Terns (excluding roseate tern)	min.-med.	low-med.	low-high	low-high	low-med.	min.-med.	min.-med
Roseate tern	min.-low	low	med.-high	med.-high	high	low	low
Auks	min.-low	min.	med.-high	med.-high	low-med.	min.	min.-low

[1]Almost exclusively peregrine falcon and merlin. Non-falcon raptors have limited use of the offshore environment.

Table 2-36: Detailed seasonal species densities (counts/km2 of survey transect) within the Empire Lease Area and the APEM NYSERDA and Empire digital aerial survey area within the Atlantic OCS. These data are only for marine birds and are supplemental to the annual counts detailed in Table 3-18 (Part III: Birds - Offshore).

		Mean densities (total count/sq. km)											
		Empire's Lease Area					APEM NYSERDA and Empire digital aerial survey area						
Taxonomic Grouping	Species	annual	winter	spring	summer	fall	annual	winter	spring	summer	fall	Num. observations	Total count
Sea ducks	Black scoter	0.070	0.012	0	0	0.296	0.026	<0.001	0.038	0	0.058	800	800
	Common eider	0	0	0	0	0	<0.001	0	0	0	0.001	4	4
	Long-tailed duck	0.002	0.012	0	0	0	<0.001	0.002	0.001	0	<0.001	23	23
	Red-breasted merganser	0	0	0	0	0	<0.001	0	<0.001	0	<0.001	11	11
	Surf scoter	0.009	0	0	0	0.040	0.012	<0.001	0.027	0	0.008	369	369
	White-winged scoter	0	0	0	0	0	0.017	0.009	0.074	0	<0.001	510	510
	Unidentified scoter	0.008	0	0	0	0.036	0.184	0.160	0.987	0	0.001	5456	5456
Phalaropes	Red phalarope	0.029	0	0	0	0.124	0.141	0	0.458	0	0.275	5401	5401
	Red-necked phalarope	0	0	0	0	0	0.010	0	0.041	<0.001	0.006	424	424
	Unidentified phalarope	0.014	0.034	0.005	0	0.031	0.184	0.001	0.327	0.010	0.490	5374	5374
Skuas and jaegers	Great skua	0	0	0	0	0	0	<0.001	<0.001	0	0	2	2
	Parasitic jaeger	0	0	0	0	0	<0.001	0	<0.001	<0.001	<0.001	6	6
	Pomarine jaeger	0	0	0	0	0	<0.001	0	<0.001	0	<0.001	2	2
	South Polar skua	0	0	0	0	0	0	0	<0.001	0	0	1	1
	Unidentified skua	0	0	0	0	0	<0.001	<0.001	<0.001	0	0	2	2
Auks	Atlantic puffin	0.002	0.005	0.002	0	0	0.090	0.020	0.271	0	0.001	3041	3041
	Black guillemot	0	0	0	0	0	<0.001	0	<0.001	0	<0.001	9	9
	Common murre	0	0	0	0	0	<0.001	0	0	0	0.002	11	11
	Dovekie	<0.001	0	0.002	0	0	0.051	0.004	0.136	0	<0.001	1814	1814
	Razorbill	0	0	0	0	0	0.080	0	0.227	0	0.002	2480	2480
	Unidentified alcid	0.356	0.356	0.926	0	0.006	0.172	0.206	0.519	<0.001	0.026	6381	6381

		Mean densities (total count/sq. km)											
		Empire's Lease Area					APEM NYSERDA and Empire digital aerial survey area						
Taxonomic Grouping	Species	annual	winter	spring	summer	fall	annual	winter	spring	summer	fall	Num. observations	Total count
	Unidentified murre	0	0	0	0	0	0.004	0	0.018	0	0	166	166
Small gulls	Bonaparte's gull	0.193	0.412	0.103	0	0.395	0.067	0.090	0.123	0	0.092	2808	2808
	Little gull	0	0	0	0	0	<0.001	0	<0.001	0	<0.001	11	11
	Unidentified small gull	0.016	0.032	0.019	0.004	0.011	0.021	0.018	0.020	0.004	0.043	740	740
Medium gulls	Black-legged kittiwake	0.057	0	0.032	0	0.200	0.016	0.003	0.001	0	0.067	643	643
	Laughing gull	0	0	0	0	0	0.004	0	0.004	0.002	0.011	147	147
	Ring-billed gull	0.001	0	0.004	0	0	0.014	0.004	0.024	0.006	0.019	385	385
Large gulls	Great black-backed gull	0.018	0.023	0.004	0.006	0.042	0.102	0.449	0.138	0.030	0.060	3167	3167
	Glaucous gull	0	0	0	0	0	0	0	<0.001	0	0	2	2
	Herring gull	0.057	0.022	0.072	0.006	0.117	0.329	0.780	0.674	0.015	0.386	11589	11589
	Iceland gull	0	0	0	0	0	<0.001	<0.001	<0.001	0	<0.001	12	12
	Lesser black-backed gull	0.019	0	0.063	0	0	0.005	0.008	0.007	0.002	0.002	102	102
	Unidentified large gull	0	0	0	0	0	0.005	0.013	0.003	0.002	0.006	138	138
All gulls	Unidentified gull	0	0	0	0	0	<0.001	<0.001	<0.001	0.001	<0.001	15	15
Small terns	Black tern	0	0	0	0	0	<0.001	0	<0.001	<0.001	0	3	3
	Least tern	0.006	0	0.013	0	0	0.005	0	0.002	0.006	0	49	49
Medium Terns	Common tern	0.041	0	0.126	0	0	0.018	0	0.054	0	0	626	626
	Forster's tern	0	0	0	0	0	0	0	<0.001	0	0	1	1
	Roseate tern	0	0	0	0	0	<0.001	0	0.001	<0.001	0	16	16
	Royal tern	0	0	0	0	0	<0.001	0	0	<0.001	<0.001	6	6
All terns	Unidentified tern	0.101	0	0.308	0	0	0.035	0	0.082	0.018	0	1039	1039
Loons	Common loon	0.118	0.120	0.201	0.063	0.055	0.040	0.052	0.096	0.002	0.024	1370	1370
	Red-throated loon	0.068	0.041	0.097	0	0.129	0.025	0.009	0.039	0	0.074	819	819
	Unidentified loon	0	0	0	0	0	<0.001	<0.001	<0.001	<0.001	0.001	23	23

		Mean densities (total count/sq. km)											
		Empire's Lease Area					APEM NYSERDA and Empire digital aerial survey area						
Taxonomic Grouping	Species	annual	winter	spring	summer	fall	annual	winter	spring	summer	fall	Num. observations	Total count
Storm-petrels	Band-rumped storm-petrel (a.k.a. Madeiran SP, or Harcourt's SP])	0	0	0	0	0	0	0	<0.001	0	0	1	1
	Leach's storm-petrel	0	0	0	0	0	<0.001	0	<0.001	<0.001	<0.001	8	8
	Unidentified storm-petrel	0.006	0	0.004	0.015	0	0.115	0	0.032	0.291	0.018	4299	4299
	White-faced storm-petrel	0	0	0	0	0	0	0	0	<0.001	0	2	2
	Wilson's storm-petrel	0	0	0	0	0	0.066	0	0.007	0.147	<0.001	1217	1217
Shearwaters and petrels	Audubon's shearwater	0	0	0	0	0	<0.001	0	0	0.002	<0.001	12	12
	Black-capped petrel	0	0	0	0	0	0.002	0	<0.001	0.003	<0.001	30	30
	Cory's shearwater	0.038	0	0	0.138	0.008	0.048	0	<0.001	0.112	0.027	1035	1035
	Great shearwater	0.012	0	0	0.043	0	0.026	0	<0.001	0.057	0.002	538	538
	Manx shearwater	0	0	0	0	0	<0.001	0	0	<0.001	0.002	18	18
	Northern fulmar	0.001	0	0.004	0	0	0.024	0.228	0.010	0	0.008	890	890
	Sooty shearwater	0.007	0	0	0.022	0	0.003	0	0.009	0.002	0	112	112
	Trindade petrel	0	0	0	0	0	0	0	<0.001	0	0	1	1
	Unidentified petrel	0.002	0	0	0.003	0.002	<0.001	0	<0.001	<0.001	0	9	9
	Unidentified large shearwater	0.011	0	0.002	0.036	0	0.029	0	0.001	0.047	0.003	450	450
	Unidentified small shearwater (Audubon's, Manx, or Little)	0.002	0	0.006	0	0	0.004	0	0.002	0.006	<0.001	89	89

		Mean densities (total count/sq. km)											
		Empire's Lease Area					APEM NYSERDA and Empire digital aerial survey area						
Taxonomic Grouping	Species	annual	winter	spring	summer	fall	annual	winter	spring	summer	fall	Num. observations	Total count
Gannets and boobies	Northern gannet	0.273	0.281	0.296	0.007	0.511	0.304	0.255	0.480	<0.001	0.495	9079	9079
Cormorants	Double-crested cormorant	0	0	0	0	0	0.001	0	<0.001	<0.001	0.004	54	54
	Unidentified cormorant	0.006	0	0.002	0	0.026	0.005	0	0.016	<0.001	0.004	314	314
Pelicans	Brown pelican	0	0	0	0	0	0	0	0	0	<0.001	1	1

3 Part III: Birds – Onshore

3.1 Methods

The impact assessment was conducted by evaluating the habitat within the Onshore Study Area that would be modified by onshore project components, identifying the birds likely to occur in these habitats, and then evaluating their potential to be affected by impact producing factors. Federally listed are discussed individually.

3.1.1 Habitat Assessment methods

Habitat was identified for each onshore export and interconnection cable route option using Google Earth (satellite and street view), New York Wildlife Action Plans, and through assessments conducted by Tetra Tech. Then, using eBird data, IPaC data, and the best available datasets, the species likely to occur in each habitat type were identified.

3.1.1.1 Data Sources

The primary datasets used to describe the habitat associated with the onshore project areas were collected from the New York Wildlife Action Plan (NYSWAP; NYSDEC 2015). Then the birds likely to use that habitat are described. In addition, data on possible bird species present was compiled from eBird citizen science data (Sullivan et al. 2009) from within a 15 km buffer of the center of the onshore site and was temporally constrained to 10 years. In addition, the USFWS IPaC database (USFWS 2019) was queried using the specific shapefiles for each onshore site.

For the EW 1 and EW 2 onshore export and interconnection cable corridors, Ecoregion designations from the NYSWAP are used to describe the general habitat that the potential cable corridor is located within or in close proximity to (NYSDEC 2015). The Ecoregions are described in the NYSWAP as: "areas of ecological homogeneity which are defined by similarities in soil, physiography, climate, hydrology, geology and vegetation, which are used to reference some species distribution information since distribution closely corresponds with ecological boundaries." High Priority Species of Greatest Conservation Need (SGCN) are also listed for each associated Ecoregion. High Priority SGCN species are described as: "status of these species is known, and conservation action is needed in the next 10 years. These species are experiencing a population decline or have identified threats that may put them in jeopardy, and are in need of timely management intervention, or they are likely to reach critical population levels in New York."

3.1.2 Impact Producing Factors

The potential impacts of the onshore components of the Project to birds were evaluated by considering the exposure of birds to project hazards. Hazards (i.e., impact producing factors) are defined as the changes to the environment caused by project activities during each development phase that have the potential to adversely affect wildlife (BOEM 2012, Goodale and Milman 2016). For the onshore components of the Project, the primary hazard is habitat modification during construction, which may cause an indirect effect of reduced foraging and breeding habitat. Other potential hazards are temporary disturbance from construction and operations activities, causing displacement from breeding and foraging habitat, and the presence of construction equipment, which in rare instances could cause individual mortality. During operations, maintenance activities have the potential to cause temporary habitat modification (e.g., ground disturbance), but the disturbance would generally be similar to or less than the construction of the onshore export and interconnection cables, impact smaller areas, and is expected to be of shorter duration. For these reasons, operations is not expected to have any specific long-term hazards (Table 3-1).

Table 3-1: Potential effects of the coastal and upland onshore Project components on birds and the Project phases for which they are assessed.

Impact-producing Factor(s)	Effect	Project Component	Description	Construction & Decommissioning*	Operations
Land disturbances	Habitat Modification (Temporary)	Coastal and Upland	Temporary disturbance of habitat by Project activities	✓	✓
Land disturbances	Habitat Modification (Permanent)	Coastal and Upland	Permanent disturbance of habitat by Project activities	✓	✓
Construction equipment and activities	Disturbance (Temporary)	Coastal and Upland	Noise and vibration producing activities	✓	✓
Construction equipment	Mortality	Coastal and Upland	Contact with equipment	✓	✓
*Effects of decommissioning are expected to be less than or equal to construction activities					

3.1.3 Final Risk Assessment

The final risk assessment was conducted using a weight-of-evidence approach by considering the severity of habitat modification and duration of hazard. The following risk categories were used:

- Minimal: Development primarily co-located in disturbed areas with little to no permanent habitat modification; hazard(s) temporary.
- Low: Development primarily co-located in disturbed areas with some permanent habitat modification; hazard(s) temporary.
- Medium: Development in non-disturbed areas with some permanent habitat modification; hazard(s) temporary and/or permanent.
- High: Development in non-disturbed areas with permanent habitat modification; multiple temporary and permanent hazards.

3.2 Results

3.2.1 EW 1 Cable Corridor

3.2.1.1 Habitat

Habitats on the EW 1 interconnection cable corridor are significantly altered by human development and are primarily used for commercial operations. This area serves as a transportation and service corridor and associated infrastructure is a dominant feature. This area, therefore, is highly unlikely to provide important habitat for most species and the cable route options and substation options are not located in Important Bird Areas (IBAs) as identified by the National Audubon Society (Figure 3-1).

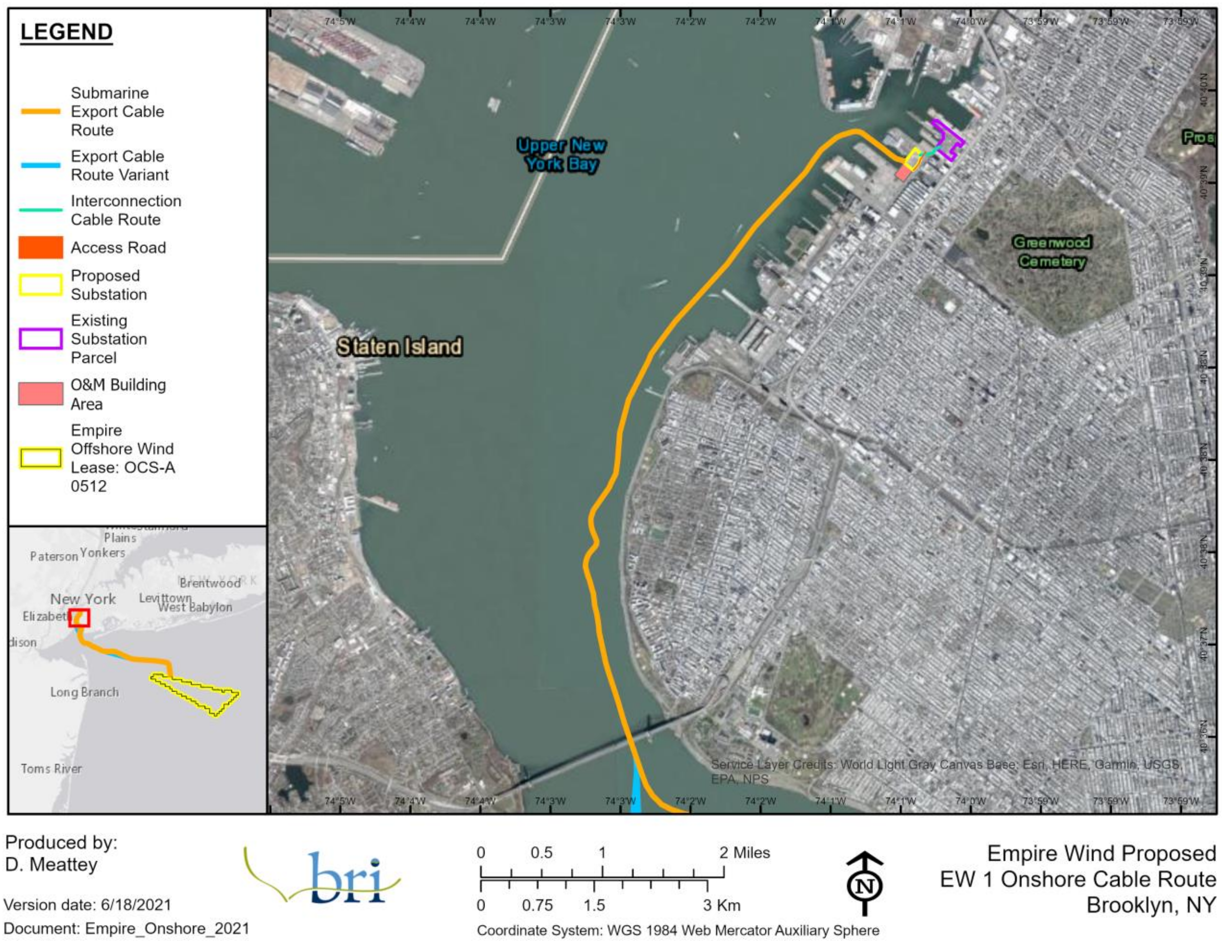

Figure 3-1: EW 1 Interconnection Cable Route, Audubon Important Bird Areas. No Important Bird Areas located within map extent

3.2.1.1.1 Export Cable landfall, Interconnection Cable Route, Onshore Substation, and O&M Base

For the proposed interconnection cable routes, the transmission lines will be co-located with existing developed areas (i.e., roads, parking lots) that pass through an intermodal shipping, warehousing, and manufacturing complex, thereby minimizing potential impacts to terrestrial wildlife habitat (Figure 3-1). The EW 1 route will terminate at the existing Gowanus POI.

The EW 1 substation parcel is located at the South Brooklyn Marine Terminal. The onshore interconnection cable route will travel approximately 0.2 mi (0.4 km) along paved areas to the existing Gowanus POI. The O&M Base will be located adjacent to the EW 1 substation parcel is also within a highly disturbed area and unlikely to provide important bird habitat.

3.2.1.2 Birds likely to occupy existing habitat

Due to the mobility of birds, a variety of species have the potential to pass through the EW 1 interconnection cable route, onshore substation, and O&M Base areas (Table 3-3). However, due to the highly developed nature of the area, the area does not provide important bird habitat for native species with the exception of species that associate with coastal urbanized areas. Furthermore, due to the urbanized nature of the area, birds are not likely to nest in the impact area, and while some birds may be displaced by Project activities, the displacement will not lead to the loss of important habitat. At the end of the Onshore Bird section, a list of all bird identified in the eBird data base, within 15 km of the site, are provided in Table 3-7 (p. 142).

3.2.1.2.1 Species of Conservation Concern

Since the EW 1 site is highly developed, it is not expected to provide habitat for species of conservation concern.

3.2.1.3 Potential Impacts

Potential impacts for each project component during construction and operations are summarized in Table 3-2.

3.2.1.3.1 Construction and Installation

Impacts related to construction and installation are considered “minimal” because EW 1 is a highly disturbed area and construction activities will not cause temporary or permanent habitat modification.

3.2.1.3.2 Operations and Maintenance

Impacts related to operations and maintenance are considered “minimal” because EW 1 is a highly disturbed area and Project related operations and maintenance activities are not likely disturb bird habitat or cause any mortality to native species.

3.2.1.3.3 Decommissioning

Impacts from decommissioning are expected to be equal to or less than impacts from construction. Impacts are considered “minimal” because EW 1 is a highly disturbed area and Project decommissioning activities are not likely to disturb bird habitat.

Table 3-2: Summary of potential impacts of coastal and onshore activities to birds at the EW 1 site

Effect	Description	Population level risk			
		Construction & Decommissioning			Operations: all components
		Landfall	Cable	Substation	
Habitat Modification (Temporary)	Temporary disturbance of upland habitat by Project activities	Minimal	Minimal	Minimal	.
Habitat Modification (Permanent)	Permanent disturbance of upland habitat by Project activities	Minimal	Minimal	Minimal	Minimal
Disturbance (Temporary)	Noise and vibration producing activities	Minimal	Minimal	Minimal	Minimal
Mortality	Contact with equipment	Minimal	Minimal	Minimal	Minimal

3.2.1.4 Mitigation and Monitoring

No mitigation or monitoring is considered necessary because the site is highly developed, provides little to no bird habitat, and impacts are considered minimal for the Project.

Table 3-3: List of birds common birds in eBird database (75 quartile) within 15 km of the EW 1 site with listing, general habitat, and conservation status. While birds are mobile and many species may pass through the area during migration, few if any species native species will be exposed to the Project. Introduced house sparrow, European starling, and rock pigeon may be present in the area. E=endangered; T=threatened; SGCN = species of greatest conservation need.

Species	Scientific Name	eBird Count	NY Conservation Need	NY Listed	IPaC	Habitat
Mallard	*Anas platyrhynchos*	3587				aquatic
Canada goose	*Branta canadensis*	3545				aquatic
Herring gull	*Larus argentatus*	3436			x	aquatic
Ring-billed gull	*Larus delawarensis*	3283			x	aquatic
Double-crested cormorant	*Phalacrocorax auritus*	3216			x	aquatic
Great black-backed gull	*Larus marinus*	3199			x	aquatic
Mute swan	*Cygnus olor*	2893				aquatic
Great blue heron	*Ardea herodias*	2718				aquatic
Wood duck	*Aix sponsa*	2529				aquatic
American black duck	*Anas rubripes*	2394	high priority SGCN			aquatic
Ruddy duck	*Oxyura jamaicensis*	2233	SGCN			aquatic
Northern shoveler	*Spatula clypeata*	2165				aquatic
Gadwall	*Mareca strepera*	2111				aquatic
American coot	*Fulica americana*	2093				aquatic
Brant	*Branta bernicla*	1922				aquatic
Laughing gull	*Leucophaeus atricilla*	1903	SGCN			aquatic
Black-crowned night-heron	*Nycticorax nycticorax*	1891	SGCN			aquatic

Species	Scientific Name	eBird Count	NY Conservation Need	NY Listed	IPaC	Habitat
Bufflehead	*Bucephala albeola*	1698				aquatic
Great egret	*Ardea alba*	1672	SGCN			aquatic
Hooded merganser	*Lophodytes cucullatus*	1506				aquatic
Pied-billed grebe	*Podilymbus podiceps*	1464	SGCN			aquatic
House sparrow	*Passer domesticus*	3637				upland
Northern cardinal	*Cardinalis cardinalis*	3630				upland
European starling	*Sturnus vulgaris*	3628				upland
Rock pigeon	*Columba livia*	3627				upland
Mourning dove	*Zenaida macroura*	3624				upland
American robin	*Turdus migratorius*	3609				upland
Blue jay	*Cyanocitta cristata*	3576				upland
Downy woodpecker	*Dryobates pubescens*	3572				upland
Red-bellied woodpecker	*Melanerpes carolinus*	3502				upland
Northern mockingbird	*Mimus polyglottos*	3406				upland
Common grackle	*Quiscalus quiscula*	3393				upland
Song sparrow	*Melospiza melodia*	3383				upland
House finch	*Haemorhous mexicanus*	3336				upland
American goldfinch	*Spinus tristis*	3308				upland
American crow	*Corvus brachyrhynchos*	3273				upland
Red-tailed hawk	*Buteo jamaicensis*	3273				upland
Black-capped chickadee	*Poecile atricapillus*	3258				upland
Red-winged blackbird	*Agelaius phoeniceus*	3170				upland
White-breasted nuthatch	*Sitta carolinensis*	3125				upland
Carolina wren	*Thryothorus ludovicianus*	3115				upland
Tufted titmouse	*Baeolophus bicolor*	3056				upland
Northern flicker	*Colaptes auratus*	2980				upland
White-throated sparrow	*Zonotrichia albicollis*	2778				upland
Hairy woodpecker	*Dryobates villosus*	2628				upland
Gray catbird	*Dumetella carolinensis*	2611				upland
Cedar waxwing	*Bombycilla cedrorum*	2257				upland
American kestrel	*Falco sparverius*	2194	SGCN			upland
Dark-eyed junco	*Junco hyemalis*	2149				upland
Eastern towhee	*Pipilo erythrophthalmus*	2057				upland
Brown-headed cowbird	*Molothrus ater*	2018				upland
Yellow-bellied sapsucker	*Sphyrapicus varius*	1963				upland
Peregrine falcon	*Falco peregrinus*	1912	SGCN	E		upland
Cooper's hawk	*Accipiter cooperii*	1881				upland
Swamp sparrow	*Melospiza georgiana*	1795				upland
Chimney swift	*Chaetura pelagica*	1751				upland
Chipping sparrow	*Spizella passerina*	1750				upland
Yellow-rumped warbler	*Setophaga coronata*	1749				upland
Hermit thrush	*Catharus guttatus*	1716				upland
Belted kingfisher	*Megaceryle alcyon*	1705				upland
House wren	*Troglodytes aedon*	1703				upland
Common yellowthroat	*Geothlypis trichas*	1679				upland
Baltimore oriole	*Icterus galbula*	1676				upland
Barn swallow	*Hirundo rustica*	1560				upland
Brown creeper	*Certhia americana*	1544				upland

Species	Scientific Name	eBird Count	NY Conservation Need	NY Listed	IPaC	Habitat
Ruby-crowned kinglet	*Regulus calendula*	1535				upland
Fox sparrow	*Passerella iliaca*	1419				upland

3.2.2 EW 2 Onshore Export and Interconnection Cable Corridor

3.2.2.1 Landscape Regions

This section describes the landscape ecoregions and SGCN avian groups associated with the EW 2 onshore export and interconnection cable routes and onshore substation (Table 3-6). The NYSWAP was informed by the U.S. EPA Level III Ecoregions, which were used to describe the corridor habitat, as this level is recommended for best locally defining characteristics, assessment and reporting (Commission for Environmental Cooperation 1997, NYSDEC 2015). Details on Level III Ecoregions can be found at EPA's website.[12] The list of all associated High Priority SGCN can be found in the most recent NYSAWP (NYSDEC 2015). Overall, 366 SGCN were identified in New York, of which 167 species were determined to be high priority SGCN. Of those, 45 are birds. We focus on a subset of the habitats deemed critical to High Priority SGCN species that occur in the project corridor.

3.2.2.1.1 North Atlantic Coast Ecoregion

The EW 2 area is located within the North Atlantic Coast ecoregion. This ecoregion is characterized by coastal, marine and estuarine habitats. The region spans Long Island, which is represented by a mix of shrublands, coastal plain ponds, grasslands, pine barrens, salt marshes and sand dunes. This area is particularly diverse as many species located in this region are at the northern and southern peripheries of their ranges. This region also contains one of the two largest colonies of endangered roseate terns in the western hemisphere located on Great Gull Island (~ 90 miles [145 km] to the east of the export cable landfall sites in an area separating Long Island and Block Island sounds), as well as the rare ecological community of scrub oaks and dwarfed pines, designated as the Long Island Pine Barrens (~50 miles [80 km] to the west of the export cable landfall site; NYSDEC 2005).

High Priority SGCN in the Ecoregion: American oystercatcher, black skimmer, cattle egret, piping plover, roseate tern, saltmarsh sparrow, seaside sparrow, buff-breasted sandpiper, little gull, whimbrel, red knot, short-billed dowitcher

3.2.2.2 Habitat

Habitats on Long Island are significantly altered by human development. This assessment focuses on subset of habitats that occur in the cable corridor and that are deemed critical to SGCN High Priority species. The south shore of Long Island is densely developed. While numerous tidal creeks and impoundments drain into the south shore bays and associated salt marshes, these

[12] https://www.epa.gov/eco-research/ecoregions-north-america

areas have been highly impacted from activities such dredging, mosquito control ditching, erosion, and removal of fill for development. Coastal habitats within the EW 2 onshore export and interconnection cable corridor consist of barrier beaches developed for tourism and recreational use; the beach areas and inland waterways are identified as global IBAs (Figure 3-2).

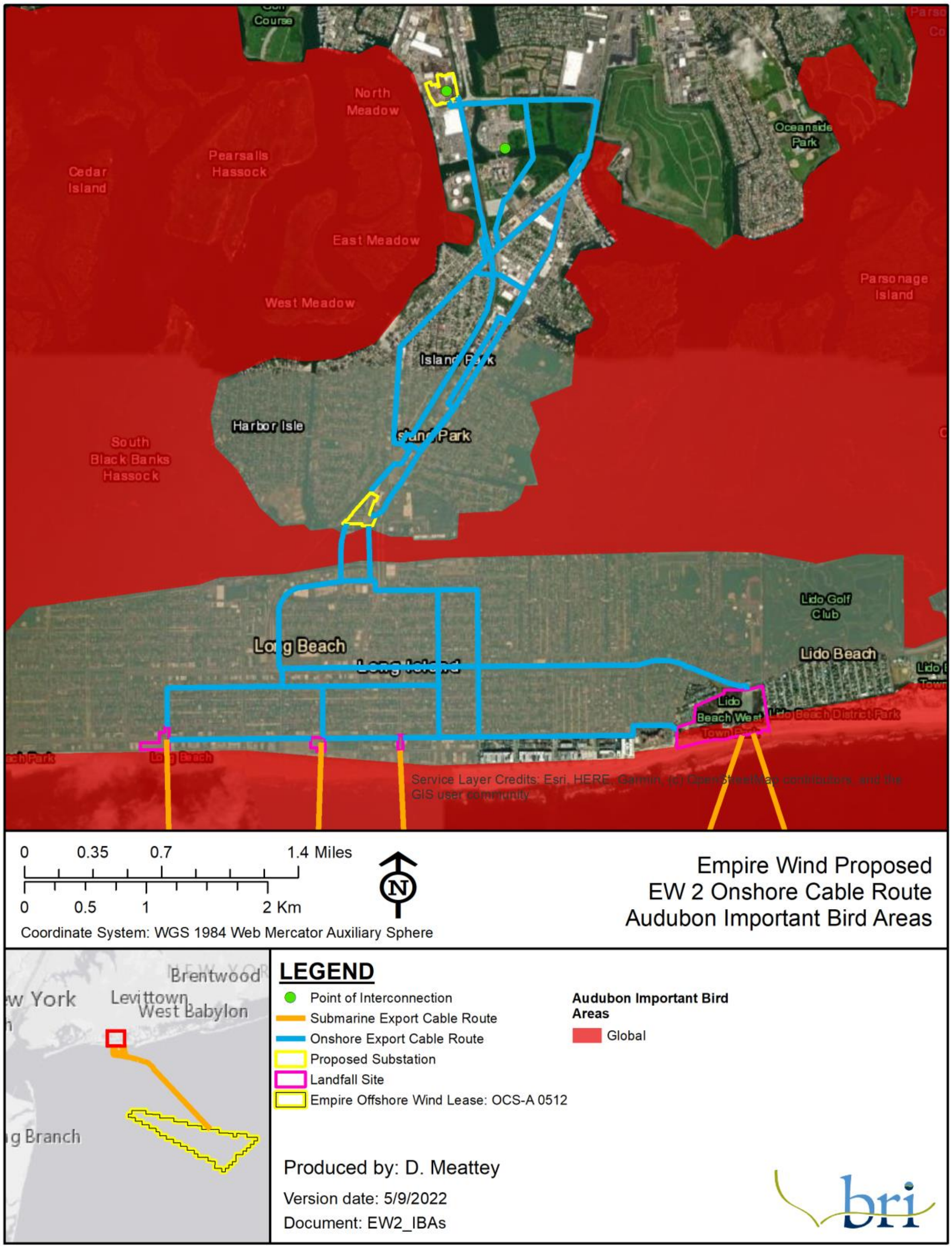

Figure 3-2: EW 2 Onshore Export and Interconnection Cable Corridor, Audubon Important Bird Areas. Red indicates Global priority.

3.2.2.2.1 EW 2 Export Cable Landfall, Onshore Export and Interconnection Cable Route and Onshore Substation

For the proposed onshore export and interconnection cable route, the transmission lines will be co-located with existing developed areas (e.g., roads) that pass through residential and commercial areas wherever possible, thereby minimizing potential impacts to terrestrial wildlife habitat (Figure 3-3). The EW 2 route will connect to one of two proposed onshore substation sites and terminate at the Oceanside POI in one of two possible locations.

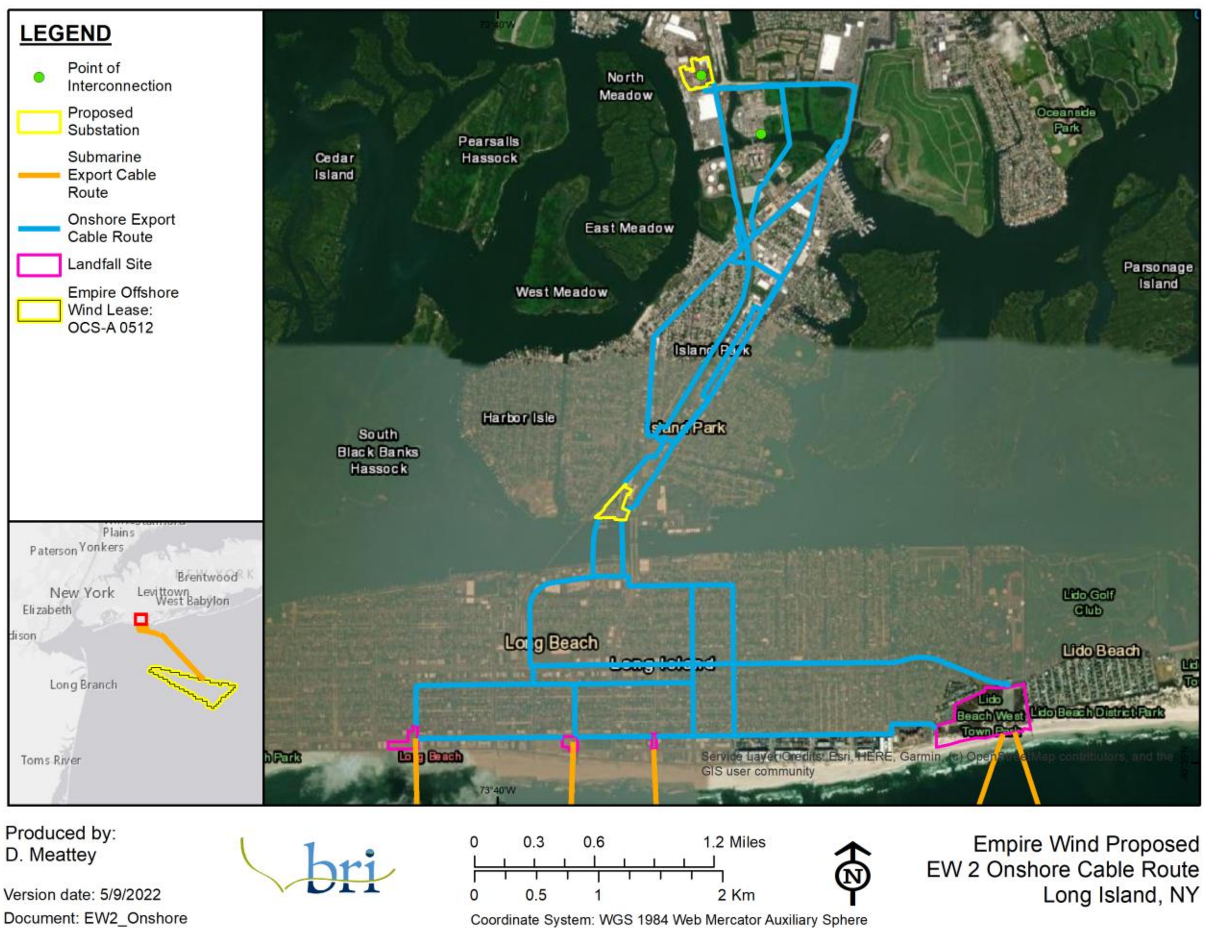

Figure 3-3: Empire Proposed EW 2 Onshore Export and Interconnection Cable Route

Trenchless installation such as horizontal directional drilling (HDD) will be used to connect submarine export cables from the Lease Area to the EW 2 export cable landfall. Multiple export cable landfall sites are under consideration, all of which are on Long Beach and Lido Beach on the Long Beach Barrier Island. This area is a center of recreation and tourist activities. The HDD allows the cable to pass under beach habitat before emerging in a small staging site. Long Beach is sandy with no vegetation and could provide habitat for common marine bird species (e.g., gulls), while Lido Beach includes vegetated dunes that provide nesting habitat to various coastal nesting species, including piping plovers and least terns. While piping plovers may pass through the area during migration and post-breeding dispersal, Long Beach is unlikely to provide important breeding habitat for plovers because it is highly developed and EW 2 Landfall A, EW 2 Landfall B, and EW 2 Landfall E sites are located in roadways and paved parking areas, directly adjacent to commercial areas and existing roadways. Piping plover nests on Lido Beach are actively monitored, and 26 chicks were fledged from 14 pairs in 2018 (Dazio 2018).

There are multiple potential onshore export cable route segment options, within the portion of the EW 2 onshore export cable construction corridor on Long Beach Island. This route splits into a secondary route when crossing the channel between Long Beach and Island Park, with additional potential cable route options within the portion of the EW 2 onshore export cable construction corridor on Island Park. It is assumed that HDD will be used for the channel crossing. Natural habitat along the route is minimal, as the landscape is highly characterized by residential and commercial development and only provides edge habitat for common urban birds. This area serves as a transportation and service corridor and associated infrastructure is a dominant feature. The cable routes co-locates along the roadways through high-density commercial and residential areas. One section of wooded parcel (approximately 0.8 ha of upland shrub) exists after the cable route crosses Long Beach Road onto Ladomus Avenue.

The onshore export and interconnection cable routes travels through a parcel of upland scrub shrub, including a channel crossing. There is an existing POI, with the proposed onshore substation to be constructed either on a previously disturbed parcel immediately to the northwest of the POI (EW 2 Onshore Substation A), or a previously disturbed parcel further to the south (EW Onshore Substation C). The proposed onshore substation sites occur in highly developed areas bordered by commercial and residential developments. Although undeveloped areas onsite at the EW 2 Onshore Substation A and EW 2 Onshore Substation C sites may have the potential to provide some habitat for certain species of birds, this area is not expected to be important habitat for any species.

3.2.2.3 Birds likely to occupy existing habitat

The eBird database indicates that a variety of bird species are present in the area of the EW 2 onshore export and interconnection cable corridors and proposed onshore substation sites. Since the area is highly developed, the birds mostly likely to be exposed to Project activities are common coastal, urban (some introduced), and upland species. The birds most likely to be exposed to the export cable landfall site would include gulls, geese, dabbling ducks, and cormorants. Upland species are likely to include European starling, house sparrow, song sparrow, and mockingbird. Adjacent to the POI, the small, wooded area that may be disturbed to support onshore export and interconnection cable installation may also support common upland species such as downy woodpecker, American goldfinch, and black-capped chickadee. A list of all birds identified in the eBird database as occurring within 15 km of the EW 2 site is provided in Table 3-7. Listed species and species of concern that may occur in the area of the EW 2 site are described in detail, below.

3.2.2.3.1 Species of Conservation Concern

Avian species found within 15 km of the EW 2 onshore export and interconnection cable corridors and proposed onshore substation sites include species listed by the federal government as Endangered, Threatened, and Birds of Conservation Concern, and by the state of New York as Endangered, Threatened, or Special Concern. In the eBird database, within 15 km of EW 2, there are 23 species listed as high priority SGCN species, five of which are state listed (Table 3-4). In addition, least terns, listed as Threatened in New York, breed in the area, including Lido Beach (Figure 3-4). Listed species that occur in upland habitats (i.e. peregrine falcon and short-eared owl) are not likely to be present in the area of the EW 2 onshore export and interconnection cable construction corridor because available habitat, including the wooded parcel adjacent to the existing substation, is located in an urban developed area. It is possible that the federally listed coastal species (i.e. terns) may pass through the beach areas at the export cable landfall site during migration; these species are discussed in further detail, below.

Table 3-4: New York State listed species in the eBird database within 15 km of the EW 2 site. T=Threatened; E = endangered.

Species	Scientific Name	eBird Count	NY Listed	Fed. Listed	Habitat
Piping plover	*Charadrius melodus*	841	E	T	aquatic
Black tern	*Chlidonias niger*	134	E		aquatic
Roseate tern	*Sterna dougallii*	111	E	E	aquatic
Peregrine falcon	*Falco peregrinus*	2982	E		upland
Short-eared owl	*Asio flammeus*	33	E		upland

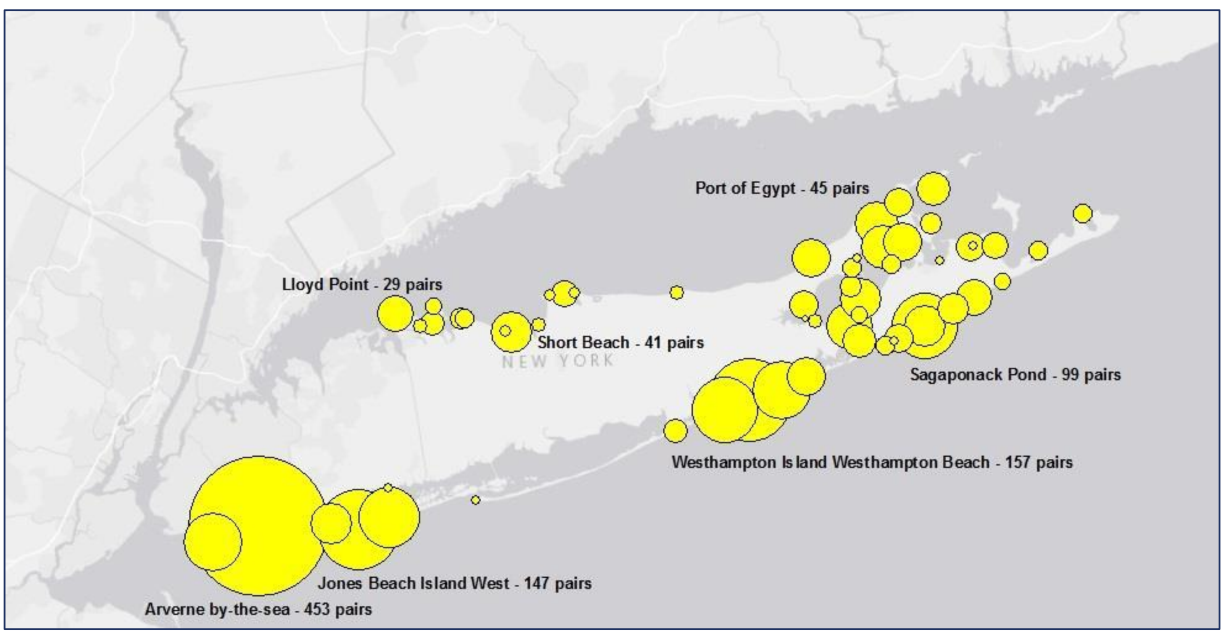

Figure 3-4: Least tern distribution on Long Island ([NYSDEC] Yew York State Department of Environmental Conservation 2018).

The federally listed piping plover, red knot, and roseate tern were detected in the eBird database as occurring within 15 km of the proposed onshore development areas at EW 2. The endangered roseate tern could fly close to or roost onshore near export cable landfall sites during migration but is unlikely to linger. Since roseate terns are only expected to be passing through the area during migration and exposure to onshore Project activities is likely ephemeral, they are not discussed in detail in this section. For further information on roseate tern see Section 3 Birds - Offshore.

The USFWS listed a subspecies of red knot as threatened under the Endangered Species Act of 1973, as amended in the Federal Register on December 11, 2014 (USFWS 2015). The *rufa* subspecies breeds in the Arctic and winters at sites as far south as Tierra del Fuego, Argentina, at the southern tip of South America. During both migrations, red knots use key staging and stopover areas to rest and feed. Major spring stopover areas are located along the mid-Atlantic coast of the USA where birds utilize habitats including sandy coastal beaches at or near tidal inlets or the mouths of bays and estuaries, peat banks, salt marshes, brackish lagoons, tidal mudflats, mangroves, and sandy/gravel beaches where they feed on clams, crustaceans, invertebrates, and the eggs of horseshoe crabs (particularly in Delaware Bay) that come ashore to spawn in late May. Red knot passage through the mid-Atlantic occurs between the third week of Apr and first week of June, with the highest counts occurring from mid to late May (Baker et al. 2013). A recent nanotag study indicated that red knots could potentially pass through the beach areas in New York during migration (Figure 2-12; Loring et al. 2018). After nesting, the timing of departure from the breeding site depends on sex (females leave first in mid-July), age (juveniles leave in late August), and breeding success (failed breeders leave in early to mid- July, while successful breeders remain until late July or August; Baker et al. 2013). They begin to arrive at Cape Cod stopover sites in mid-July, with long and mid-distance migrants typically leaving before mid-September. Short-distance migrants and juveniles stay in the area until early November (Loring et al. 2018). Stopover locations in New Jersey (Stone Harbor, Avalon, and Brigantine Islands) are similar to those in MA, but later onset of harsh winter weather allows short-distance migrants and juveniles to remain in the area occasionally into January.

Piping plover populations were federally listed as Threatened and Endangered in 1986 and are listed in New York. The Northern Great Plains and Atlantic Coast populations are Threatened, and the Great Lakes population is Endangered. Atlantic Coast piping plovers nest on coastal beaches, sandflats at the ends of sand spits and barrier islands, gently sloped foredunes, sparsely vegetated dunes, and washover areas cut into or between dunes. Breeding and wintering plovers feed by probing for invertebrates at or just below the surface on exposed wet sand in wash zones, intertidal ocean beach, wrack lines, washover passes, mud, sand, and algal flats, and the shorelines of streams, ephemeral ponds, lagoons and salt marshes. They use beaches adjacent to foraging areas for roosting and preening. Small sand dunes, debris, and sparse vegetation within adjacent beaches provides shelter from wind and extreme temperatures.

Piping plovers arrive on the breeding grounds during mid-March through mid-May and remain for 3 to 4 months per year, and depart for the wintering grounds from mid-July through late October (Elliott-Smith and Haig 2004, USFWS 2019). Egg laying occurs during May and June.

Incubation lasts 25-31 days, while chicks fledge after another 28-35 days. Peak hatch typically occurs in June, and chicks fledge within about 35 days (Elliott-Smith and Haig 2004). The post-breeding dispersal period occurs through late August. By early September, most have departed for wintering areas (NYSDEC 2019). One piping plover affixed with a digital VHF transmitter (nanotag) from a study conducted in Massachusetts and Rhode Island (n=102), between 2015 and 2017, was estimated to pass through coastal New York during migration (Loring et al. 2019). Piping plovers are documented to breed in the area, including Lido Beach (Figure 3-5).

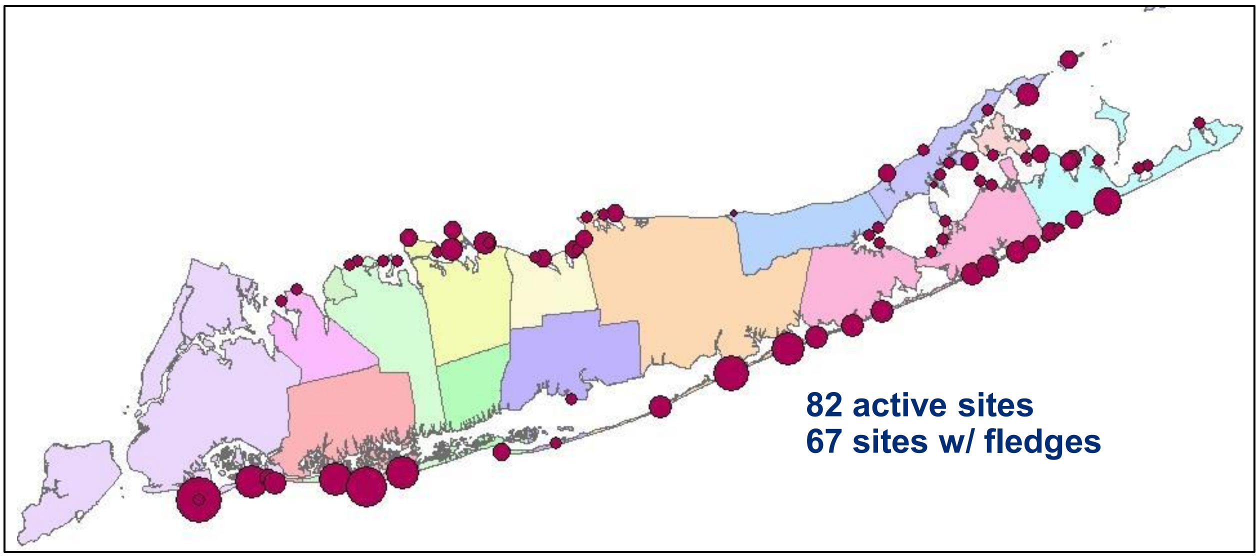

Figure 3-5: Piping plover breeding sites in New York ([NYSDEC] Yew York Department of Environmental Conservation 2018).

Piping plovers are sensitive to disturbance during breeding. The presence of people is stressful for adults and chicks, forcing them to spend significantly less time foraging, which may result in decreased overall reproductive success (Burger 1990). Excessive disturbance may cause piping plovers to desert the nest, exposing eggs or chicks to the summer sun and predators. Interrupted feedings may stress juvenile birds during critical periods in their development, and foot and vehicle traffic may crush eggs or chicks (USFWS 2001). Examples of actions that may affect this species include construction of any new permanent or temporary structure, grading, vegetation removal, equipment storage, any new or expanded human activity during the nesting season of March 15 to August 31; this includes activities involving motorized vehicles, permanent or temporary increases in noise or disturbance during the nesting season, including, but not limited to, construction work. Best management practices for protecting Piping plovers include avoiding permanent or temporary modification of nest habitat and avoiding noise and disturbance during the nesting season, particularly work involving use of motorized vehicles (USFWS 2019).

3.2.2.4 Potential Impacts

Potential impacts for each project component, by development phase, are summarized in Table 3-5.

3.2.2.4.1 Construction and Installation

3.2.2.4.1.1 Habitat Modification

Export cable landfall (coastal beach areas): Overall, temporary coastal disturbance is expected to be "minimal" to "low" because trenchless installation such as horizontal directional drilling (HDD) and time of year restrictions will be used to avoid disturbance of the inter-tidal zone and beach areas. If disturbance in potentially suitable habitat is necessary during the seasons when federally listed species may be present (mid-March to mid-September), Empire will conduct site-specific bird surveys prior to construction to identify if piping plovers or red knots are using the area. Empire will also contact USFWS and the NYSDEC for the most recent information on piping plover and red knot use of the area. Based upon the findings of the survey, best practices determined in coordination with the USFWS and NYSDEC will be applied to minimize any potential disturbance to listed species. Impacts from permanent habitat modification are expected to be "minimal," because any disturbed areas are expected to return to prior conditions after completion of construction.

Onshore export and interconnection cable corridor and onshore substation (upland areas): Overall, temporary and permanent impacts to bird populations from onshore export and interconnection cable corridor activities are expected to be "minimal" because the cable will be, to the extent practical, co-located with existing developed areas (i.e., roads,) to limit disturbance to habitat. Adjacent to the POI, temporary and permanent impacts are expected to be "minimal" to "low" because the small non-developed area that will be altered is not expected to provide critical habitat for most species of birds because it is located in an already urbanized area.

3.2.2.4.1.2 Temporary Disturbance: Noise and Vibration

For the land fall area, noise and vibration generated by construction equipment and HDD may temporarily displace some birds within nearby habitat. These birds are expected to return once construction activity is complete, and, thus, the potential impacts to bird populations from noise is expected to be "minimal" to "low". For other project components, noise is not expected to be an independent hazard; and for all project components there are not expected to be any permanent impacts from noise.

3.2.2.4.1.3 Direct Mortality

Due to their generally high mobility, birds are likely to leave the corridor as construction progresses. Any direct mortality to birds from construction activities should be extremely limited; therefore, for all onshore project components, potential impacts to bird populations as a result of direct mortality are expected to be "minimal".

3.2.2.4.2 Operations and Maintenance

For all onshore project components, operations and maintenance activities are expected to create few, if any hazards, that would cause potential effects to birds (BOEM] 2018). There is the potential for birds to be temporarily disturbed by noise during maintenance activities, but these are expected to be ephemeral in nature, and birds that are disturbed would readily return to the area once the activities have ceased. Across the landscape, fixed above ground structures (e.g., buildings, transmission lines) can cause mortality due to collision or electrocution, but risk to birds from the Project is likely low because most transmission lines will be buried, and buildings will be built primarily in existing disturbed areas. For these reasons, the potential impacts to bird populations are expected to be "minimal" for the operations of coastal and onshore components of the Project.

3.2.2.4.3 Decommissioning

Impacts during decommissioning are expected to be similar or less than those experienced during construction, as described above. It is important to note that advances in decommissioning methods/technologies are expected to occur throughout the operations phase of the Project. A full decommissioning plan will be approved by BOEM prior to any decommissioning activities, and potential impacts will be re-evaluated at that time.

Table 3-5: Summary of potential impacts of coastal and onshore activities to birds at the EW 2 site.

Effect	Description	Population level risk			
		Construction & Decommissioning			Operations: all components
		Landfall	Cable	Substation	
Habitat Modification (Temporary)	Temporary disturbance of upland habitat by Project activities	Minimal - Low	Minimal	Minimal - Low	.
Habitat Modification (Permanent)	Permanent disturbance of upland habitat by Project activities	Minimal	Minimal	Minimal - Low	Minimal
Disturbance (Temporary)	Noise and vibration producing activities	Minimal - Low	Minimal	Minimal	Minimal
Mortality	Contact with equipment	Minimal	Minimal	Minimal	Minimal

3.2.2.5 Mitigation and Monitoring

Empire proposes to minimize risk to birds by (a) using HDD in coastal areas, (b) co-locating project activities with existing disturbed areas, and (c) timing construction and operations to avoid critical periods when endangered and threatened species may be affected (see[BOEM 2018). Furthermore, prior to construction, the Project will survey all areas of suitable nesting habitat that would be disturbed by development for raptor nests, wading bird colonies, seabird nests, shorebird nests, and Endangered and Threatened species. If any nesting birds are found, Empire will contact USFWS and state wildlife officials and identify the best practices for avoiding impacts. Empire will further *minimize* potential effects by cutting trees and vegetation between September and April, when possible, to avoid impact to forest nesting birds; and, to the extent practicable, limit activities in beach areas from mid-March to mid-September to minimize potential effects to beach nesting birds. Since impacts are considered to be "minimal" to "low", no post-construction monitoring is proposed.

Table 3-6: List of birds common birds in eBird database (75 quartile) within 15 km of EW 2 with listing, general habitat, and conservation status. E=endangered; T=threatened; SGCN = species of greatest conservation need; CN = conservation need.

Species	Scientific Name	eBird Count	NY Conservation Need	NY Listed	IPaC	Habitat
Herring gull	*Larus argentatus*	3521			x	aquatic
Canada goose	*Branta canadensis*	3506				aquatic
Great black-backed gull	*Larus marinus*	3440			x	aquatic
Mallard	*Anas platyrhynchos*	3427				aquatic
Double-crested cormorant	*Phalacrocorax auritus*	3334			x	aquatic
Ring-billed gull	*Larus delawarensis*	3333			x	aquatic
Mute swan	*Cygnus olor*	2891				aquatic
American black duck	*Anas rubripes*	2830	high priority SGCN			aquatic
Great blue heron	*Ardea herodias*	2644				aquatic
Brant	*Branta bernicla*	2521				aquatic
Great egret	*Ardea alba*	2485	SGCN			aquatic
American oystercatcher	*Haematopus palliatus*	2479			x	aquatic
Greater yellowlegs	*Tringa melanoleuca*	2201	SGCN			aquatic
Black-crowned night-heron	*Nycticorax nycticorax*	2162	SGCN			aquatic
Laughing gull	*Leucophaeus atricilla*	2133	SGCN			aquatic
Snowy egret	*Egretta thula*	2050	SGCN			aquatic
Black-bellied plover	*Pluvialis squatarola*	1953	SGCN			aquatic
Gadwall	*Mareca strepera*	1949				aquatic
Sanderling	*Calidris alba*	1841	potential CN			aquatic
Ruddy duck	*Oxyura jamaicensis*	1837	SGCN			aquatic
Forster's tern	*Sterna forsteri*	1770	SGCN			aquatic
Yellow-crowned night-heron	*Nyctanassa violacea*	1712	SGCN			aquatic
Dunlin	*Calidris alpina*	1608			x	aquatic
Northern shoveler	*Spatula clypeata*	1585				aquatic
Common loon	*Gavia immer*	1550	SGCN		x	aquatic
Red-breasted merganser	*Mergus serrator*	1549			x	aquatic
Green-winged teal	*Anas crecca*	1507				aquatic
Killdeer	*Charadrius vociferus*	1496				aquatic
Glossy ibis	*Plegadis falcinellus*	1456	SGCN			aquatic
European starling	*Sturnus vulgaris*	3498				upland
House sparrow	*Passer domesticus*	3477				upland
Song sparrow	*Melospiza melodia*	3475				upland
Northern mockingbird	*Mimus polyglottos*	3470				upland
Northern cardinal	*Cardinalis cardinalis*	3463				upland
Mourning dove	*Zenaida macroura*	3446				upland
American robin	*Turdus migratorius*	3424				upland
Rock pigeon	*Columba livia*	3292				upland
House finch	*Haemorhous mexicanus*	3106				upland
Peregrine falcon	*Falco peregrinus*	2982	SGCN	E		upland
Downy woodpecker	*Dryobates pubescens*	2965				upland
American crow	*Corvus brachyrhynchos*	2953				upland
Red-winged blackbird	*Agelaius phoeniceus*	2844				upland
American goldfinch	*Spinus tristis*	2777				upland
Black-capped chickadee	*Poecile atricapillus*	2530				upland
Tree swallow	*Tachycineta bicolor*	2354				upland

Species	Scientific Name	eBird Count	NY Conservation Need	NY Listed	IPaC	Habitat
Blue jay	*Cyanocitta cristata*	2325				upland
Northern flicker	*Colaptes auratus*	2192				upland
Carolina wren	*Thryothorus ludovicianus*	2177				upland
Osprey	*Pandion haliaetus*	2162				upland
Gray catbird	*Dumetella carolinensis*	2136				upland
White-throated sparrow	*Zonotrichia albicollis*	2130				upland
Fish crow	*Corvus ossifragus*	2114				upland
Common grackle	*Quiscalus quiscula*	2078				upland
Yellow-rumped warbler	*Setophaga coronata*	1863				upland
Red-bellied woodpecker	*Melanerpes carolinus*	1836				upland
Eastern towhee	*Pipilo erythrophthalmus*	1711				upland
Brown-headed cowbird	*Molothrus ater*	1654				upland
Northern harrier	*Circus hudsonius*	1617				upland
Belted kingfisher	*Megaceryle alcyon*	1607				upland
Common yellowthroat	*Geothlypis trichas*	1590				upland
Boat-tailed grackle	*Quiscalus major*	1534				upland
Barn swallow	*Hirundo rustica*	1513				upland
Yellow warbler	*Setophaga petechia*	1477				upland
Cedar waxwing	*Bombycilla cedrorum*	1434				upland
Swamp sparrow	*Melospiza georgiana*	1427				upland
Dark-eyed junco	*Junco hyemalis*	1408				upland

3.3 Summary and Conclusions

Onshore project activities are expected to largely avoid potential impacts to birds because nearly all development will be co-located with existing areas of development. At the export cable landfall sites, potential impacts to birds using the shoreline habitats will be minimized by using horizontal directional drilling. Along the cable route and at substations, impacts will be minimized by conducting tree cutting outside the nesting period where appropriate or required. Since Empire will largely avoid and minimize any potential impacts, onshore construction, operations, and decommissioning activities are not expected to affect the populations of breeding or migratory birds.

Table 3-7: List of species identified in the eBird database within 15 km of each potential onshore site.

Species	Scientific Name	EW 1 eBird Count	EW 2 eBird Count
Snow goose	*Anser caerulescens*	360	713
Pink-footed goose	*Anser brachyrhynchus*	.	79
Brant	*Branta bernicla*	1922	2521
Cackling goose	*Branta hutchinsii*	55	64
Canada goose	*Branta canadensis*	3545	3506
Mute swan	*Cygnus olor*	2893	2891
Wood duck	*Aix sponsa*	2529	931
Blue-winged teal	*Spatula discors*	117	603
Northern shoveler	*Spatula clypeata*	2165	1585
Gadwall	*Mareca strepera*	2111	1949
Eurasian wigeon	*Mareca penelope*	.	87
American wigeon	*Mareca americana*	1053	1143
Mallard	*Anas platyrhynchos*	3587	3427
American black duck	*Anas rubripes*	2394	2830
Northern pintail	*Anas acuta*	334	580
Green-winged teal	*Anas crecca*	763	1507
Canvasback	*Aythya valisineria*	57	134
Redhead	*Aythya americana*	104	420
Ring-necked duck	*Aythya collaris*	892	701
Greater scaup	*Aythya marila*	660	1095
Lesser scaup	*Aythya affinis*	330	584
King eider	*Somateria spectabilis*	.	47
Common eider	*Somateria mollissima*	116	795
Harlequin duck	*Histrionicus histrionicus*	.	493
Surf scoter	*Melanitta perspicillata*	271	638
White-winged scoter	*Melanitta deglandi*	213	355
Black scoter	*Melanitta americana*	328	969
Long-tailed duck	*Clangula hyemalis*	580	968
Bufflehead	*Bucephala albeola*	1698	1236
Common goldeneye	*Bucephala clangula*	444	229
Barrow's goldeneye	*Bucephala islandica*	32	.

Species	Scientific Name	EW 1 eBird Count	EW 2 eBird Count
Hooded merganser	*Lophodytes cucullatus*	1506	1279
Common merganser	*Mergus merganser*	295	333
Red-breasted merganser	*Mergus serrator*	1313	1549
Ruddy duck	*Oxyura jamaicensis*	2233	1837
Ring-necked pheasant	*Phasianus colchicus*	335	323
Wild turkey	*Meleagris gallopavo*	280	.
Pied-billed grebe	*Podilymbus podiceps*	1464	904
Horned grebe	*Podiceps auritus*	823	879
Red-necked grebe	*Podiceps grisegena*	210	126
Eared grebe	*Podiceps nigricollis*	.	33
Western grebe	*Aechmophorus occidentalis*	.	.
Rock pigeon	*Columba livia*	3627	3292
Mourning dove	*Zenaida macroura*	3624	3446
Yellow-billed cuckoo	*Coccyzus americanus*	372	226
Black-billed cuckoo	*Coccyzus erythropthalmus*	176	65
Common nighthawk	*Chordeiles minor*	348	42
Chimney swift	*Chaetura pelagica*	1751	758
Ruby-throated hummingbird	*Archilochus colubris*	1193	468
Rufous hummingbird	*Selasphorus rufus*	111	.
Clapper rail	*Rallus crepitans*	100	1355
Virginia rail	*Rallus limicola*	49	.
Sora	*Porzana carolina*	39	31
Common gallinule	*Gallinula galeata*	35	.
American coot	*Fulica americana*	2093	1050
American avocet	*Recurvirostra americana*	.	132
American oystercatcher	*Haematopus palliatus*	899	2479
Black-bellied plover	*Pluvialis squatarola*	525	1953
American Golden- plover	*Pluvialis dominica*	45	100
Semipalmated plover	*Charadrius semipalmatus*	446	1174
Piping plover	*Charadrius melodus*	237	841
Killdeer	*Charadrius vociferus*	1288	1496
Whimbrel	*Numenius phaeopus*	37	108
Hudsonian godwit	*Limosa haemastica*	.	90
Marbled godwit	*Limosa fedoa*	.	157
Ruddy turnstone	*Arenaria interpres*	302	1041
Red knot	*Calidris canutus*	92	737
Stilt sandpiper	*Calidris himantopus*	.	441
Sanderling	*Calidris alba*	673	1841
Dunlin	*Calidris alpina*	326	1608
Purple sandpiper	*Calidris maritima*	327	407
Baird's sandpiper	*Calidris bairdii*	37	86
Least sandpiper	*Calidris minutilla*	394	1177
White-rumped sandpiper	*Calidris fuscicollis*	60	505
Buff-breasted sandpiper	*Calidris subruficollis*	.	32
Pectoral sandpiper	*Calidris melanotos*	65	437
Semipalmated sandpiper	*Calidris pusilla*	398	1257
Western sandpiper	*Calidris mauri*	.	271
Short-billed dowitcher	*Limnodromus griseus*	70	1158

Species	Scientific Name	EW 1 eBird Count	EW 2 eBird Count
Long-billed dowitcher	*Limnodromus scolopaceus*	.	158
American woodcock	*Scolopax minor*	468	147
Wilson's snipe	*Gallinago delicata*	160	84
Wilson's phalarope	*Phalaropus tricolor*	.	81
Spotted sandpiper	*Actitis macularius*	963	895
Solitary sandpiper	*Tringa solitaria*	338	306
Greater yellowlegs	*Tringa melanoleuca*	533	2201
Willet	*Tringa semipalmata*	327	1329
Lesser yellowlegs	*Tringa flavipes*	180	1108
Razorbill	*Alca torda*	55	153
Bonaparte's gull	*Chroicocephalus philadelphia*	254	498
Black-headed gull	*Chroicocephalus ridibundus*	71	42
Laughing gull	*Leucophaeus atricilla*	1903	2133
Ring-billed gull	*Larus delawarensis*	3283	3333
Herring gull	*Larus argentatus*	3436	3521
Iceland gull	*Larus glaucoides*	146	79
Lesser black-backed gull	*Larus fuscus*	186	528
Glaucous gull	*Larus hyperboreus*	.	.
Great black-backed gull	*Larus marinus*	3199	3440
Least tern	*Sternula antillarum*	311	1006
Gull-billed tern	*Gelochelidon nilotica*	.	430
Caspian tern	*Hydroprogne caspia*	39	105
Black tern	*Chlidonias niger*	.	134
Roseate tern	*Sterna dougallii*	.	111
Common tern	*Sterna hirundo*	750	1320
Forster's tern	*Sterna forsteri*	526	1770
Royal tern	*Thalasseus maximus*	166	321
Black skimmer	*Rynchops niger*	359	1036
Red-throated loon	*Gavia stellata*	866	1107
Pacific loon	*Gavia pacifica*	.	.
Common loon	*Gavia immer*	1356	1550
Wilson's storm-petrel	*Oceanites oceanicus*	.	.
Northern gannet	*Morus bassanus*	439	782
Great cormorant	*Phalacrocorax carbo*	852	465
Double-crested cormorant	*Phalacrocorax auritus*	3216	3334
American white pelican	*Pelecanus erythrorhynchos*	.	108
American bittern	*Botaurus lentiginosus*	50	58
Great blue heron	*Ardea herodias*	2718	2644
Great egret	*Ardea alba*	1672	2485
Snowy egret	*Egretta thula*	720	2050
Little blue heron	*Egretta caerulea*	197	932
Tricolored heron	*Egretta tricolor*	.	353
Cattle egret	*Bubulcus ibis*	64	.
Green heron	*Butorides virescens*	1138	1039
Black-crowned night-heron	*Nycticorax nycticorax*	1891	2162
Yellow-crowned night-heron	*Nyctanassa violacea*	310	1712
Glossy ibis	*Plegadis falcinellus*	416	1456
White-faced ibis	*Plegadis chihi*	.	30

Species	Scientific Name	EW 1 eBird Count	EW 2 eBird Count
Black vulture	*Coragyps atratus*	179	.
Turkey vulture	*Cathartes aura*	1346	182
Osprey	*Pandion haliaetus*	1388	2162
Northern harrier	*Circus hudsonius*	753	1617
Sharp-shinned hawk	*Accipiter striatus*	1242	847
Cooper's hawk	*Accipiter cooperii*	1881	1080
Bald eagle	*Haliaeetus leucocephalus*	427	339
Red-shouldered hawk	*Buteo lineatus*	447	56
Broad-winged hawk	*Buteo platypterus*	187	.
Red-tailed hawk	*Buteo jamaicensis*	3273	1290
Rough-legged hawk	*Buteo lagopus*	40	58
Barn owl	*Tyto alba*	46	394
Eastern screech- owl	*Megascops asio*	247	.
Great horned owl	*Bubo virginianus*	391	324
Snowy owl	*Bubo scandiacus*	184	278
Barred owl	*Strix varia*	163	.
Long-eared owl	*Asio otus*	67	.
Short-eared owl	*Asio flammeus*	.	33
Northern saw-whet owl	*Aegolius acadicus*	210	.
Belted kingfisher	*Megaceryle alcyon*	1705	1607
Yellow-bellied sapsucker	*Sphyrapicus varius*	1963	409
Red-headed woodpecker	*Melanerpes erythrocephalus*	461	86
Red-bellied woodpecker	*Melanerpes carolinus*	3502	1836
Downy woodpecker	*Dryobates pubescens*	3572	2965
Hairy woodpecker	*Dryobates villosus*	2628	737
Pileated woodpecker	*Dryocopus pileatus*	34	.
Northern flicker	*Colaptes auratus*	2980	2192
American kestrel	*Falco sparverius*	2194	653
Merlin	*Falco columbarius*	1154	963
Peregrine falcon	*Falco peregrinus*	1912	2982
Monk parakeet	*Myiopsitta monachus*	1406	439
Olive-sided flycatcher	*Contopus cooperi*	223	.
Eastern wood-pewee	*Contopus virens*	1139	389
Yellow-bellied flycatcher	*Empidonax flaviventris*	189	36
Acadian flycatcher	*Empidonax virescens*	121	37
Alder flycatcher	*Empidonax alnorum*	37	.
Willow flycatcher	*Empidonax traillii*	374	728
Least flycatcher	*Empidonax minimus*	402	123
Eastern phoebe	*Sayornis phoebe*	1400	932
Great crested flycatcher	*Myiarchus crinitus*	918	490
Eastern kingbird	*Tyrannus tyrannus*	1168	683
Northern shrike	*Lanius borealis*	.	46
White-eyed vireo	*Vireo griseus*	639	387
Yellow-throated vireo	*Vireo flavifrons*	274	76
Blue-headed vireo	*Vireo solitarius*	789	293
Philadelphia vireo	*Vireo philadelphicus*	172	.
Warbling vireo	*Vireo gilvus*	1302	509
Red-eyed vireo	*Vireo olivaceus*	1240	648

Species	Scientific Name	EW 1 eBird Count	EW 2 eBird Count
Blue jay	*Cyanocitta cristata*	3576	2325
American crow	*Corvus brachyrhynchos*	3273	2953
Fish crow	*Corvus ossifragus*	1367	2114
Common raven	*Corvus corax*	779	247
Horned lark	*Eremophila alpestris*	493	1129
Northern rough-winged swallow	*Stelgidopteryx serripennis*	613	315
Purple martin	*Progne subis*	66	84
Tree swallow	*Tachycineta bicolor*	1400	2354
Bank swallow	*Riparia riparia*	273	320
Barn swallow	*Hirundo rustica*	1560	1513
Cliff swallow	*Petrochelidon pyrrhonota*	58	45
Carolina chickadee	*Poecile carolinensis*	.	.
Black-capped chickadee	*Poecile atricapillus*	3258	2530
Tufted titmouse	*Baeolophus bicolor*	3056	1149
Red-breasted nuthatch	*Sitta canadensis*	1293	936
White-breasted nuthatch	*Sitta carolinensis*	3125	1401
Brown creeper	*Certhia americana*	1544	496
House wren	*Troglodytes aedon*	1703	979
Winter wren	*Troglodytes hiemalis*	1187	295
Marsh wren	*Cistothorus palustris*	332	838
Carolina wren	*Thryothorus ludovicianus*	3115	2177
Blue-gray gnatcatcher	*Polioptila caerulea*	842	524
Golden-crowned kinglet	*Regulus satrapa*	1133	742
Ruby-crowned kinglet	*Regulus calendula*	1535	785
Eastern bluebird	*Sialia sialis*	261	54
Varied thrush	*Ixoreus naevius*	94	.
Veery	*Catharus fuscescens*	683	142
Gray-cheeked thrush	*Catharus minimus*	435	39
Swainson's thrush	*Catharus ustulatus*	798	150
Hermit thrush	*Catharus guttatus*	1716	781
Wood thrush	*Hylocichla mustelina*	1174	212
American robin	*Turdus migratorius*	3609	3424
Gray catbird	*Dumetella carolinensis*	2611	2136
Brown thrasher	*Toxostoma rufum*	1390	1251
Northern mockingbird	*Mimus polyglottos*	3406	3470
European starling	*Sturnus vulgaris*	3628	3498
American pipit	*Anthus rubescens*	255	266
Cedar waxwing	*Bombycilla cedrorum*	2257	1434
House finch	*Haemorhous mexicanus*	3336	3106
Purple finch	*Haemorhous purpureus*	721	222
Common redpoll	*Acanthis flammea*	127	57
Red crossbill	*Loxia curvirostra*	35	64
White-winged crossbill	*Loxia leucoptera*	89	36
European goldfinch	*Carduelis carduelis*	426	.
Pine siskin	*Spinus pinus*	578	197
American goldfinch	*Spinus tristis*	3308	2777
Lapland longspur	*Calcarius lapponicus*	35	197
Snow bunting	*Plectrophenax nivalis*	157	629

Species	Scientific Name	EW 1 eBird Count	EW 2 eBird Count
Grasshopper sparrow	*Ammodramus savannarum*	.	.
Chipping sparrow	*Spizella passerina*	1750	753
Clay-colored sparrow	*Spizella pallida*	76	55
Field sparrow	*Spizella pusilla*	1045	360
Lark sparrow	*Chondestes grammacus*	44	82
American tree sparrow	*Spizelloides arborea*	627	597
Fox sparrow	*Passerella iliaca*	1419	712
Dark-eyed junco	*Junco hyemalis*	2149	1408
White-crowned sparrow	*Zonotrichia leucophrys*	611	365
White-throated sparrow	*Zonotrichia albicollis*	2778	2130
Vesper sparrow	*Pooecetes gramineus*	113	60
Seaside sparrow	*Ammospiza maritima*	.	536
Saltmarsh sparrow	*Ammospiza caudacuta*	.	1273
Savannah sparrow	*Passerculus sandwichensis*	1092	1313
Song sparrow	*Melospiza melodia*	3383	3475
Lincoln's sparrow	*Melospiza lincolnii*	492	79
Swamp sparrow	*Melospiza georgiana*	1795	1427
Eastern towhee	*Pipilo erythrophthalmus*	2057	1711
Yellow-breasted chat	*Icteria virens*	267	42
Bobolink	*Dolichonyx oryzivorus*	166	132
Eastern meadowlark	*Sturnella magna*	139	127
Orchard oriole	*Icterus spurius*	422	96
Baltimore oriole	*Icterus galbula*	1676	634
Red-winged blackbird	*Agelaius phoeniceus*	3170	2844
Brown-headed cowbird	*Molothrus ater*	2018	1654
Rusty blackbird	*Euphagus carolinus*	675	307
Common grackle	*Quiscalus quiscula*	3393	2078
Boat-tailed grackle	*Quiscalus major*	409	1534
Ovenbird	*Seiurus aurocapilla*	1286	271
Worm-eating warbler	*Helmitheros vermivorum*	373	54
Louisiana waterthrush	*Parkesia motacilla*	496	65
Northern waterthrush	*Parkesia noveboracensis*	1182	678
Golden-winged warbler	*Vermivora chrysoptera*	37	.
Blue-winged warbler	*Vermivora cyanoptera*	462	119
Black-and-white warbler	*Mniotilta varia*	1260	595
Prothonotary warbler	*Protonotaria citrea*	130	.
Tennessee warbler	*Oreothlypis peregrina*	486	67
Orange-crowned warbler	*Oreothlypis celata*	346	80
Nashville warbler	*Oreothlypis ruficapilla*	637	132
Connecticut warbler	*Oporornis agilis*	71	.
Mourning warbler	*Geothlypis philadelphia*	215	.
Kentucky warbler	*Geothlypis formosa*	71	.
Common yellowthroat	*Geothlypis trichas*	1679	1590
Hooded warbler	*Setophaga citrina*	361	.
American redstart	*Setophaga ruticilla*	1276	871
Cape May warbler	*Setophaga tigrina*	472	91
Cerulean warbler	*Setophaga cerulea*	51	.
Northern parula	*Setophaga americana*	1030	441

Species	Scientific Name	EW 1 eBird Count	EW 2 eBird Count
Magnolia warbler	*Setophaga magnolia*	913	340
Bay-breasted warbler	*Setophaga castanea*	302	79
Blackburnian warbler	*Setophaga fusca*	450	120
Yellow warbler	*Setophaga petechia*	1294	1477
Chestnut-sided warbler	*Setophaga pensylvanica*	707	167
Blackpoll warbler	*Setophaga striata*	818	305
Black-throated blue warbler	*Setophaga caerulescens*	948	319
Palm warbler	*Setophaga palmarum*	1012	780
Pine warbler	*Setophaga pinus*	986	435
Yellow-rumped warbler	*Setophaga coronata*	1749	1863
Yellow-throated warbler	*Setophaga dominica*	139	31
Prairie warbler	*Setophaga discolor*	499	198
Black-throated green warbler	*Setophaga virens*	779	256
Canada warbler	*Cardellina canadensis*	608	101
Wilson's warbler	*Cardellina pusilla*	550	72
Summer tanager	*Piranga rubra*	195	.
Scarlet tanager	*Piranga olivacea*	686	196
Northern cardinal	*Cardinalis cardinalis*	3630	3463
Rose-breasted grosbeak	*Pheucticus ludovicianus*	703	224
Blue grosbeak	*Passerina caerulea*	127	.
Indigo bunting	*Passerina cyanea*	660	205
Painted bunting	*Passerina ciris*	36	.
Dickcissel	*Spiza americana*	51	39
House sparrow	*Passer domesticus*	3637	3477

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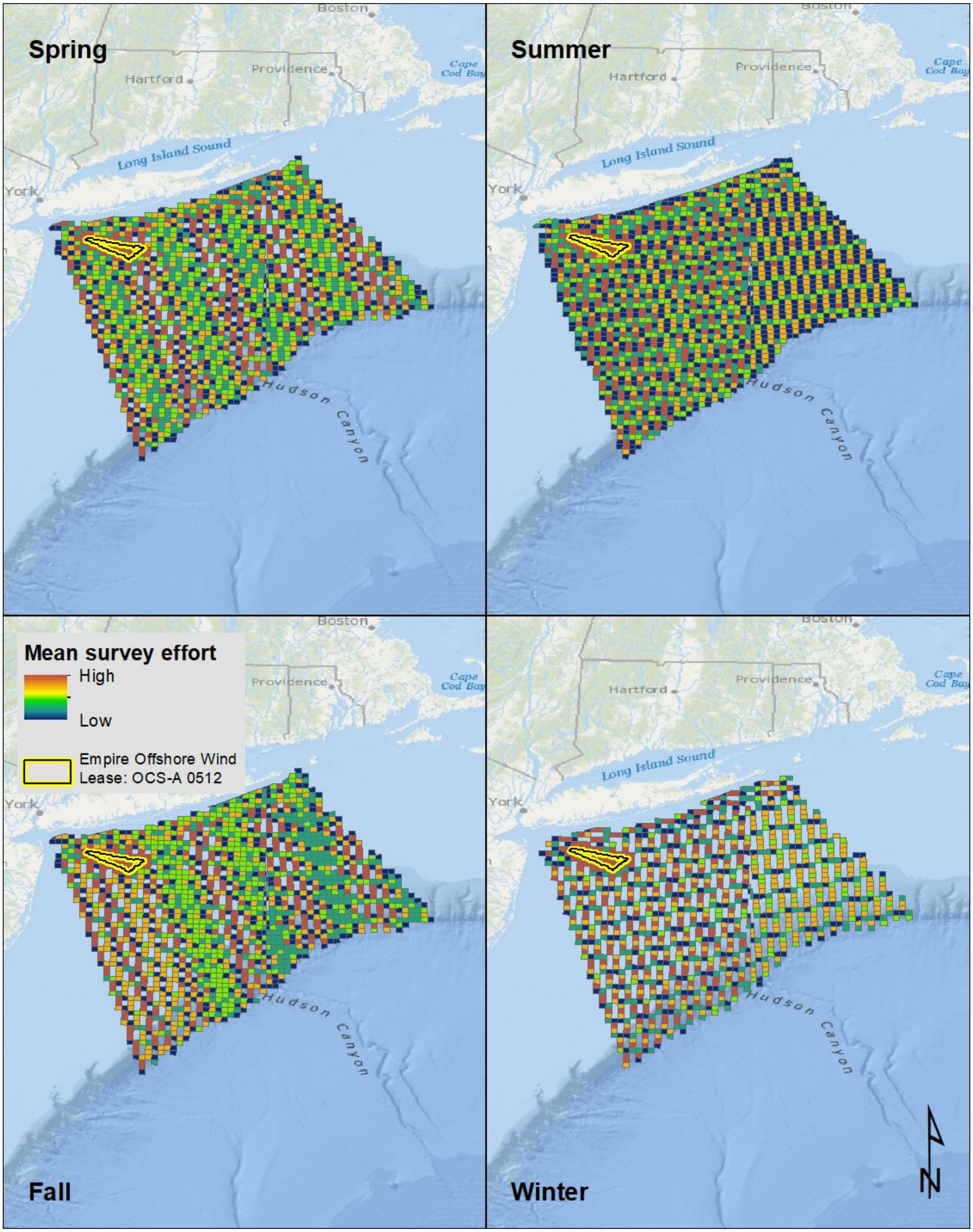
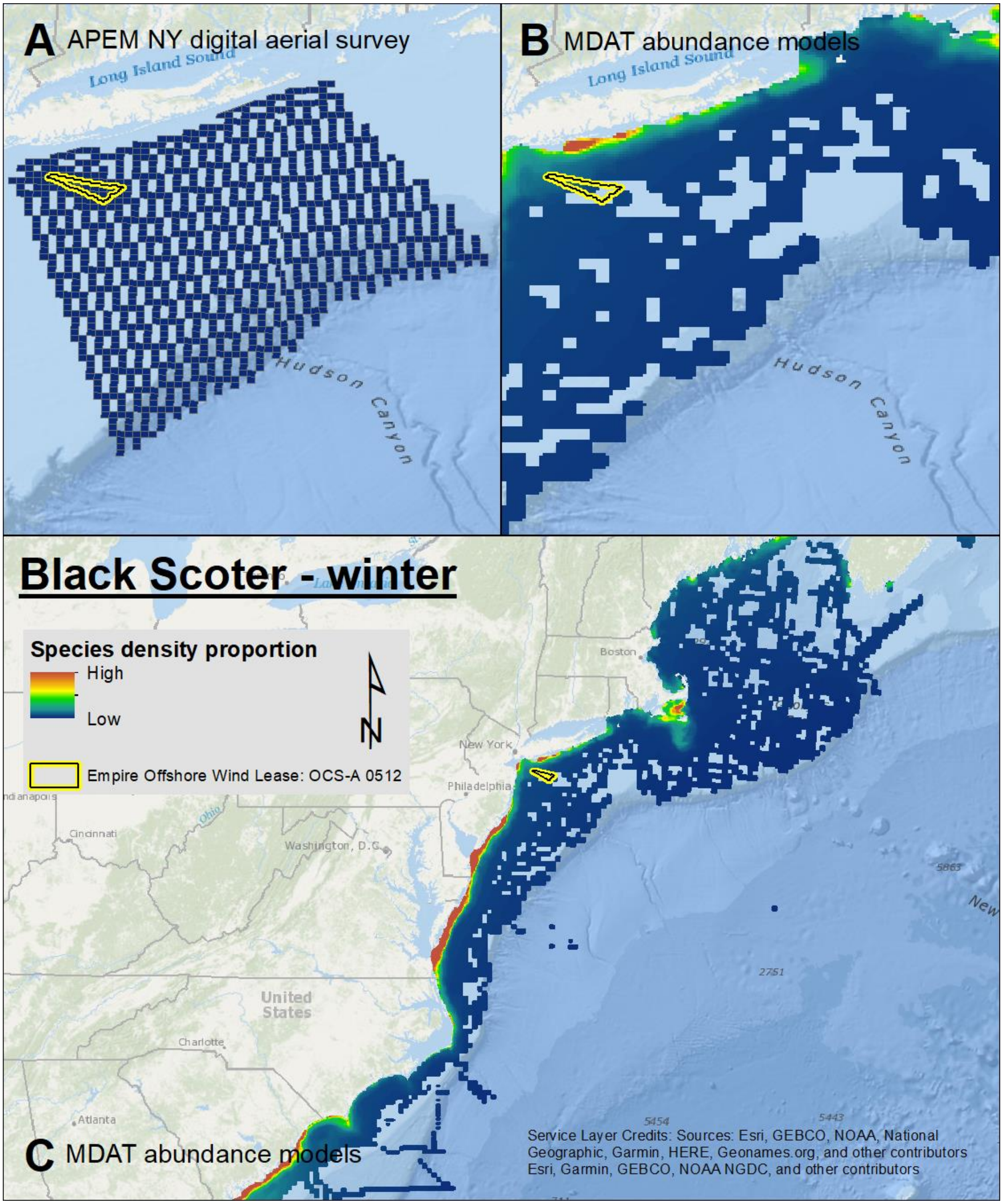
Part V: Maps -Assessment of Exposure for Marine Birds for the Lease Area

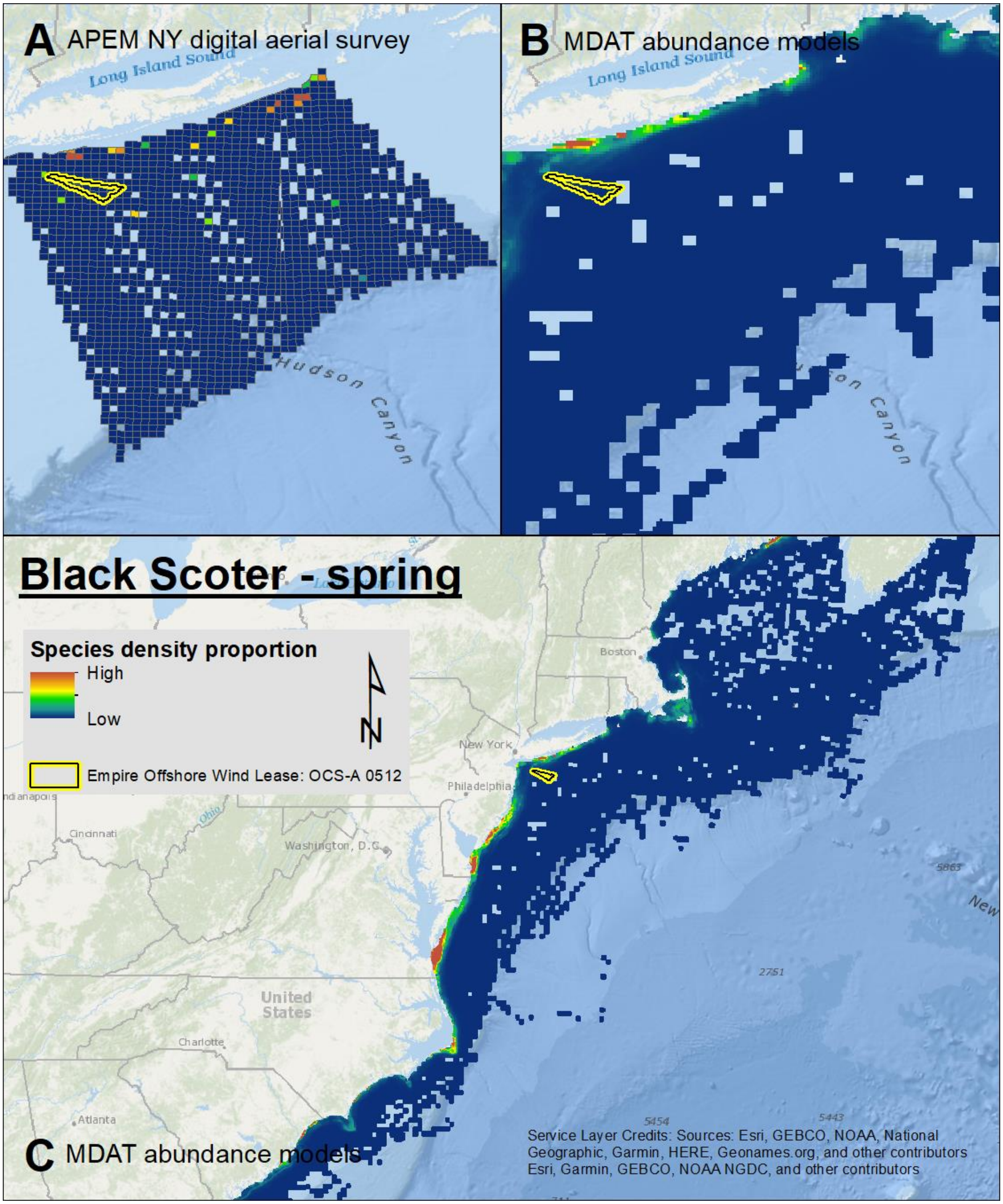
Table of Maps



Map 1. APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial seasonal survey effort. Mean survey effort in sq. km by full or partial lease block inside and outside the lease area. Error! Bookmark not defined.



Map 2. Winter Black Scoter density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



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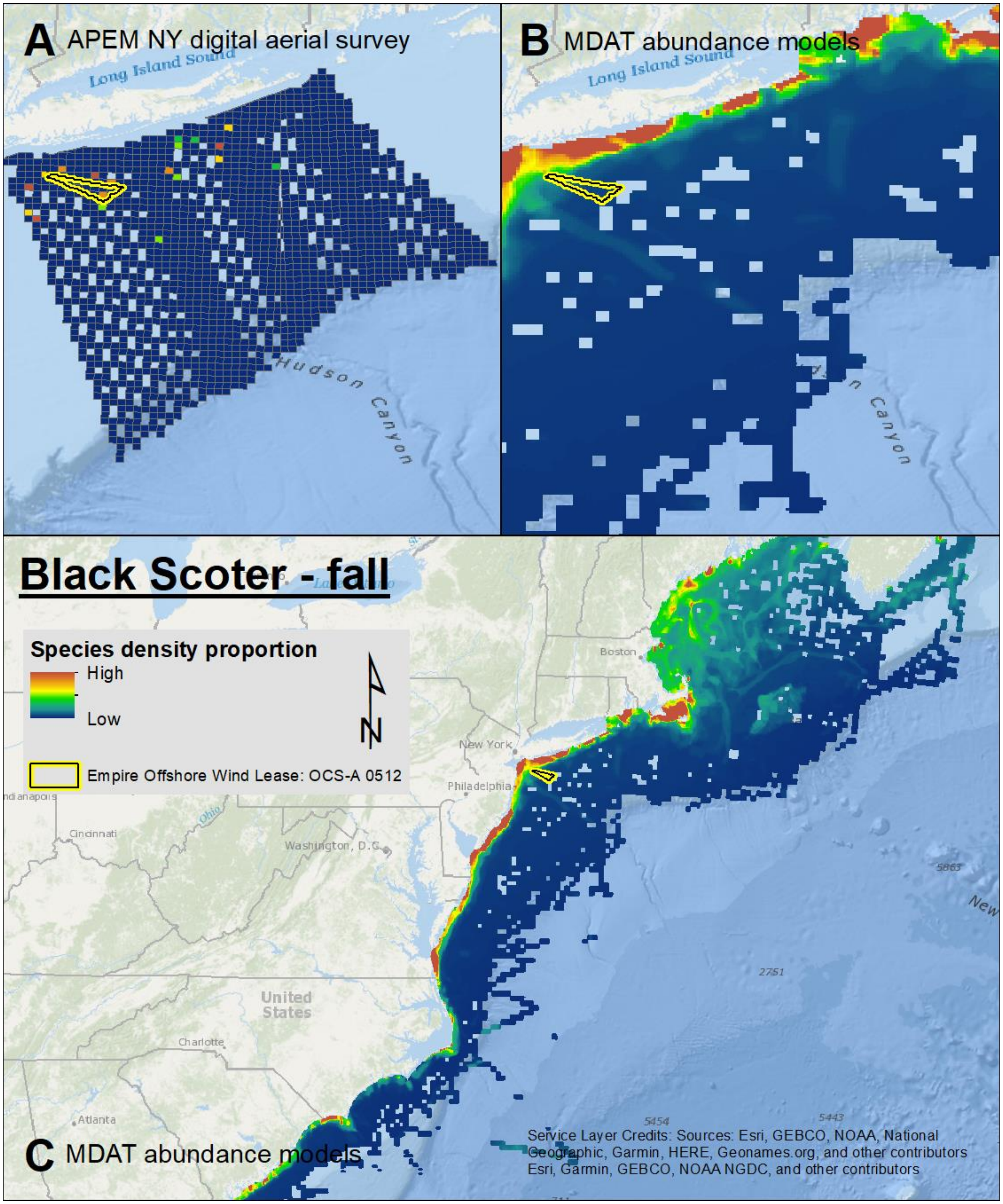

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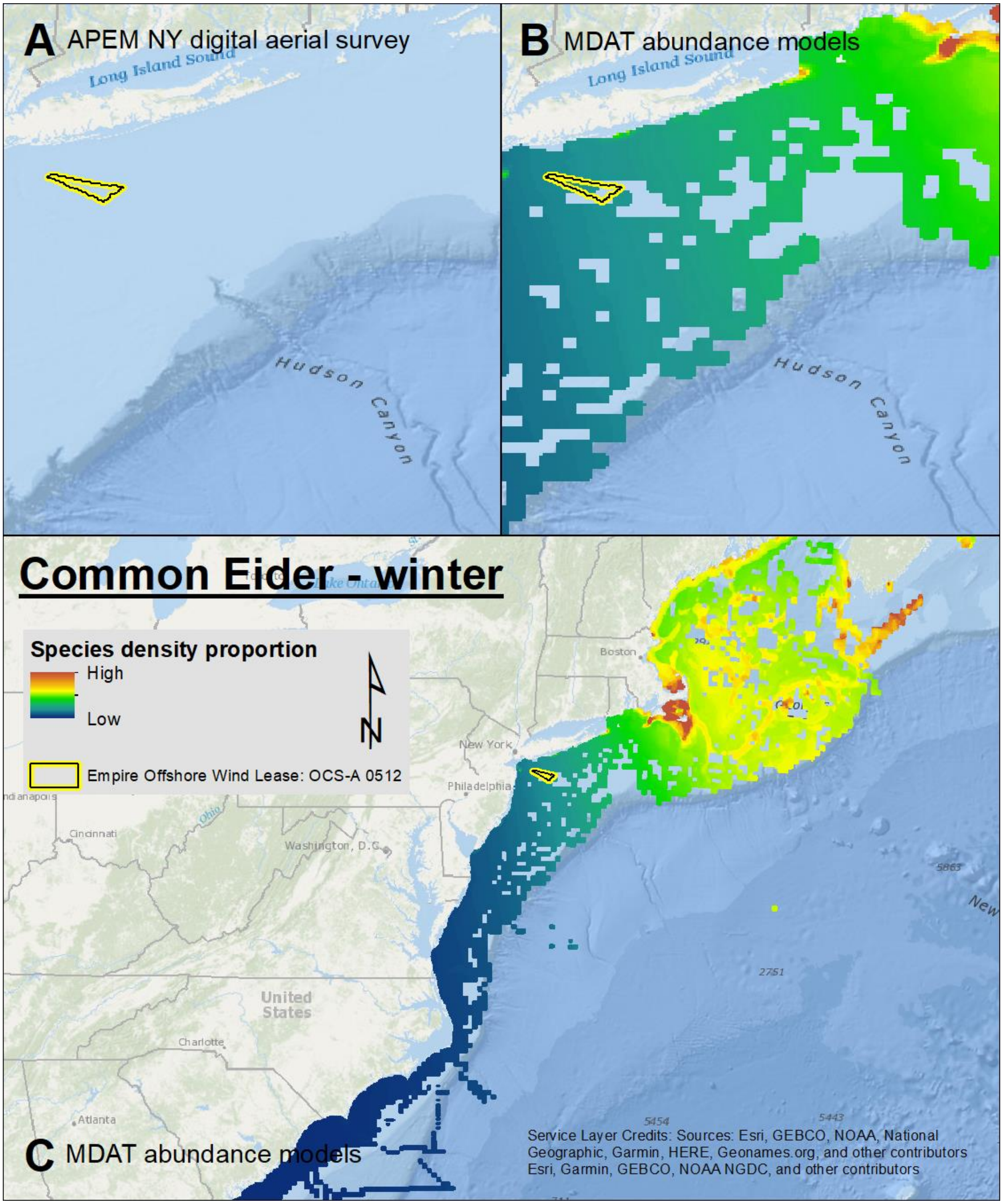
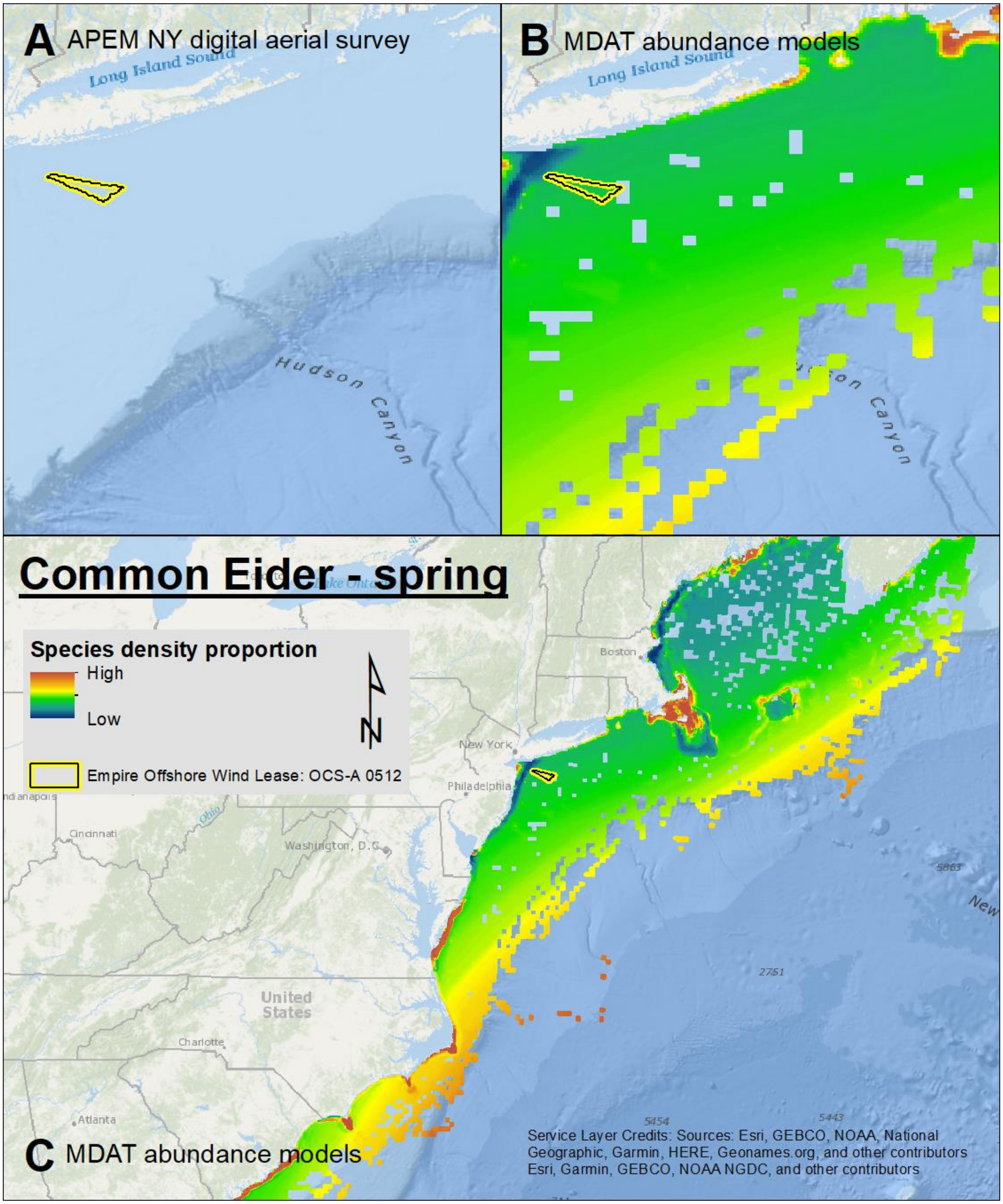


Map 5. Winter Common Eider density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



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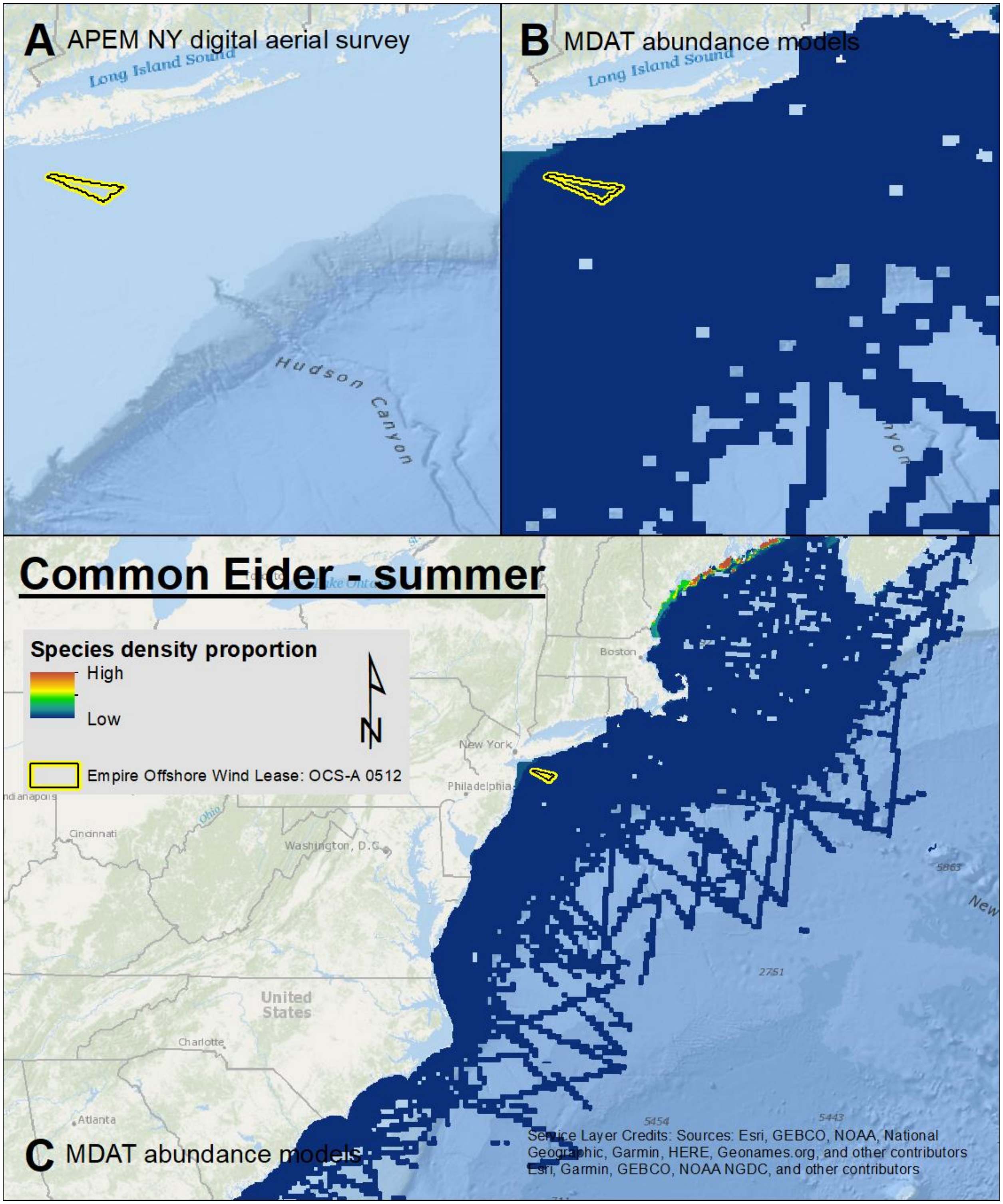

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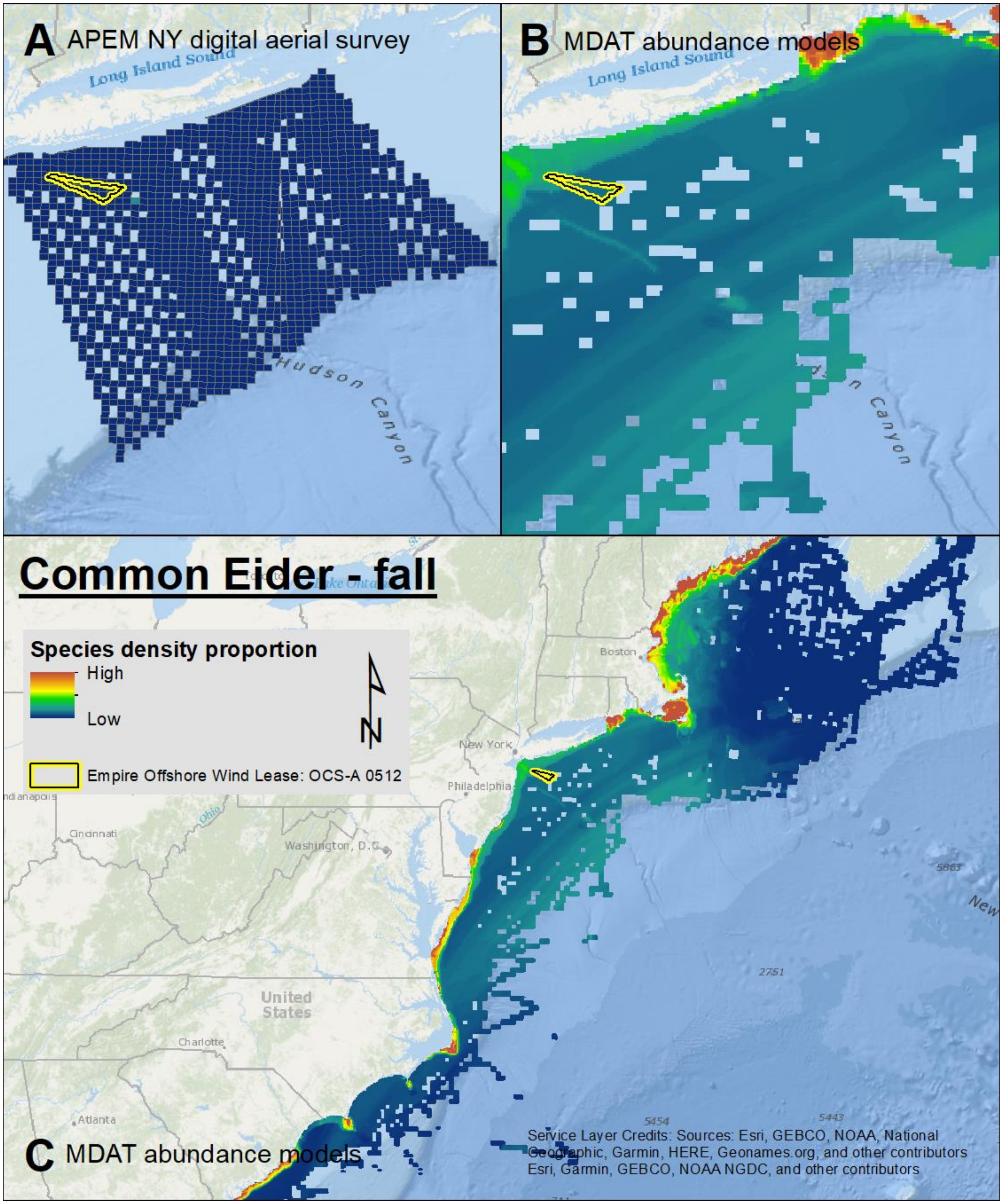

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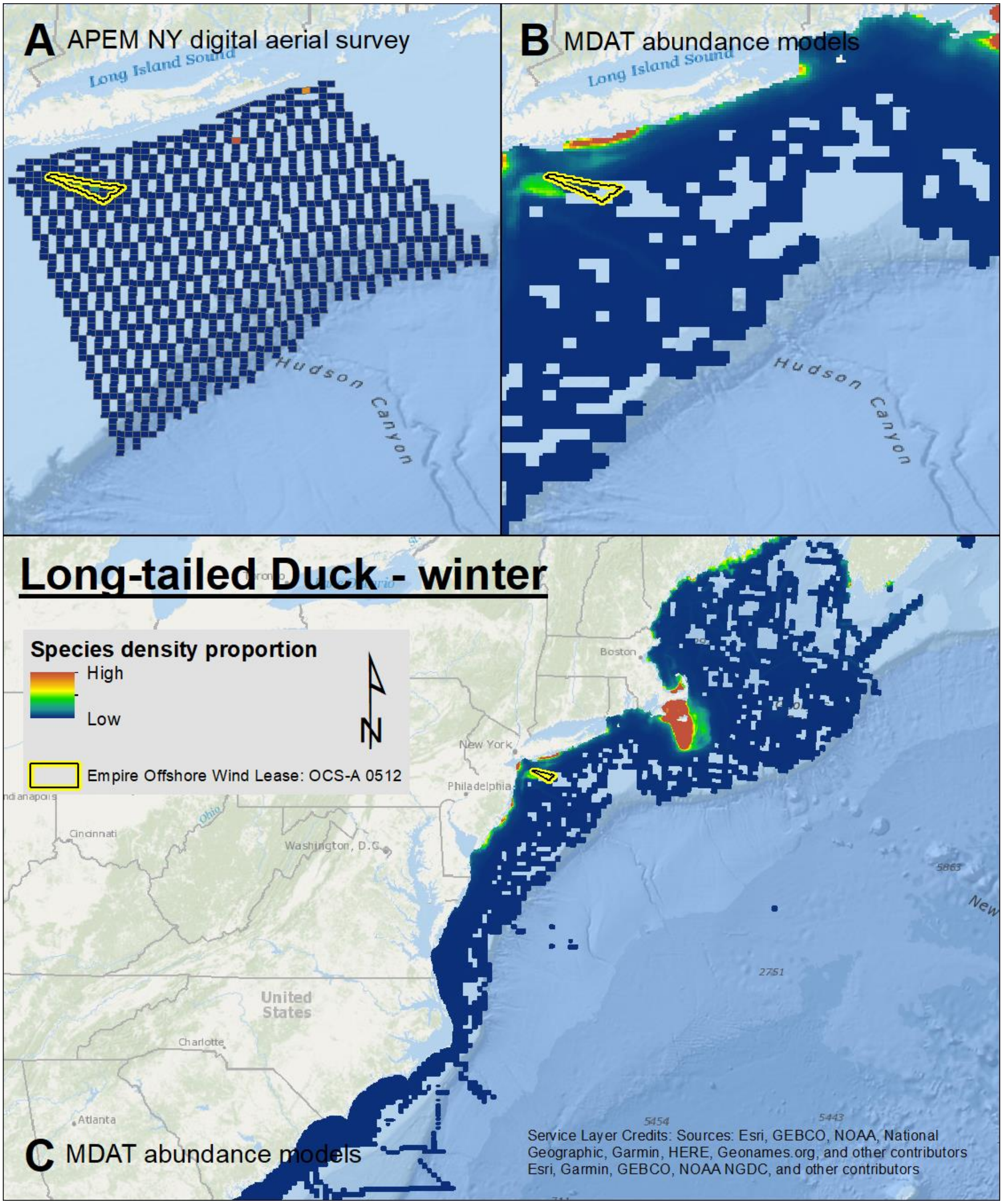
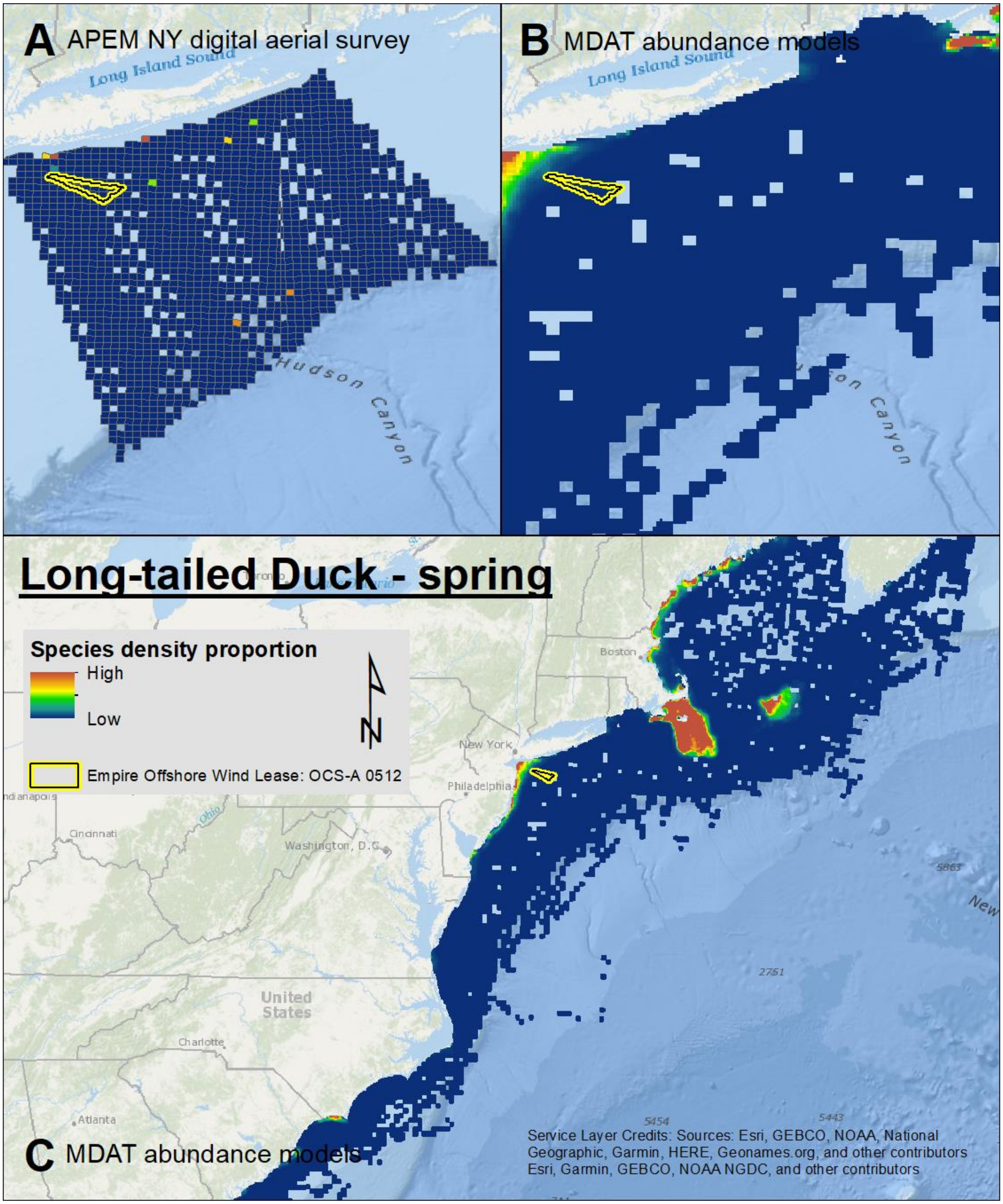


Map 9. Winter Long-tailed Duck density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



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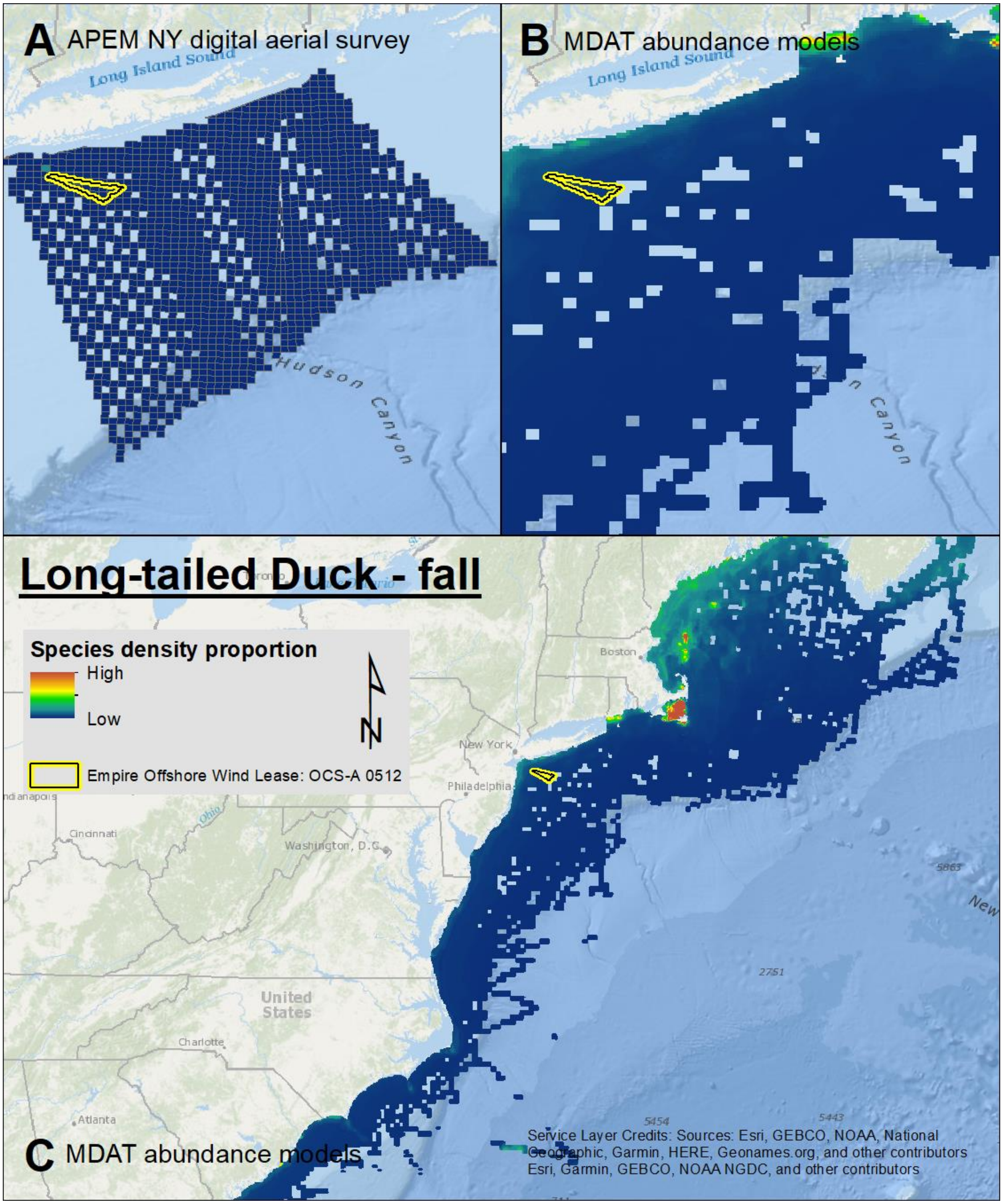

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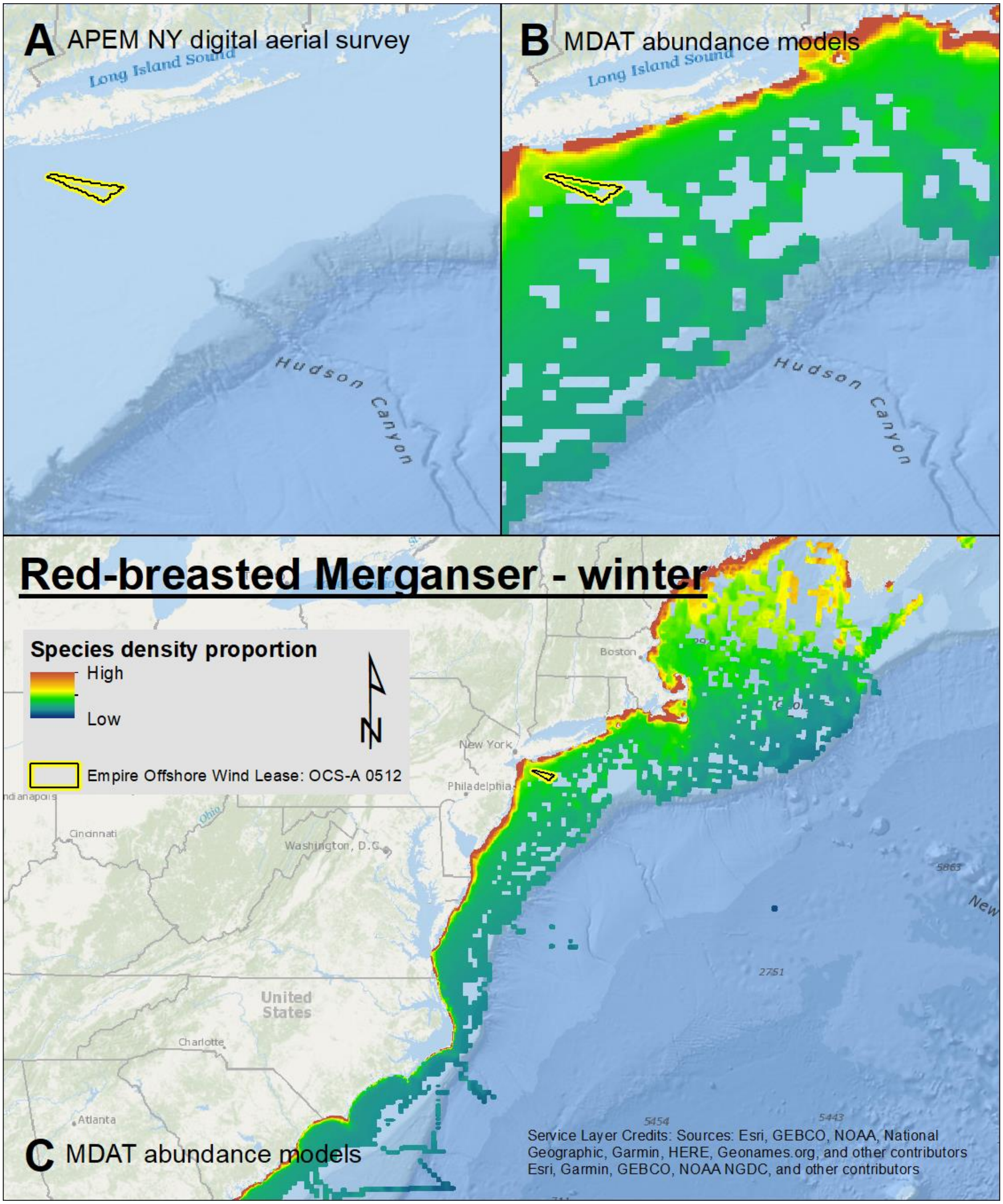
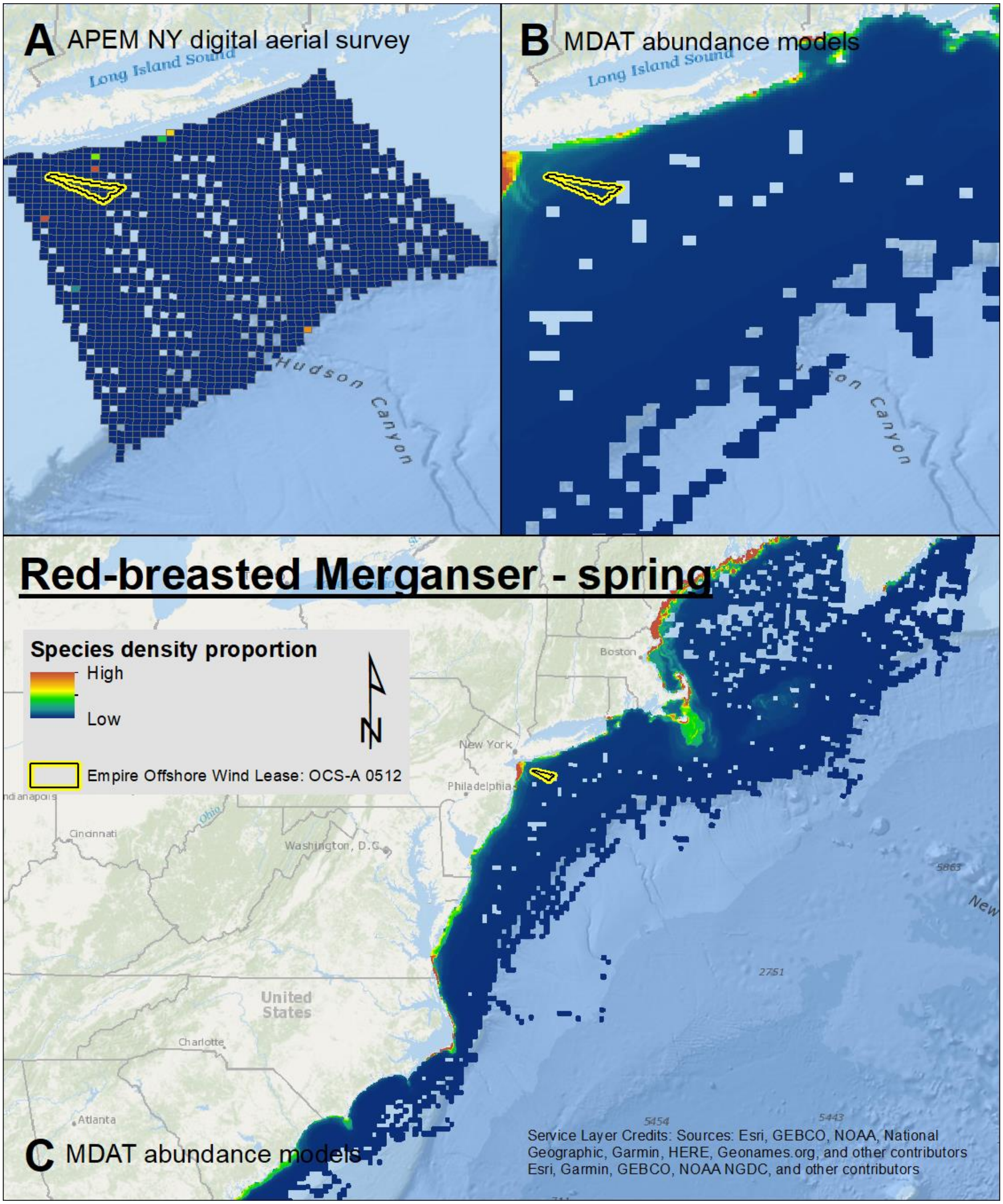


Map 12. Winter Red-breasted Merganser density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



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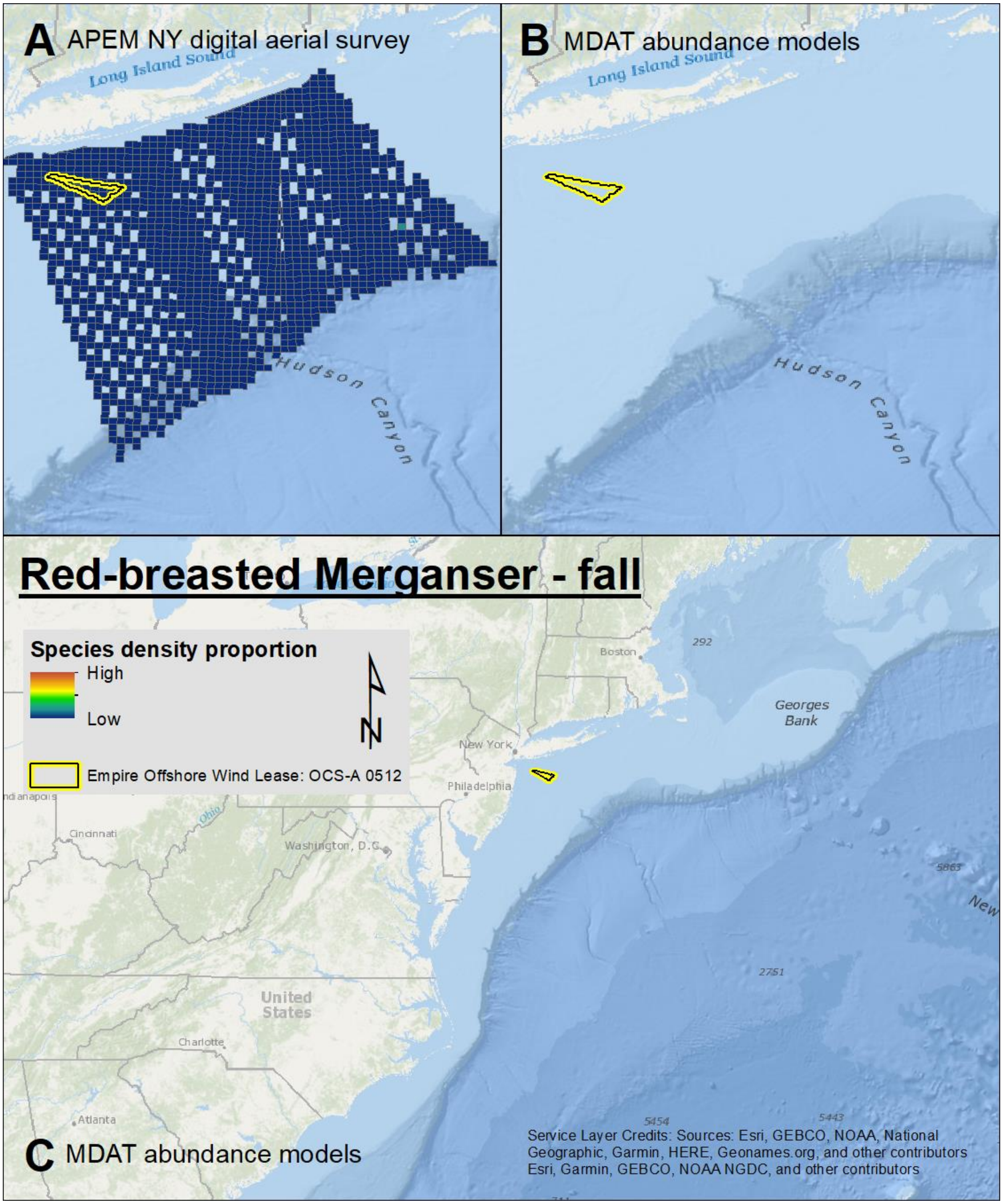

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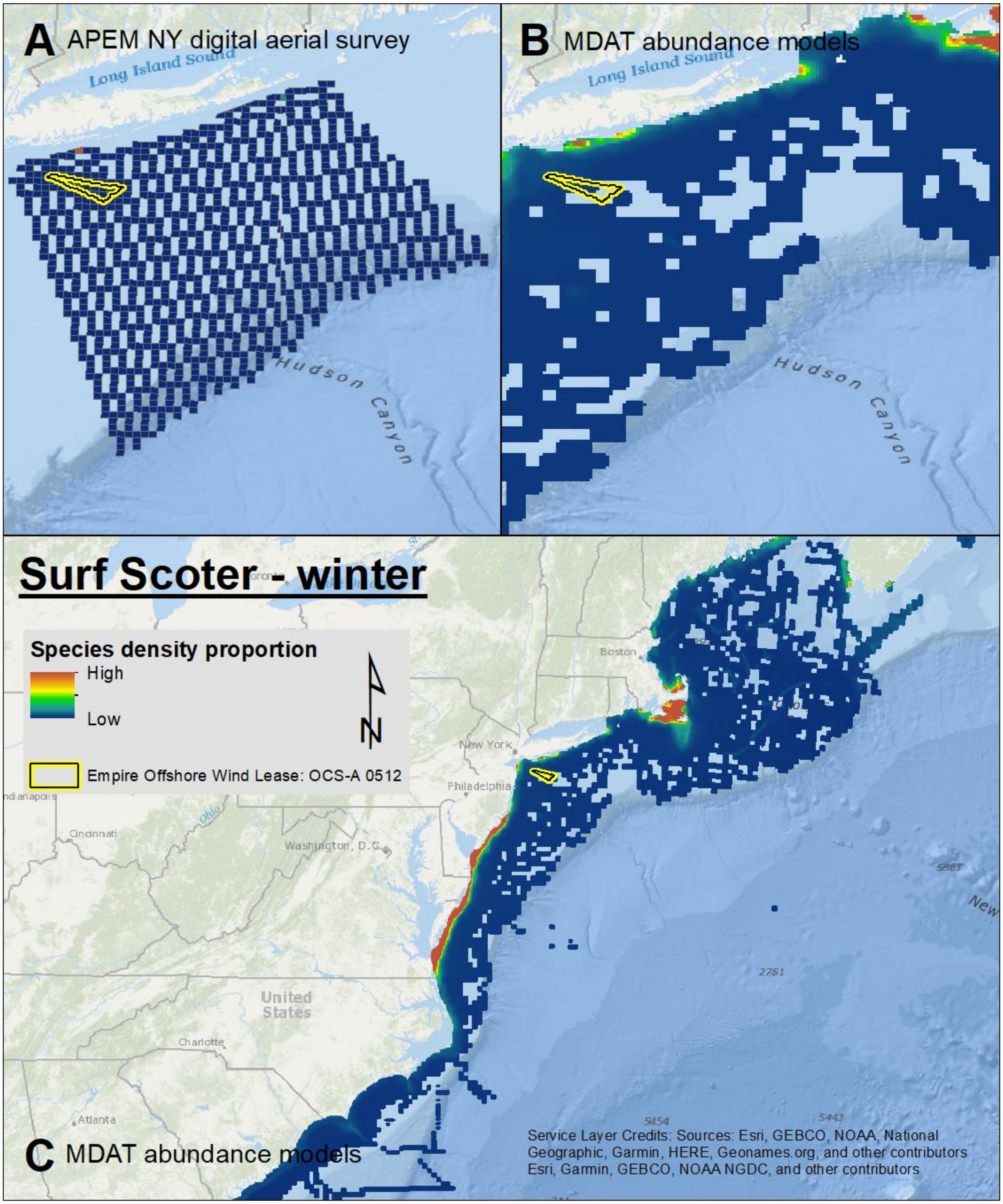

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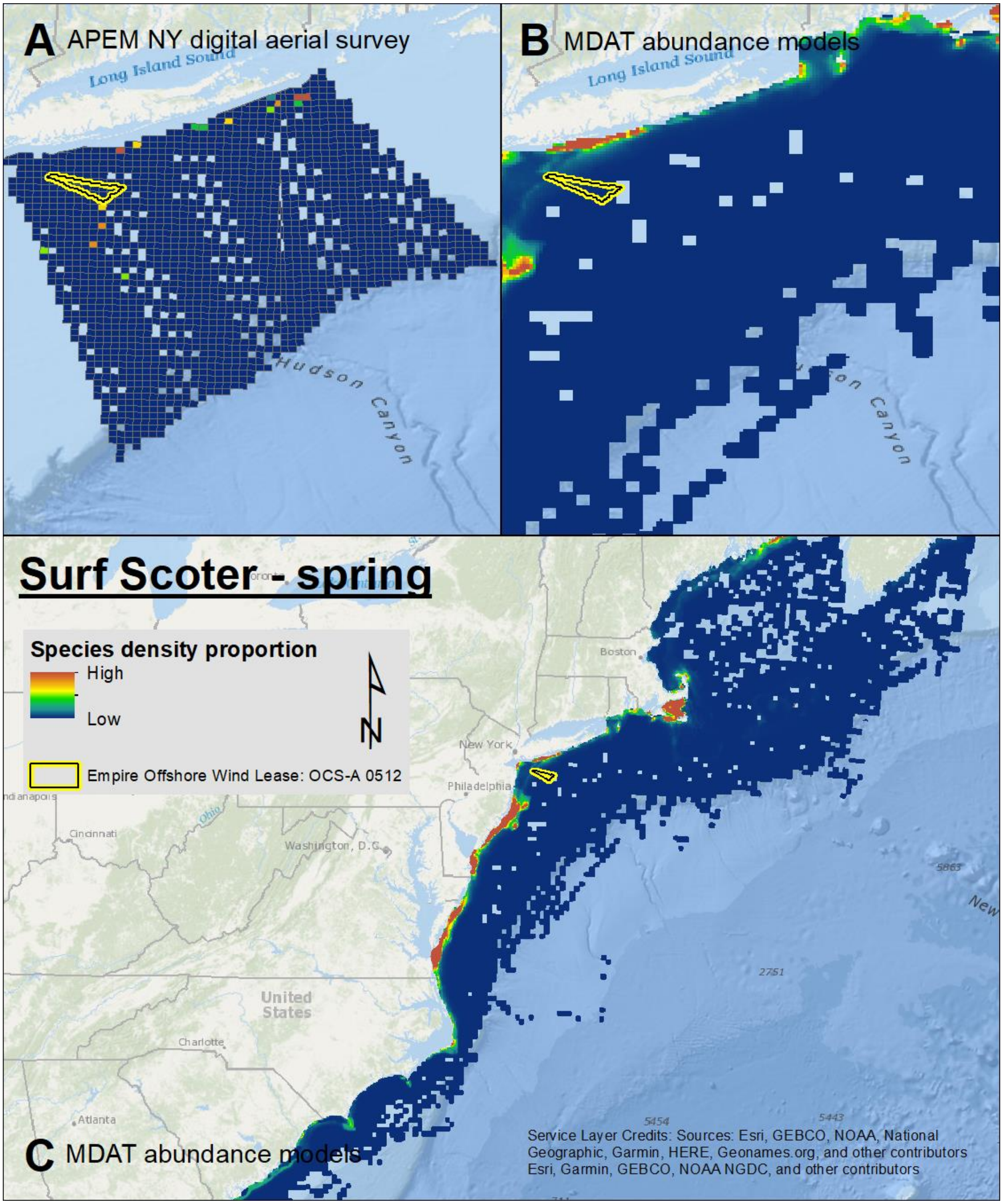

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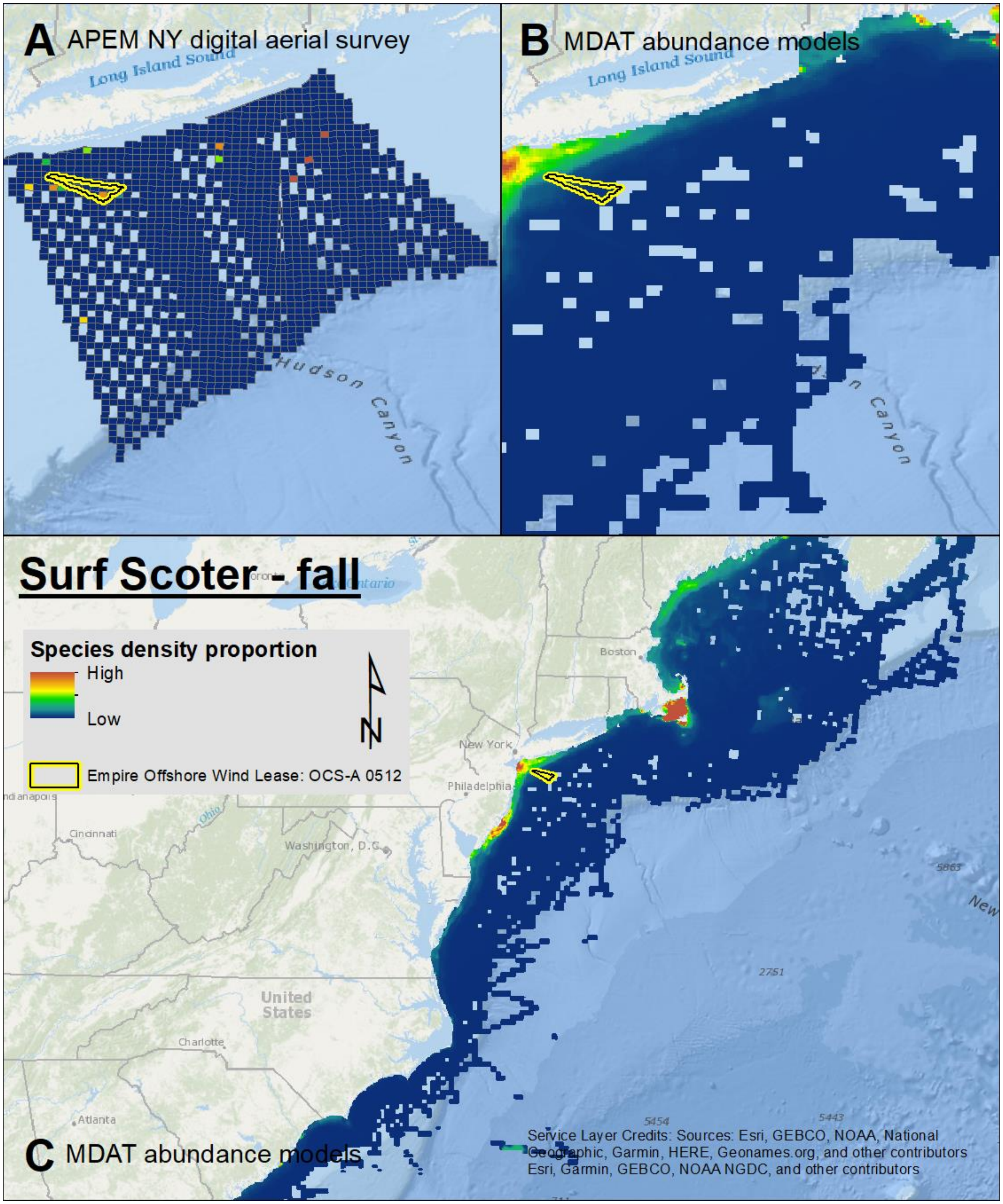

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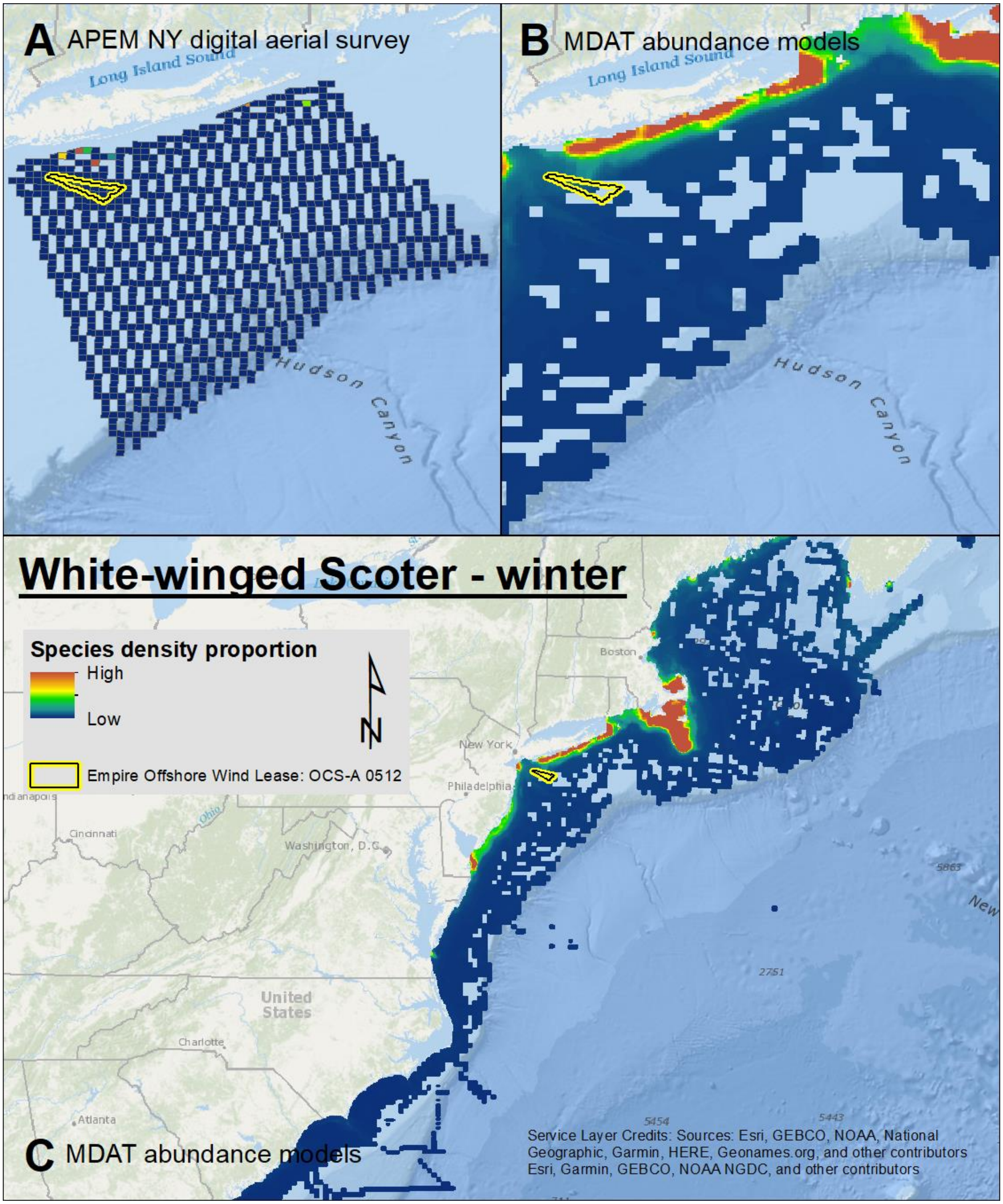

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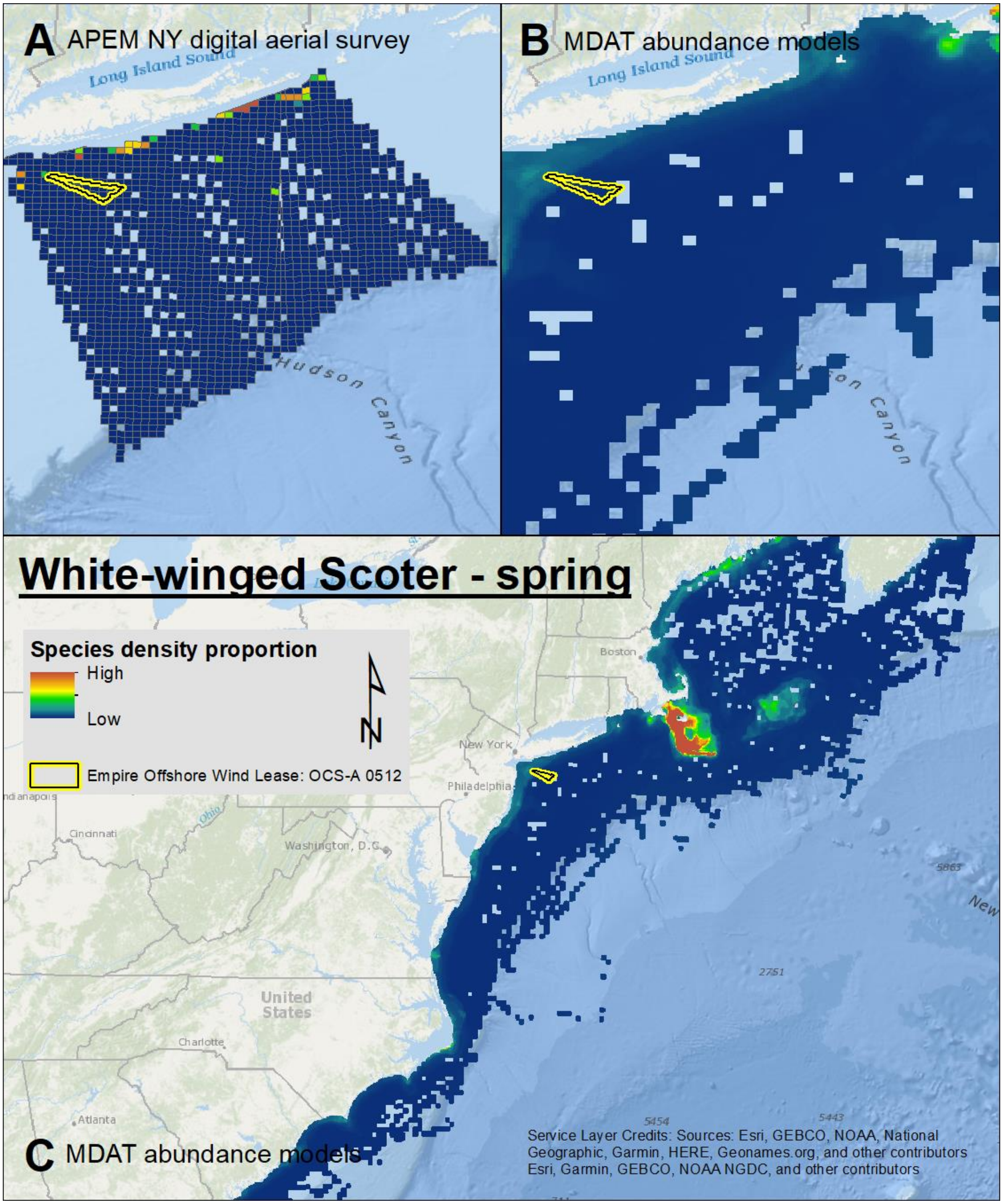

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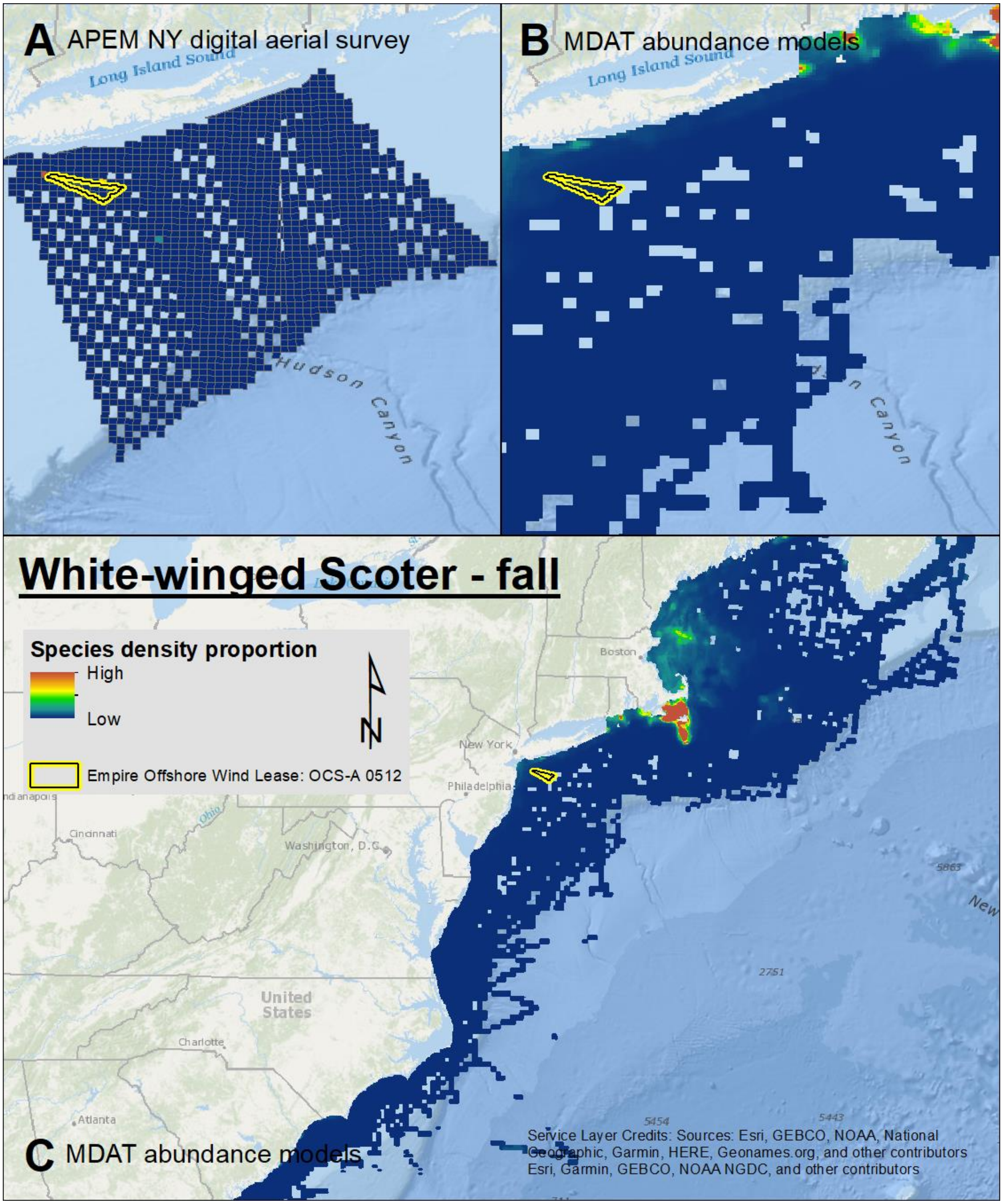

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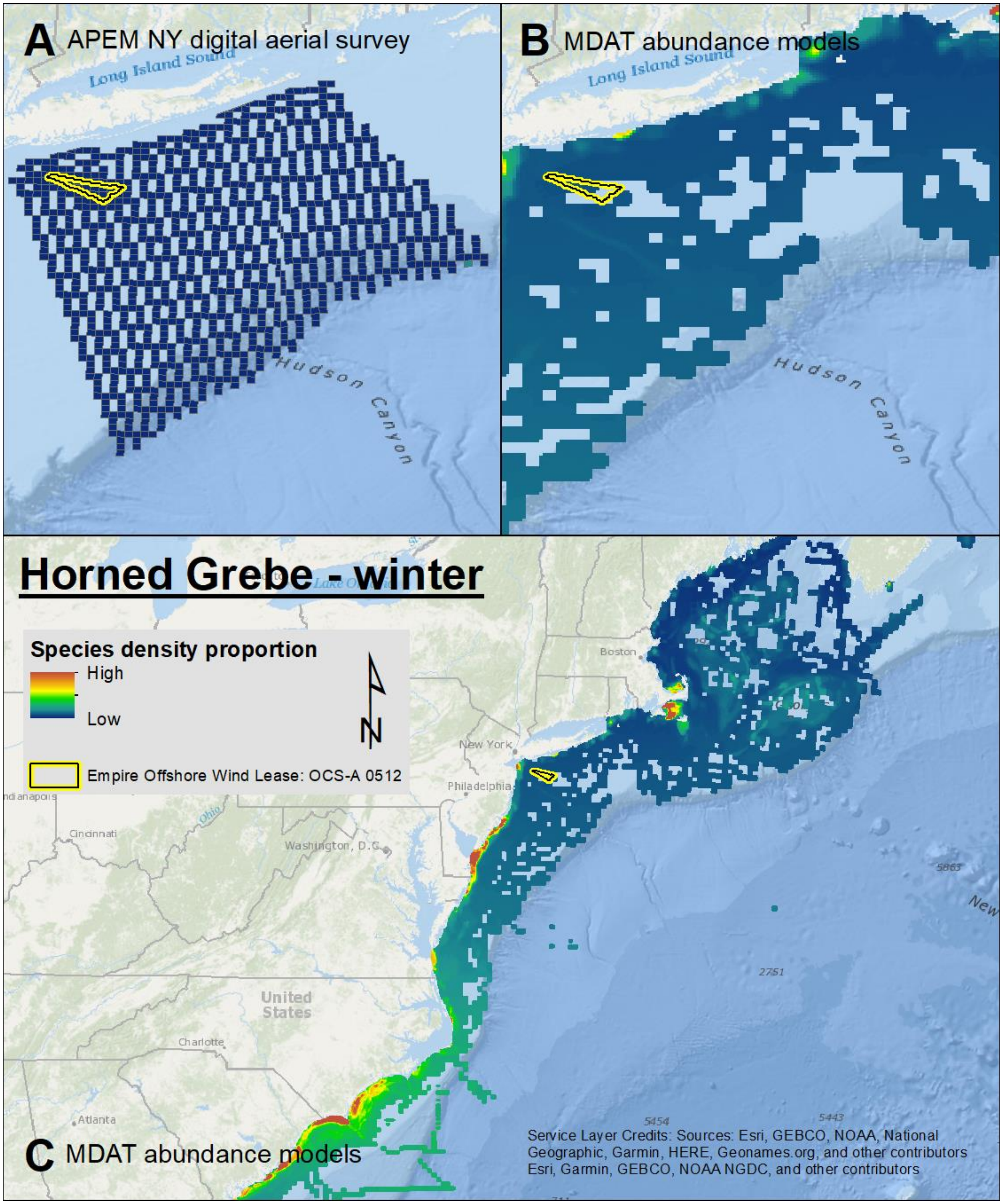

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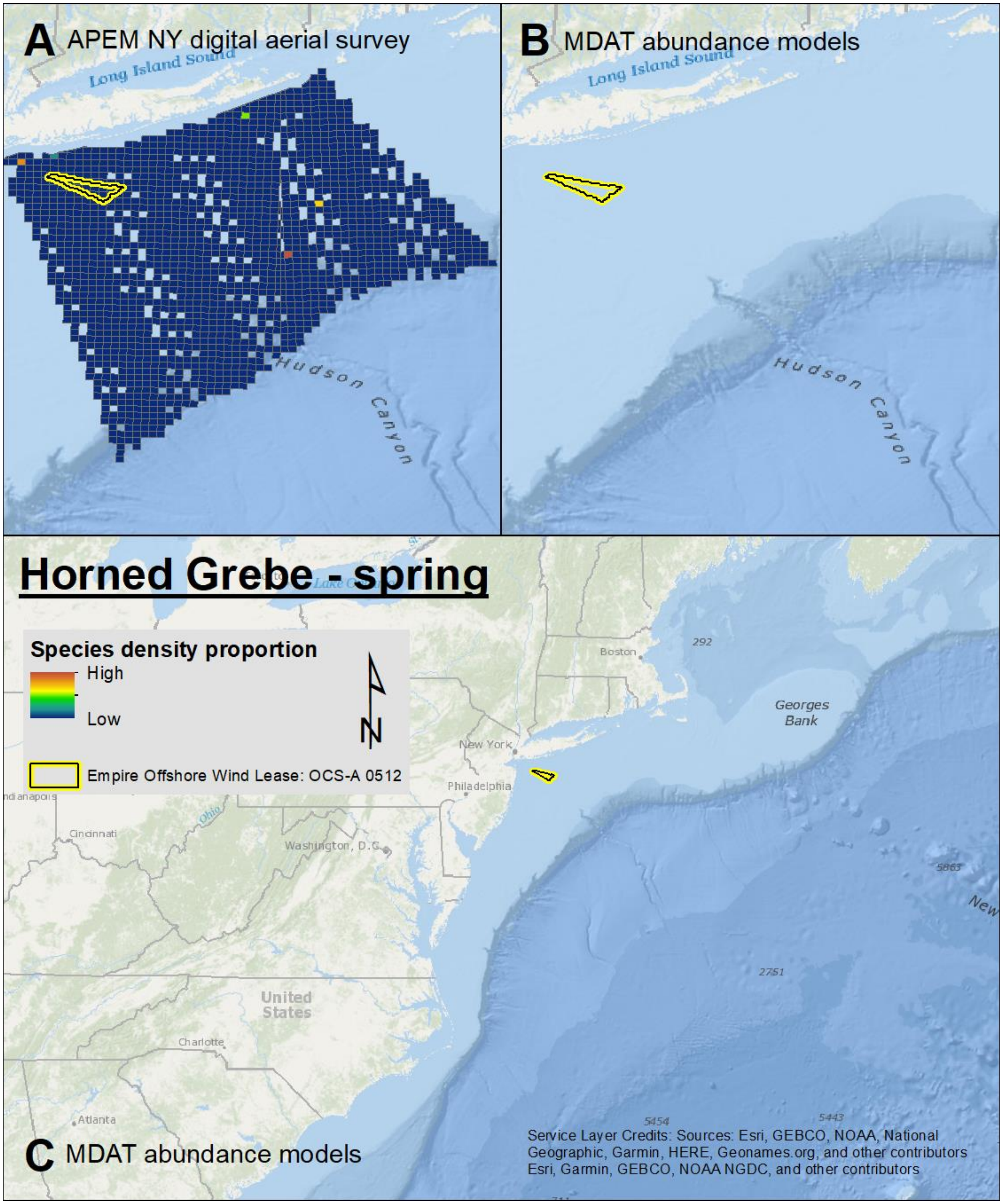

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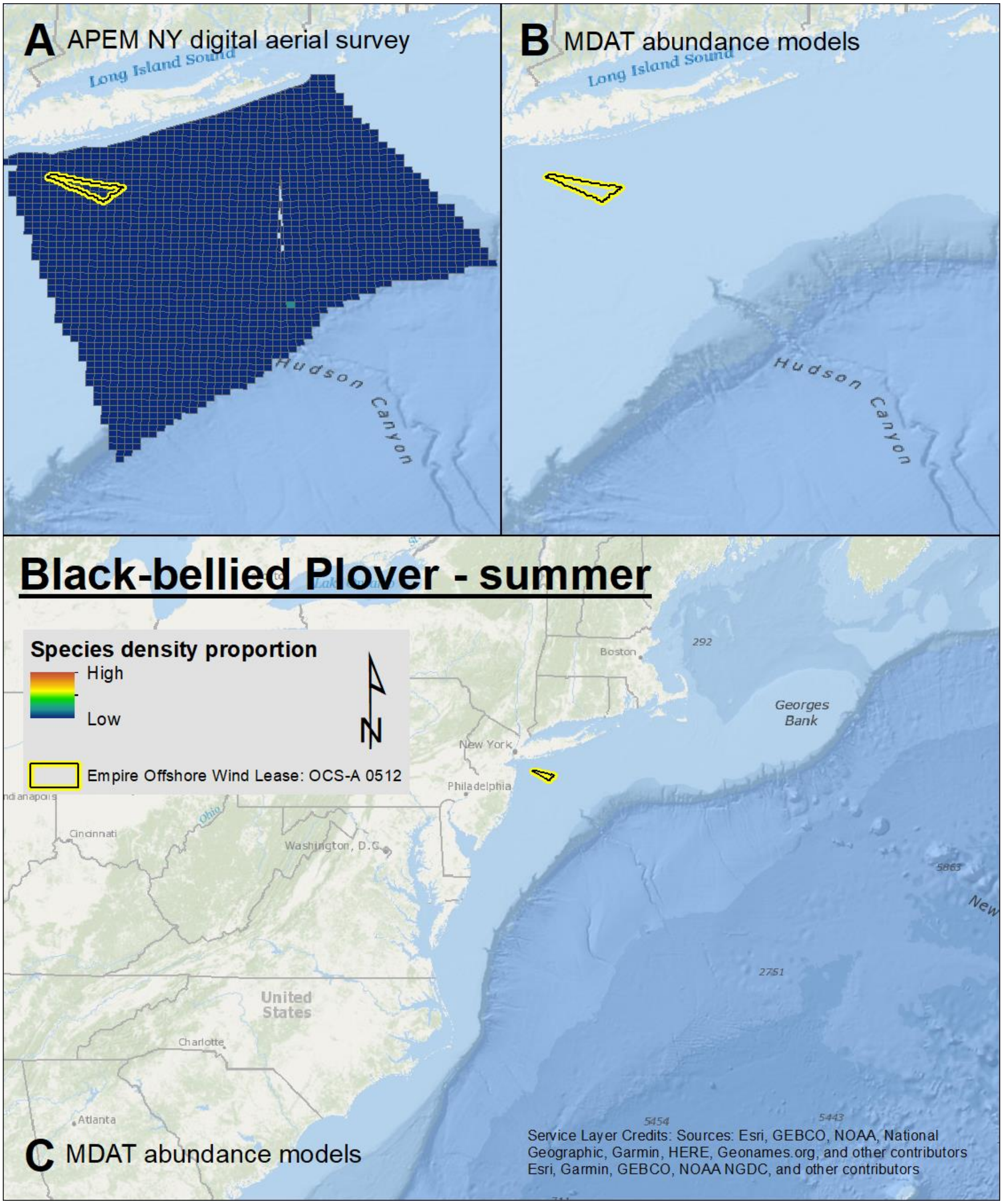

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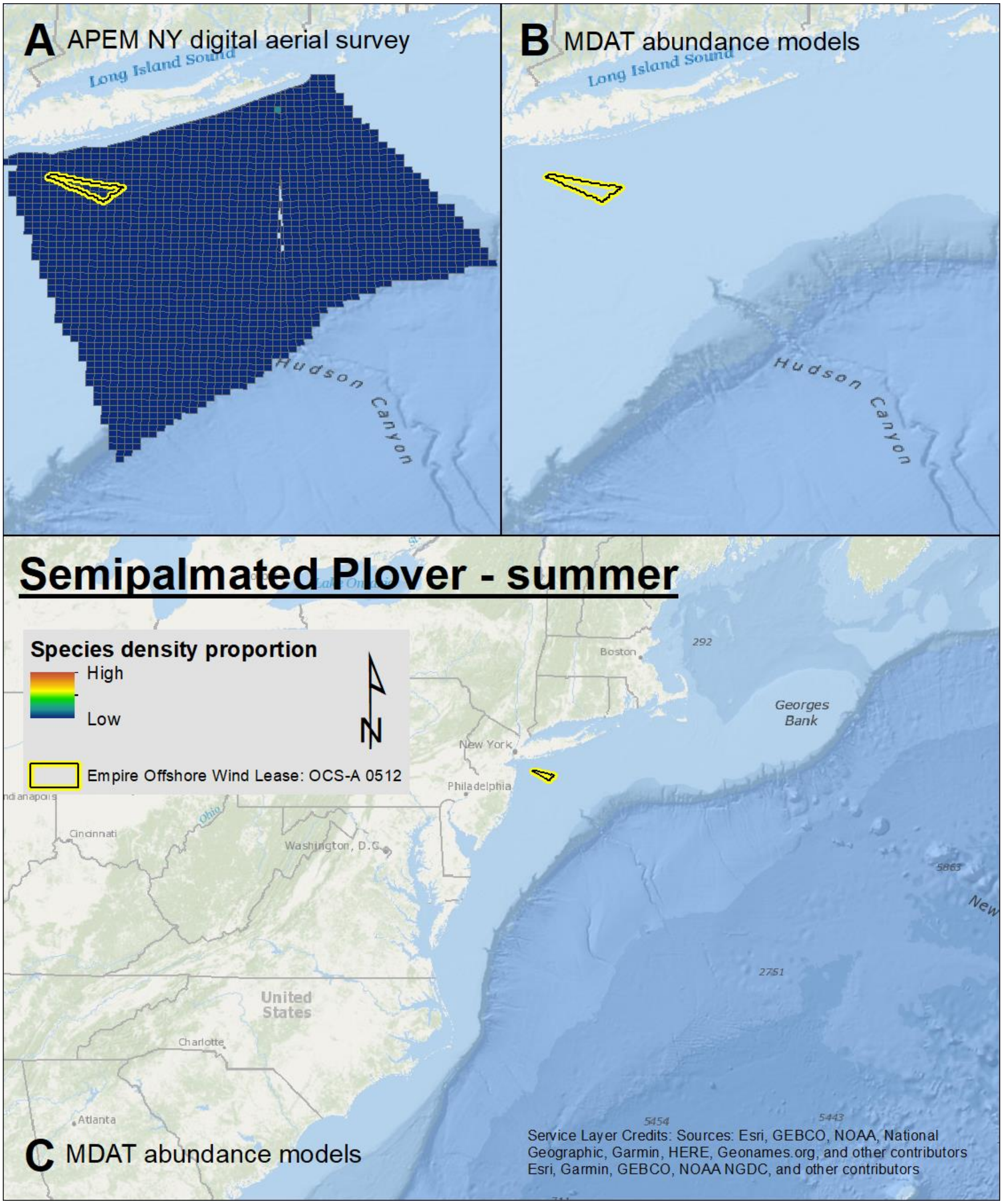

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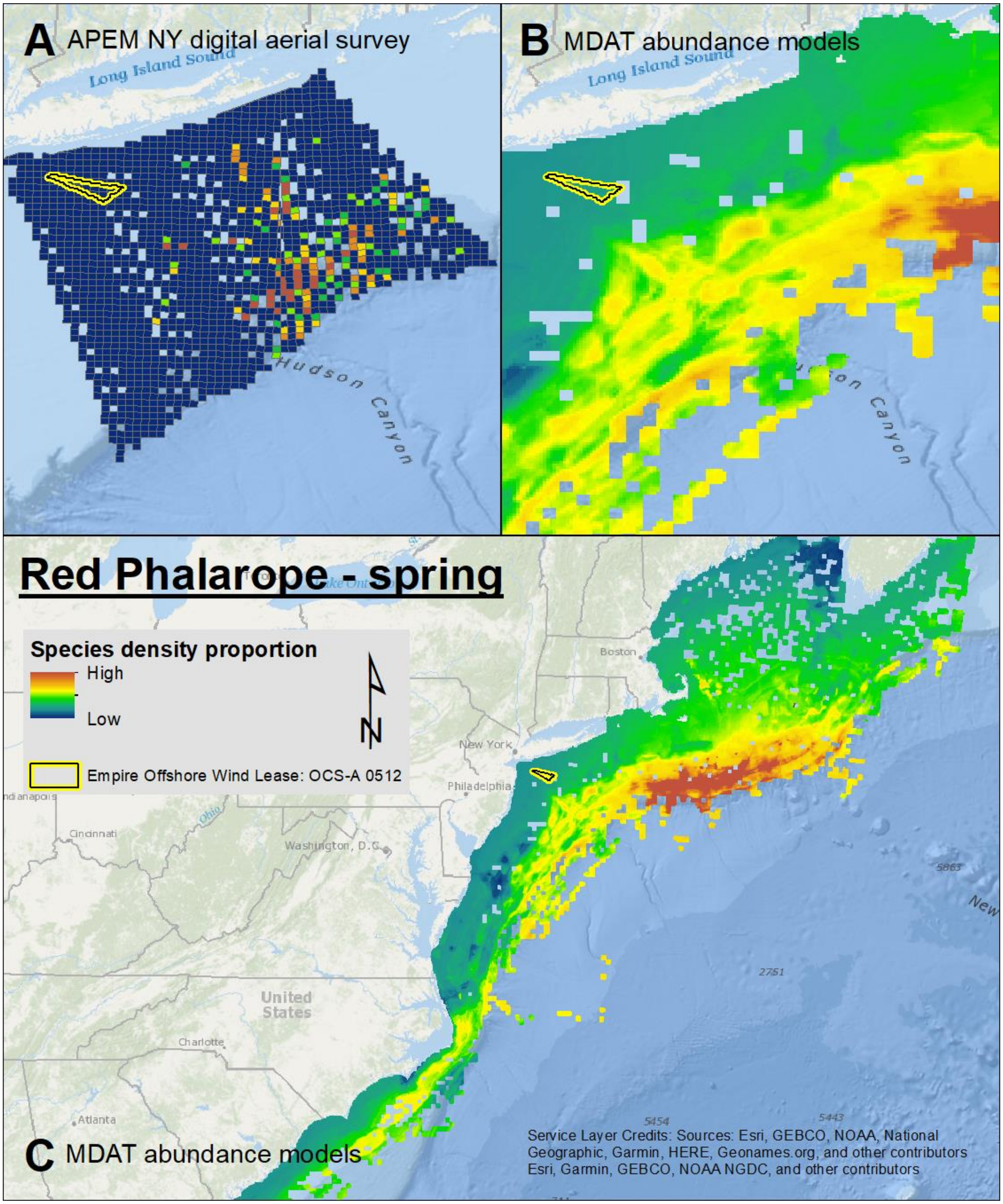

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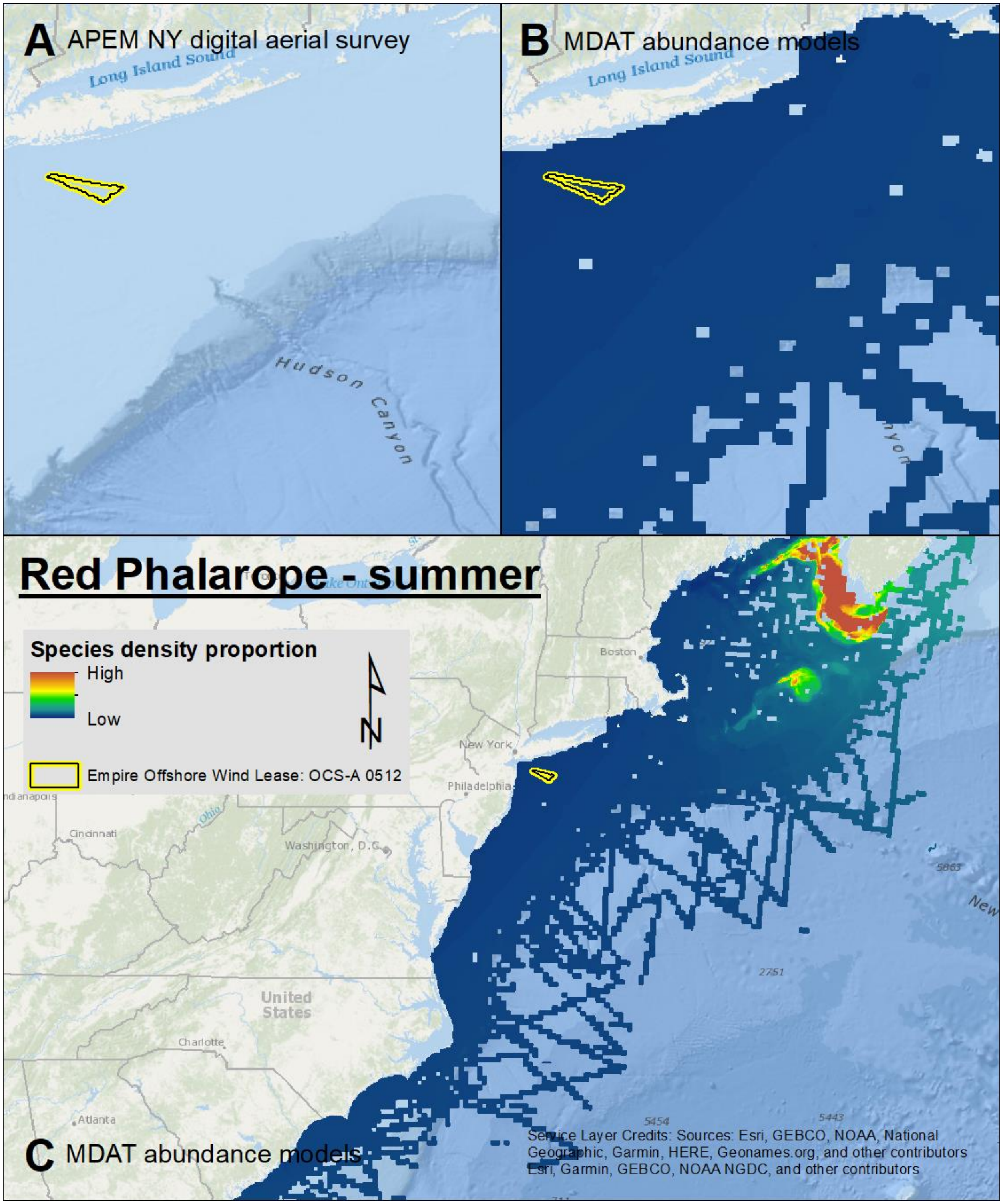

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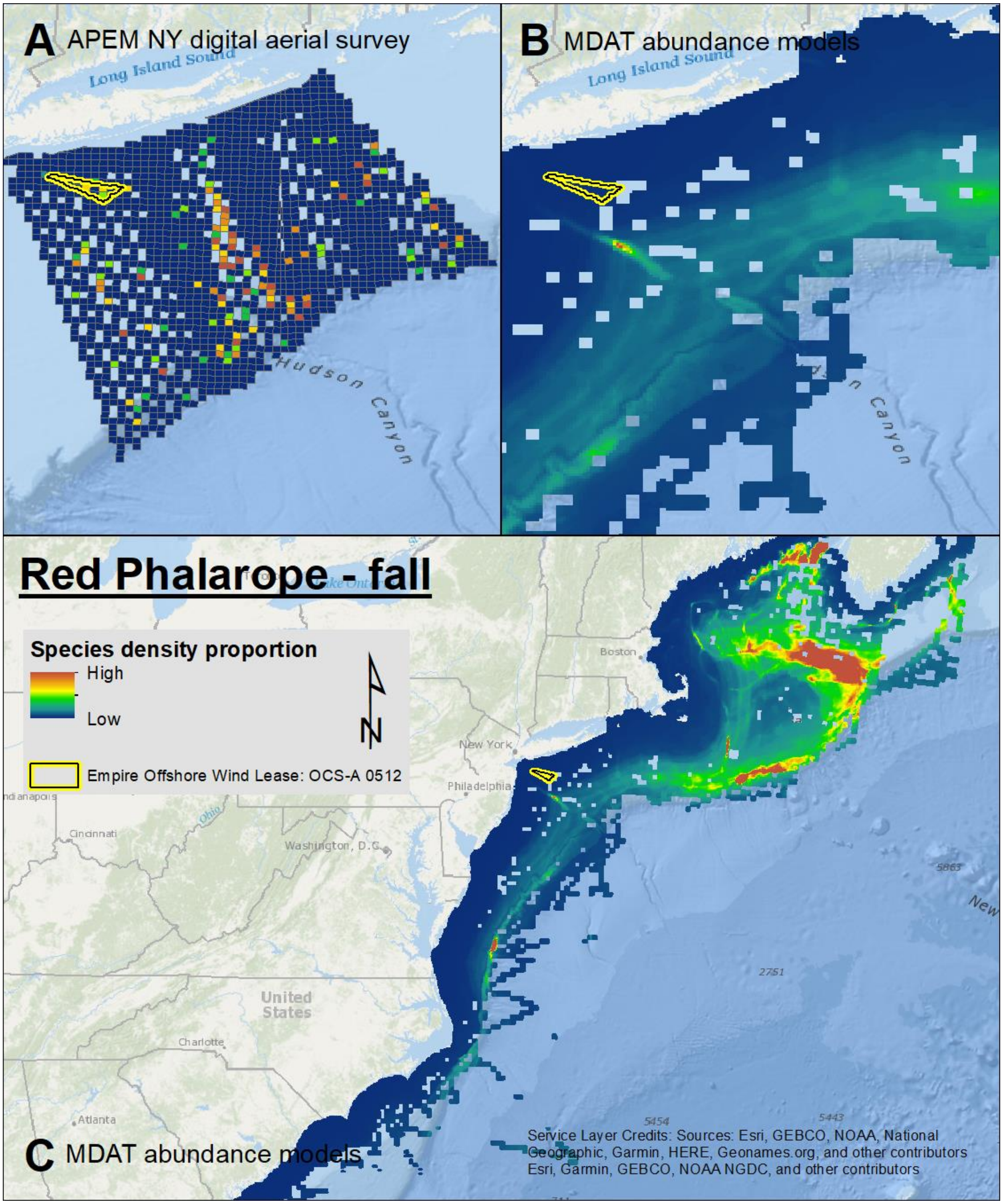

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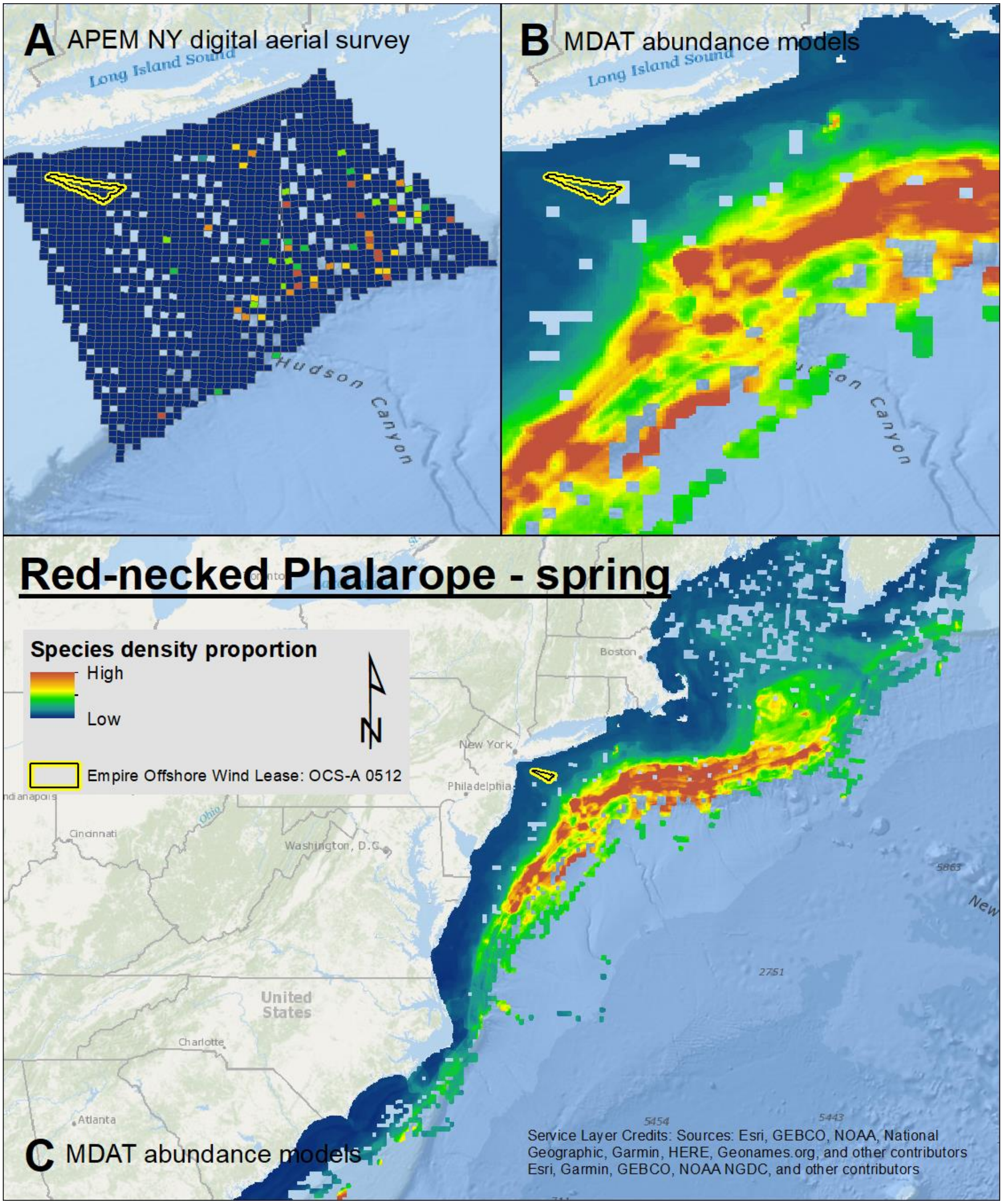

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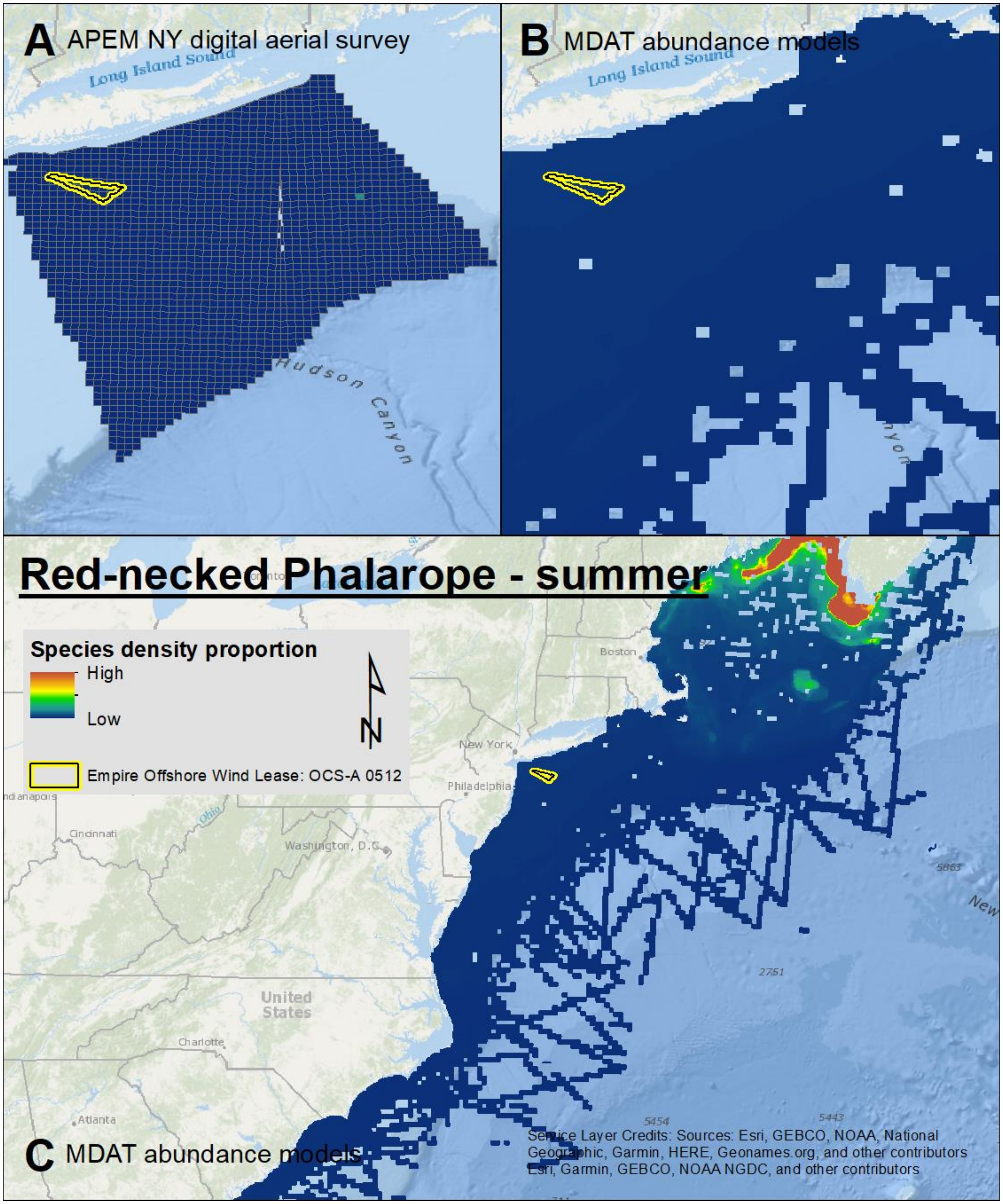

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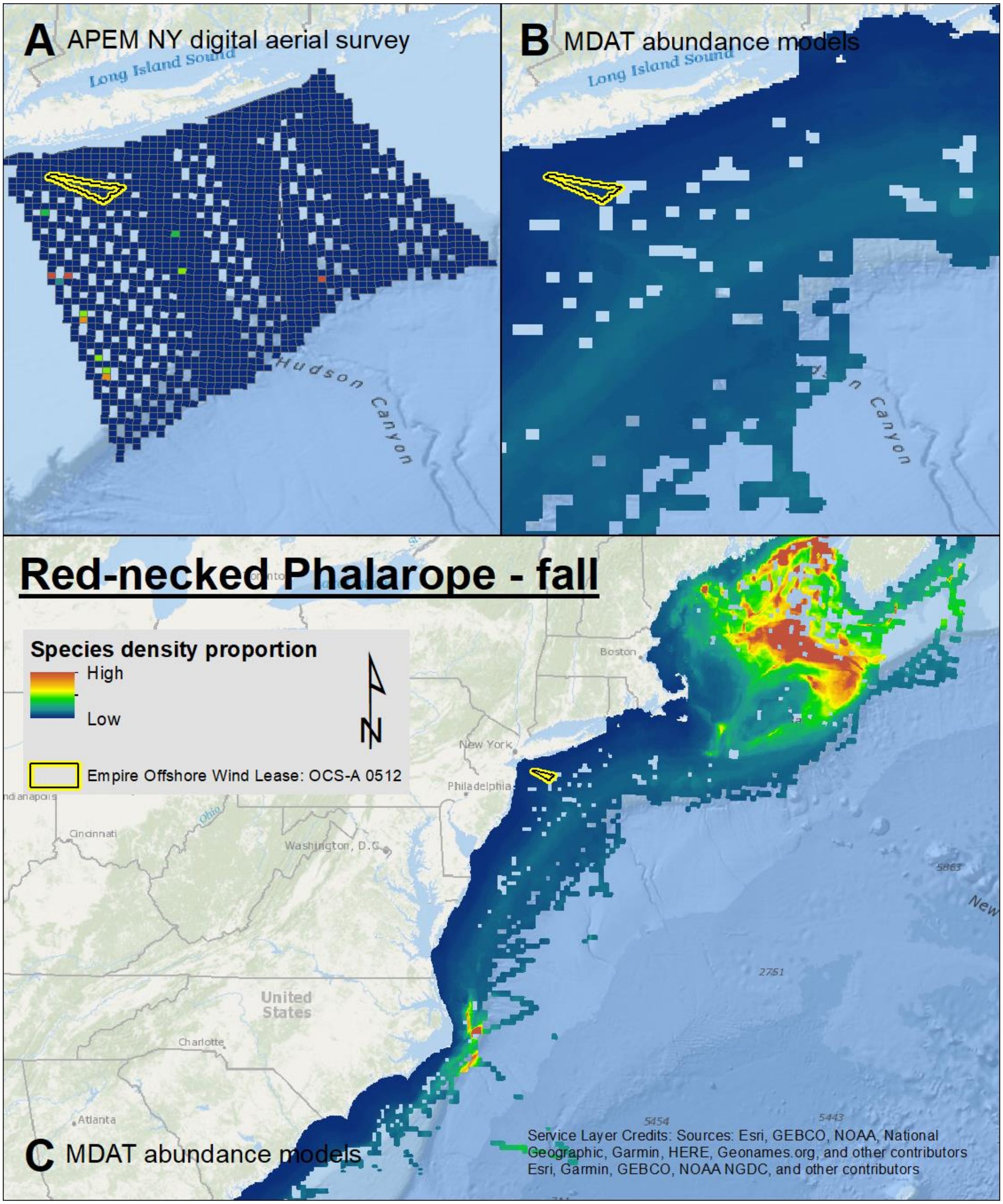

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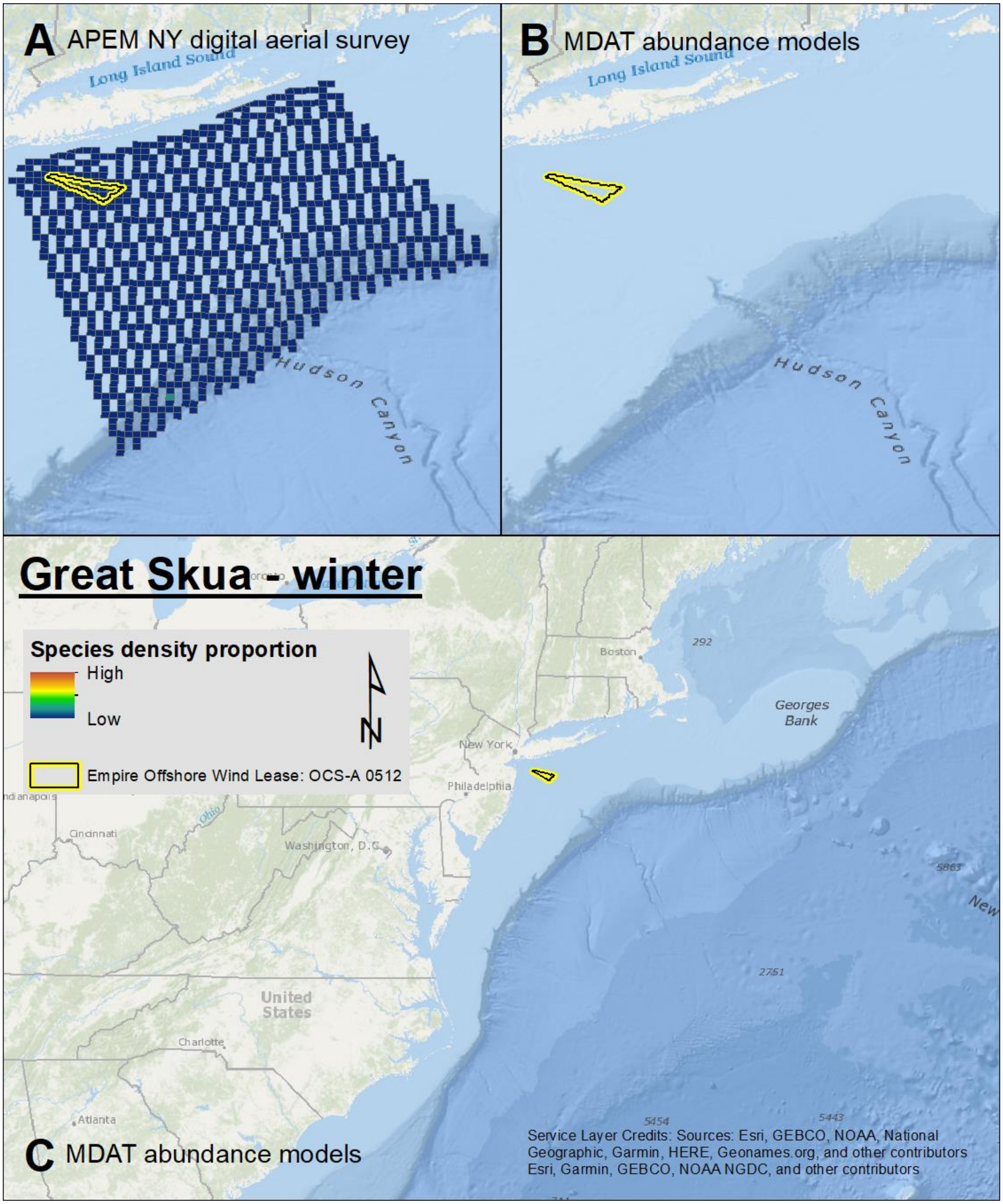
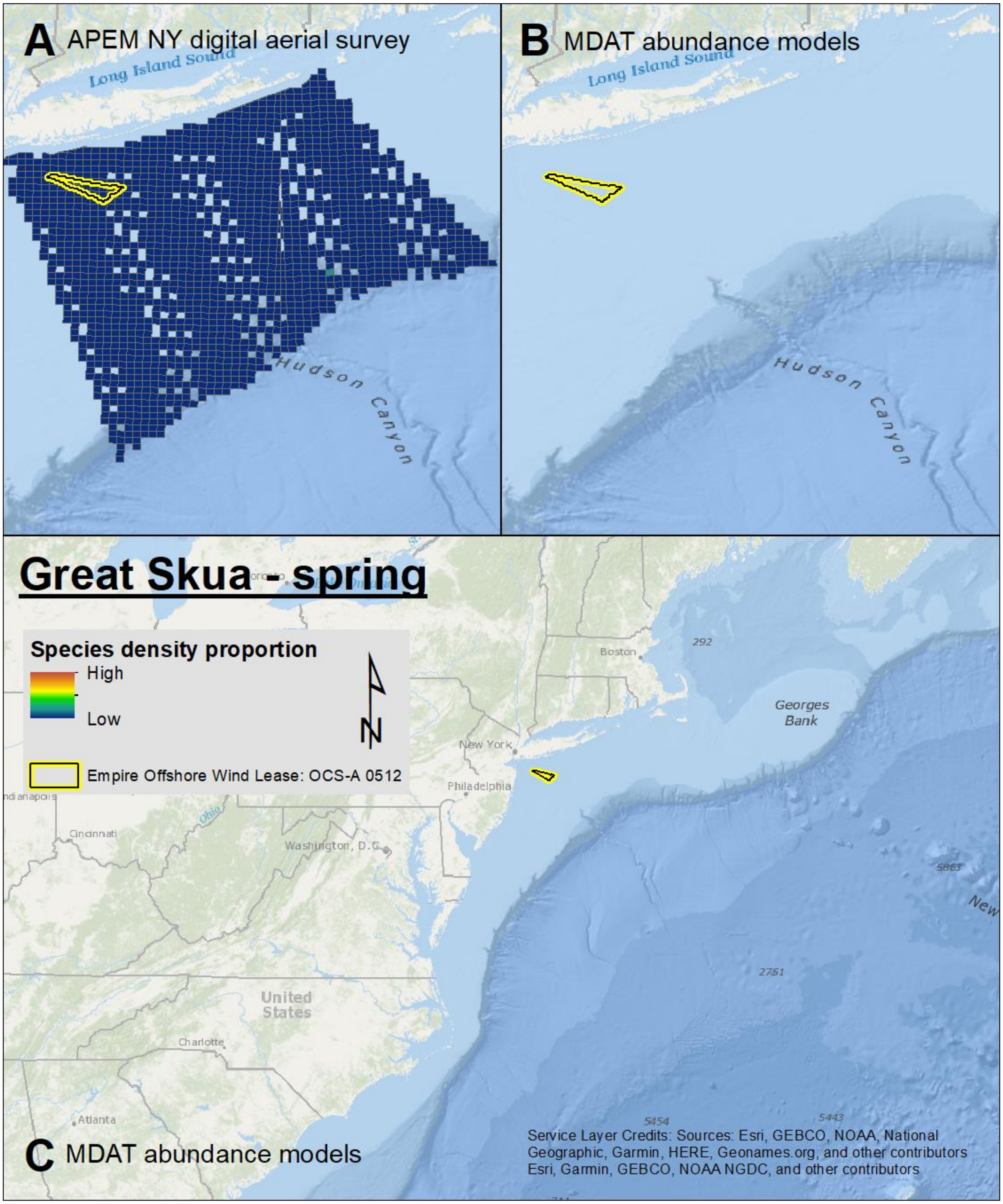
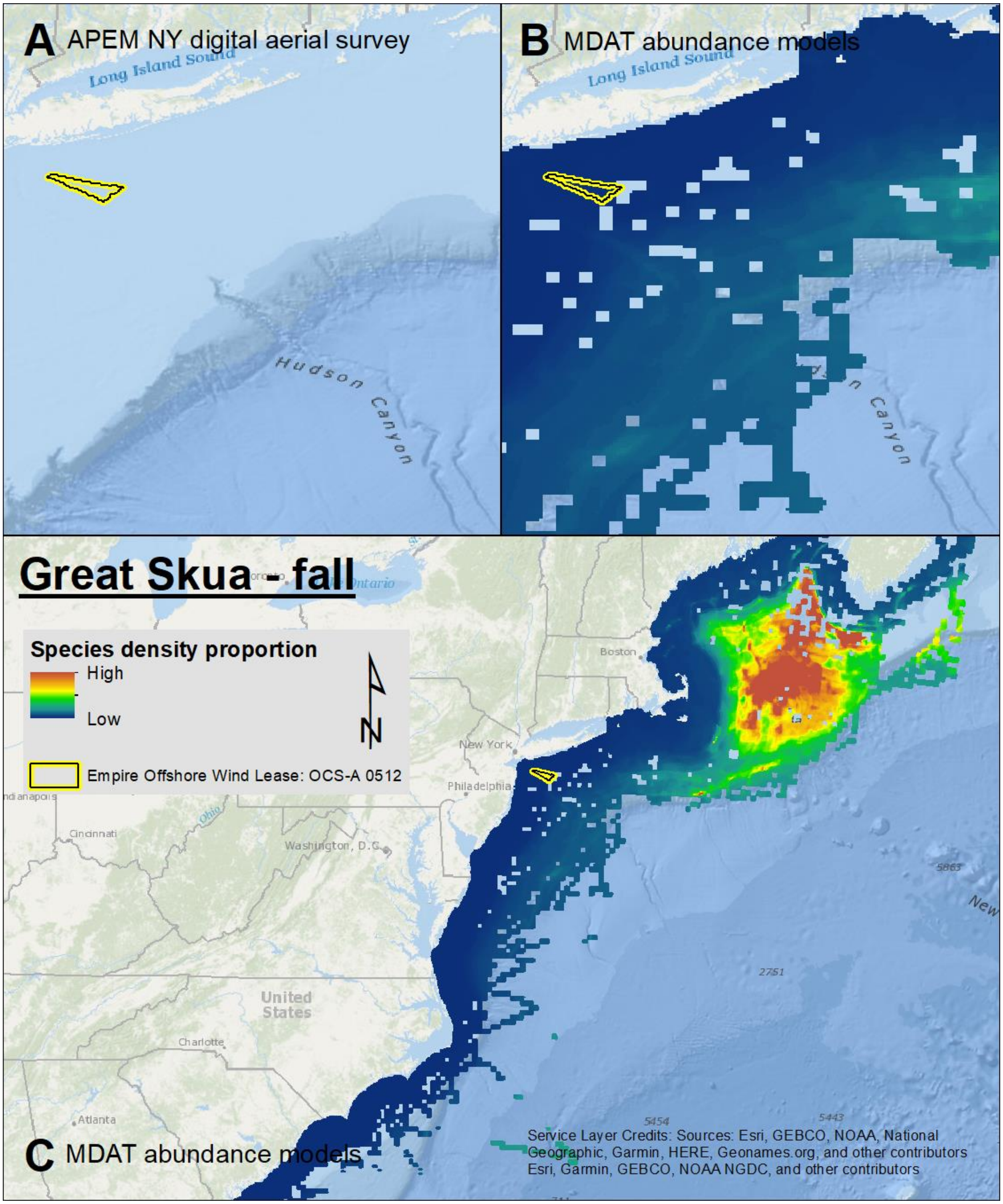


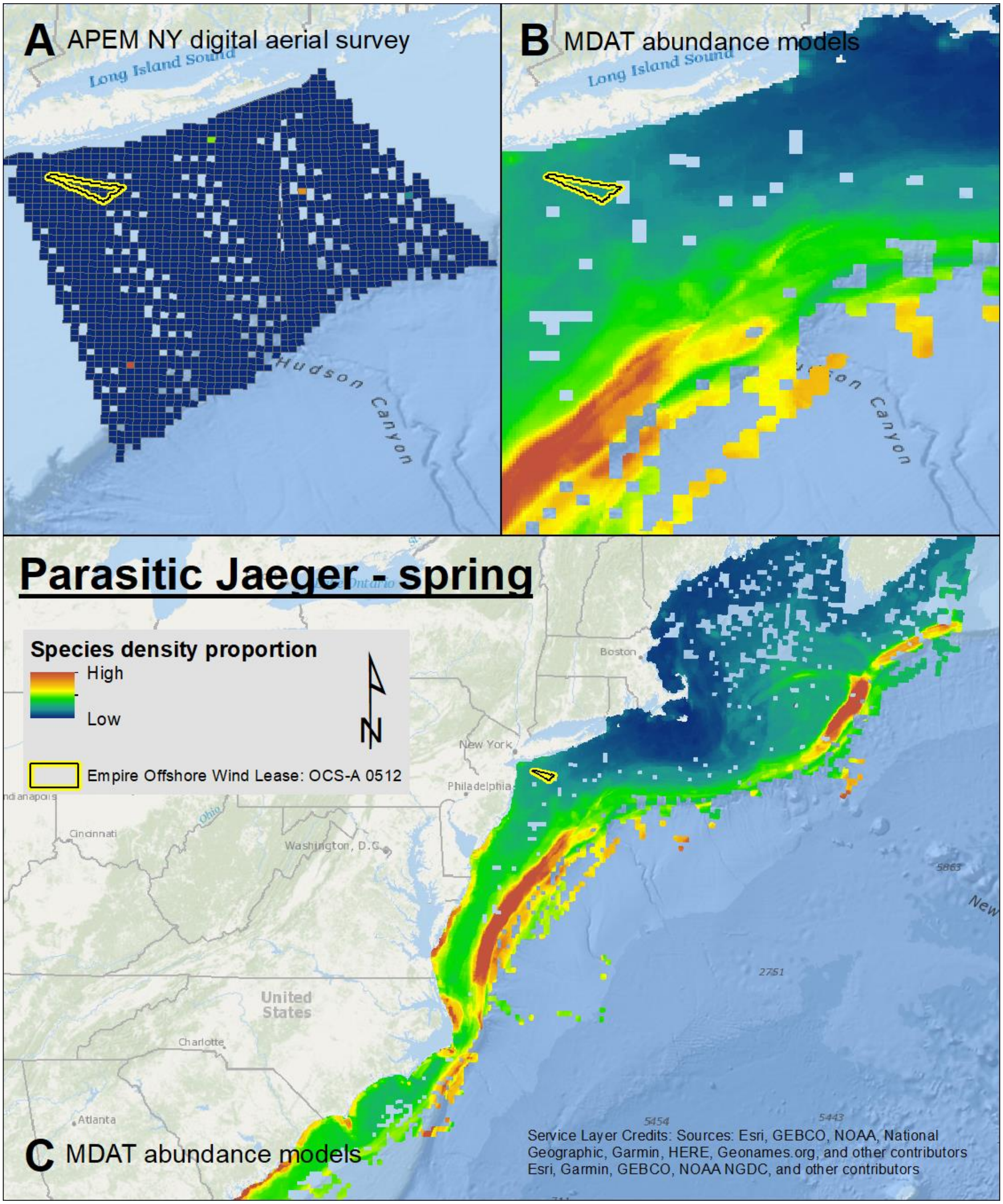
Map 31. Winter Great Skua density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



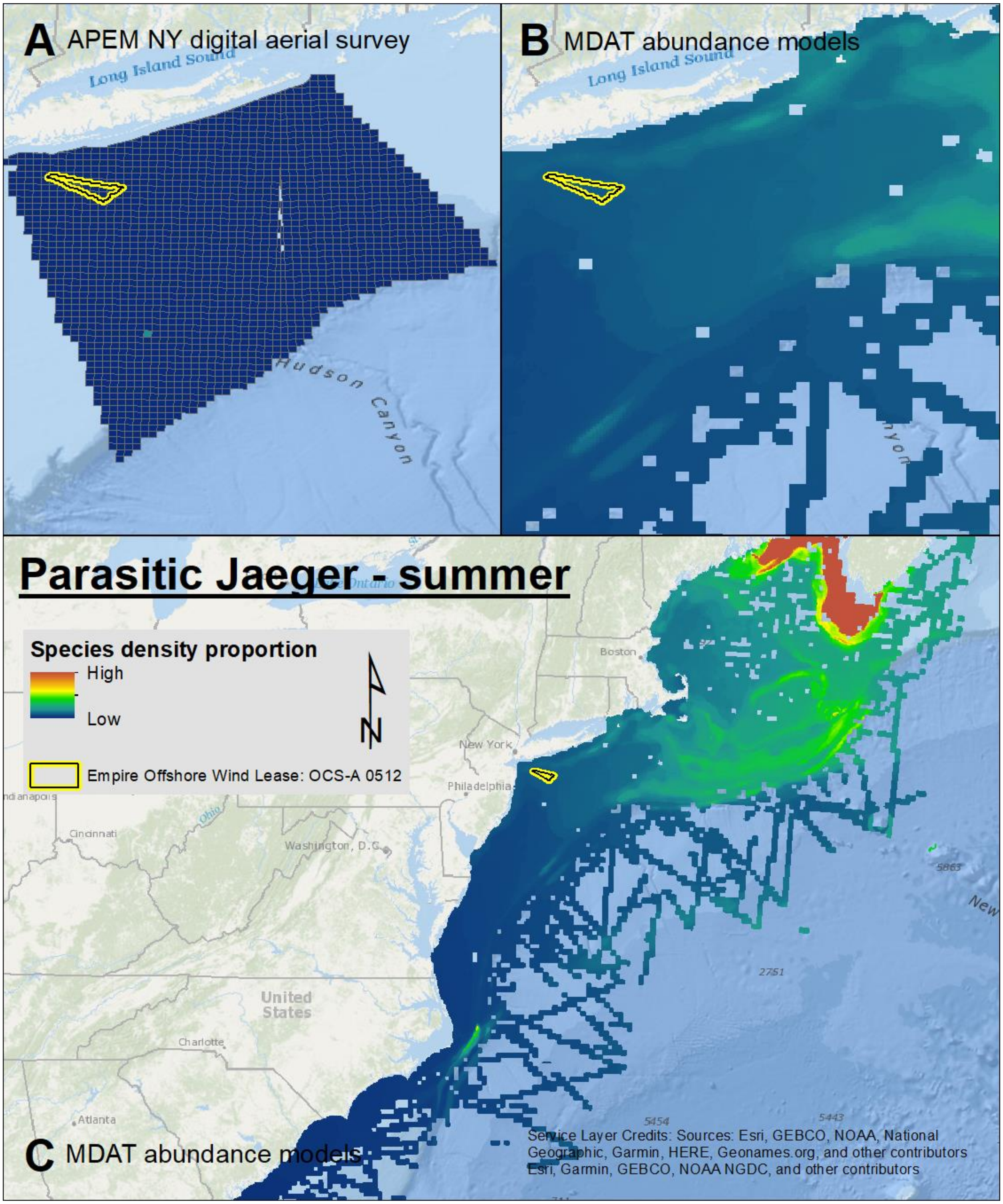
Map 32. Spring Great Skua density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



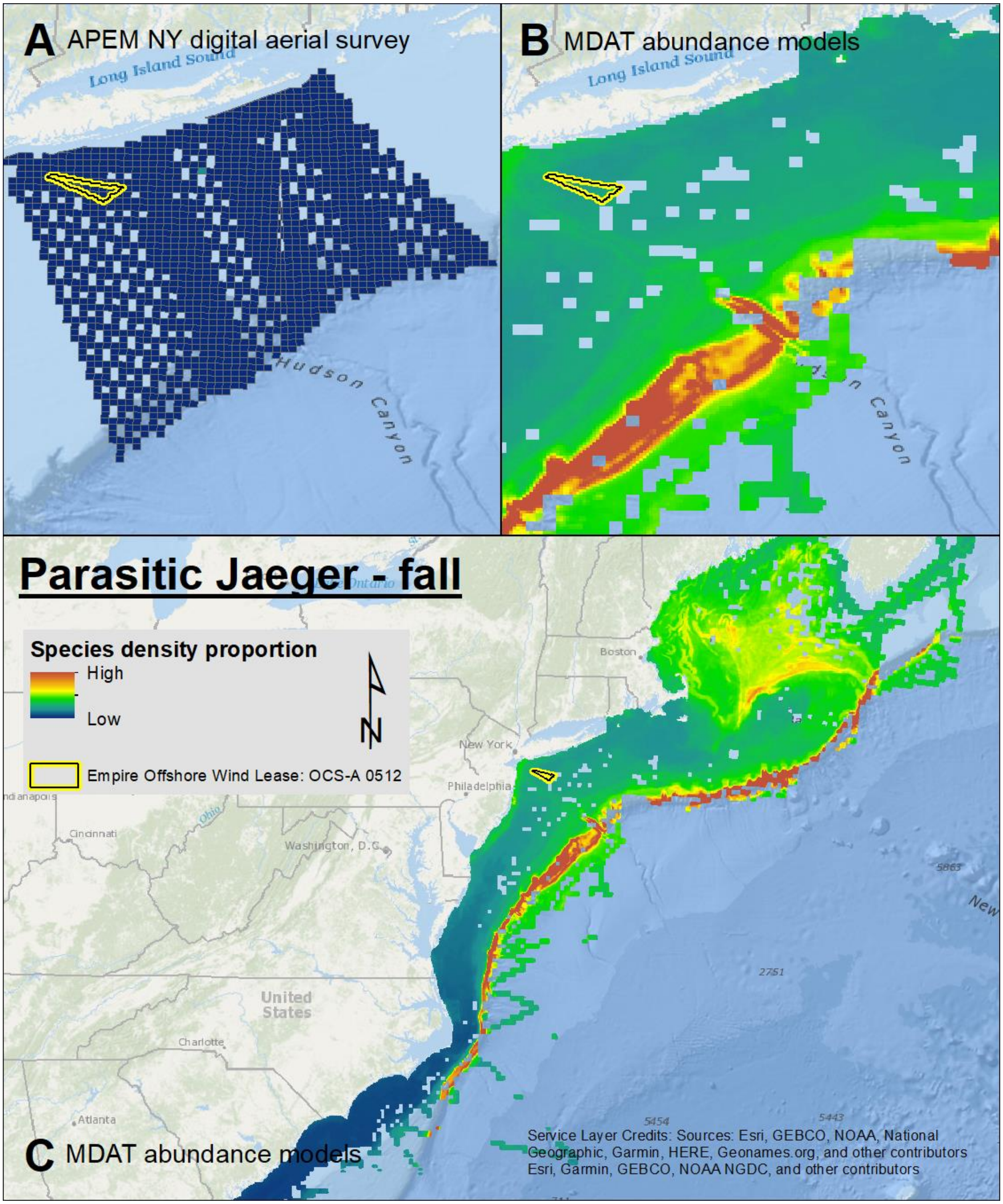
Map 33. Fall Great Skua density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



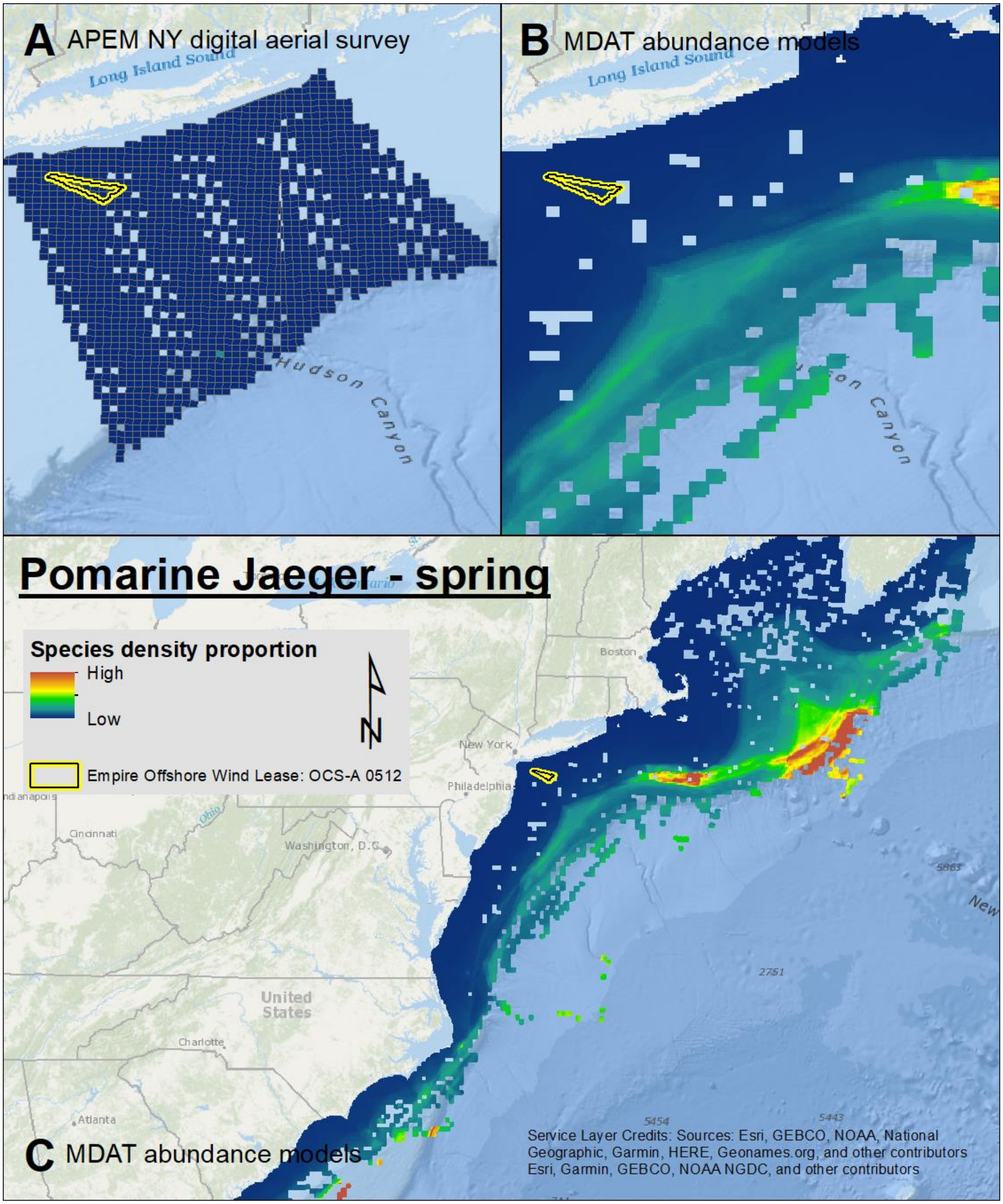
Map 34. Spring Parasitic Jaeger density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



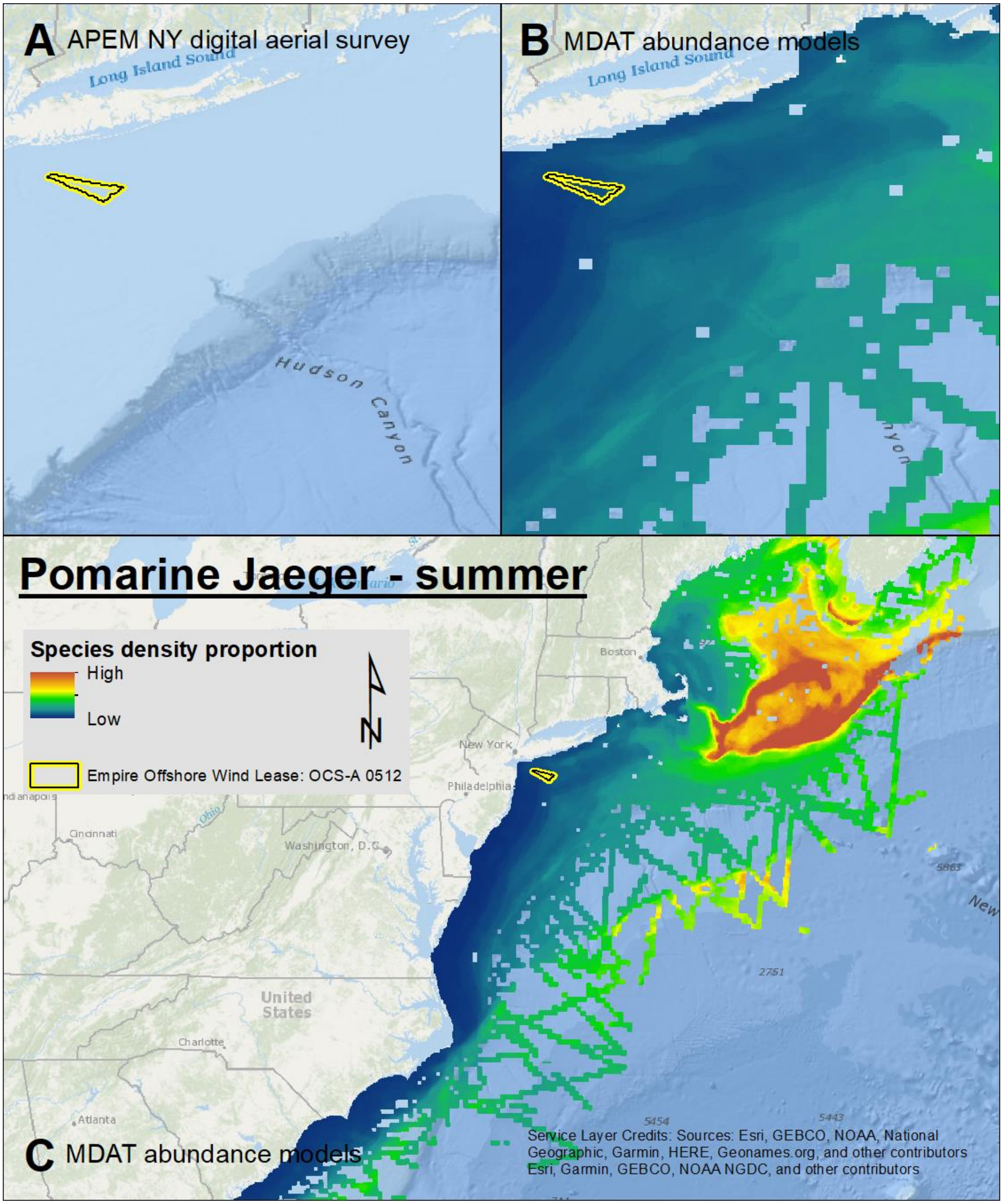
Map 35. Summer Parasitic Jaeger density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



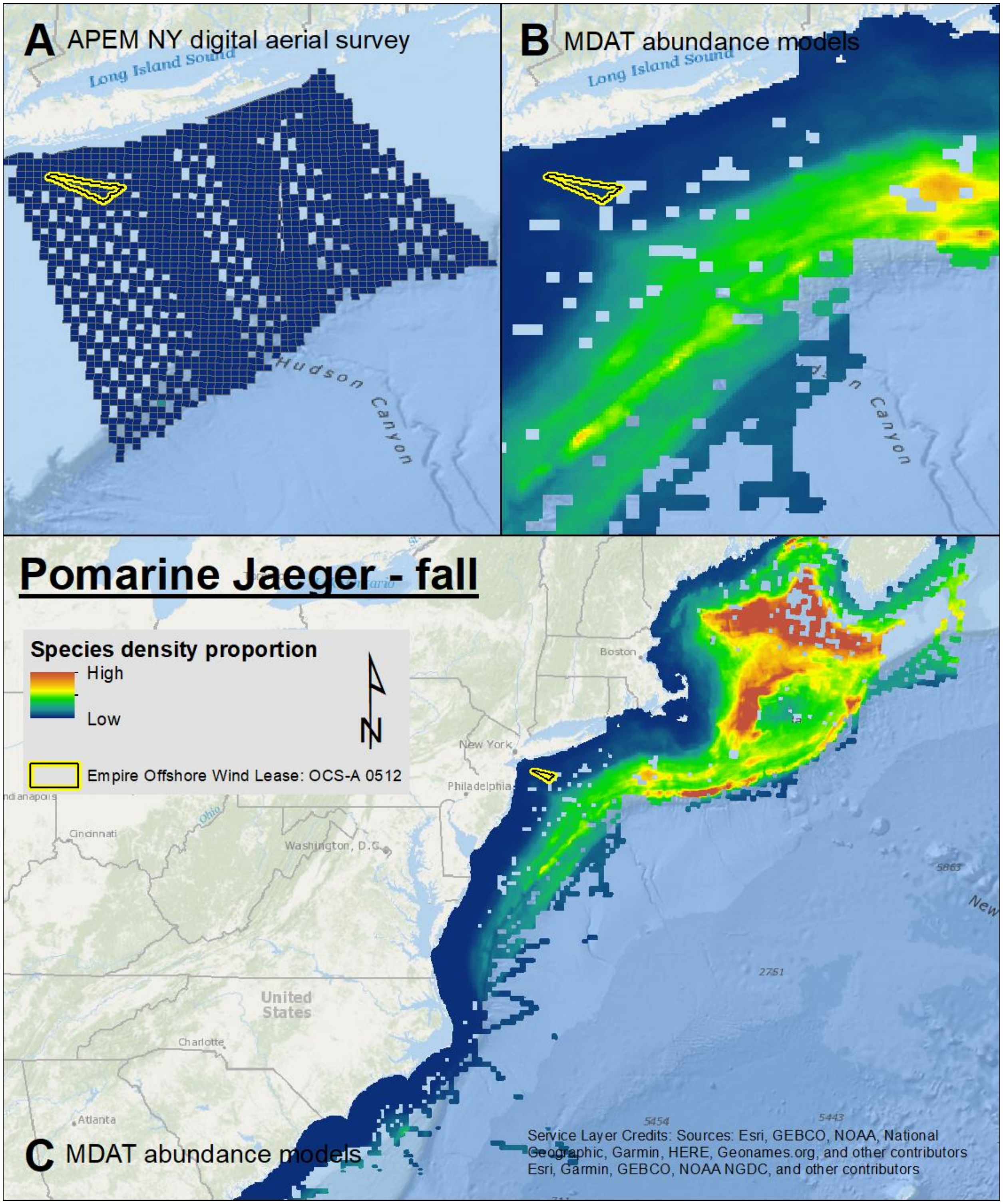
Map 36. Fall Parasitic Jaeger density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



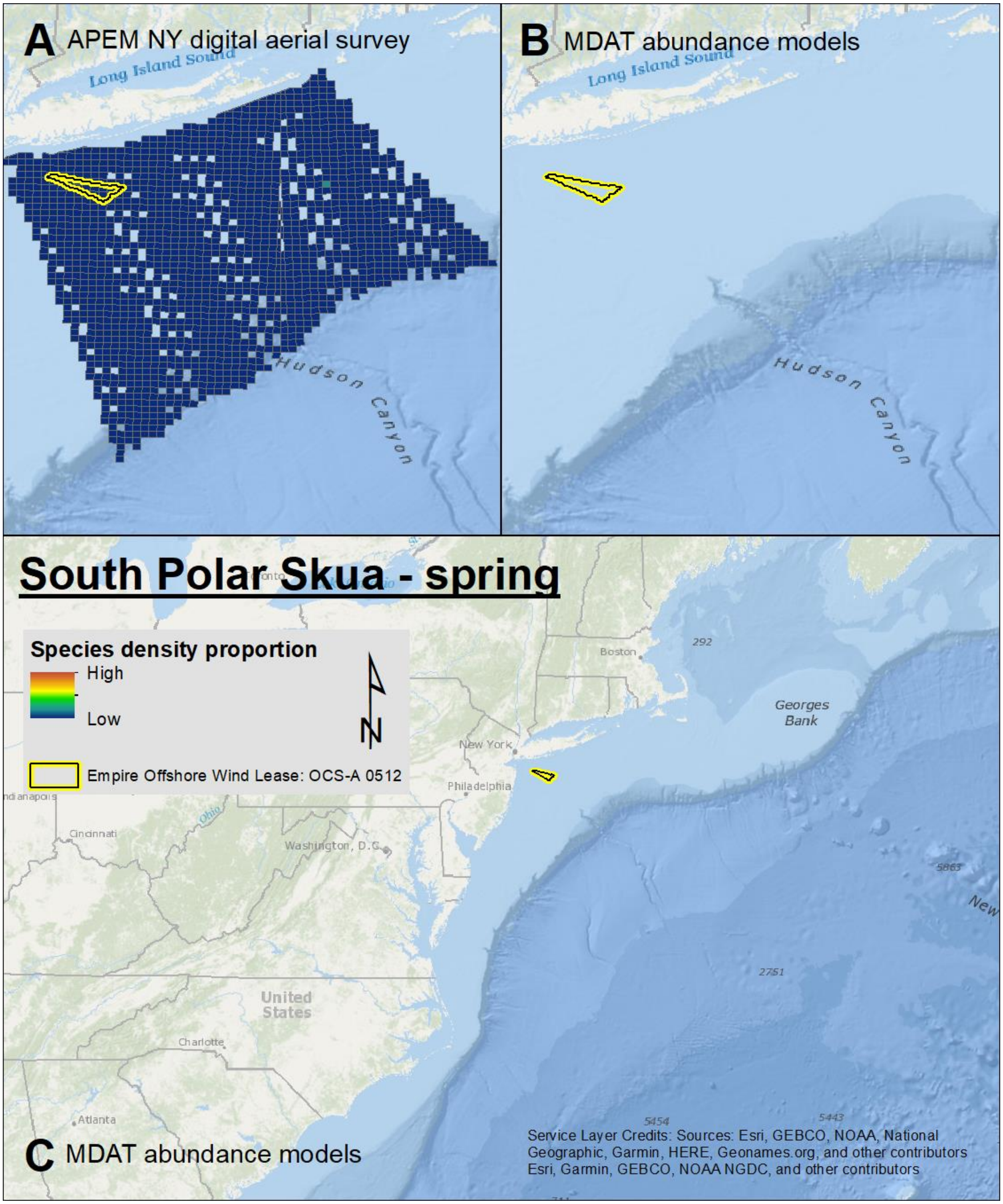
Map 37. Spring Pomarine Jaeger density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



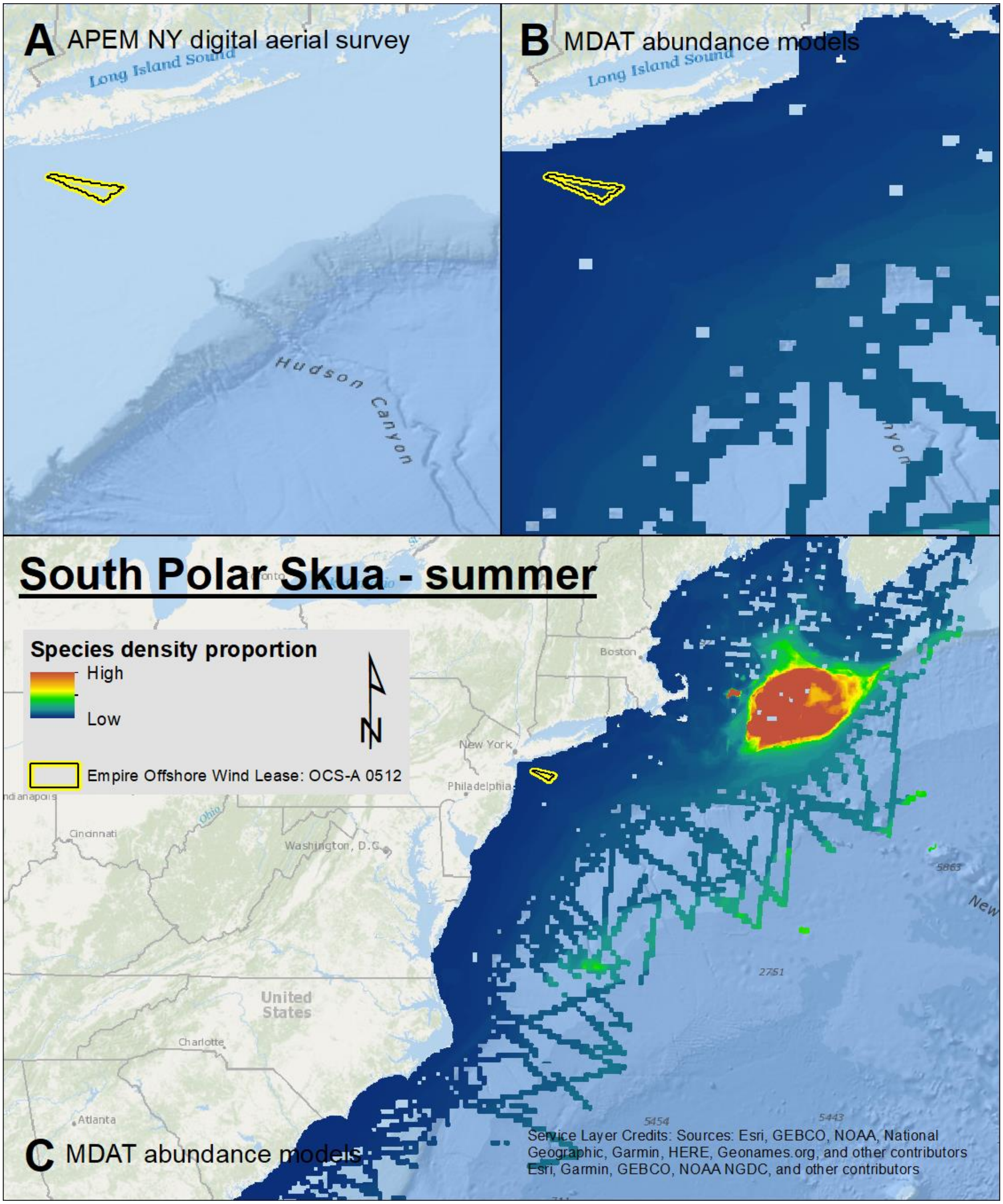
Map 38. Summer Pomarine Jaeger density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



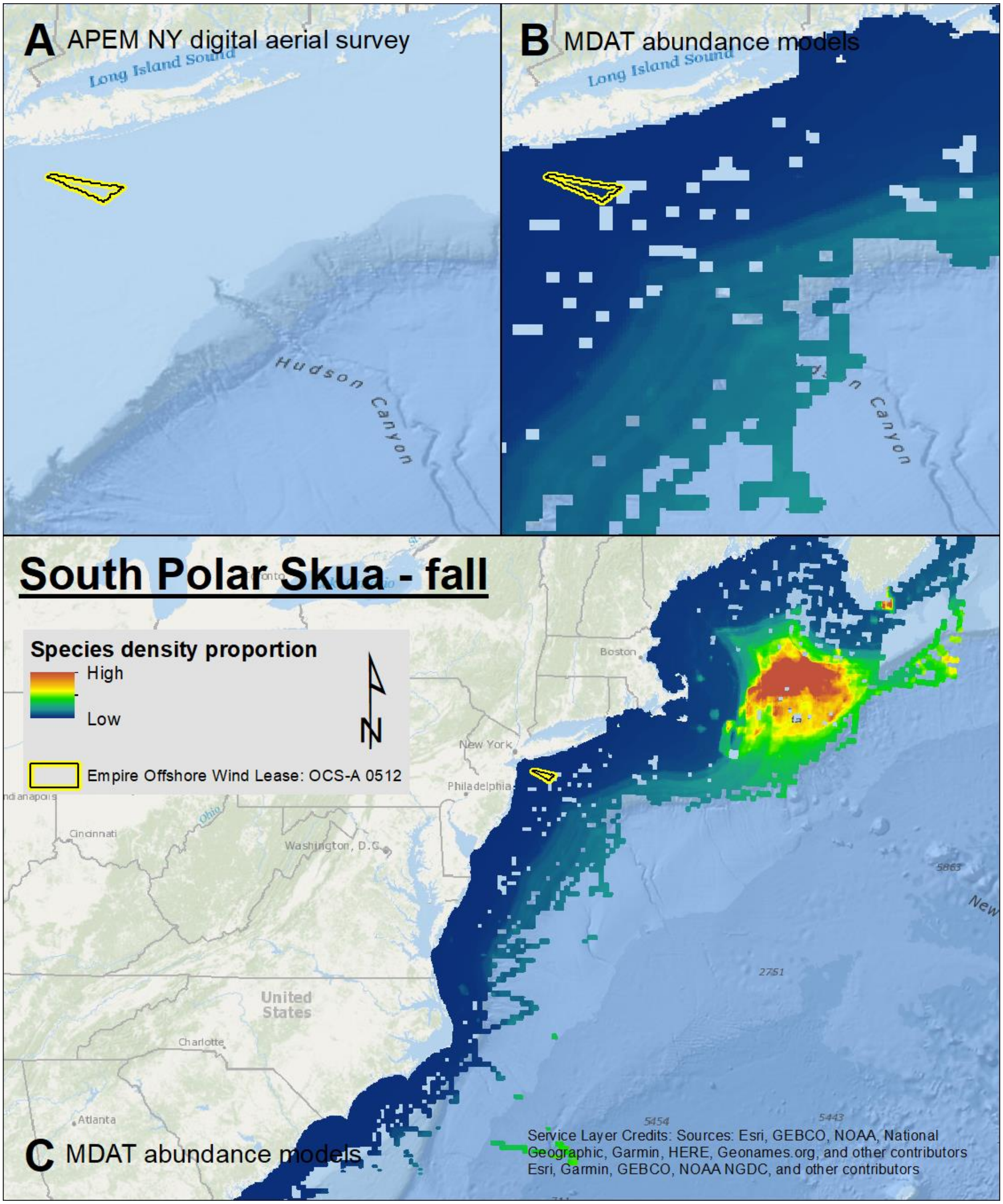
Map 39. Fall Pomarine Jaeger density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



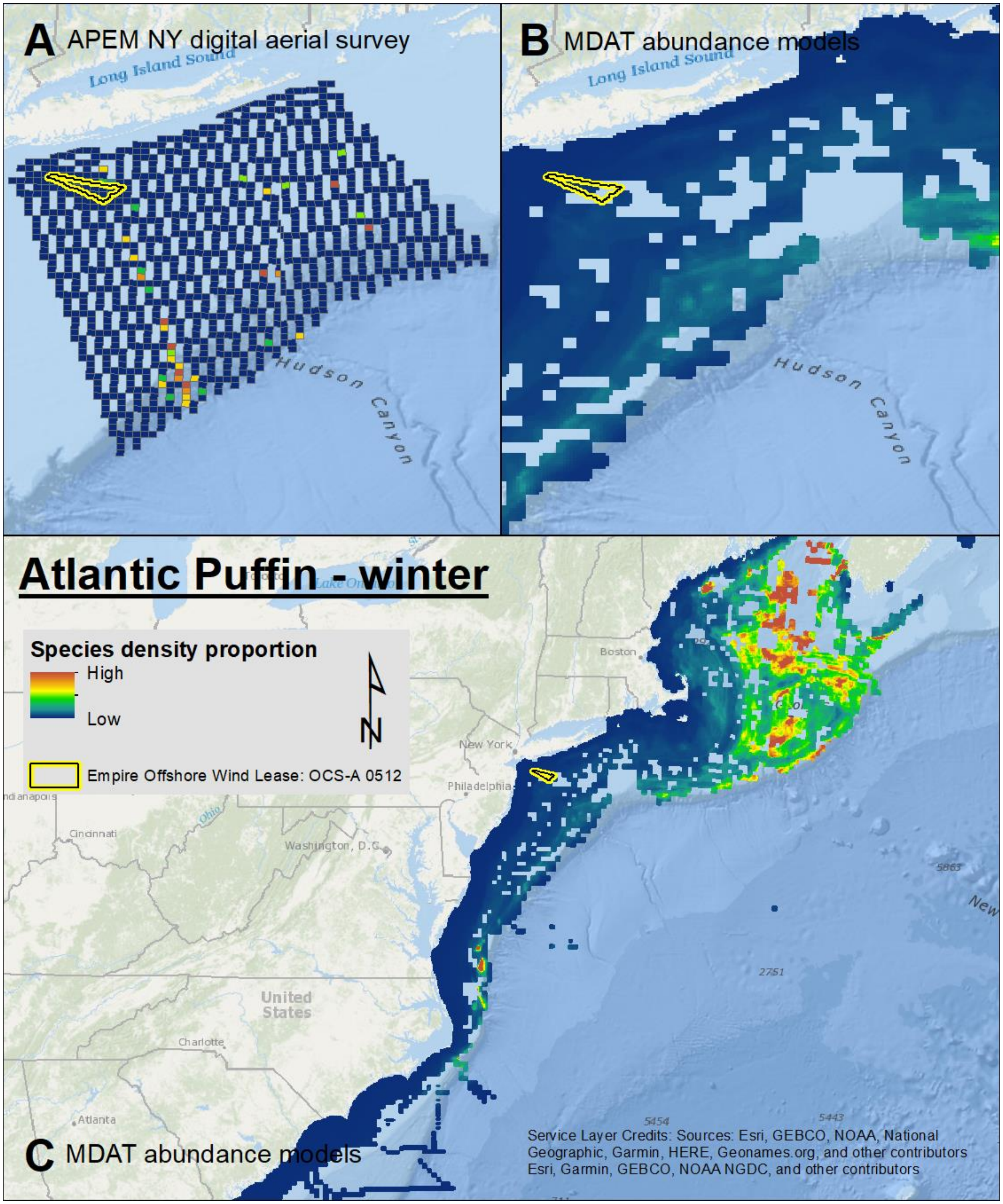
Map 40. Spring South Polar Skua density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



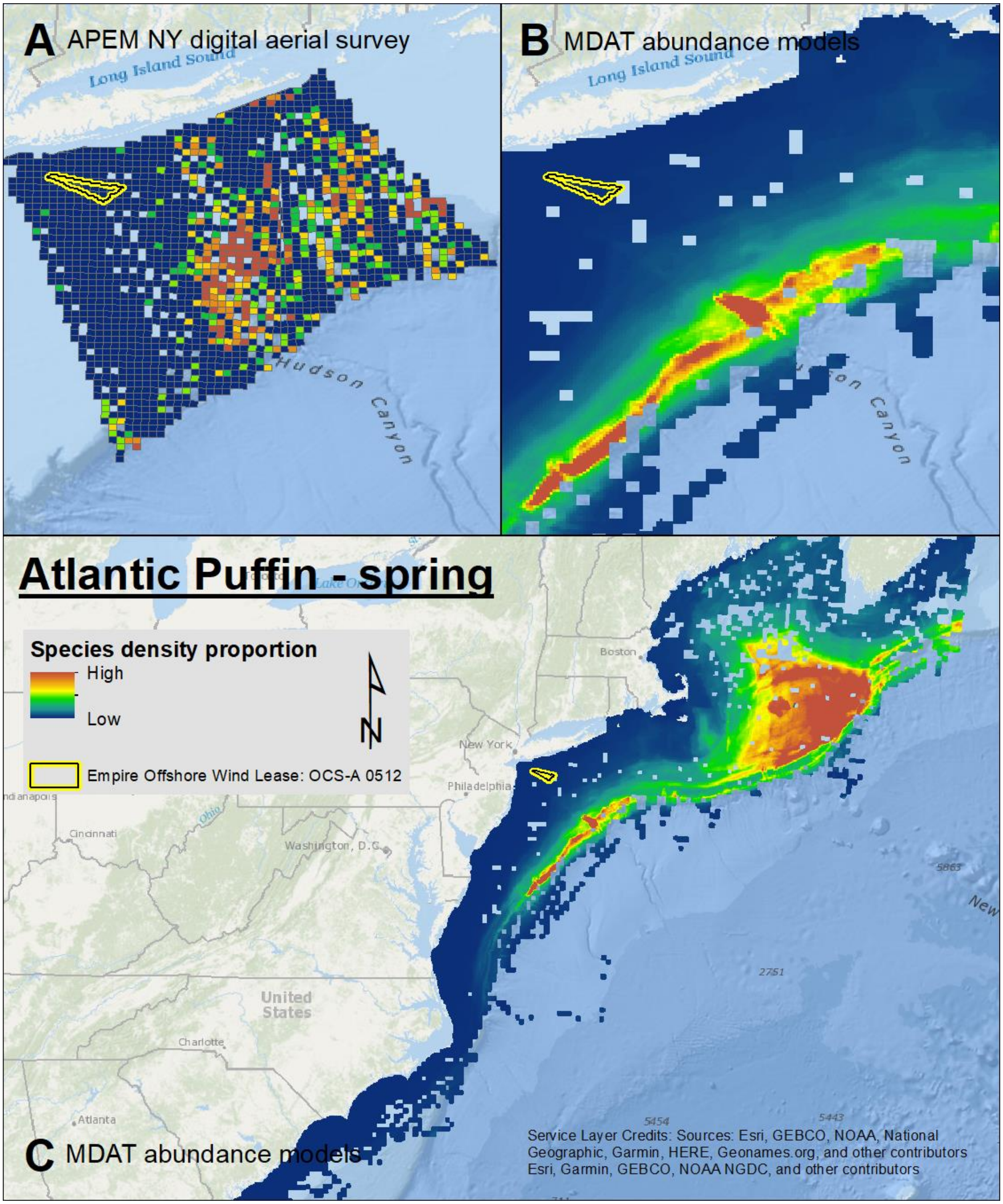
Map 41. Summer South Polar Skua density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



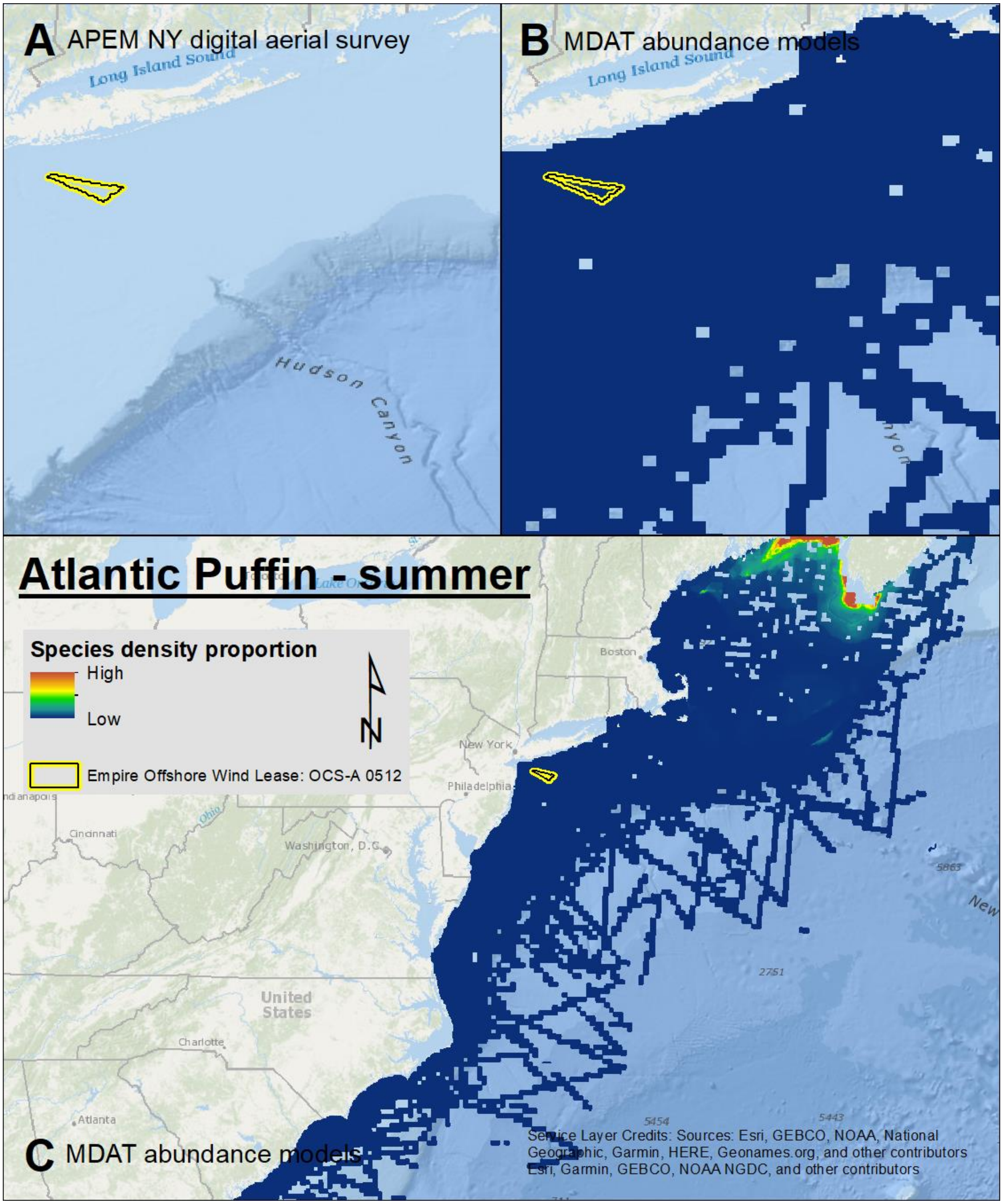
Map 42. Fall South Polar Skua density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



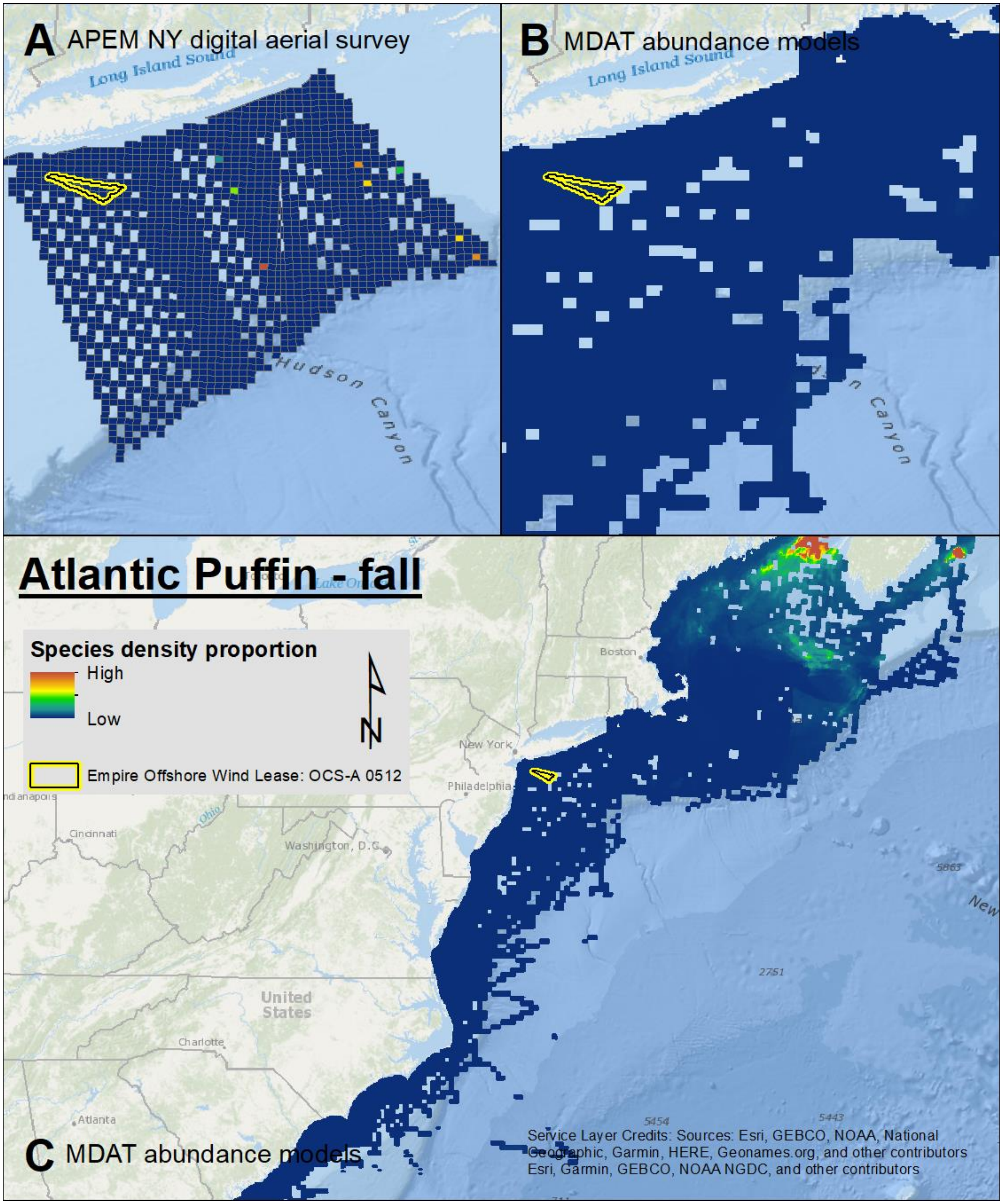
Map 43. Winter Atlantic Puffin density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



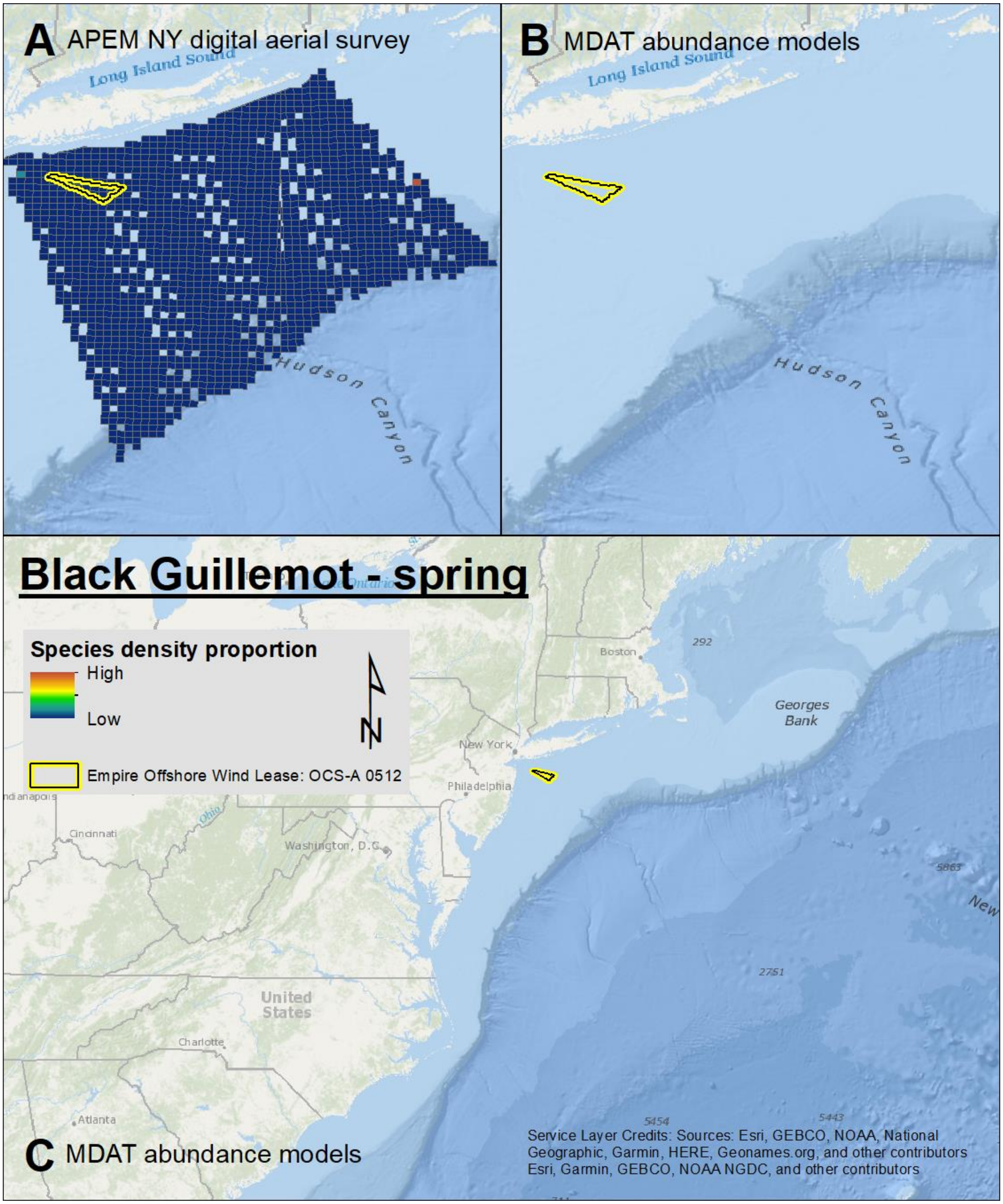
Map 44. Spring Atlantic Puffin density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



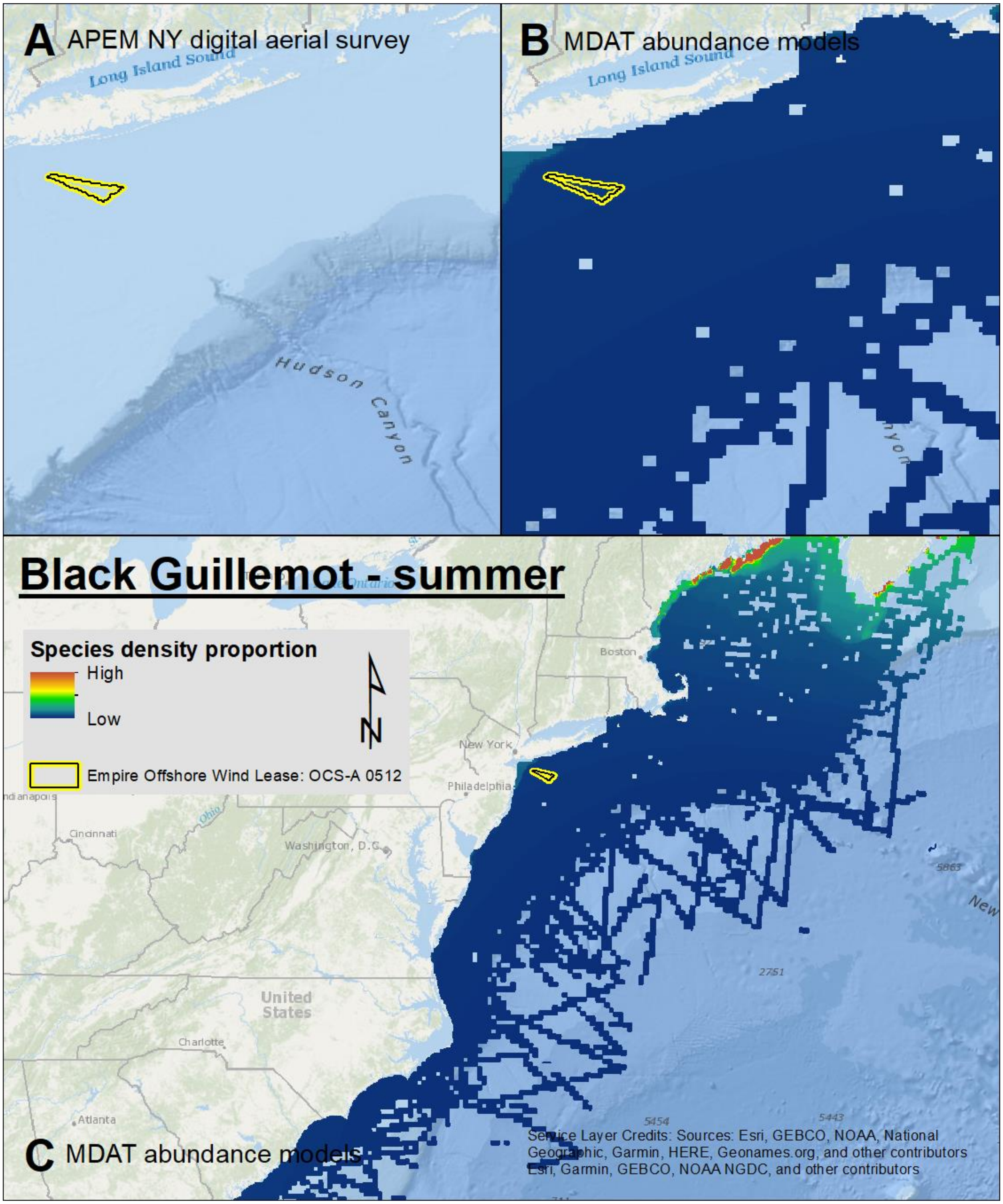
Map 45. Summer Atlantic Puffin density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



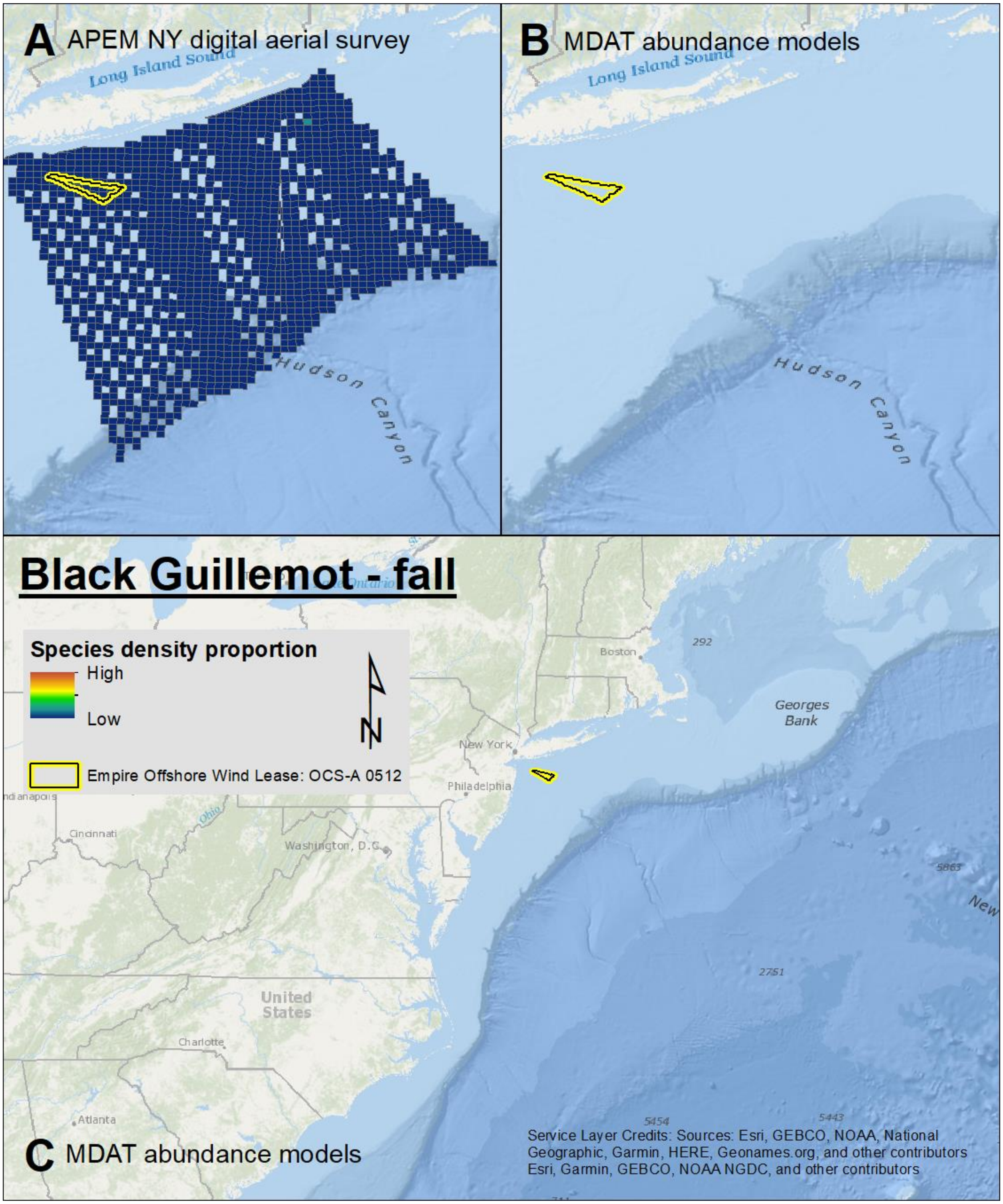
Map 46. Fall Atlantic Puffin density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



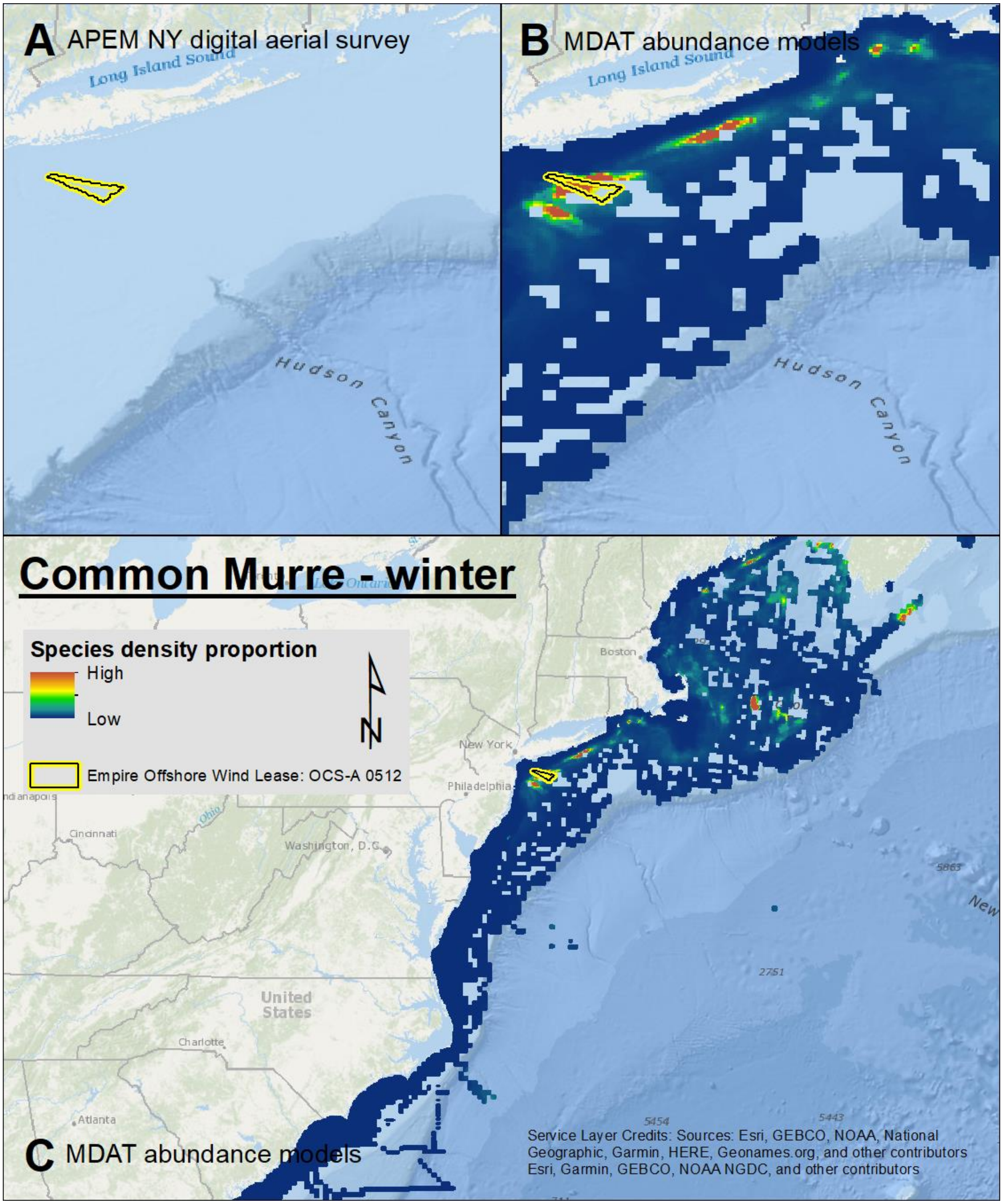
Map 47. Spring Black Guillemot density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



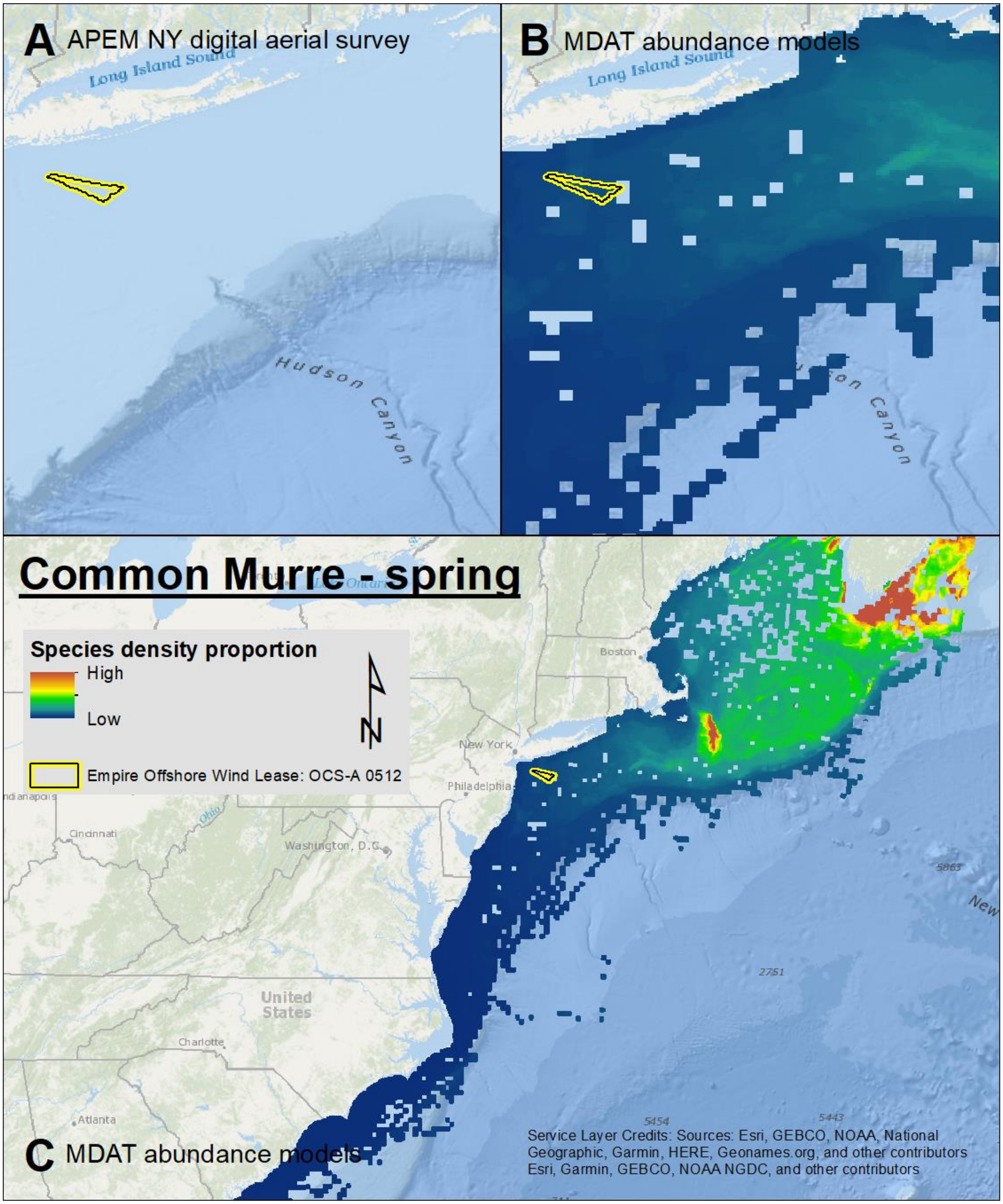
Map 48. Summer Black Guillemot density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



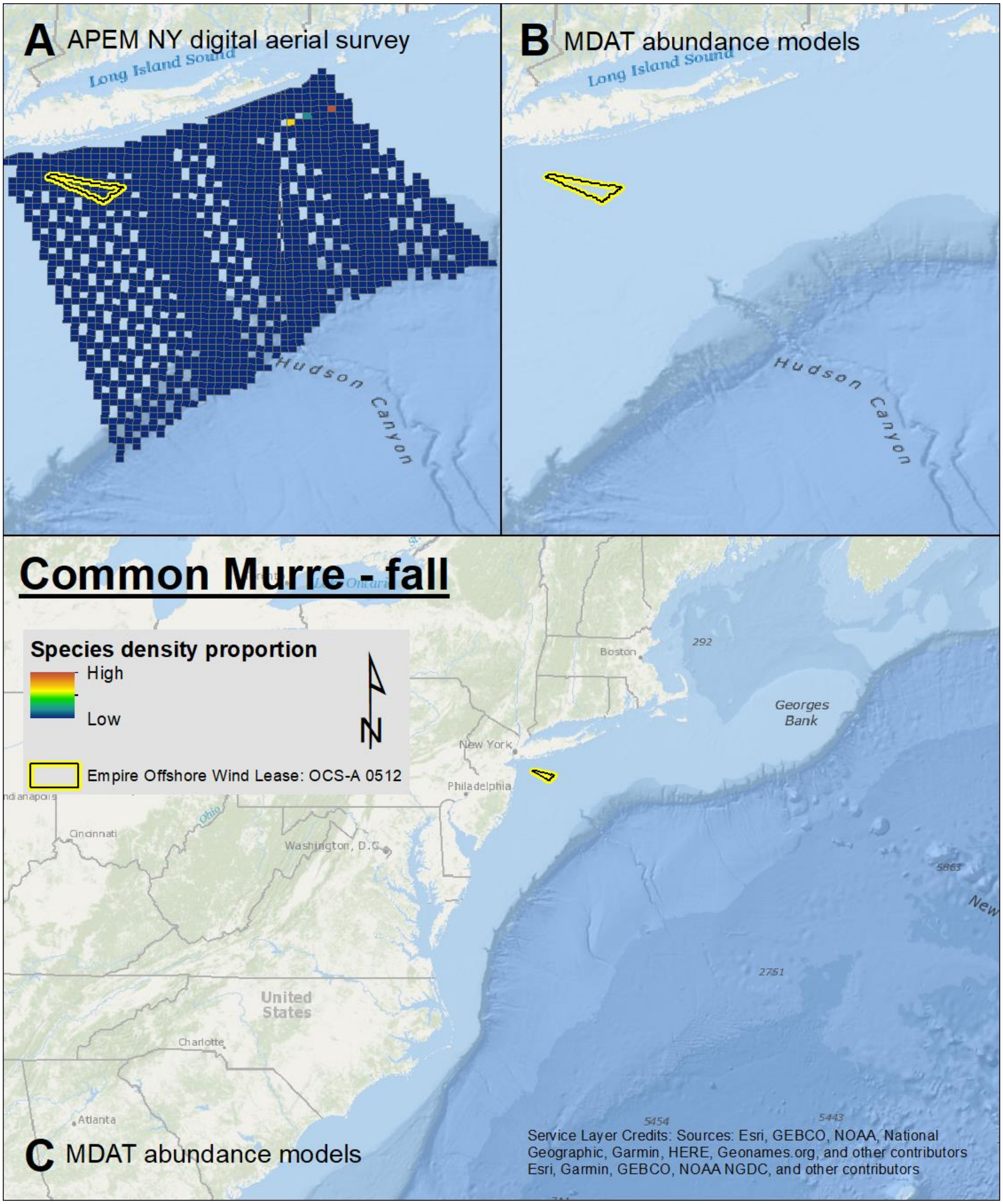
Map 49. Fall Black Guillemot density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



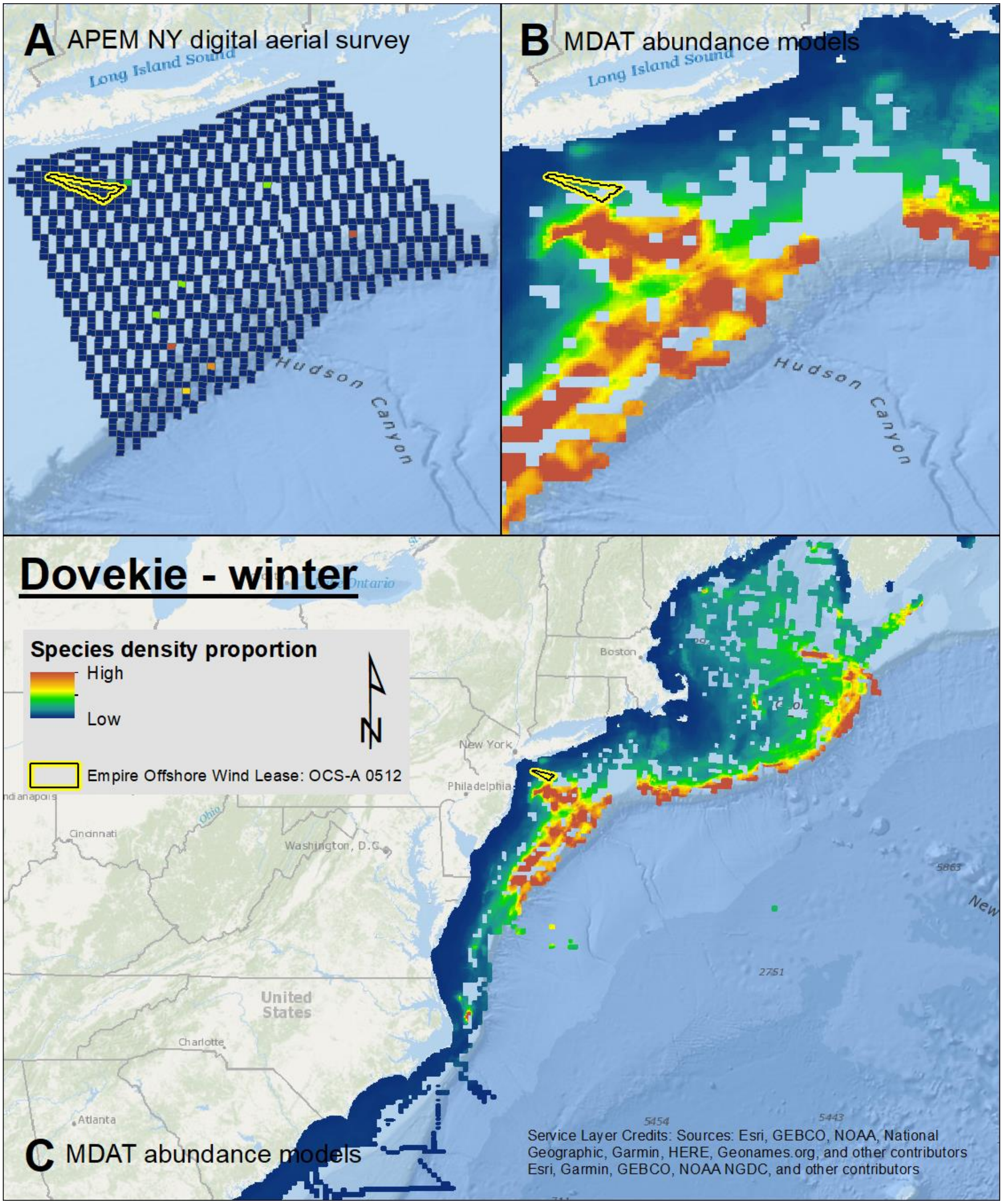
Map 50. Winter Common Murre density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



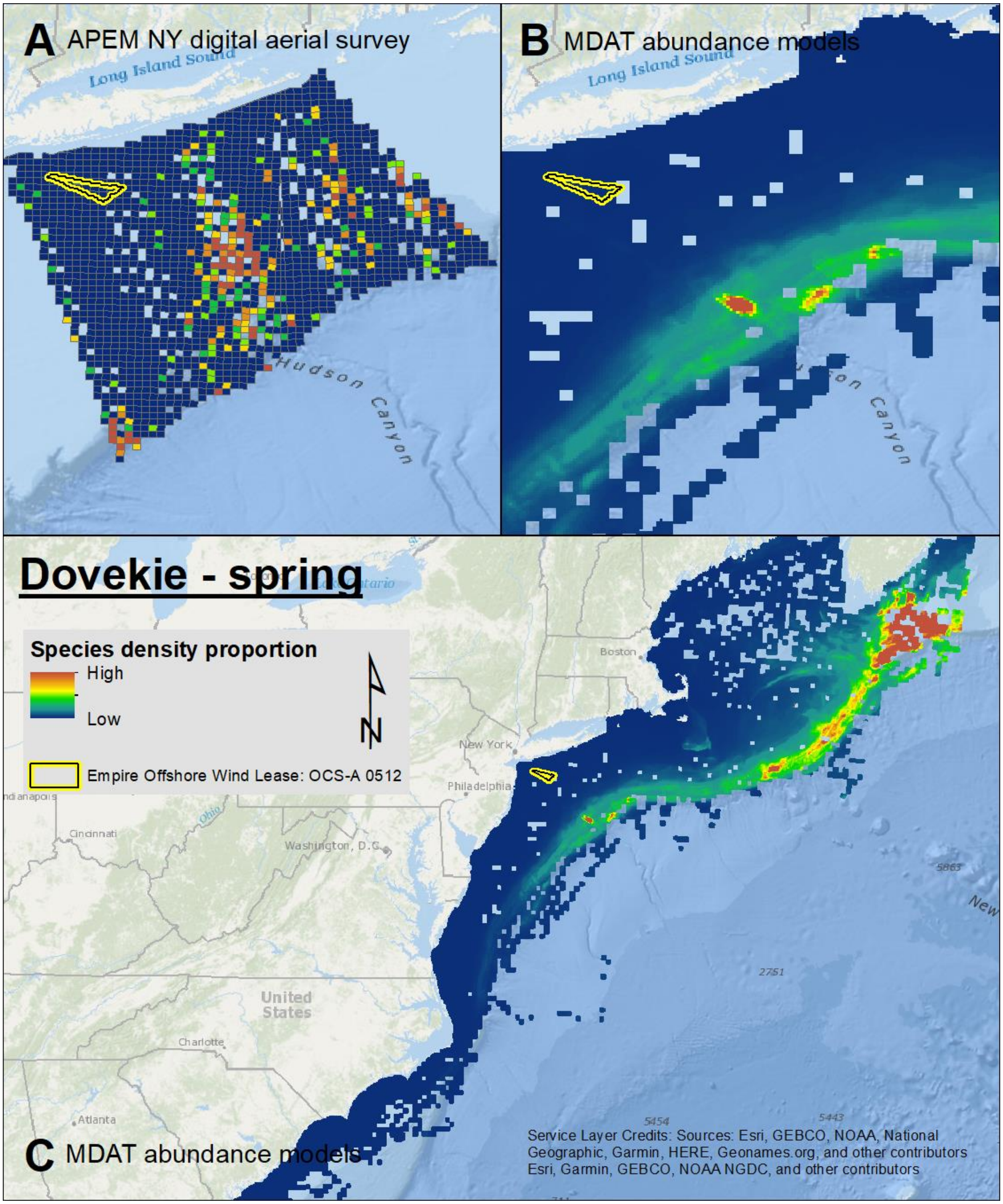
Map 51. Spring Common Murre density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



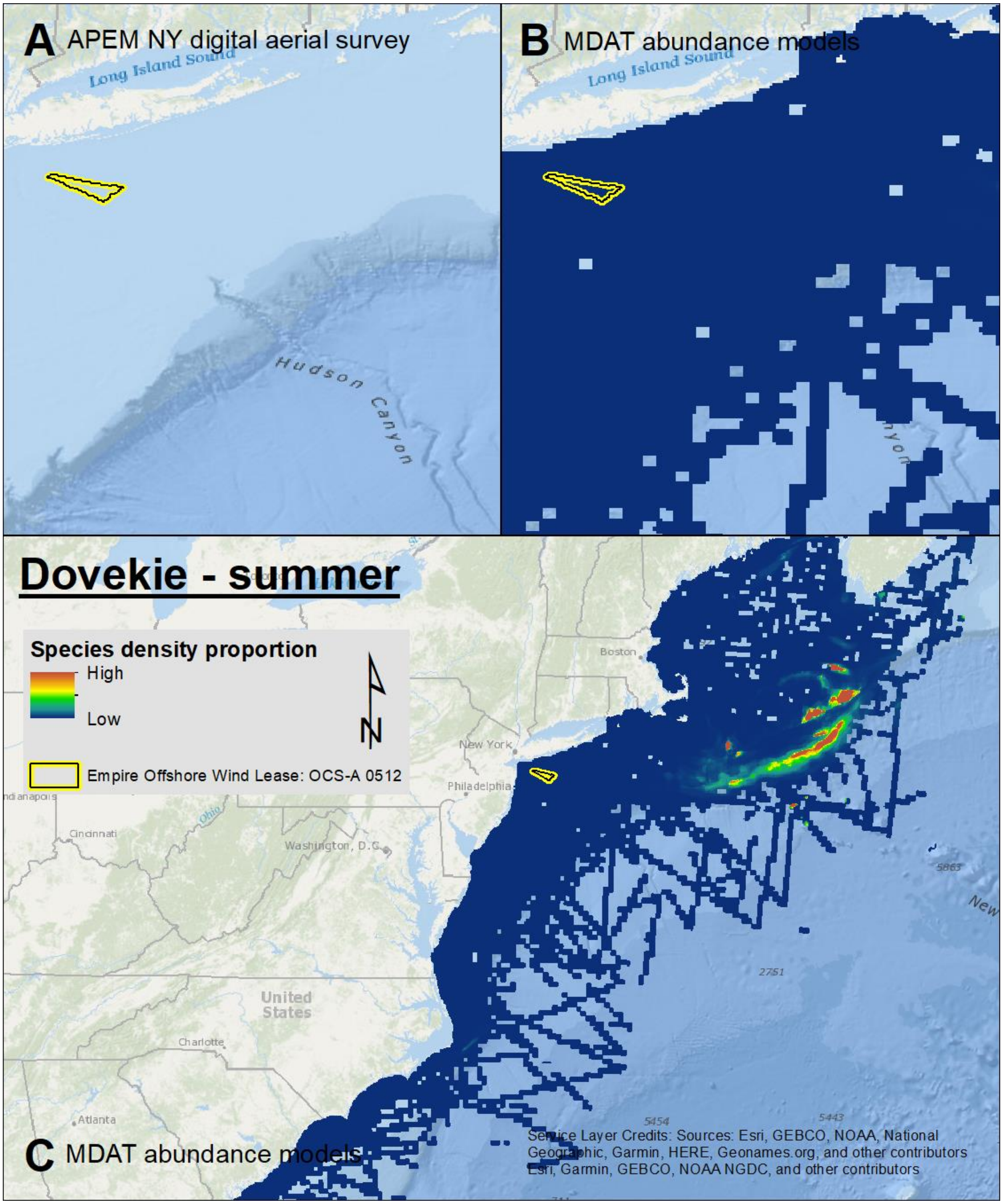
Map 52. Fall Common Murre density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



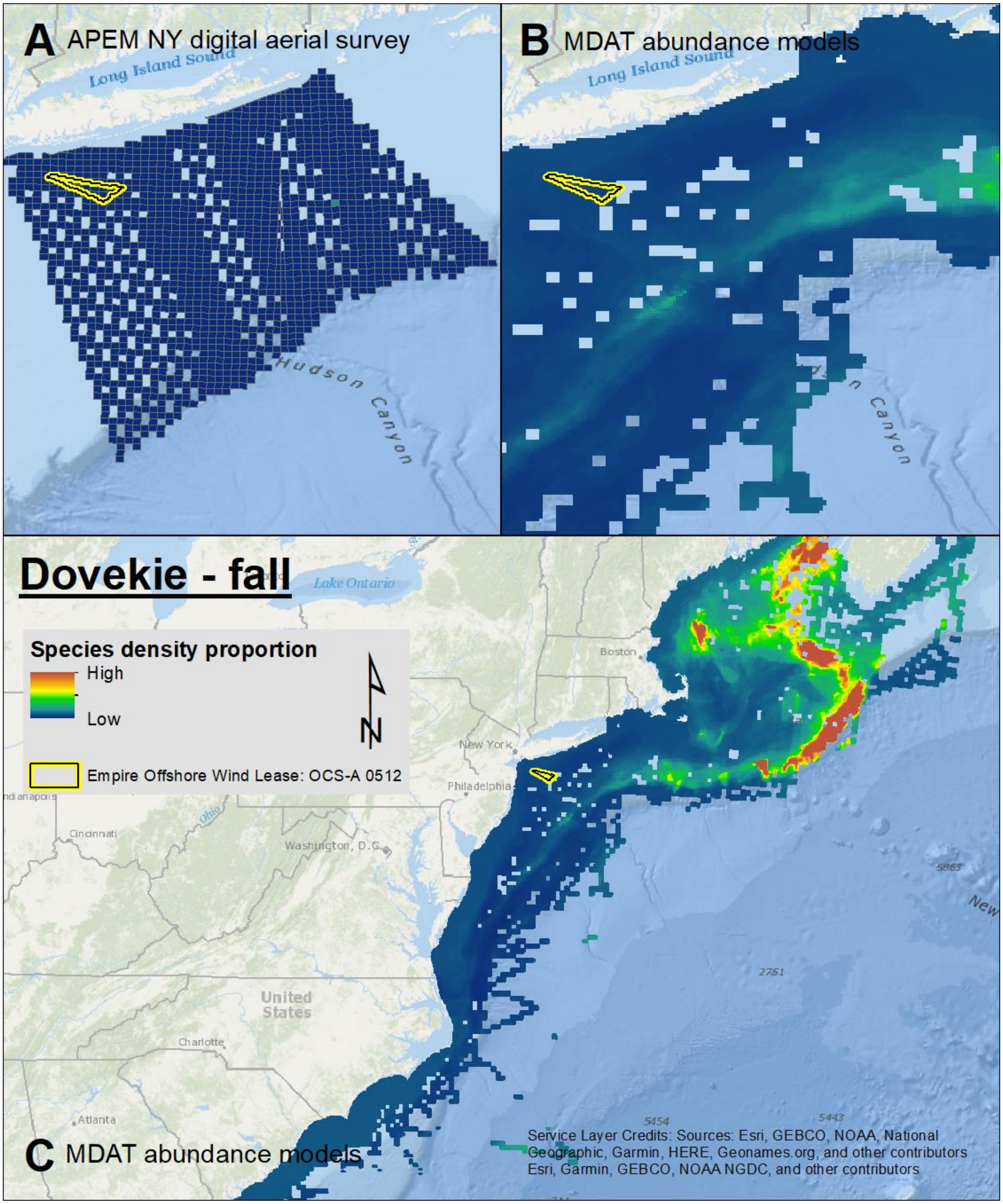
Map 53. Winter Dovekie density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



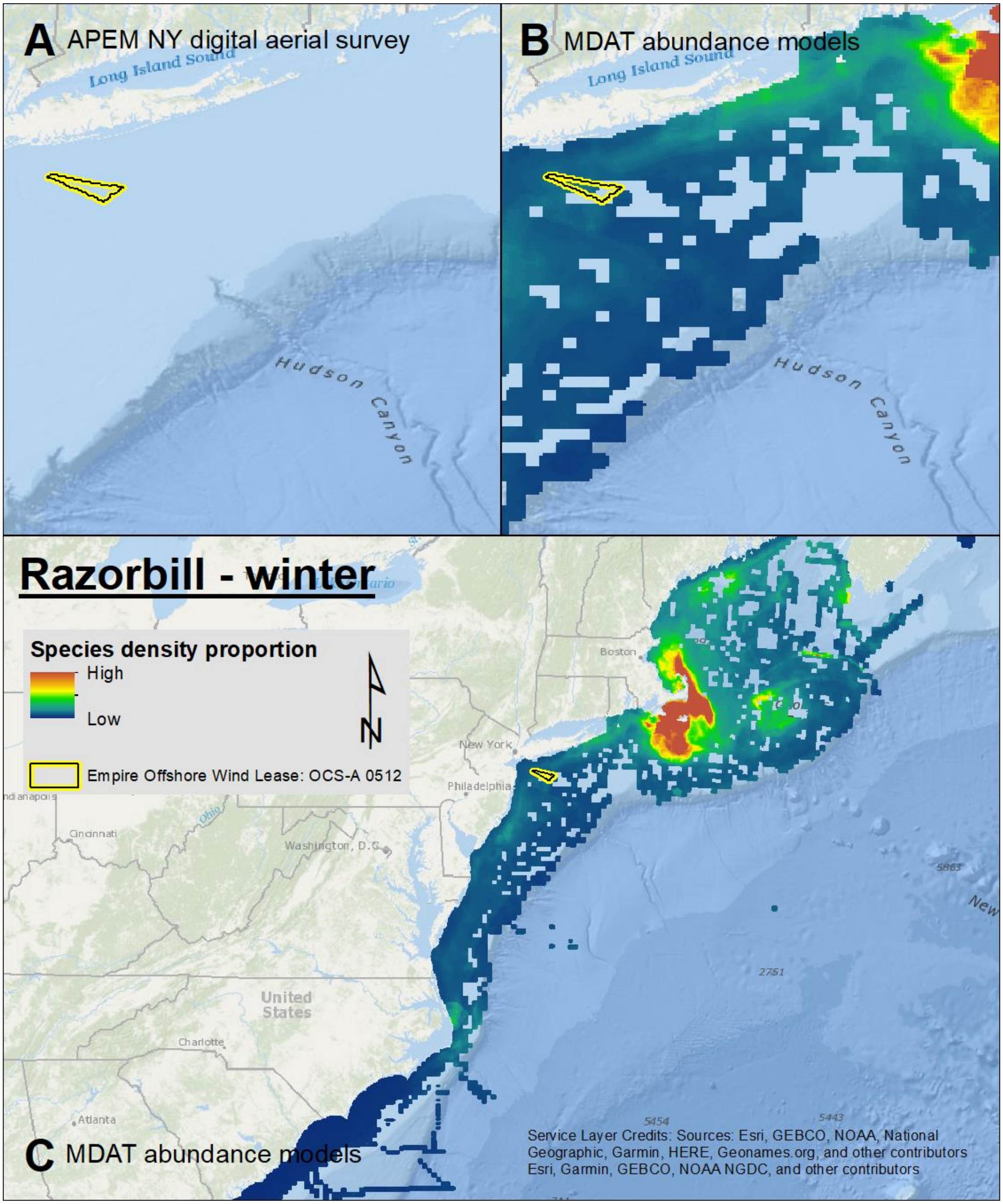
Map 54. Spring Dovekie density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



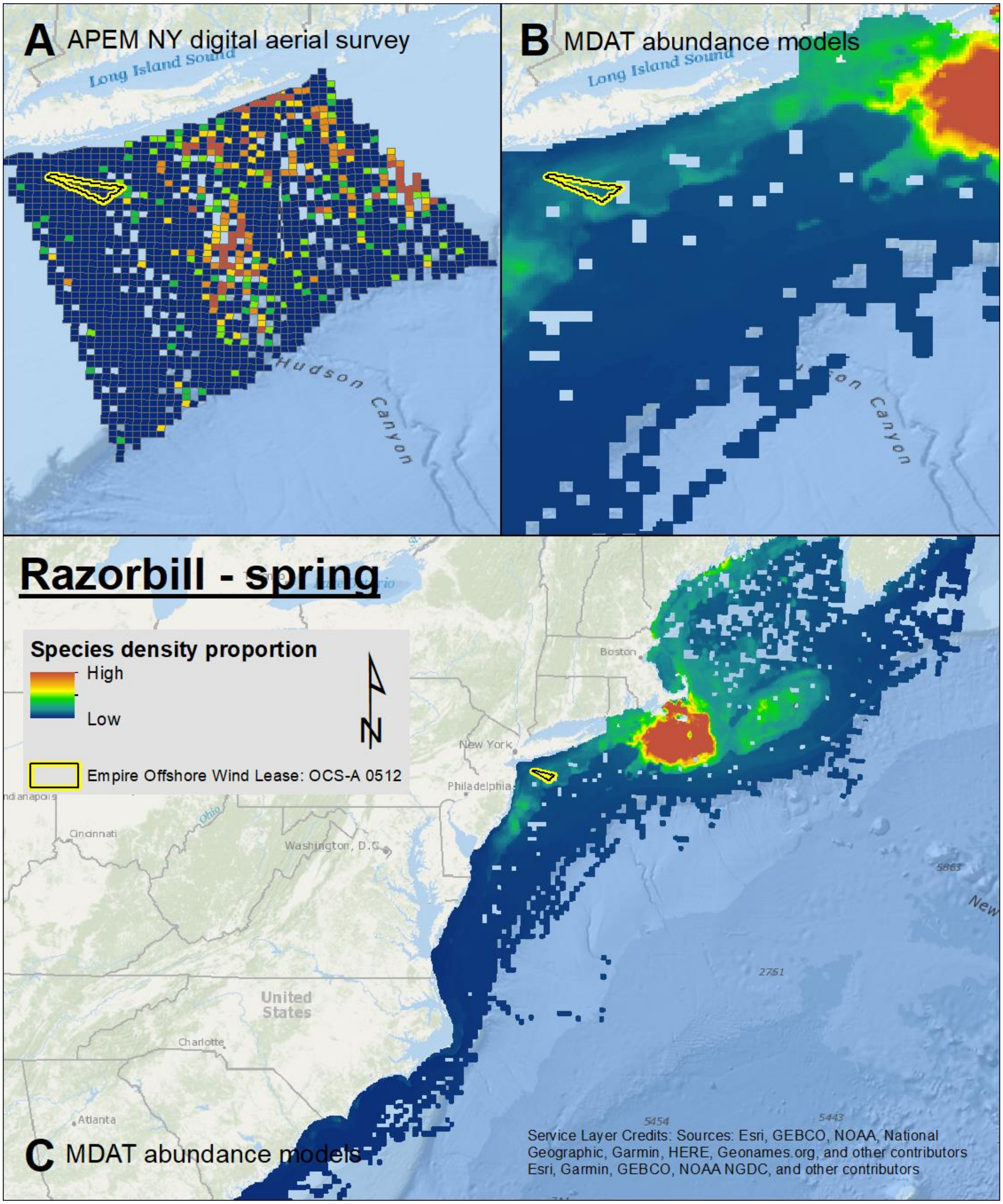
Map 55. Summer Dovekie density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



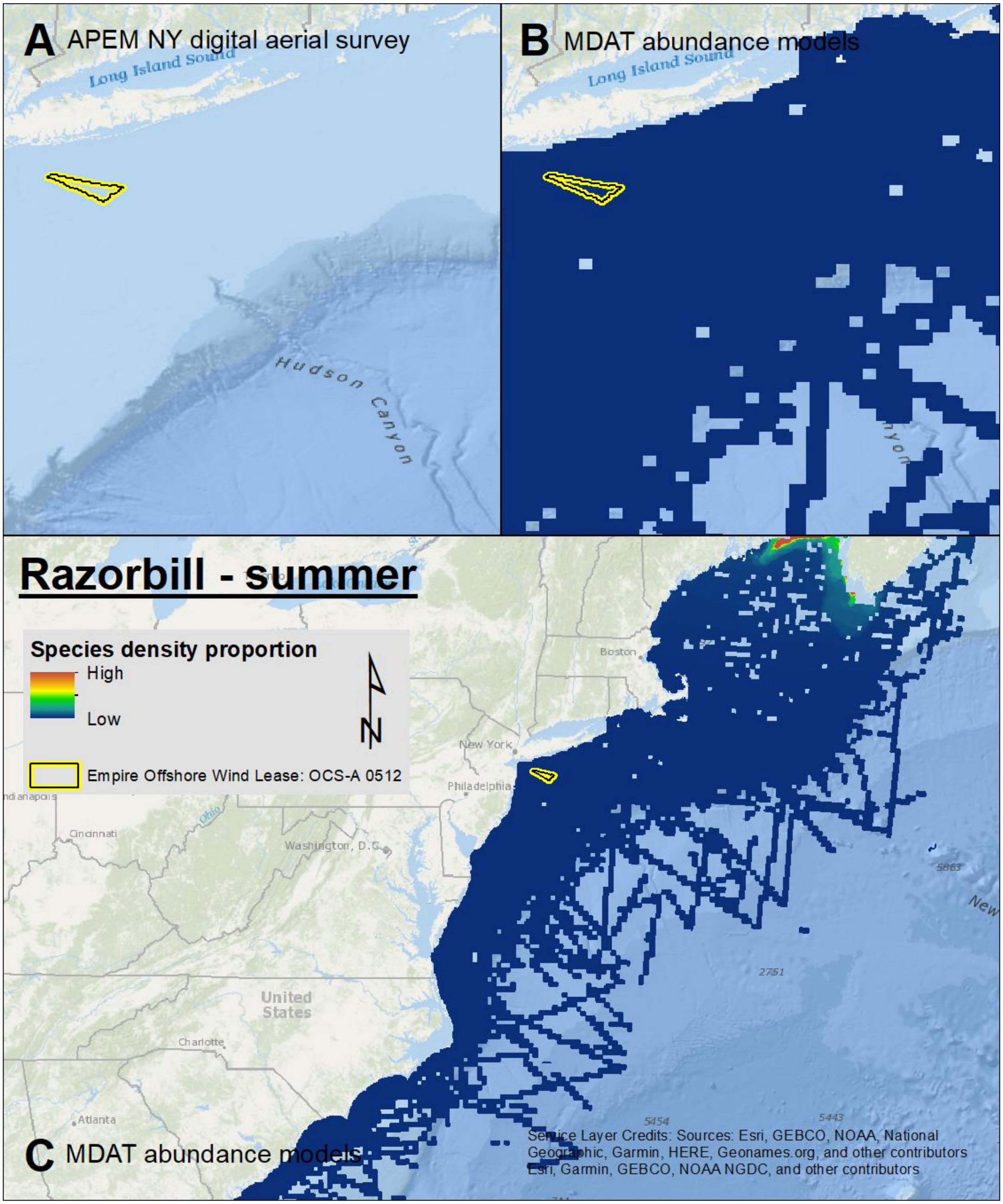
Map 56. Fall Dovekie density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



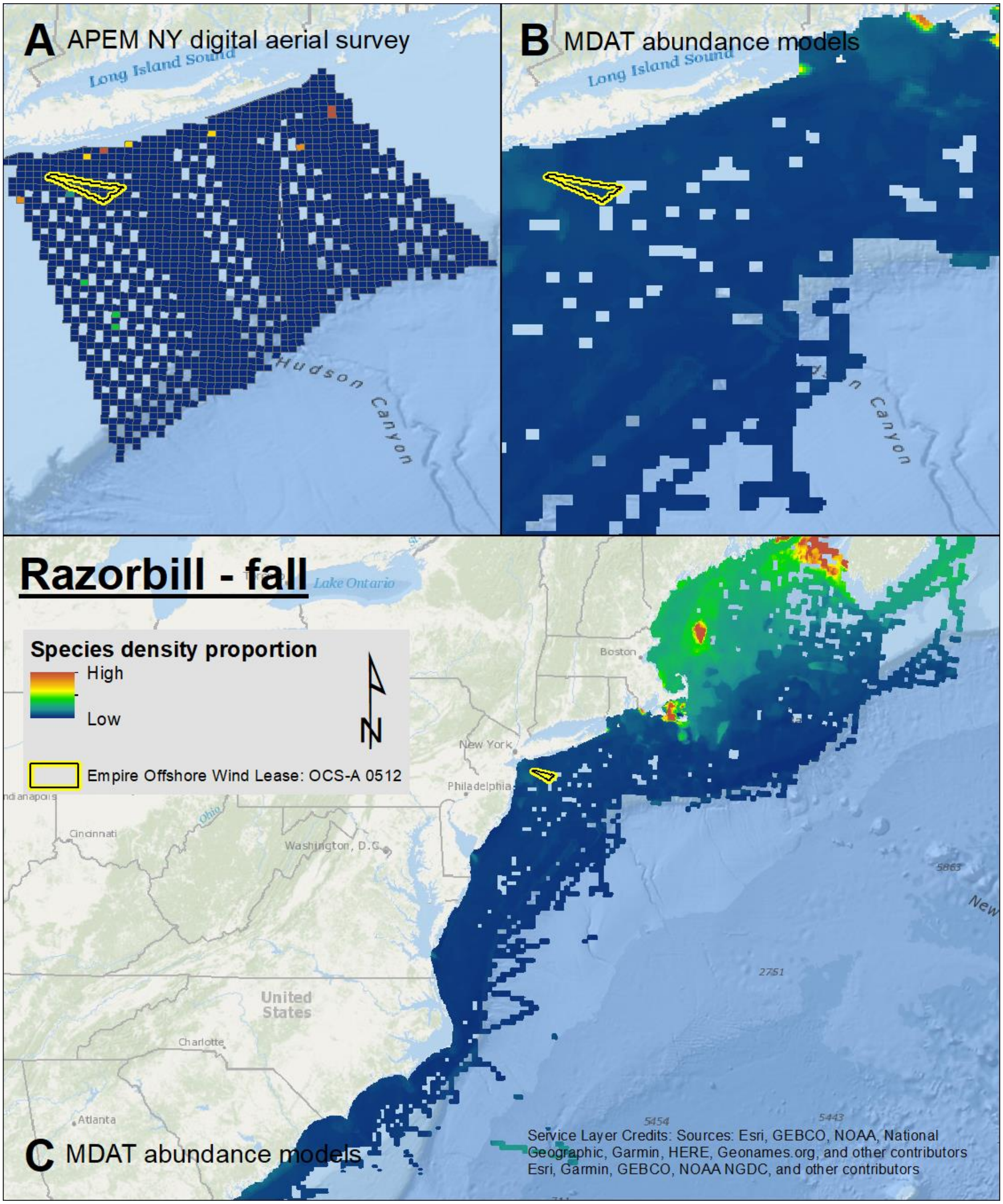
Map 57. Winter Razorbill density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



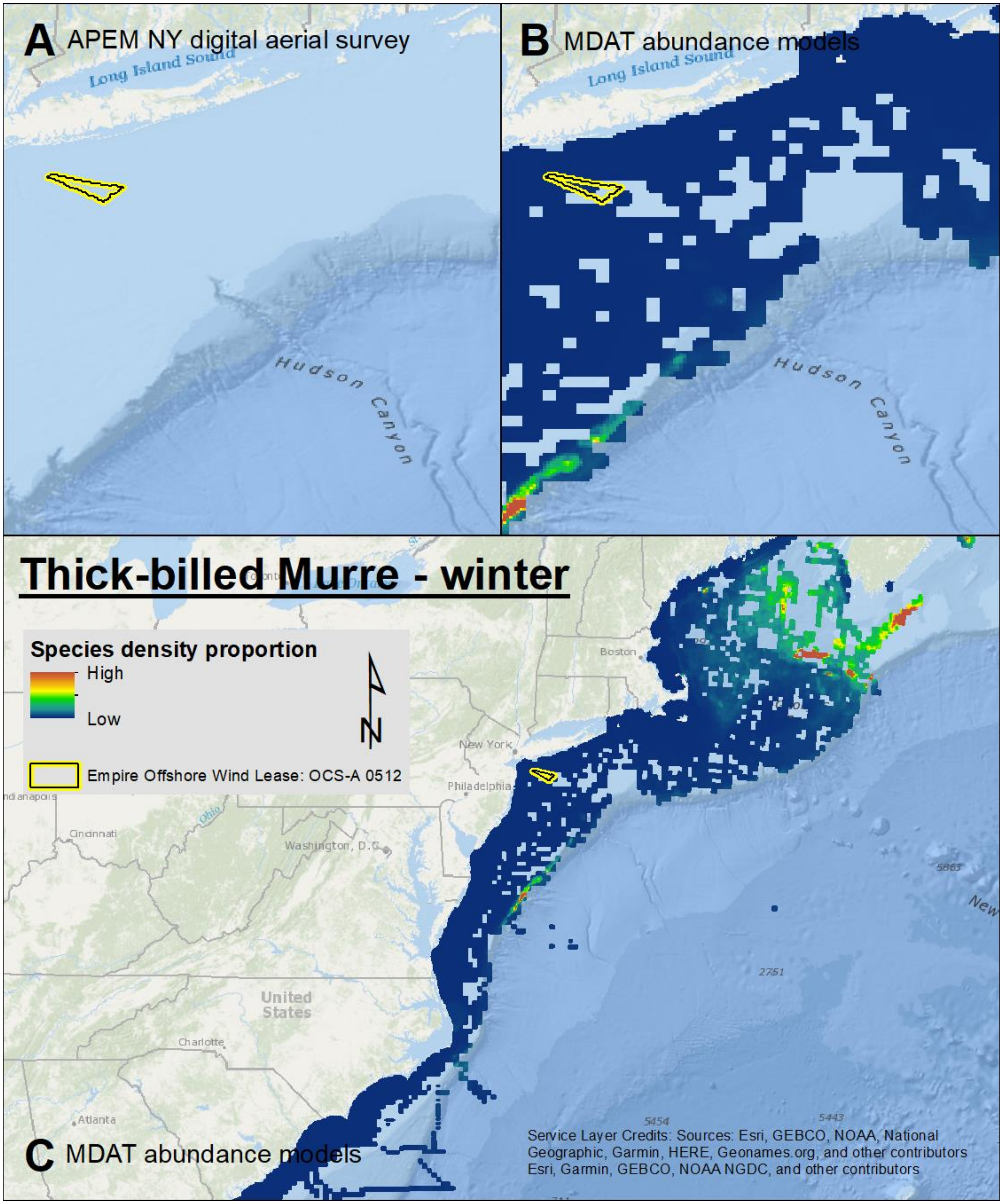
Map 58. Spring Razorbill density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



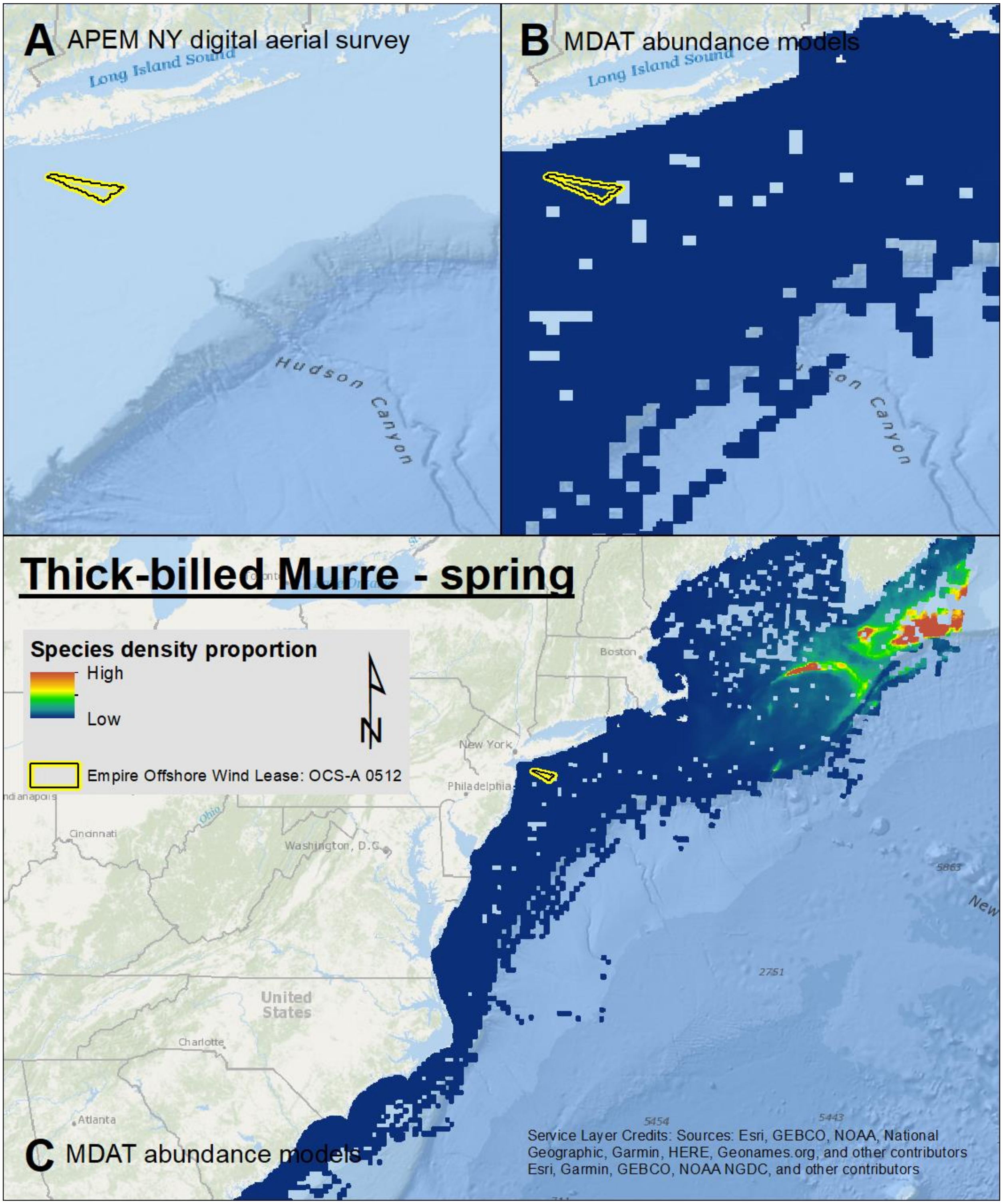
Map 59. Summer Razorbill density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



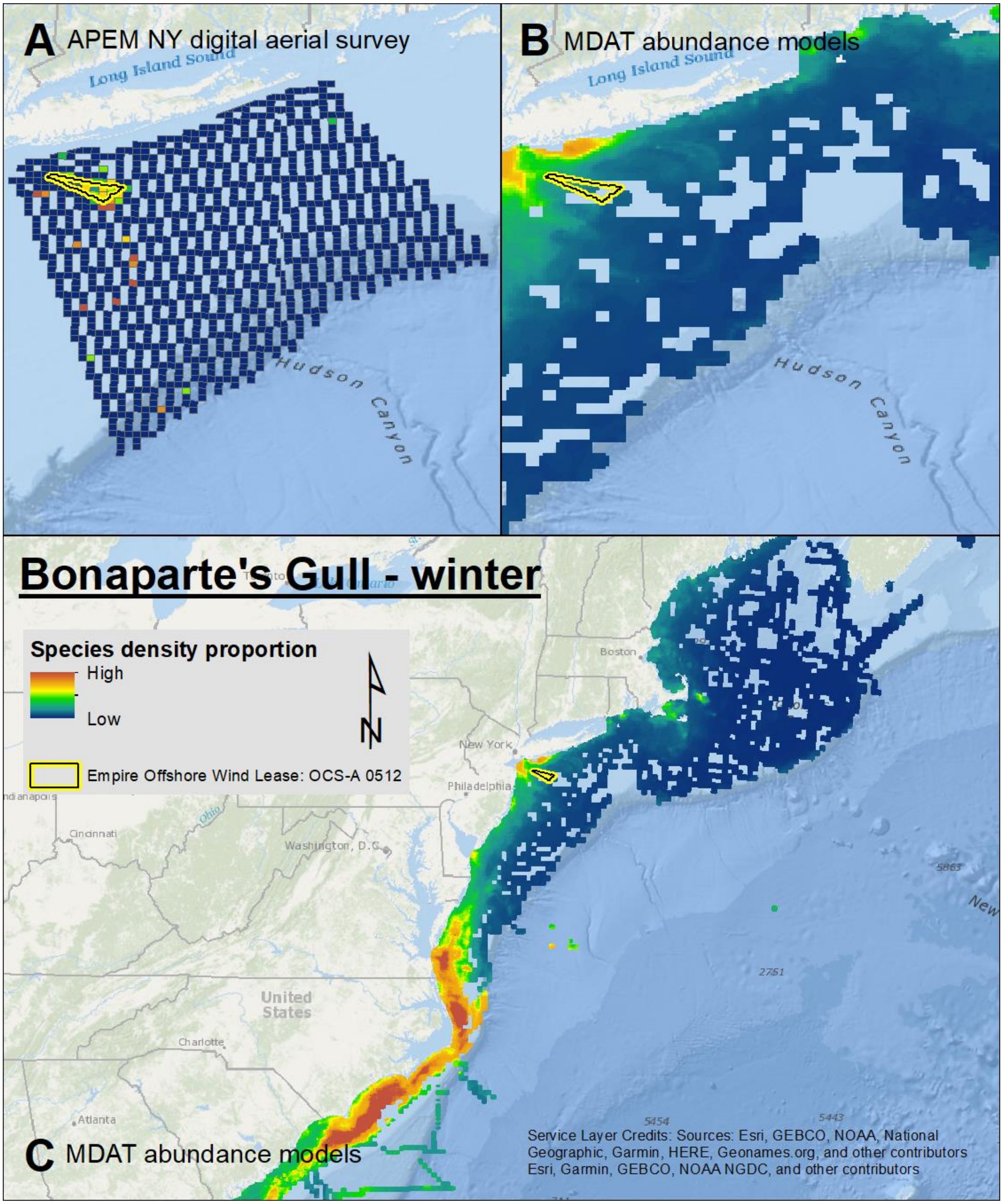
Map 60. Fall Razorbill density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



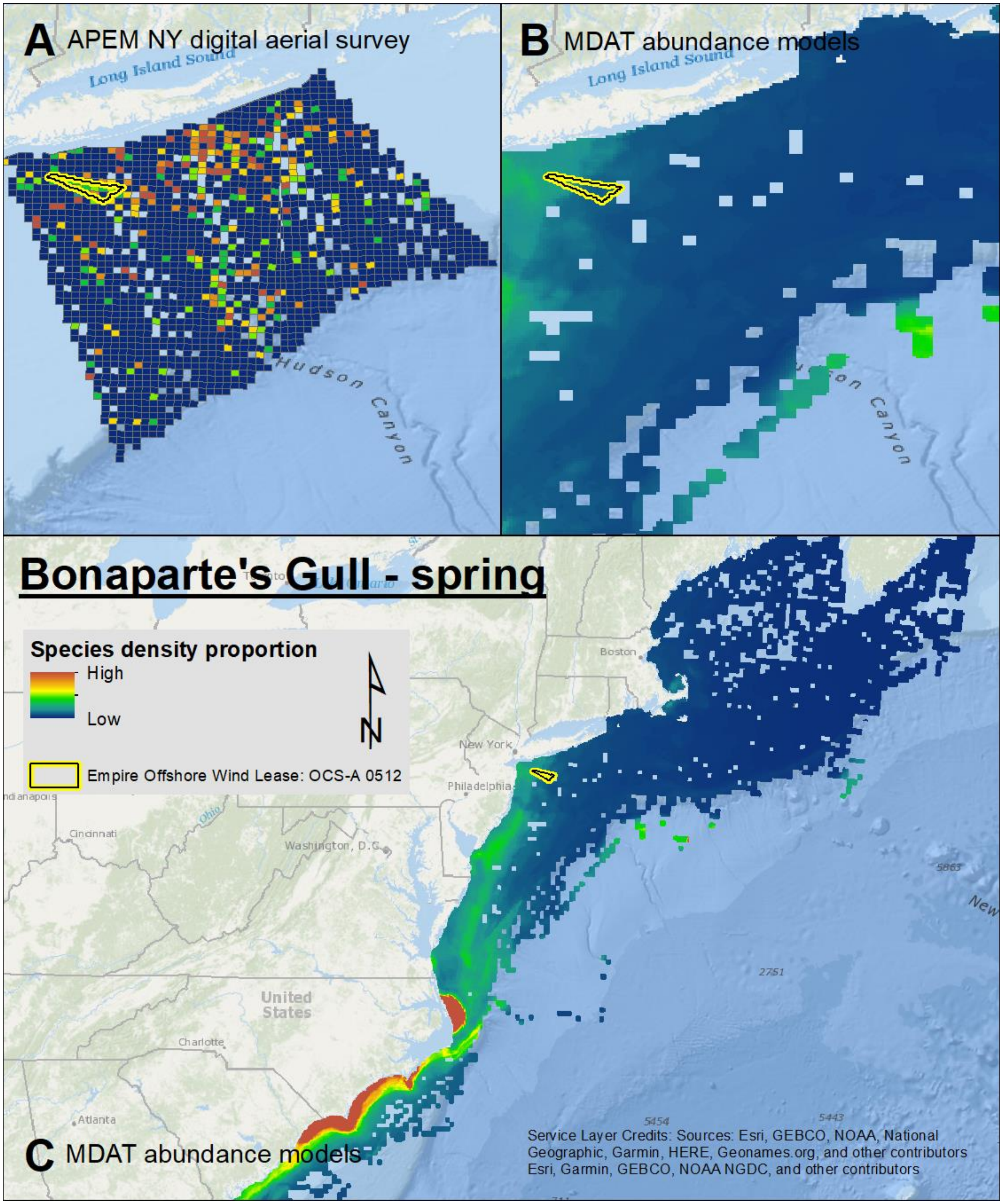
Map 61. Winter Thick-billed Murre density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



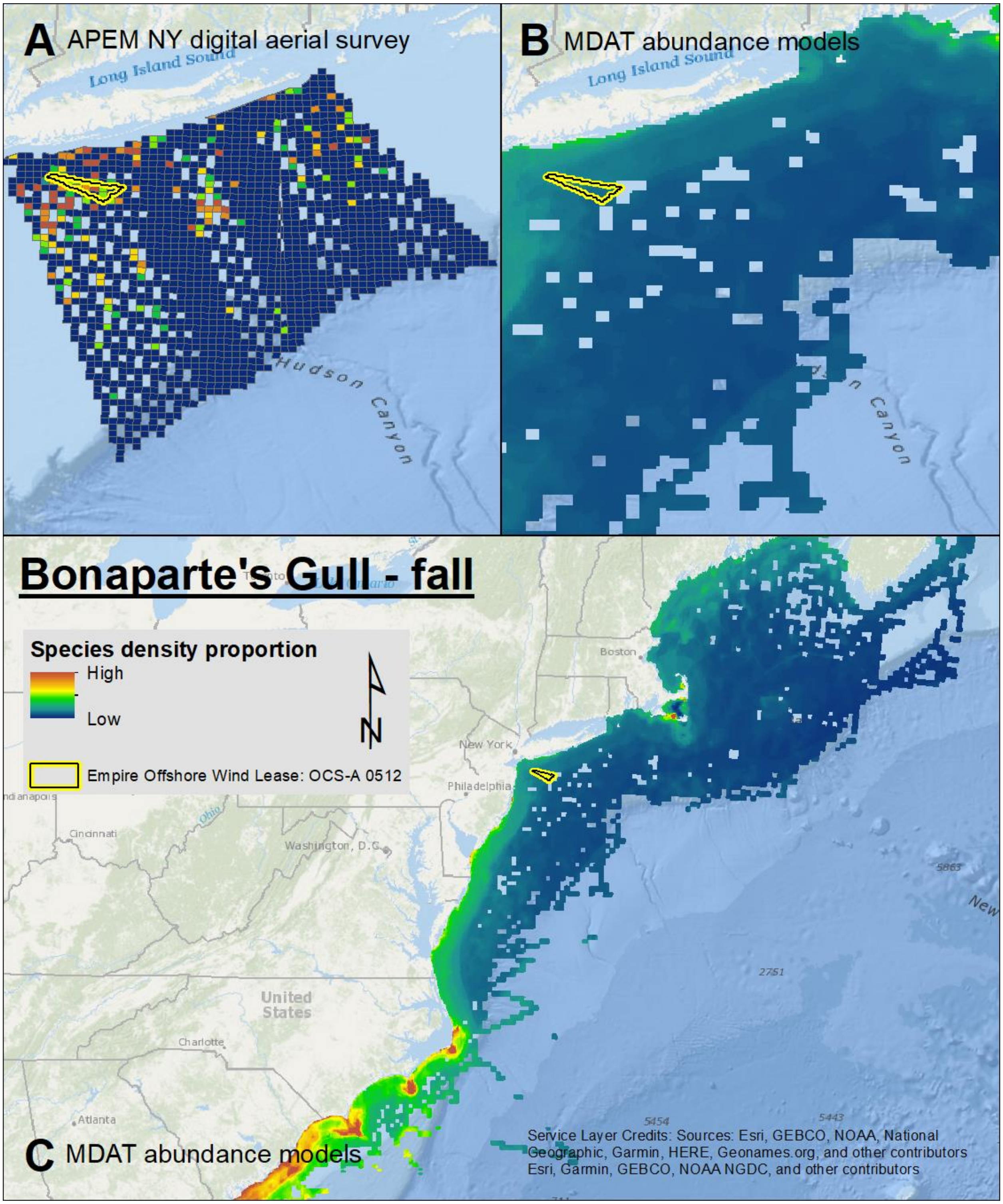
Map 62. Spring Thick-billed Murre density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



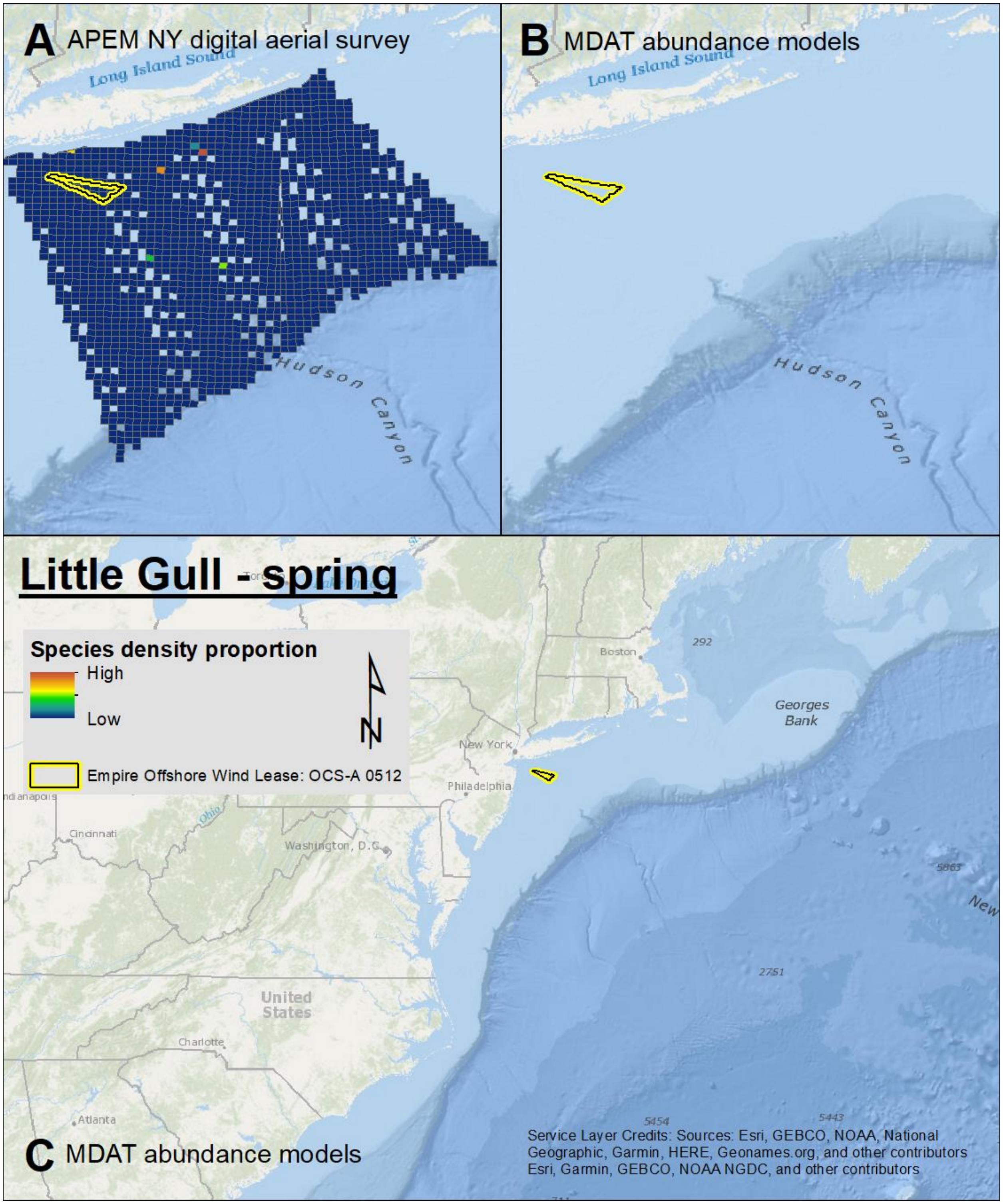
Map 63. Winter Bonaparte's Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



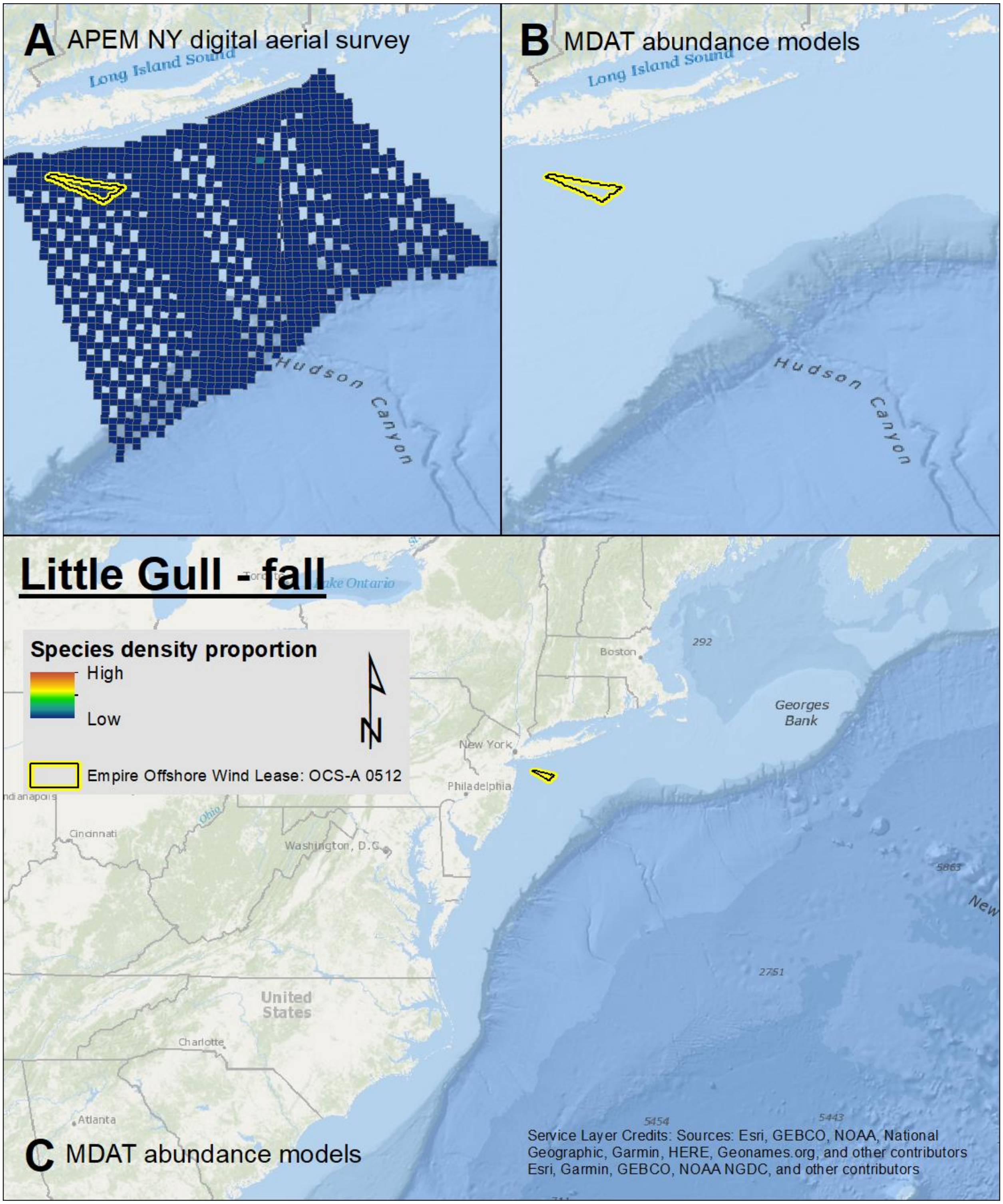
Map 64. Spring Bonaparte's Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



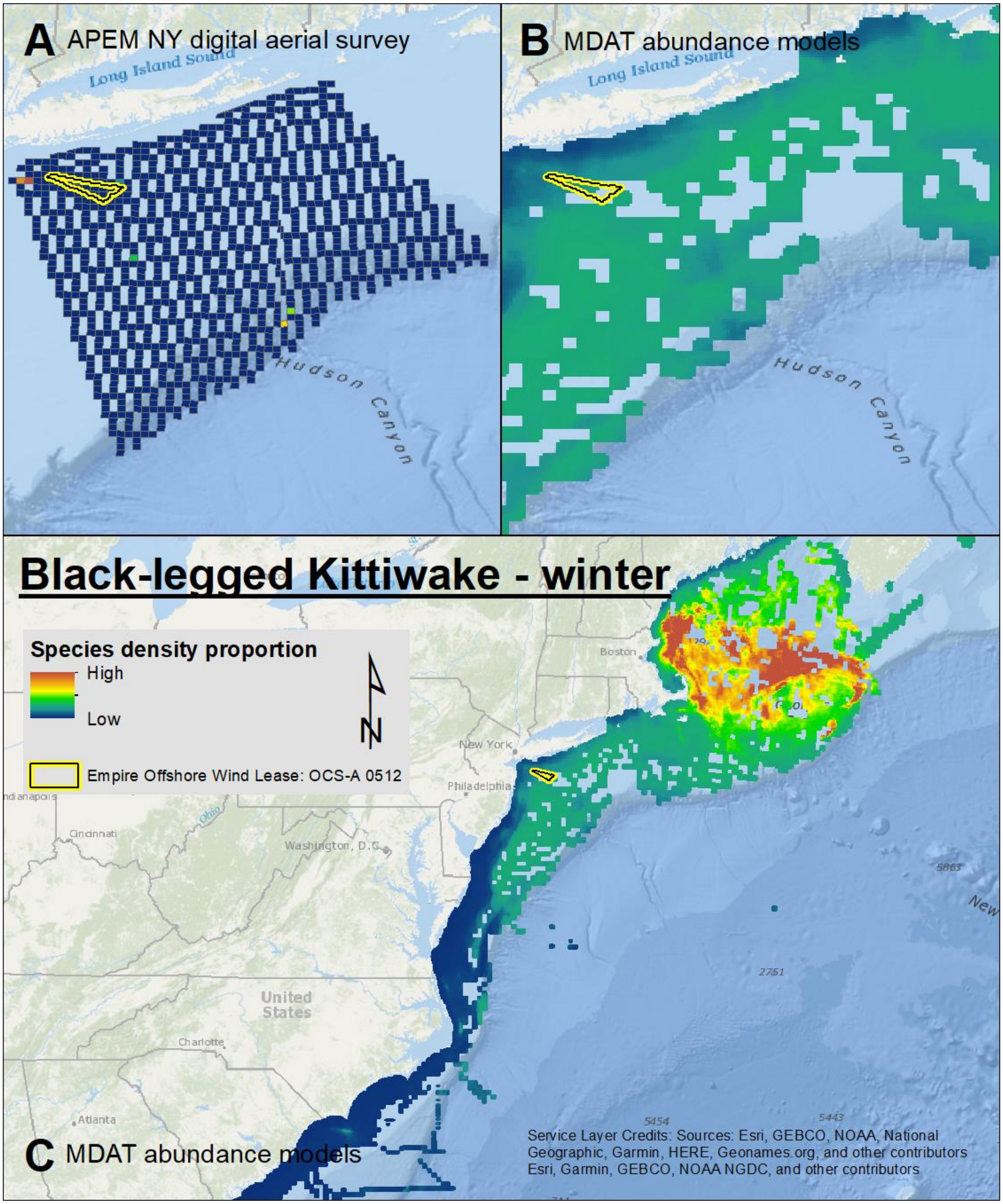
Map 65. Fall Bonaparte's Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



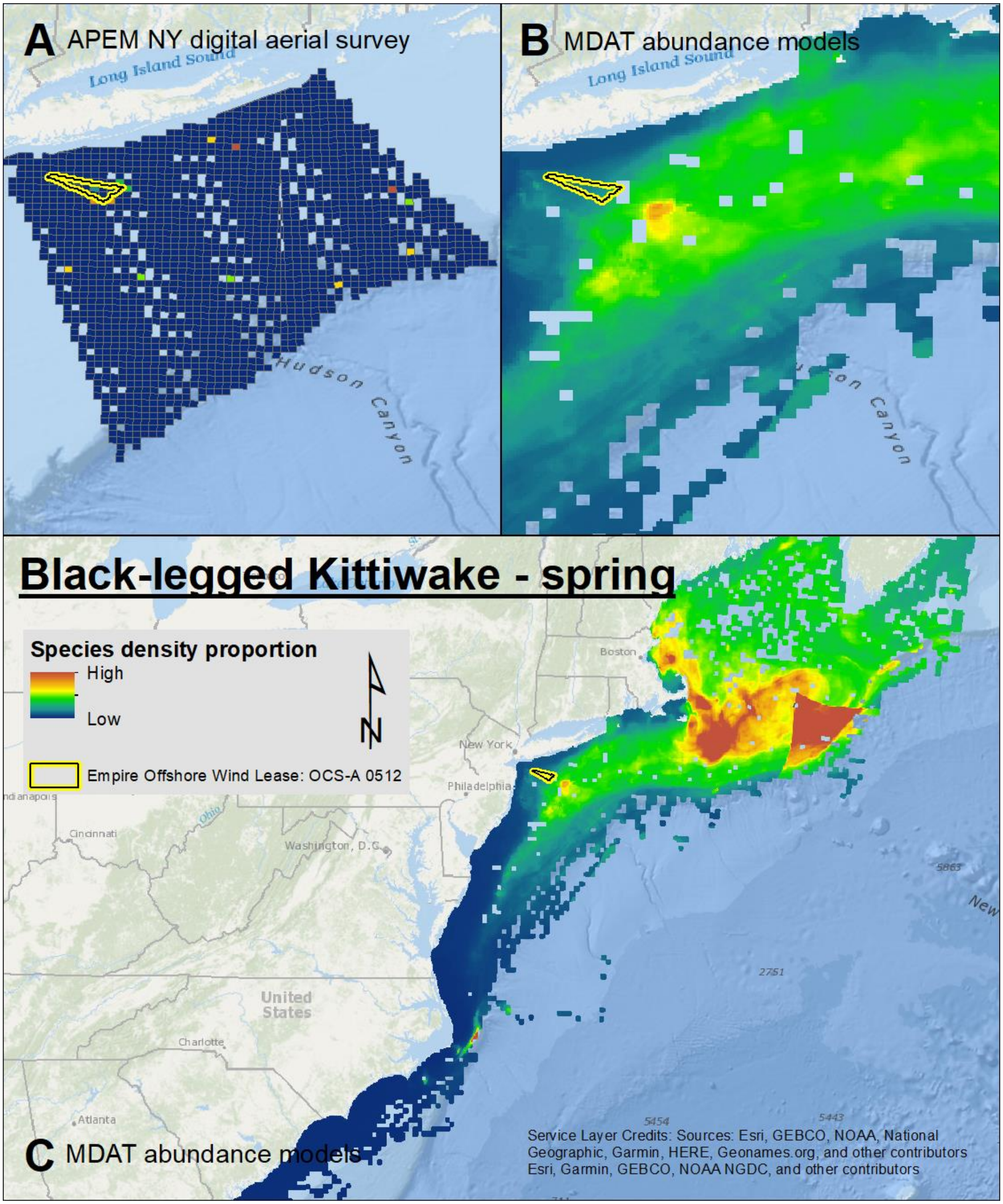
Map 66. Spring Little Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



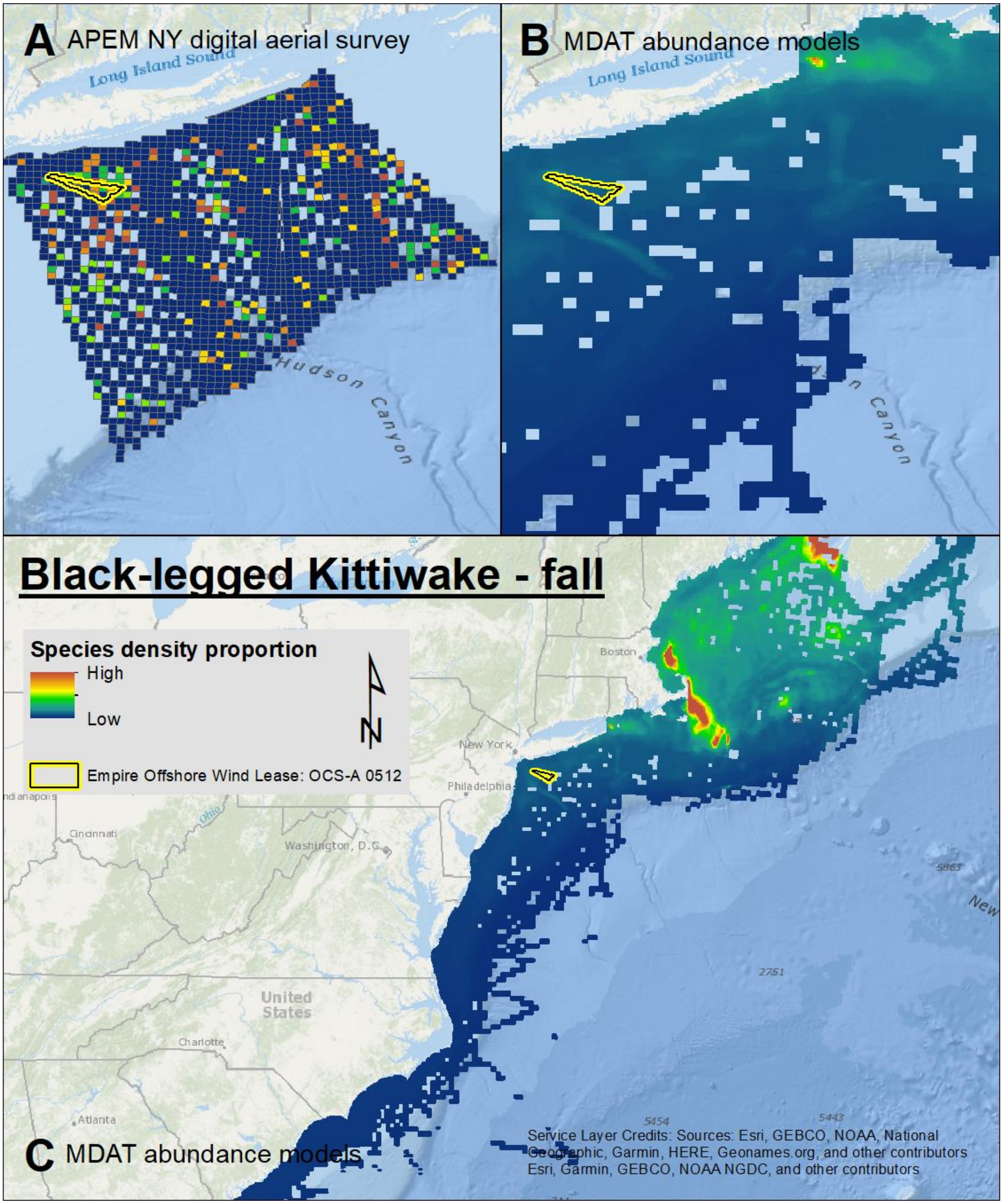
Map 67. Fall Little Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



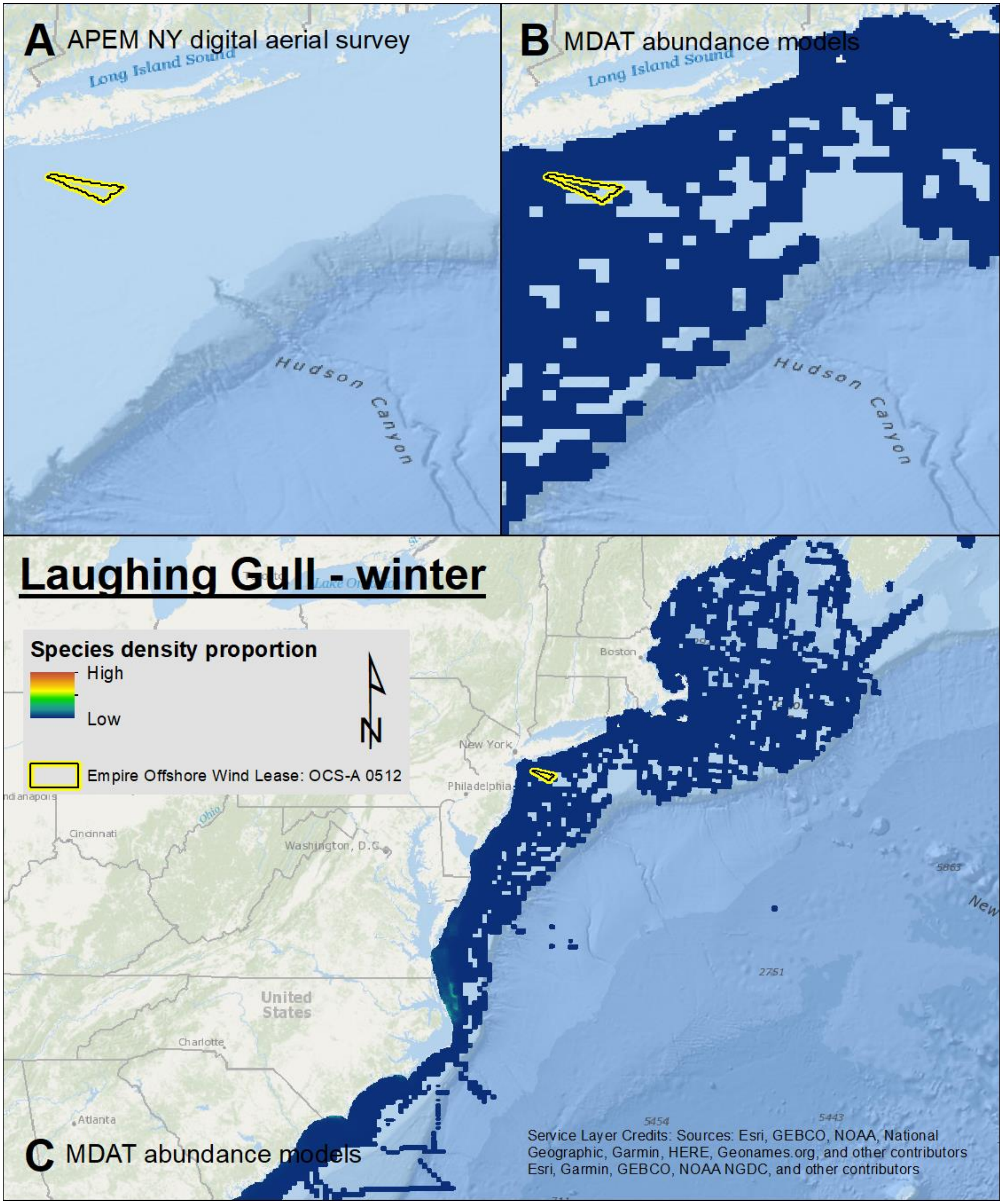
Map 68. Winter Black-legged Kittiwake density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



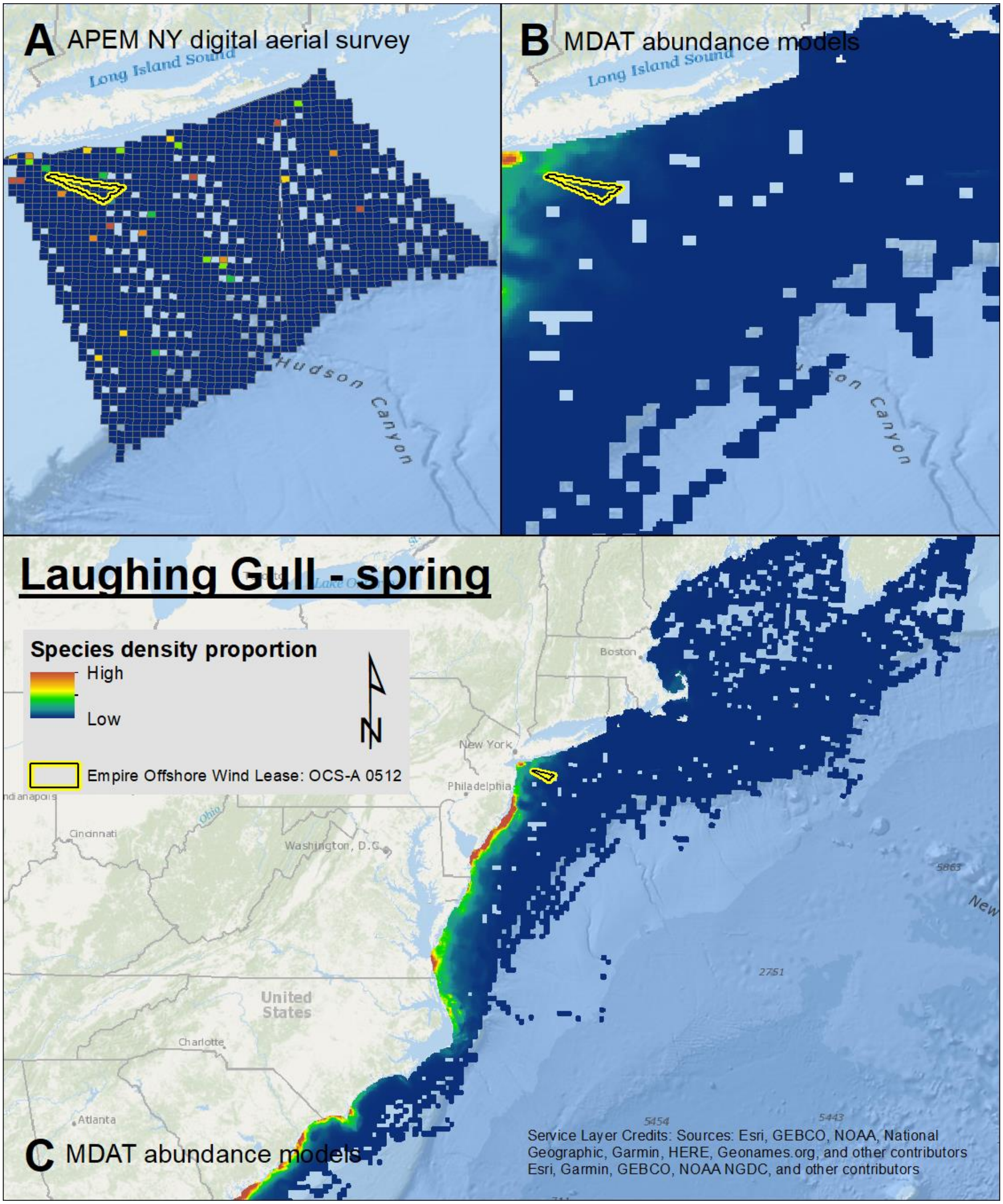
Map 69. Spring Black-legged Kittiwake density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



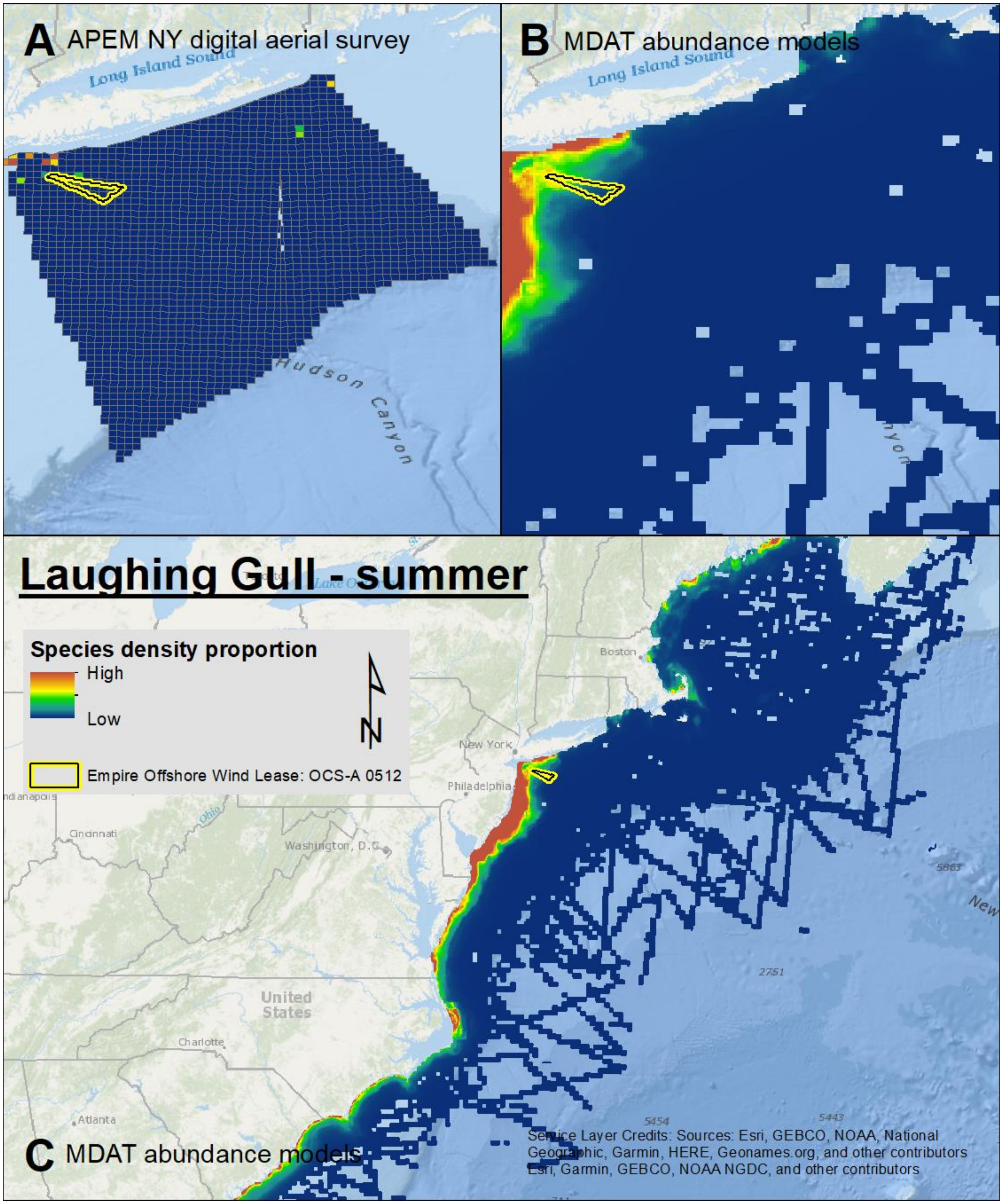
Map 70. Fall Black-legged Kittiwake density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



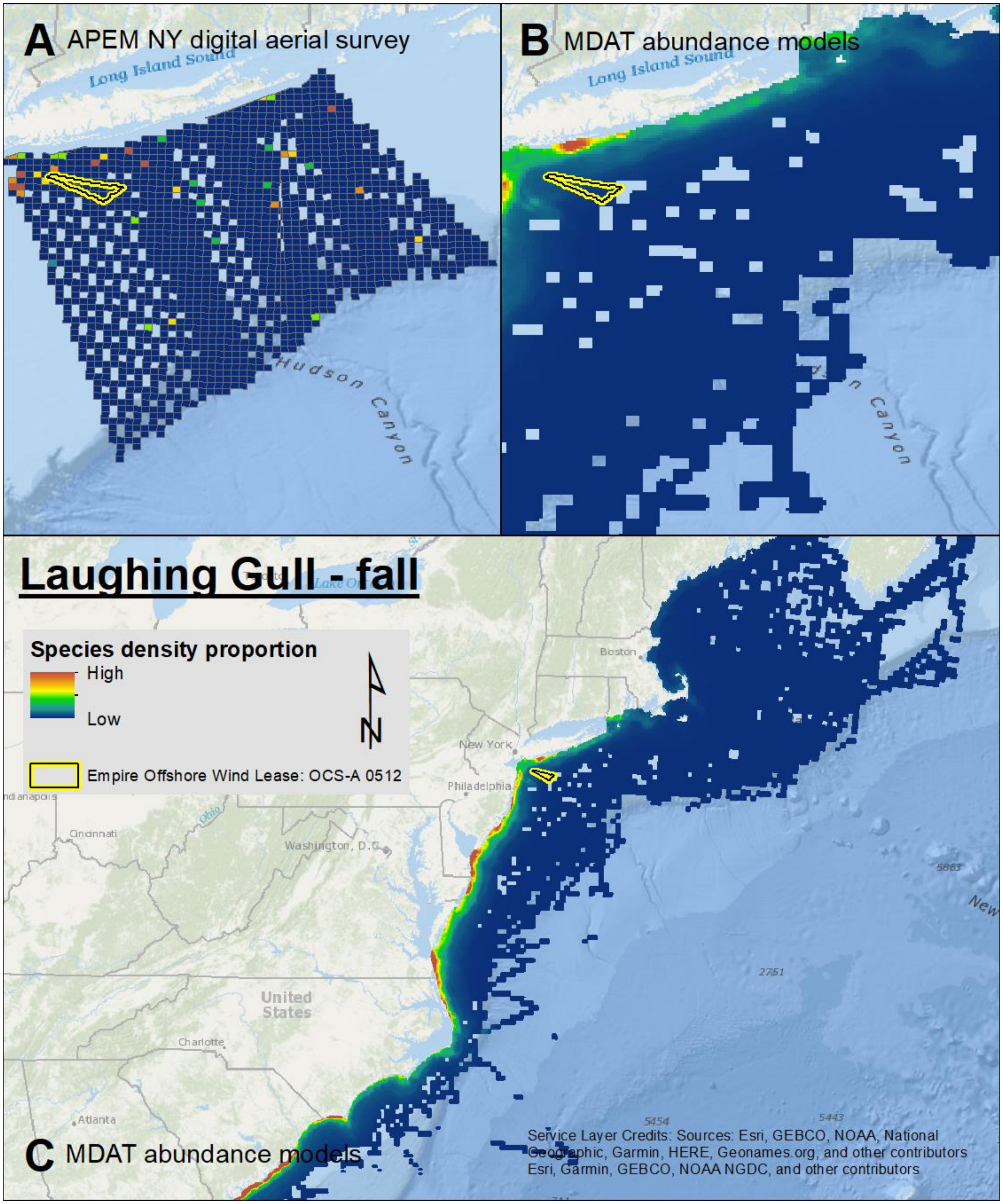
Map 71. Winter Laughing Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



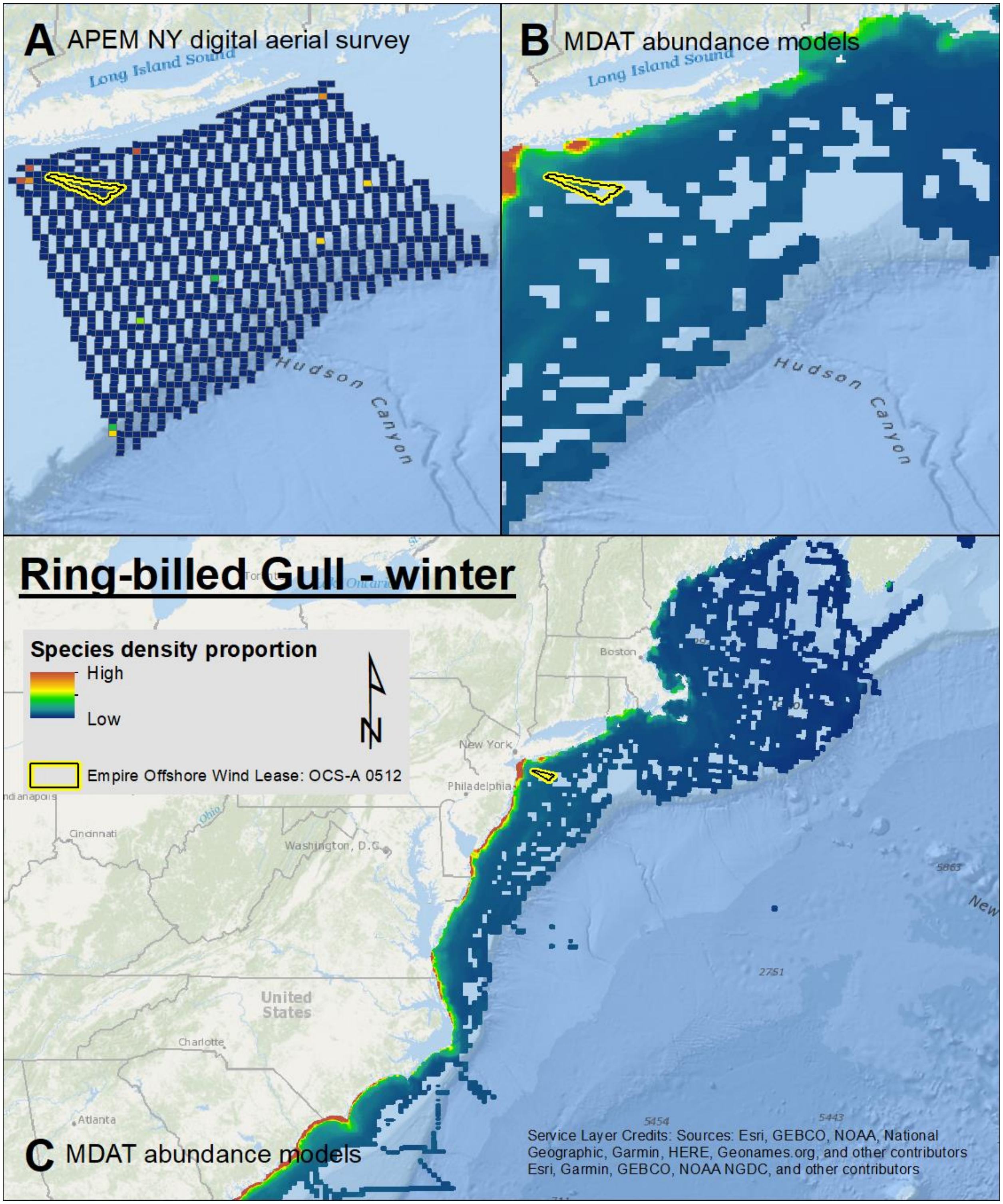
Map 72. Spring Laughing Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



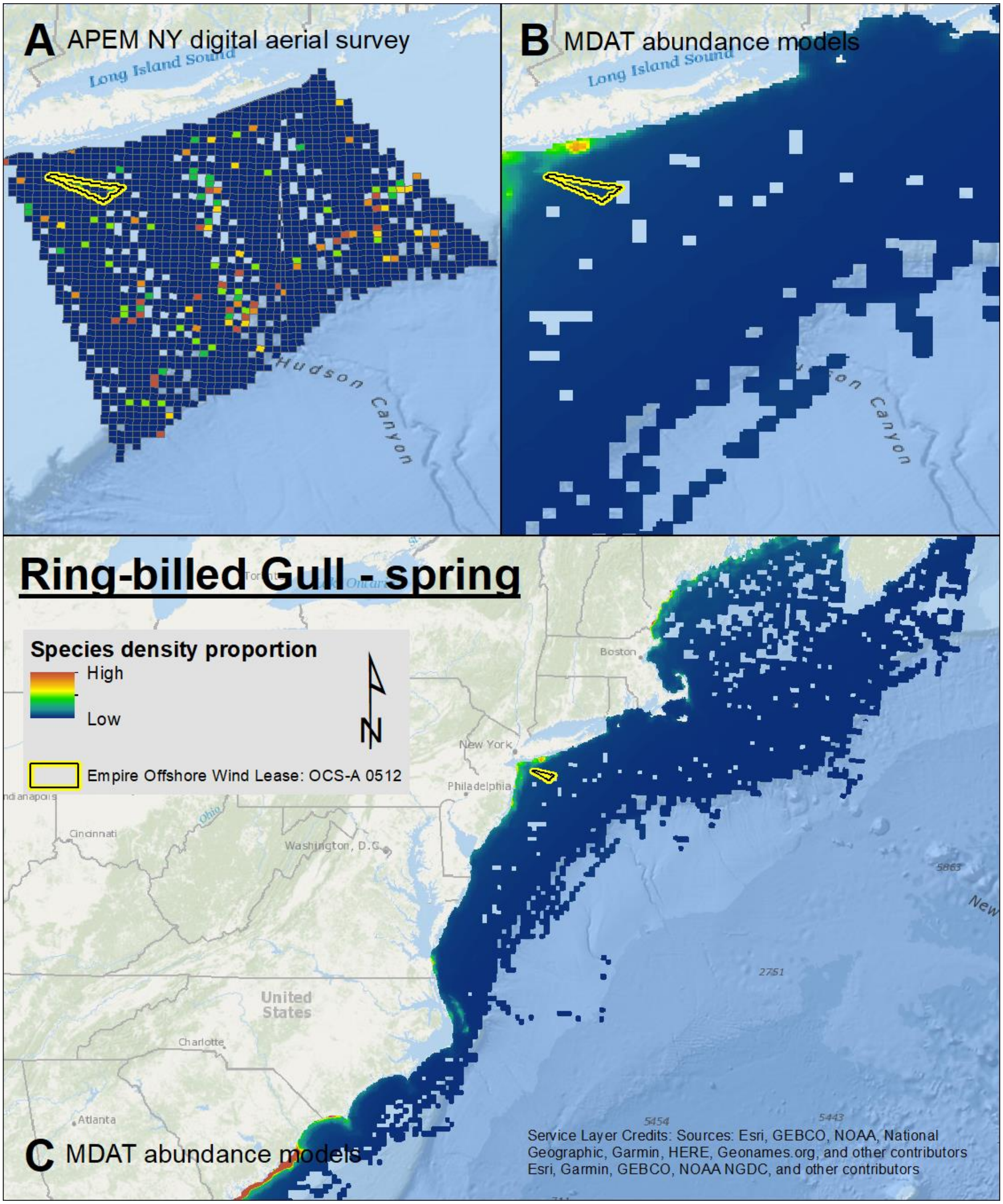
Map 73. Summer Laughing Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



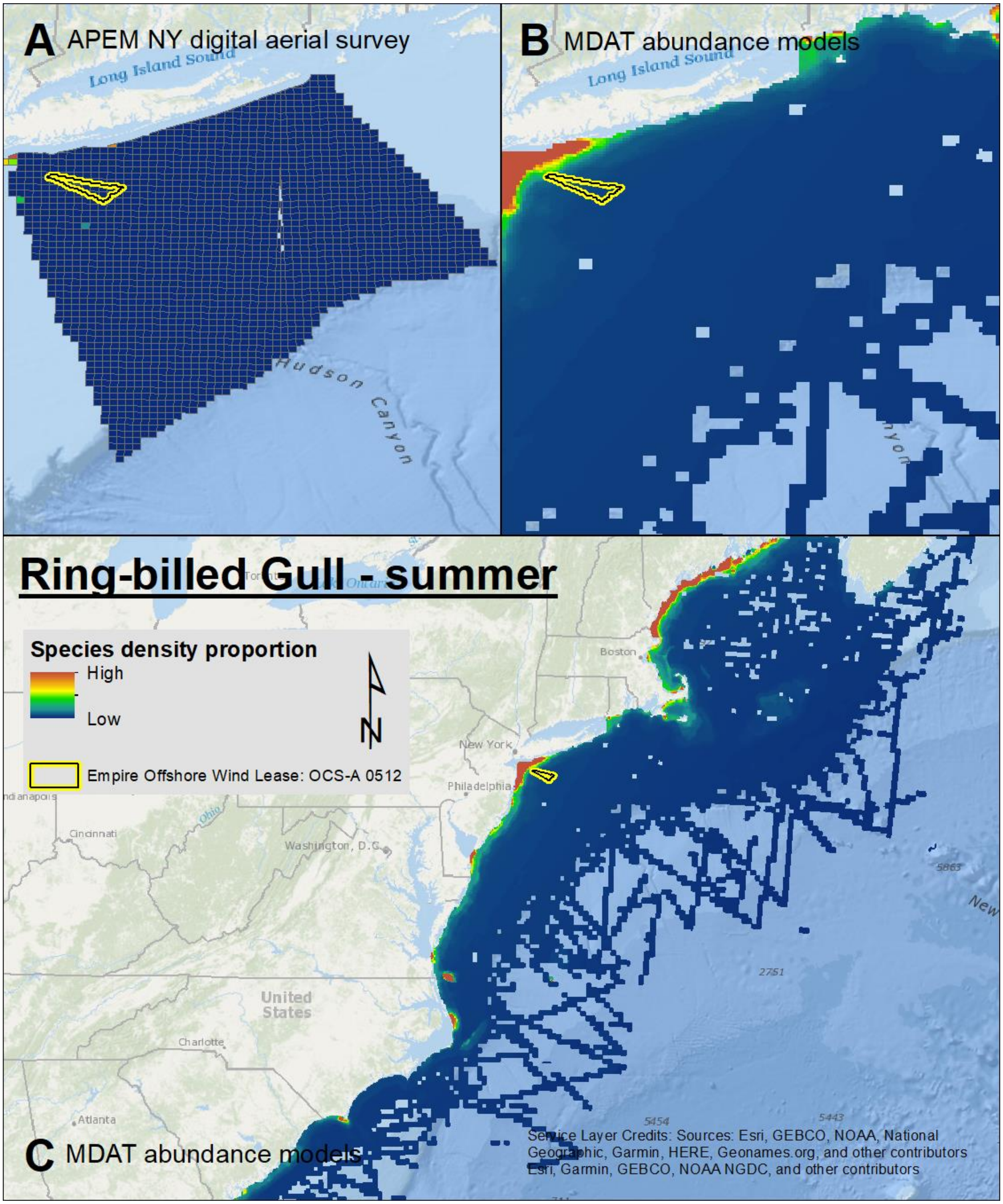
Map 74. Fall Laughing Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



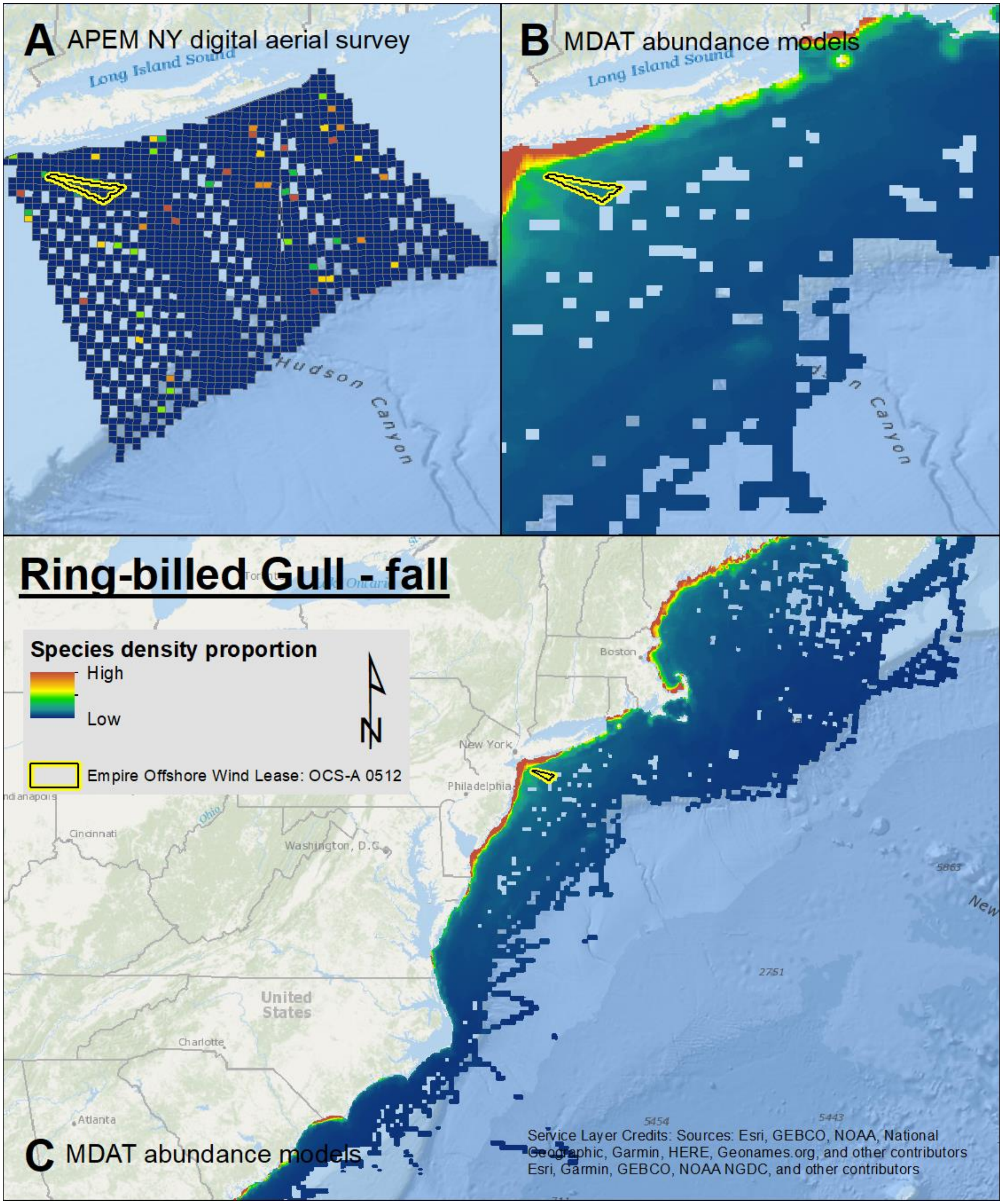
Map 75. Winter Ring-billed Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



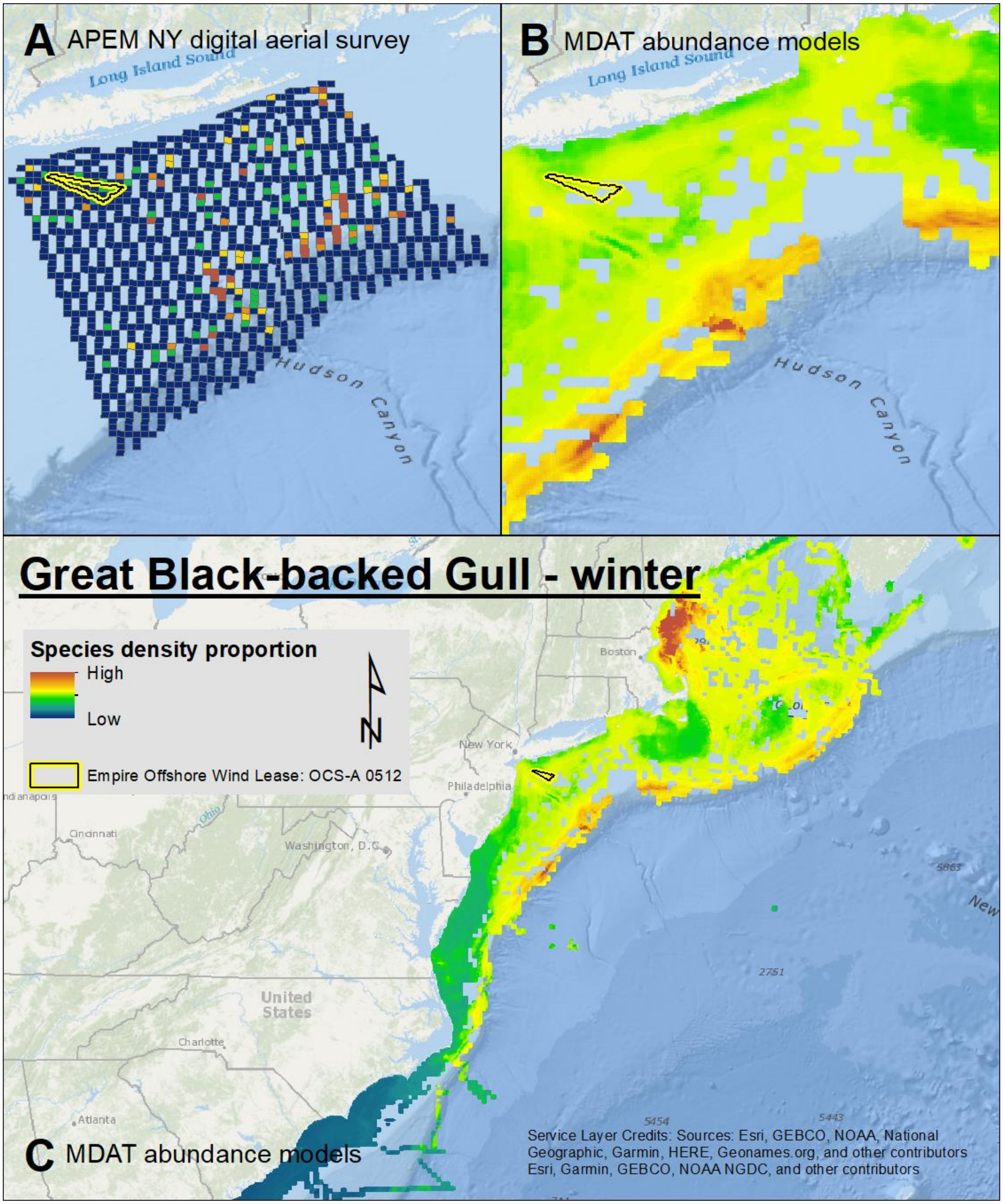
Map 76. Spring Ring-billed Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



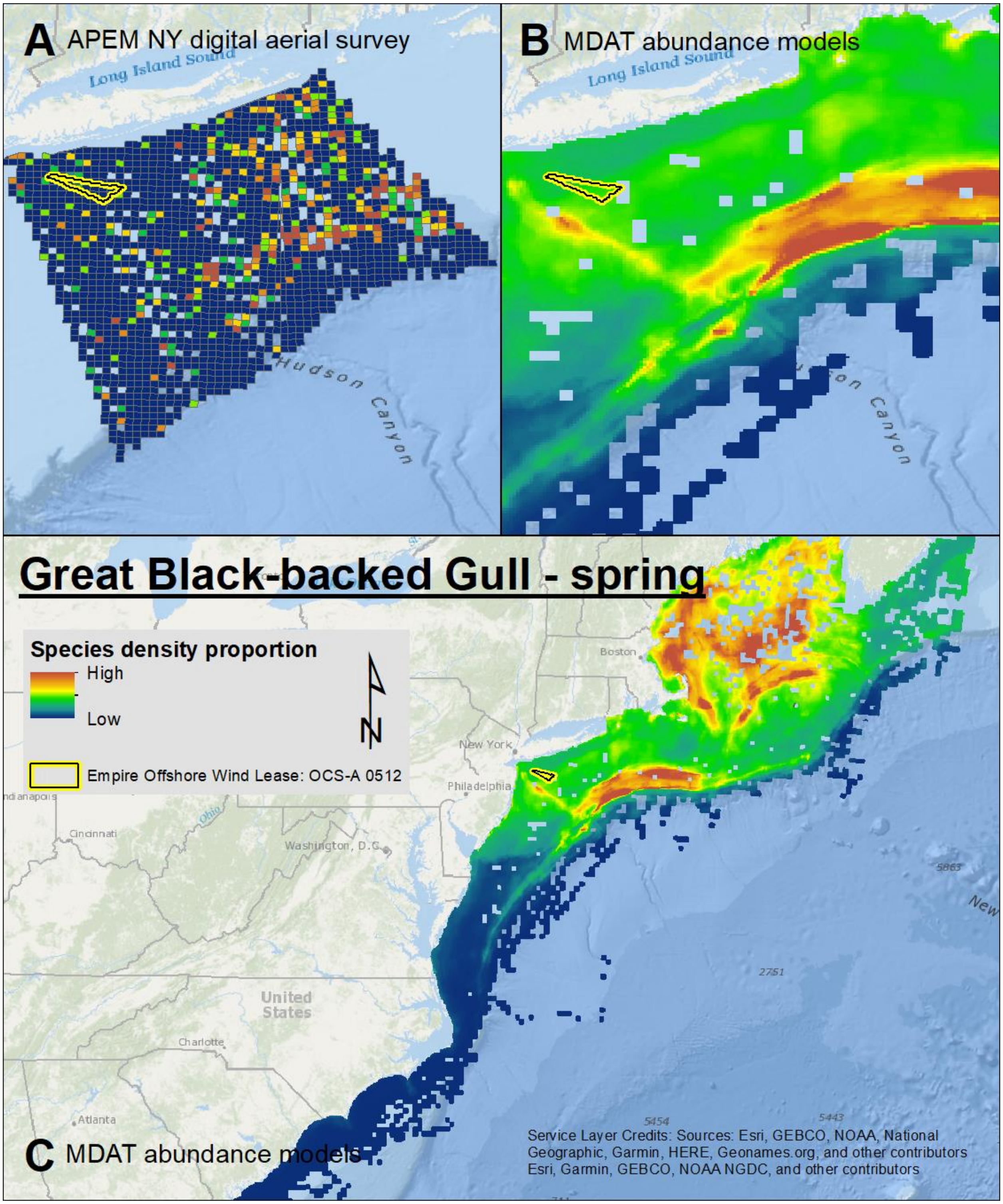
Map 77. Summer Ring-billed Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



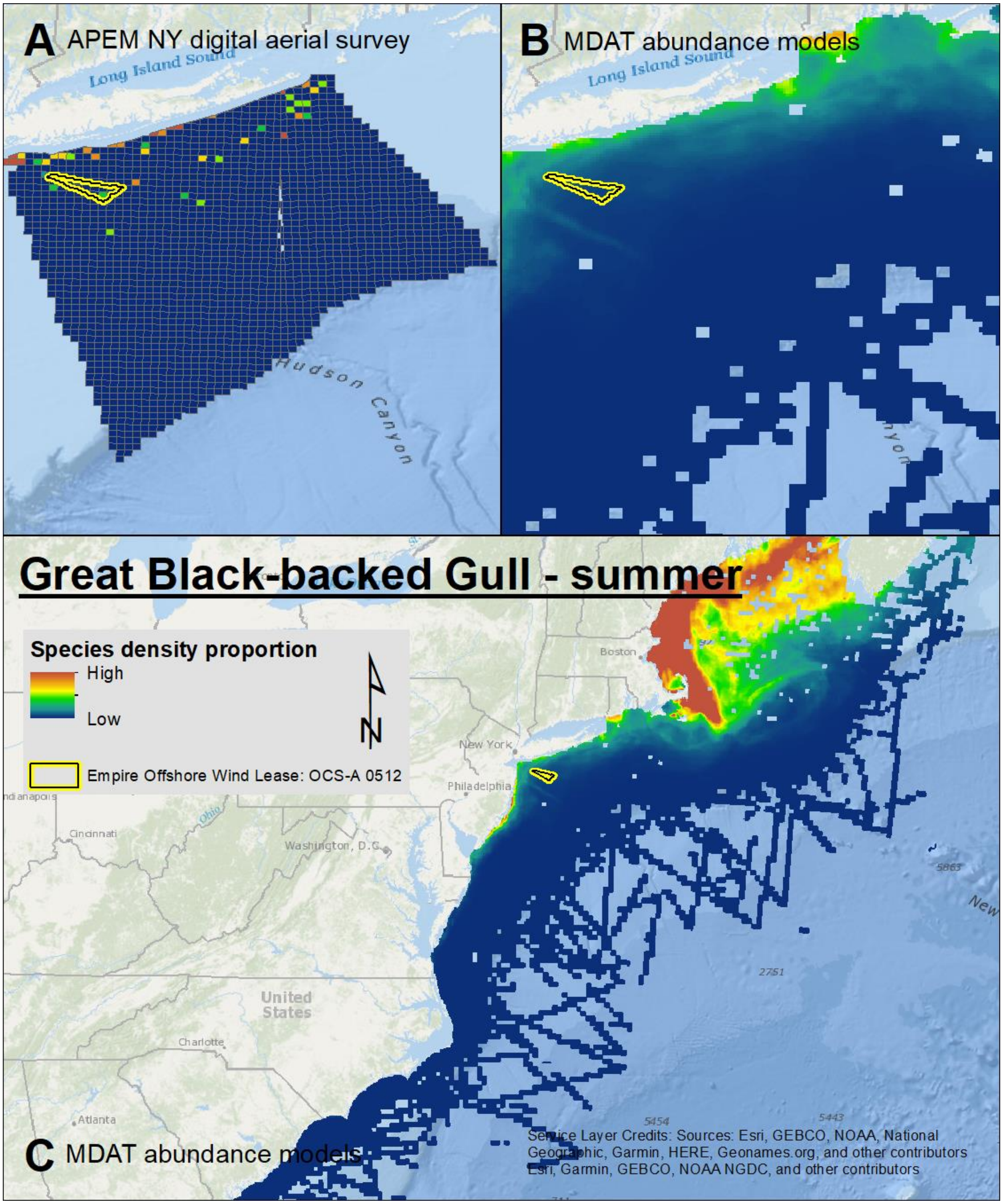
Map 78. Fall Ring-billed Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



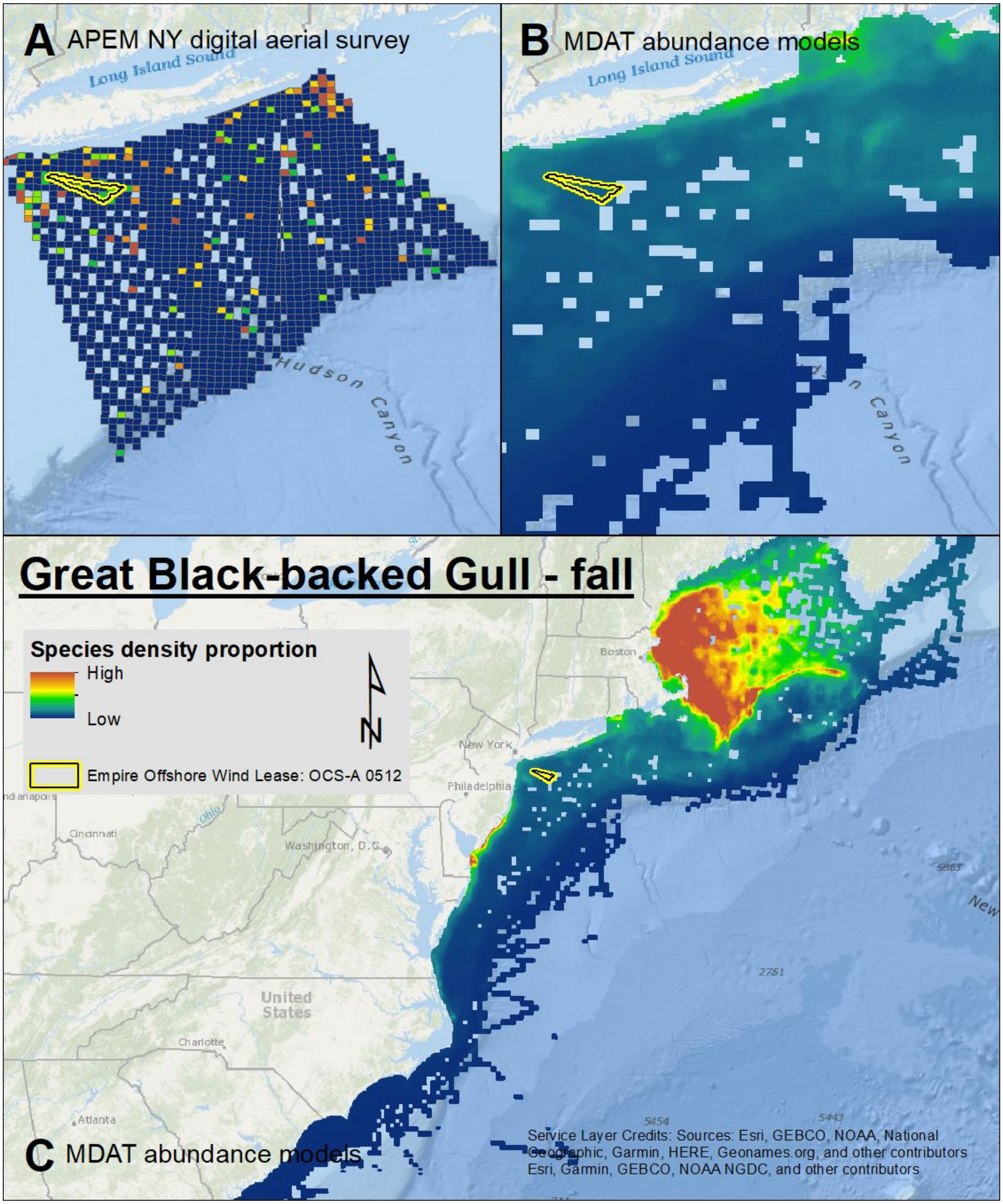
Map 79. Winter Great Black-backed Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



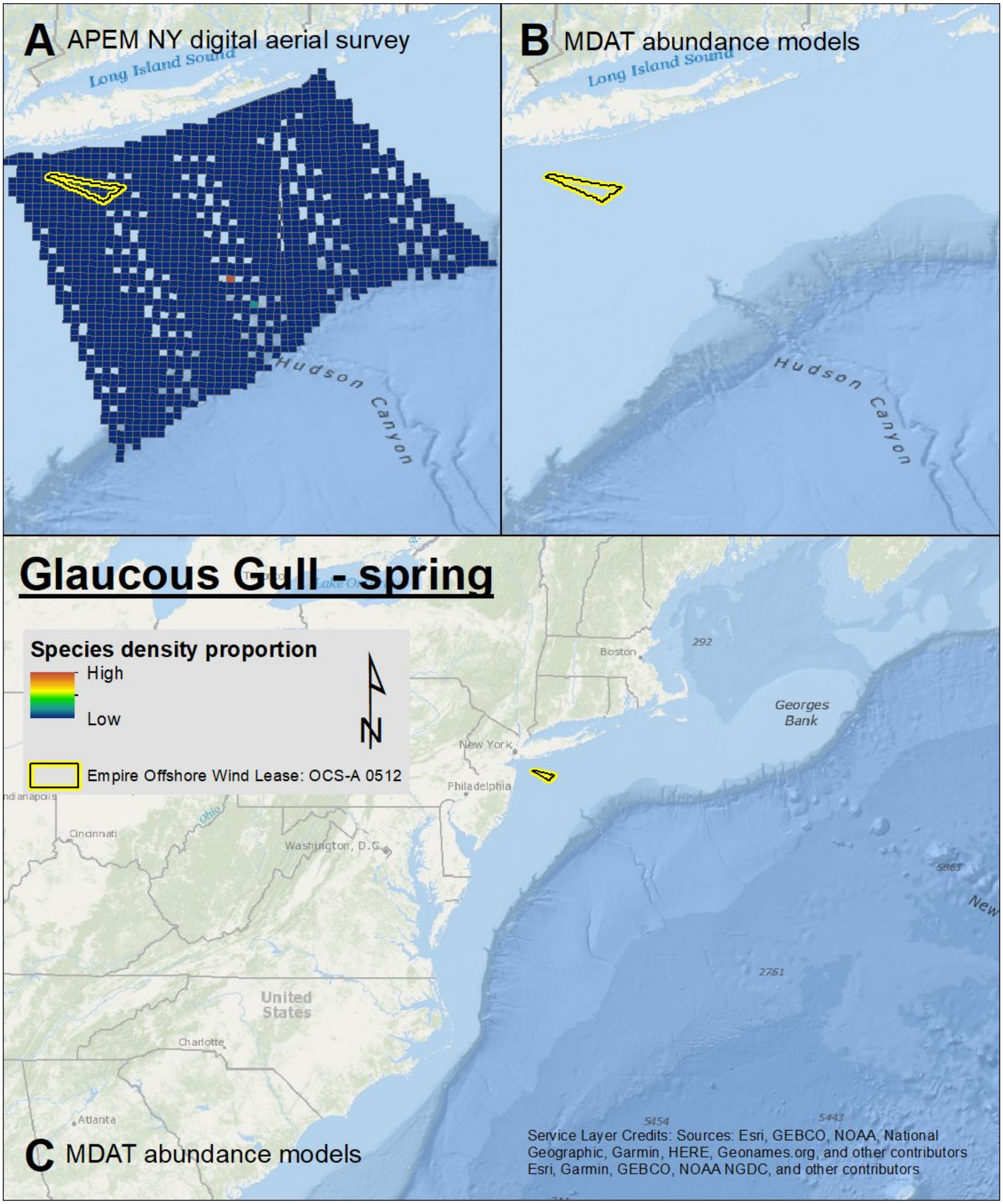
Map 80. Spring Great Black-backed Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



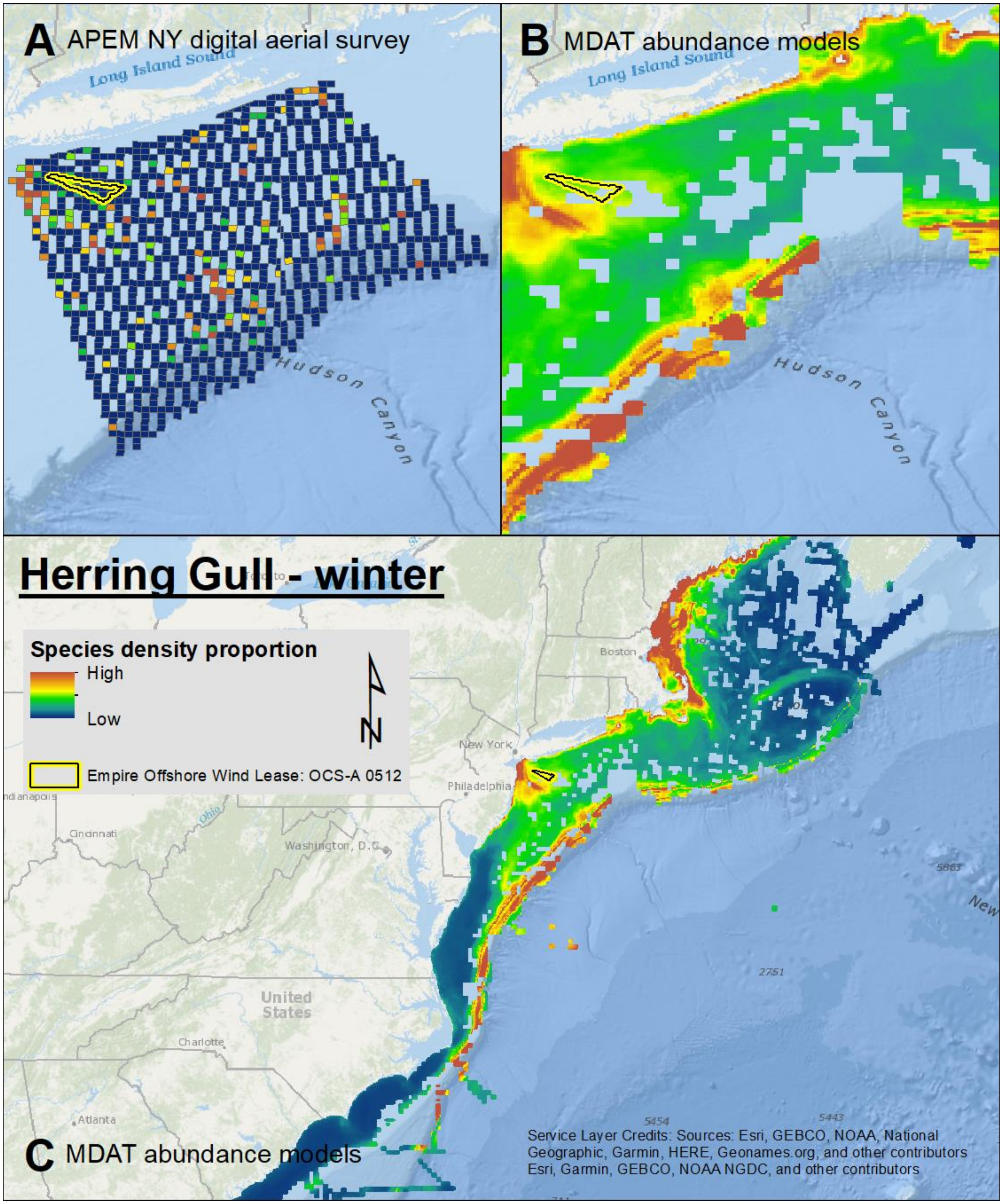
Map 81. Summer Great Black-backed Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



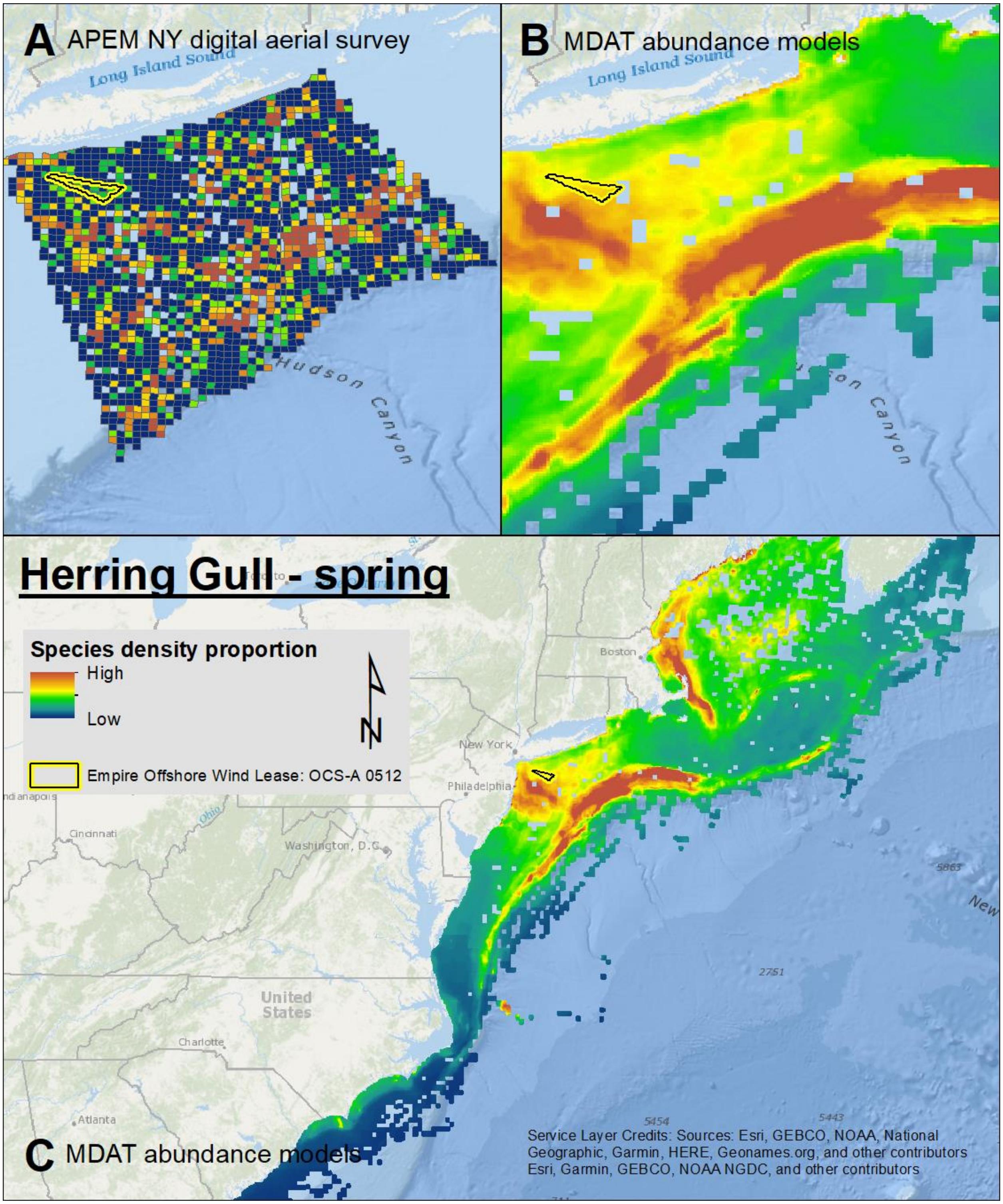
Map 82. Fall Great Black-backed Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



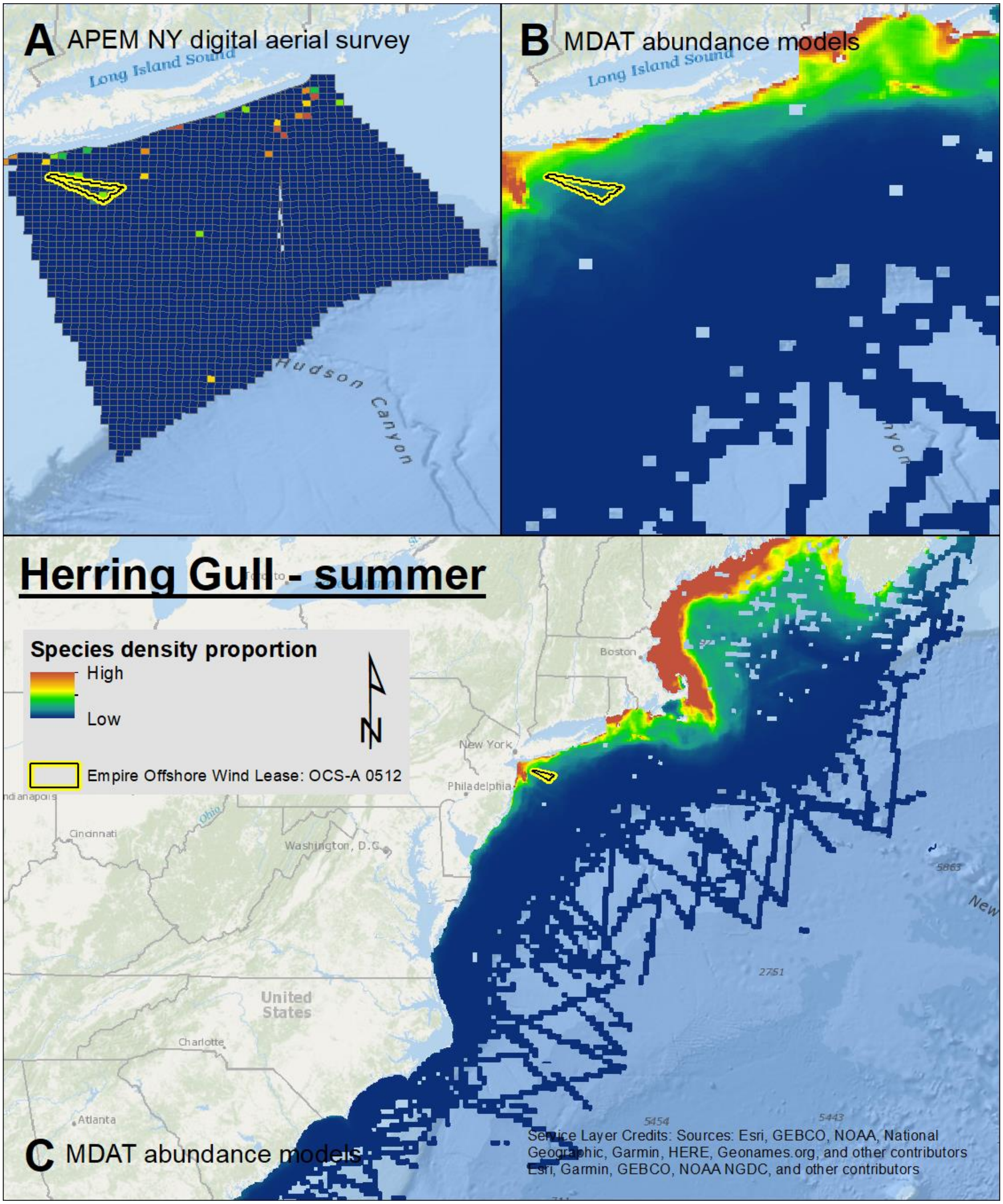
Map 83. Spring Glaucous Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



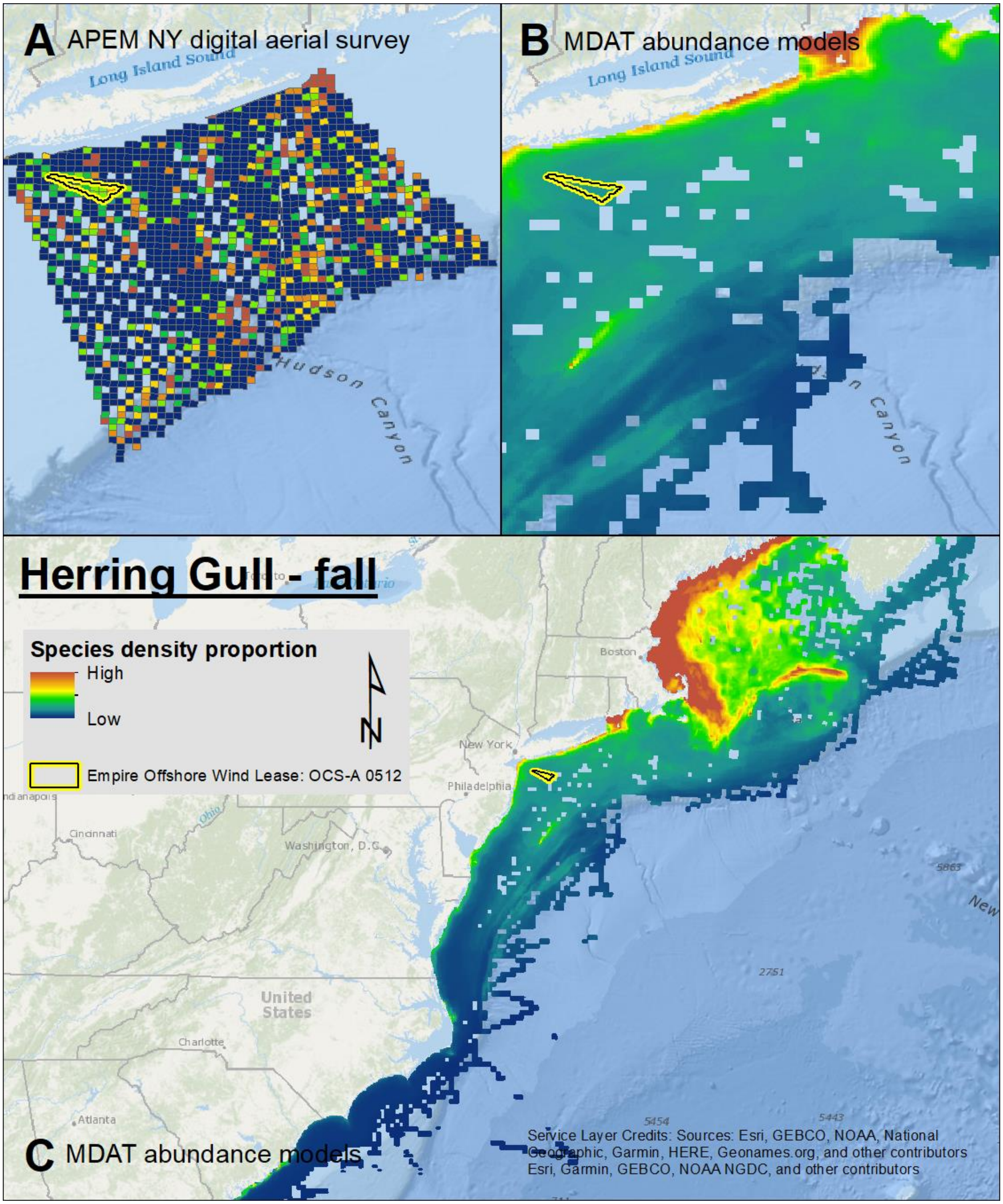
Map 84. Winter Herring Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



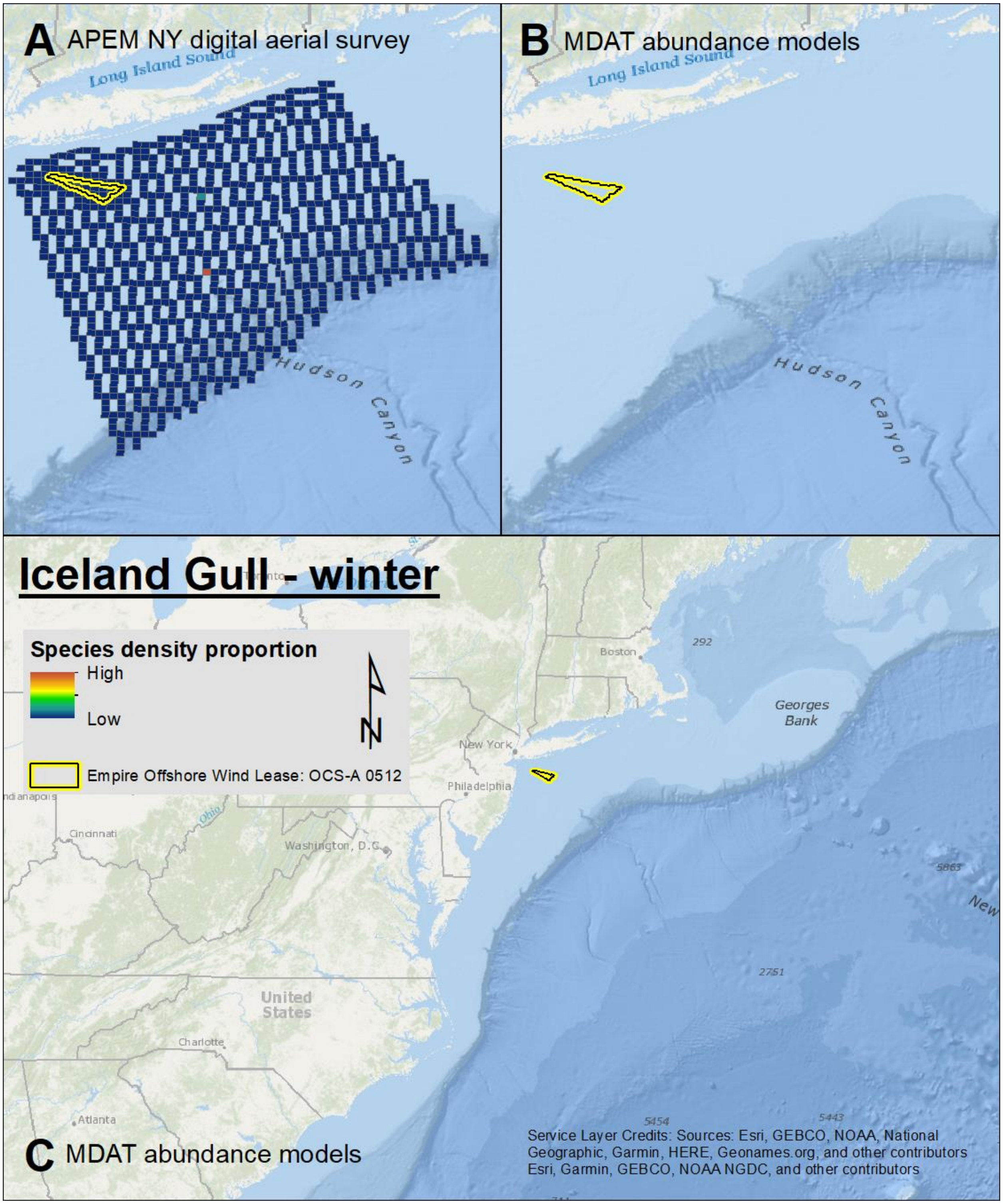
Map 85. Spring Herring Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



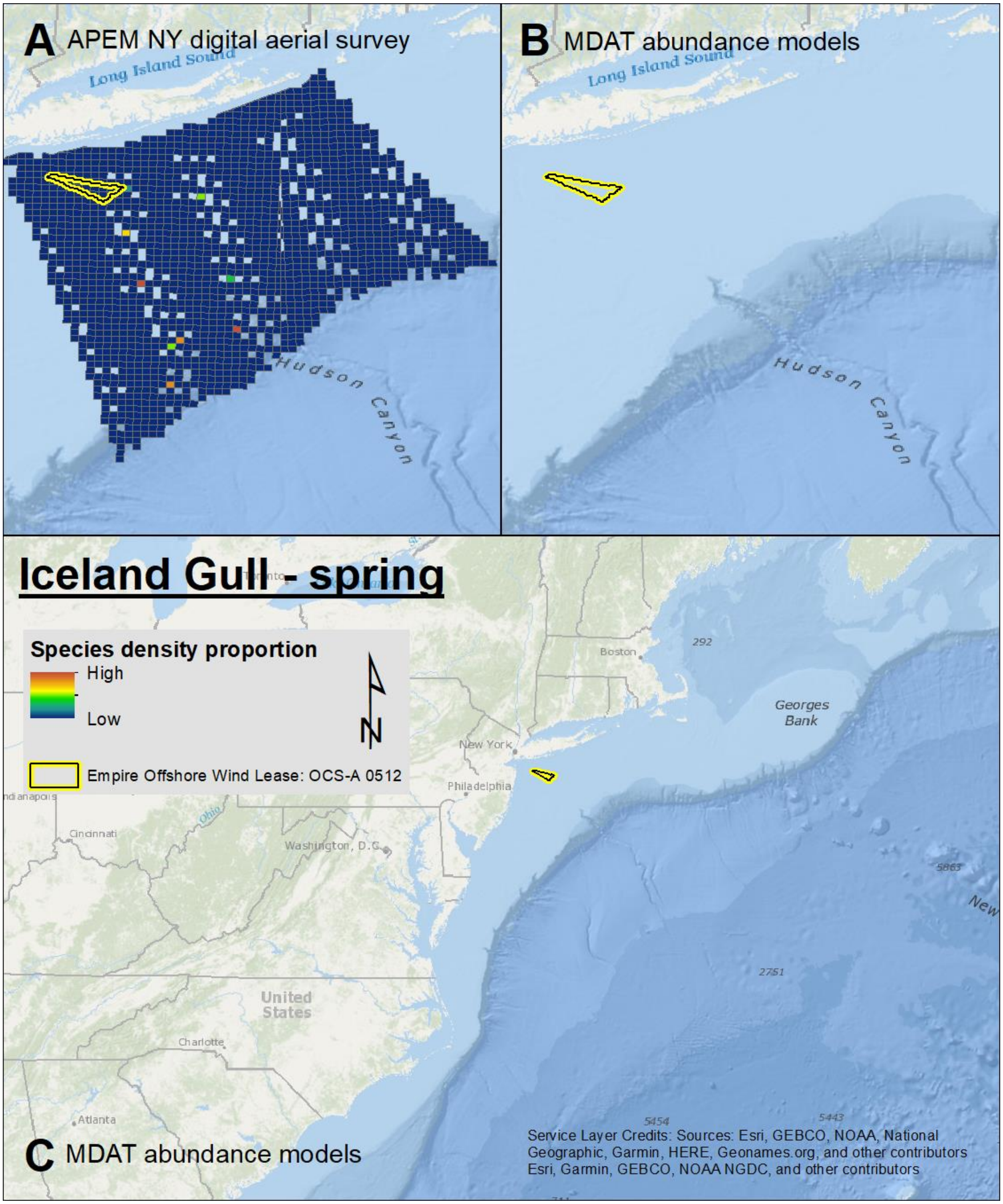
Map 86. Summer Herring Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



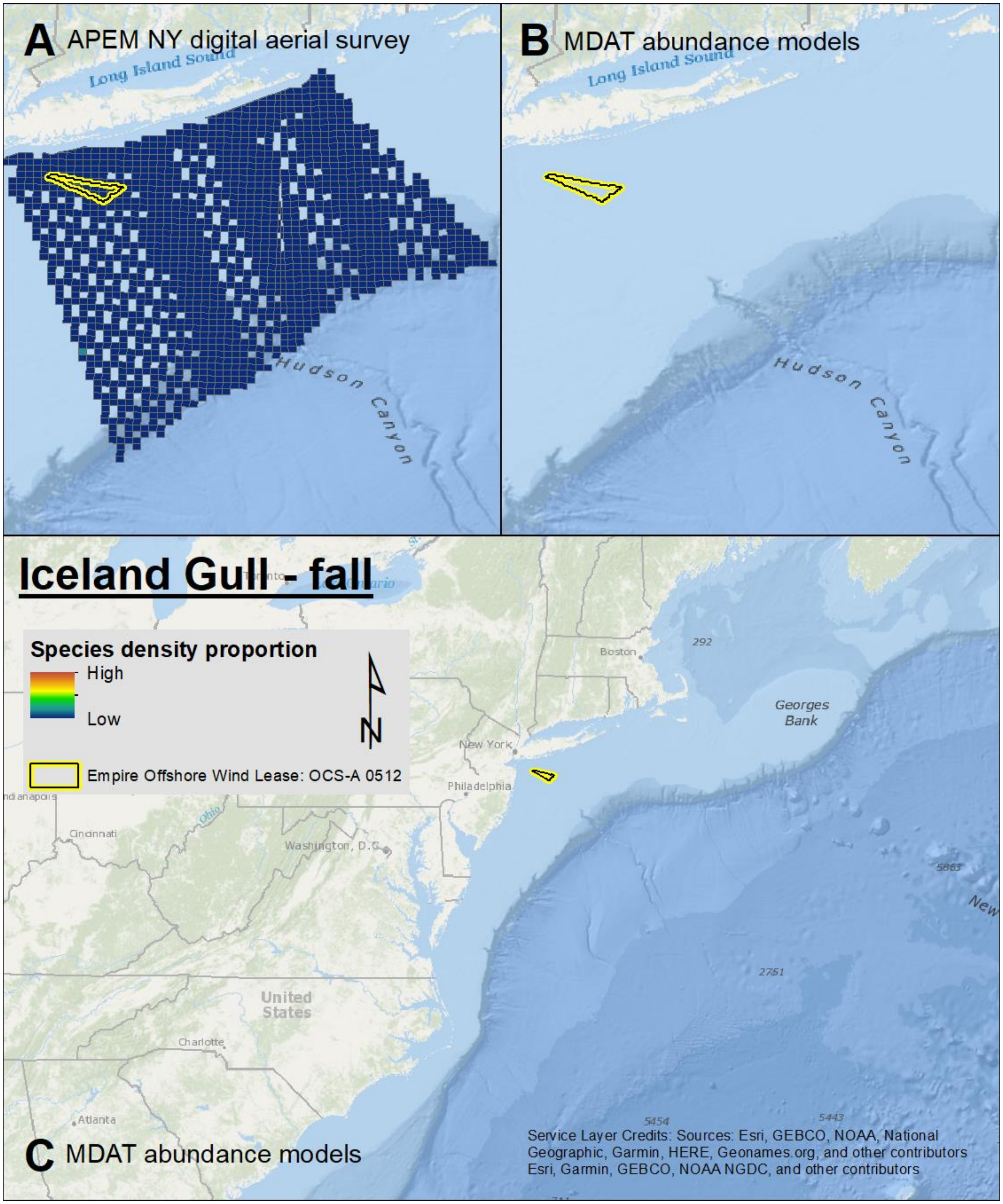
Map 87. Fall Herring Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



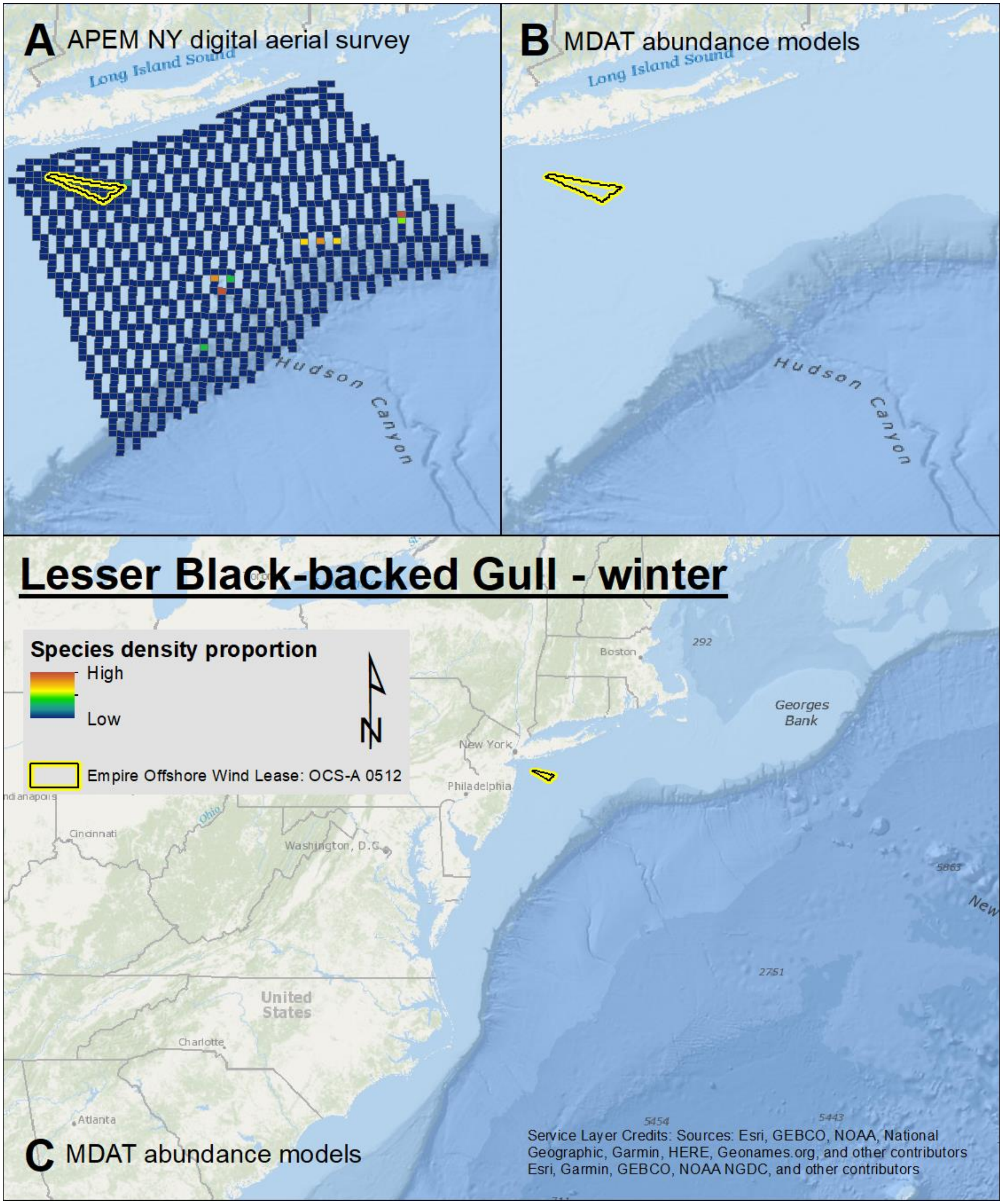
Map 88. Winter Iceland Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



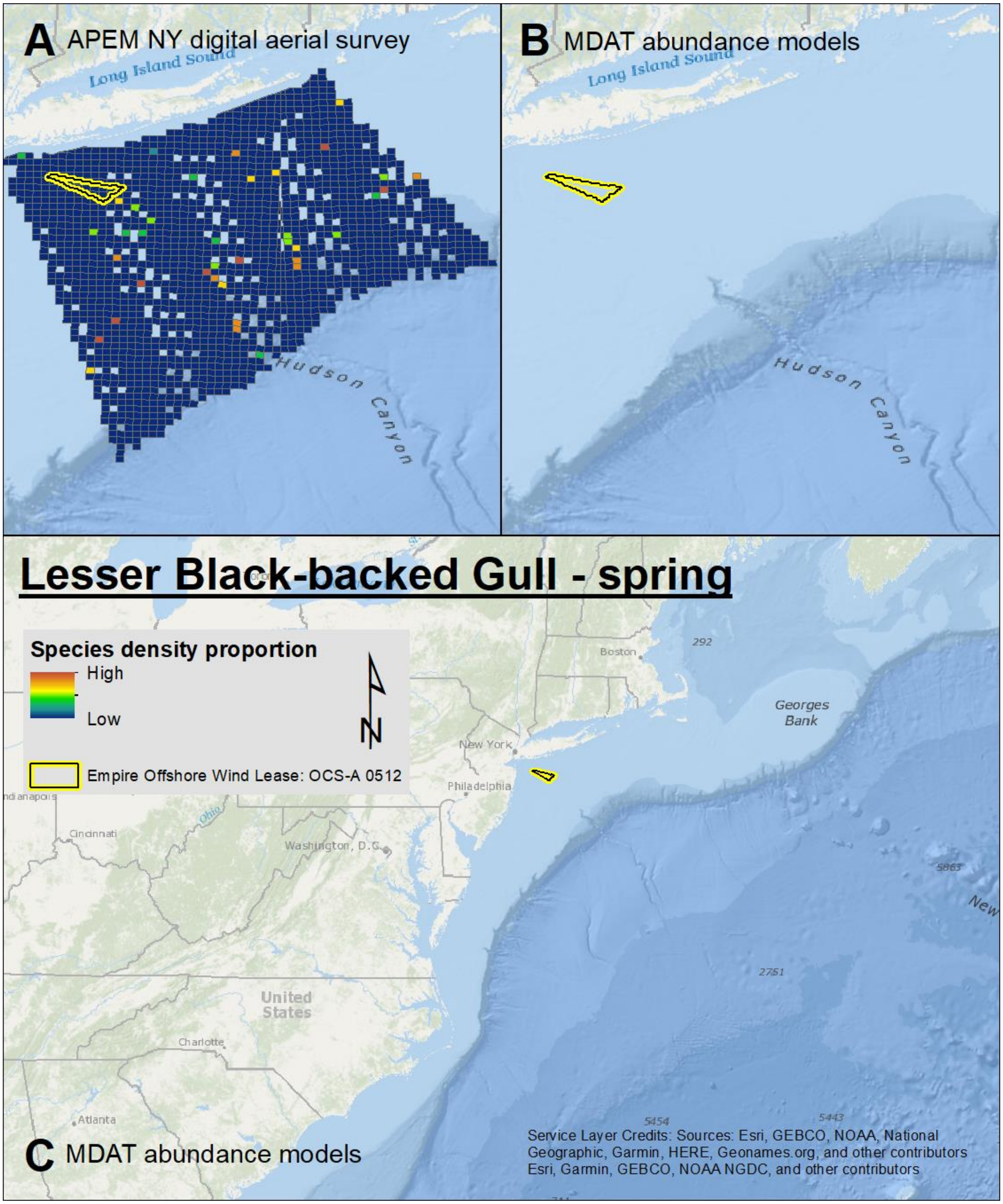
Map 89. Spring Iceland Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



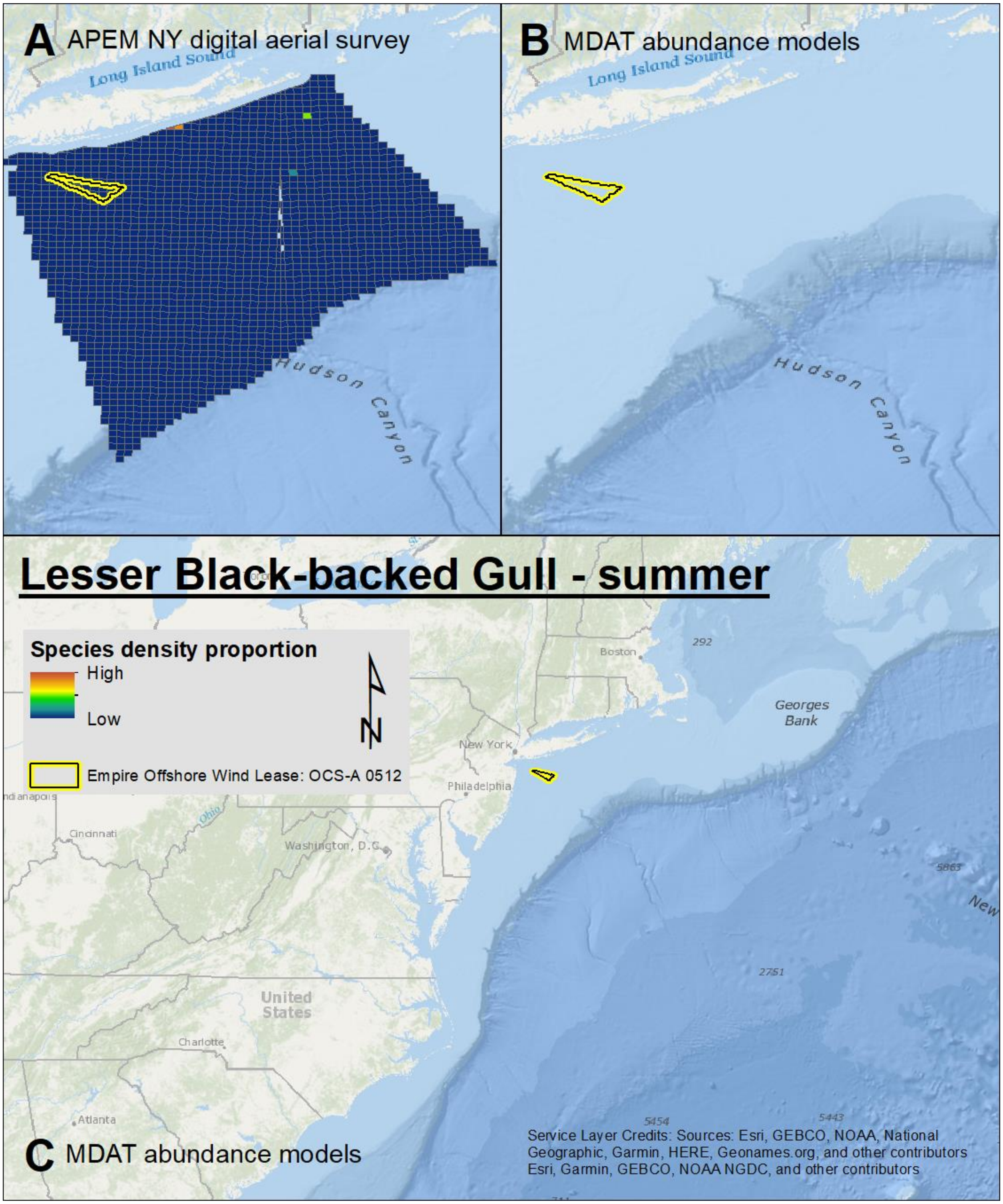
Map 90. Fall Iceland Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



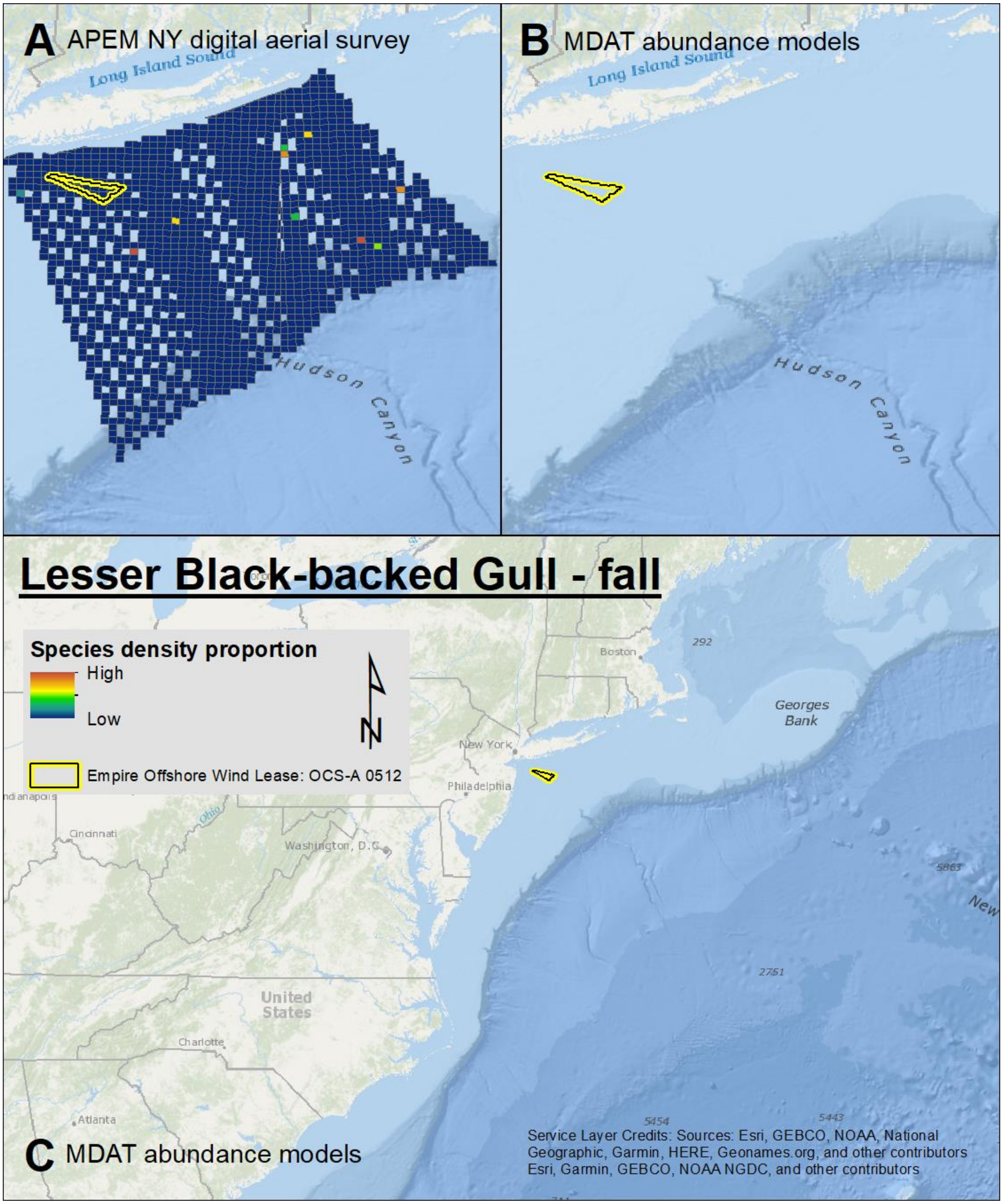
Map 91. Winter Lesser Black-backed Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



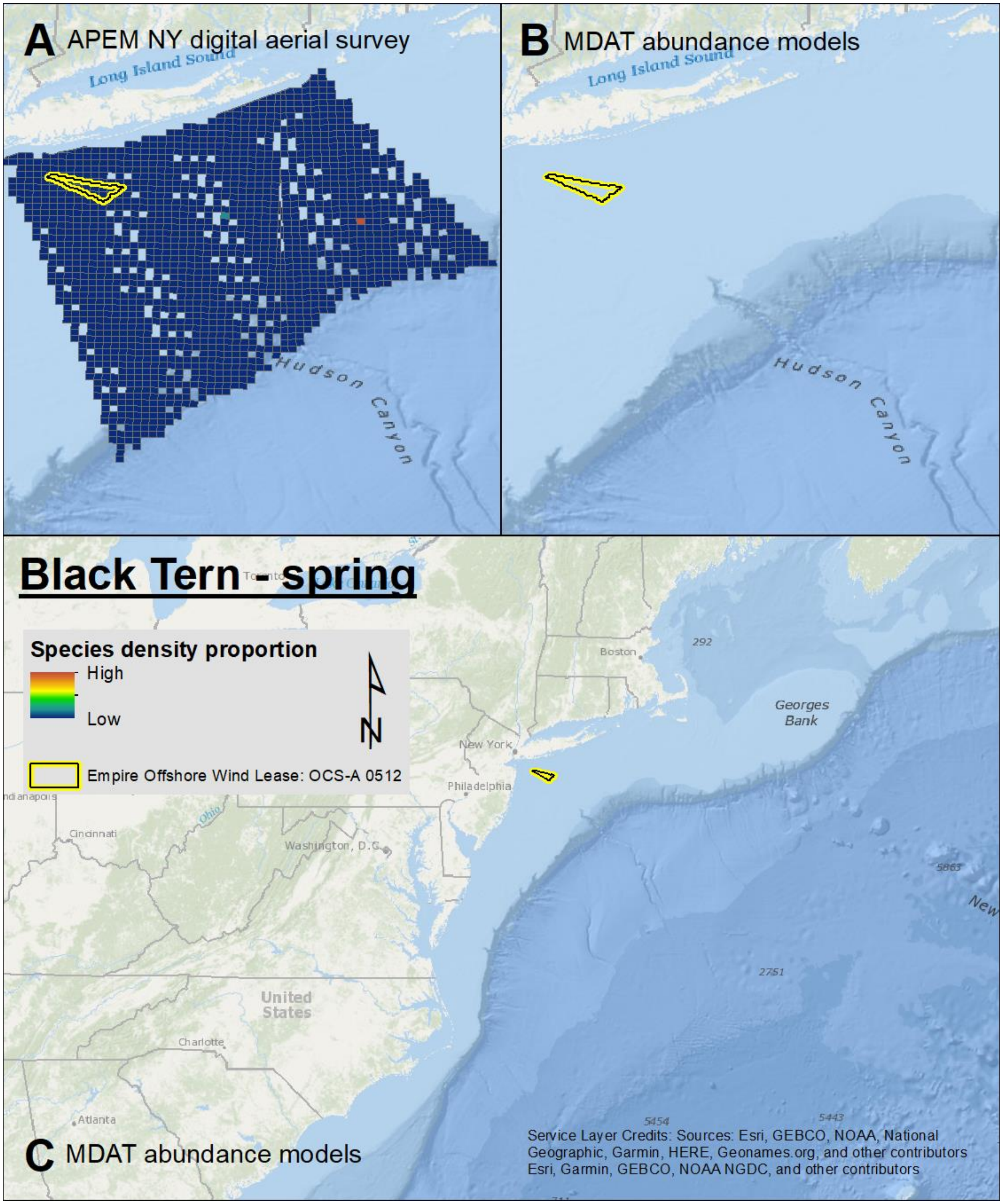
Map 92. Spring Lesser Black-backed Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



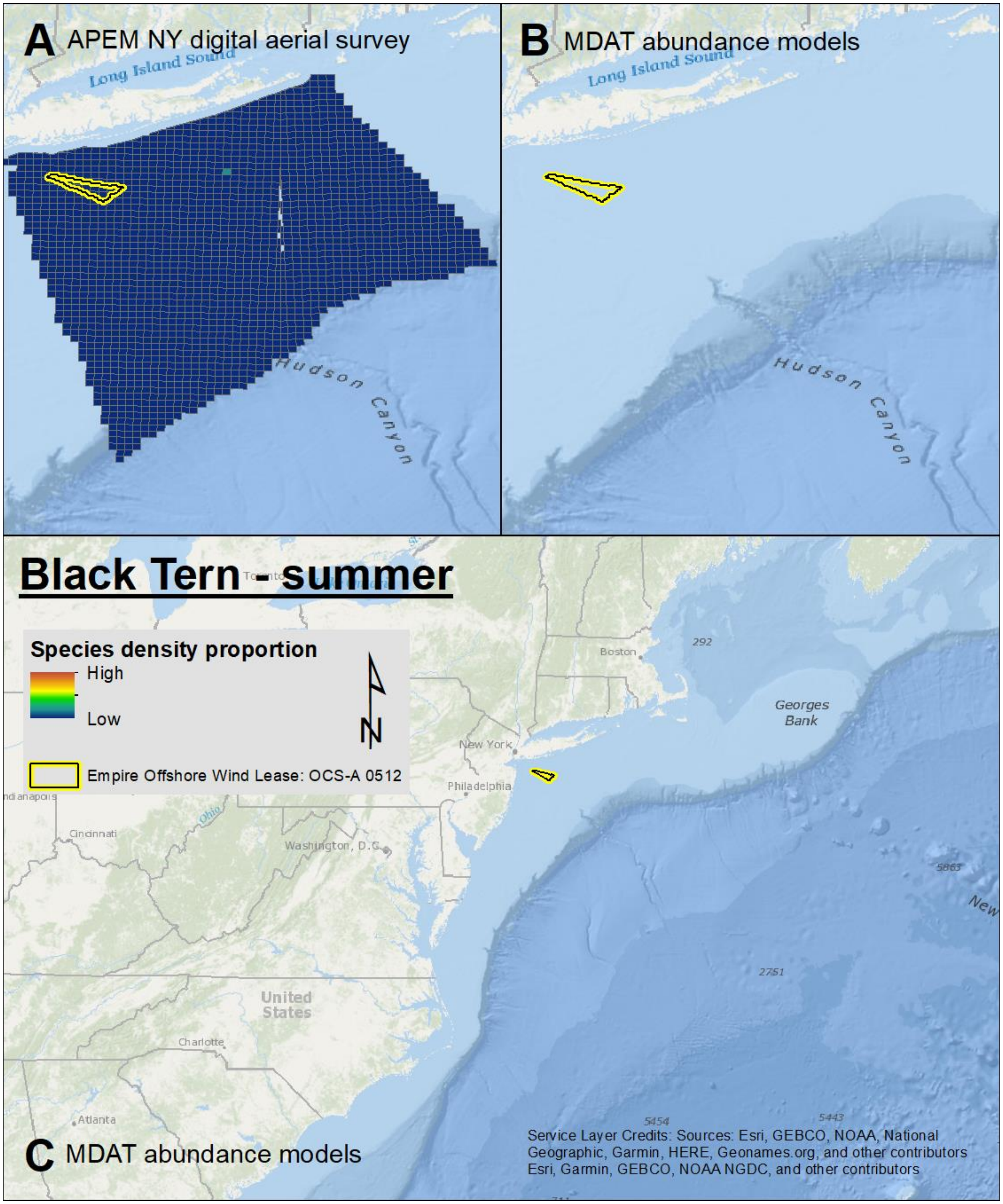
Map 93. Summer Lesser Black-backed Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



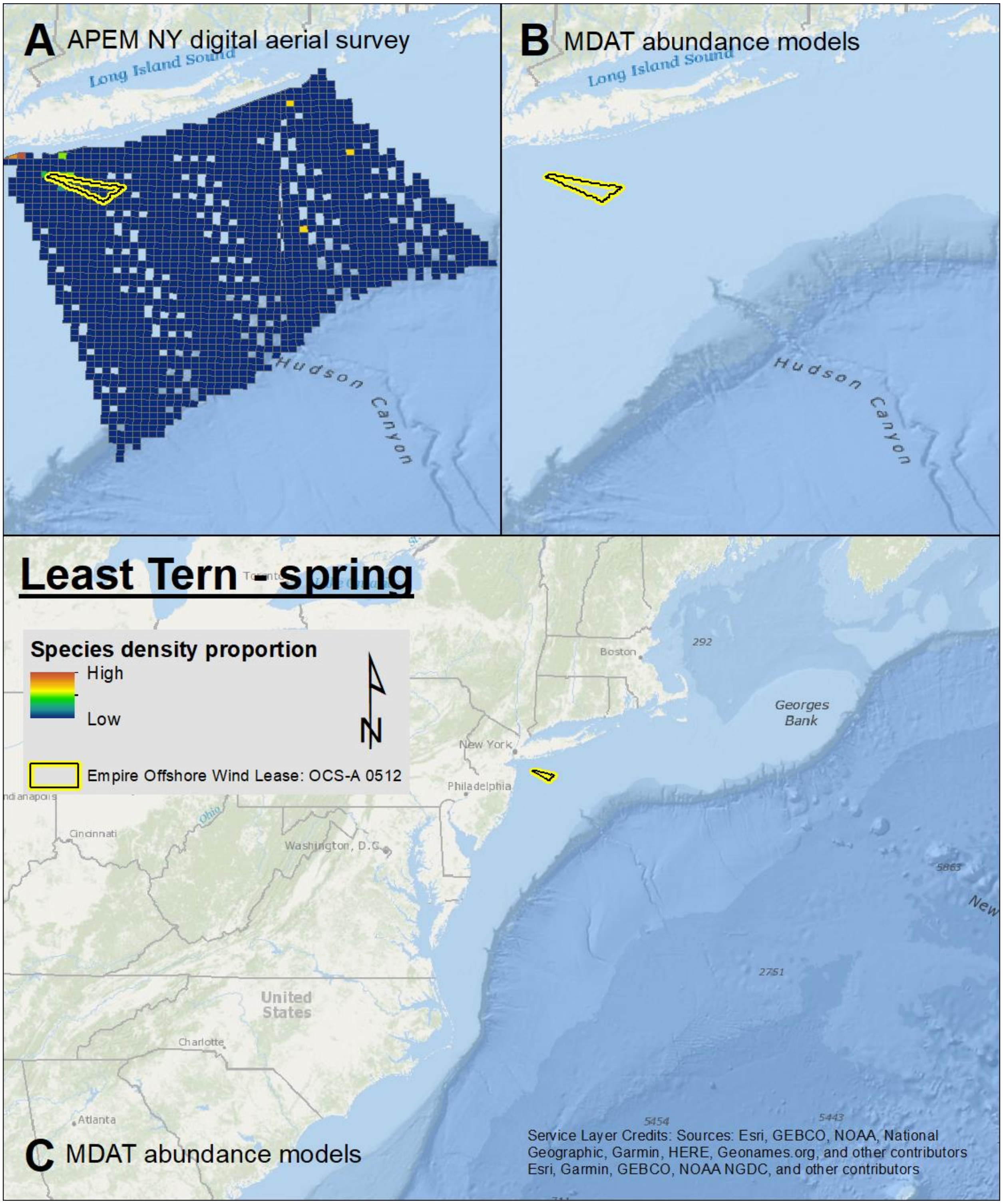
Map 94. Fall Lesser Black-backed Gull density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



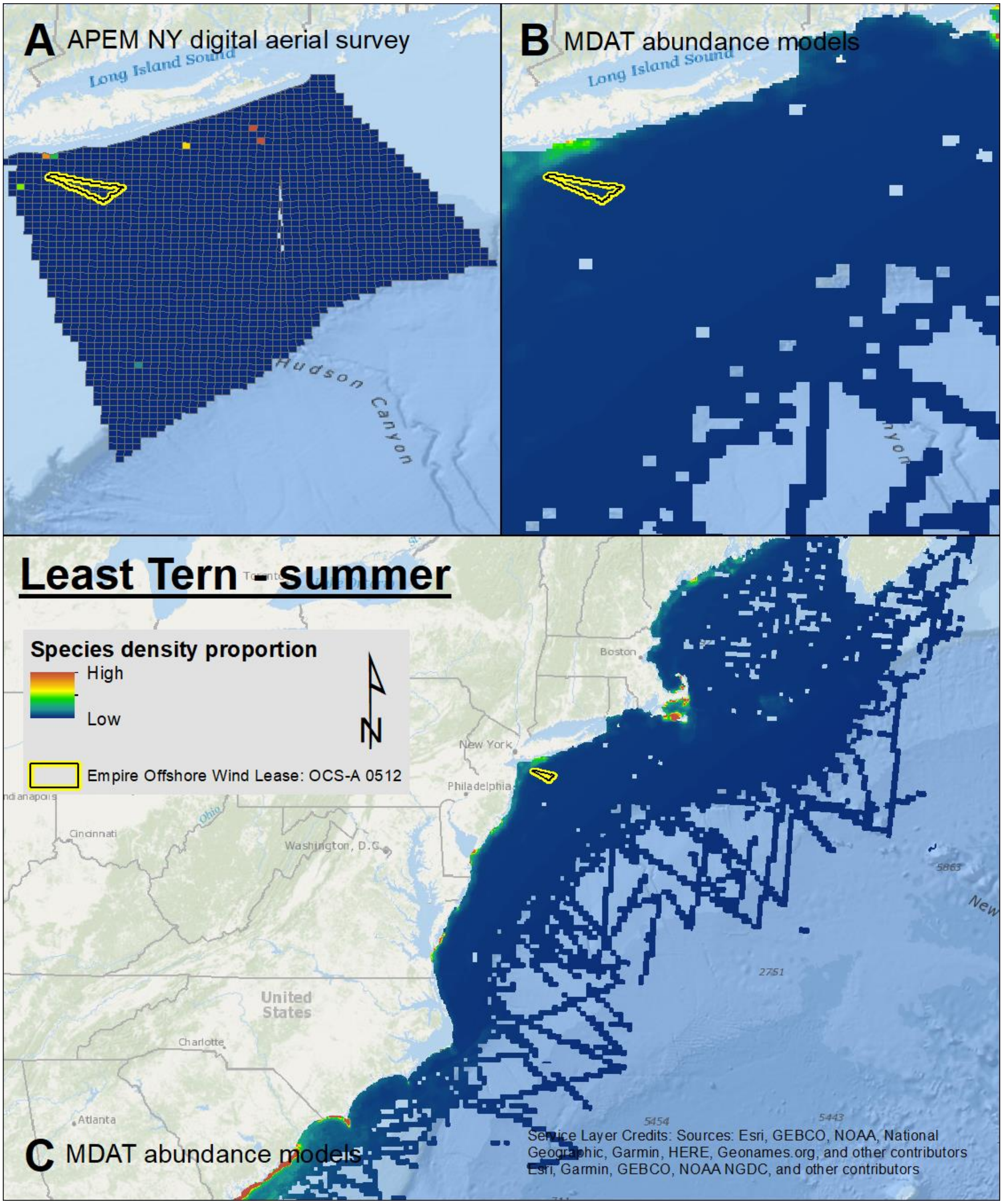
Map 95. Spring Black Tern density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



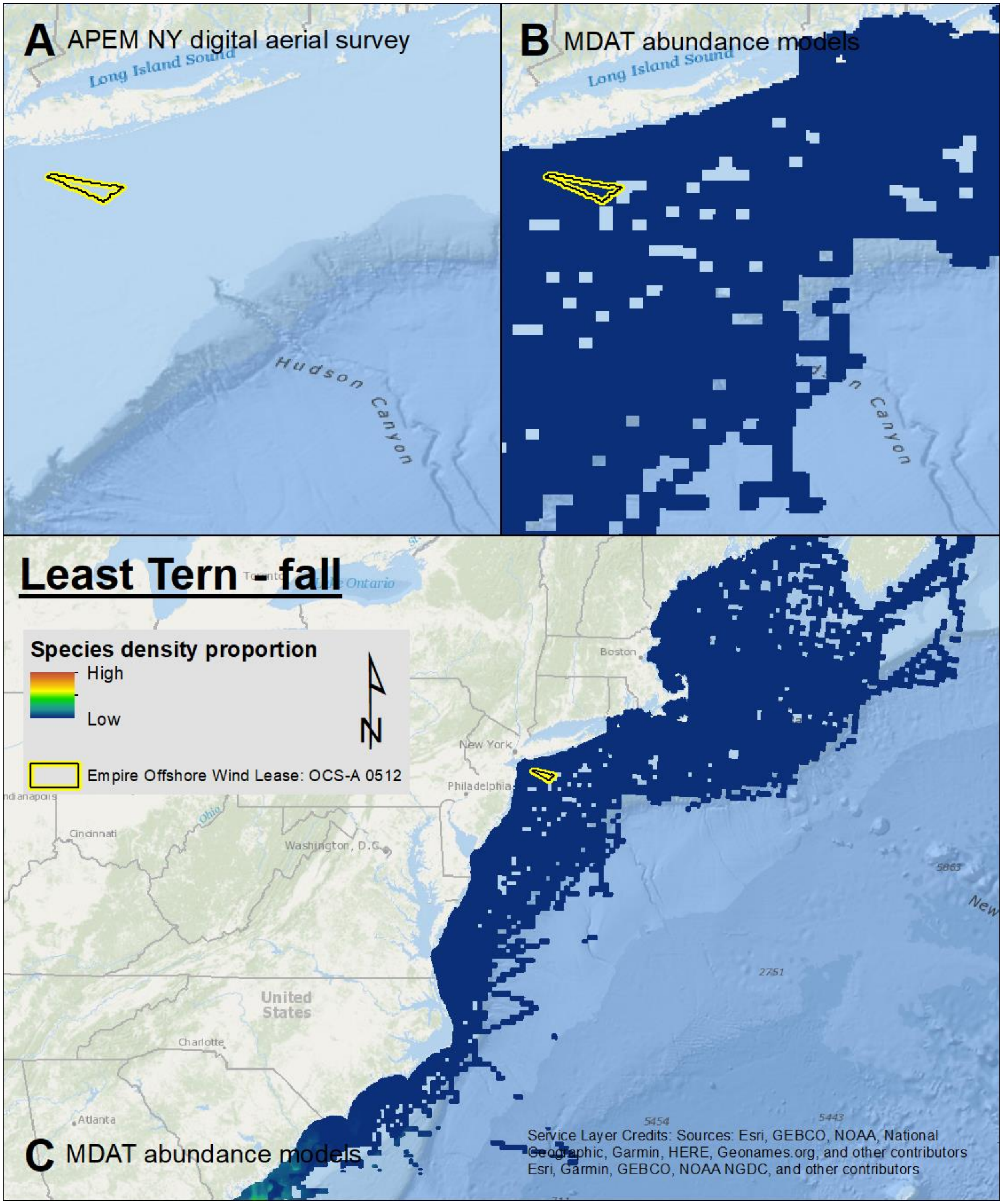
Map 96. Summer Black Tern density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



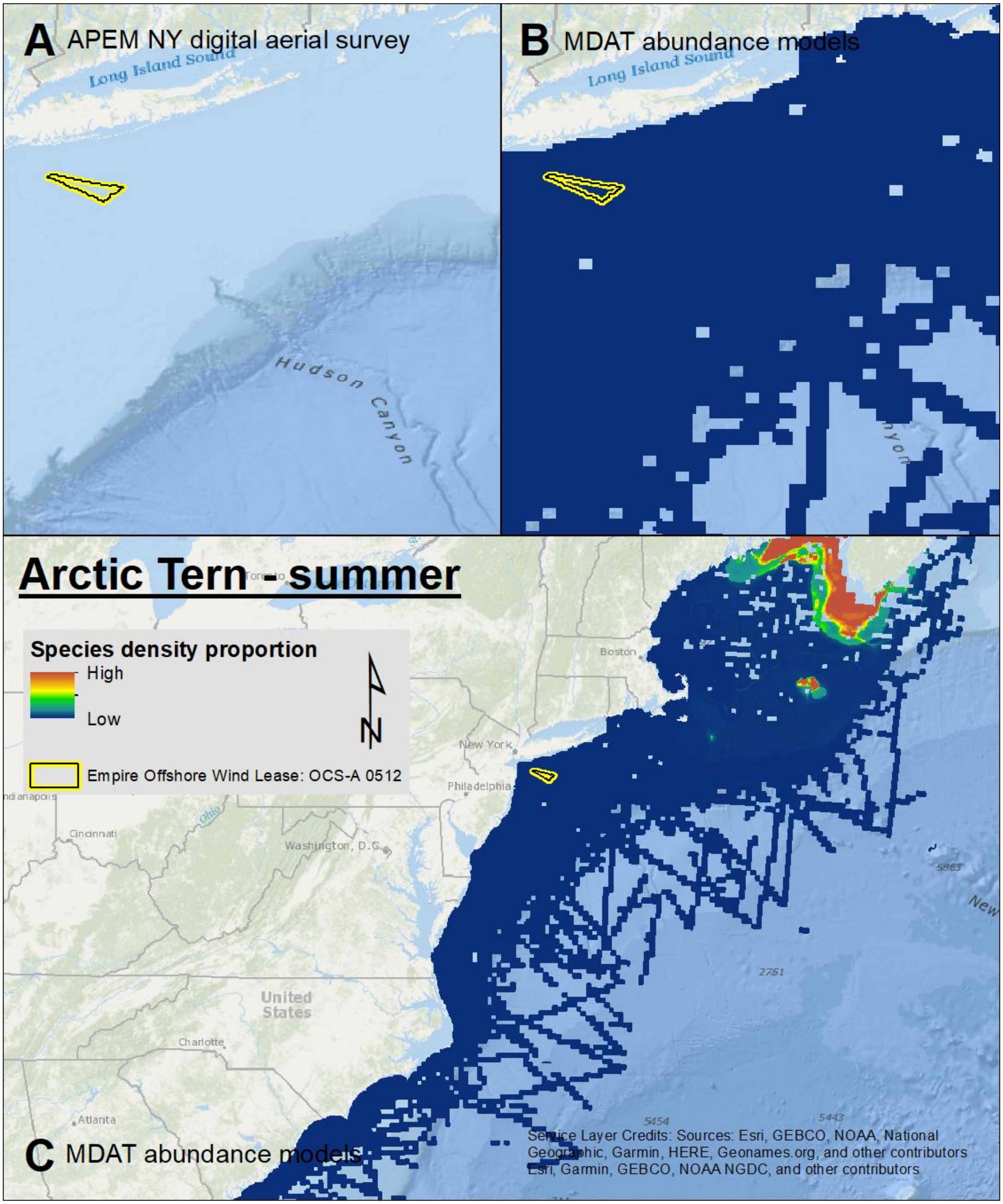
Map 97. Spring Least Tern density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



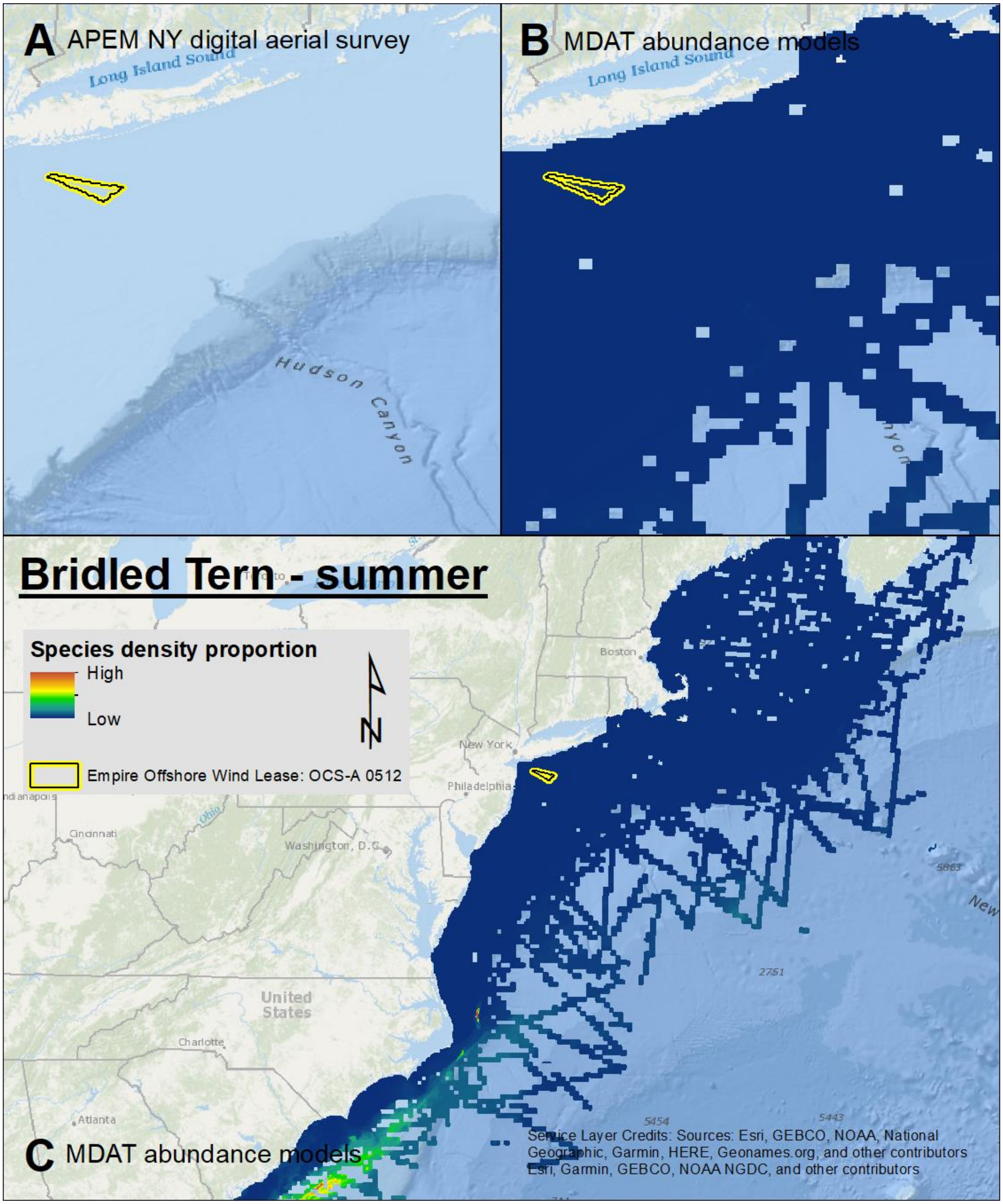
Map 98. Summer Least Tern density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



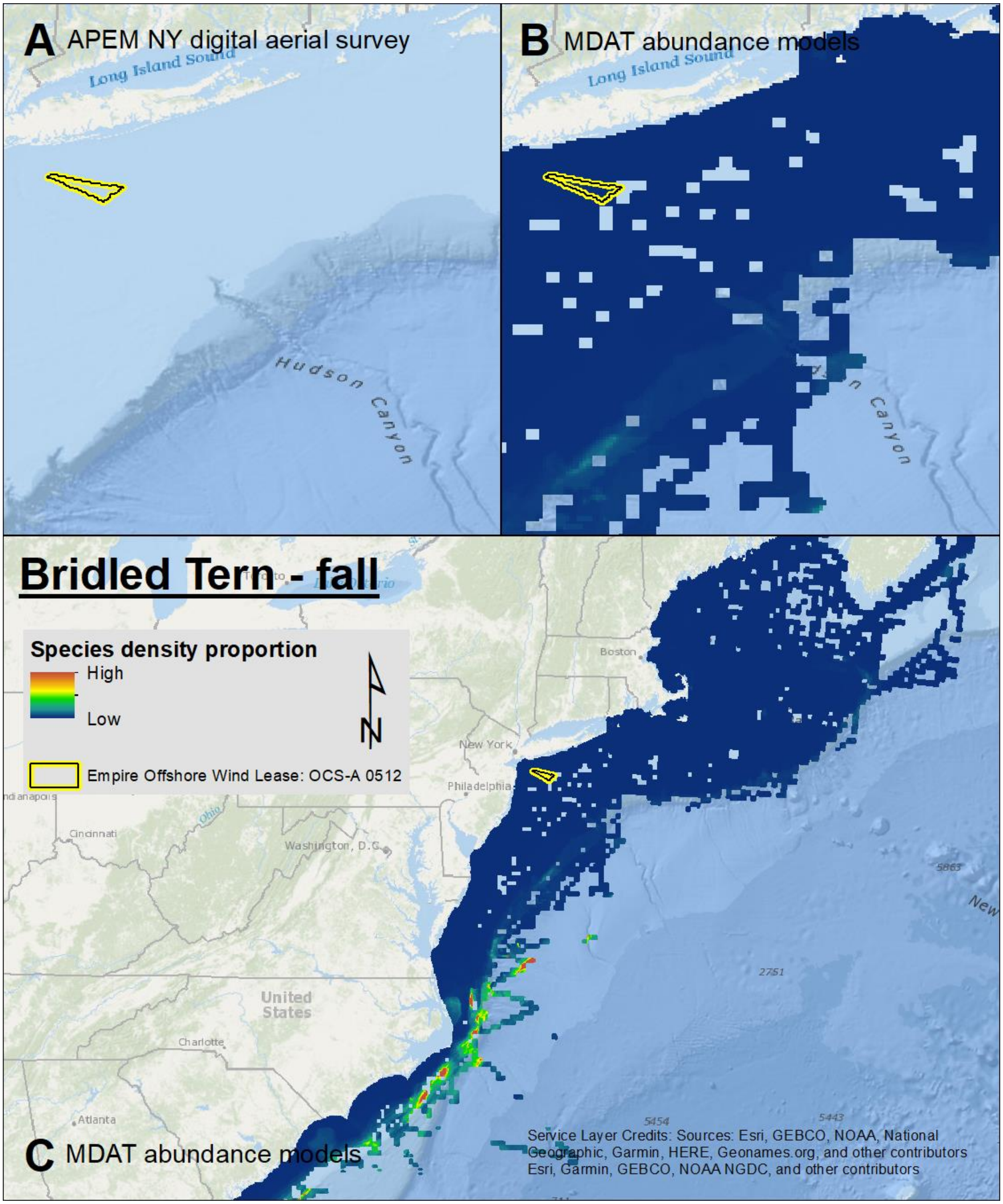
Map 99. Fall Least Tern density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



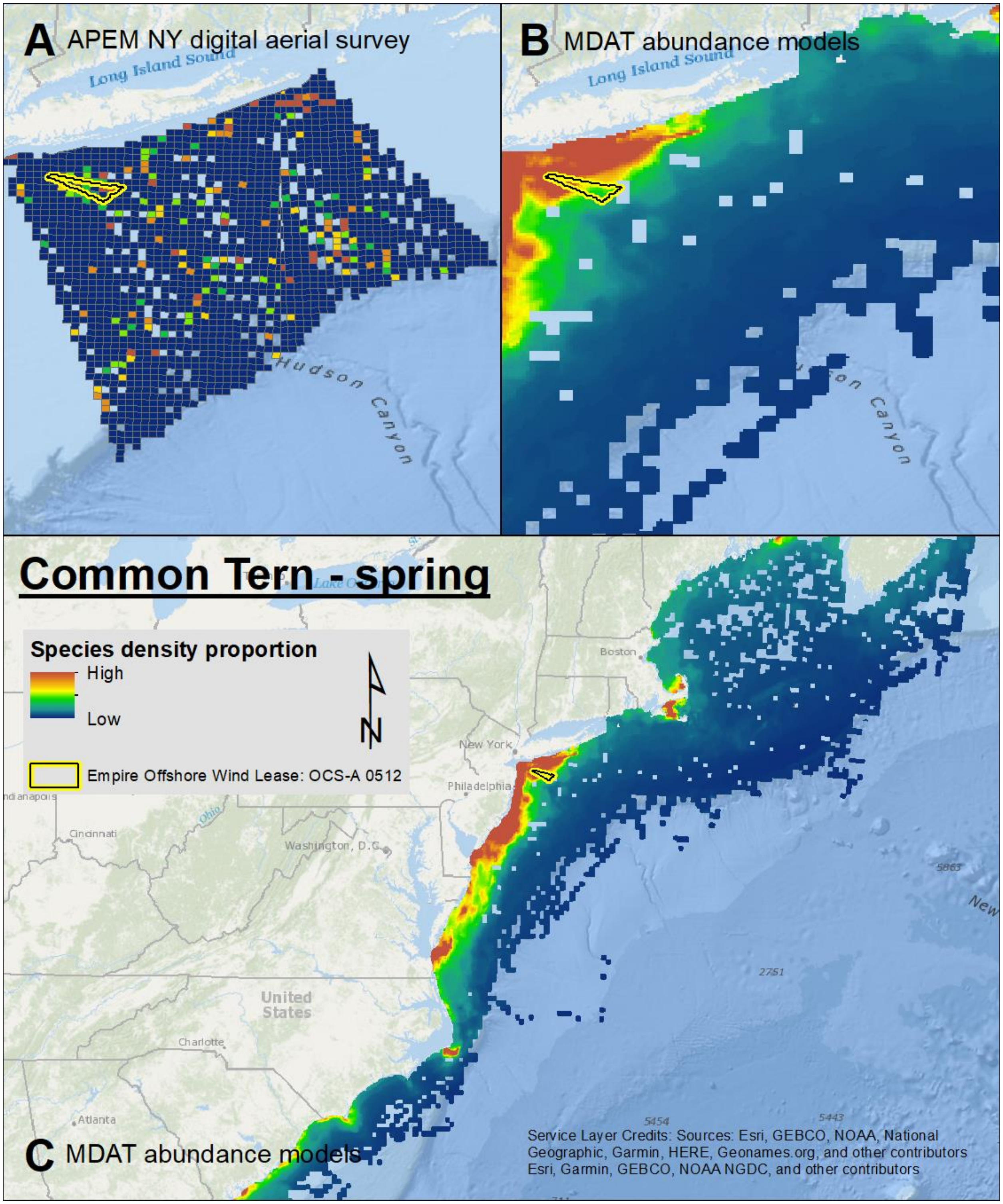
Map 100. Summer Arctic Tern density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



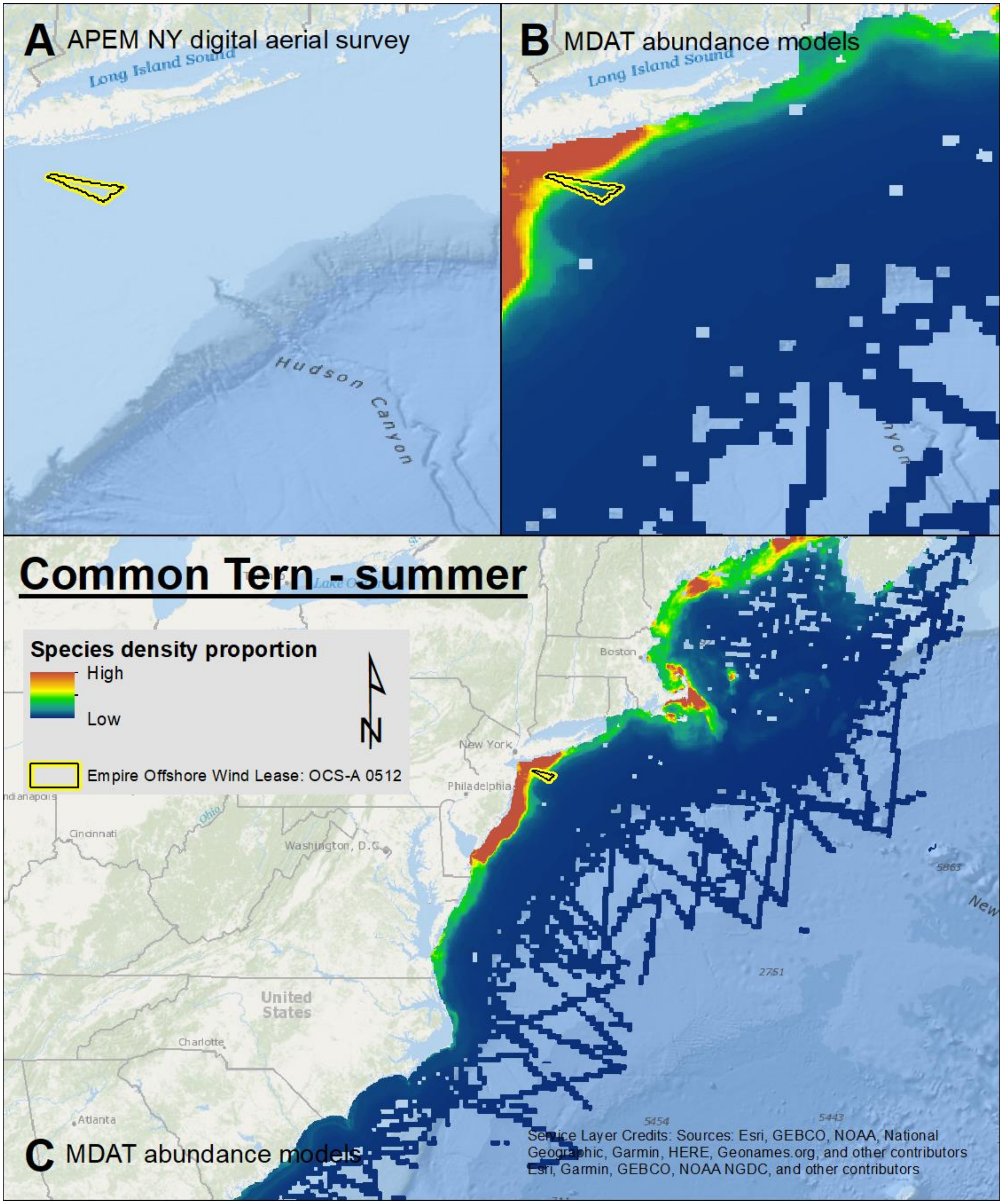
Map 101. Summer Bridled Tern density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



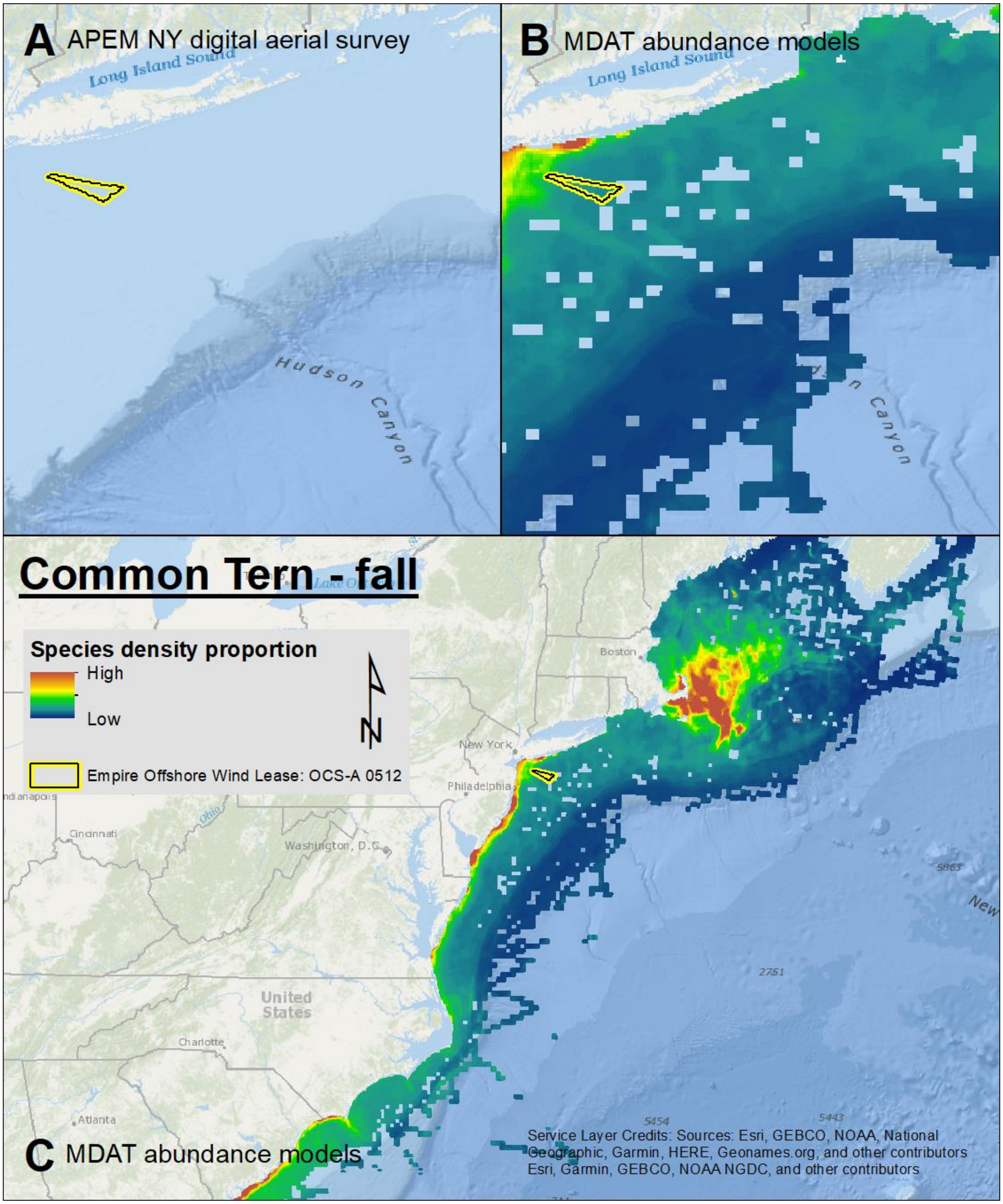
Map 102. Fall Bridled Tern density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



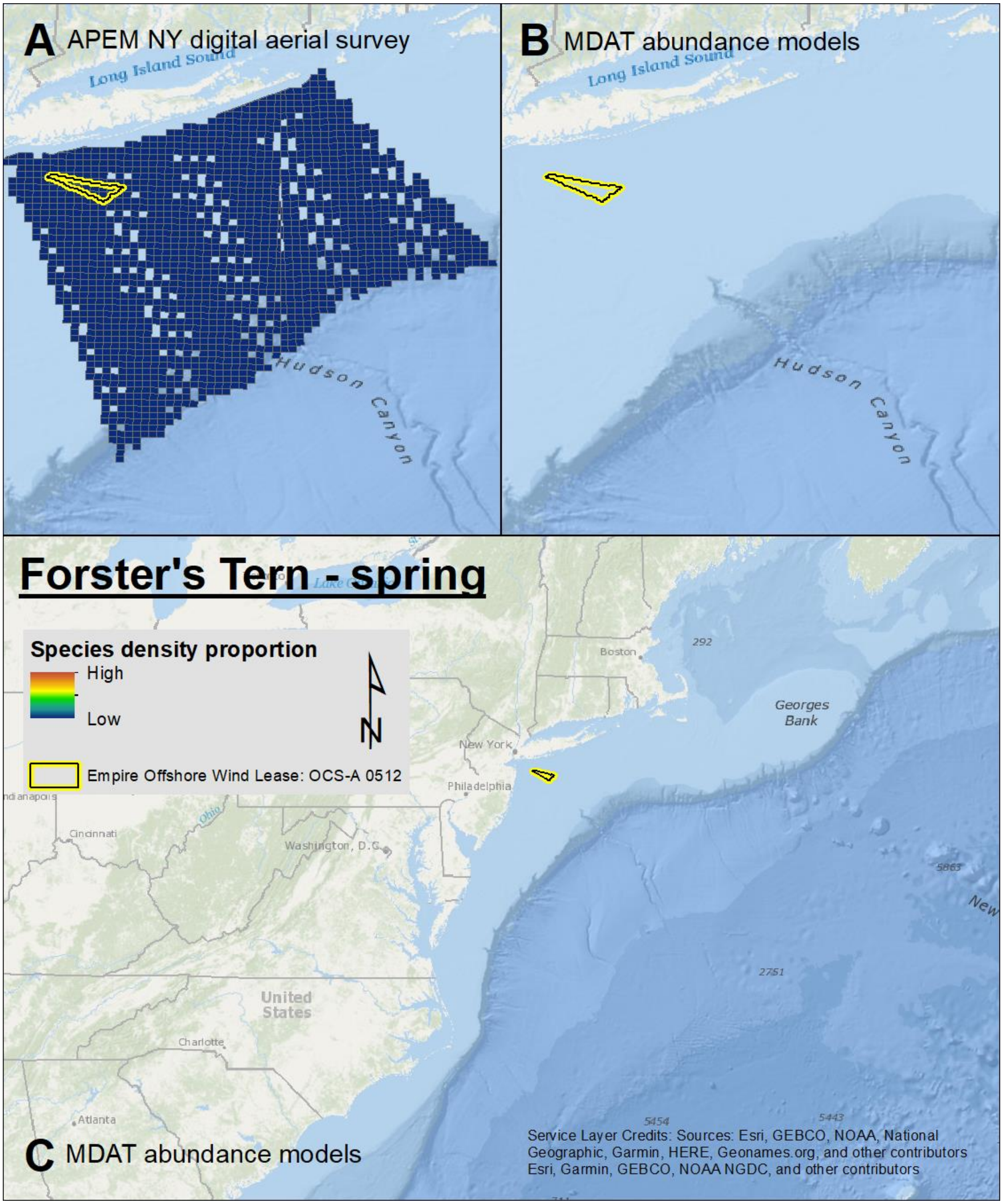
Map 103. Spring Common Tern density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



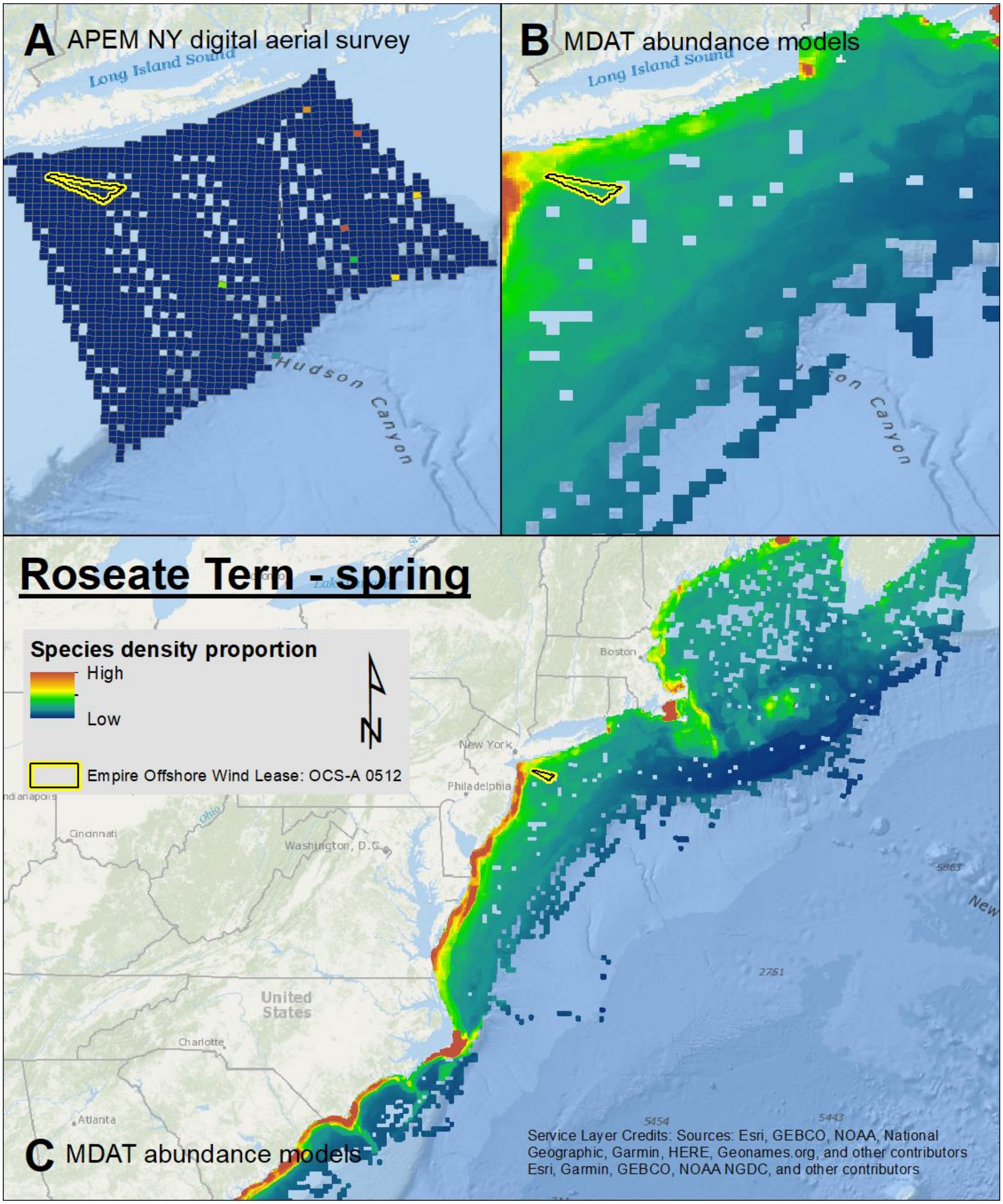
Map 104. Summer Common Tern density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



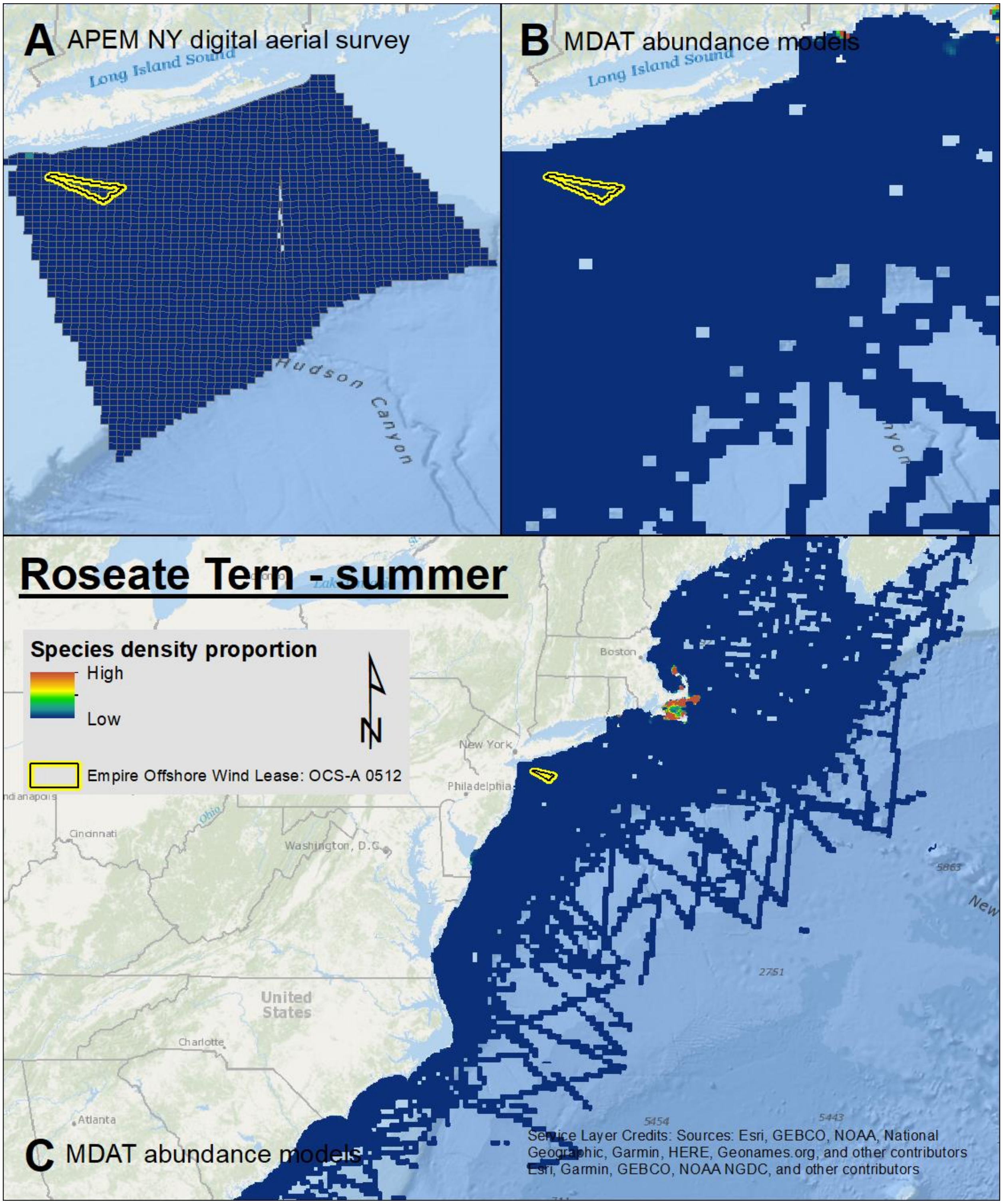
Map 105. Fall Common Tern density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



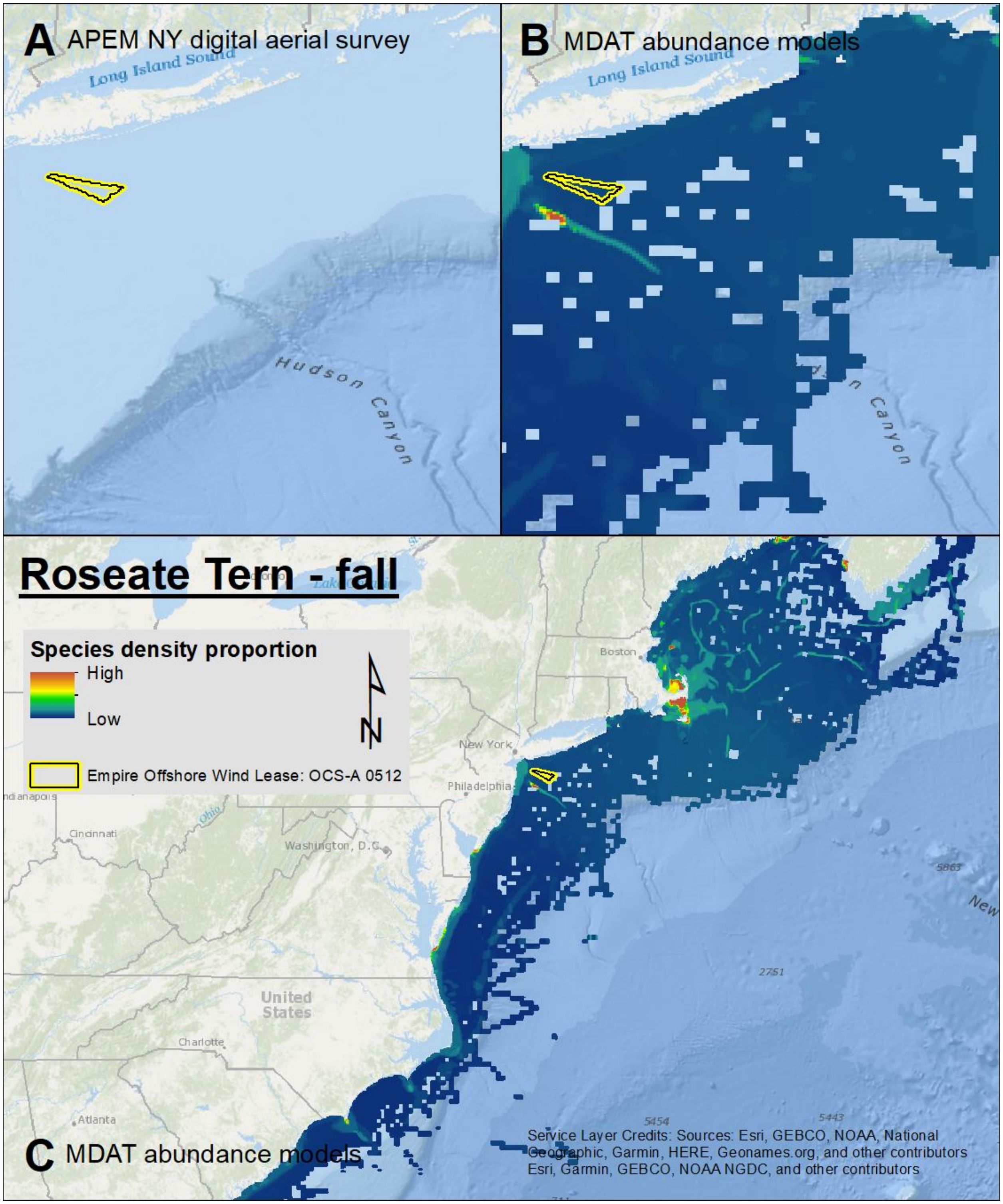
Map 106. Spring Forster's Tern density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



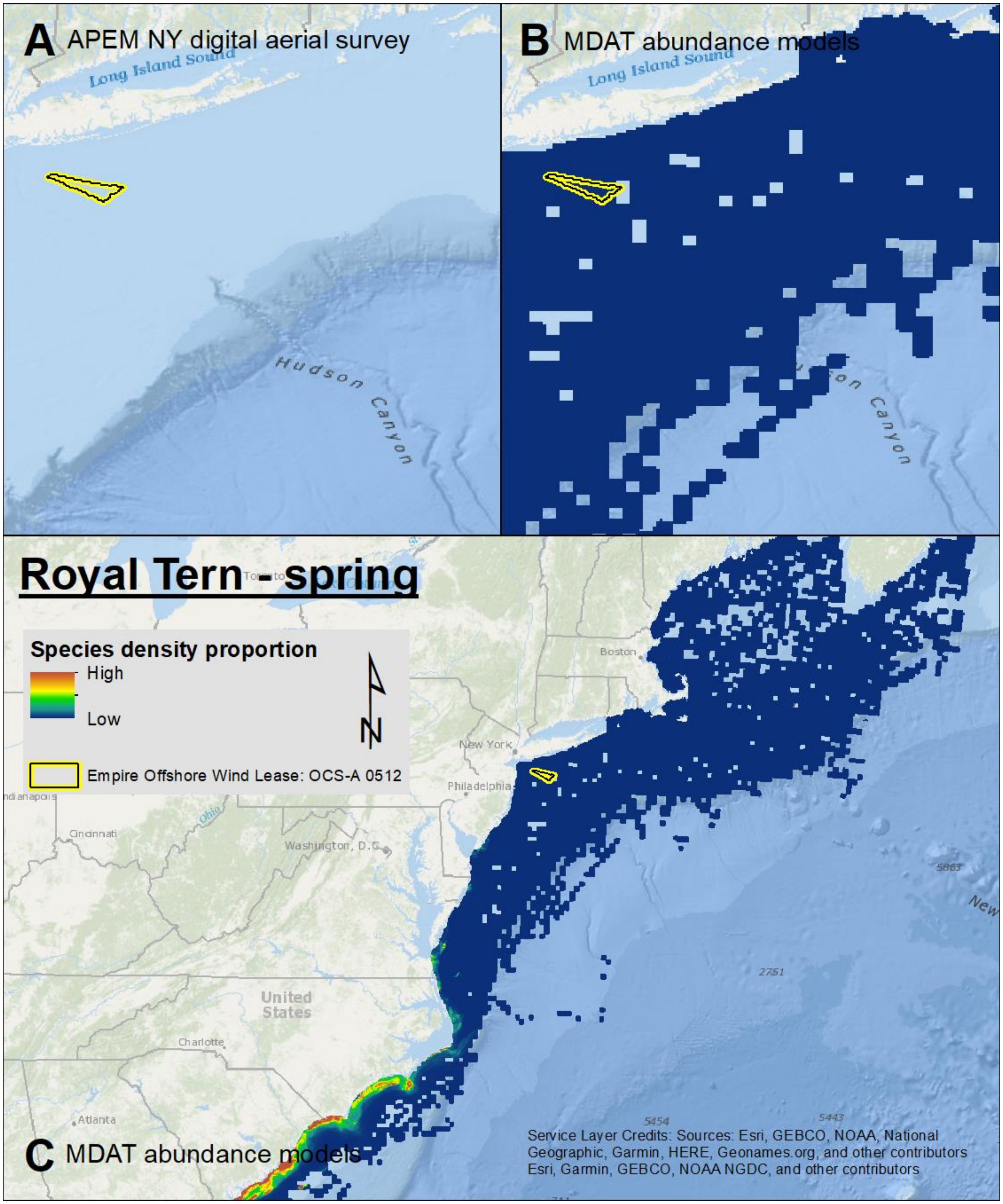
Map 107. Spring Roseate Tern density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



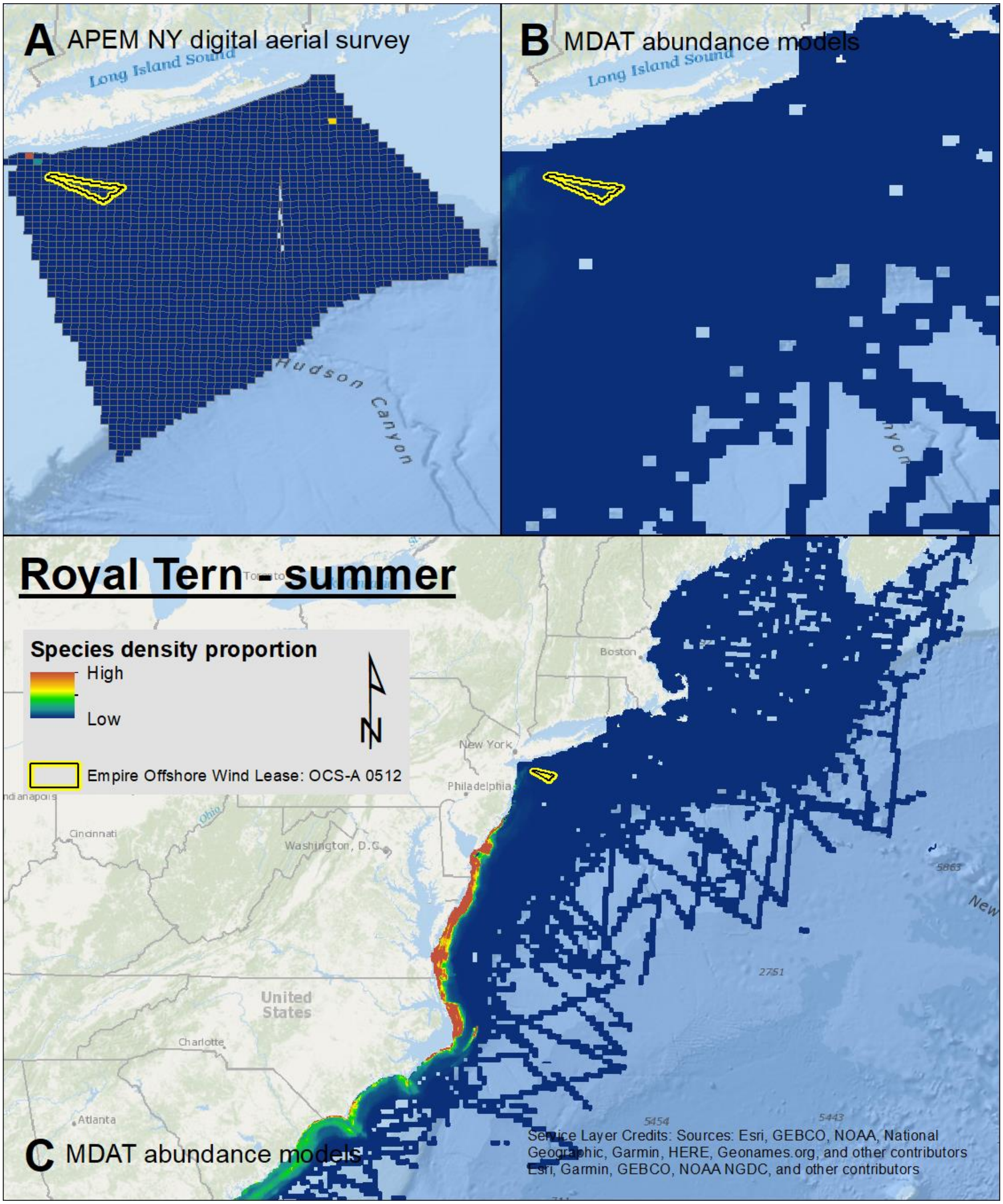
Map 108. Summer Roseate Tern density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



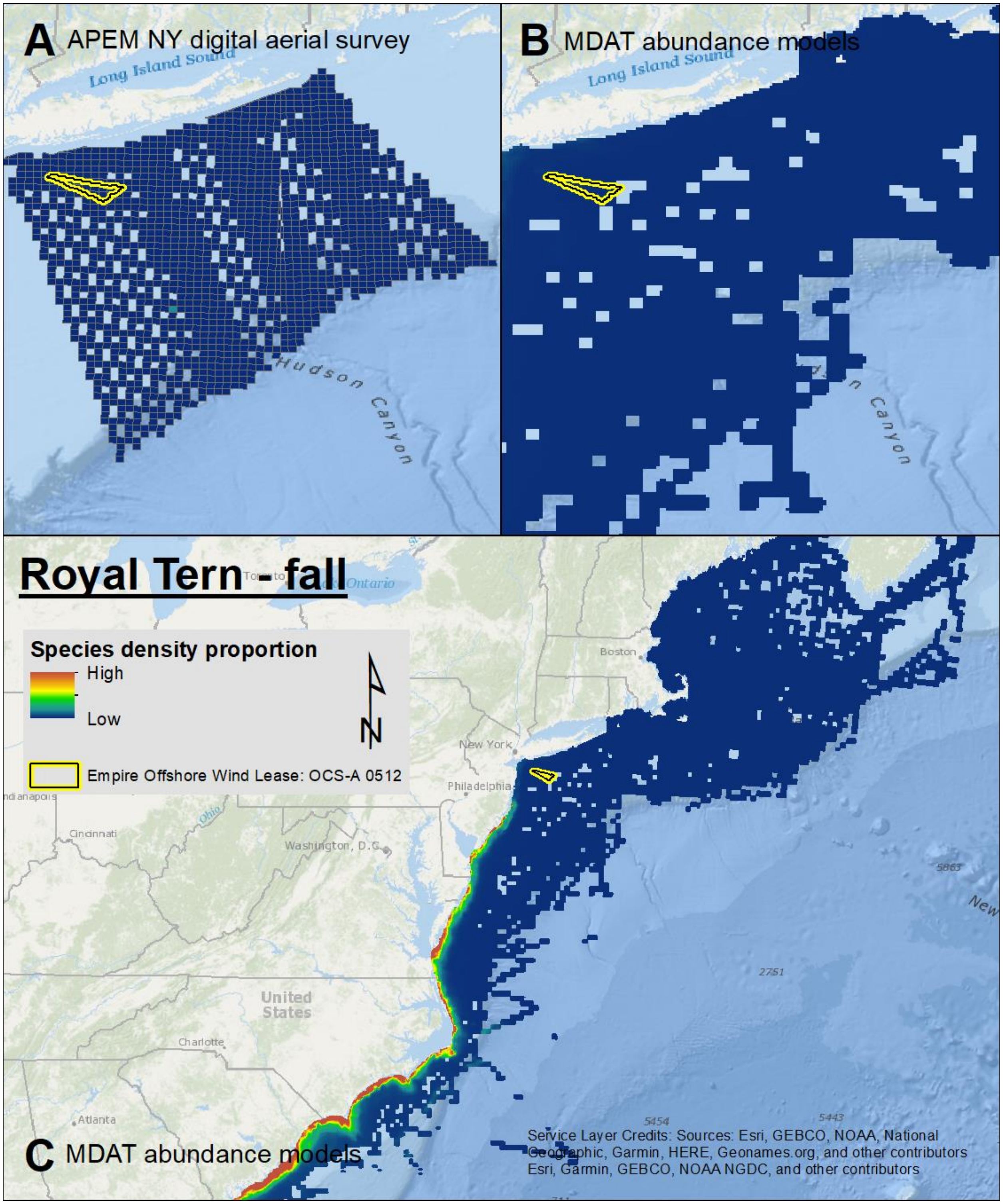
Map 109. Fall Roseate Tern density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



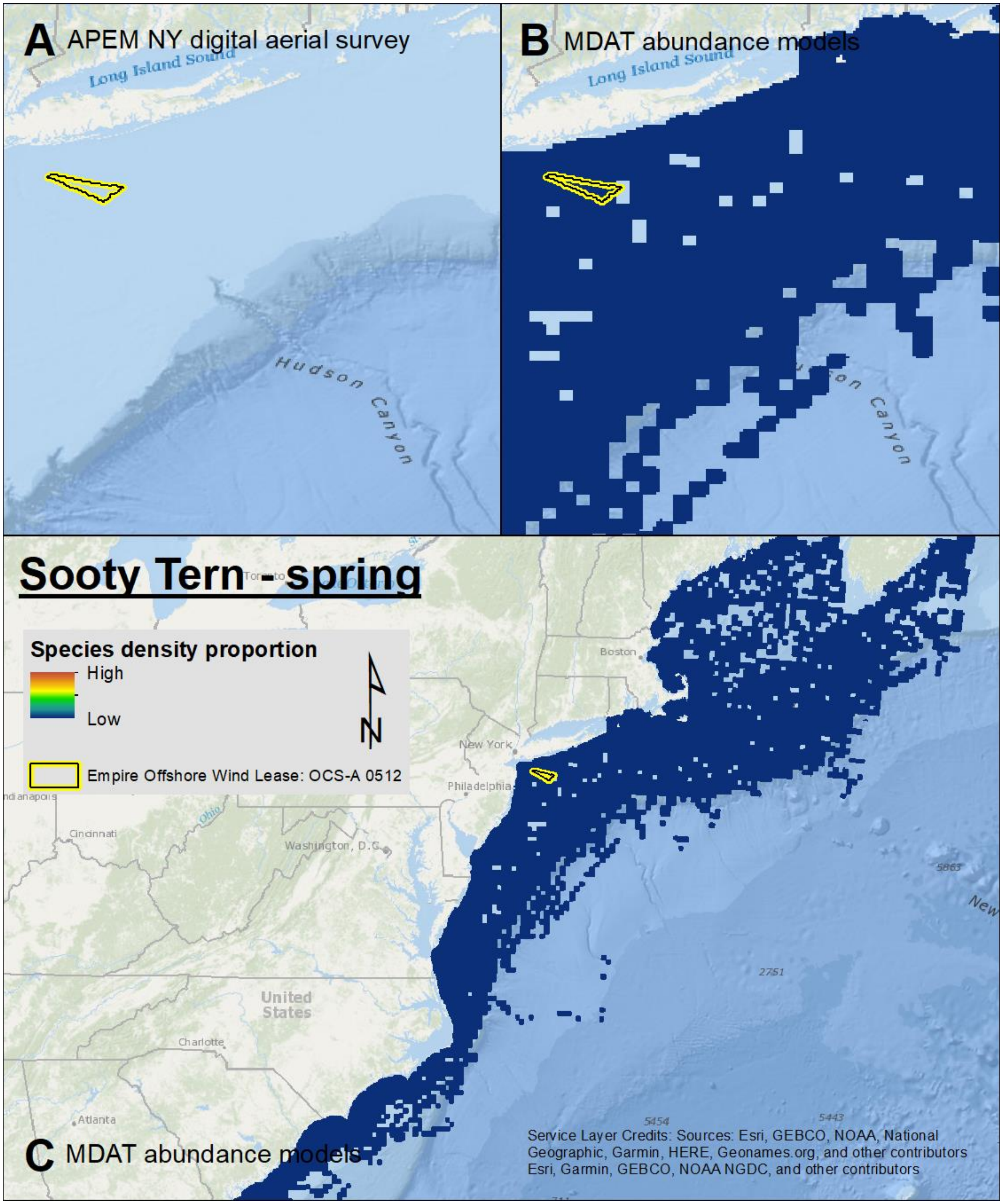
Map 110. Spring Royal Tern density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



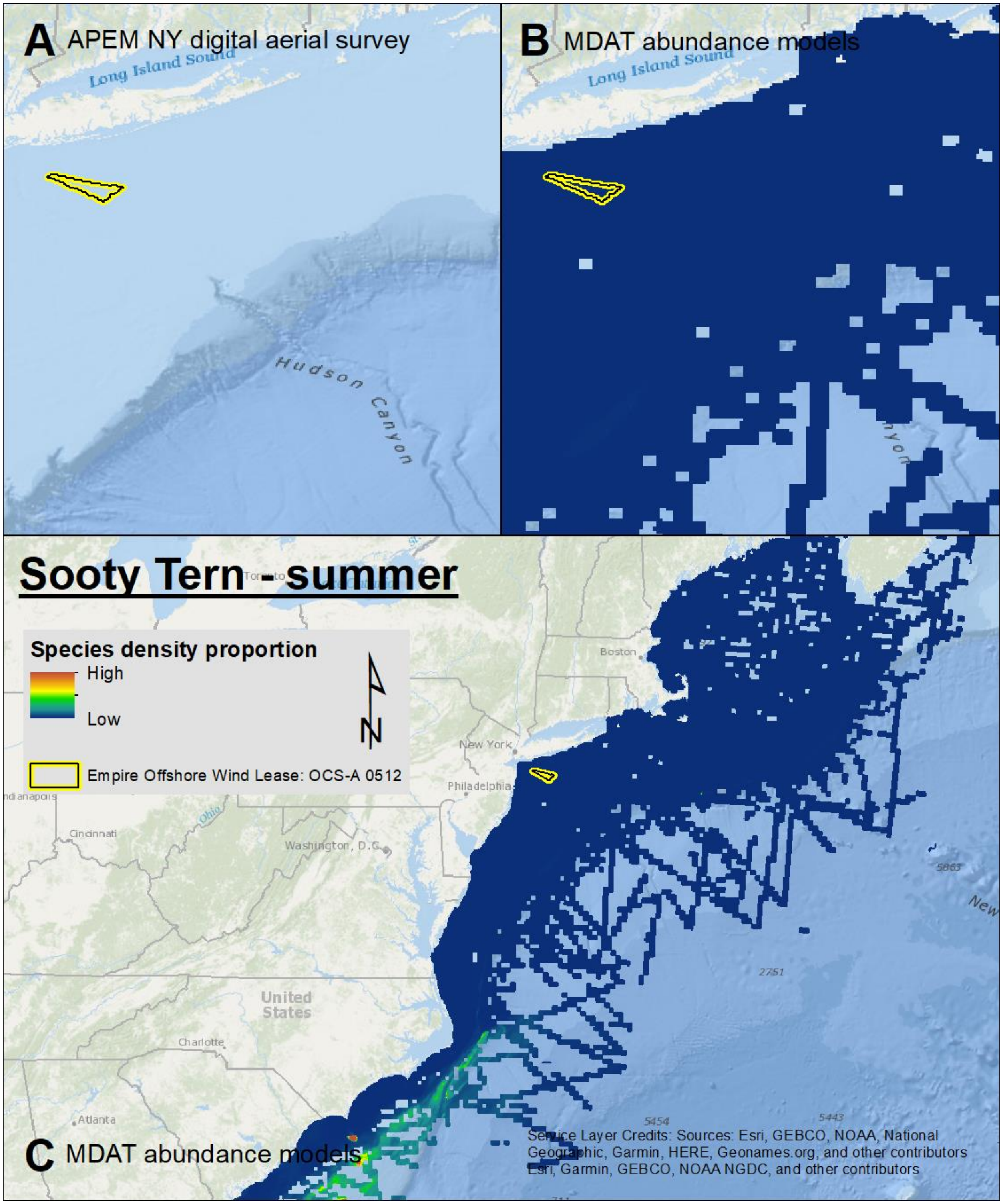
Map 111. Summer Royal Tern density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



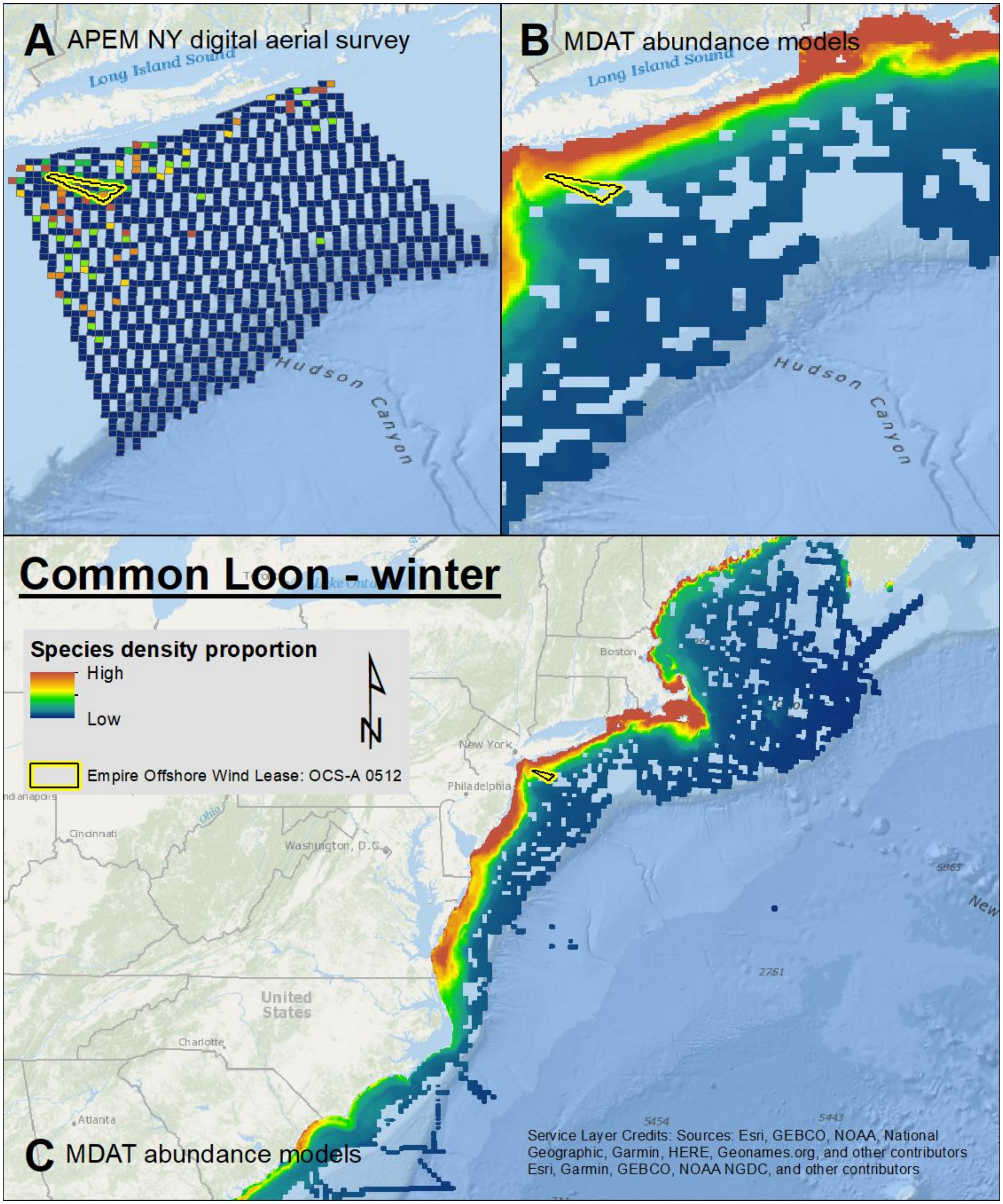
Map 112. Fall Royal Tern density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



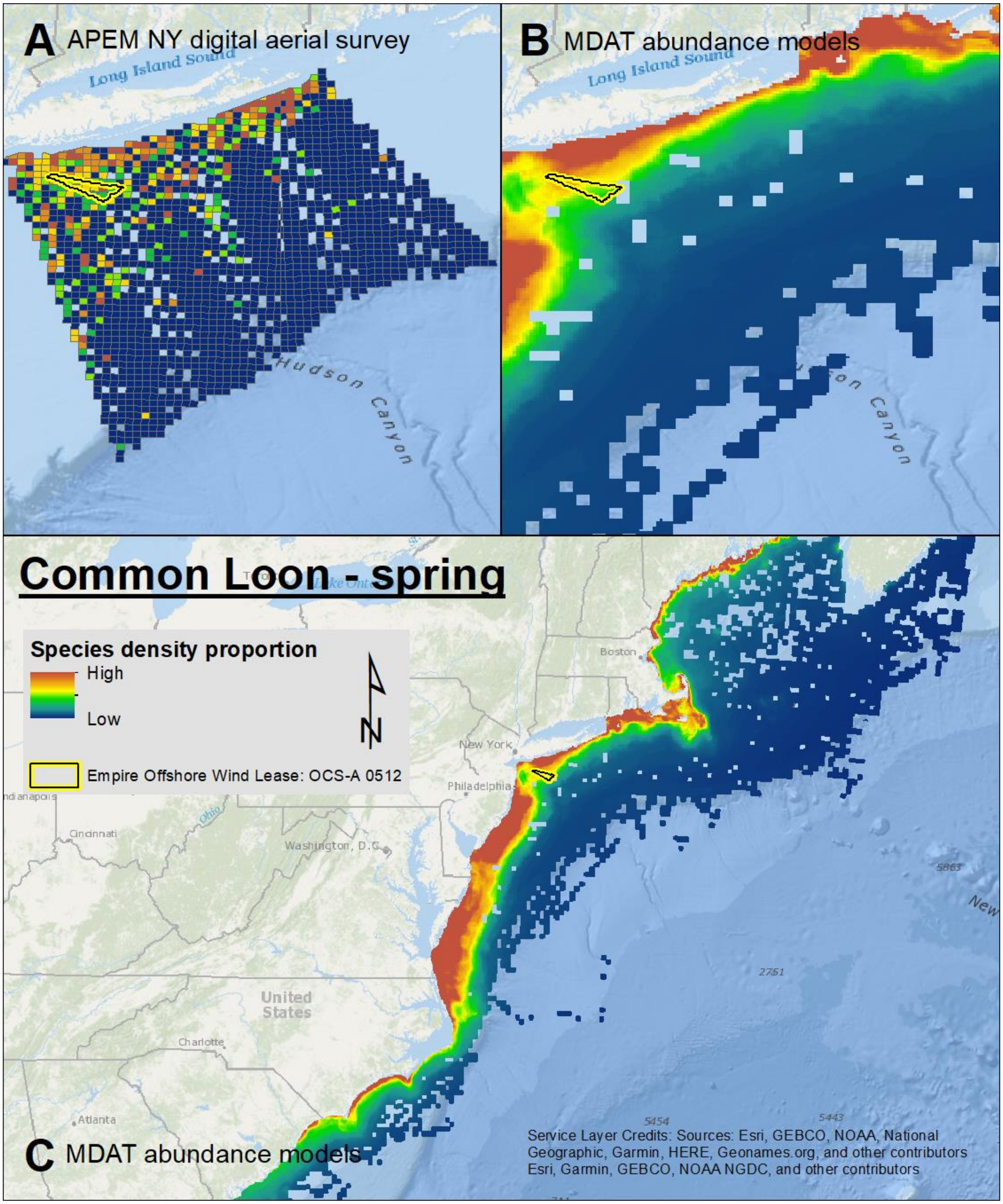
Map 113. Spring Sooty Tern density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



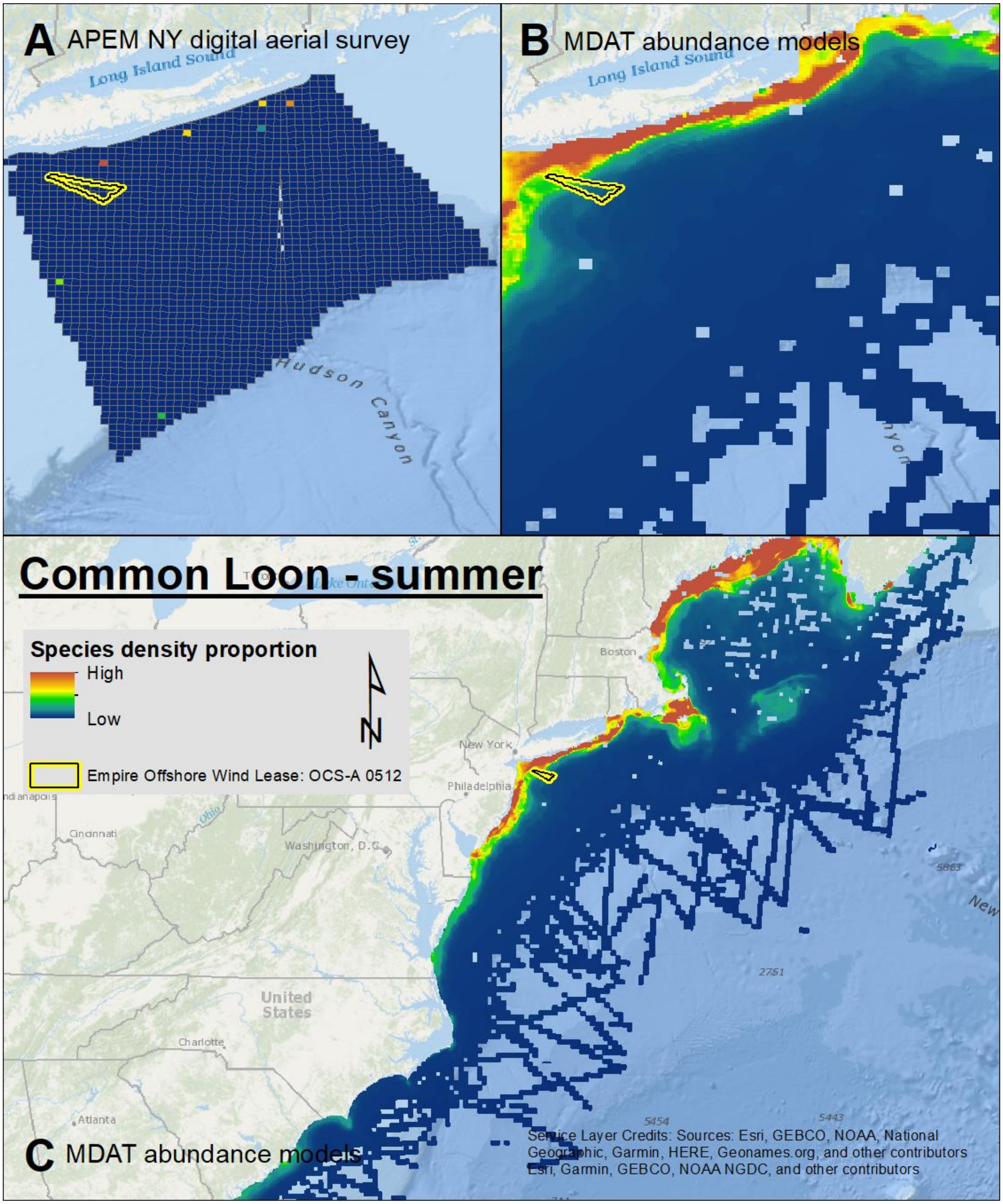
Map 114. Summer Sooty Tern density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



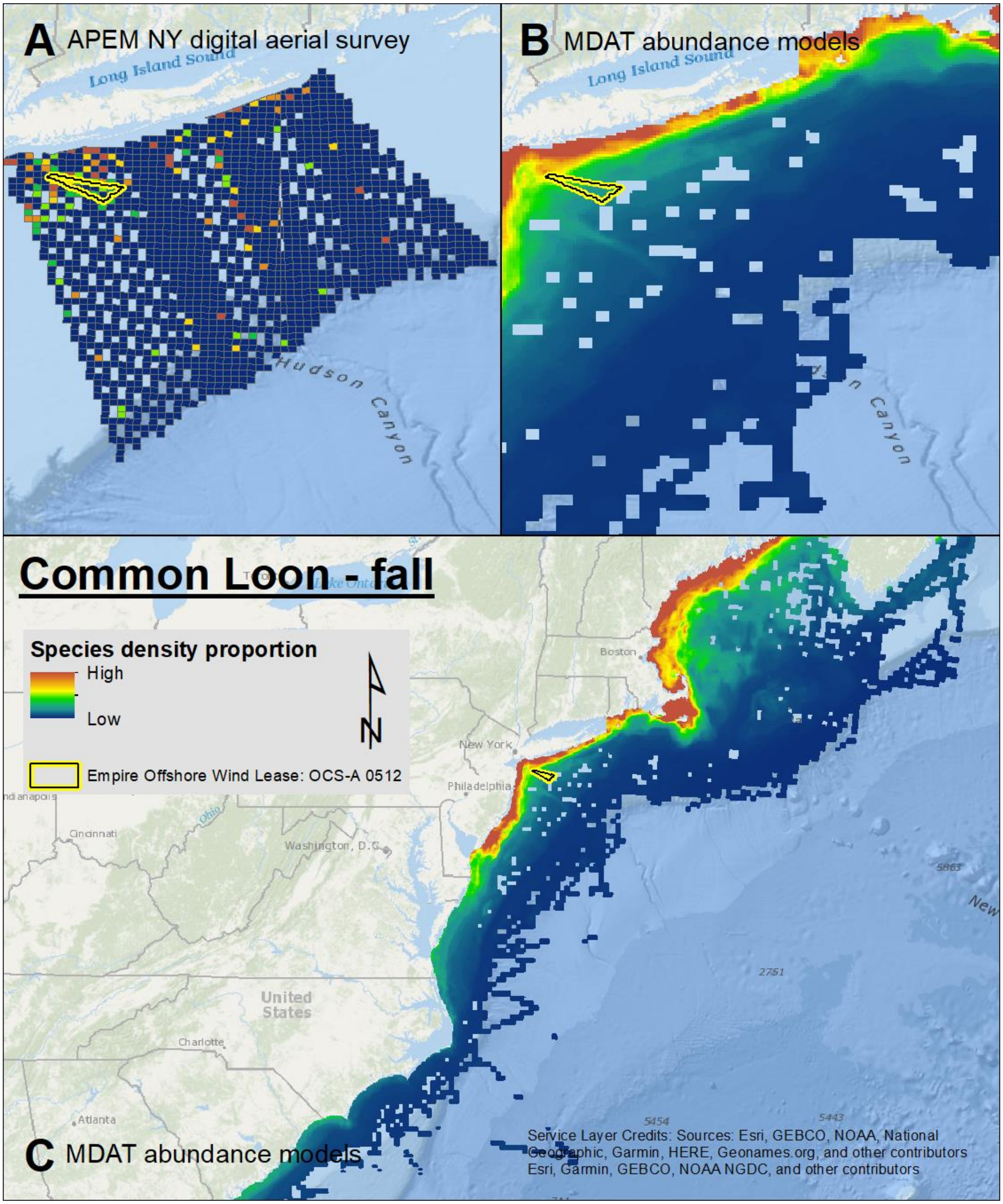
Map 115. Winter Common Loon density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



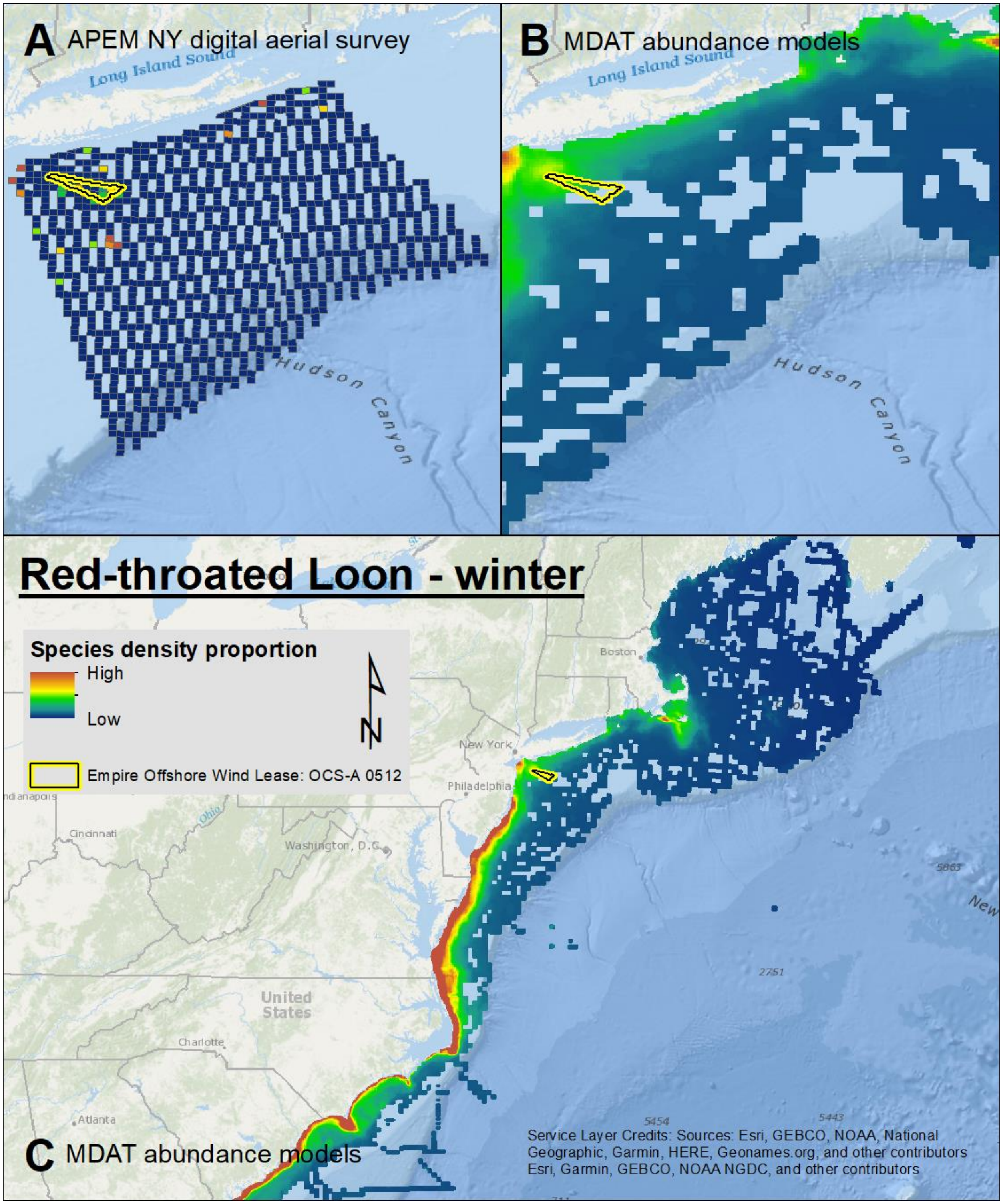
Map 116. Spring Common Loon density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



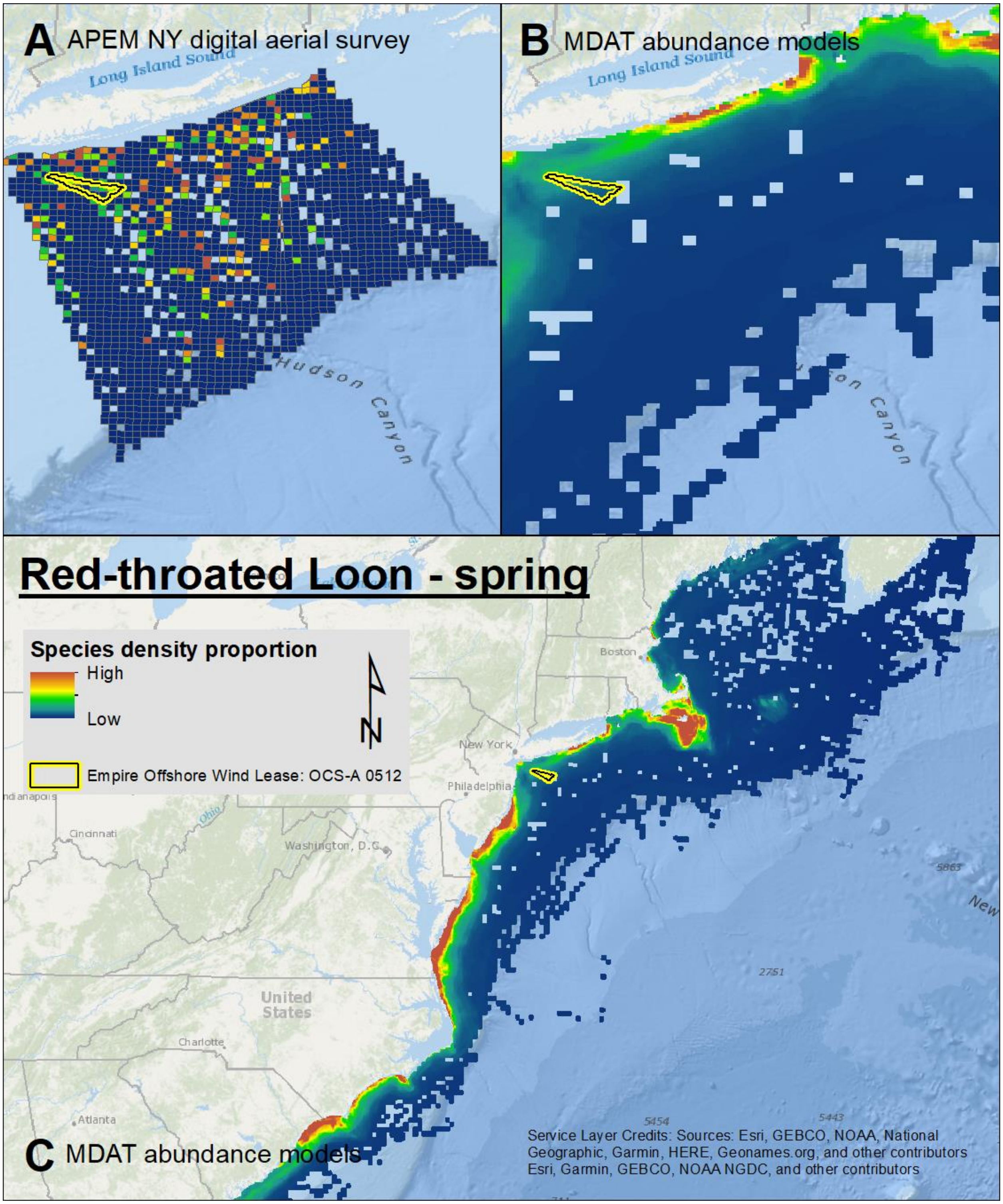
Map 117. Summer Common Loon density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



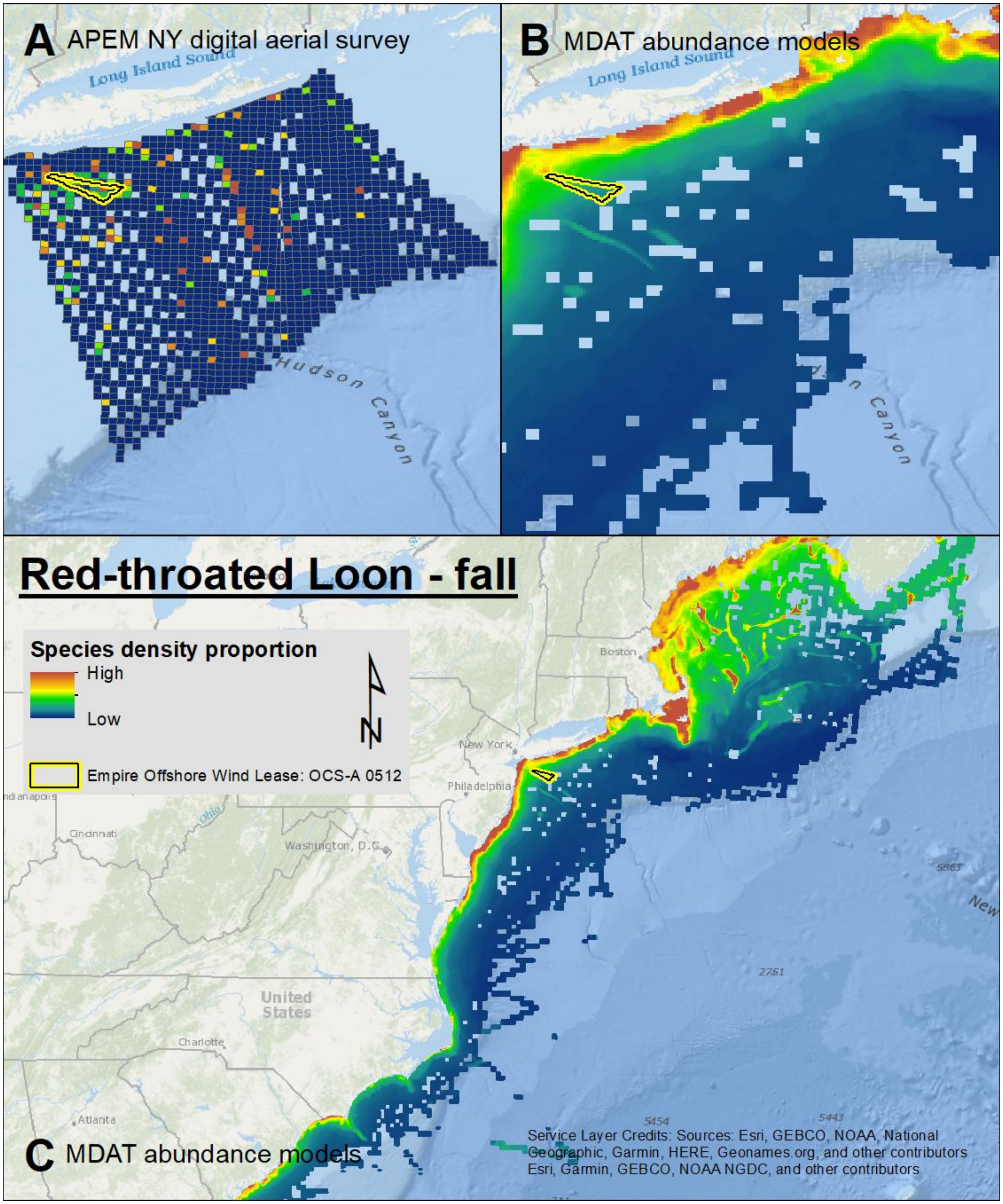
Map 118. Fall Common Loon density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



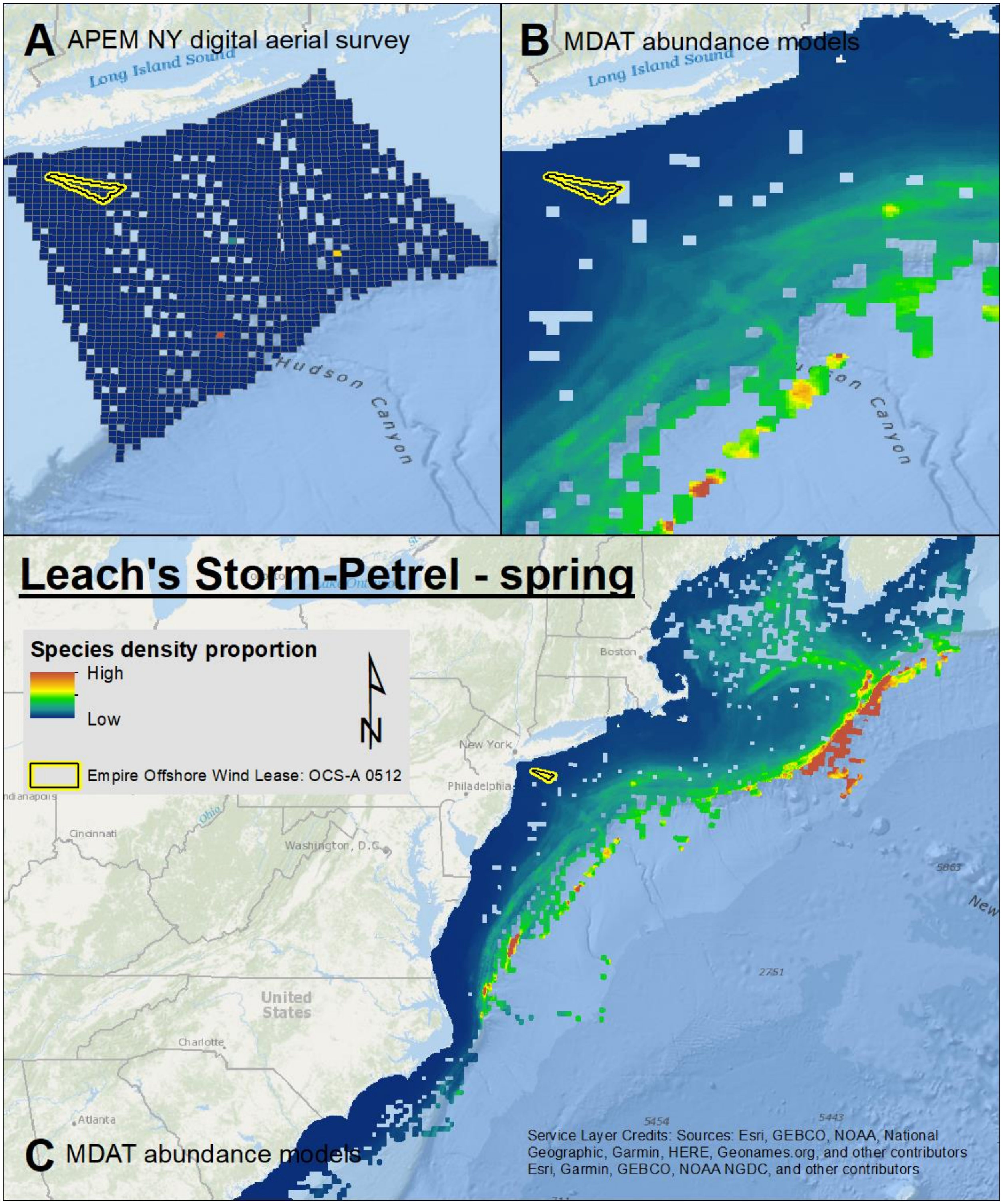
Map 119. Winter Red-throated Loon density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



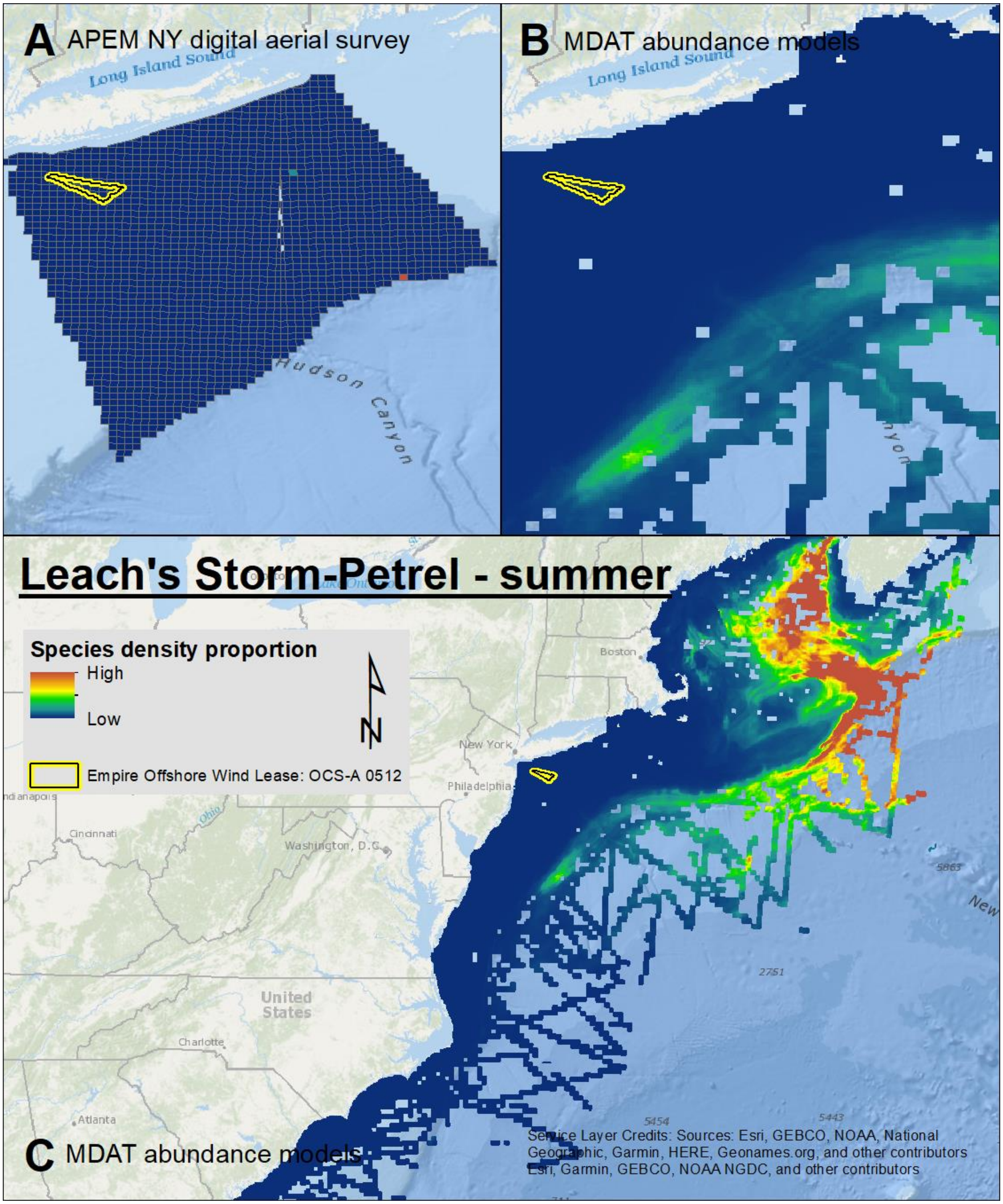
Map 120. Spring Red-throated Loon density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



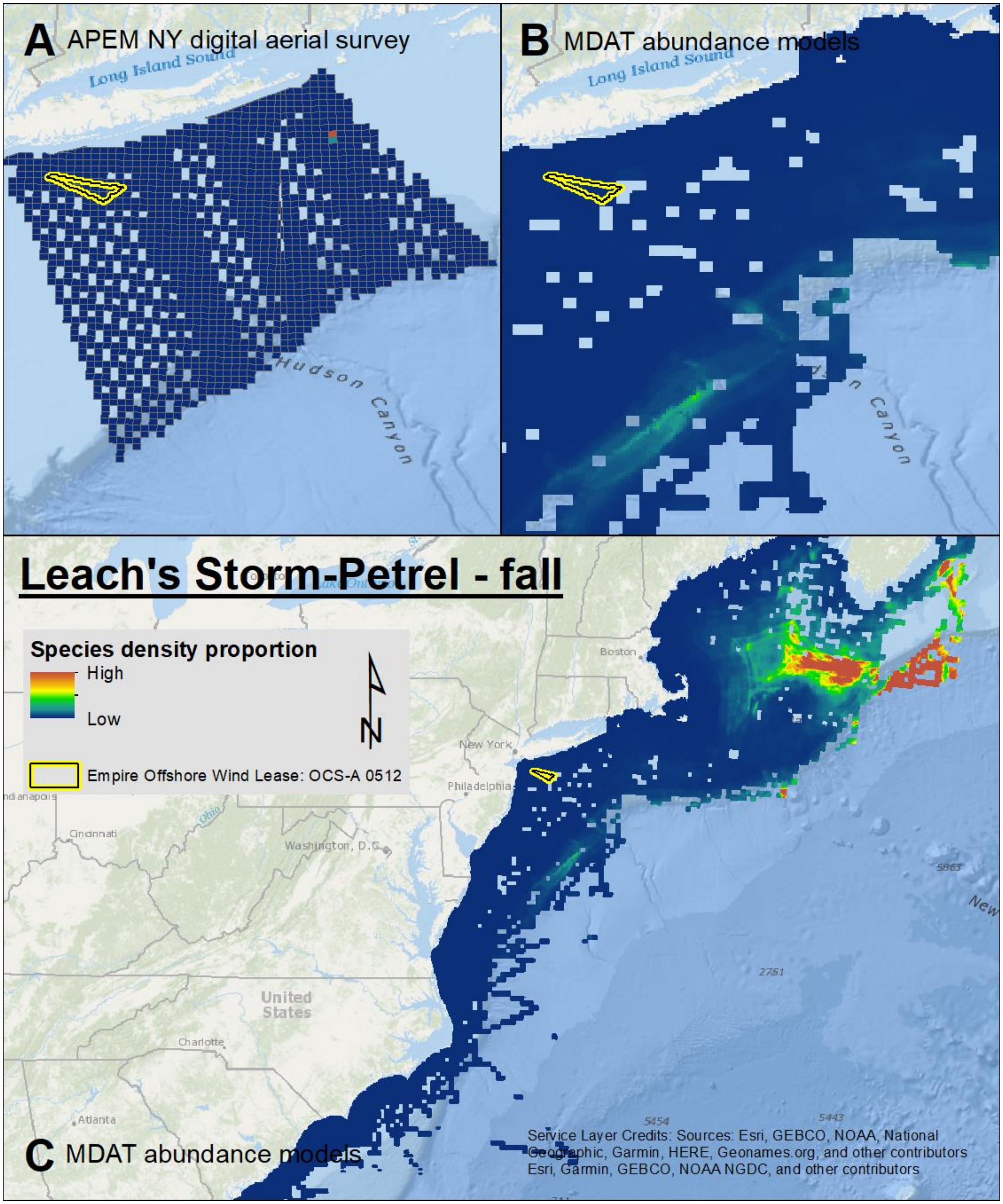
Map 121. Fall Red-throated Loon density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



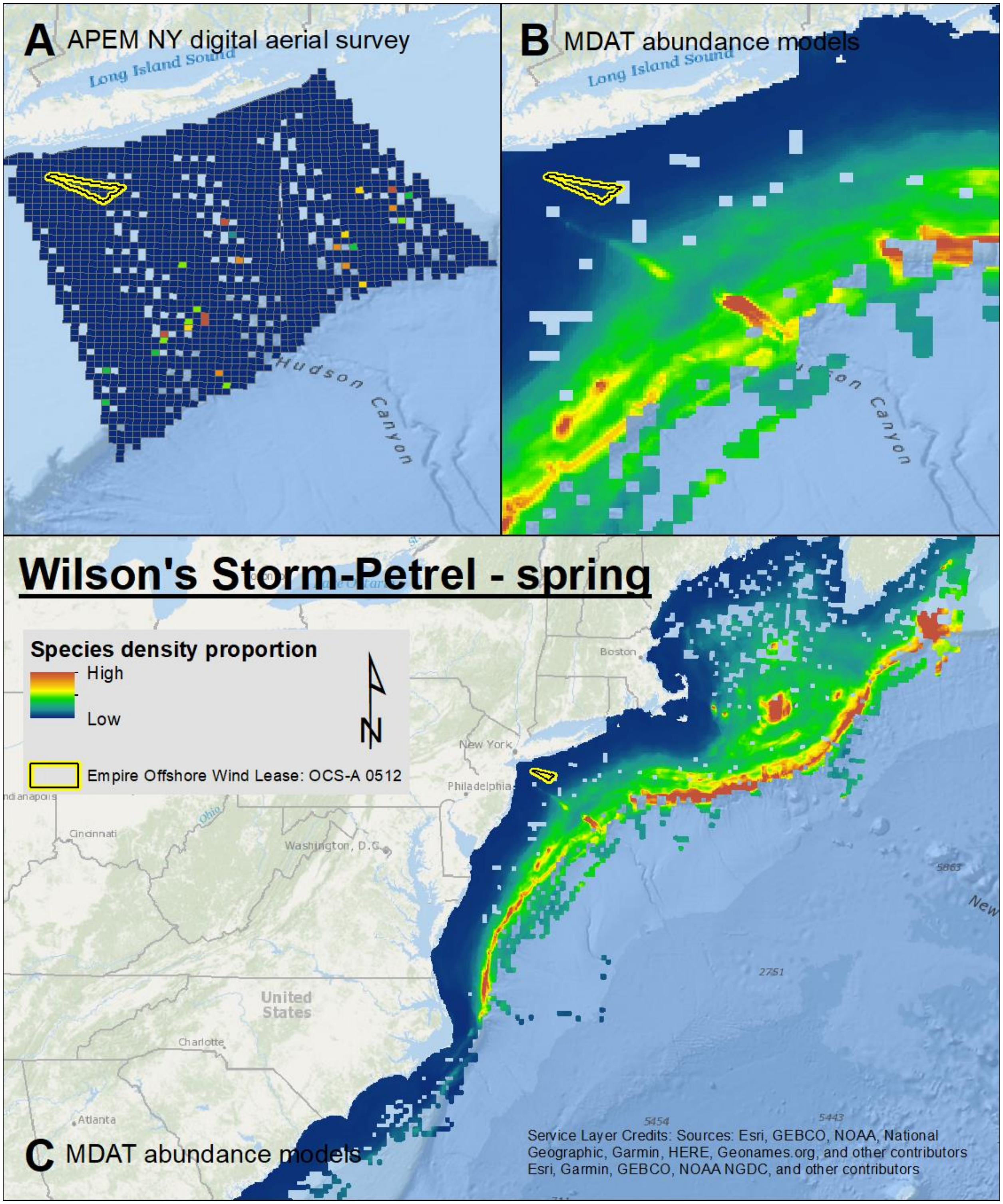
Map 122. Spring Leach's Storm-Petrel density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



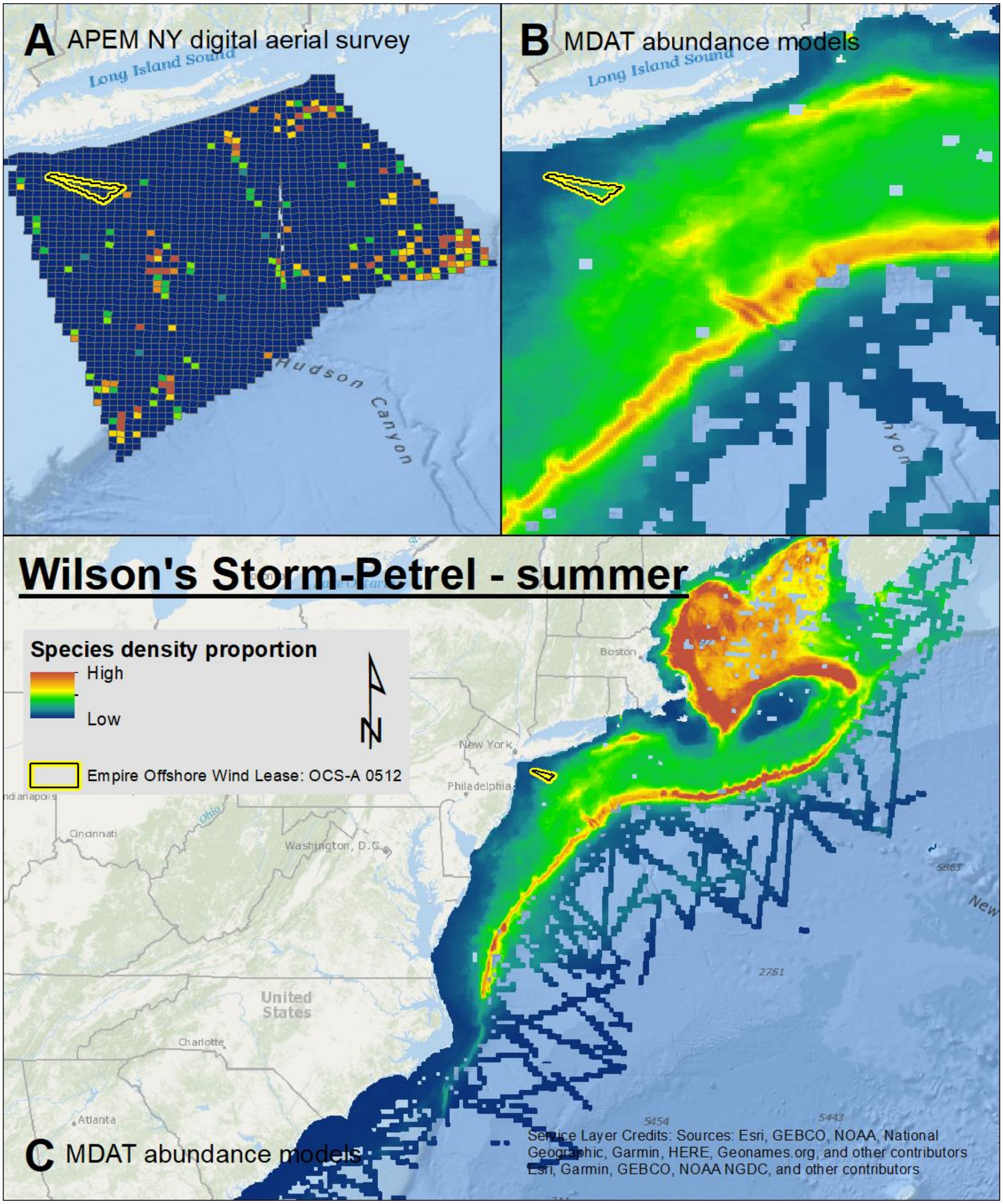
Map 123. Summer Leach's Storm-Petrel density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



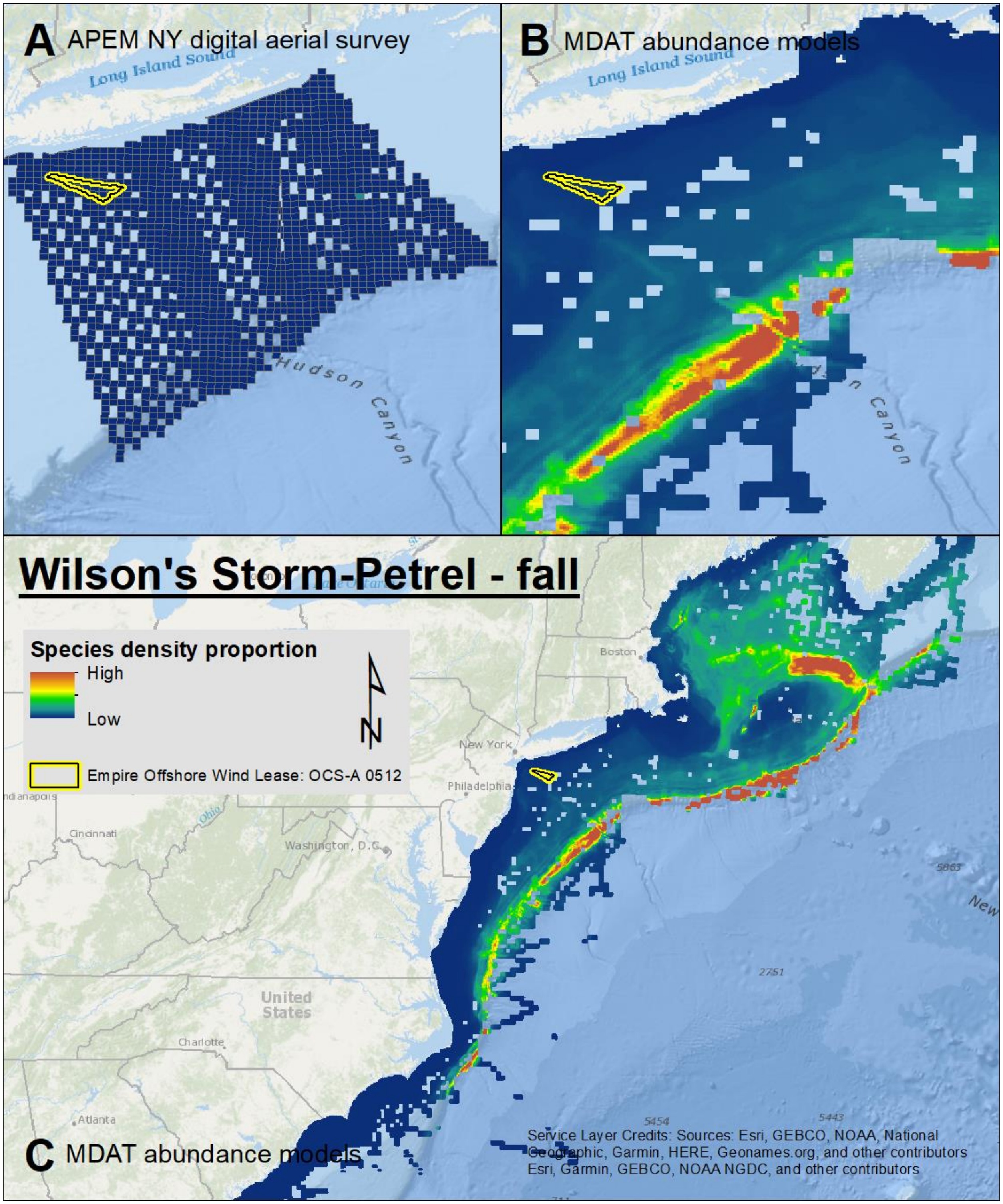
Map 124. Fall Leach's Storm-Petrel density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



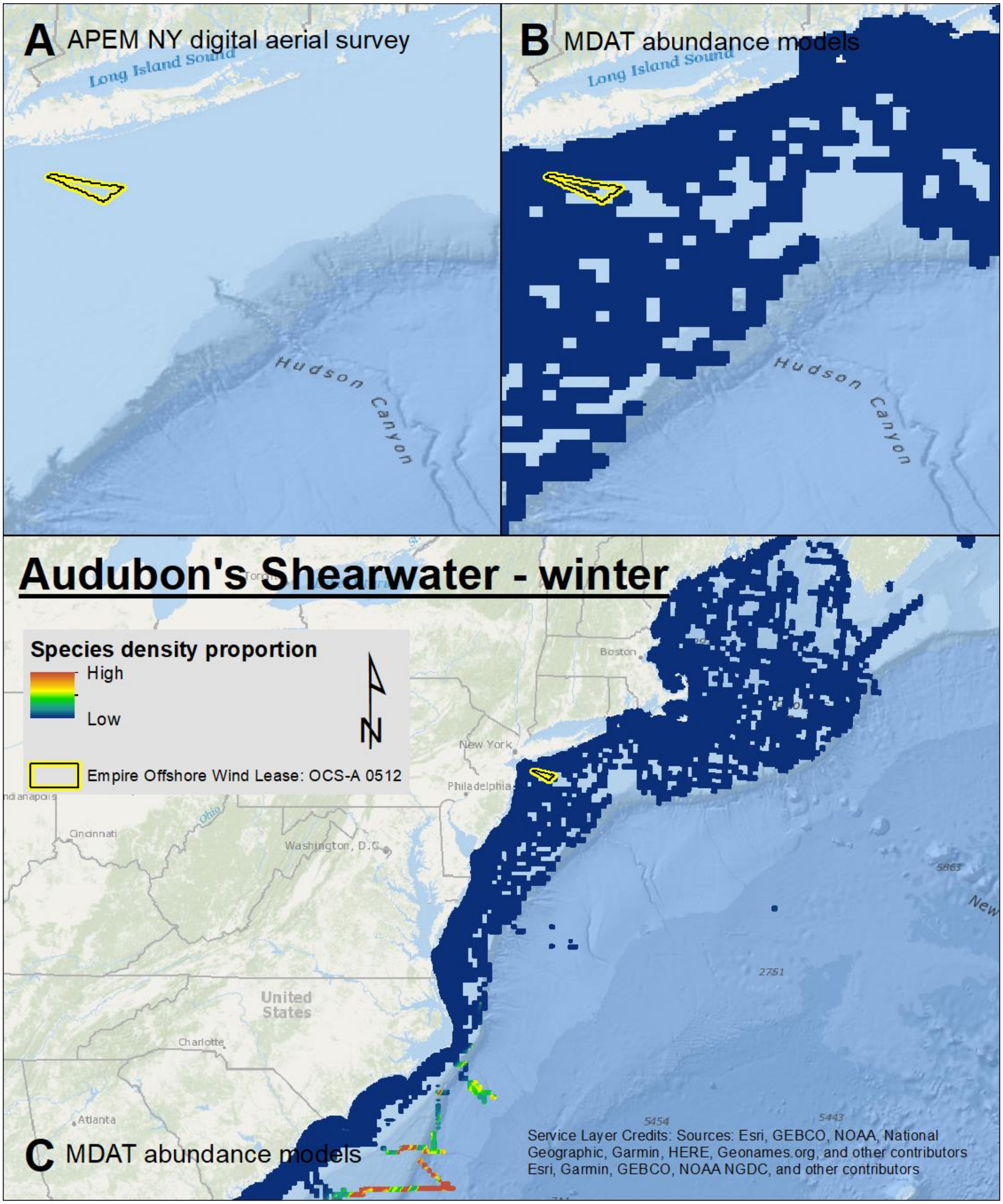
Map 125. Spring Wilson's Storm-Petrel density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



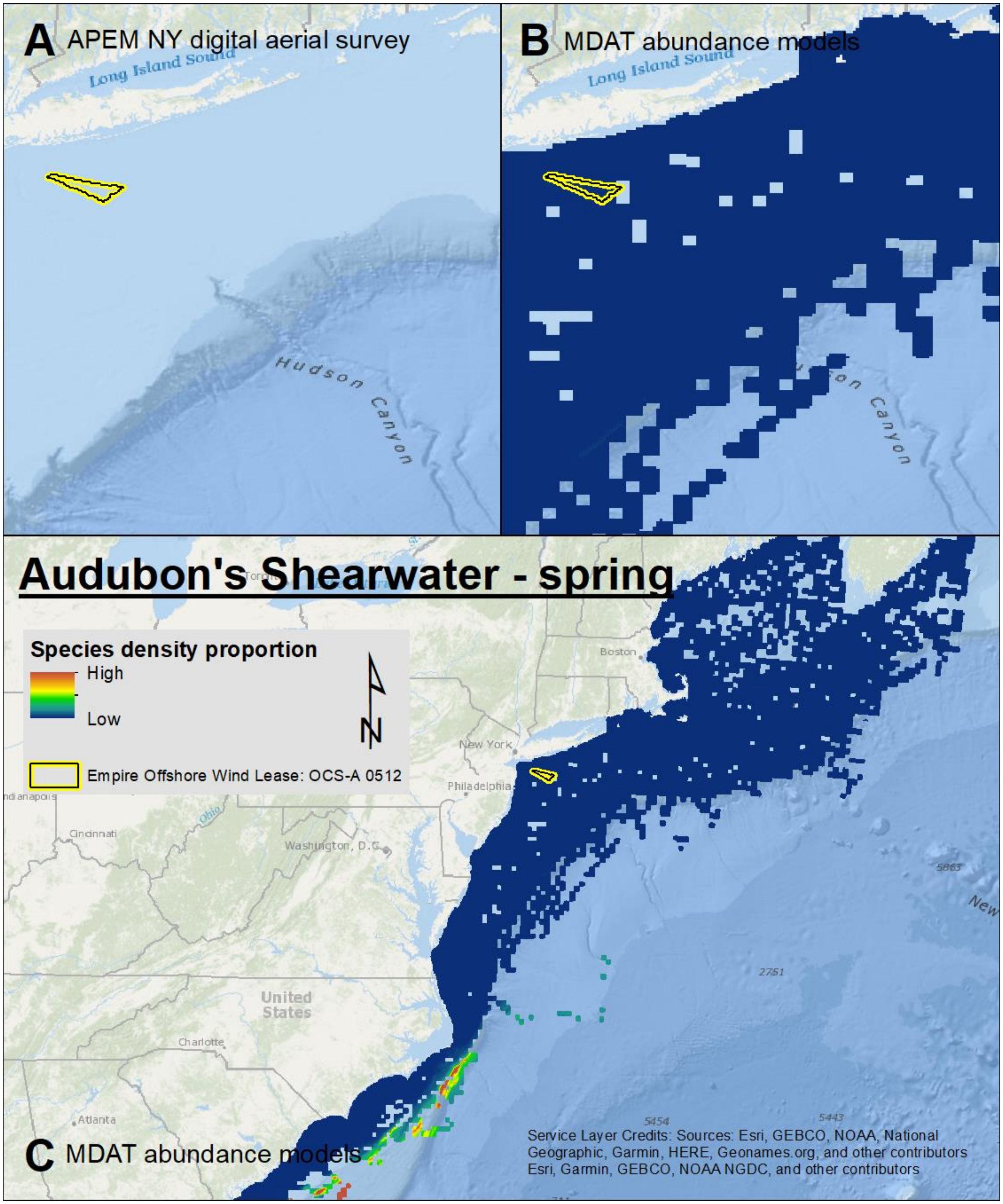
Map 126. Summer Wilson's Storm-Petrel density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



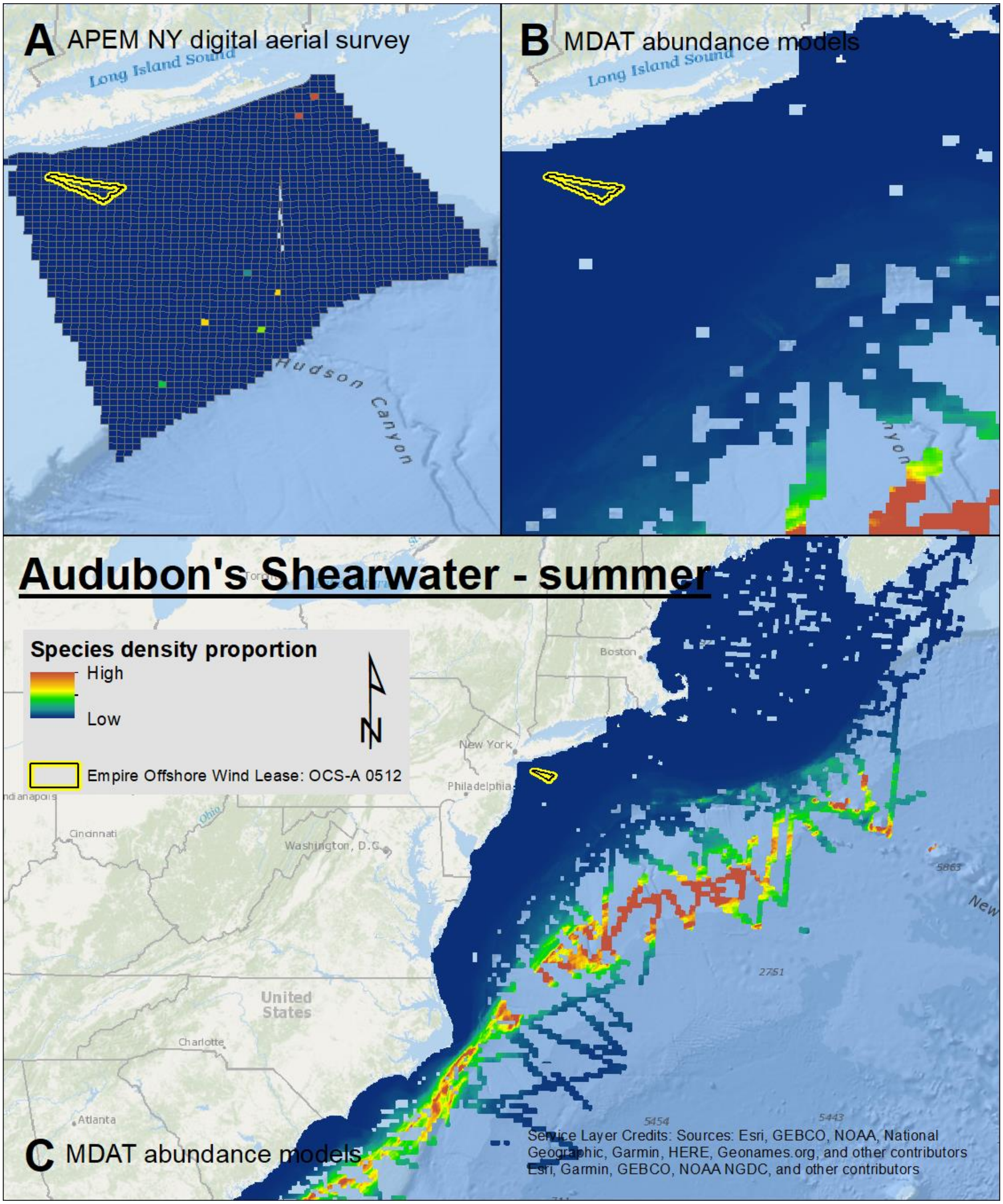
Map 127. Fall Wilson's Storm-Petrel density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



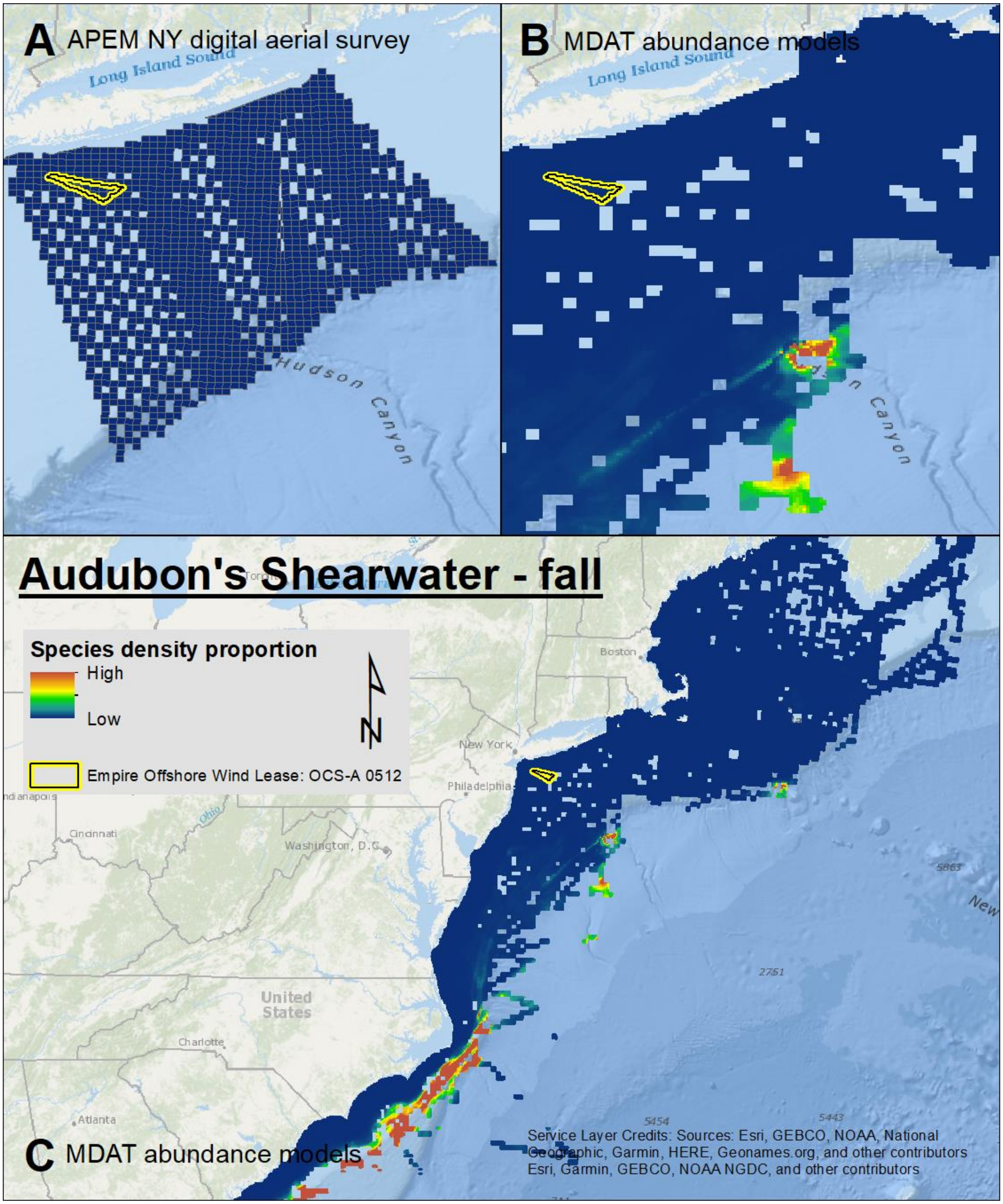
Map 128. Winter Audubon's Shearwater density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



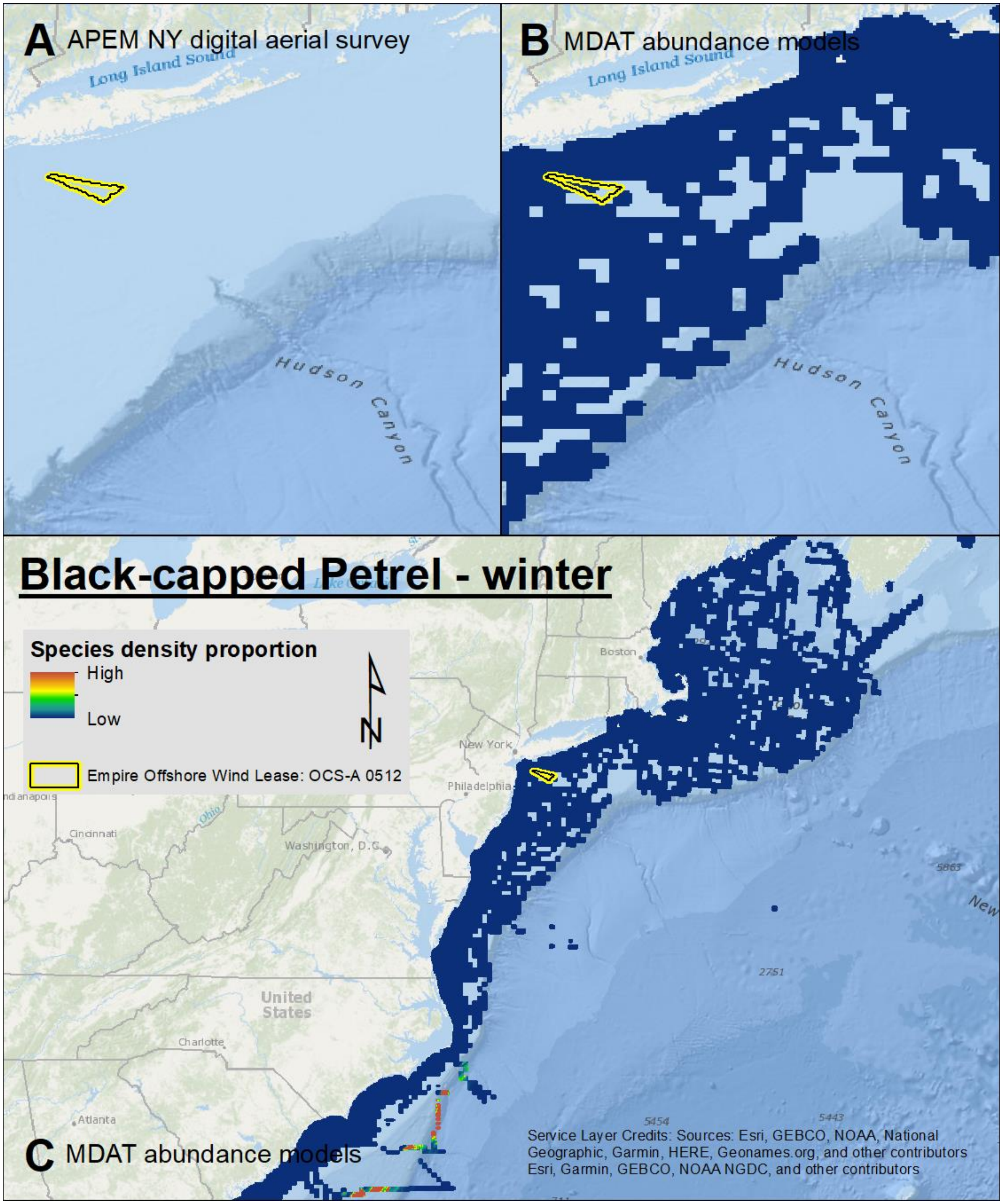
Map 129. Spring Audubon's Shearwater density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



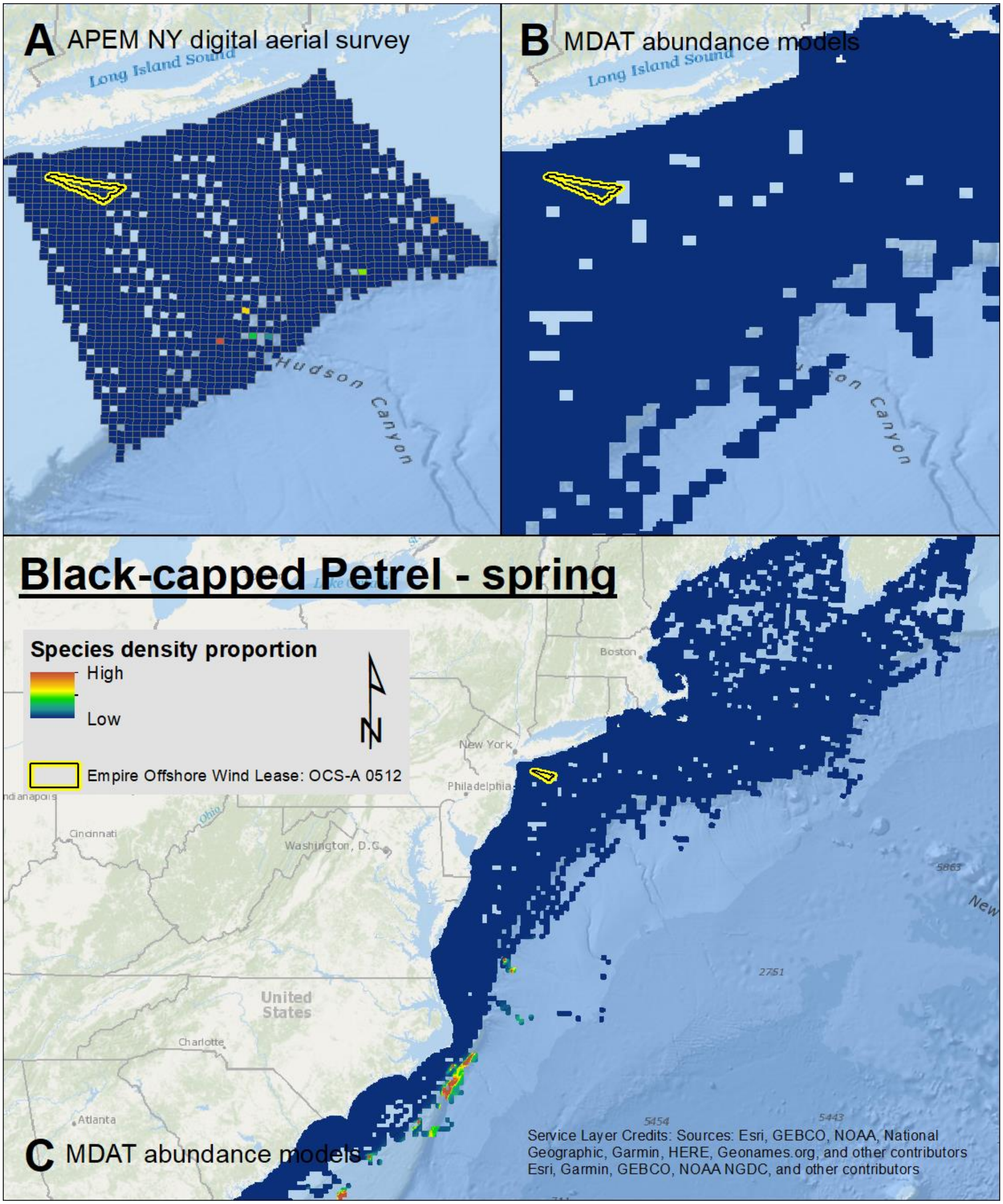
Map 130. Summer Audubon's Shearwater density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



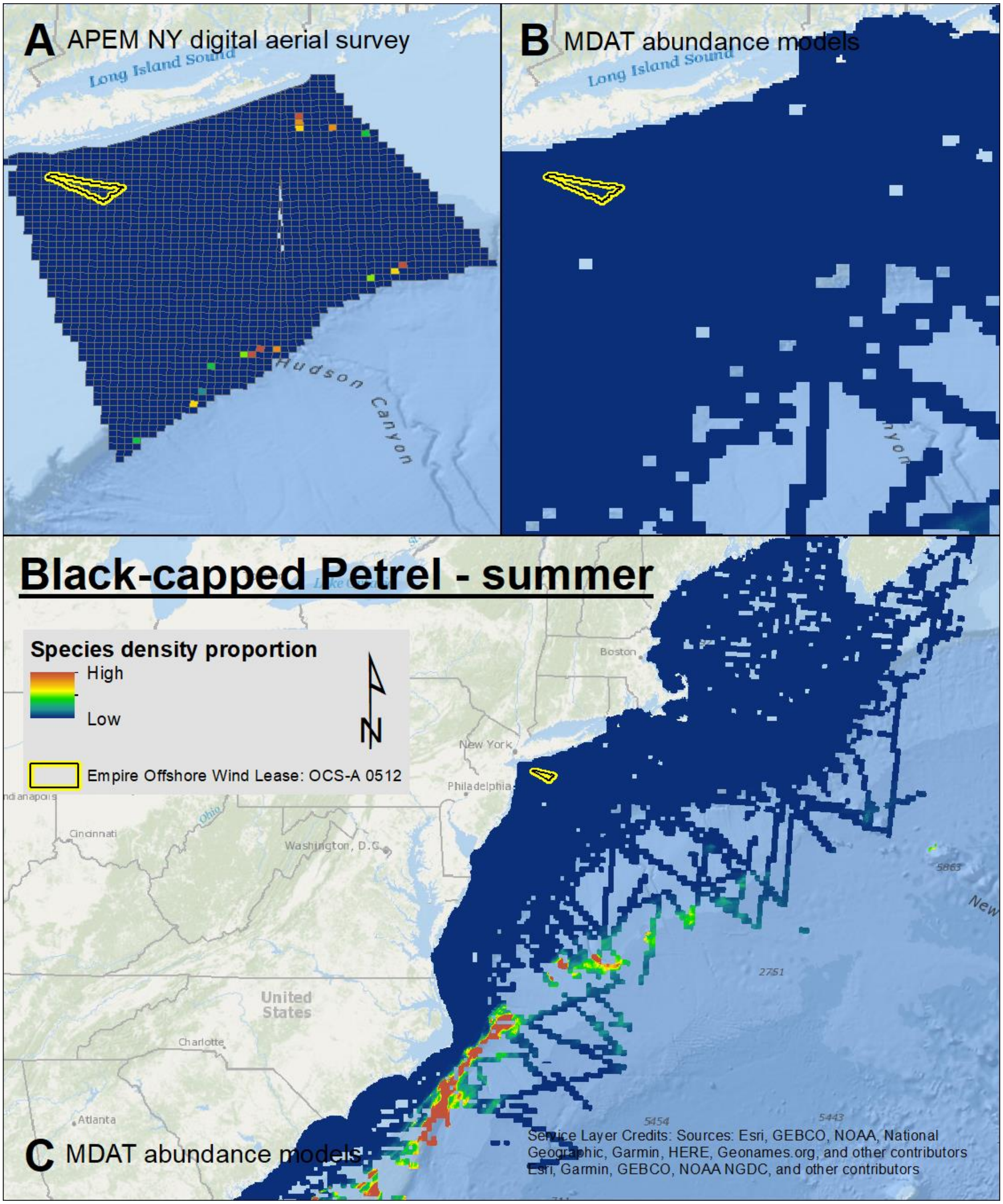
Map 131. Fall Audubon's Shearwater density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



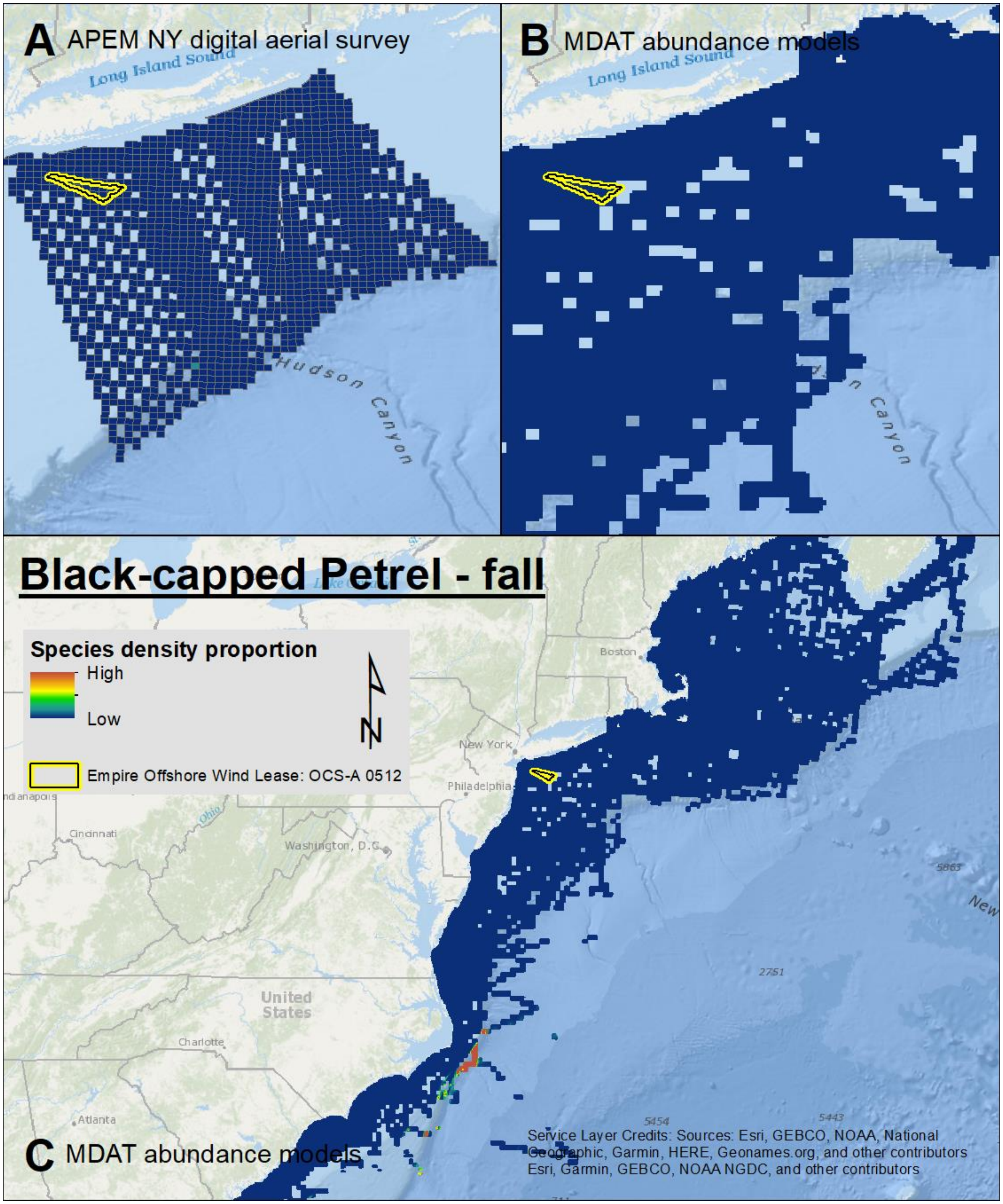
Map 132. Winter Black-capped Petrel density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



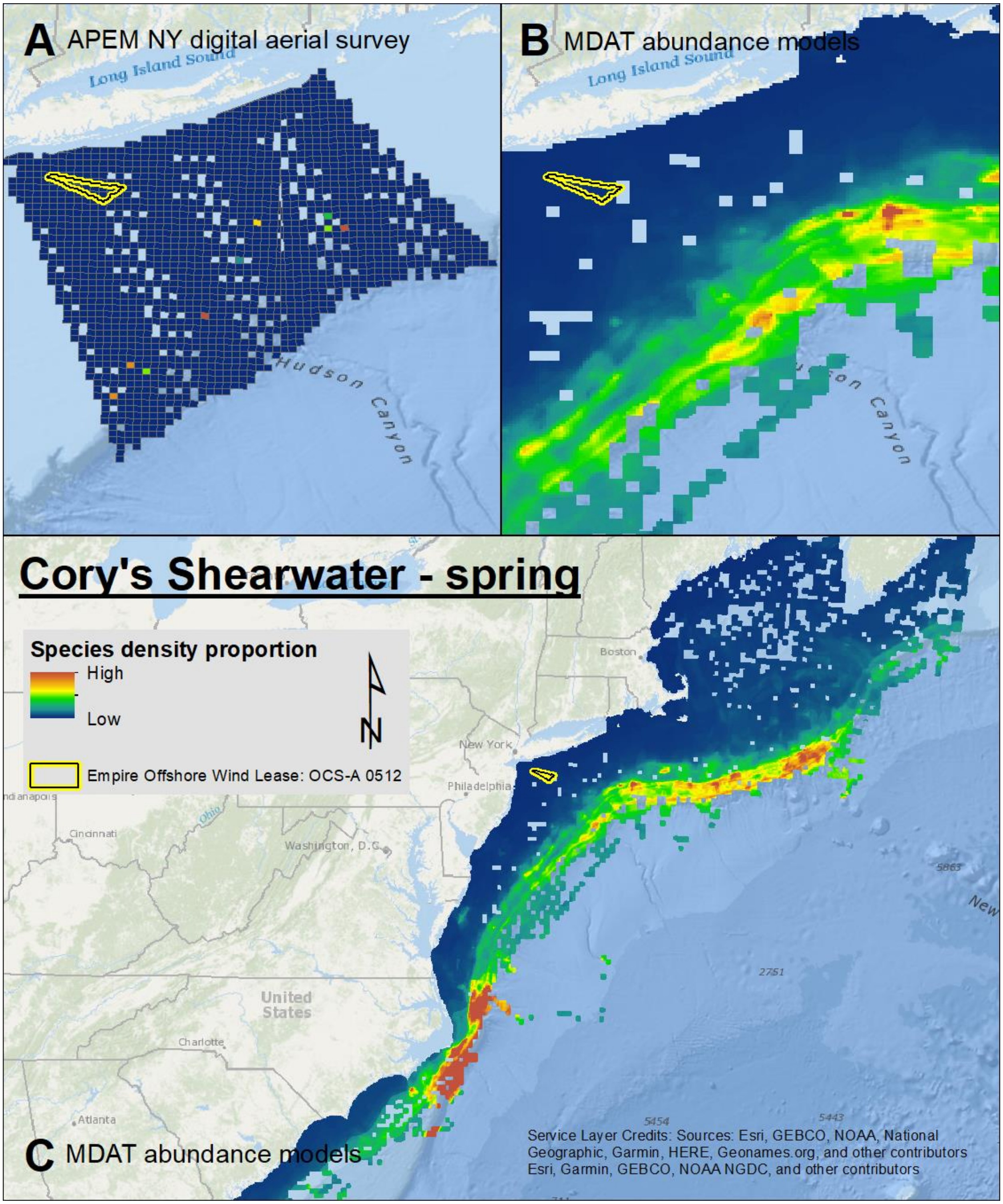
Map 133. Spring Black-capped Petrel density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



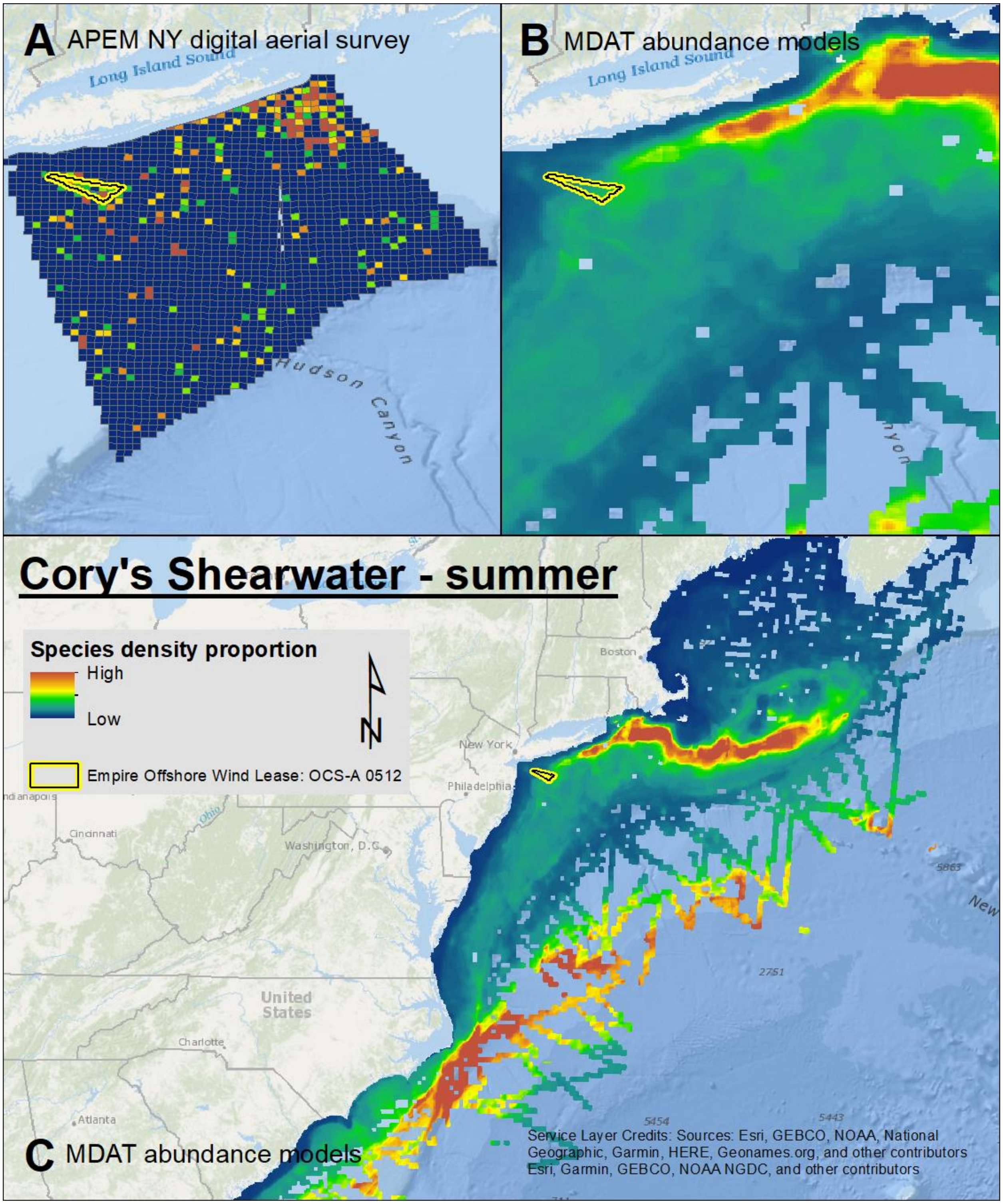
Map 134. Summer Black-capped Petrel density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



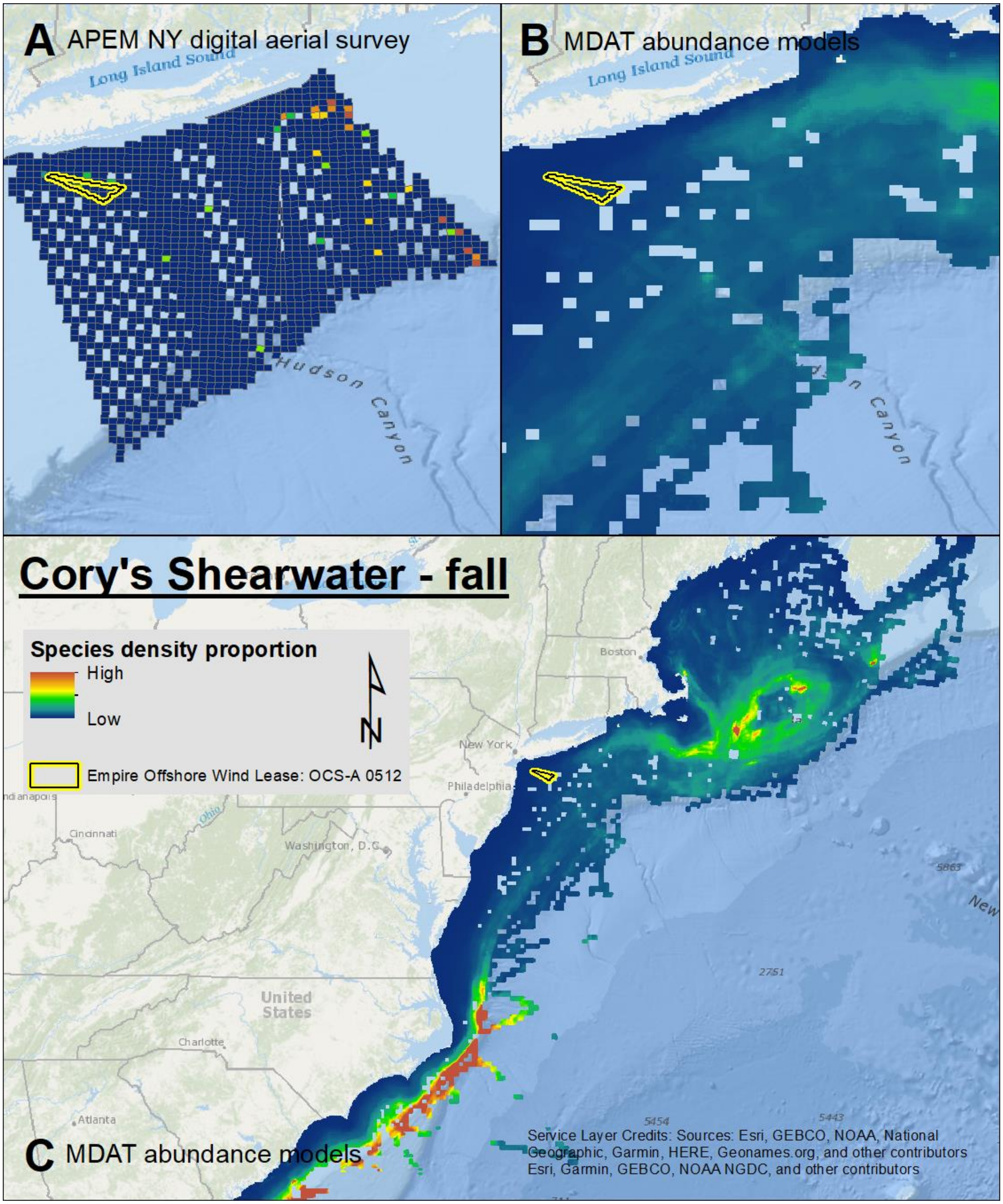
Map 135. Fall Black-capped Petrel density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



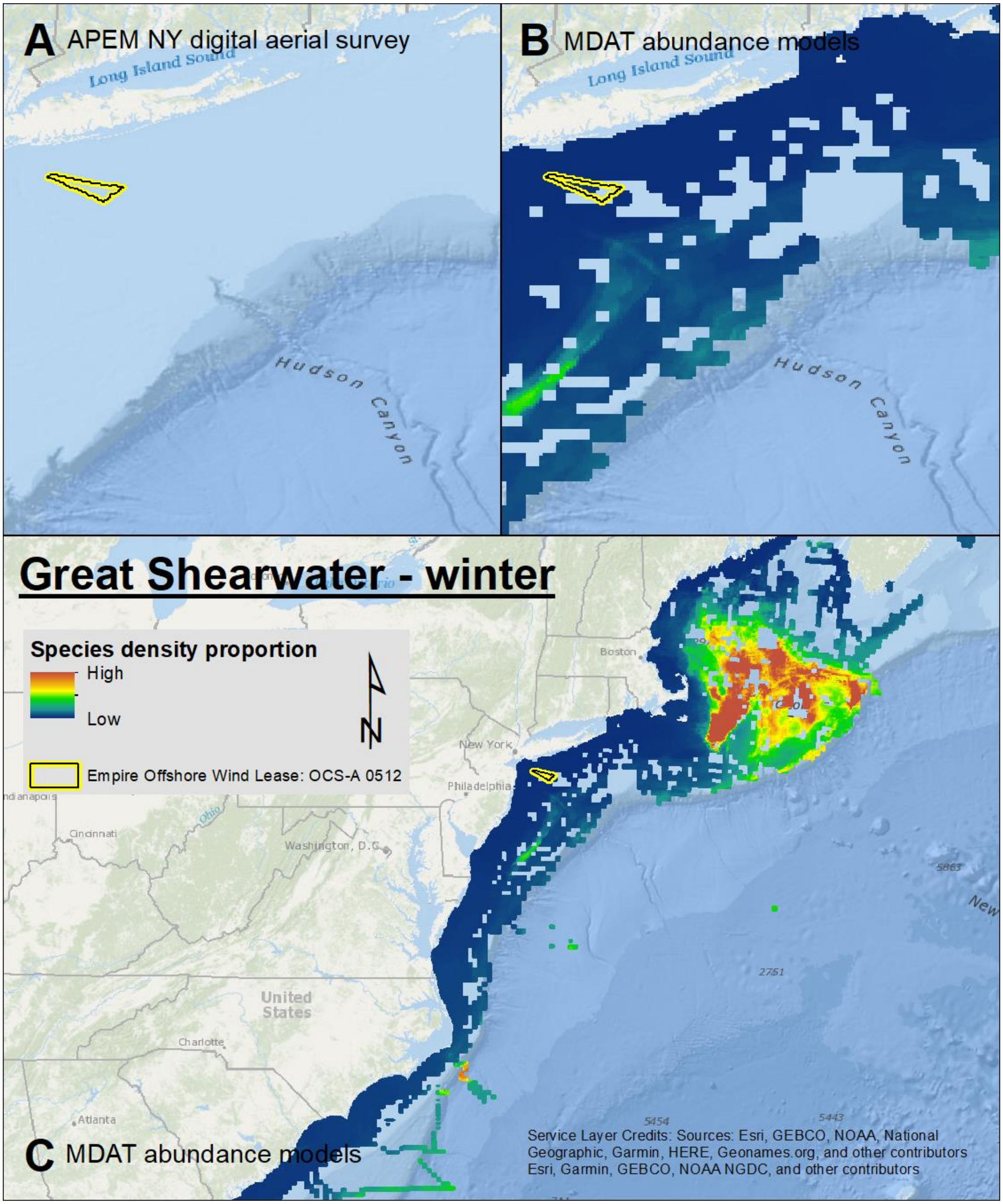
Map 136. Spring Cory's Shearwater density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



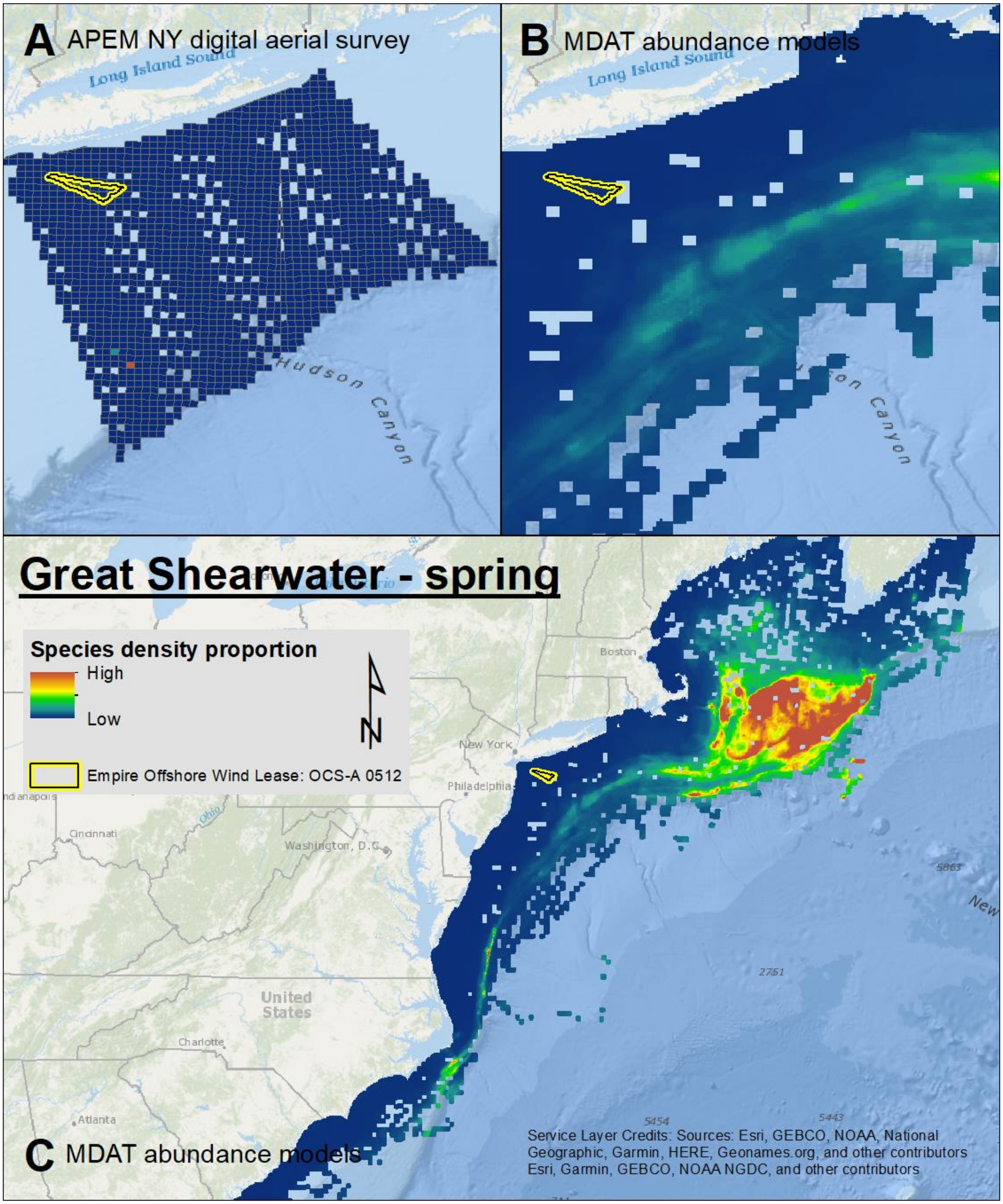
Map 137. Summer Cory's Shearwater density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



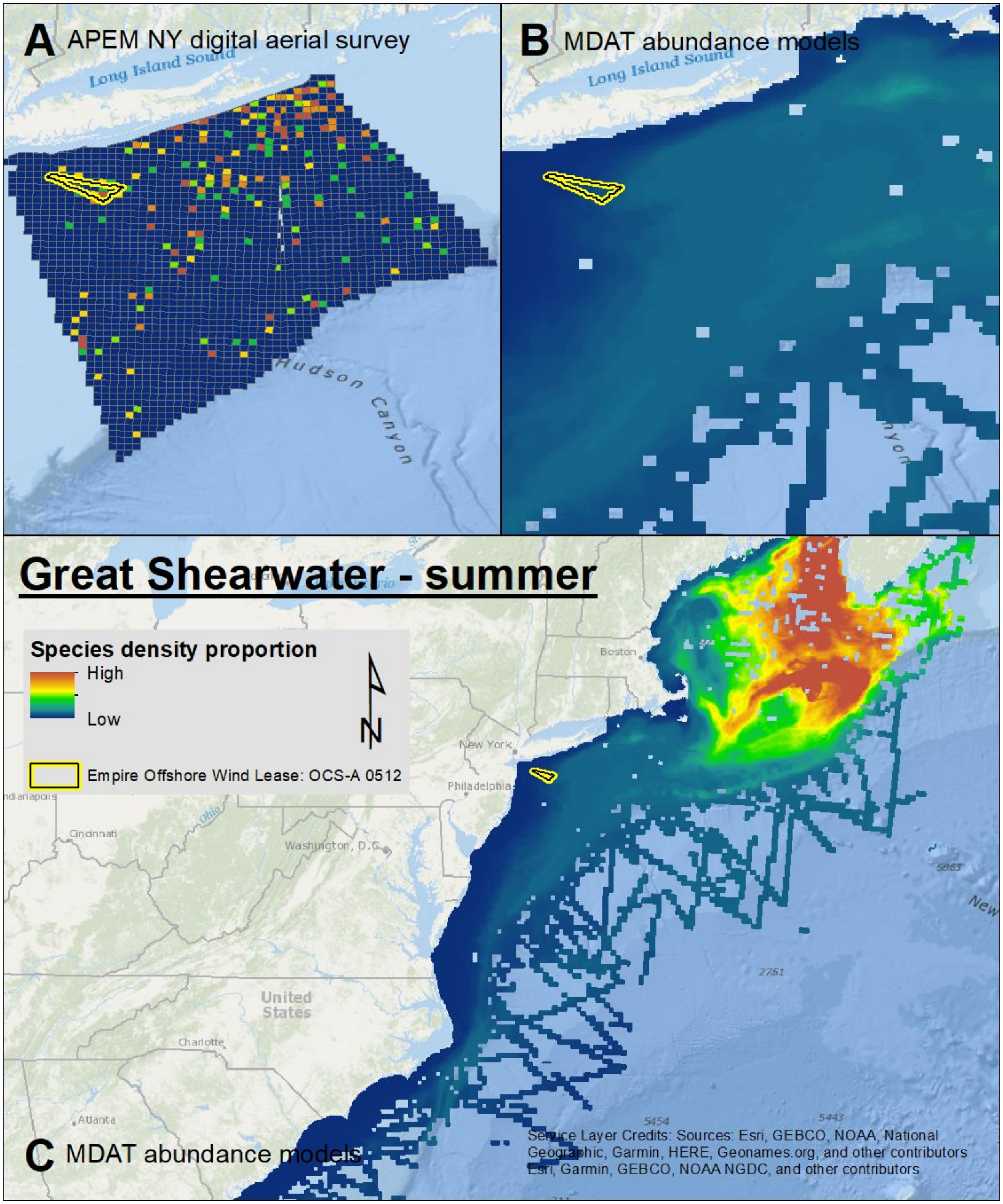
Map 138. Fall Cory's Shearwater density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



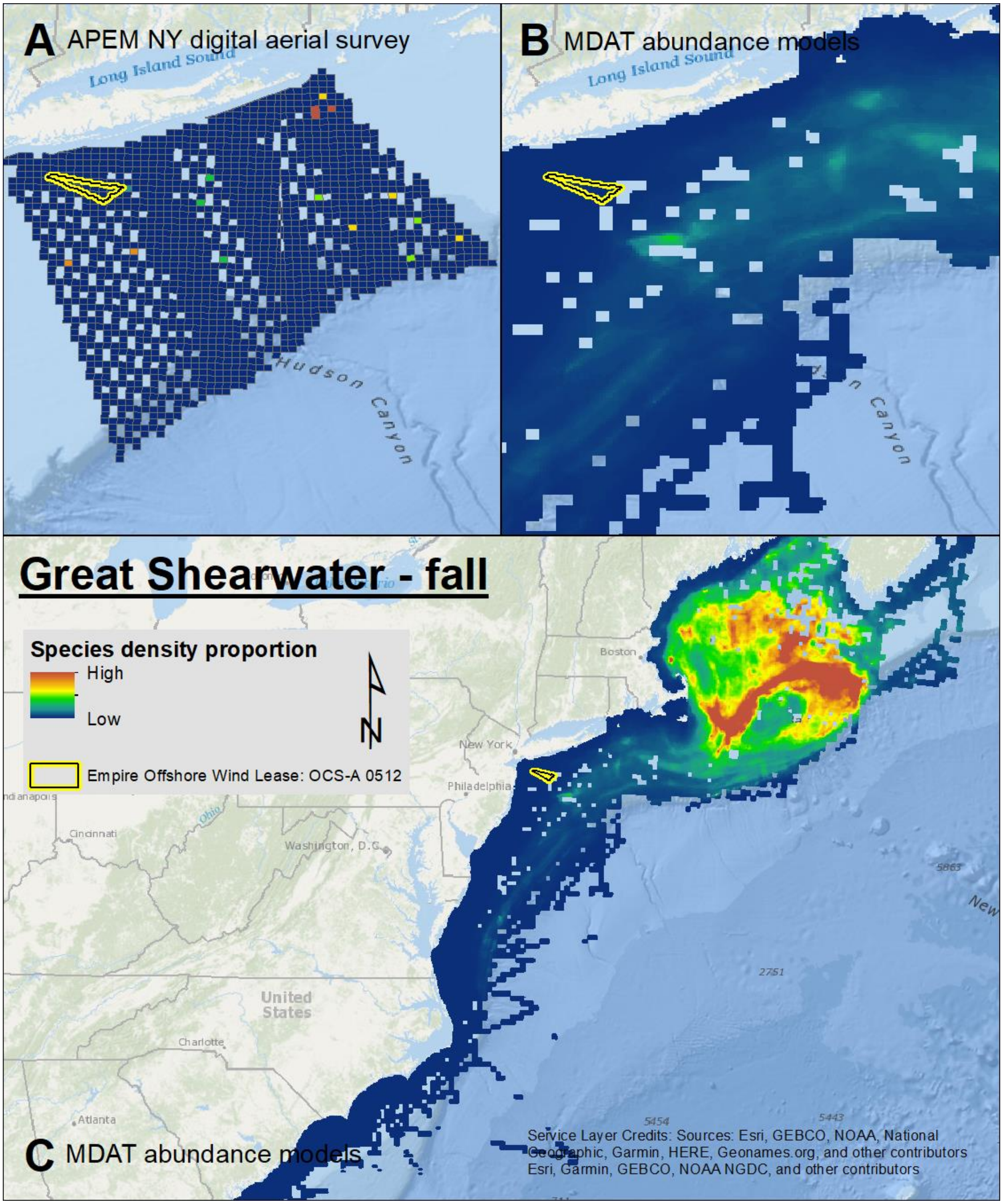
Map 139. Winter Great Shearwater density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



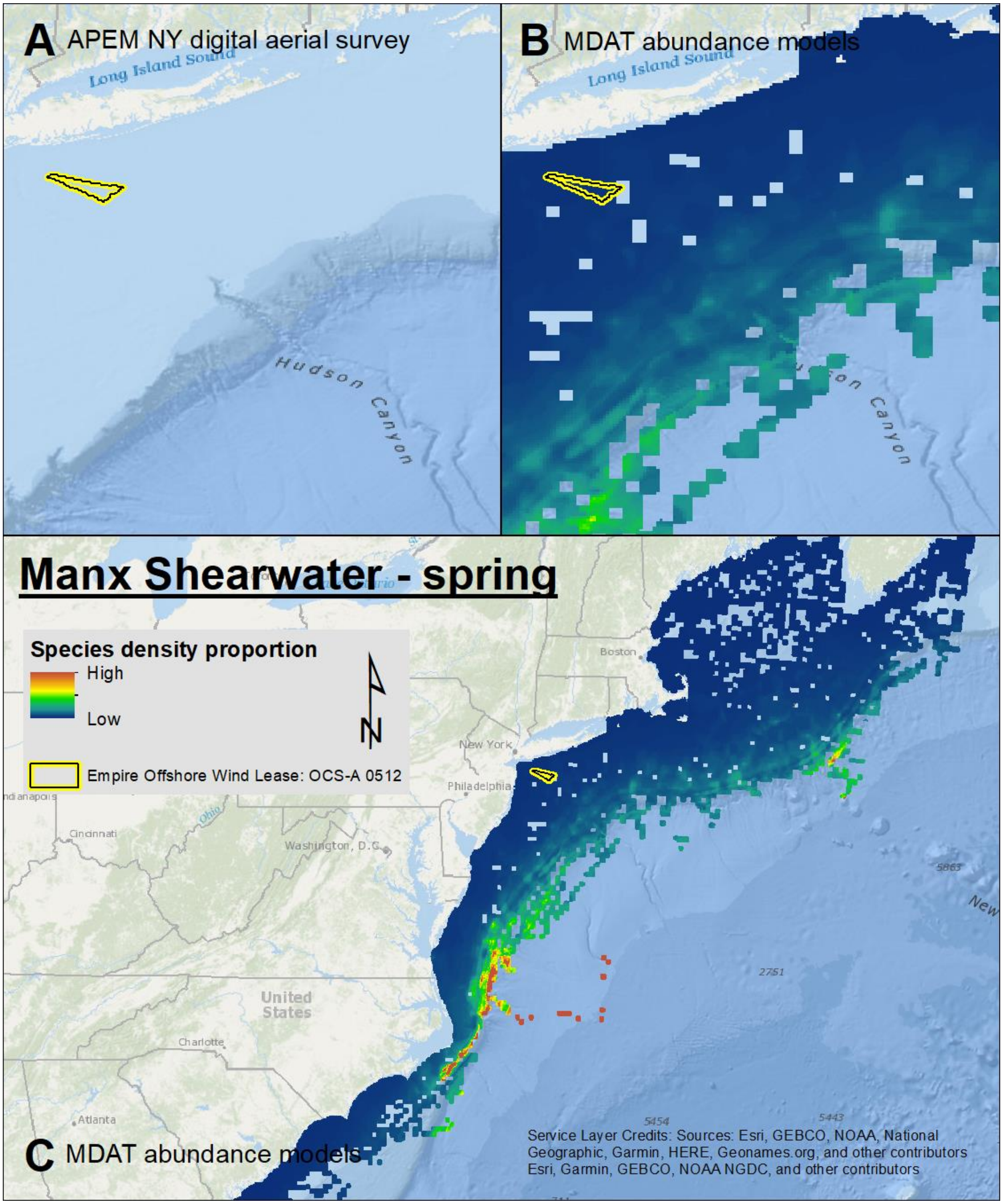
Map 140. Spring Great Shearwater density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



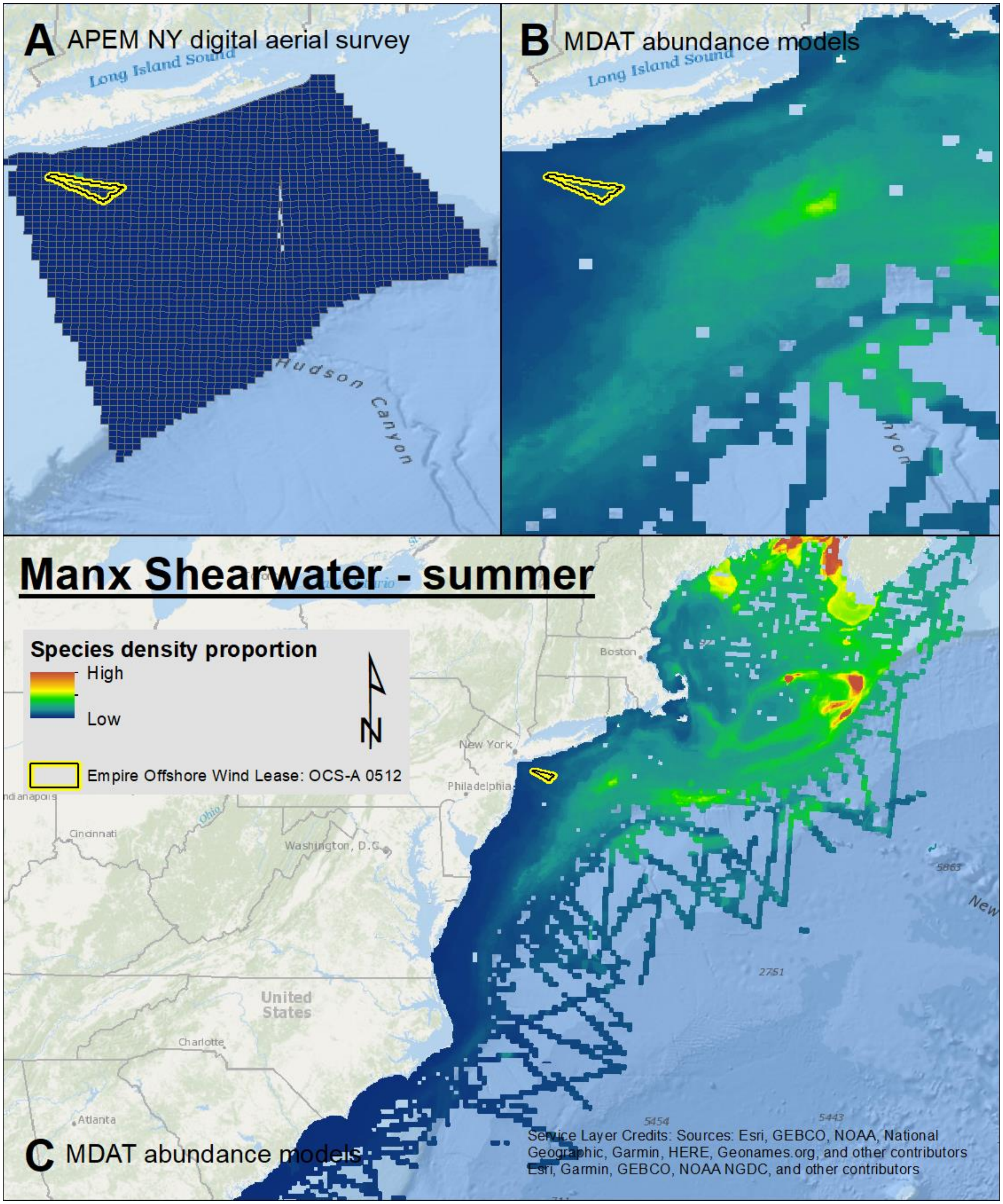
Map 141. Summer Great Shearwater density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



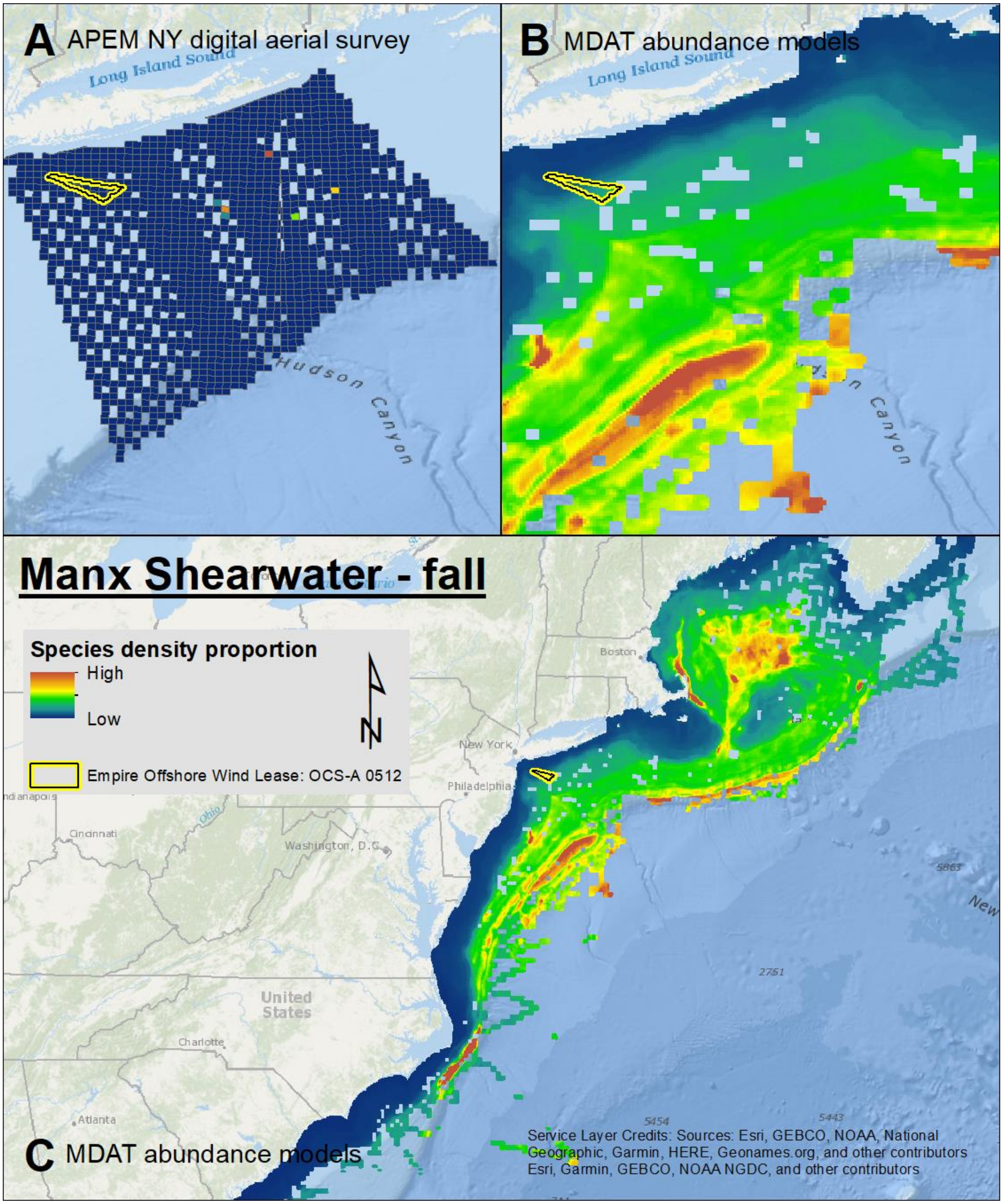
Map 142. Fall Great Shearwater density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



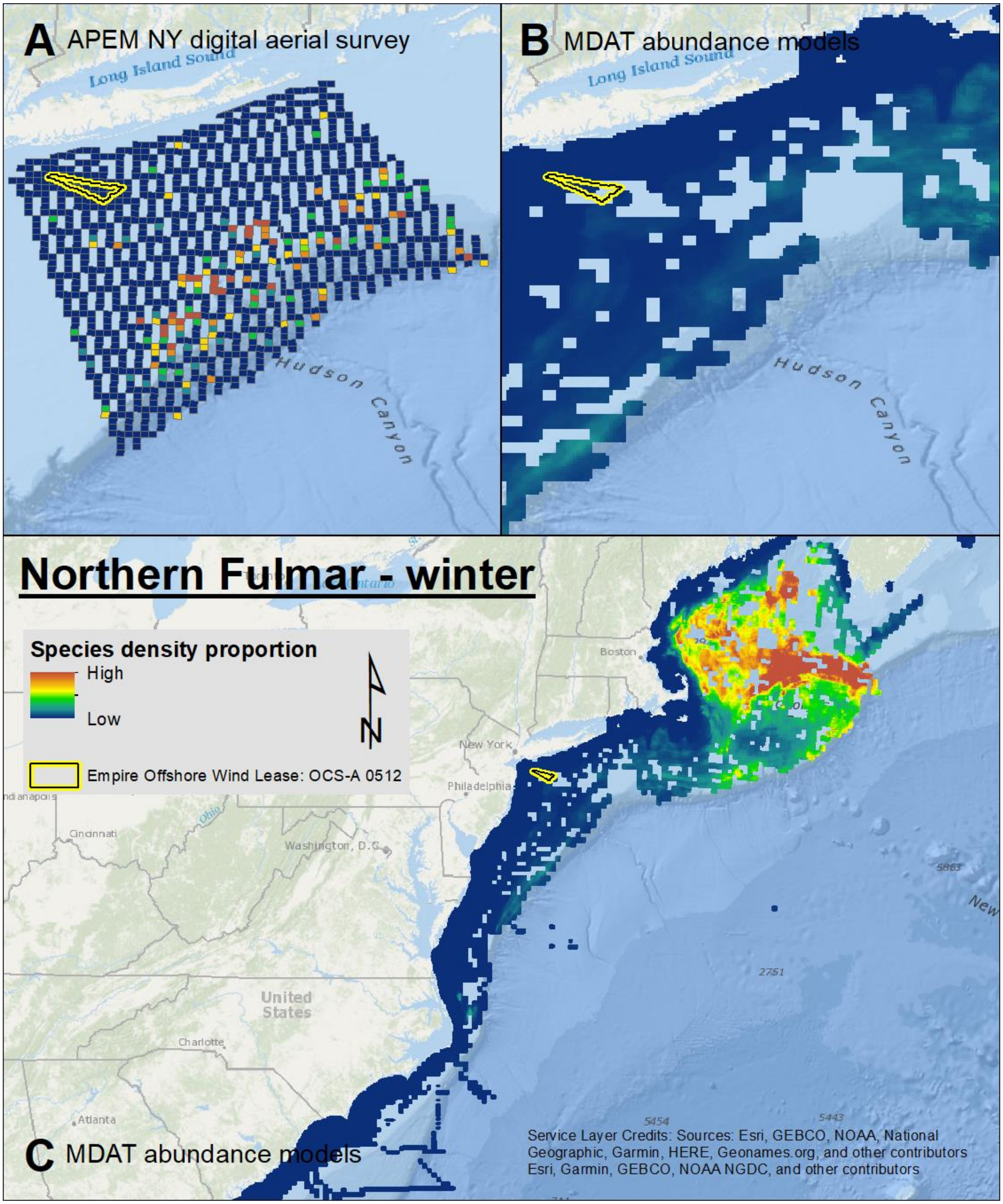
Map 143. Spring Manx Shearwater density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



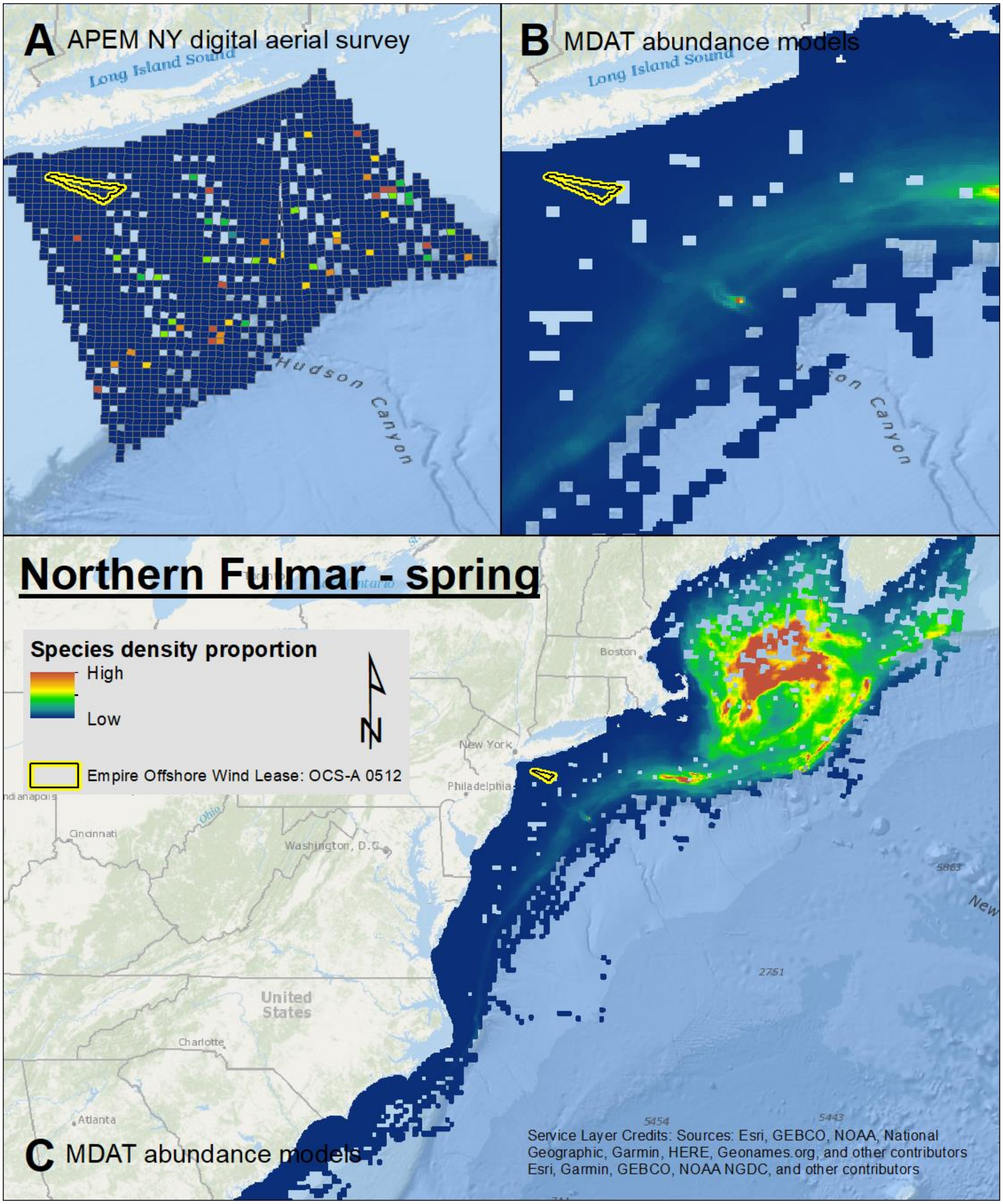
Map 144. Summer Manx Shearwater density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



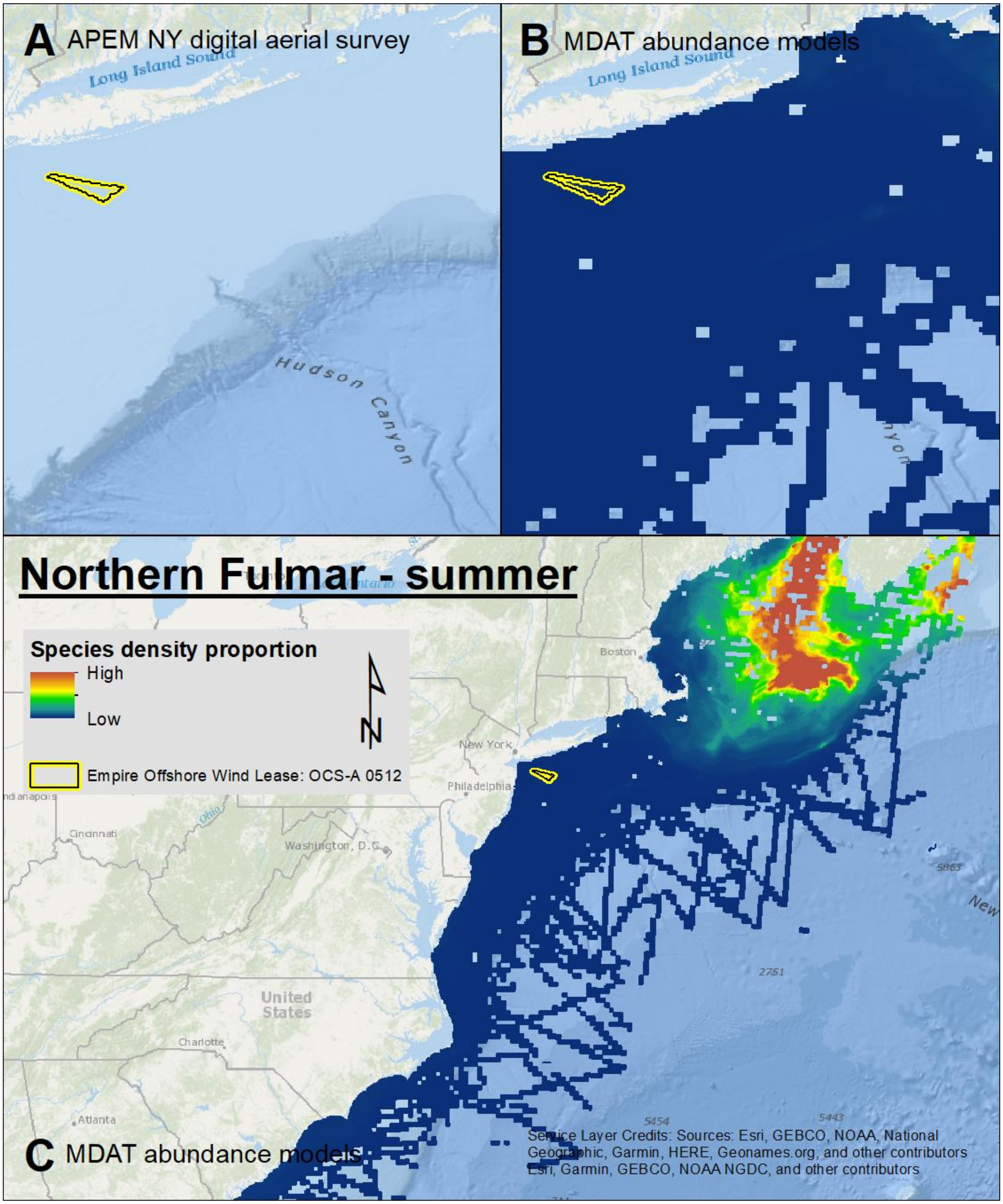
Map 145. Fall Manx Shearwater density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



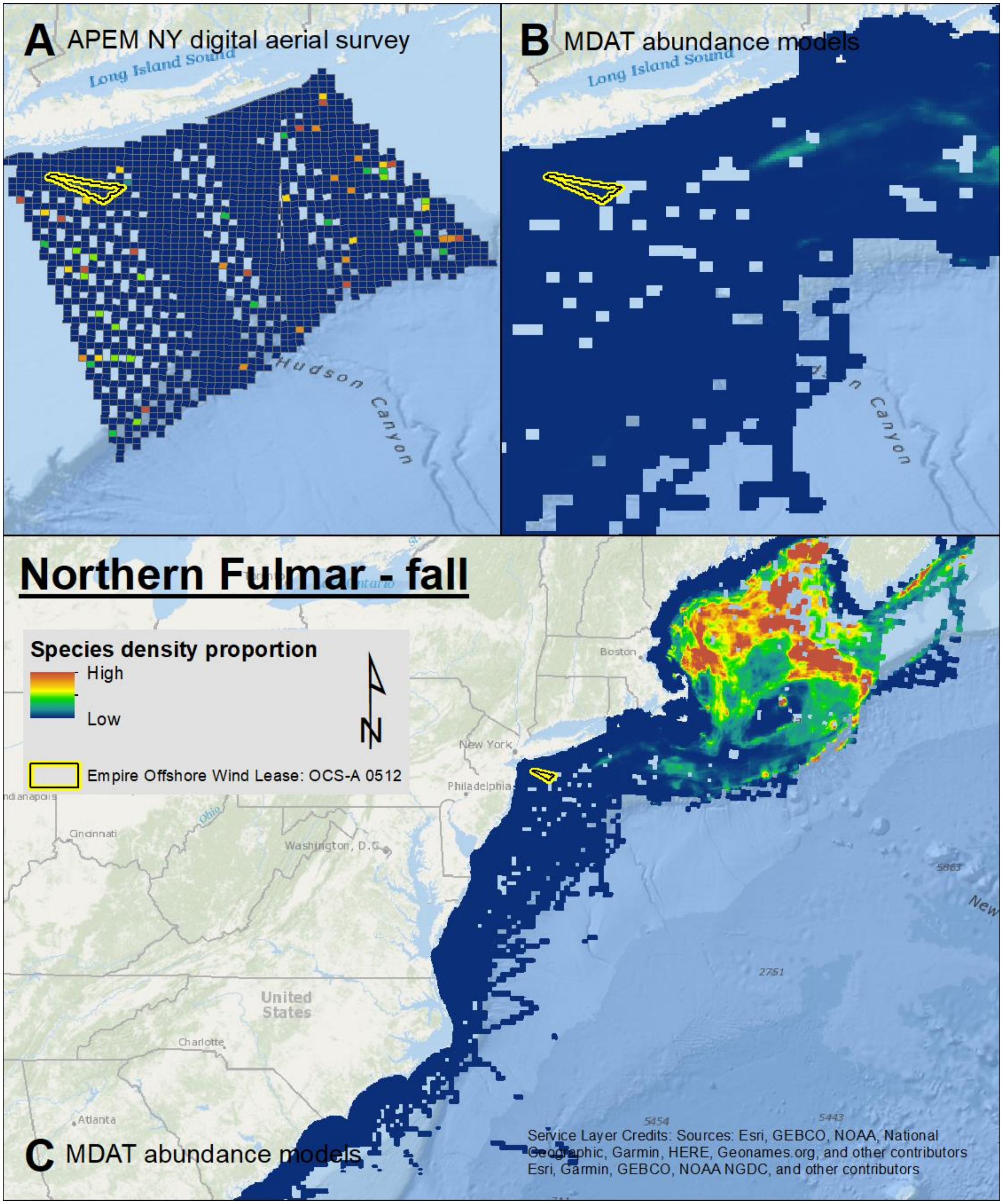
Map 146. Winter Northern Fulmar density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



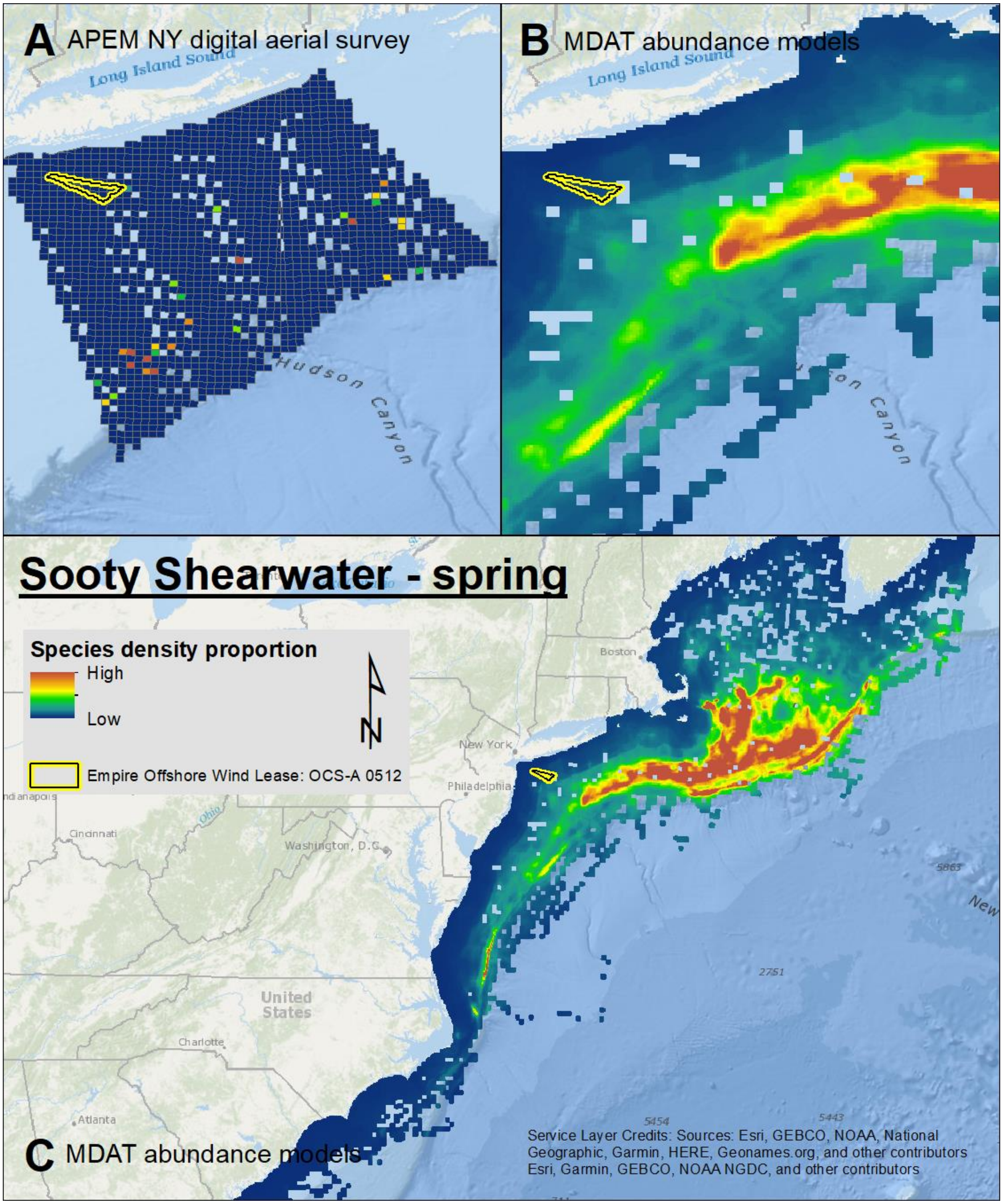
Map 147. Spring Northern Fulmar density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



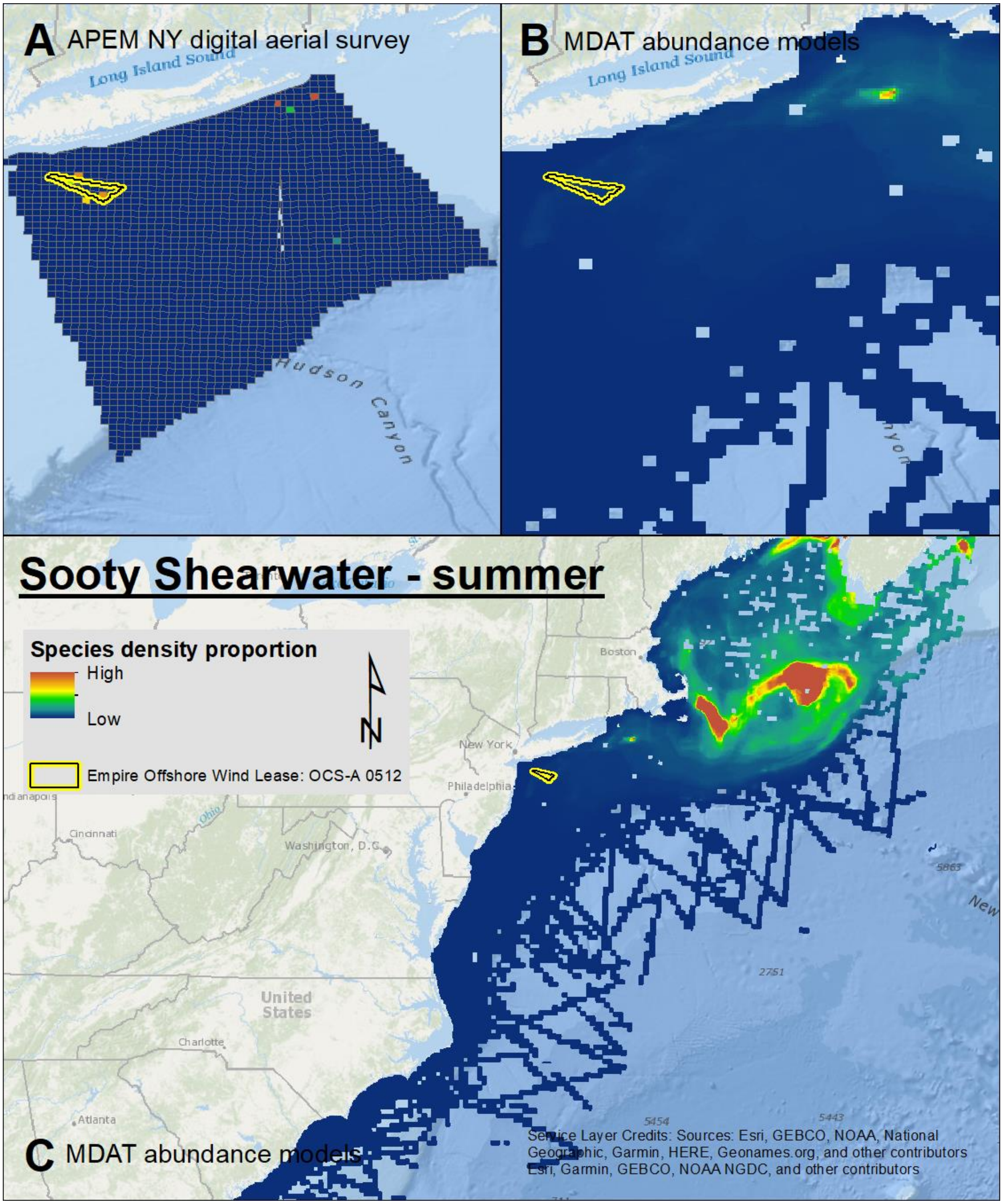
Map 148. Summer Northern Fulmar density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



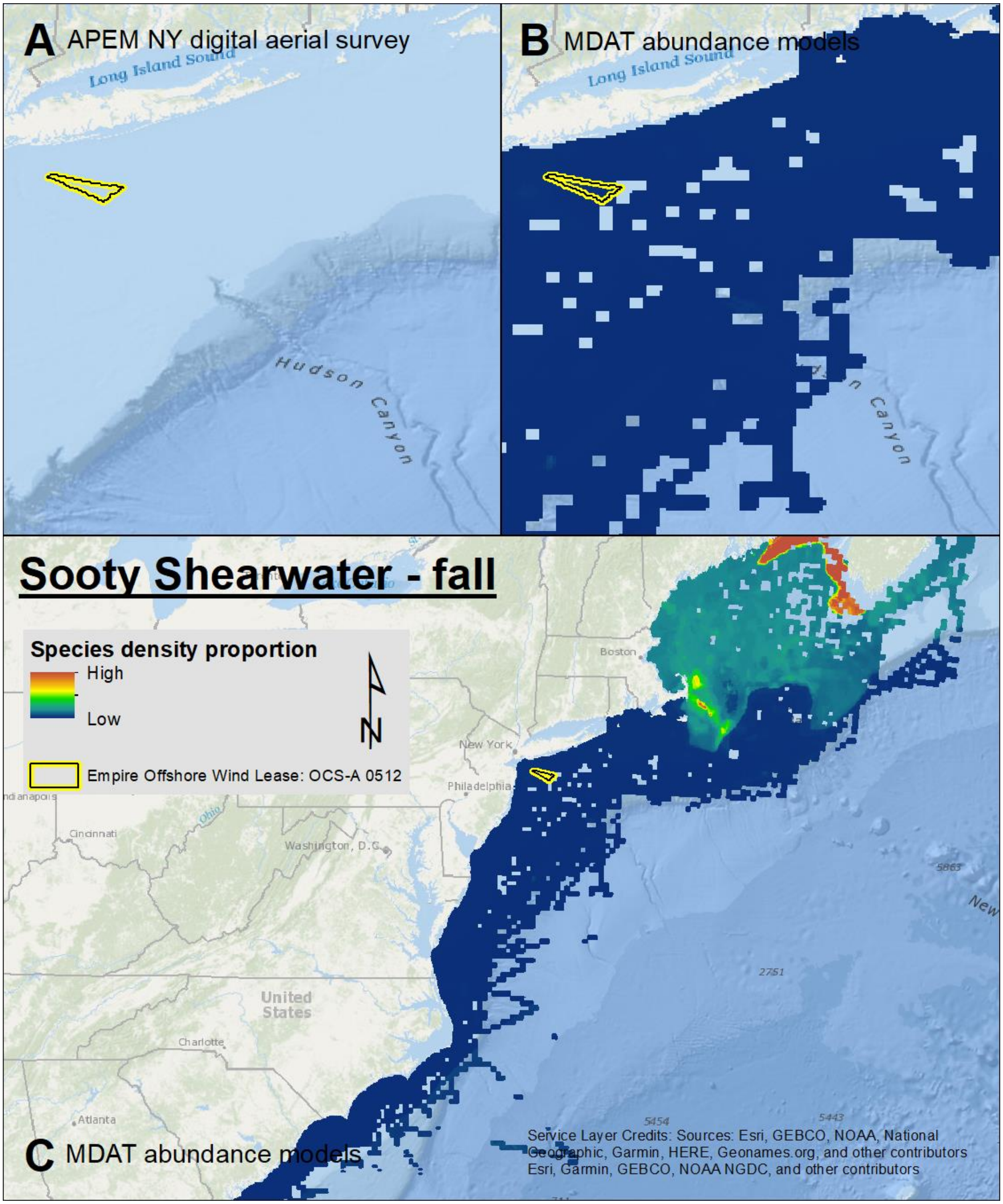
Map 149. Fall Northern Fulmar density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



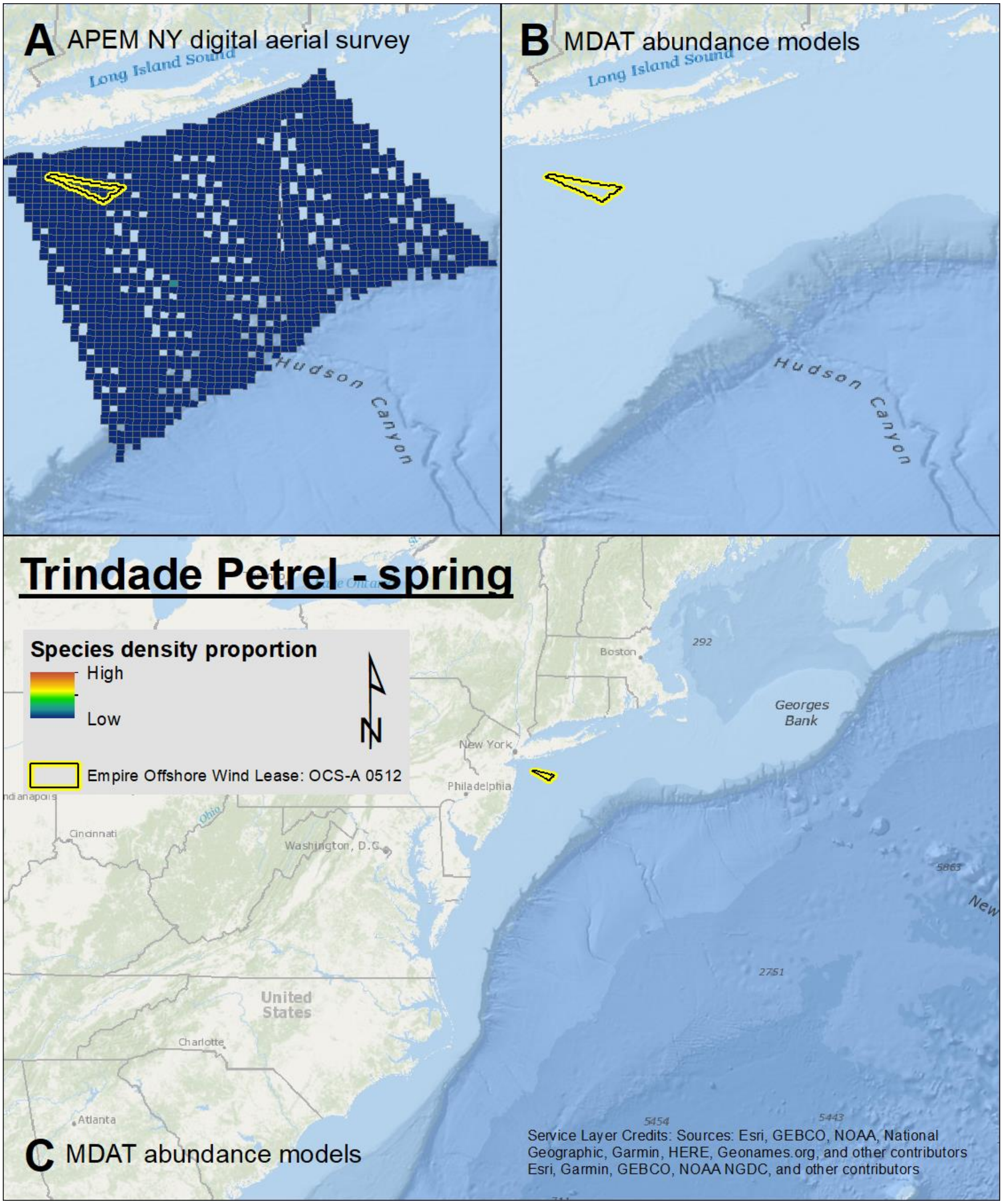
Map 150. Spring Sooty Shearwater density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



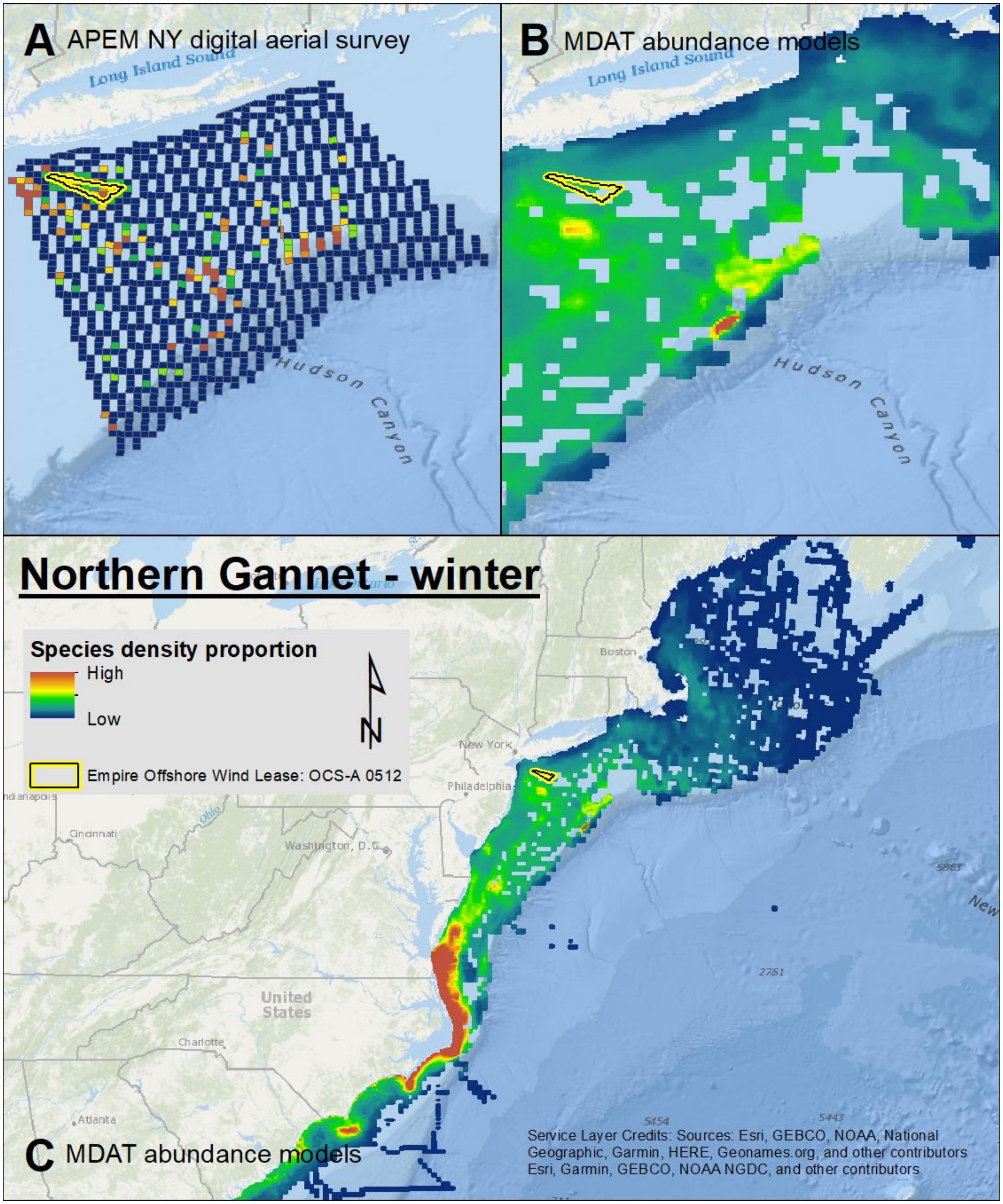
Map 151. Summer Sooty Shearwater density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



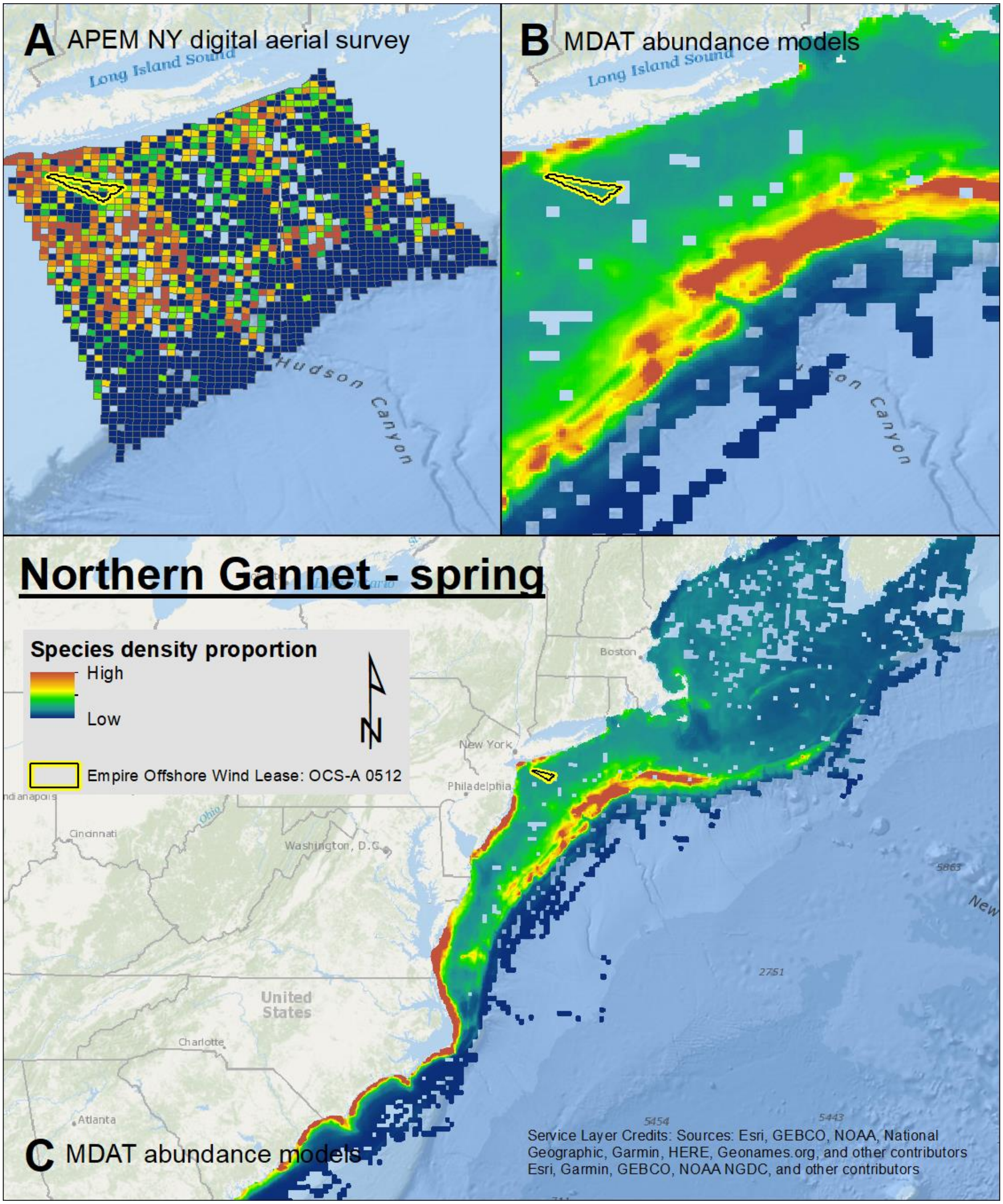
Map 152. Fall Sooty Shearwater density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



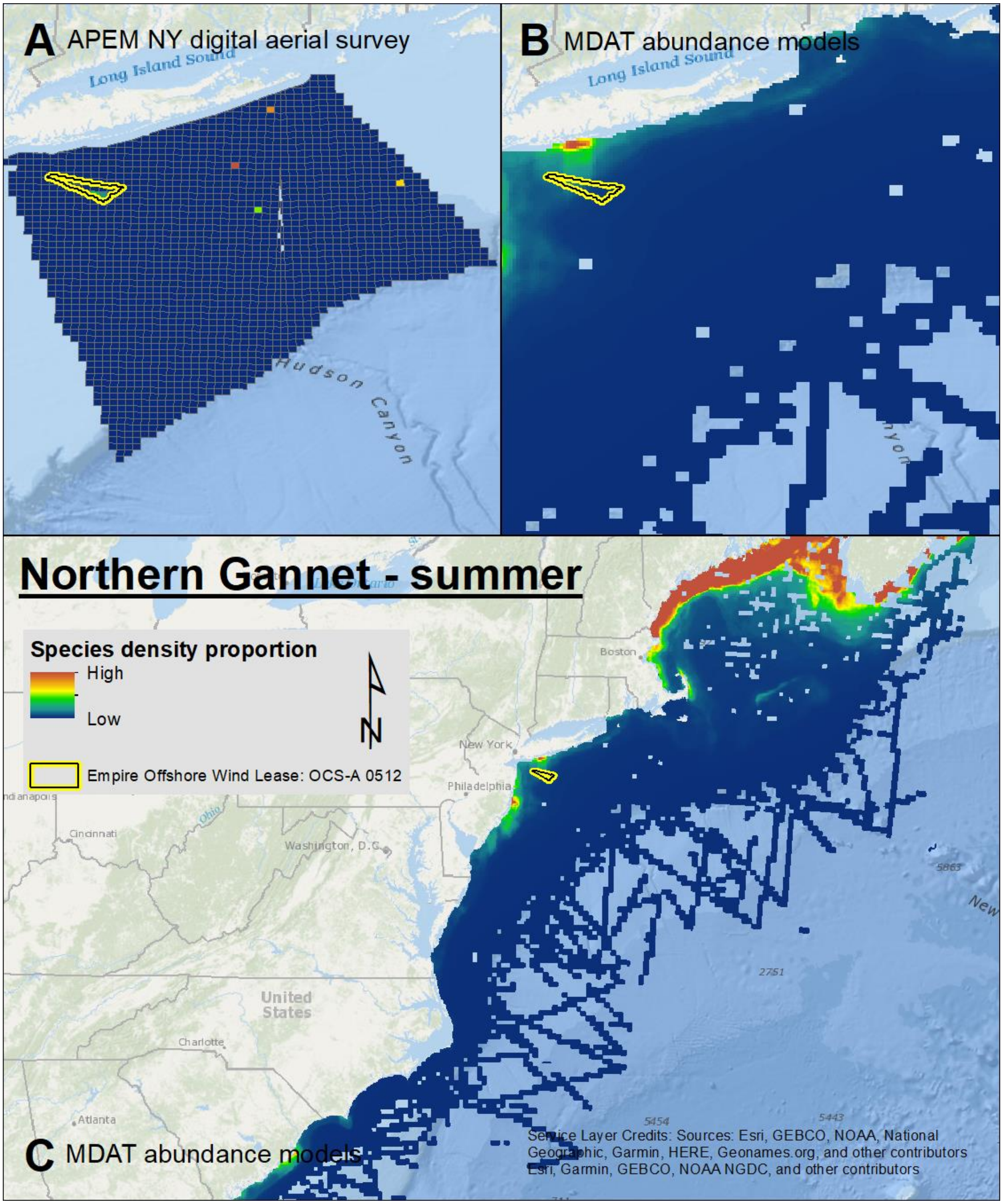
Map 153. Spring Trindade Petrel density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



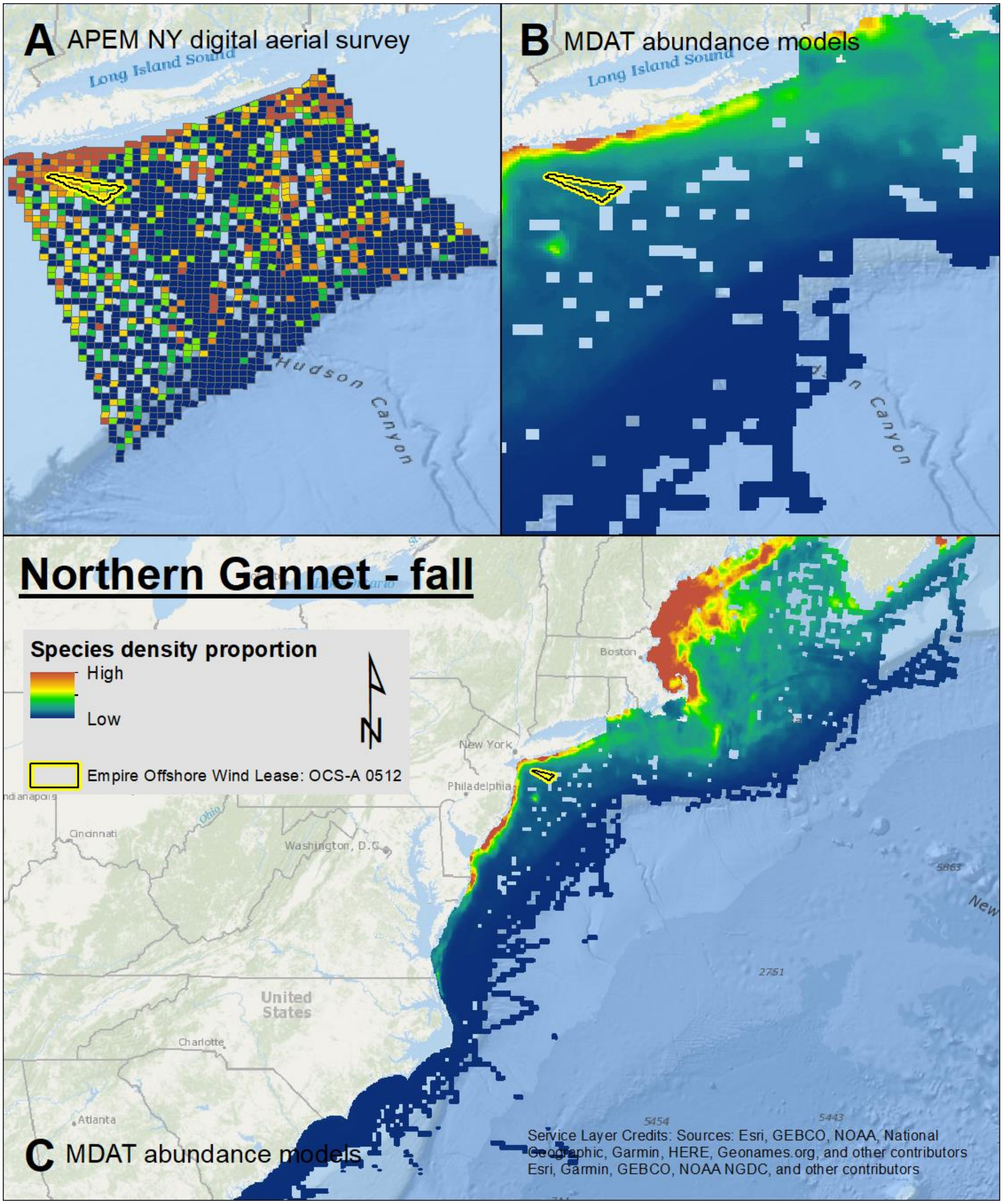
Map 154. Winter Northern Gannet density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



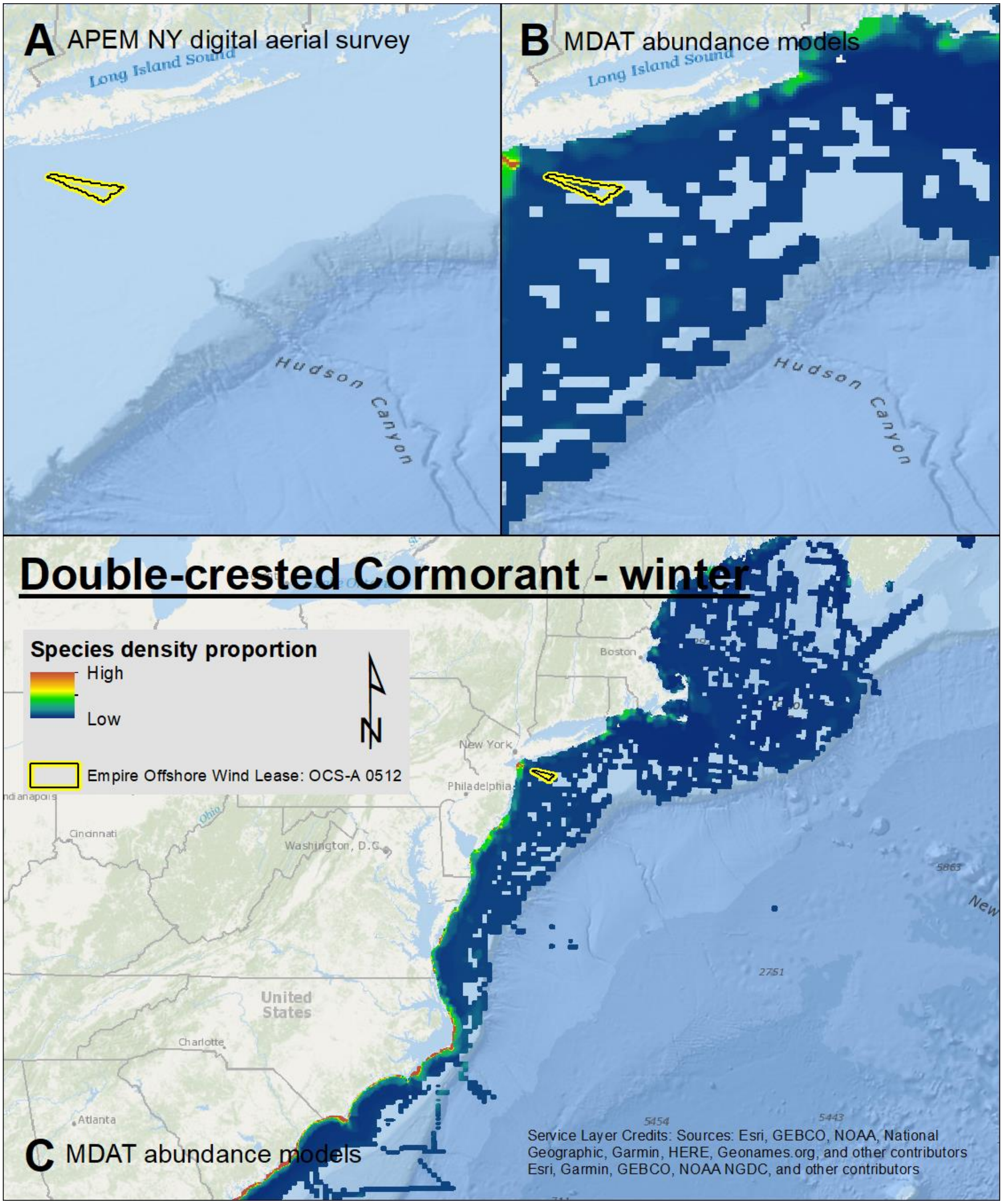
Map 155. Spring Northern Gannet density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



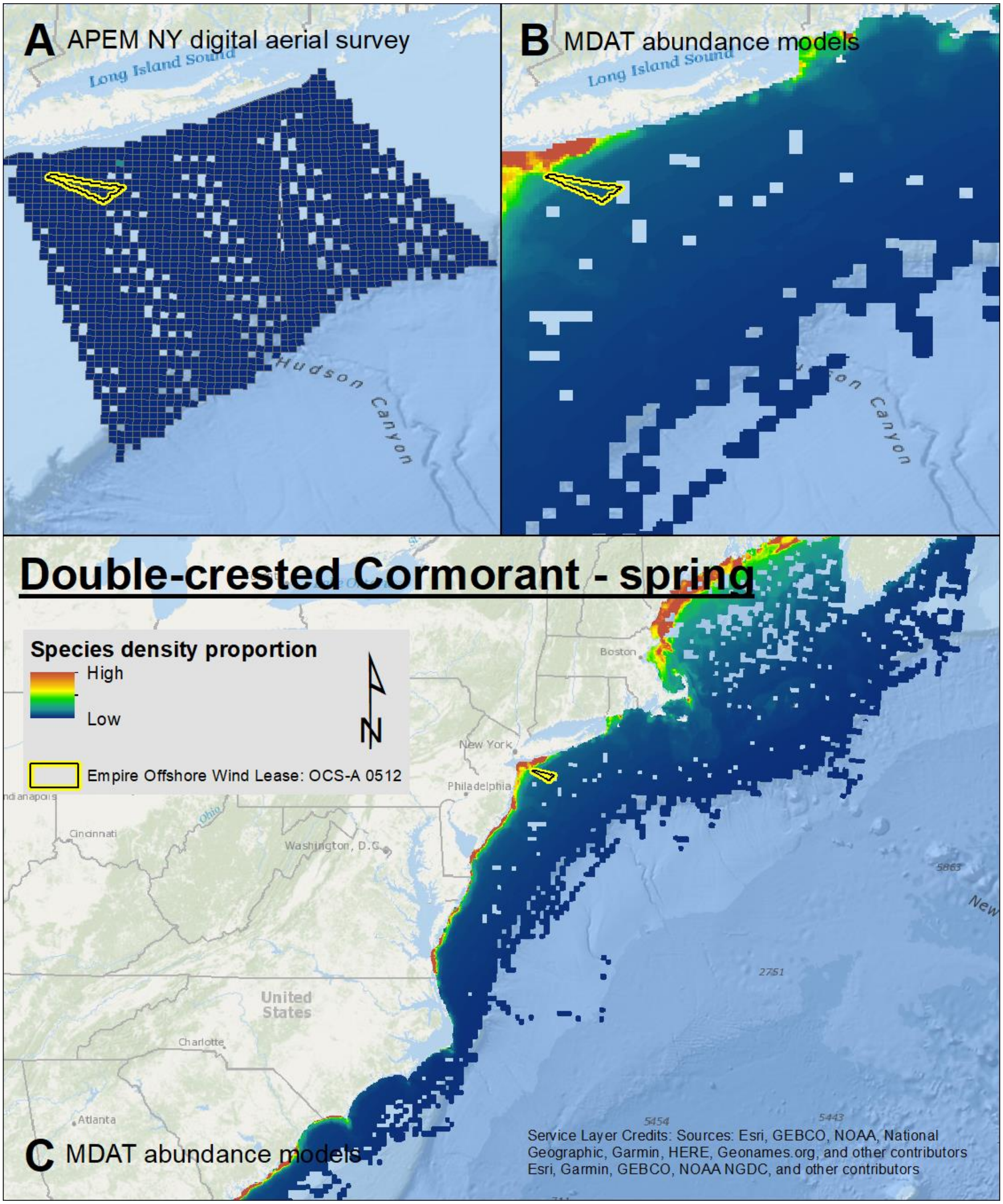
Map 156. Summer Northern Gannet density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



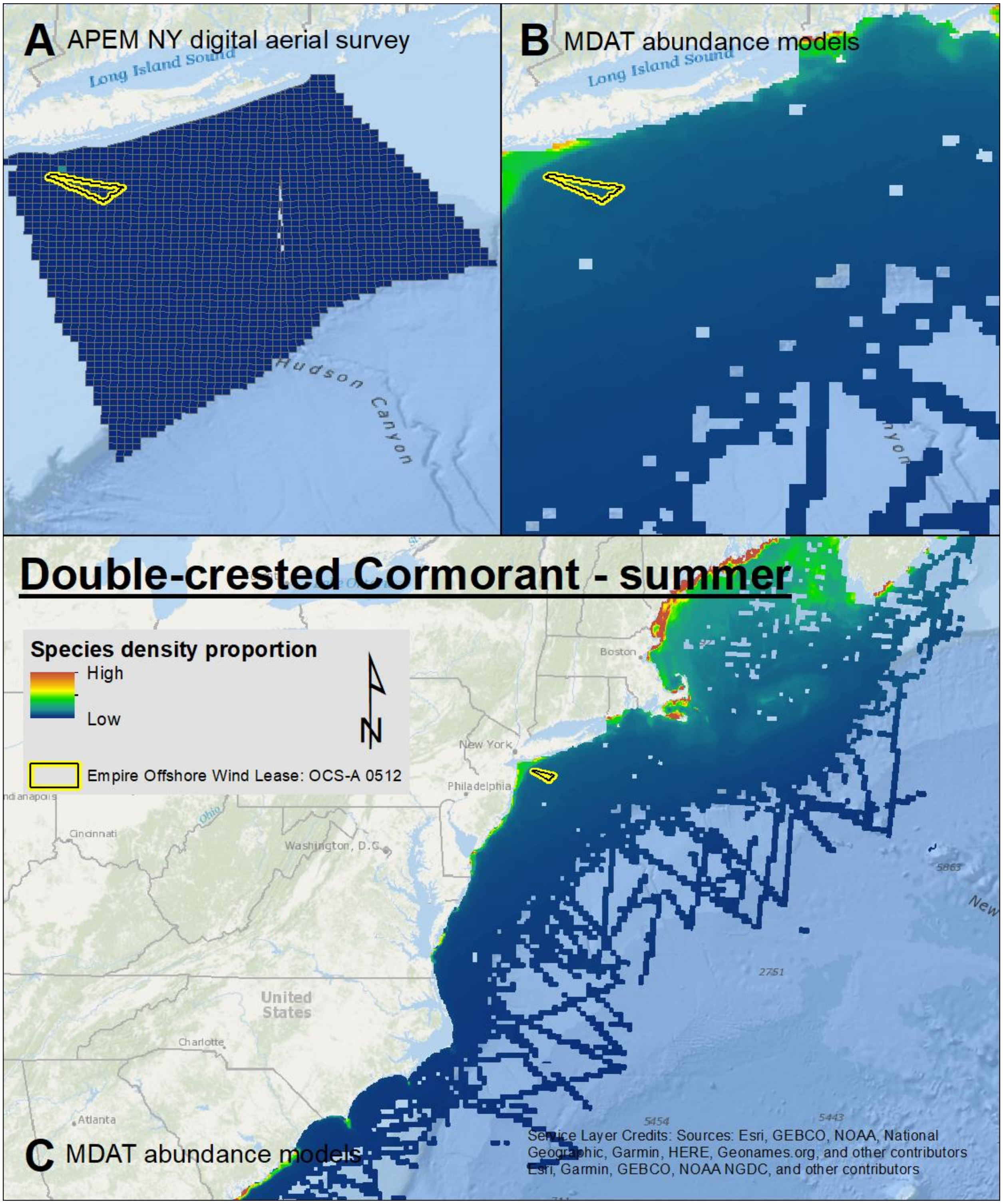
Map 157. Fall Northern Gannet density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



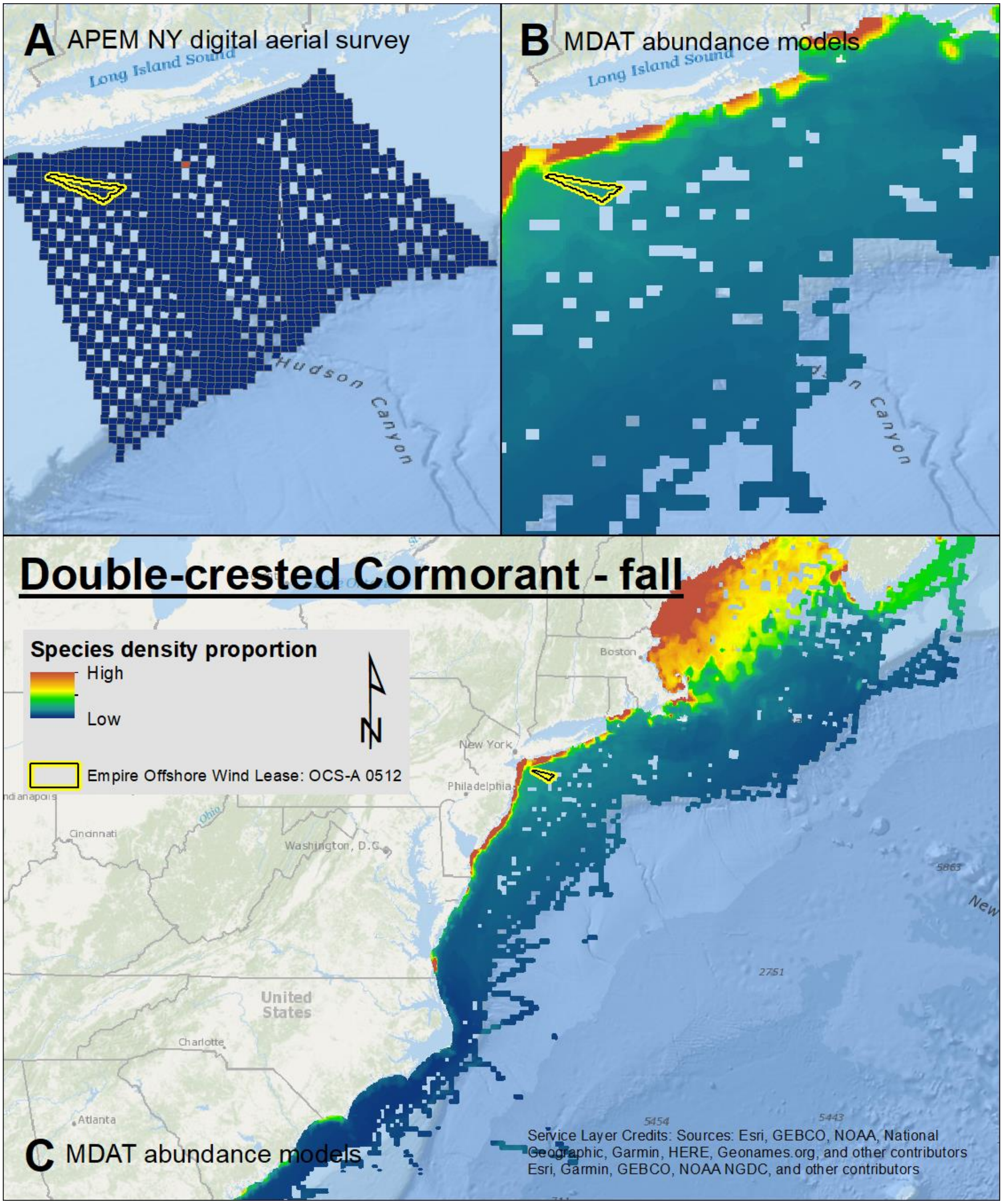
Map 158. Winter Double-crested Cormorant density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



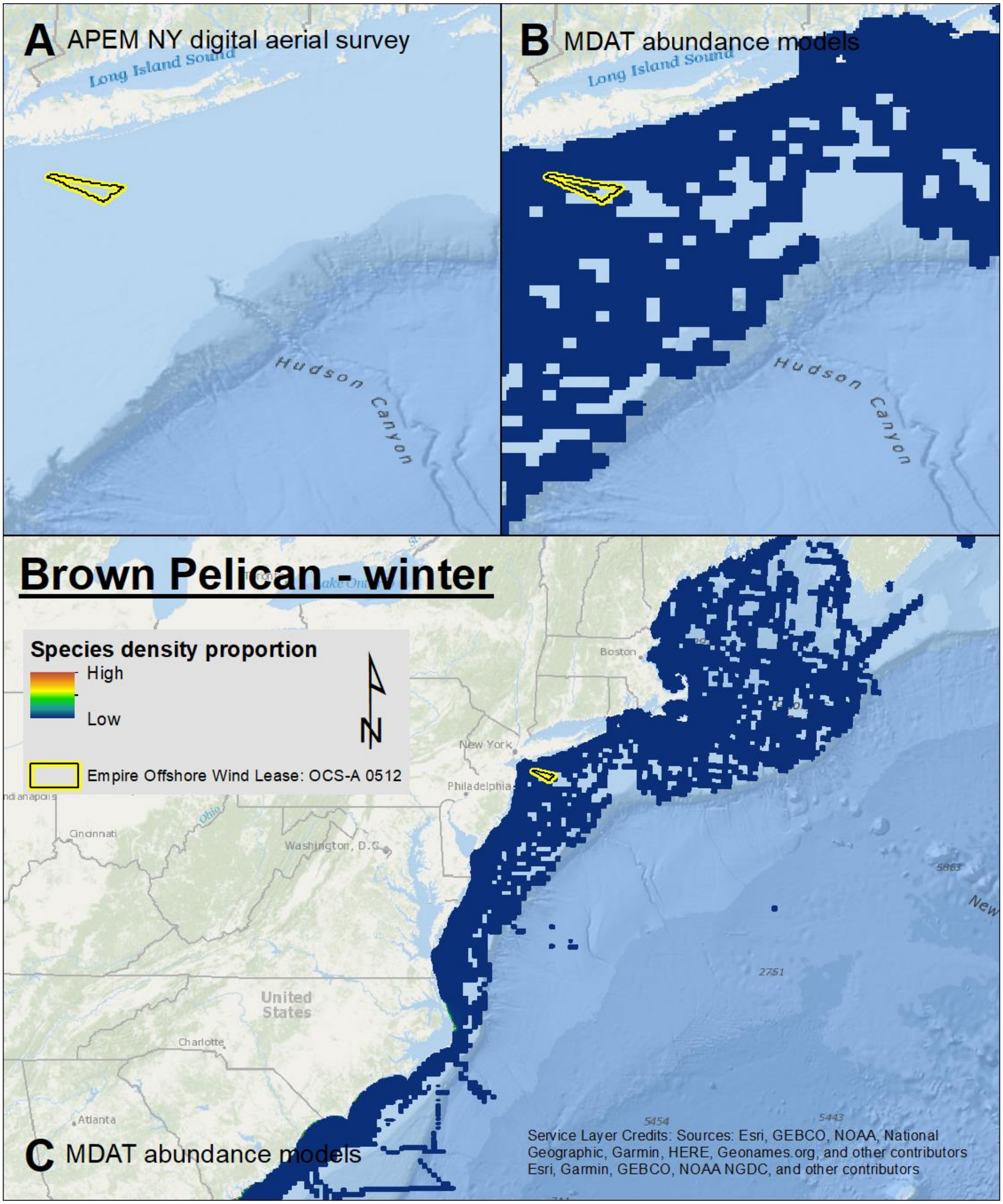
Map 159. Spring Double-crested Cormorant density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



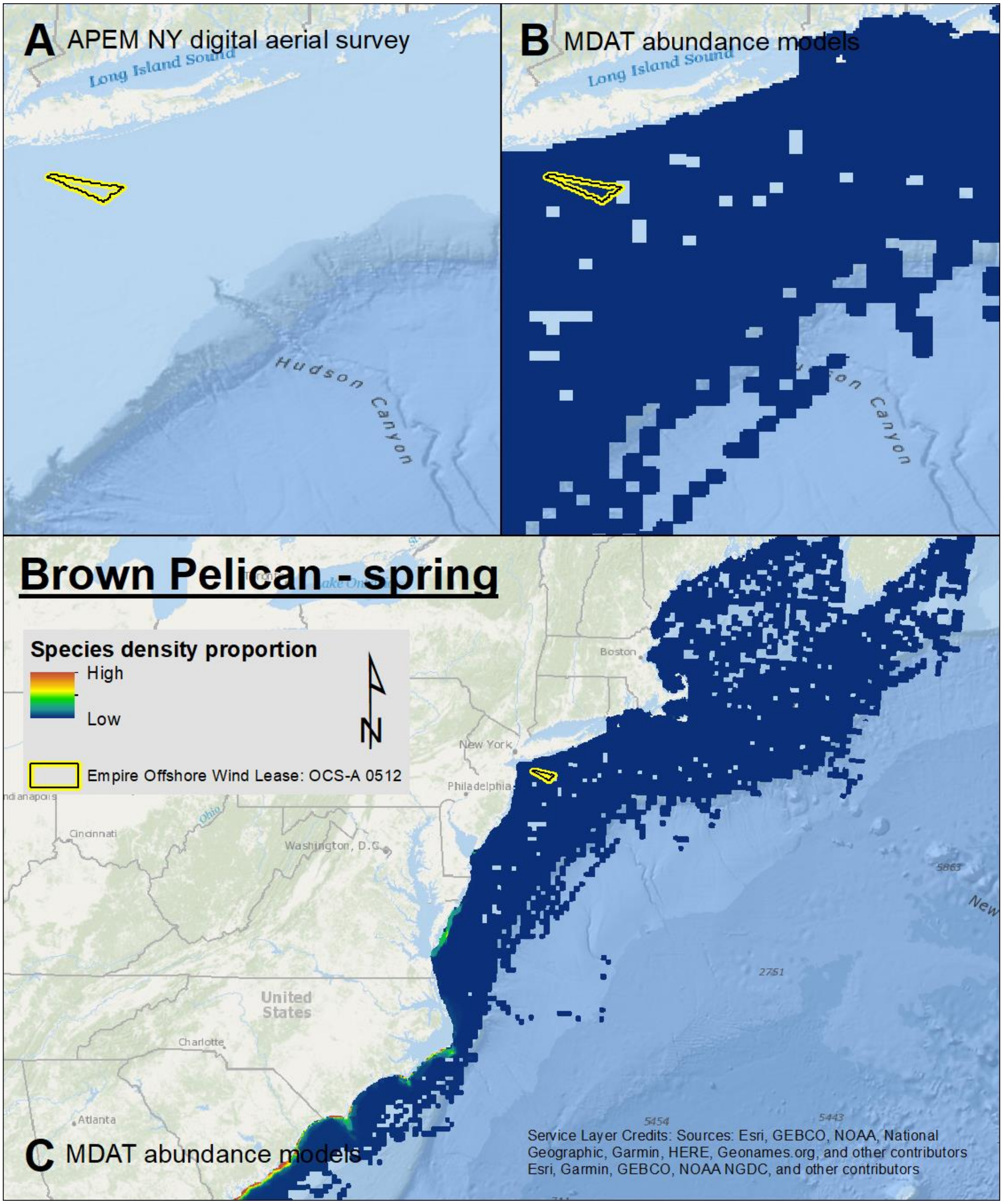
Map 160. Summer Double-crested Cormorant density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



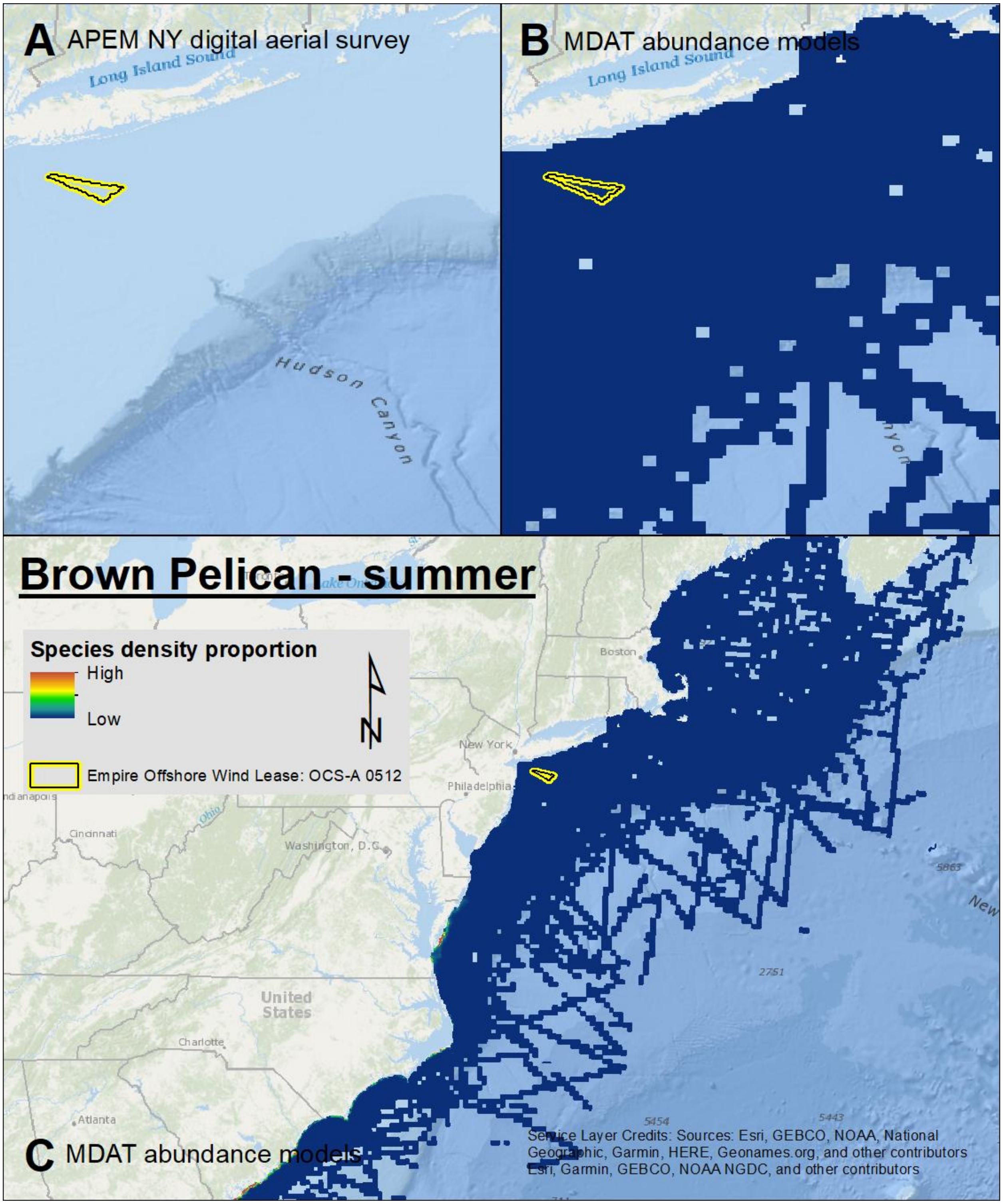
Map 161. Fall Double-crested Cormorant density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



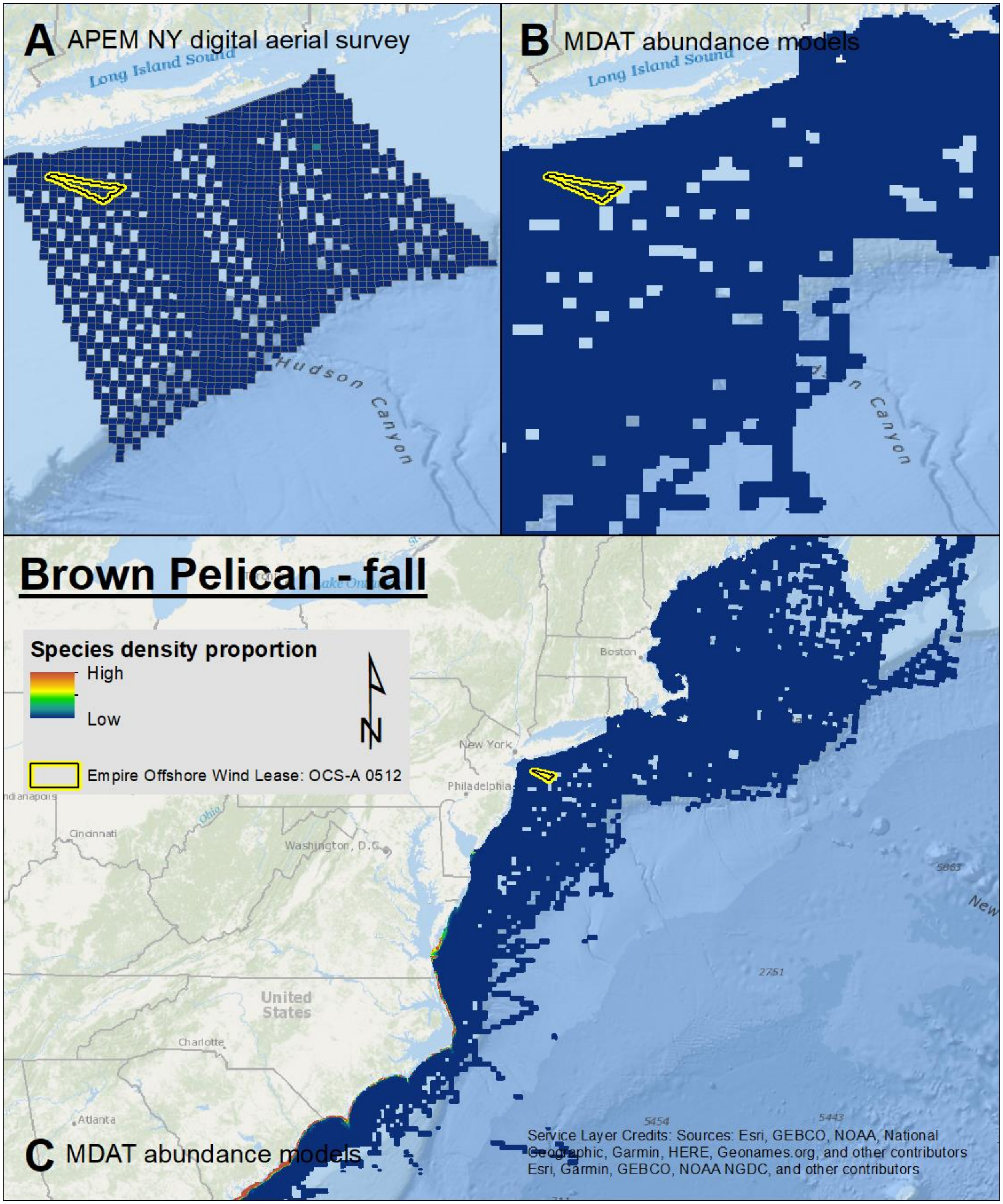
Map 162. Winter Brown Pelican density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



Map 163. Spring Brown Pelican density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



Map 164. Summer Brown Pelican density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.



Map 165. Fall Brown Pelican density proportions in the APEM NY (NYSERDA and Empire Offshore Wind Lease: OCS-A 0512) high resolution digital aerial survey data (A) and the MDAT data at local (B) and regional scales (C). The scale for all maps is representative of relative spatial variation in the sites within the season for each data source. Error! Bookmark not defined.