ECOLOGICAL CHARACTERIZATION SUMMARY 2019

LONG ISLAND SOUND

BLUE PLAN

Sustainable Ecosystems - Compatible Uses

Document prepared by Emily Shumchenia of E & C Enviroscape, LLC in cooperation with the Blue Plan Ecological Experts Group and the Blue Plan Development Team

Cover Photo: Peter Auster, University of Connecticut/Mystic Aquarium

TABLE OF CONTENTS

Figures and Tables

Purpose

The purpose of the Ecological Characterization Summary is to form a bridge between the Long Island Sound Resource and Use Inventory ("Inventory"), which cataloged the best available stakeholder- and expert-reviewed geospatial information about the ecosystem, and the Ecologically Significant Areas (ESA) approach and results.

The Ecological Experts Group (EEG) used the Inventory as a starting point, recommended additional datasets, and guided the development of new datasets to contribute to the identification of ESA. Not all datasets in the Inventory were recommended by the EEG for inclusion in the ESA process (see Appendix).

This document describes each dataset considered by the EEG, and presents maps of each dataset used by the EEG in the ESA process. Additional rationale for why certain datasets were not used in the ESA process is included in the Appendix.

The Ecological Characterization Summary catalogs and presents a more complete picture of the map products used for developing the ESA. Whereas the Blue Plan and its Appendices include maps of each final ESA criterion, this document includes maps of the original source datasets prior to analysis and extraction of ESA. This document summarizes the stage of the EEG's work to ensure that there was relevant data available in the Inventory, or that could be relatively easily developed from existing datasets, to support each ESA criterion. ESA criteria are listed in Table 1.

Table 1. Ecologically Significant Areas Criteria

Pillar 1: Areas with rare, sensitive, or vulnerable species, communities, or habitats	1. Hard bottom and complex seafloor 2. Submerged aquatic vegetation 3. Endangered, threatened, species of concern, or candidate species listed under state or federal ESA, and their habitats 4. Cold water corals 5. Coastal wetland
Pillar 2: Areas of high natural productivity, biological persistence, diversity, and abundance, including areas important for supporting or exhibiting such features, relative to the following characteristics or species:	6. Cetaceans 7. Pinnipeds 8. Sea turtles and other reptiles 9. Birds 10. Fish 11. Mobile invertebrates 12. Sessile-mollusk-dominated communities 13. Managed shellfish beds 14. Soft bottom benthic communities[1]

[1] As of January 2019, this ESA criterion was defined by the EEG and included in the Blue Plan but not accompanied by a spatial representation.

Process

Once the EEG had defined the ESA criteria as described in the Ecologically Significant Areas chapter of the Blue Plan, they tentatively assigned datasets from the Inventory to one or more relevant ESA criteria. Table 2 shows the results of this "crosswalk". The EEG found three types of relationships between the Inventory and the ESA criteria:

1. A dataset from the Inventory could reasonably be considered relevant to one or more ESA criteria
2. A dataset from the Inventory did not clearly pertain to any of the ESA criteria
3. An ESA criterion was not adequately portrayed by any of the Inventory datasets OR the Inventory identified gaps in information relevant to an ESA criterion

An example of the first type of relationship is the CT DEEP Marine Fisheries Long Island Sound Trawl Survey data described in Chapter 6 of the Inventory, which is relevant to both the Fish and Mobile Invertebrates criteria. An example of the second type of relationship is the sediment chemical and contaminant data from USGS described in Chapter 10 of the Inventory, which are not relevant to identifying Hard Bottom and Complex Seafloor or any other ESA criteria. The third type of relationship is perhaps the most important to capture, because it indicates the need for future data development and/or research. The EEG noted that topics in this category have the potential to contribute to the identification of ESA for Long Island Sound in the future, but that at present, comprehensive data are unavailable or inadequate. These topics include:

High Priority Restoration Sites

Based on the first description of ESA in the Blue Plan legislation, one of the original drafts of the ESA Pillar 1 included a criterion for "high priority restoration sites". Some restoration activities were described in Inventory Chapter 24 on Research, Monitoring, and Education, however, restoration as a topic was not included in the ecological sections of the Inventory and therefore does not appear in Table 2. Compounding the lack of comprehensive restoration data in the Inventory, the EEG felt it would be difficult to parse and identify ESA for high priority restoration sites. First, doing so would require application of a prioritization scheme, and potentially, further development and application of restoration-specific criteria. As a result, the EEG did not develop a criterion for high priority restoration sites in the January 2019 ESA criteria. The EEG points interested readers to the Long Island Sound Study's Stewardship Area Atlas.

Plankton

Phytoplankton and zooplankton are critical components of the LIS food web and are a fundamental expression of "productivity" which is relevant to ESA Pillar 2. The EEG reviewed and discussed data and information for both phytoplankton and zooplankton contained in the Inventory and elsewhere. There were challenges in applying the concept of ESA to ecosystem components with such high temporal and spatial variability. Further challenges emerged when considering thresholds for ecological significance; for example, high phytoplankton biomass can often be associated with blooms, which may be indicative of high water-column nutrient concentrations and poor water quality. Phytoplankton and zooplankton datasets were not used in the January 2019 ESA criteria. Plankton may be a more viable category for the next iteration of ESA.

Macroalgae

Seaweed and macroalgae were identified by experts throughout the Blue Plan development process as important components of the LIS ecosystem, especially for their contributions to productivity as expressed in ESA Pillar 2. The Inventory identifies decades of research on macroalgae and extensive observations of macroalgal distribution from the Millstone Environmental Laboratory. However, consistent and comparable Sound-wide macroalgae data were not identified. Furthermore, the EEG expected similar challenges to those with phytoplankton in identifying areas of ecological significance for macroalgae, considering spatial and temporal variability, bloom dynamics, and floating/rafting species. Macroalgal data were not used in the January 2019 ESA criteria.

Table 2. Crosswalk between datasets identified in the Inventory resources topics (column 1) and Ecologically Significant Areas Criteria. For each Inventory dataset, an "x" is placed the box or boxes under relevant/applicable ESA criteria. Inventory datasets that were found to be not relevant to any ESA criteria are highlighted in grey. For brevity, the criteria are represented here by the numbers in Table 1.

	Ecologically Significant Area Criteria (see Table 1 for numbers)													
Inventory dataset	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
PLANTS														
Chapter 2 – Phytoplankton, Macroalgae, Eelgrass, and Submerged aquatic vegetation														
Surface chlorophyll-a concentrations and PAR, CT DEEP LIS Water Quality Monitoring Program														
2002, 2006, 2009 eelgrass mapping available on CT DEEP GIS website		x												
2012 eelgrass mapping, Tiner et al. 2013		x												
2017 eelgrass mapping, Bradley & Paton 2018		x												

	Ecologically Significant Area Criteria (see Table 1 for numbers)													
Inventory dataset	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
ANIMALS														
Federal and State Endangered Species Act Critical Habitats			x											
Chapter 3 – Marine mammals														
Predicted cetacean density – Duke Marine Geospatial Ecology Lab, 2018			x			x								
Cetacean and seal strandings in Connecticut, 1997-2017, Mystic Aquarium			x			x								
Seal concentration areas							x							
Chapter 4 – Sea turtles														
Sea turtle stranding data, Riverhead Foundation for Marine Research and Preservation			x					x						
Chapter 5 – Birds														
Bird abundance, eBird			x						x					
CT DEEP Migratory waterfowl concentration areas, 1991			x						x					
NOAA Environmental Sensitivity Index bird special use areas, 2014-2015			x						x					
Audubon Important Bird Areas, 2014, 2017			x						x					
Chapter 6 – Fish, pelagic invertebrates, shellfish, and zooplankton														
Fish and invertebrate abundance and biomass, CT DEEP Marine Fisheries Long Island Sound Trawl Survey			x							x	x			
Fish persistence, Long Island Sound Ecological Assessment										x				
American lobster thermal habitats, Stevens Institute and CT DEEP Marine Fisheries											x			

	Ecologically Significant Area Criteria (see Table 1 for numbers)													
Inventory dataset	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Essential Fish Habitat, NOAA GARFO										x				
Connecticut natural shellfish beds, CT Bureau of Aquaculture													x	
Connecticut recreational shellfish beds, CT Bureau of Aquaculture													x	
Zooplankton abundance, CT DEEP Long Island Sound Water Quality Monitoring Program														
Chapter 7 – Benthic invertebrates														
Maps and data from Long Island Sound Ecological Assessment														x
Epifaunal and infaunal abundance, richness, diversity near Stratford Shoals, 2012-2013, Long Island Sound Seafloor Mapping Project												x		x
Benthic species richness, 1981-1982, Pelligrino & Hubbard														x
Cold water corals observations, 2012-2013, Long Island Sound Seafloor Mapping Project				x										
HABITATS														
Chapter 8 – Coastal wetlands														
Coastal wetland maps, NOAA Environmental Sensitivity Index, 2014					x									
National Wetland Inventory estuarine/marine wetlands					x									
Chapter 9 – Bathymetry and seafloor complexity														
Bathymetric depth classes, Landscape Position Index, Ecological Marine Unit richness, Seafloor slope, Standard deviation of	x													

	Ecologically Significant Area Criteria (see Table 1 for numbers)													
Inventory dataset	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
seafloor slope, Sediment thresholds, Hard bottom locations, Soft sediment maps, Seabed forms, Long Island Sound Ecological Assessment														
Bathymetry data and multibeam surveys, NOAA National Ocean Service	x													
Chapter 10 – Sediments and geochemistry														
Sediment data, geochemistry data, Long Island Sound Seafloor Mapping Project	x													
Sediment texture samples in Long Island Sound, USGS	x													
Long Island Sound surficial sediment map, USGS	x													
Sediment chemical and contaminant data, USGS														
Sediment chemical and contaminant data, EPA National Coastal Condition Assessment														
Sediment chemical and contaminant data, NOAA National Status & Trends														
Chapter 11 – Physical oceanography, meteorology, and water quality														
Surface and bottom water temperature, salinity, dissolved oxygen, nutrient concentration, CT DEEP Long Island Sound Water Quality Monitoring Program														
Regional-scale oceanography and meteorology data, Northeast and Mid-Atlantic Ocean Data Portals														
Long Island Sound oceanography and meteorology data, University of Connecticut														

	Ecologically Significant Area Criteria (see Table 1 for numbers)													
Inventory dataset	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Chapter 12 – Ecologically notable places and ecological marine units														
Ecological Marine Units, Long Island Sound Ecological Assessment	x													
Ecologically Notable Places, Long Island Sound Ecological Assessment														

Results

The following sections describe and present the datasets that were used by the EEG to identify ESA in Long Island Sound. The results are organized by ESA criteria. Many of the datasets below were characterized in the Blue Plan Resource and Use Inventory and are therefore also listed in Table 2. Other datasets were identified after the Inventory was completed and are described in the context of ESA for the first time here. Still others were developed specifically for the purpose of supporting the ESA process, and are also described for the first time here. Where possible, data are visualized using the recommended symbology and cartography of the data source.

Pillar 1: Areas with rare, sensitive, or vulnerable species, communities, or habitats

1. Hard bottom and complex seafloor

Hard bottom

Long Island Sound Ecological Assessment hard bottom points

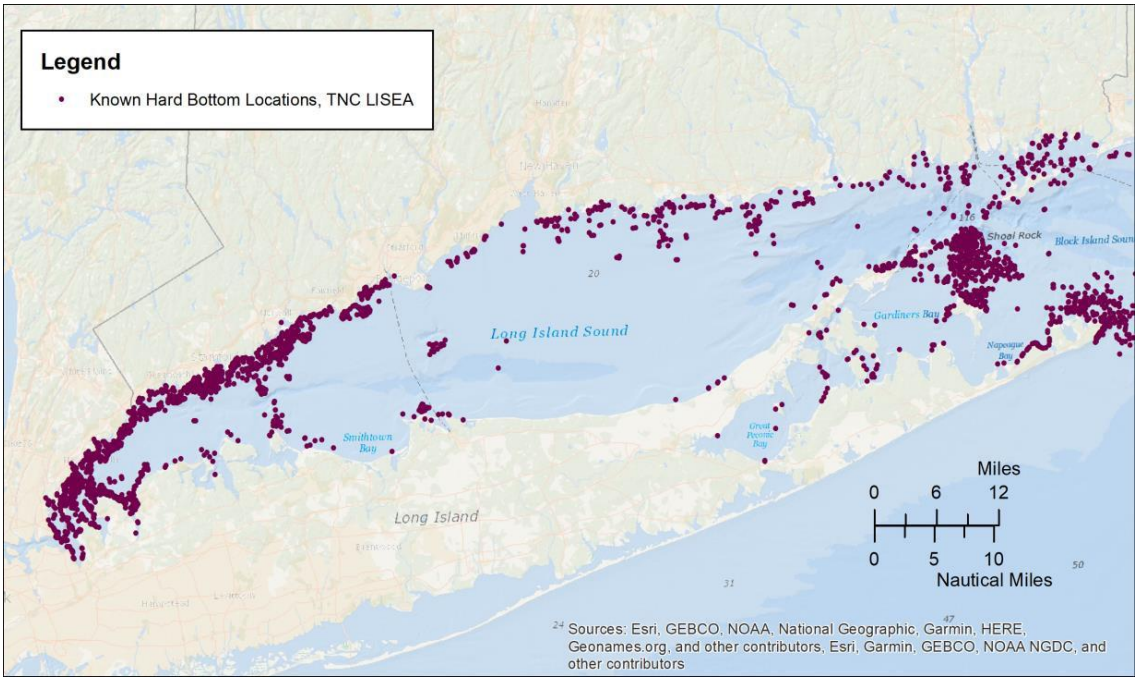

Figure 1. Known hard bottom points; The Nature Conservancy Long Island Sound Ecological Assessment (TNC LISEA)

Source – The Nature Conservancy Long Island Sound Ecological Assessment (TNC LISEA)

In the Blue Plan Resource and Use Inventory - yes

Summary – Points described as "bedrock", "boulders", "rock", or "rocky" from two USGS databases (usSEABED and East Coast Sediment Texture Database) and from NOAA Electronic Nautical Charts. All known hard bottom locations were included as ESA.

Status/comments – The EEG preferred to use of the known hard bottom points versus the conservative hard bottom model presented in the TNC LISEA.

Long Island Sound Mapping and Research Collaborative SEABOSS Surveys

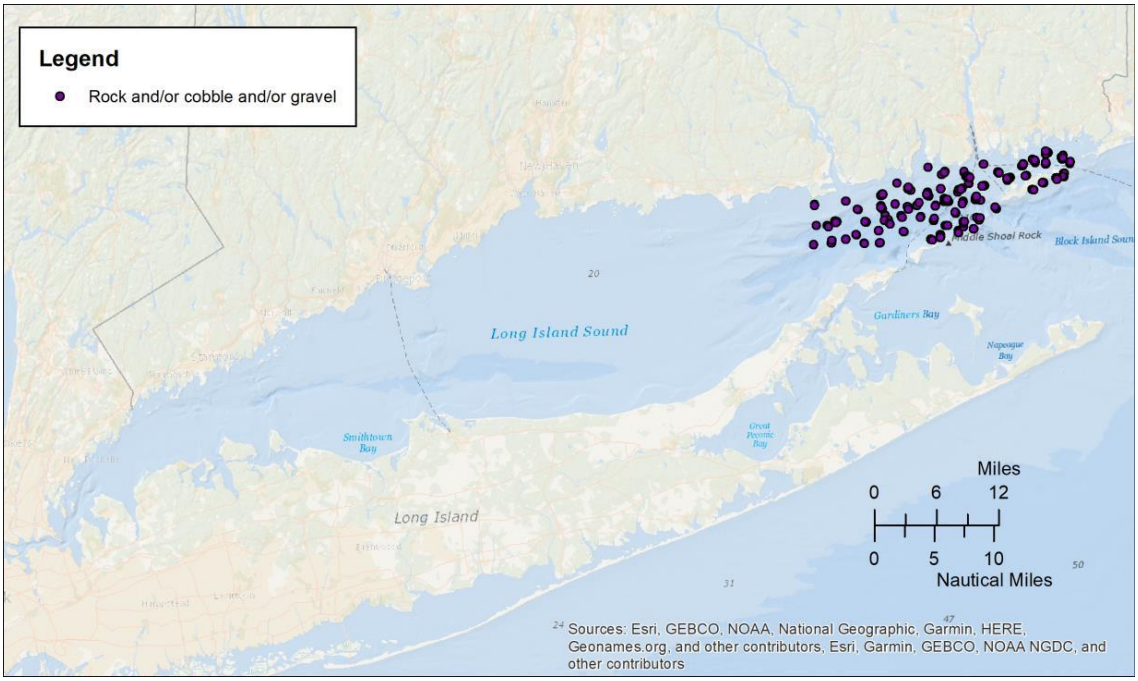

Figure 2. Observations of hard bottom from the Long Island Sound Mapping and Research Collaborative 2017 SEABOSS surveys in eastern Long Island Sound

Source – Conroy and Auster, University of Connecticut, Long Island Sound Mapping and Research Collaborative (LISMaRC), Long Island Sound Seafloor Mapping Project

In the Blue Plan Resource and Use Inventory - no; added to the EC Summary by the EEG

Summary – Points described as "rock", and/or "cobble", and/or "gravel" from 2017 SEABOSS surveys in eastern Long Island Sound. All locations with hard bottom were included as ESA.

Status/comments – These unpublished data were provided by EEG members to supplement the existing observations of hard bottom in Long Island Sound. Spatially limited to eastern Long Island Sound.

Long Island Sound surficial sediment map

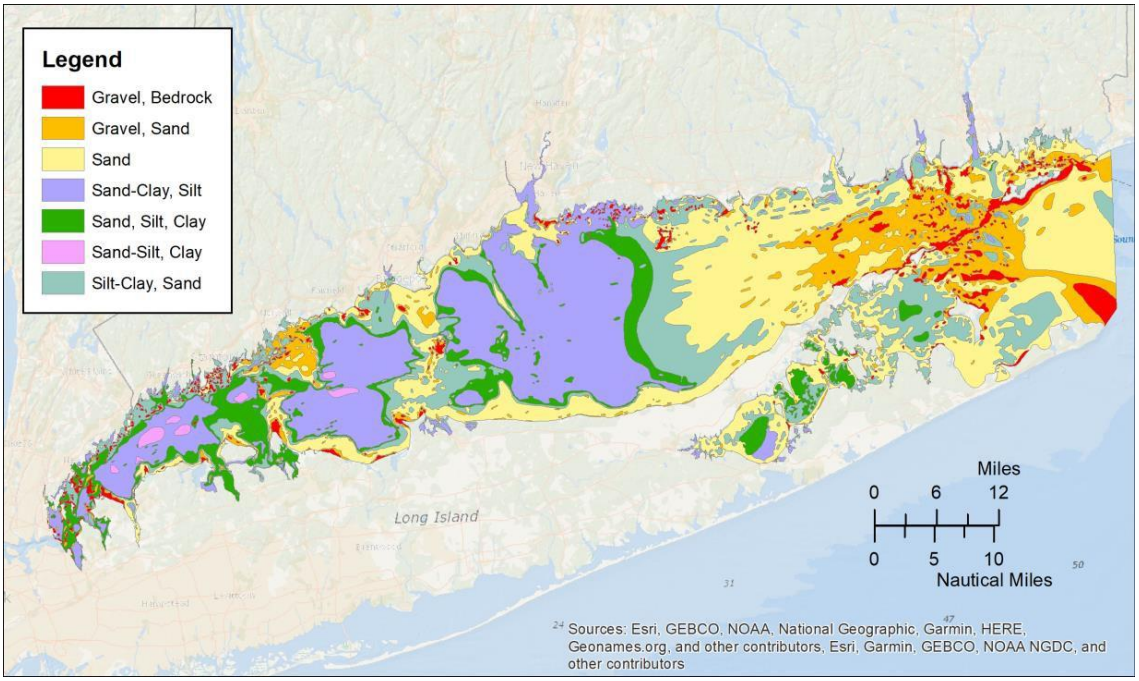

Figure 3. Long Island Sound surficial sediment map; USGS, Poppe et al., 2000

Source – USGS, Poppe et al., 2000

In the Blue Plan Resource and Use Inventory - yes

Summary – The USGS Coastal and Marine Geology Program, in cooperation with CT DEEP, produced detailed geologic maps of the seafloor in Long Island Sound. The maps define the geological variability of seafloor, on the primary controls of benthic habitat diversity, improve understanding of the processes that control the distribution and transport of bottom sediments, benthic habitats, and associated infaunal community structures. The EEG selected areas of "gravel, bedrock" as ESA (red polygons above).

Status/comments – Interpretations integrate thousands of available samples, analyses, and descriptions.

Complex seafloor

Terrain ruggedness index (TRI), 8m composite

Source – EEG

In the Blue Plan Resource and Use Inventory – no; created by EEG

Summary – The EEG recognized that available Long Island Sound-wide bathymetry datasets were of low resolution (~83 m) when compared with the recent individual multibeam survey data available from NOAA National Ocean Service (from 0.5m to 8m resolution). The EEG identified the need to mosaic the available high-resolution data from NOAA to support an improved representation of bathymetry and seafloor complexity. A composite bathymetry dataset with a horizontal resolution of 8 meters was created for Long Island Sound by mosaicking the most recent federal and local datasets from NOAA (Figure 4). In areas where high-resolution data were unavailable, the lower resolution data (~83 m) were included in the mosaic. The footprints of the highest-resolution multibeam surveys in the mosaic within the boundaries of the Blue Plan planning area are shaded with grey in Figure 3. This composite was used to calculate seafloor complexity. The Terrain Ruggedness Index (TRI) is a seafloor complexity metric that reflects the difference between the depth at each point on the seafloor and the depth of the points surrounding it. TRI was calculated at the scale of a single pixel (8m) and scaled from 0 to 100 (Figure 5). The EEG selected the top quintile of the TRI as ESA.

Status/comments – New dataset reflecting the highest resolution bathymetry and complexity dataset available.

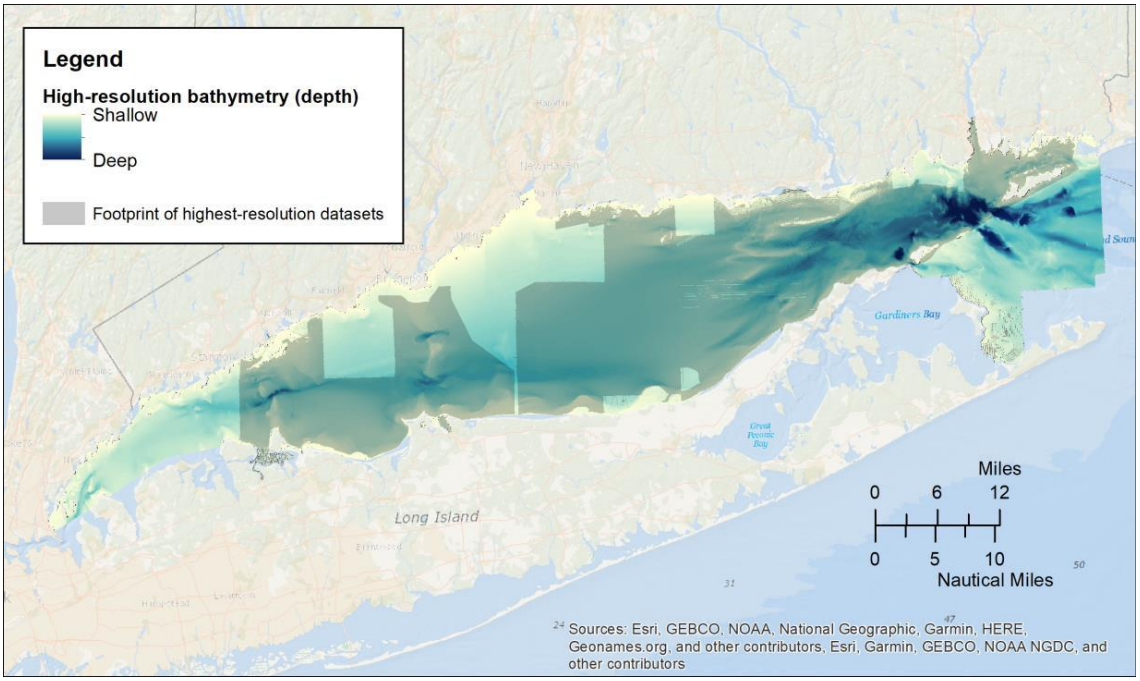

Figure 4. 8-meter horizontal resolution bathymetry mosaic for Long Island Sound. The highest resolution datasets within the Blue Plan planning area are shaded in grey.

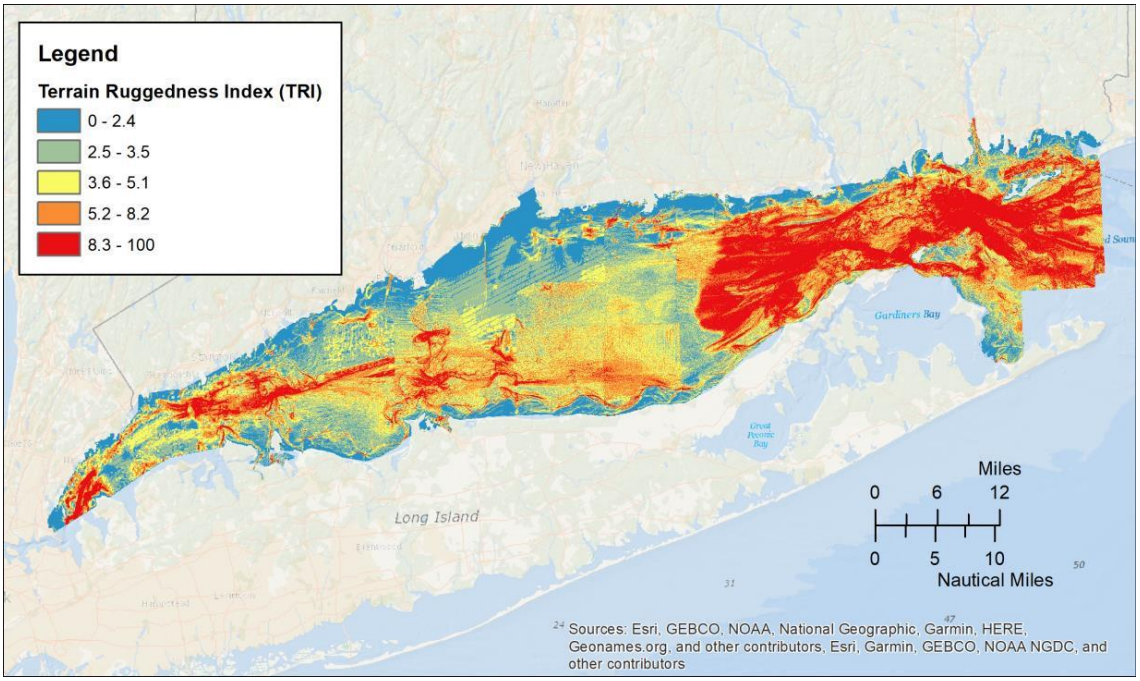

Figure 5. Terrain Ruggedness Index (TRI) calculated from the 8-m bathymetry dataset in Figure 3, re-scaled from 0-100 and classified by quintiles

Wrecks and obstructions

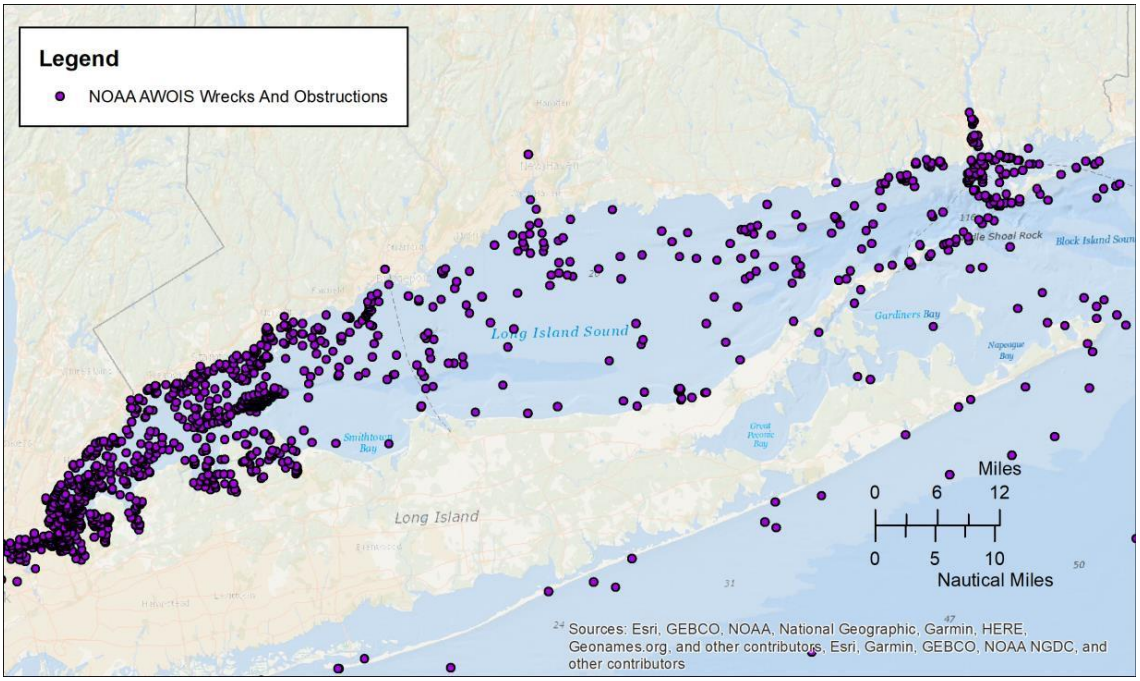

Figure 6. Wrecks and obstructions; NOAA Office of Coast Survey Automated Wreck and Obstruction Information System (AWOIS)

Source – NOAA Office of Coast Survey Automated Wreck and Obstruction Information System (AWOIS)

In the Blue Plan Resource and Use Inventory - yes

Summary – Contains information on over 10,000 submerged wrecks and obstructions in US coastal waters. However, the Office of Coast Survey stopped updating AWOIS. The EEG considered all wrecks and obstructions as ESA.

Status/comments – Authoritative resource on locations of wrecks and obstructions nationally

2. Submerged Aquatic Vegetation

The Inventory discussed four previous eelgrass surveys that were available for use in identifying ESA (2002, 2006, 2009, and 2012). After the publication of the Inventory, the results of an additional survey conducted in 2017 was made available. All five surveys were integrated by the EEG into the ESA criterion for Submerged aquatic vegetation. The EEG considered any areas where eelgrass occurred to be ESA.

It is important to note that eelgrass surveys have been limited in scope to eastern Long Island Sound. This means that while it is commonly understood that eelgrass is limited in extent to eastern Long Island Sound, it is possible that eelgrass or other submerged aquatic vegetation exists elsewhere in the Sound.

Sources –

- Tiner 2002, Interpretation and identification of Eelgrass beds located in the Long Island Sound Eastern Connecticut shoreline, Fishers Island NYS and the Northshore of Long Island NYS, USFWS National Wetlands Inventory Program
- Tiner 2006, Delineations of 2006 eelgrass beds, eastern Connecticut to Rhode Island border, USFWS National Wetlands Inventory Program
- Tiner et al. 2010, 2009 Eelgrass Survey for Eastern Long Island Sound, Connecticut and New York. USFWS National Wetlands Inventory Program
- Tiner et al. 2013, 2012 Eelgrass Survey for Eastern Long Island Sound, Connecticut and New York. USFWS National Wetlands Inventory Program
- Bradley and Paton 2018, Tier 1 mapping of *Zostera marina* in Long Island Sound and change analysis (2017 survey year)

In the Blue Plan Resource and Use Inventory – yes, all years but 2017 survey

Summary – Aerial photography eelgrass mapping with field verification, conducted by the University of Rhode Island, the USFWS, and the USGS (depending on the particular survey year).

Status/comments – Authoritative eelgrass maps used by the state of Connecticut.

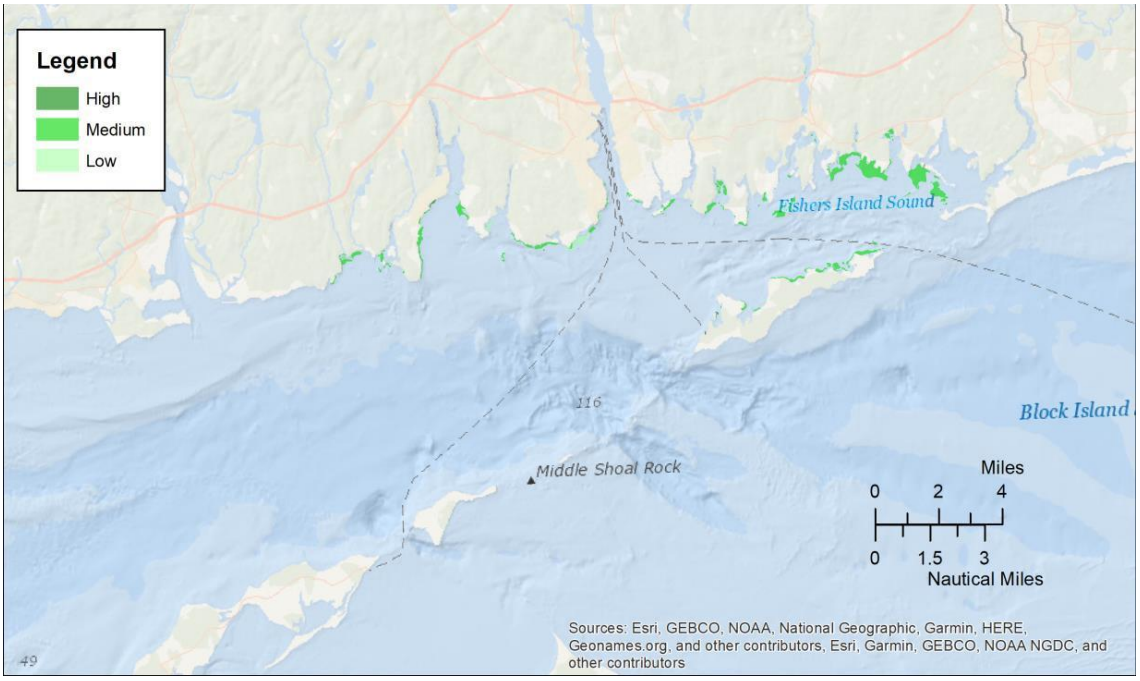

Figure 7. Zoomed view of eastern Long Island Sound showing eelgrass coverage as depicted in Tiner 2002, Interpretation and identification of Eelgrass beds located in Long Island Sound Eastern Connecticut shoreline, Fishers Island NYS and the Northshore of Long Island NYS, USFWS National Wetlands Inventory Program.

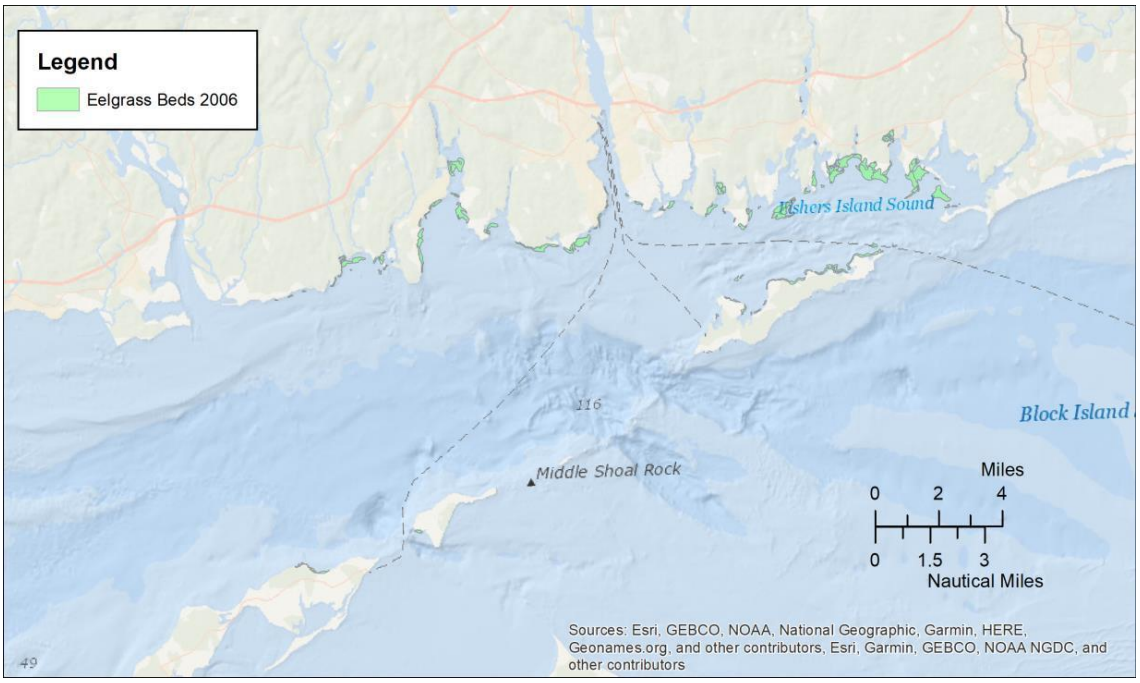

Figure 8. Eelgrass; Tiner 2006, Delineations of 2006 eelgrass beds, eastern Connecticut to Rhode island border, USFWS National Wetlands Inventory Program

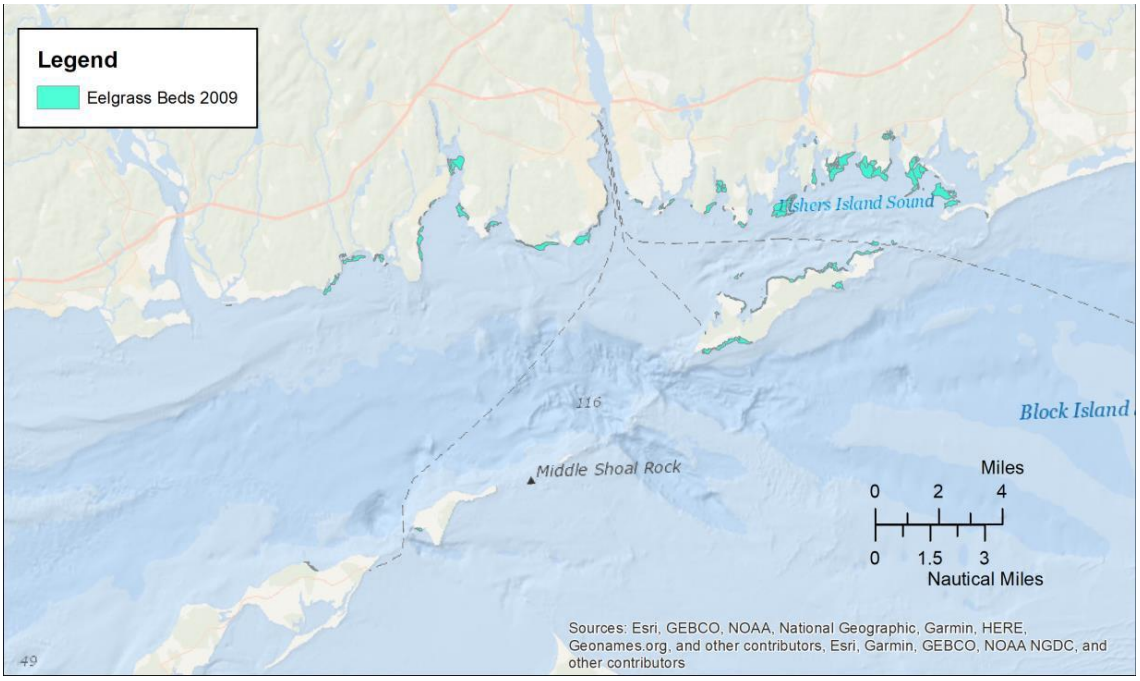

Figure 9. Zoomed view of eastern Long Island Sound showing eelgrass coverage as depicted in Tiner et al. 2010, 2009 Eelgrass Survey for Eastern Long Island Sound, Connecticut and New York. USFWS National Wetlands Inventory Program

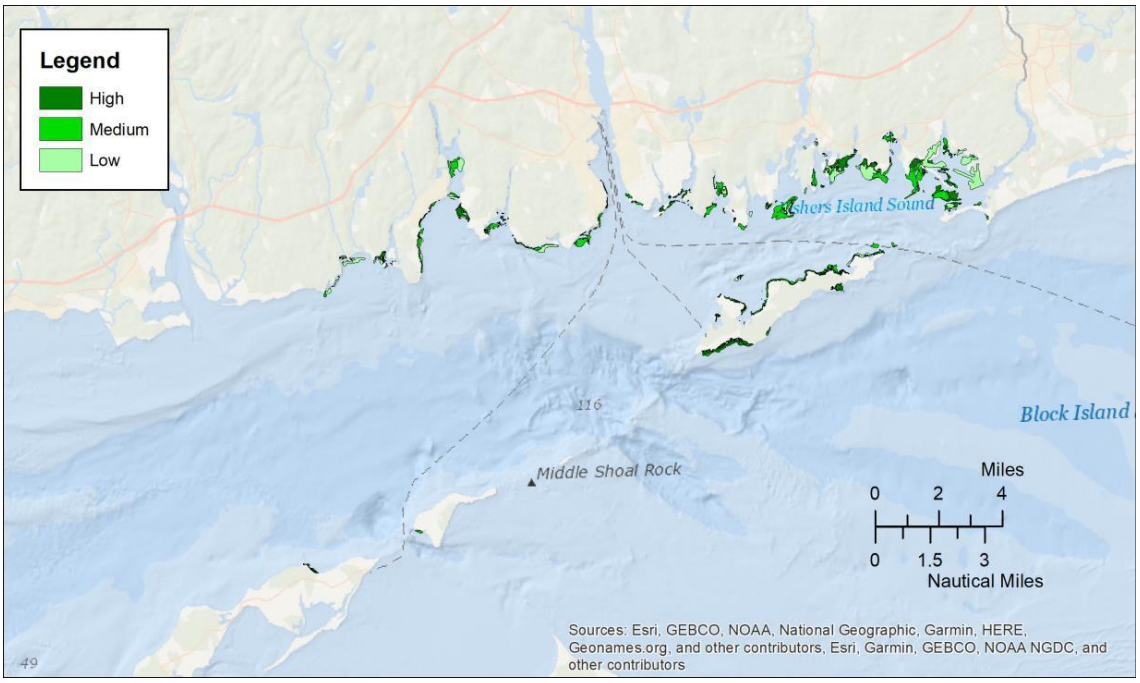

Figure 10. Zoomed view of eastern Long Island Sound showing eelgrass coverage as depicted in Tiner et al. 2013, 2012 Eelgrass Survey for Eastern Long Island Sound, Connecticut and New York. USFWS National Wetlands Inventory Program

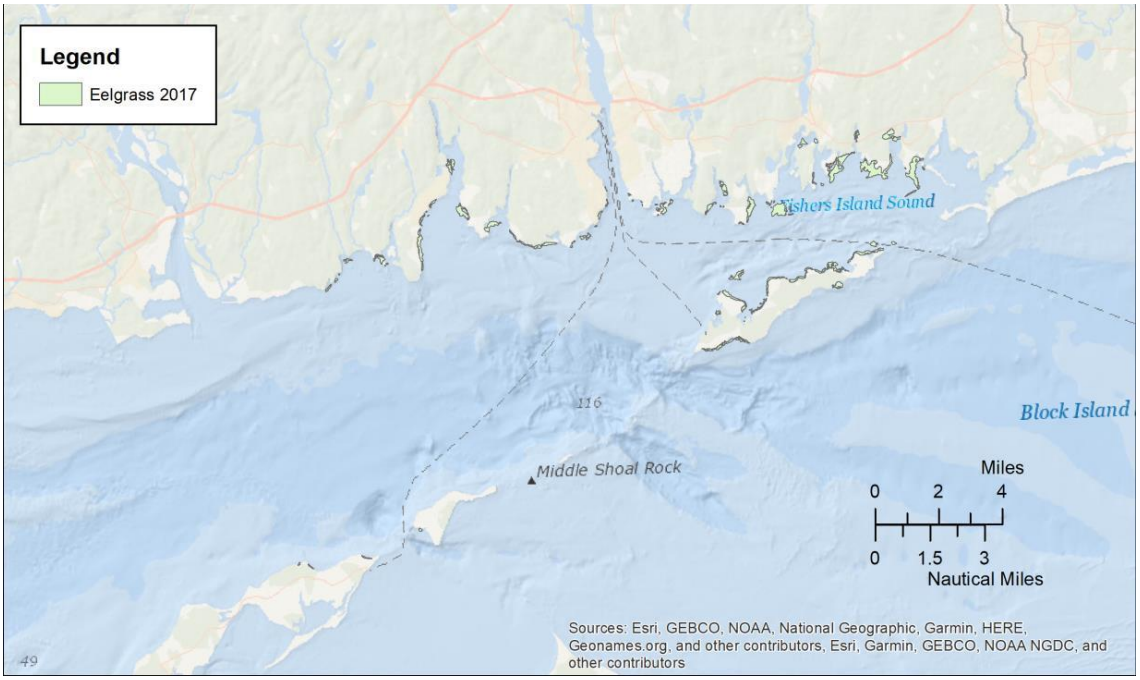

Figure 11. Zoomed view of eastern Long Island Sound showing eelgrass coverage as depicted in Bradley and Paton 2018, Tier 1 mapping of Zostera marina in Long Island Sound and change analysis

3. Endangered, threatened, species of concern or candidate species listed under state or federal ESA, and their habitats

The Inventory did not dedicate a specific section to the topic of endangered/threatened species. For relevant taxa (e.g., marine mammals, sea turtles, birds, fish), the Inventory did note that data regarding endangered species and their habitats could potentially be obtained from Federal sources. The EEG subsequently identified the following additional datasets from the states that are used for endangered species consultation, conservation, and protection. Many of these datasets are relevant to each entire state and are not specific to Long Island Sound. Lastly, a dataset for Roseate tern was added by the EEG. This dataset was created, along with datasets for additional bird species, by a member of the EEG in response to the data gaps identified in the Inventory. More detail is provided in Pillar 2, #9 (Birds).

Atlantic sturgeon gear restriction areas

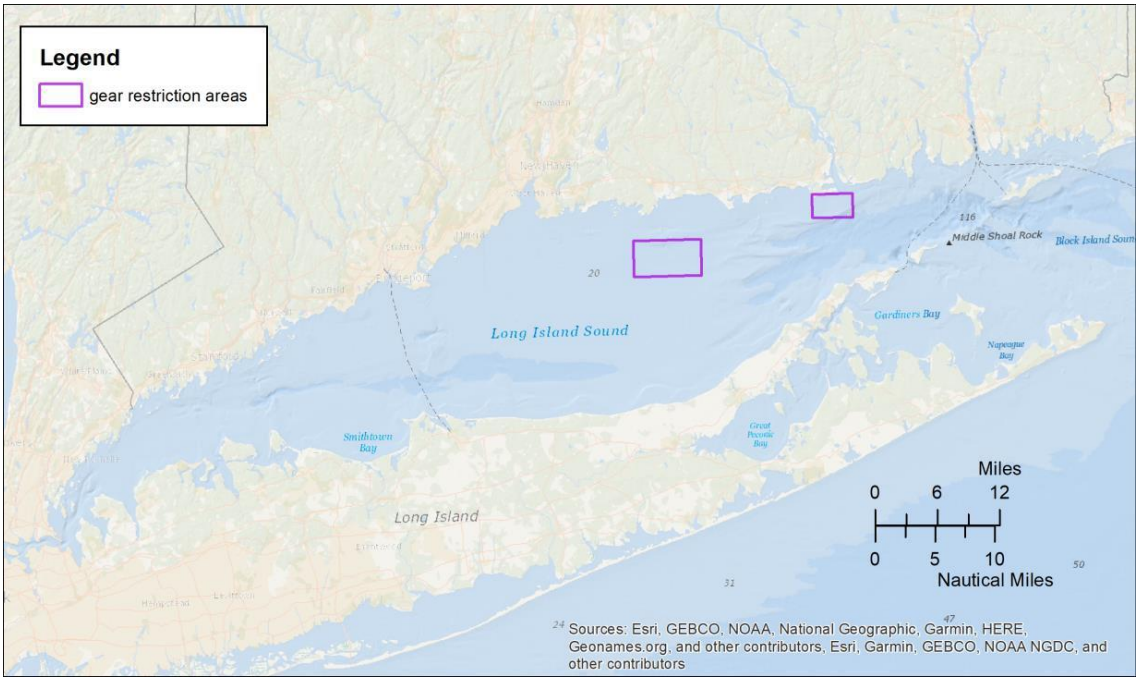

Figure 12. Atlantic sturgeon gear restriction areas from CT DEEP Marine Fisheries

Source – CT DEEP Marine Fisheries

In the Blue Plan Resource and Use Inventory - no; added to the EC Summary by the EEG

Summary – This layer depicts the locations of Atlantic sturgeon gear restriction areas as described in CT DEEP Notice to Commercial Fishermen dated 04/27/2012. Recommended zoom scales 1:50,000 - 1:150,000 (inch:feet). In 2012, polygons were created in ArcGIS by digitizing the areas described in the Notice of Declaration of Regulation Change (12-08): "Under the authority of 26-102 of the Connecticut General Statutes, the Commissioner of Energy and Environmental Protection is authorized to establish closed areas on any state waters and prescribe conditions for the operation of commercial fishing activity when he deems it necessary for resource conservation. In accordance with the aforementioned authority Section 26-159a-6 Use of commercial fishing gear is amended as follows: NEW SUBSECTION (B) No person shall use, set or tend any otter trawl, beam trawl, sink or anchored gillnet in the following areas of Long Island Sound: (1) Falkner Island Gear Restricted Area, (2) Connecticut River Mouth Gear Restricted Area. Full text of the Declaration, including latitudinal and longitudinal coordinates, can be found at the CT DEEP website: http://www.ct.gov/deep/cwp/view.asp?A=2588&Q=503242. No restrictions or legal prerequisites for using the data after access is granted. The data is suitable for use at an appropriate scale, and is not recommended for use other than at scales 1:50,000 - 1:150,000. Although this data has been used by the State of Connecticut, Department of Energy and Environmental Protection, no warranty, expressed or implied, is made by the State of Connecticut, Department of Energy and Environmental Protection as to the accuracy of the data and or related materials. The act of distribution shall not constitute any such warranty, and no responsibility is assumed by the State of

Connecticut, Department of Energy and Environmental Protection in the use of these data or related materials. The user assumes the entire risk related to the use of these data. Once the data is distributed to the user, modifications made to the data by the user should be noted in the metadata. When printing this data on a map or using it in a software application, analysis, or report, please acknowledge the State of Connecticut, Department of Energy and Environmental Protection as the source of the information. These data are suitable for planning purposes only, and should not be used to make regulatory or jurisdictional boundary determinations. All gear restriction areas were considered by the EEG to be ESA.

Status/comments – Added by EEG with recommendation by CT DEEP Marine Fisheries.

Atlantic and shortnose sturgeon high and medium use areas

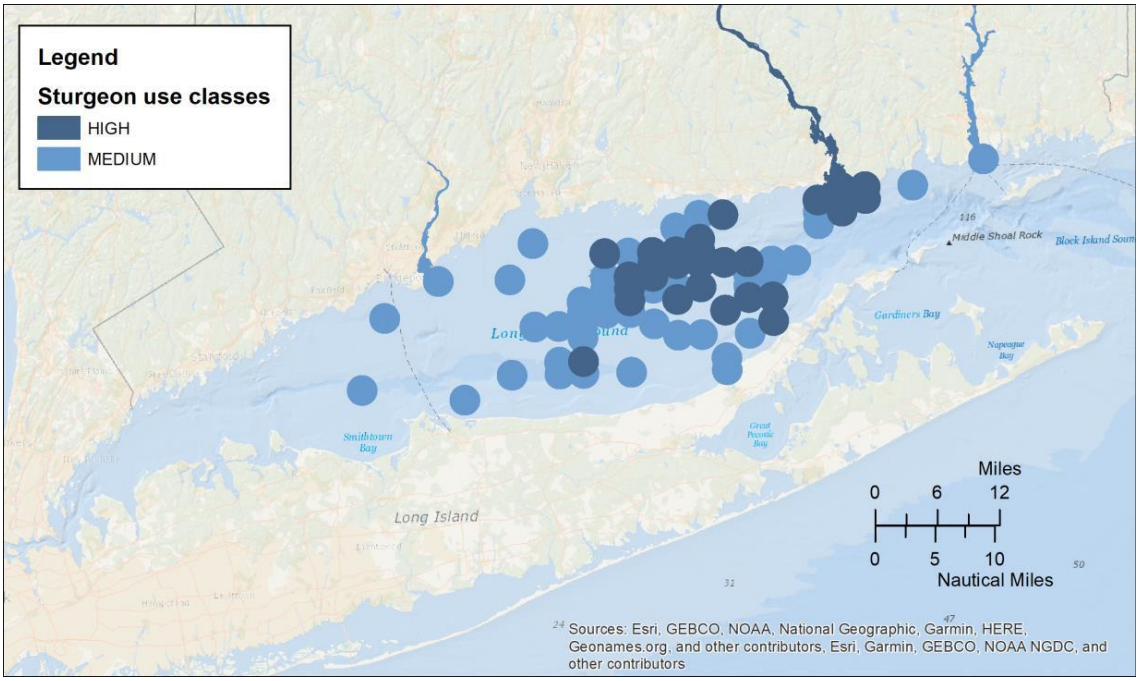

Figure 13. Sturgeon (Atlantic and shortnose) use classes from CT DEEP Marine Fisheries

Source – CT DEEP Marine Fisheries

In the Blue Plan Resource and Use Inventory - no; added to the EC Summary by the EEG

Summary – Sturgeon Use Class based on combination of data from directed sturgeon research collections, acoustic surveys, LIS Trawl Survey catches and scientific observations through 2013. Atlantic sturgeon and shortnose sturgeon are Federally endangered and listed as endangered in both Connecticut and New York. High and medium use classes were considered by the EEG to be ESA.

Status/comments – Added by EEG with recommendation by CT DEEP Marine Fisheries.

Sturgeon migratory corridor

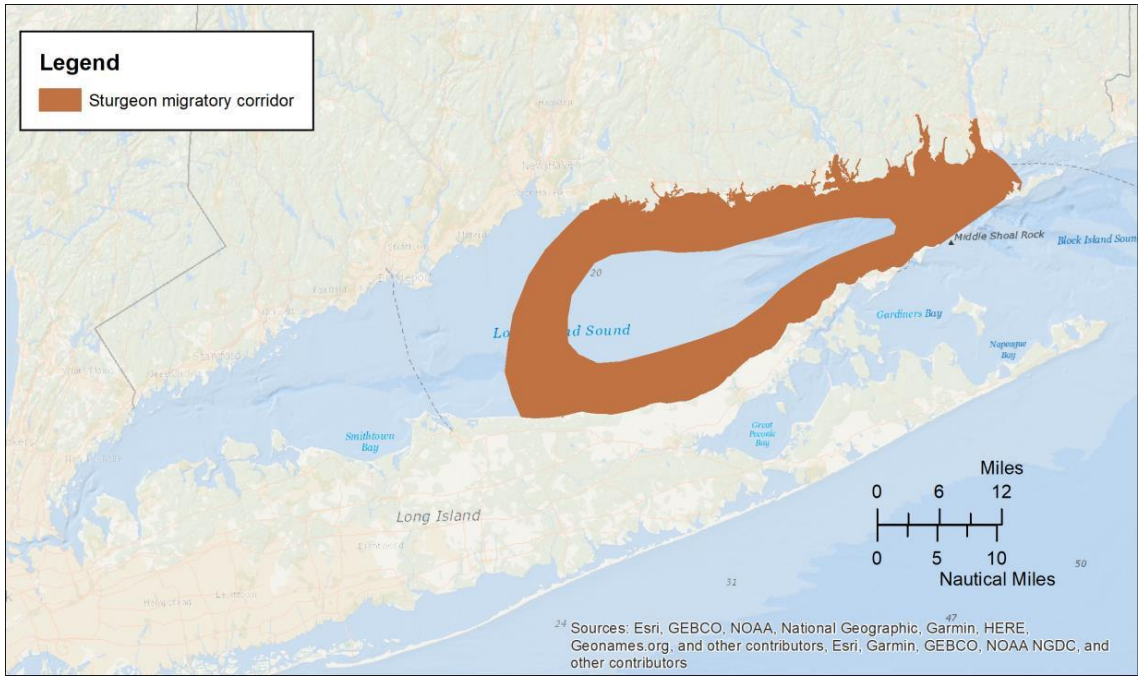

Figure 14. Sturgeon migratory corridor provided by CT DEEP Marine Fisheries

Source – CT DEEP Marine Fisheries

In the Blue Plan Resource and Use Inventory - no; added to the EC Summary by the EEG

Summary – Provided by CT DEEP Marine Fisheries. Atlantic sturgeon and shortnose sturgeon are Federally endangered and listed as endangered in both Connecticut and New York. The entire migratory corridor was considered by the EEG to be ESA.

Status/comments – Added by EEG with recommendation by CT DEEP Marine Fisheries.

Roseate tern summer occurrence

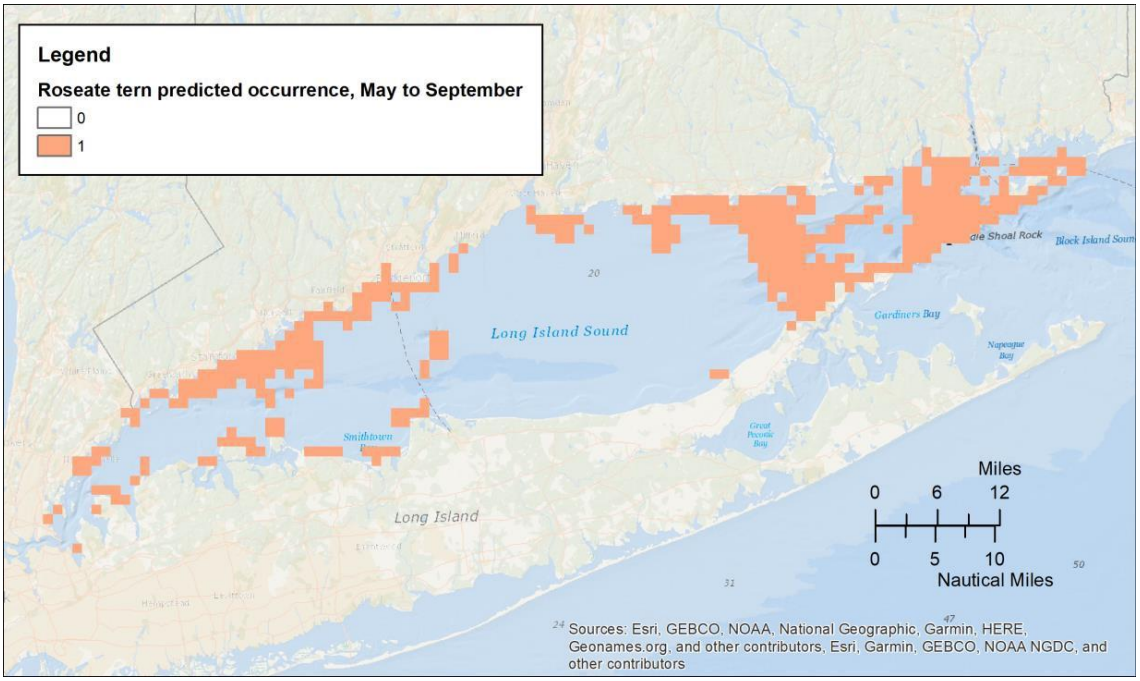

Figure 15. Predicted occurance for reseate tern, May to September, University of Connecticut

Source – EEG; University of Connecticut

In the Blue Plan Resource and Use Inventory - no; added to the EC Summary by the EEG

Summary – These data represent one layer among several that were generated by Valerie Steen and Chris Elphick at the University of Connecticut. Dr. Elphick is a member of the EEG, and recognized the need for species-level bird data to help identify ESA. From the suite of data products generated by Steen and Elphick, the roseate tern data were extracted for inclusion in the "Endangered, etc." ESA criterion. Roseate terns are Federally endangered and also have endangered status in Connecticut and New York. All predicted occurrence areas were considered by the EEG to be ESA.

Status/comments – Best available representation of this endangered species in Long Island Sound.

Connecticut Natural Diversity Database (NDDB)

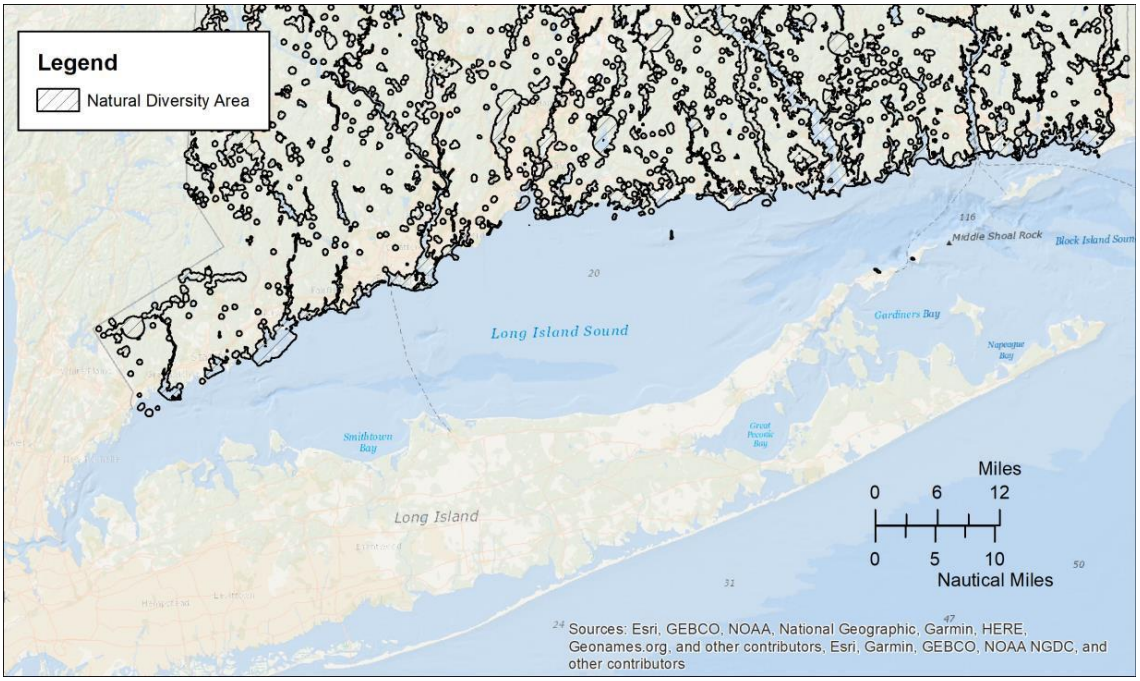

Figure 16. Connecticut Natural Diversity Database (NDDB); CT DEEP

Source – CT DEEP

In the Blue Plan Resource and Use Inventory – no; added to the EC Summary by the EEG

Summary – Maps that represent approximate locations of endangered, threatened and special concern species and significant natural communities in Connecticut, compiled from CT DEEP staff, scientists, conservation groups, and landowners. All natural diversity areas were considered by the EEG to be ESA.

Status/comments – While not detailed or specific, these are the data that a project proponent or applicant may be directed by the state to consult.

Connecticut critical habitats

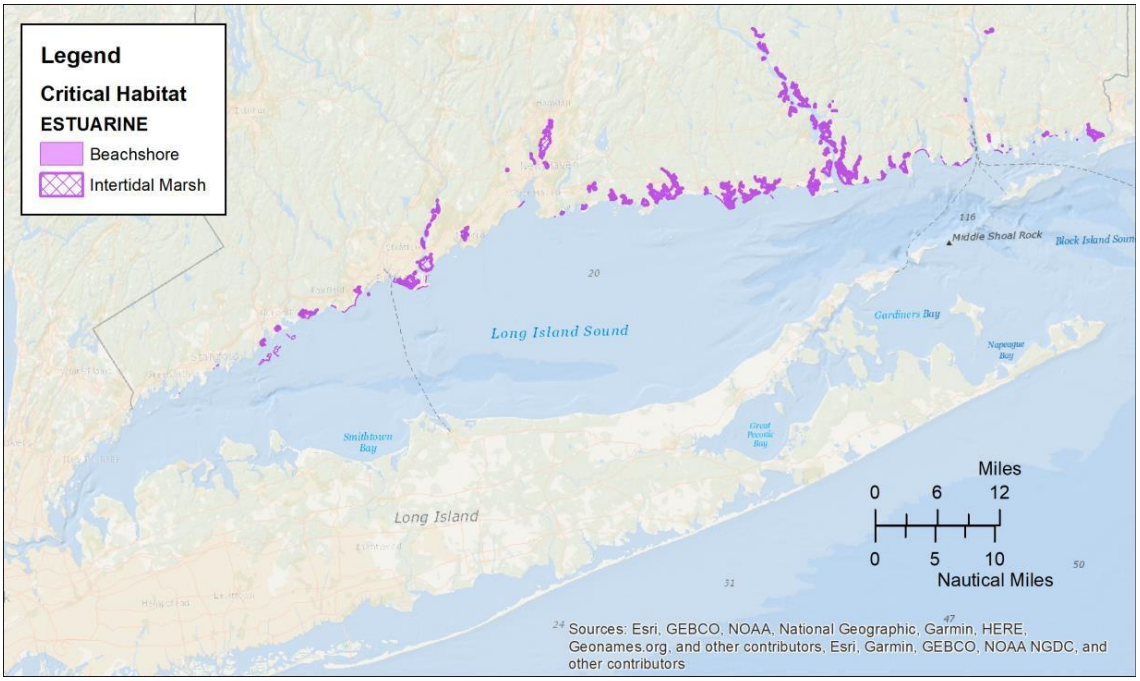

Figure 17. Connecticut critical habitats, showing only those in Estuarine environments; CT DEEP

Source – CT DEEP

In the Blue Plan Resource and Use Inventory – no; added to the EC Summary by the EEG

Summary – Identification and distribution of a subset of important wildlife habitats identified in the Connecticut Comprehensive Wildlife Conservation Strategy. Estuarine habitats were extracted from the full database for consideration as ESA.

Status/comments – Represents features that may be captured via other datasets such as coastal wetlands and NDDB, but included for completeness.

New York rare animals and rare plants

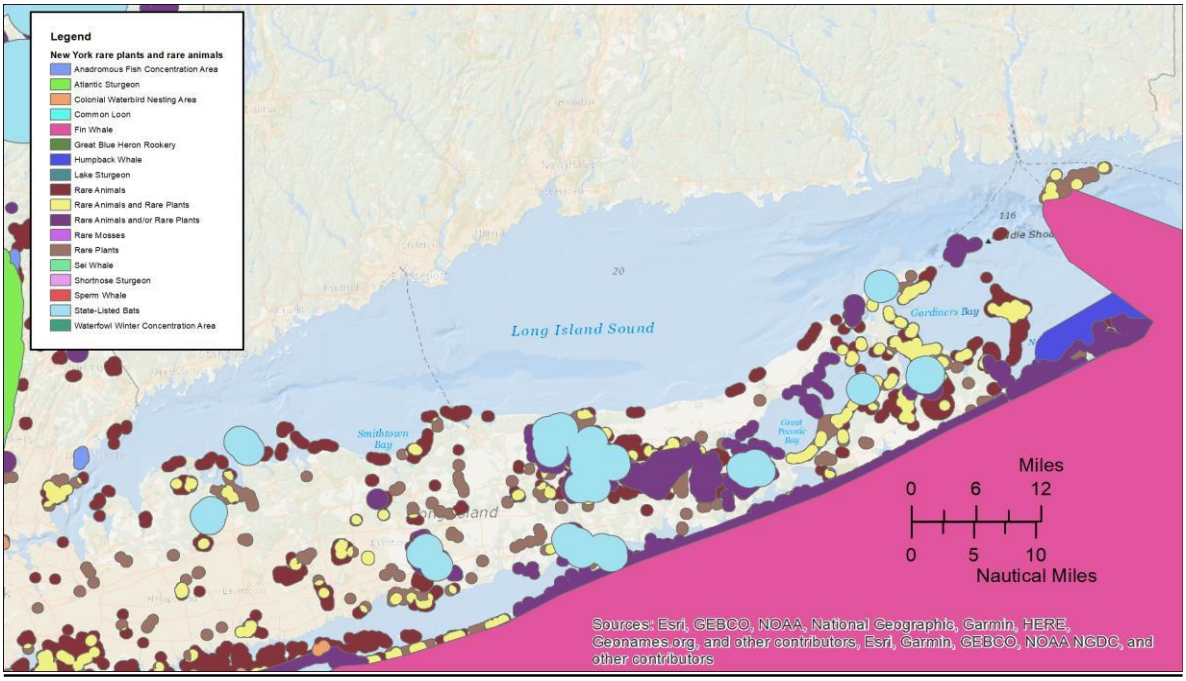

Figure 18. New York rare animals and rare plants; NY DEC

Source – New York Department of Environmental Conservation

In the Blue Plan Resource and Use Inventory – no; added to the EC Summary by the EEG

Summary – Analogous to the CT NDDB, maps that represent approximate locations of rare species, including endangered, threatened, and species of concern in New York. All areas with rare plants or animals present were considered by the EEG to be ESA.

Status/comments – While not detailed or specific, these are the data that a project proponent or applicant may be directed by the state to consult.

New York Significant Natural Communities

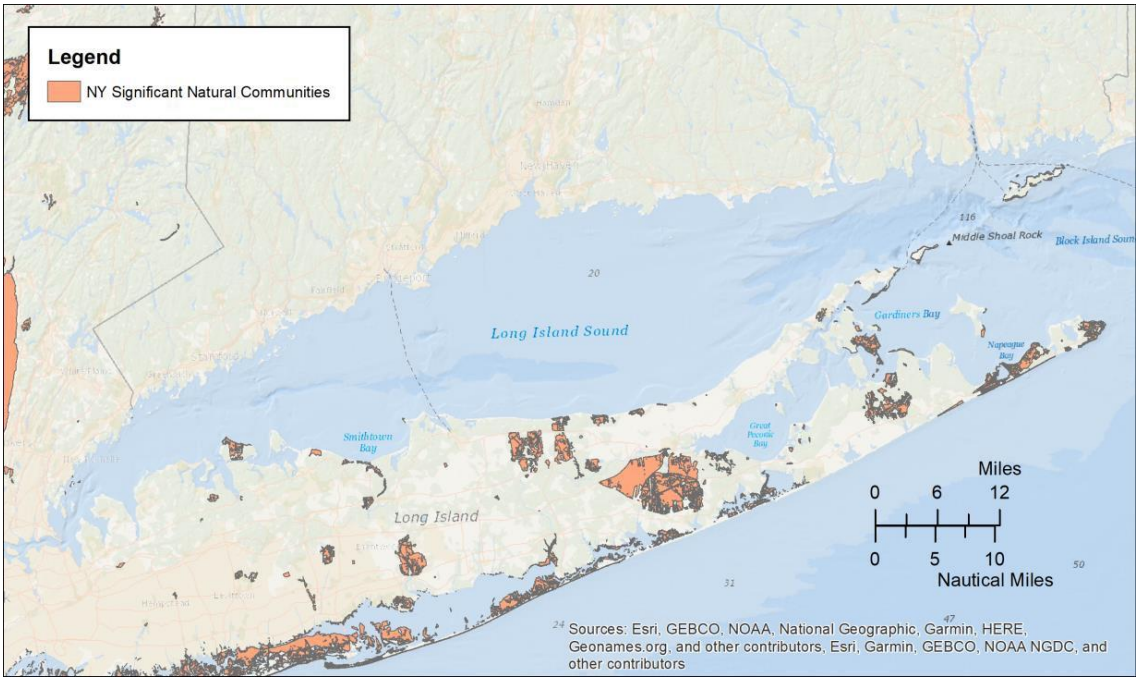

Figure 19. New York significant natural communities; NY DEC

Source – New York Department of Environmental Conservation

In the Blue Plan Resource and Use Inventory – no; added to the EC Summary by the EEG

Summary – Database of New York locations of rare or high-quality wetlands, forests, grasslands, ponds, streams, and other types of habitats, ecosystems, and ecological areas. All NY Significant Natural Communities areas were considered by the EEG to be ESA.

Status/comments – While not detailed or specific, these are the data that a project proponent or applicant may be directed by the state to consult.

New York Significant Coastal Fish and Wildlife Habitats

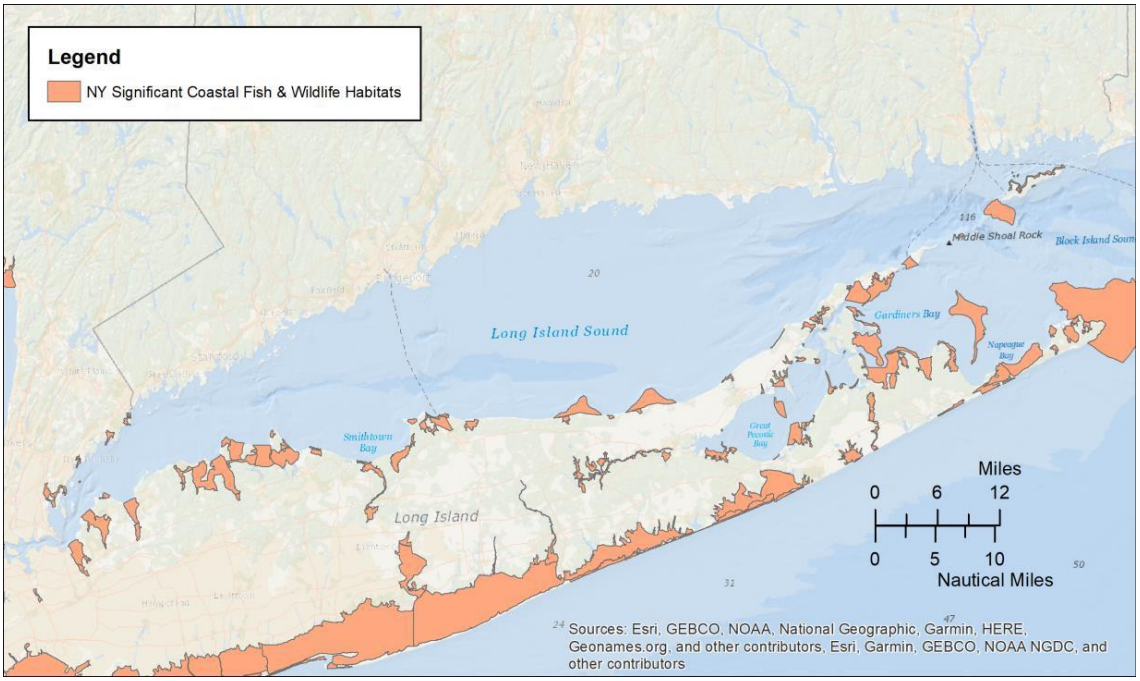

Figure 20. New York Significant Coastal Fish and Wildlife Habitats; NY Department of Environmental Conservation and Department of State

Source – NY DEC and DOS

In the Blue Plan Resource and Use Inventory – no; added to the EC Summary by the EEG

Summary – Habitats in New York that: are essential to the survival of a large portion of a particular fish or wildlife population; support populations of species which are endangered, threatened or of special concern; support populations having significant commercial, recreational, or educational value; or exemplify a habitat type which is not commonly found in the State or in a coastal region. All NY Significant Coastal Fish and Wildlife Habitats were considered by the EEG to be ESA.

Status/comments – Included since these areas were identified from a similar criteria- based process for NY coastal habitats in the 1980s.

US Endangered Species Act Critical Habitats

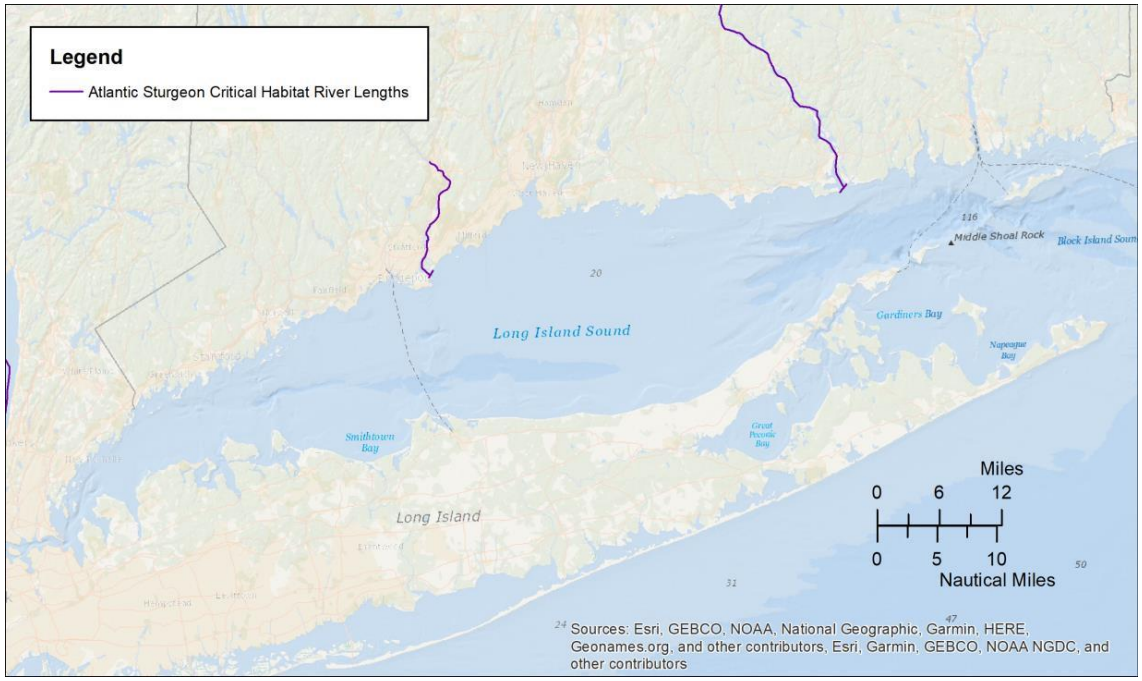

Figure 21. US Endangered Species Act Critical Habitat delineations for Atlantic sturgeon from NOAA GARFO Protected Resources Division

Source – NOAA Greater Atlantic Region Fisheries Office Protected Resources Division

In the Blue Plan Resource and Use Inventory – yes

Summary – Endangered Species Act Critical Habitat in Long Island Sound is defined for Atlantic sturgeon as segments of the Connecticut River and Housatonic River. All critical habitats were considered by the EEG to be ESA.

Status/comments – Included; these are Federal statutory areas

4. Cold water corals

Cold water coral presence

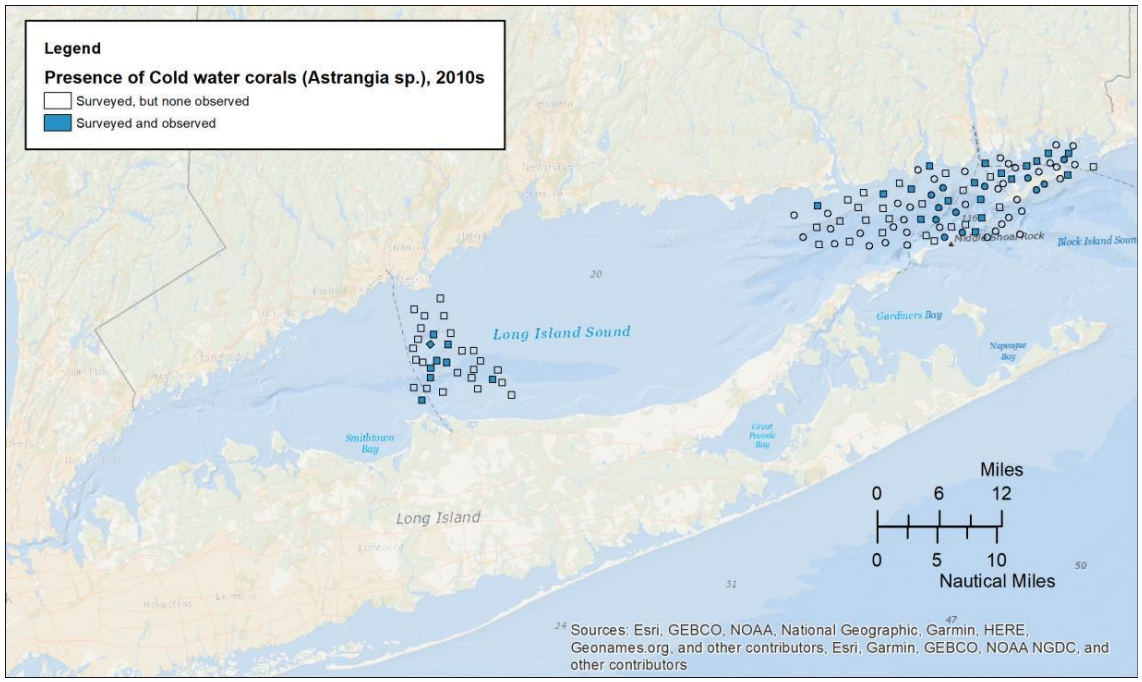

Figure 22. Cold water coral presence, University of Connecticut, Long Island Sound Mapping and Research Collaborative, Long Island Sound Seafloor Mapping Project

Source – University of Connecticut, Long Island Sound Mapping and Research Collaborative, Long Island Sound Seafloor Mapping Project

In the Blue Plan Resource and Use Inventory – yes

Summary – Observed presence of cold water corals within two discrete study areas – Stratford Shoals and eastern Long Island Sound. Survey effort was limited to these areas. Surveys did not cover all of Long Island Sound, and as a result, cold water corals could exist outside of the areas shown on this map.

Stratford Shoals data are published in the Long Island Sound Cable Fund Steering Committee Seafloor Mapping report (2015)[2]. Eastern Long Island Sound data were collected in 2017, are still being fully analyzed, and were provided in unpublished form by EEG members Chris Conroy and Peter Auster.

All areas where cold water corals were observed to be present were considered by the EEG to be ESA.

Status/comments – Spatially limited to Stratford Shoals and eastern Long Island Sound.

[2] Long Island Sound Cable Fund Steering Committee. (2015). Seafloor mapping of Long Island Sound - Final report: Phase 1 Pilot Project. Stamford, CT: US Environmental Protection Agency Long Island Sound Study. http://longislandsoundstudy.net/wp-content/uploads/2010/02/LISCF_PilotMappingProject_Report_Final_June2015-reduced-file-size.pdf

5. Coastal wetlands

Coastal wetlands

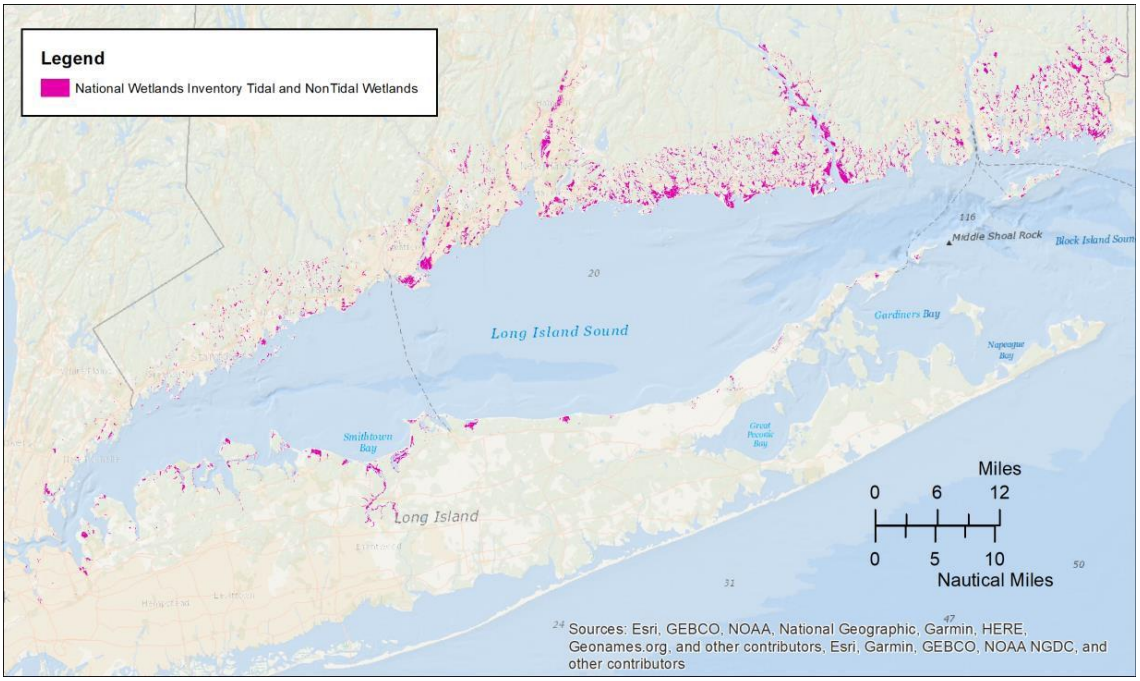

Figure 23. Coastal wetlands; USFWS National Wetlands Inventory

Source – USFWS National Wetlands Inventory

In the Blue Plan Resource and Use Inventory – yes

Summary – Delineation of coastal wetlands for Connecticut and New York, clipped to the boundary of the Long Island Sound Study. All areas with coastal wetlands were considered by the EEG to be ESA.

Status/comments – Reflects the most recent and comprehensive data.

Pillar 2: Areas of high natural productivity, biological persistence, diversity, and abundance, including areas important for supporting or exhibiting such features

6. Cetaceans

Predicted cetacean density

Source – Duke University Marine Geospatial Ecology Lab, Marine-life Data and Analysis Team, Northeast Ocean Data Portal

In the Blue Plan Resource and Use Inventory – yes

Summary – These data include predicted density maps for 30 cetacean species or species guilds at the Atlantic-coast scale (Figure 24). The EEG extracted data relevant to 11 species or species guilds with predicted densities in Long Island Sound. The 11 species or species guilds are: Cuvier's beaked whale, Fin whale, Humpback whale, Harbor porpoise, Mesoplodont beaked whales, Minke whale, North Atlantic right whale, Pilot whale, Sei whale, and Sperm whale, and Unidentified beaked whales. These layers were compiled and a total abundance layer, clipped to the Blue Plan planning area, was developed (Figure 25). The EEG used this total abundance layer as an input to the cetaceans ESA criterion, and selected areas where at least 5 individuals (of any species) were present on an annual basis.

Status/comments – Data products fully cover the Blue Plan planning area, were updated in 2018, and have been used in the Northeast and Mid-Atlantic regional planning processes.

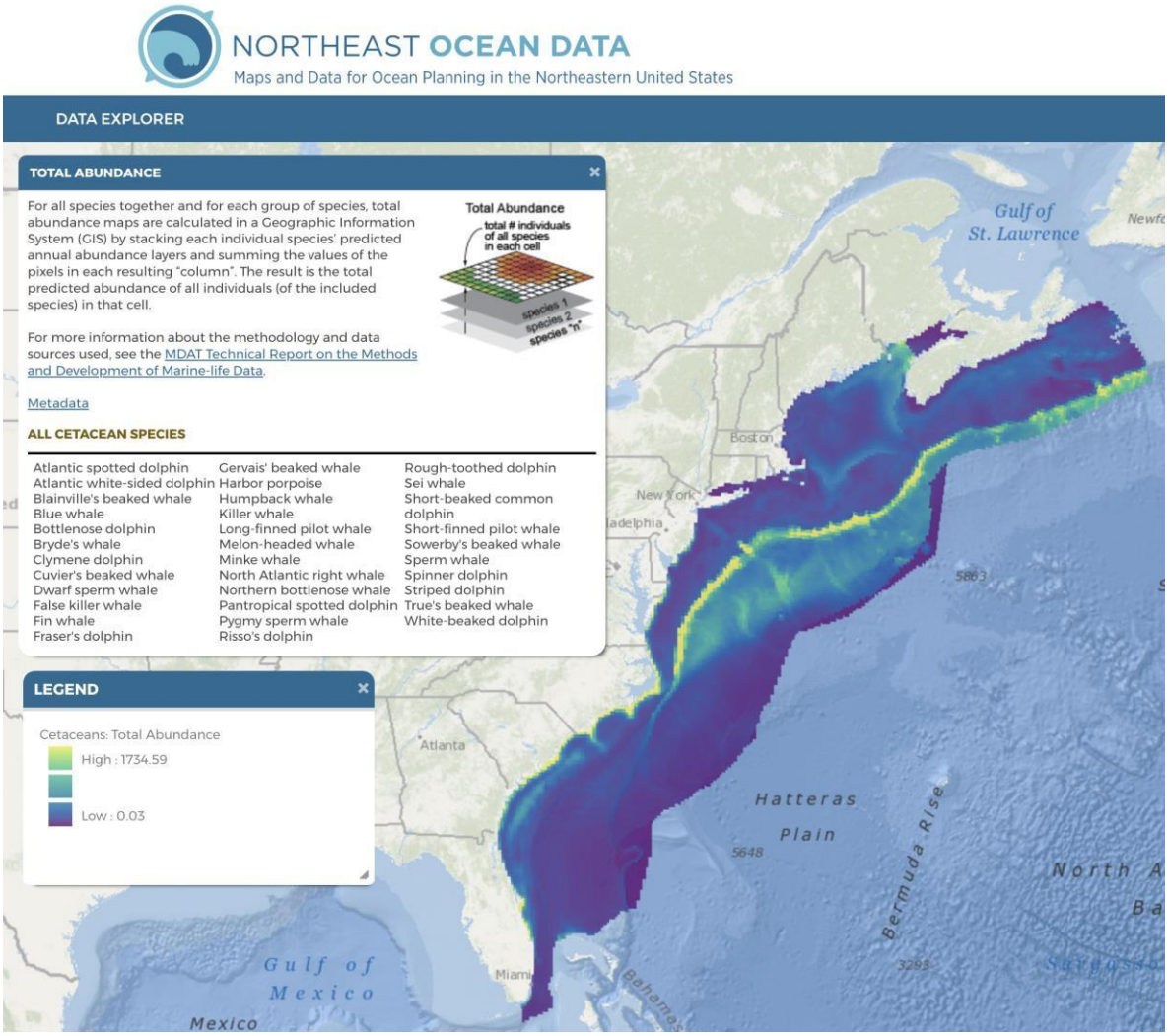

Figure 24. Predicted cetacean total abundance for 30 species or species guilds at the Atlantic-coast scale as presented on the Northeast Ocean Data Portal, www.northeastoceandata.org; Duke University Marine Geospatial Ecology Lab, Marine-life Data and Analysis Team, Northeast Ocean Data Portal

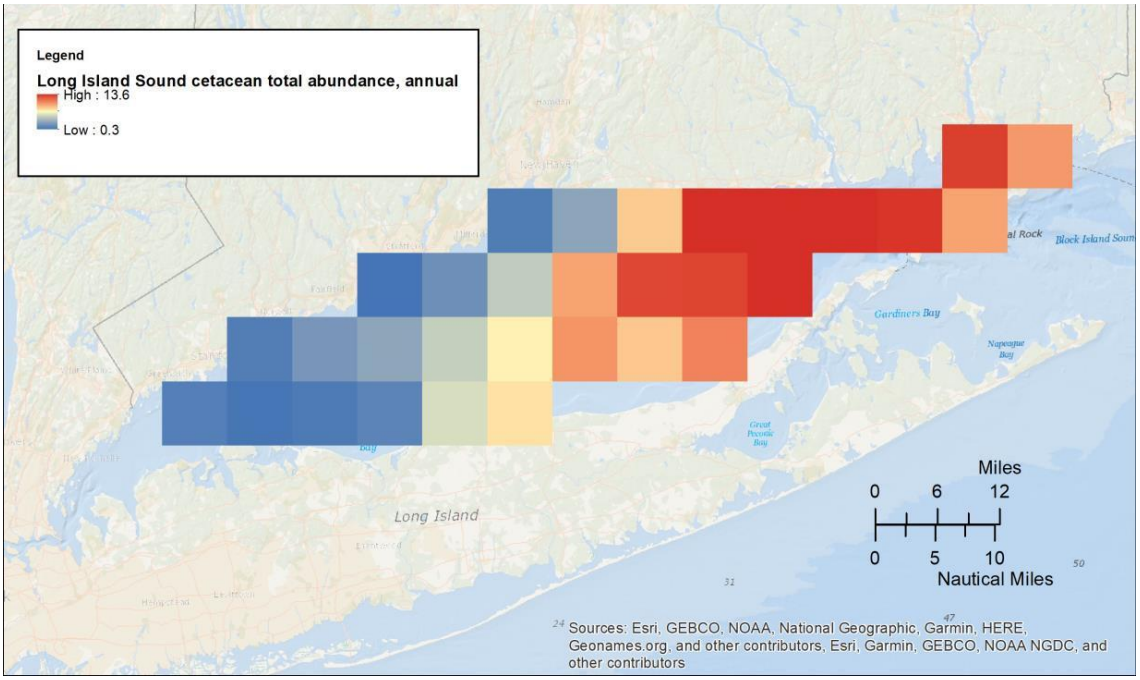

Figure 25. Predicted cetacean abundance for 11 species or species guilds at the Long Island Sound-scale; Duke University Marine Geospatial Ecology Lab, Marine Life Data and Analysis Team, Northeast Ocean Data Portal

Expert participatory mapping for cetaceans

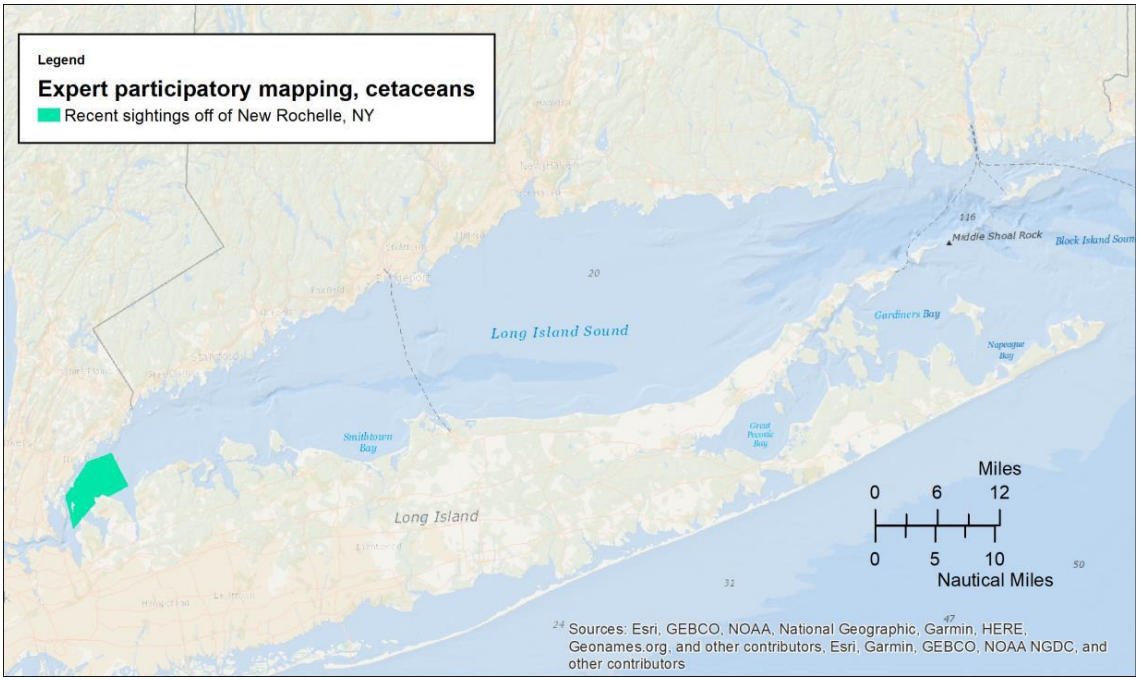

Figure 26. Area representing recent observations of Humpback whales in Long Island Sound, delineated through expert participatory mapping

Source – Patrick Comins, Executive Director, Connecticut Audubon Society

In the Blue Plan Resource and Use Inventory – no; added to the EC Summary by the EEG

Summary – On January 3, 2019, Patrick Comins delineated an additional area important to cetaceans in Long Island Sound that was not reflected in the predicted cetacean density products described above. The delineated area represents increased recent observations of Humpback whales off of New Rochelle, NY. This area was included in the final map of ESA for cetaceans.

Status/comments – Noted in the ESA documentation as expert participatory mapping.

7. Pinnipeds

Seal concentration areas

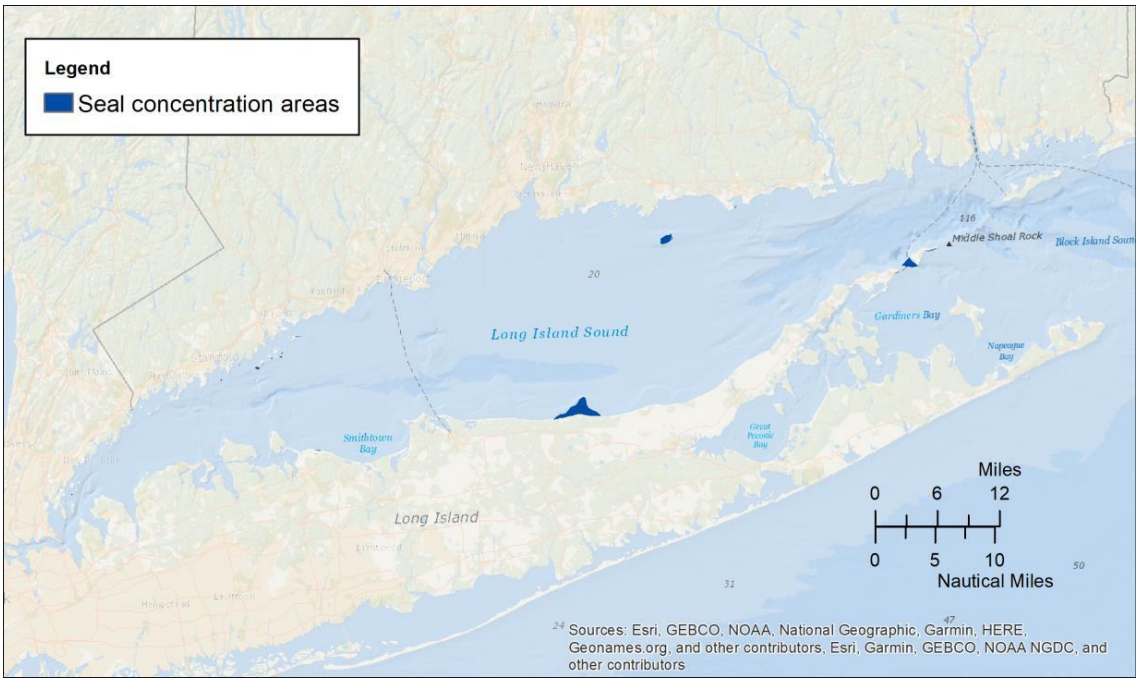

Figure 27. Seal concentration areas; Blue Plan development team, CT DEEP

Source – Blue Plan development team, CT DEEP

In the Blue Plan Resource and Use Inventory – yes

Summary – NOAA Environmental Sensitivity Index delineation of seal concentration areas in Long Island Sound, augmented by expert participatory mapping during the review period for potential data products to include in the Blue Plan Inventory, fall 2017. All seal concentration areas were considered by the EEG to be ESA.

Status/comments – Depicts haul-out locations but does not reflect all areas important for in-water behaviors.

8. Sea turtles and other reptiles

Sea turtle live strandings and in-water observations

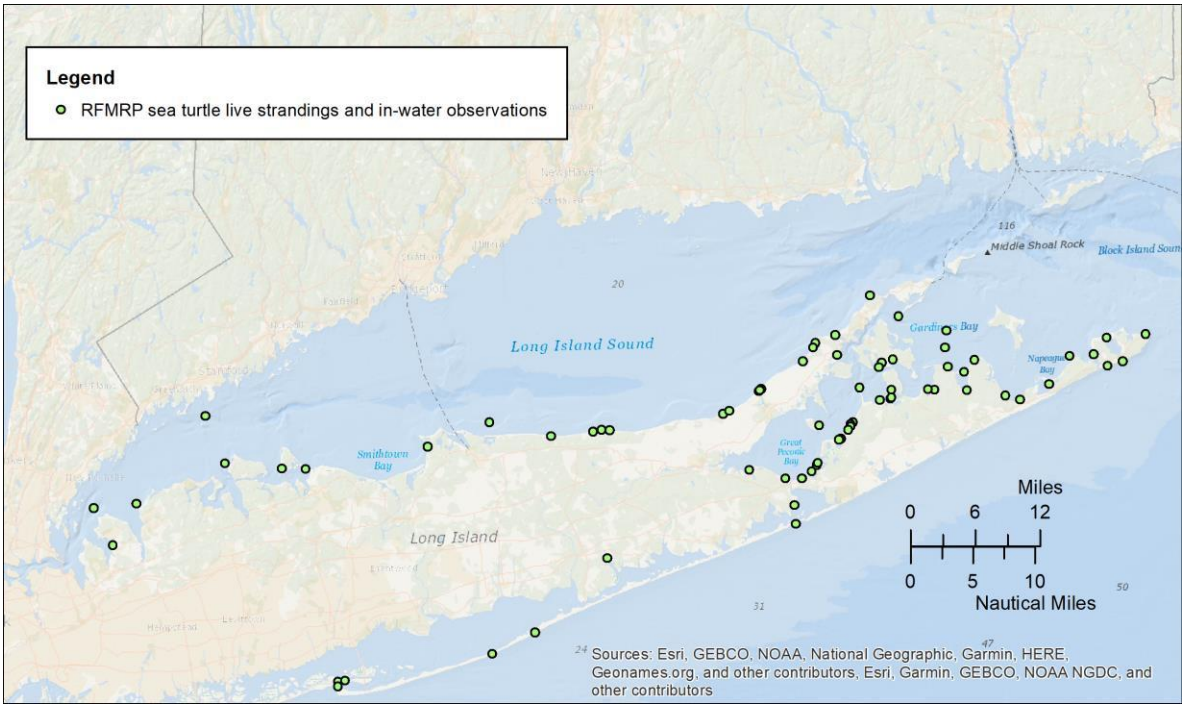

Figure 28. Sea turtle strandings and in-water observations; Riverhead Foundation for Marine Research and Preservation (RFMRP)

Source – Riverhead Foundation for Marine Research and Preservation

In the Blue Plan Resource and Use Inventory – no; added to the EC Summary by the EEG

Summary – EEG member Maxine Montello, Rescue Program Director at the Riverhead Foundation, provided the locations of recent observations of live sea turtles, stranded or in-water, near the New York coast In Long Island Sound from 2005-2017. Although the Riverhead Foundation also records observations of dead sea turtles (stranded and in-water), the EEG decided to exclude these observations from consideration as ESA because they do not represent instances of active habitat use. All areas where live strandings and in-water observations occurred were considered by the EEG to be ESA.

Status/comments – Very few but verified records of live sea turtle habitat use.

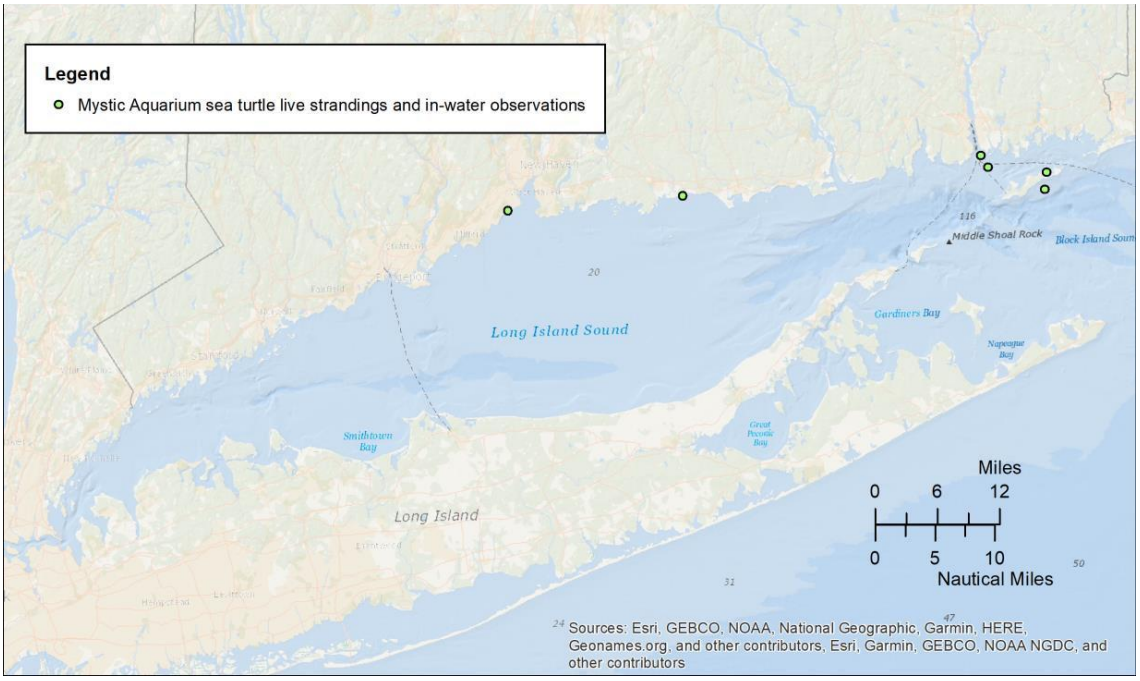

Figure 29. Sea turtle live strandings and in-water observations; Mystic Aquarium Animal Rescue Program

Source – Mystic Aquarium Animal Rescue Program

In the Blue Plan Resource and Use Inventory – yes

Summary – EEG member Maxine Montello, Rescue Program Director at the Riverhead Foundation, coordinated with the Mystic Aquarium Animal Rescue Program to provide the locations of recent observations of live sea turtles, stranded or in-water near Connecticut coast In Long Island Sound from 2001-2018. Although the Mystic Aquarium also records observations of dead sea turtles (stranded and in-water), the EEG decided to exclude these observations from consideration as ESA because they do not represent instances of active habitat use. All areas where live strandings and in-water observations occurred were considered by the EEG to be ESA.

Status/comments – Very few but verified records of live sea turtle habitat use.

2018 coastal Connecticut sea turtle mortality events

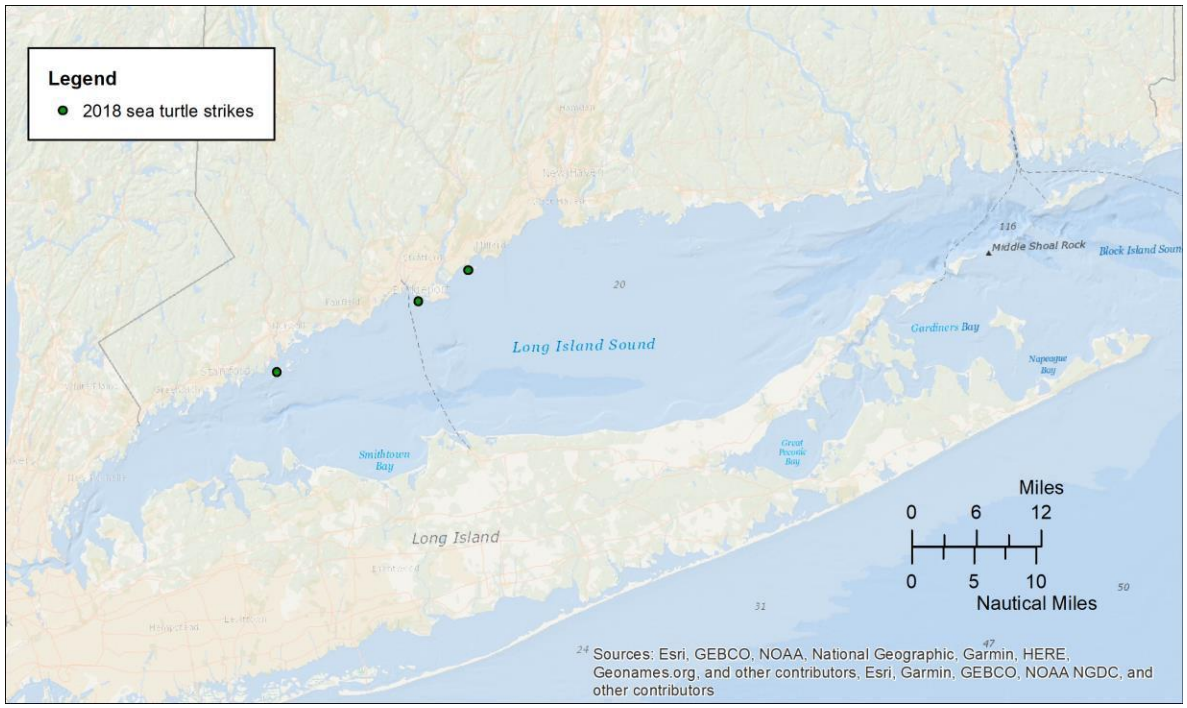

Figure 30. 2018 coastal Connecticut sea turtle mortality events; EEG

Source – EEG

In the Blue Plan Resource and Use Inventory – no; added to the EC Summary by the EEG

Summary – EEG member Maxine Montello, Rescue Program Director at the Riverhead Foundation, coordinated with the EEG to identify and map locations of 2018 mortality events at Silver Sand State Park, Long Beach, and Sheffield Island. The EEG considered these areas important to characterizing recent sea turtle habitat use, and included them as ESA.

Status/comments – Reflect recent trends in sea turtle habitat use.

Northern diamondback terrapin occurrence

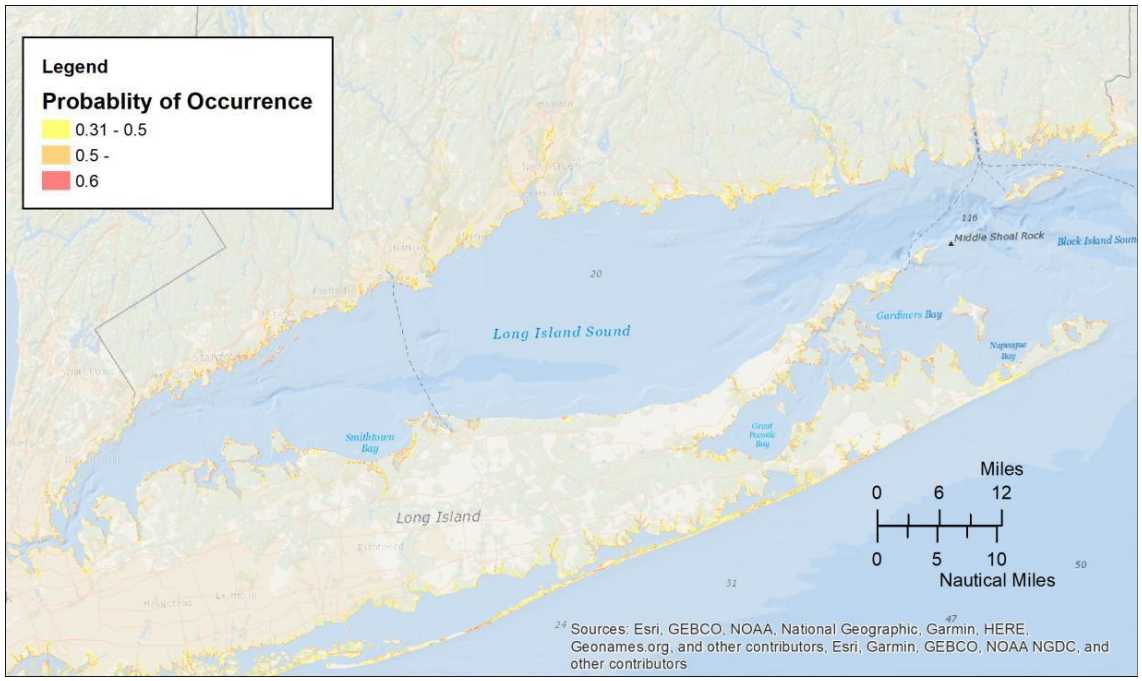

Figure 31. Northern diamondback terrapin occurrence; Conserve Wildlife Foundation of NJ

Source – Conserve Wildlife Foundation of NJ via North Atlantic Landscape Conservation Cooperative (NALCC) website

In the Blue Plan Resource and Use Inventory – no; added to the EC Summary by the EEG

Summary – Northern diamondback terrapins are brackish-water species with habitat in coastal marsh and estuarine areas of Long Island Sound. EEG member Maxine Montello, Rescue Program Director at the Riverhead Foundation, requested that data relating to northern diamondback terrapin occurrence be included in the ESA process, if available. During expert review of the draft ESA in December 2018, Shannon Kearny of CT DEEP Wildlife Division pointed the EEG to the probability of occurrence models for northern diamondback terrapin that are available via the NALCC website. These data represent the predicted probability of occurrence of diamondback terrapins from a Maxent model using documented observations from Massachusetts to Virginia between 2000-2012. The data product depicts the predicted probability of occurrence on a 0 - 1 scale, with 0.7722 being the highest possible value. A threshold of 0.3188 was generated by the modeling program (Maxent) and is considered a relatively conservative threshold that has been used as an indicator for suitable habitat in other studies. The EEG considered areas with a predicted probability of occurrence >0.3188 to be ESA.

Status/comments – Data are downloadable from NALLC website; web services are hosted by USGS.

9. Birds

Seabird occurrence

Source – University of Connecticut (UConn), Steen and Elphick

In the Blue Plan Resource and Use Inventory – no; added to the EC Summary by the EEG

Summary – In response to inadequate data and data gaps identified in the Inventory, EEG member Chris Elphick, professor at the UConn, and Valerie Steen, post-doctoral fellow at UConn, volunteered to develop draft seabird data products for a number of individual bird species common to Long Island Sound. The species data products were constructed using eBird observations and several environmental covariates from the Inventory, including depth and eelgrass. The resulting outputs include predicted occurrence maps for 7 species in summer (May to September) and 23 species in winter (October to April) in Long Island Sound (Table 3). With these data, the EEG created summer and winter species richness layers (Figures 32 and 33). The EEG used these layers as inputs to the birds ESA criterion and selected the top quintile of species richness from each season as ESA.

Status/comments – Not peer-reviewed (except by the EEG) or published, but the most comprehensive set of species-level bird data products specifically developed for Long Island Sound. During informal review by birders with expertise in Long Island Sound, a few places were identified where model results seemed somewhat incorrect, but no major prediction errors were identified.

Table 3. Species for which predicted occurrence models were developed

Summer	Winter
• Common tern • Double-crested cormorant • Great black-backed gull • Herring gull • Laughing gull • Ring-billed gull • Roseate tern	• American black duck • Black scoter • Bonaparte's gull • Brant • Bufflehead • Common eider • Common goldeneye • Common loon • Double-crested cormorant • Great black-backed gull • Great cormorant • Greater scaup • Herring gull • Horned grebe • Laughing gull • Lesser scaup • Long-tailed duck • Northern gannet • Red breasted merganser • Red throated loon • Ring-billed gull • Surf scoter • White wing scoter

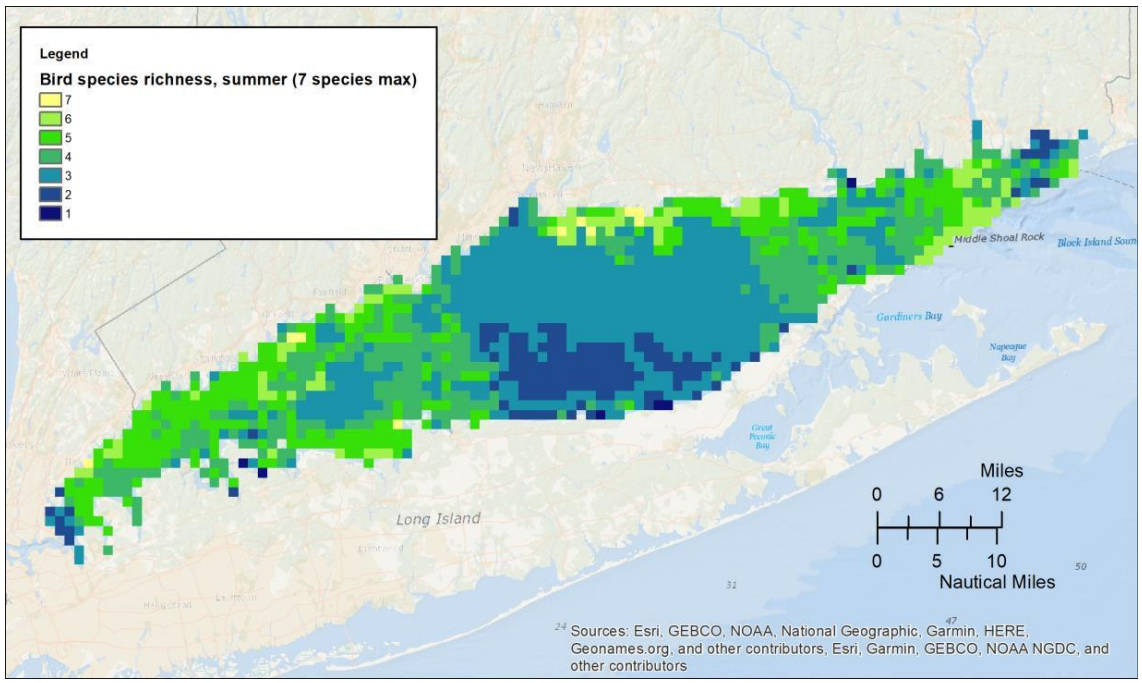

Figure 32. Predicted summer seabird species richness, compiled from 7 predicted species occurrence layers; University of Connecticut

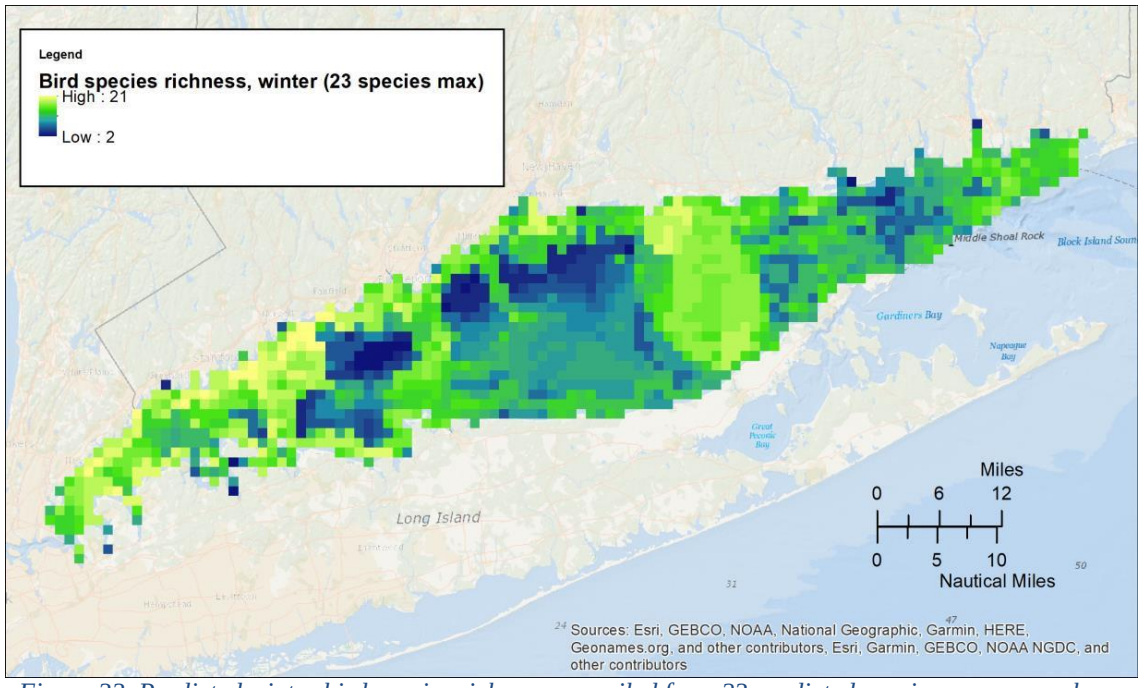

Figure 33. Predicted winter bird species richness, compiled from 23 predicted species occurrence layers; University of Connecticut

Expert participatory mapping for birds

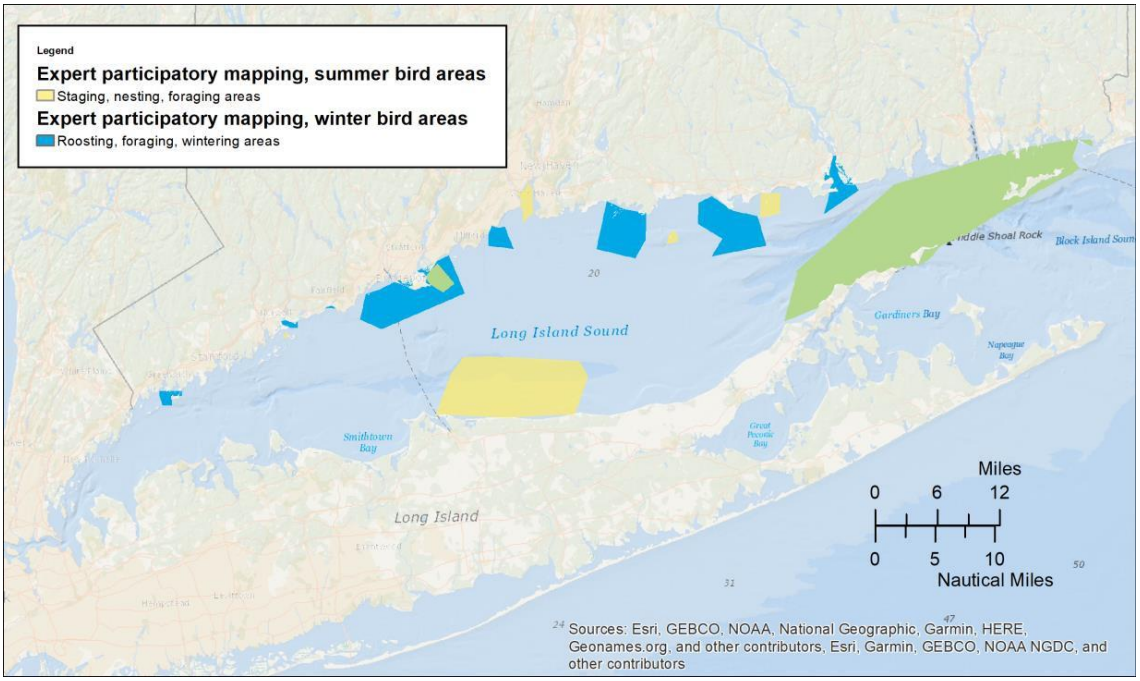

Figure 34. Areas important to bird staging, nesting, foraging, roosting, and wintering delineated through expert participatory mapping. The summer staging, nesting and foraging areas (yellow) are partially transparent to better show where these areas overlap with roosting, foraging, and wintering areas. The Race appears green because it is where roseate and common terns forage in summer, and is also an important wintering area for razorbills (Patrick Comins, personal communication, 1/3/19).

Source – Patrick Comins, Executive Director, Connecticut Audubon Society

In the Blue Plan Resource and Use Inventory – no; added to the EC Summary by the EEG

Summary – On January 3, 2019, Patrick Comins delineated additional areas important to various bird species in Long Island Sound that were not reflected in the predicted occurrence products described above. The delineated areas represent staging, nesting, and foraging areas in summer, and roosting, foraging, and wintering areas in winter. These areas were included in the final map of ESA for birds.

Status/comments – Noted in the ESA documentation as expert participatory mapping.

10. Fish

Persistently productive areas for fish

Source – TNC LISEA

In the Blue Plan Resource and Use Inventory – yes

Summary – The Long Island Sound Ecological Assessment (LISEA) identified persistently productive areas for fish using 26 years (1984-2009) of CT DEEP Marine Fisheries Long Island Sound Trawl Survey (LISTS) data. These places have the highest number of species that have persisted there for the longest period (i.e., throughout each period of the LISTS, or 3 periods totaling 26 years at the time of the assessment) and each of these species have been detected at a frequency higher than expected, from just under 1 standard deviation to over 2 standard deviations above the mean. These persistently productive places for each species were aggregated into persistently productive places for fish functional groups: diadromous (Figure 35), pelagic (Figure 36), and demersal species (Figure 37). The detailed methods, maps, and data describing persistently productive places for each functional group can be accessed via The Nature Conservancy's Conservation Gateway. These maps were used as inputs (among others described below) to the identification of ESA for fish.

Status/comments – Generally good coverage of the Blue Plan planning area, but limitations in spatial and habitat coverage have been noted (Gottschall and Paliceo 2014, Gottschall et al. 2000). The spatial coverage and survey effort for the LISTS survey is mapped in Figure 46). The persistence metric provides a good "historical" perspective on fish distribution in Long Island Sound. The LISEA analysis integrates many years of data on many species. This layer should be used in a complementary way with additional depictions of more recent fish community distribution and abundance.

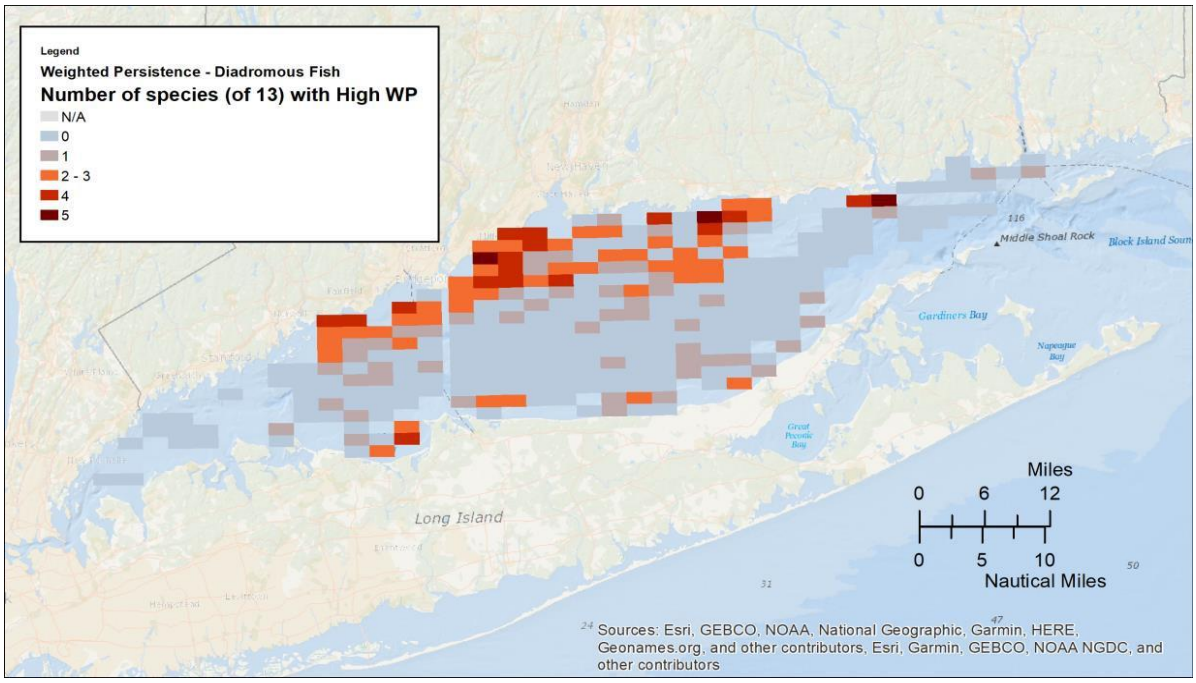

Figure 35. Areas of high weighted persistence for diadromous fish; The Nature Conservancy Long Island Sound Ecological Assessment

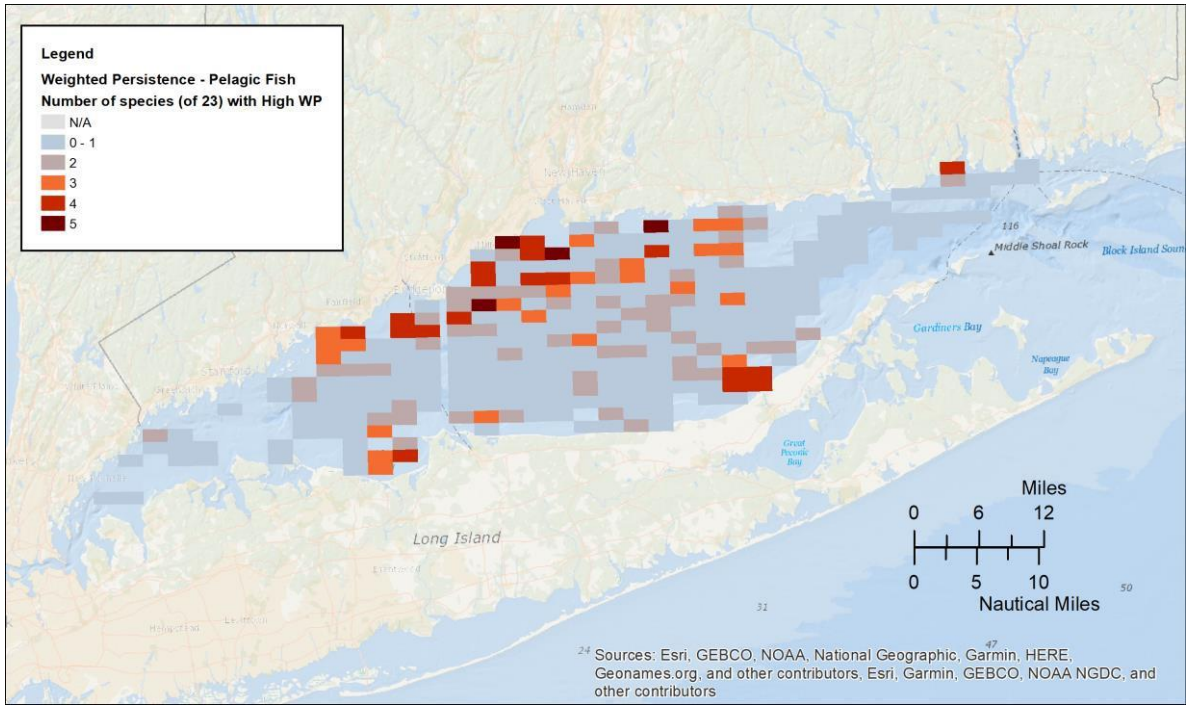

Figure 36. Areas of high weighted persistence for pelagic fish; The Nature Conservancy Long Island Sound Ecological Assessment

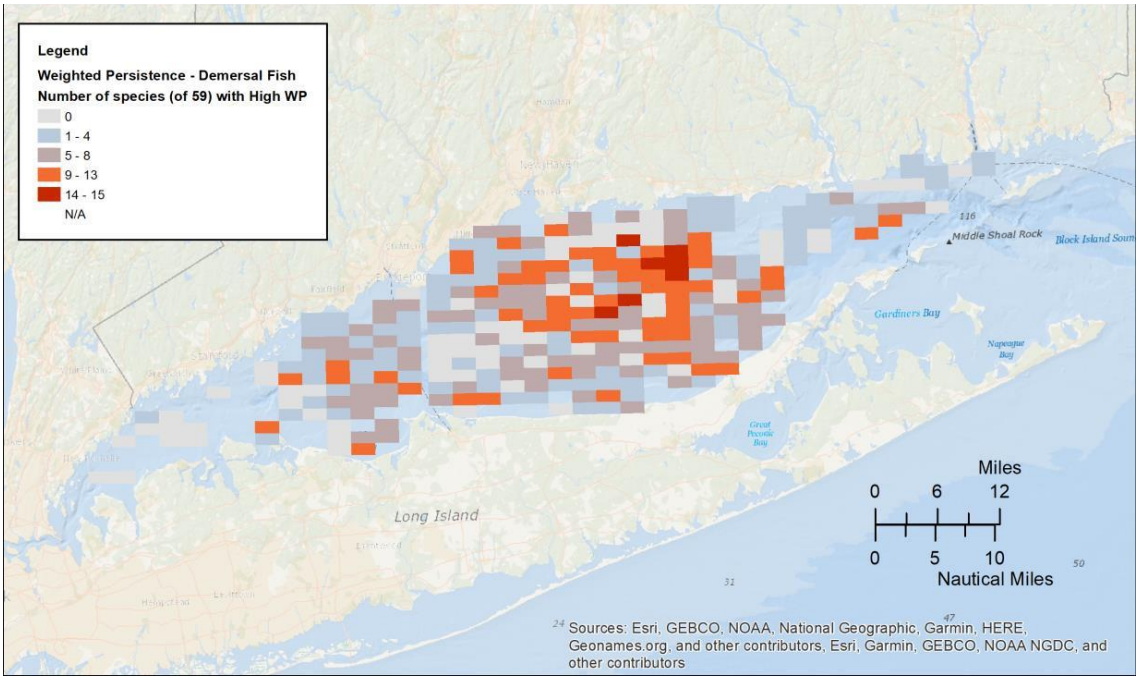

Figure 37. Areas of high weighted persistence for demersal fish; The Nature Conservancy Long Island Sound Ecological Assessment

Fish abundance

Source – CT DEEP Marine Fisheries

In the Blue Plan Resource and Use Inventory – yes

Summary – All input data were provided by CT DEEP Marine Fisheries. They offered several recommendations for the use of fish abundance data from its Long Island Sound Trawl Survey (LISTS):

- Map natural log of abundance on the LISTS grid
- Use spring and fall results
- Use results summarized by decade as prepared by CT DEEP Marine Fisheries, 1995- 2004 and 2005-2014
- Use results summarized by functional group, as designated by CT DEEP Marine Fisheries (demersal and pelagic)
- Include species caught in greater than 5 trawls in each of the above seasons/decades

While the EEG originally intended to use the most recent decade of data only (to reflect the most current conditions in the fish community), the EEG agreed with the Marine Fisheries recommendation to use both decades, especially considering the shifts in the Long Island Sound fish community that have occurred since the mid-90s. Developing data products sensitive to seasonal and decadal changes allowed important temporal patterns to be displayed on the maps that would contribute to identification of ESA.

The recommendations resulted in the development of 8 separate layers that each contributed to the identification of ESA (Table 4 and Figures 38-45). The top quintile of fish abundance for each layer was considered by the EEG as ESA.

Status/comments – Generally good coverage of the Blue Plan planning area, but limitations in spatial and habitat coverage have been noted (Gottschall and Paliceo 2014, Gottschall et al. 2000). The spatial coverage and survey effort for the LISTS survey is mapped in Figure 46). Important to show abundance patterns in both fall and spring and within the two decades to capture the major recent patterns in fish abundance in the Sound.

Table 4. The 8 summary data layers developed from the LISTS data for fish.

Data layer description	**Map**
Demersal species fall abundance, 1995-2004	Figure 38
Demersal species spring abundance, 1995-2004	Figure 39
Demersal species fall abundance, 2005-2014	Figure 40
Demersal species spring abundance, 2005-2014	Figure 41
Water column species fall abundance, 1995-2004	Figure 42
Water column species spring abundance, 1995-2004	Figure 43
Water column species fall abundance, 2005-2014	Figure 44
Water column species spring abundance, 2005-2014	Figure 45

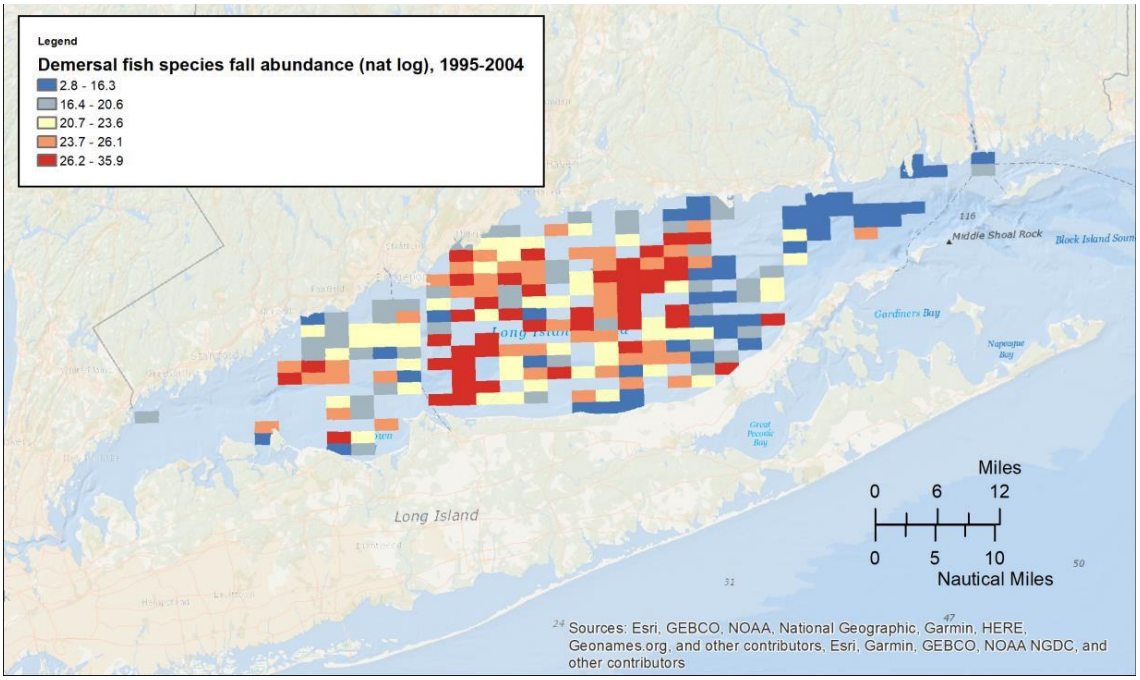

Figure 38. Demersal fish species fall abundance (natural log), 1995-2004, classified by quintile; CT DEEP Marine Fisheries Long Island Sound Trawl Survey

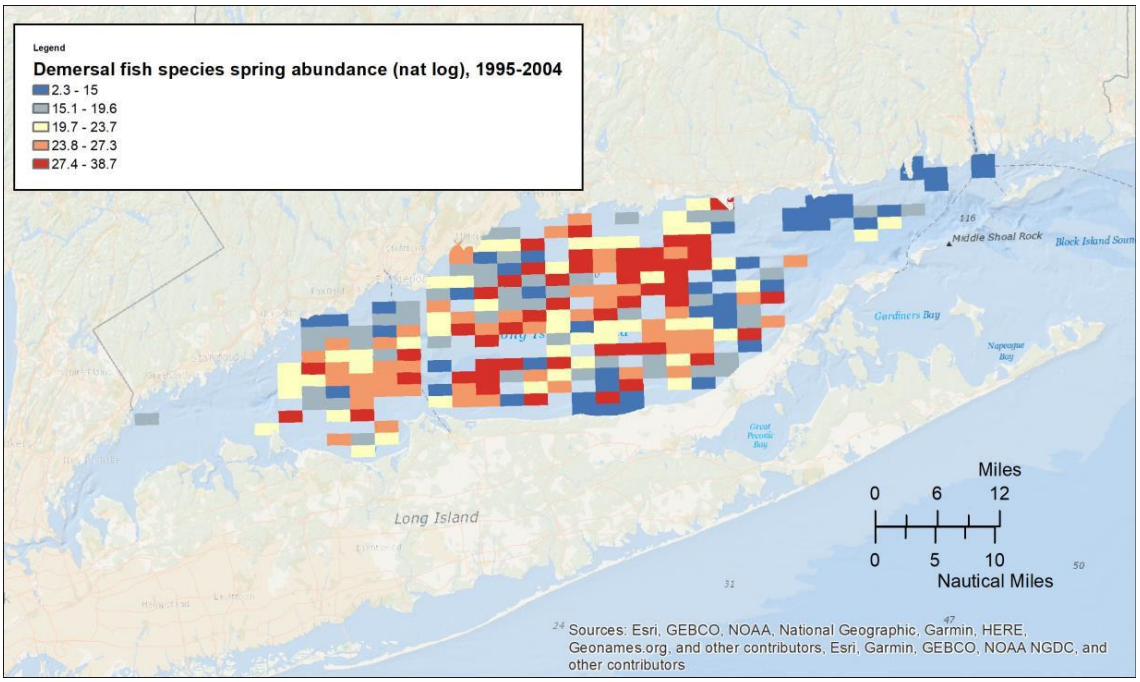

Figure 39. Demersal fish species spring abundance (natural log), 1995-2004, classified by quintile; CT DEEP Marine Fisheries Long Island Sound Trawl Survey

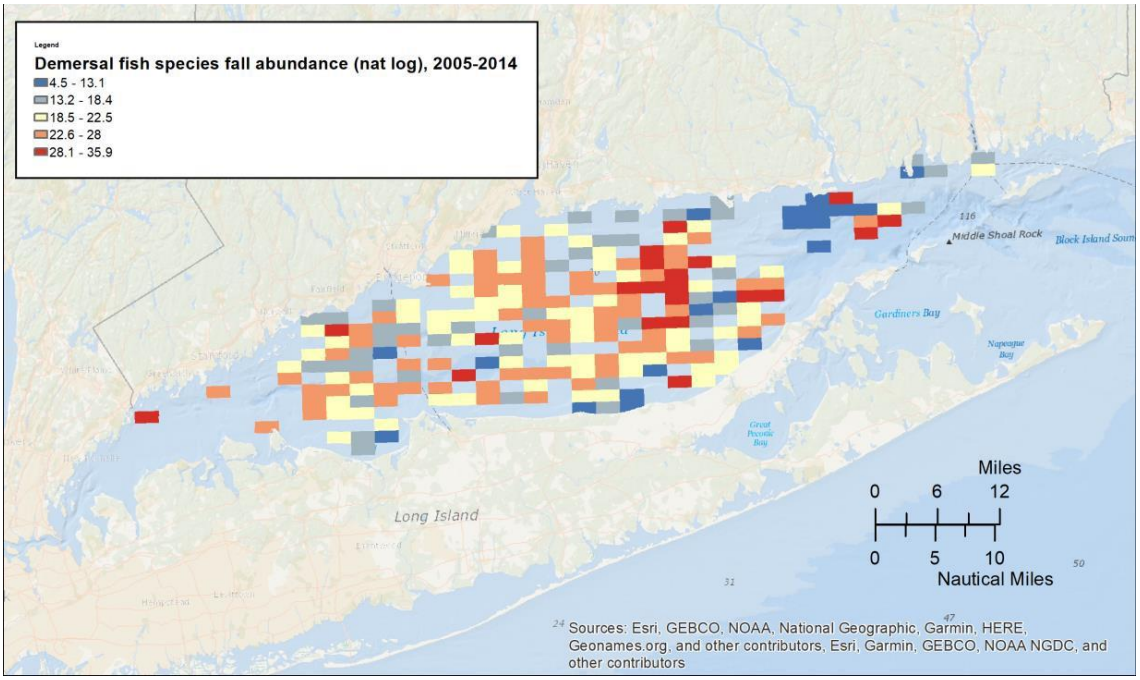

Figure 40. Demersal fish species fall abundance (natural log), 2005-2014, classified by quintile; CT DEEP Marine Fisheries Long Island Sound Trawl Survey

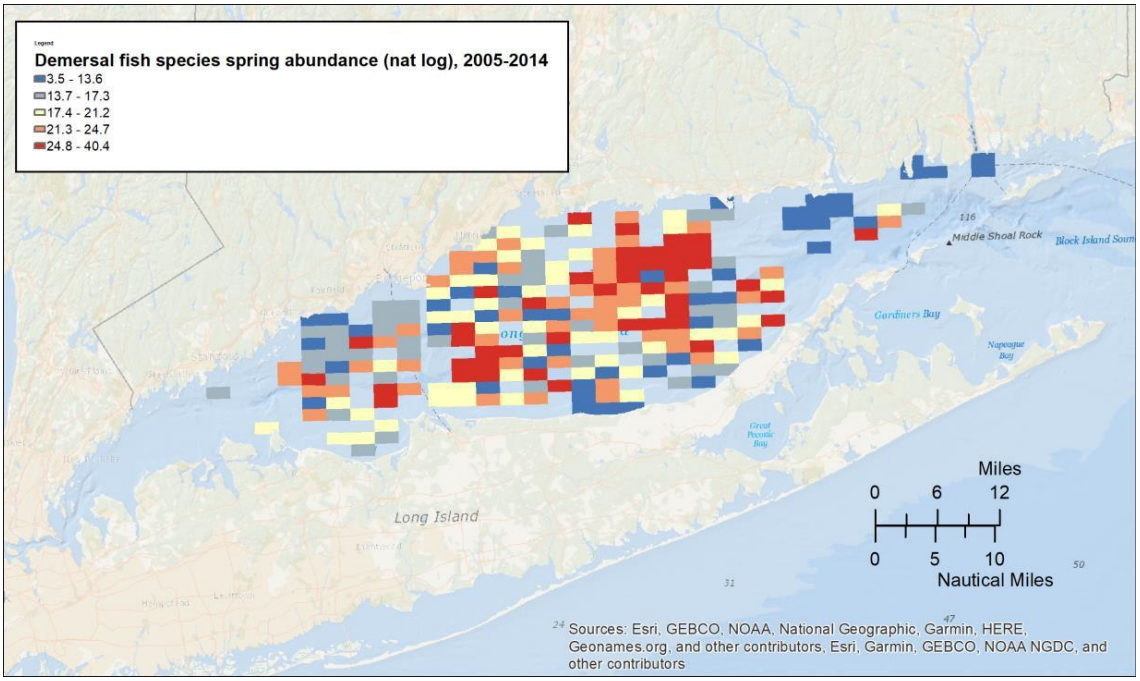

Figure 41. Demersal fish species spring abundance (natural log), 2005-2014, classified by quintile; CT DEEP Marine Fisheries Long Island Sound Trawl Survey

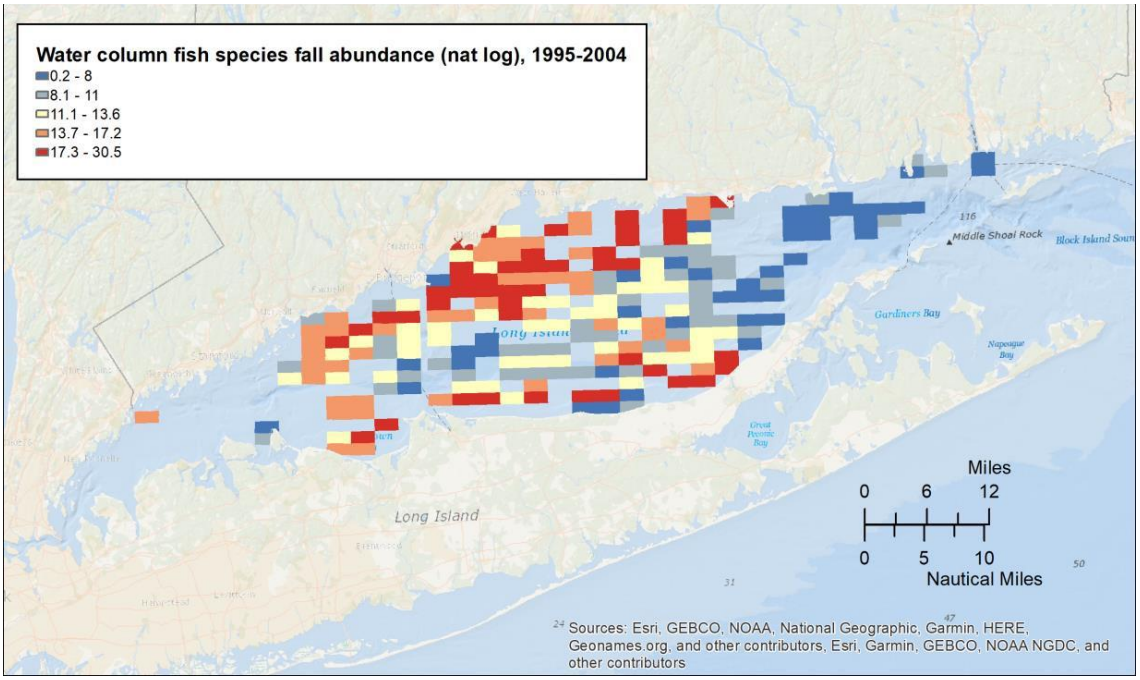

Figure 42. Water column fish species abundance (natural log), 1995-2004, classified by quintile; CT DEEP Marine Fisheries Long Island Sound Trawl Survey

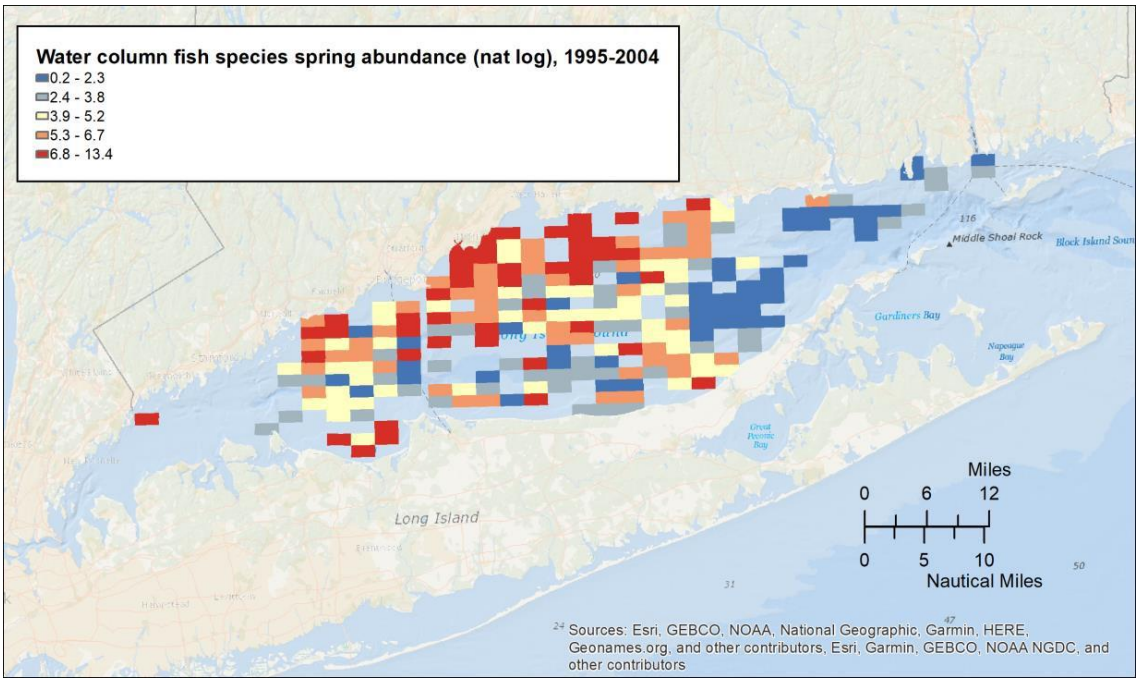

Figure 43. Water column fish species spring abundance (natural log), 1995-2004, classified by quintile; CT DEEP Marine Fisheries Long Island Sound Trawl Survey

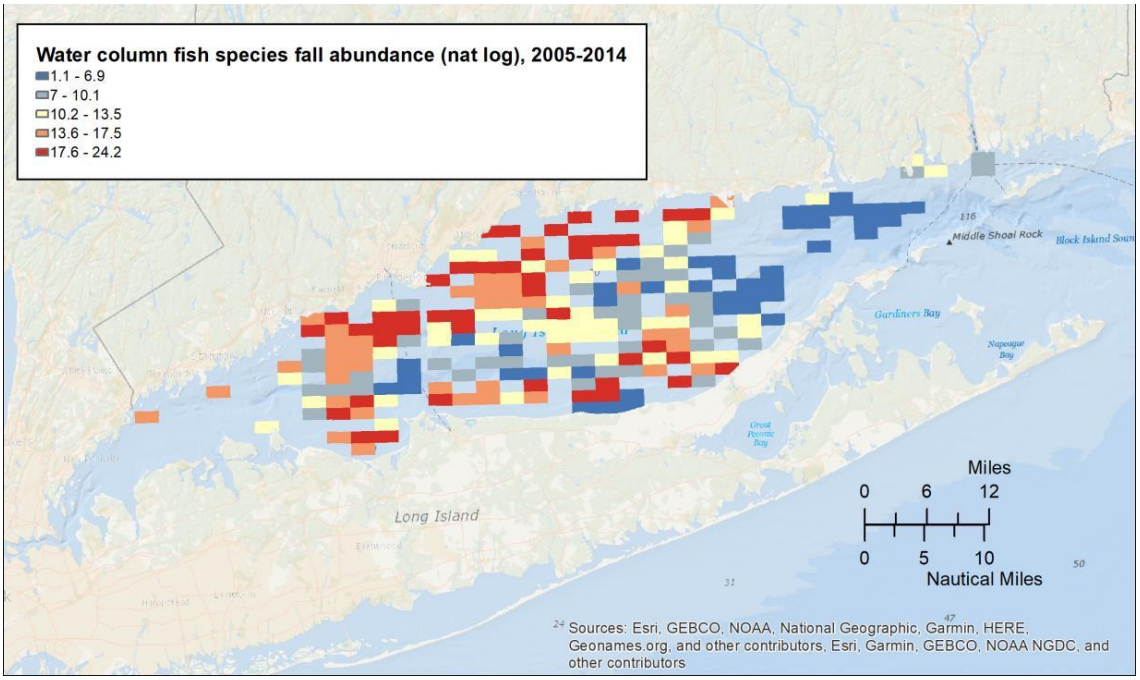

Figure 44. Water column fish species fall abundance (natural log), 2005-2014, classified by quintile; CT DEEP Marine Fisheries Long Island Sound

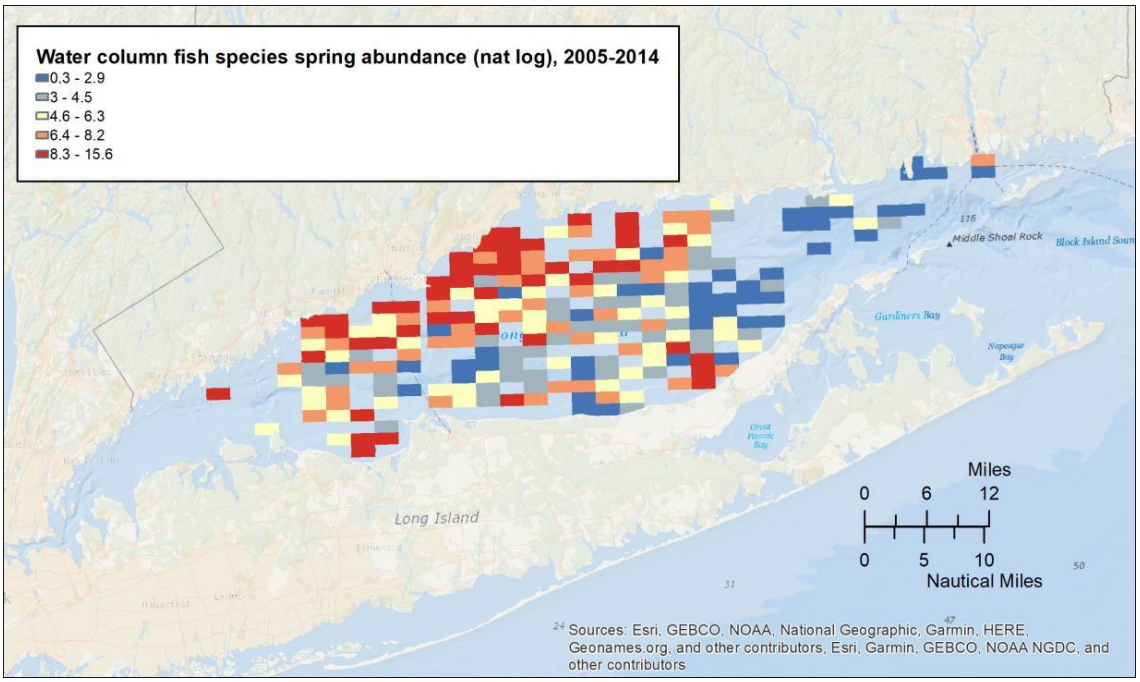

Figure 45. Water column fish species spring abundance (natural log), 2005-2014, classified by quintile; CT DEEP Marine Fisheries Long Island Sound Trawl Survey

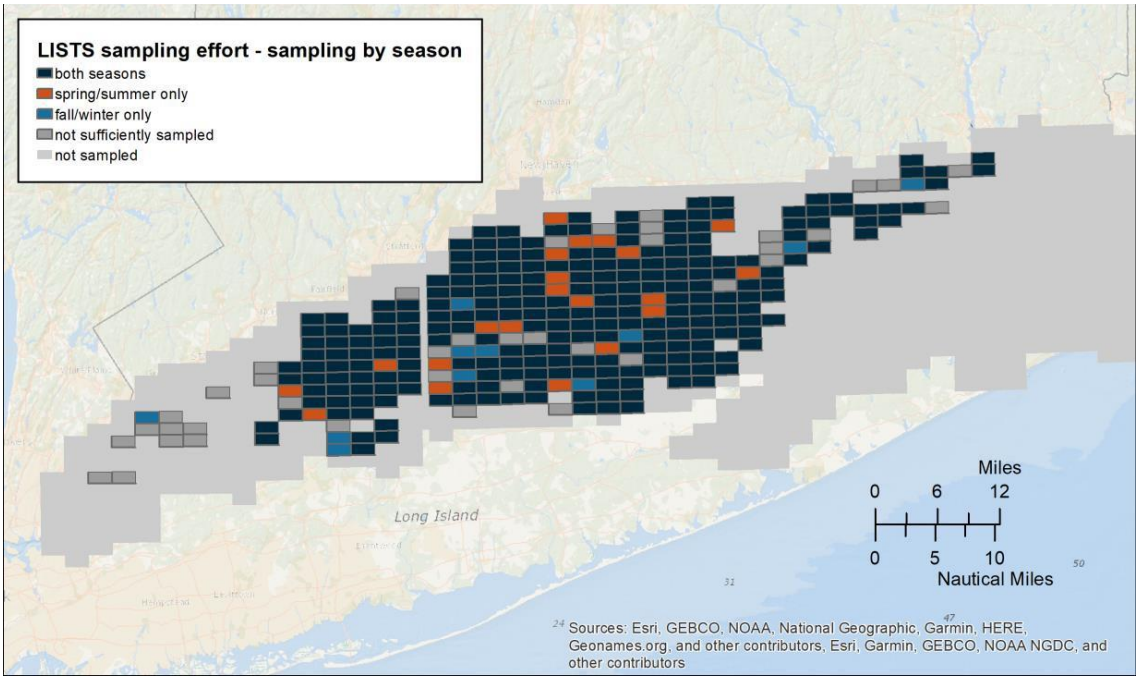

Figure 46. Grid cells sampled by the Connecticut DEEP Marine Fisheries Long Island Sound Trawl Survey (1984-2009). Map credit: The Nature Conservancy, Long Island Sound Ecological Assessment. TNC considered grid cells that did not have survey points in at least two of three periods (1984-1992, 1993-2001, 2002-2009) to be insufficiently sampled for their weighted persistence analyses. Note, there are some areas that cannot be effectively sampled by the Survey (e.g. The Race, shoals, reefs, and trenches).

11. Mobile invertebrates

Mobile invertebrate biomass

Source – CT DEEP Marine Fisheries

In the Blue Plan Resource and Use Inventory – yes

Summary – All input data were provided by CT DEEP Marine Fisheries. They offered several recommendations for the use of mobile invertebrate biomass data from its Long Island Sound Trawl Survey (LISTS):

- Map natural log of biomass on the LISTS grid
- Use spring and fall results
- Use results summarized by decade as prepared by CT DEEP Marine Fisheries, 1995- 2004 and 2005-2014
- Include species caught in greater than 5 trawls in each of the above seasons/decades (Table 5)

Table 5. Mobile invertebrate species present in greater than 5 tows in any of the seasons and date ranges for the Long Island Sound Trawl Survey between 1995 and 2014.

Species group	**Common name**	**Scientific name**
Decapods	Blue crab	*Callinectes sapidus*
Decapods	Flat claw hermit crab	*Pagurus pollicaris*
Decapods	Lady crab	*Ovalipes ocellatus*
Decapods	Rock crab	*Cancer irroratus*
Decapods	Spider crab	*Libinia emarginata*
N/A	Horseshoe crab	*Limulus polyphemus*
N/A	American lobster	*Homarus americanus*
N/A	Long-finned squid	*Loligo pealeii*

While the EEG originally intended to use the most recent decade of data only (to reflect the most current conditions in the mobile invertebrate community), the EEG agreed with the Marine Fisheries recommendation to use both decades, especially considering the shifts in the Long Island Sound fish and mobile invertebrate community that have occurred since the mid-90s. Developing data products sensitive to seasonal and decadal changes allowed important temporal patterns to be displayed on the maps that would contribute to identification of ESA. The recommendations resulted in the development of 16 separate layers that each contributed to the identification of ESA (Table 6 and Figures 47-62). The top quintile of biomass for each layer was considered by the EEG as ESA.

Status/comments – Generally good coverage of the Blue Plan planning area, but limitations in spatial and habitat coverage have been noted (Gottschall and Paliceo 2014, Gottschall et al. 2000). The spatial coverage and survey effort for the LISTS survey is mapped in Figure 46). Important to show abundance patterns in both fall and spring and within the two decades to capture the major recent patterns in mobile invertebrate biomass in the Sound.

Table 6. The 16 data layers developed from the LISTS data for mobile invertebrates.

Data layer description	Maps
Decapod species spring biomass, 1995-2004	Figure 47
Decapod species fall biomass, 1995-2004	Figure 48
Decapod species spring biomass, 2005-2014	Figure 49
Decapod species fall biomass, 2005-2014	Figure 50
Horseshoe crab spring abundance, 1995-2004	Figure 51
Horseshoe crab fall abundance, 1995-2004	Figure 52
Horseshoe crab spring abundance, 2005-2014	Figure 53
Horseshoe crab fall abundance, 2005-2014	Figure 54

American lobster spring abundance, 1995-2004	Figure 55
American lobster fall abundance, 1995-2004	Figure 56
American lobster spring abundance, 2005-2014	Figure 57
American lobster fall abundance, 2005-2014	Figure 58
Long-finned squid spring abundance, 1995-2004	Figure 59
Long-finned squid fall abundance, 1995-2004	Figure 60
Long-finned squid spring abundance, 2005-2014	Figure 61
Long-finned squid fall abundance, 2005-2014	Figure 62

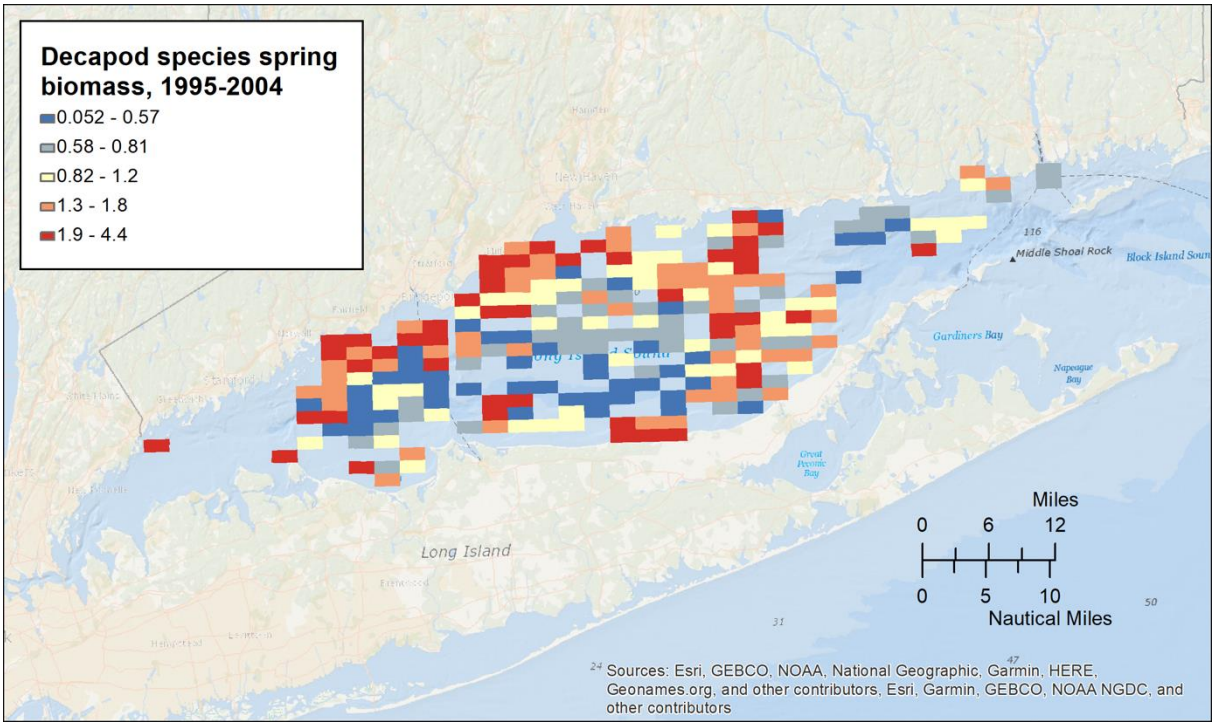

Figure 47. Decapod species spring biomass, 1995-2004; CT DEEP Marine Fisheries Long Island Sound

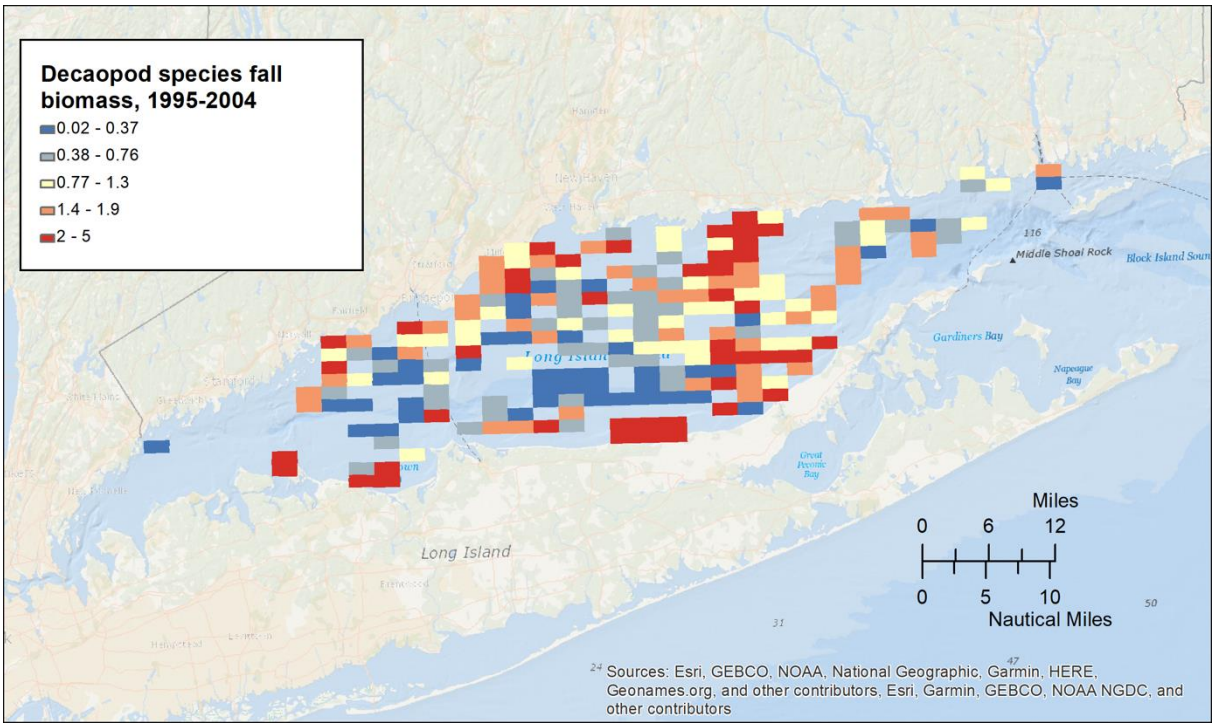

Figure 48. Decapod species fall biomass, 1995-2004; CT DEEP Marine Fisheries Long Island Sound

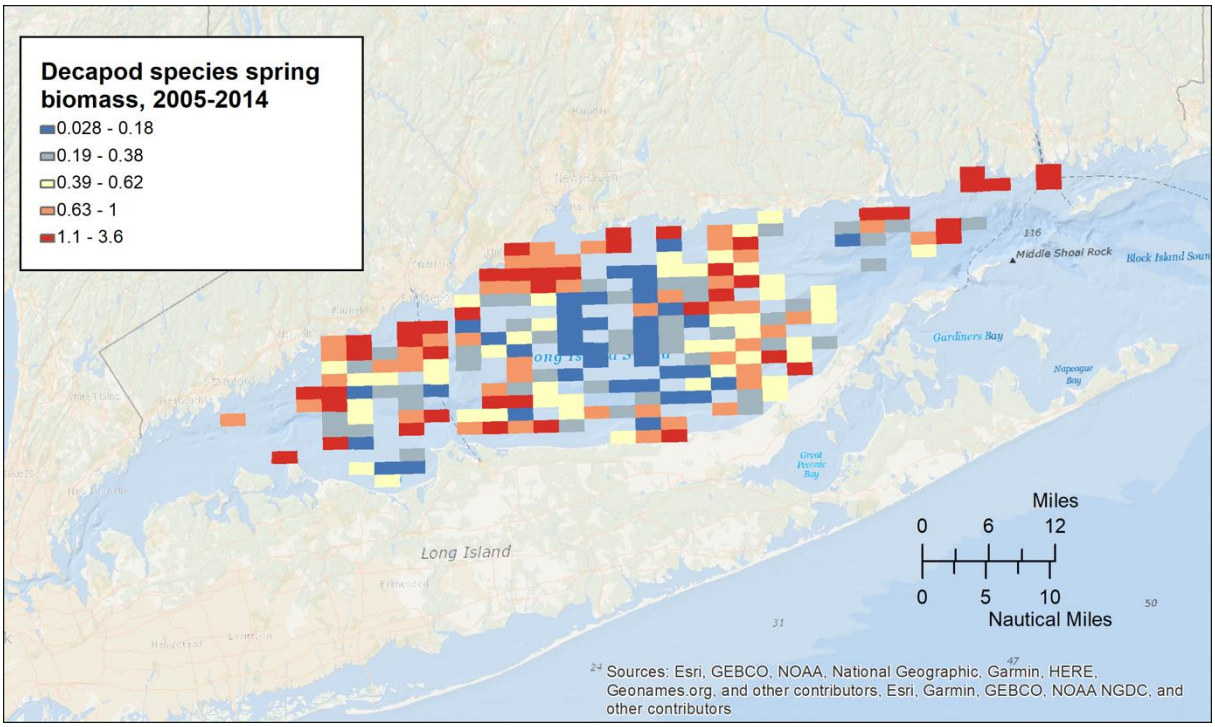

Figure 49. Decapod species spring biomass, 2005-2014; CT DEEP Marine Fisheries Long Island Sound

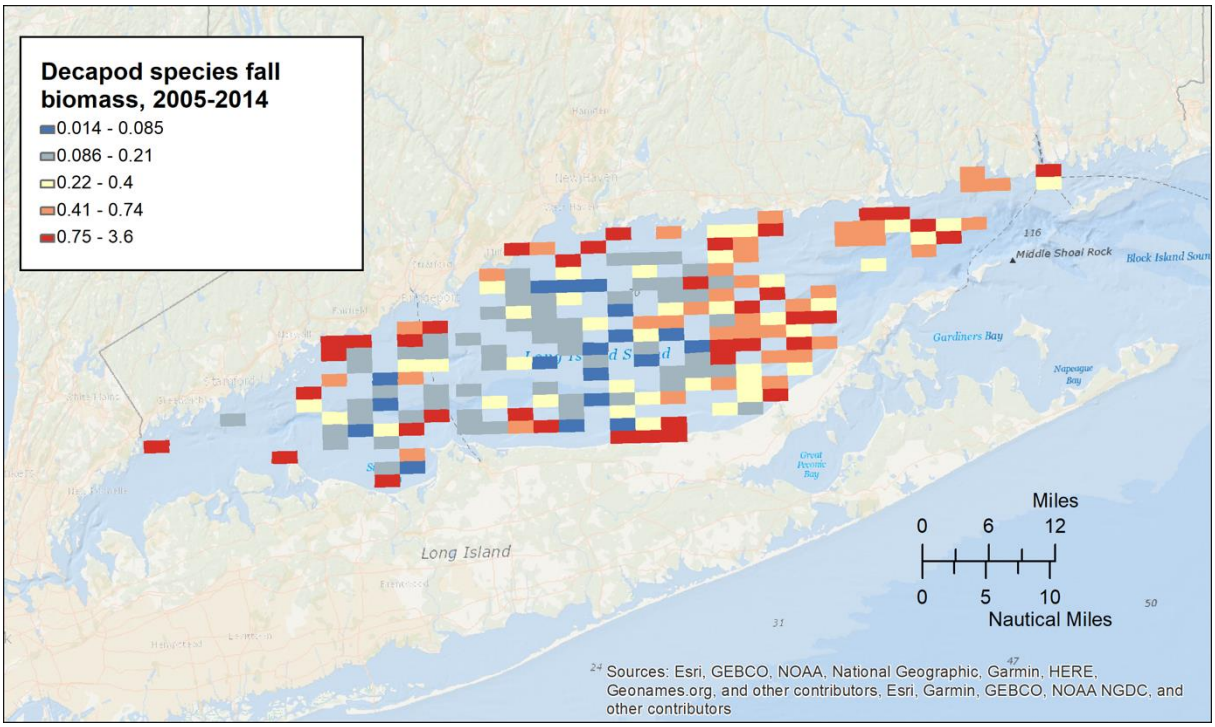

Figure 50. Decapod species fall biomass, 2005-2014; CT DEEP Marine Fisheries Long Island Sound

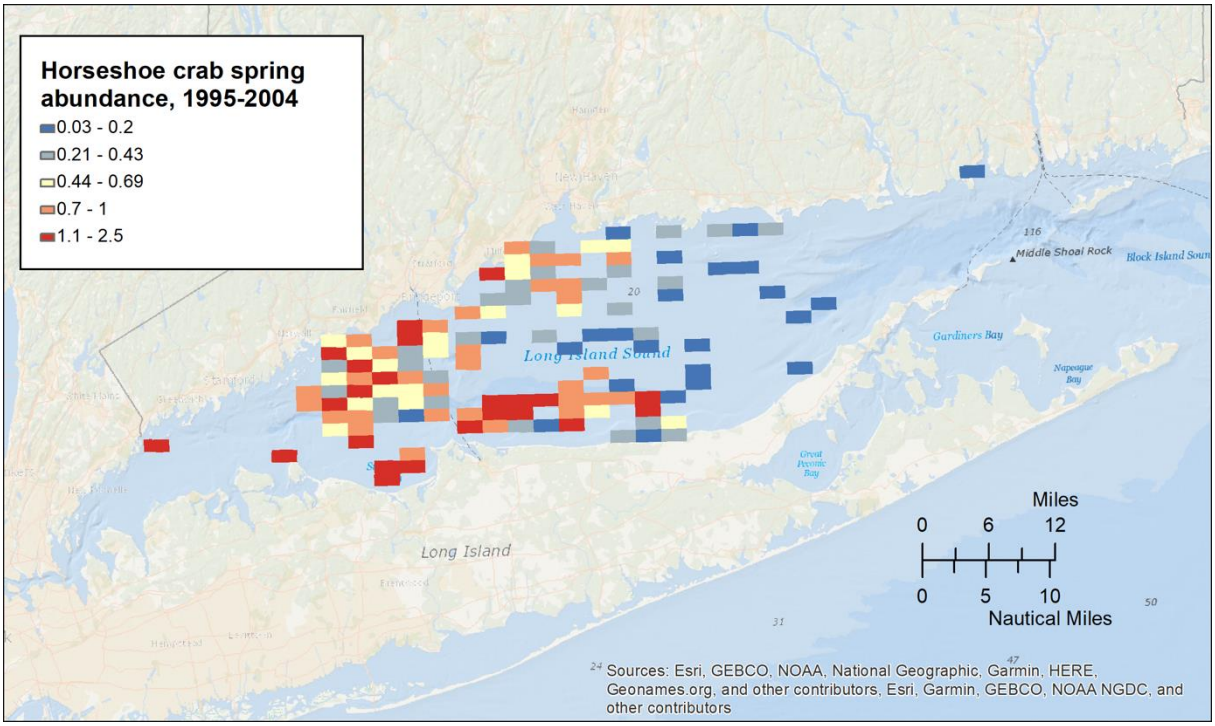

Figure 51. Horseshoe crab spring abundance, 1995-2004; CT DEEP Marine Fisheries Long Island Sound

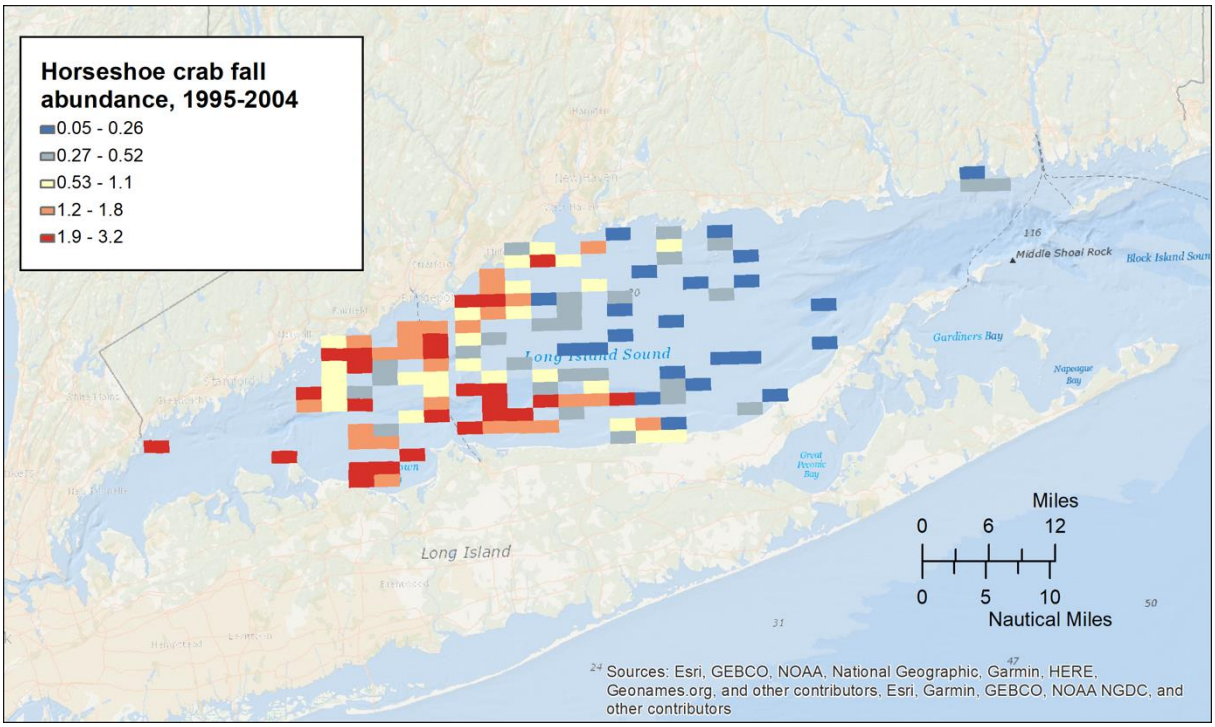

Figure 52. Horseshoe crab fall abundance, 1995-2004; CT DEEP Marine Fisheries Long Island Sound

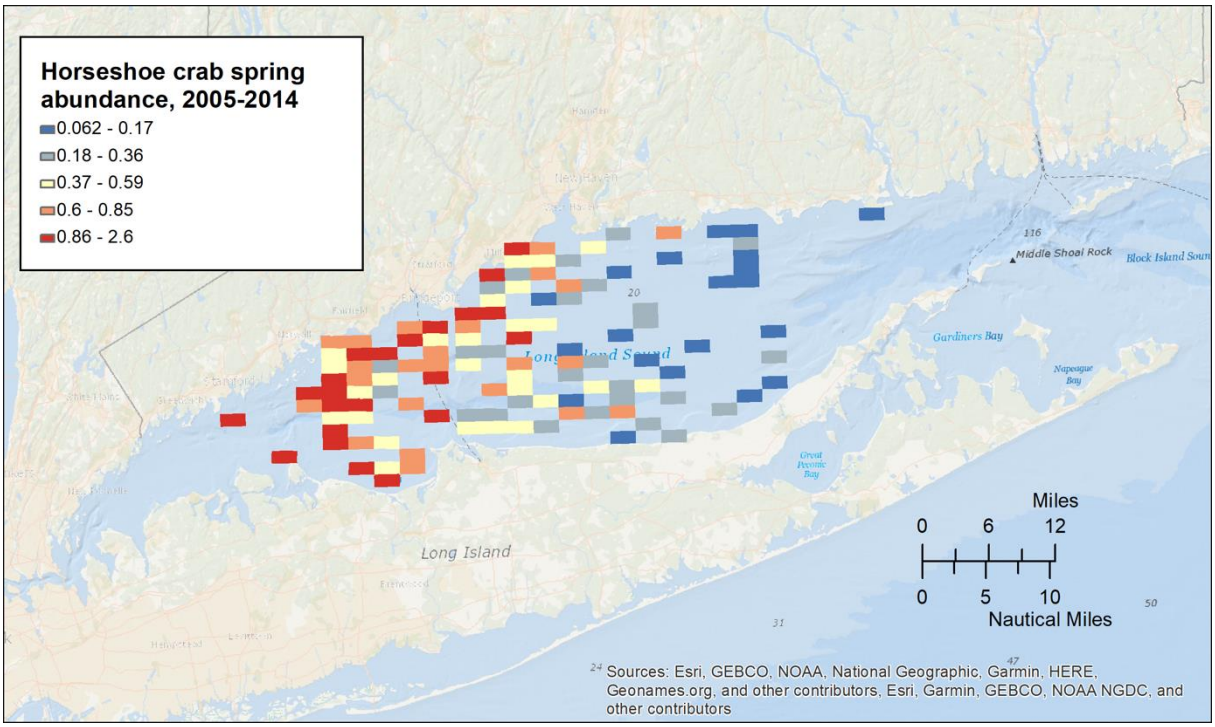

Figure 53. Horseshoe crab spring abundance, 2005-2014; CT DEEP Marine Fisheries Long Island Sound

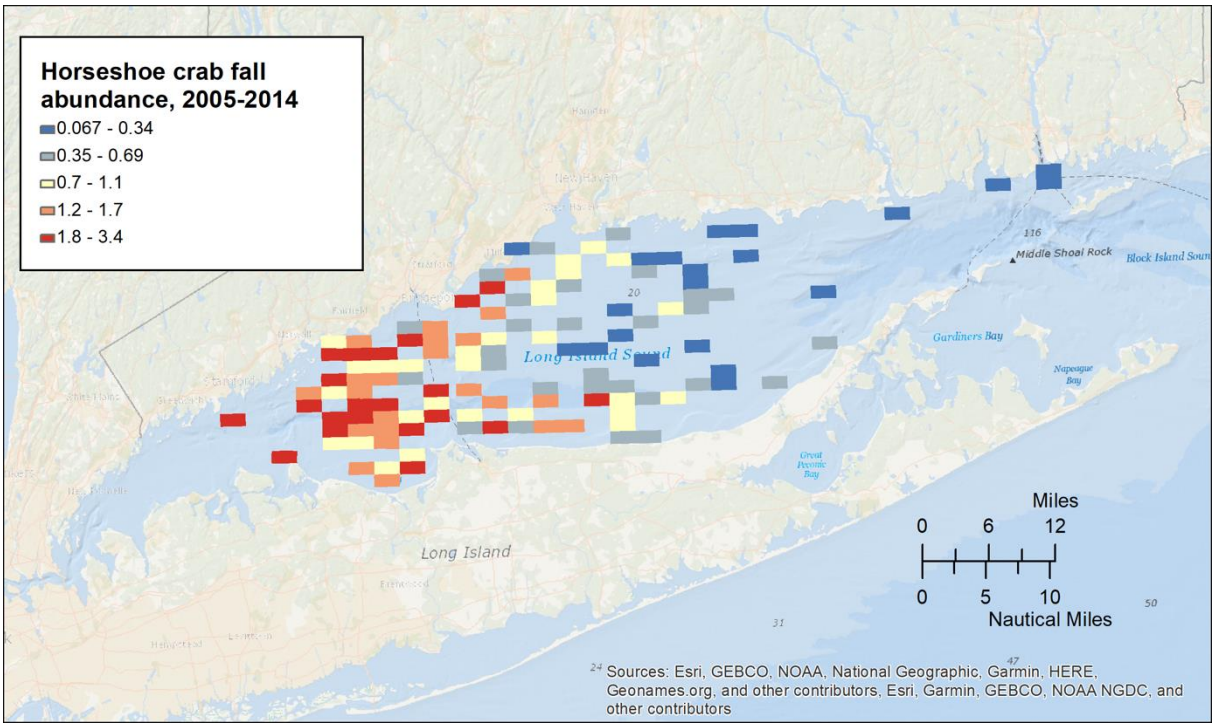

Figure 54. Horseshoe crab fall abundance, 2005-2014; CT DEEP Marine Fisheries Long Island Sound

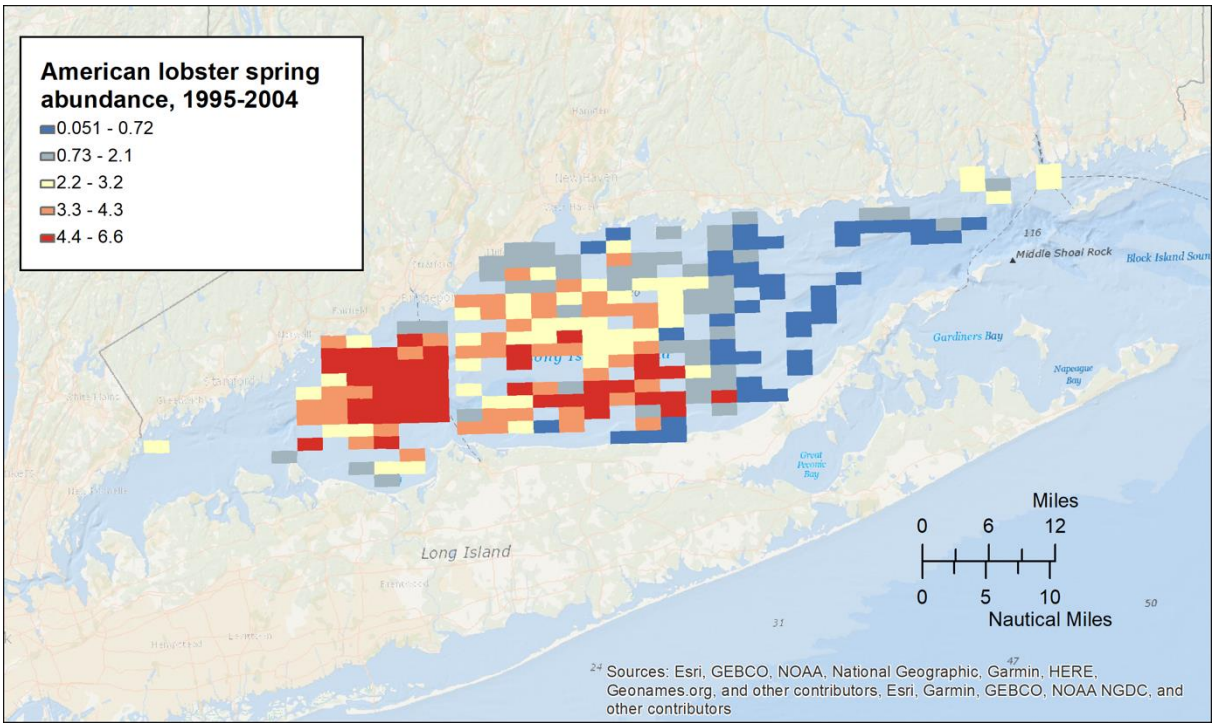

Figure 55. American lobster spring abundance, 1995-2004; CT DEEP Marine Fisheries Long Island Sound

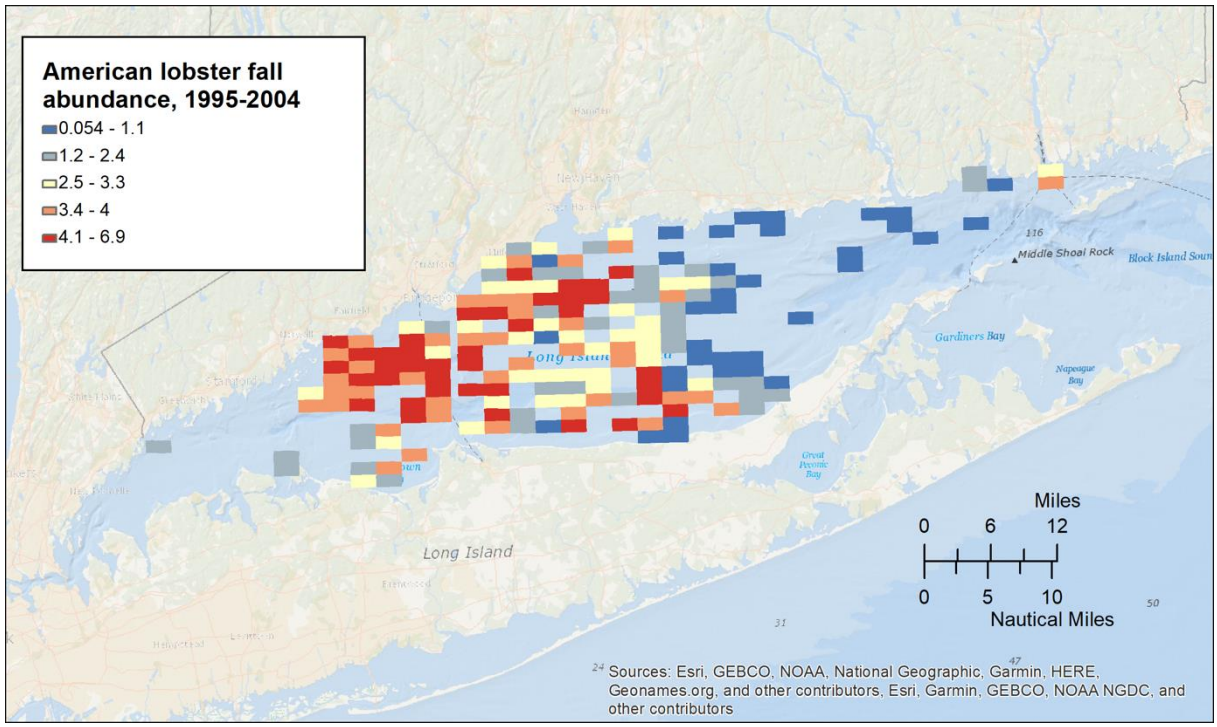

Figure 56. American lobster fall abundance, 1995-2004; CT DEEP Marine Fisheries Long Island Sound

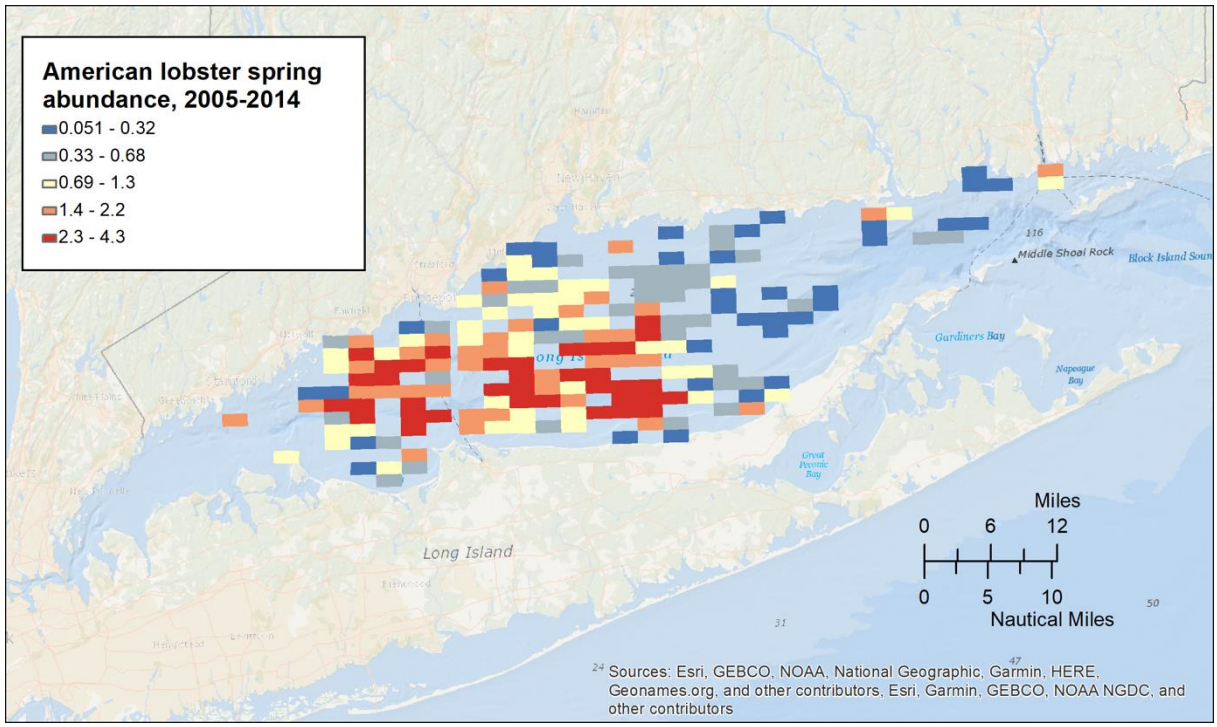

Figure 57. American lobster spring abundance, 2005-2014; CT DEEP Marine Fisheries Long Island Sound

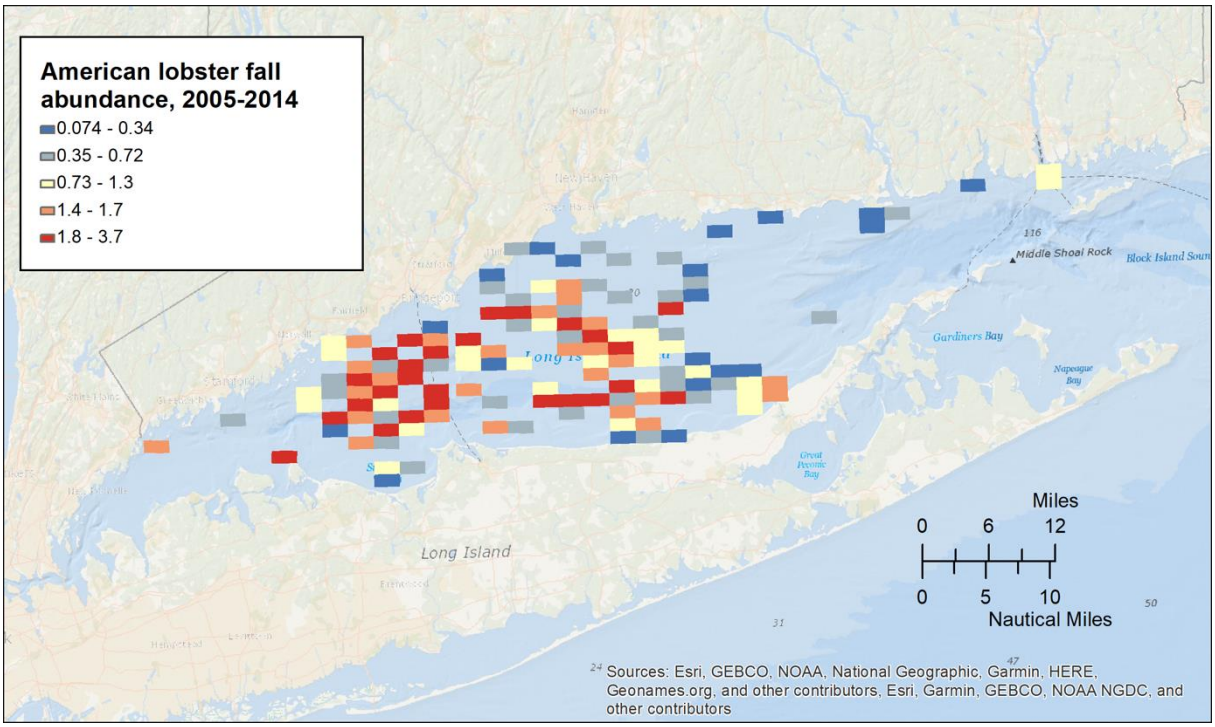

Figure 58. American lobster fall abundance, 2005-2014; CT DEEP Marine Fisheries Long Island Sound

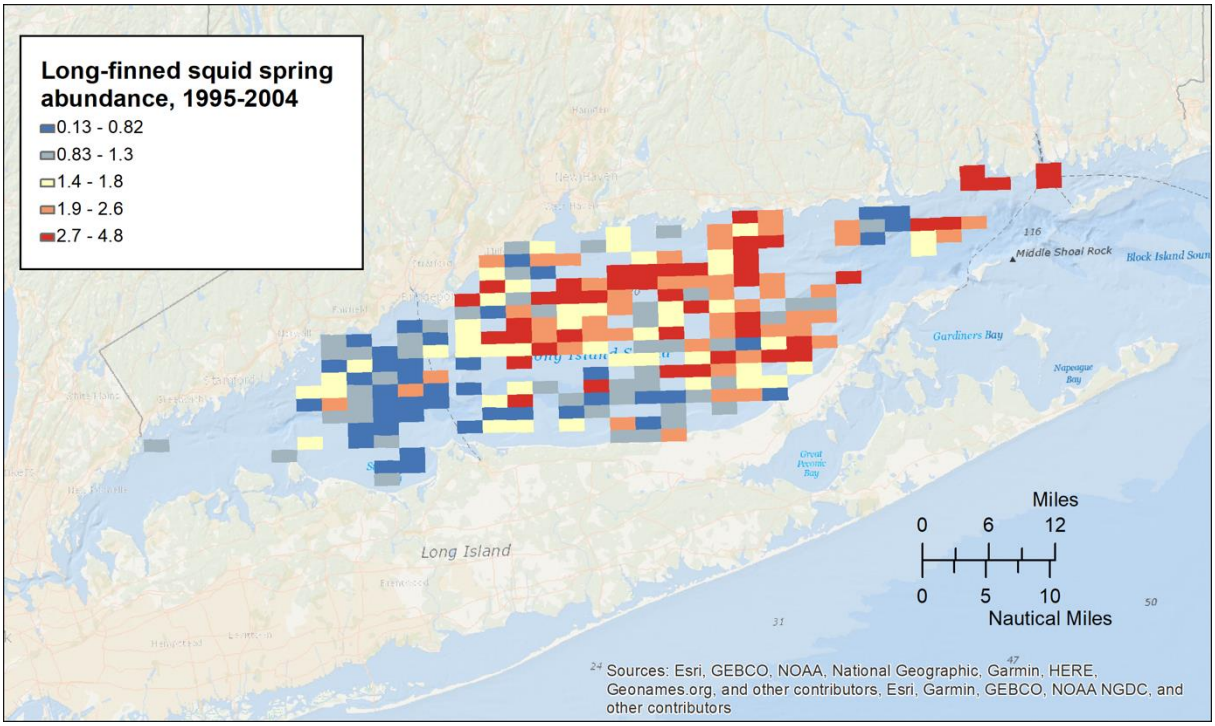

Figure 59. Long-finned squid spring abundance, 1995-2004; CT DEEP Marine Fisheries Long Island Sound

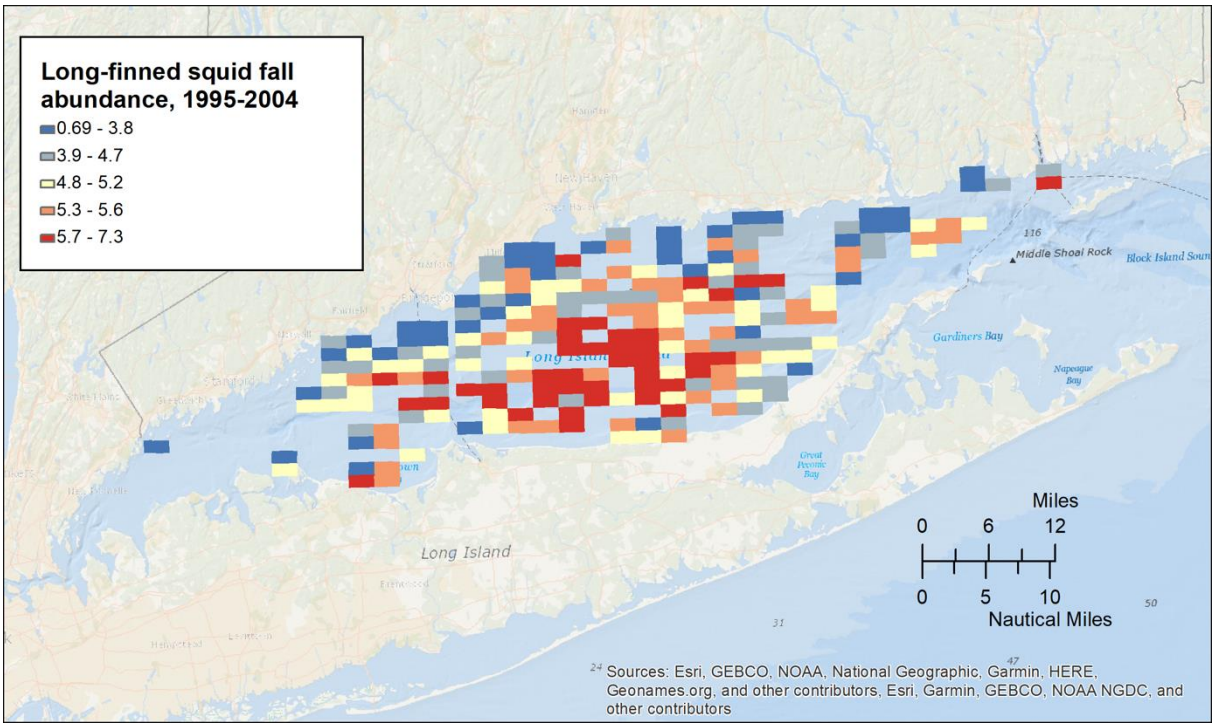

Figure 60. Long-finned squid fall abundance, 1995-2004; CT DEEP Marine Fisheries Long Island Sound

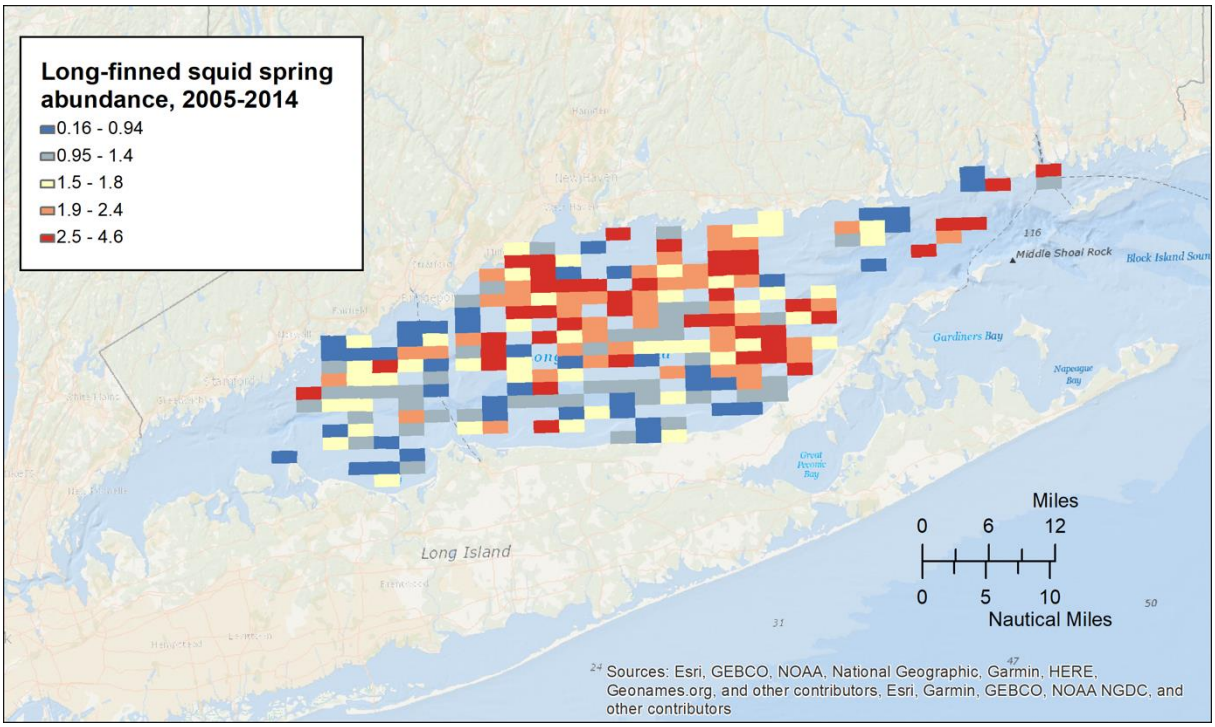

Figure 61. Long-finned squid spring abundance, 2005-2014; CT DEEP Marine Fisheries Long Island Sound

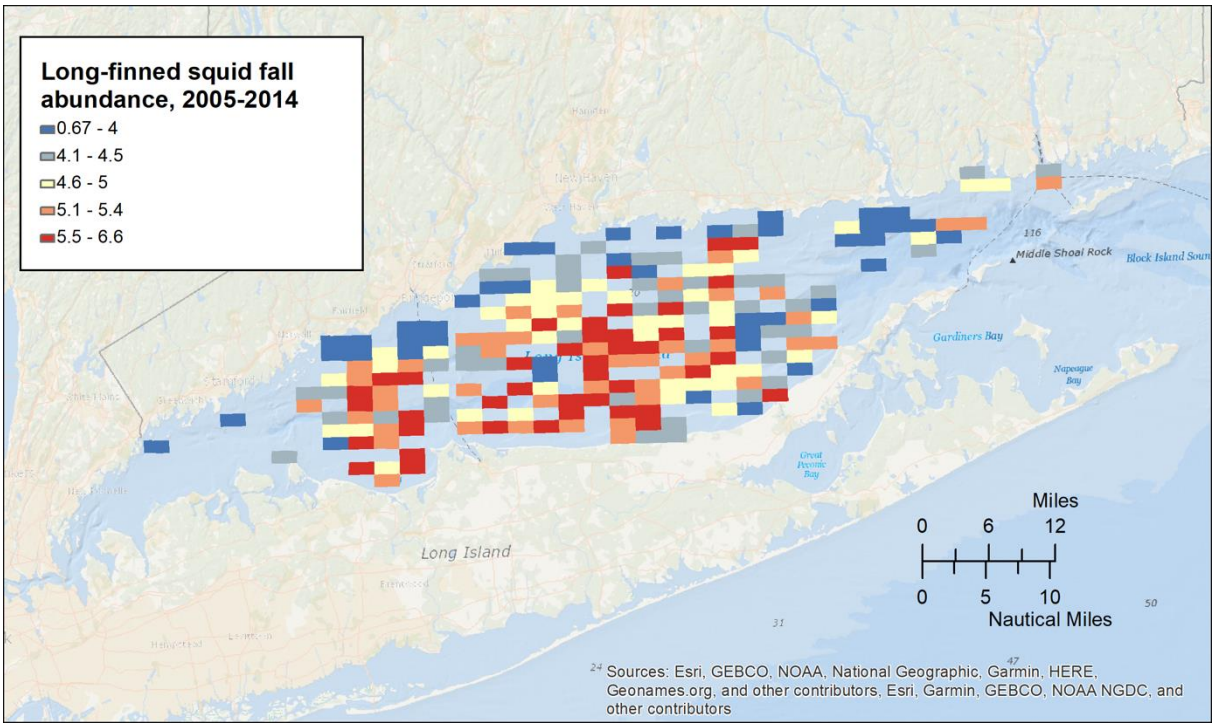

Figure 62. Long-finned squid fall abundance, 2005-2014; CT DEEP Marine Fisheries Long Island Sound

Predicted horseshoe crab spawning beach use

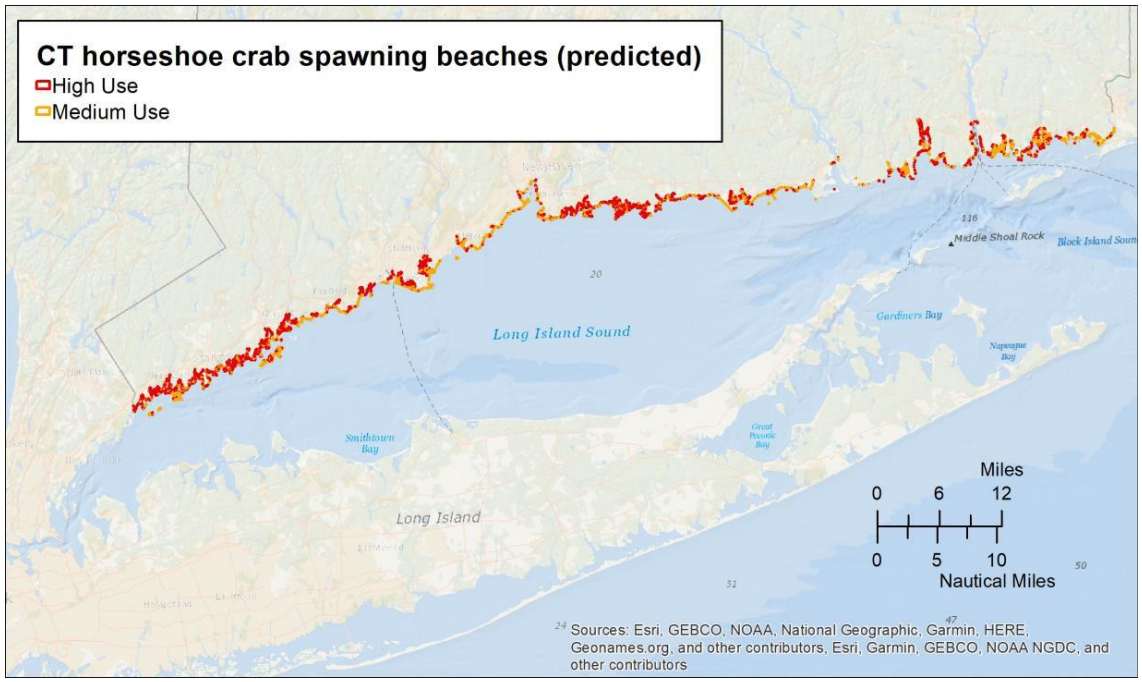

Figure 63. Predicted horseshoe crab spawning beach use; CT DEEP Marine Fisheries

Source – CT DEEP Marine Fisheries

In the Blue Plan Resource and Use Inventory – yes

Summary – Predicted horseshoe crab spawning use classifications for Connecticut beaches. These data are derived from Alicia Landi's thesis and are symbolized by use class. Use classes are high or medium (low or unknown classes are removed) and characterize costal segments predicted to be important horseshoe crab spawning beaches. Additional information can be found in Landi et al. 2014[3] All high and medium use-classes were considered by the EEG to be ESA.

Status/comments – These data were included in Connecticut's 2015 Wildlife Action Plan Key Habitats and Communities. These data are delineations of beaches, so clipping to the Blue Plan planning area omits many features and retains parts of polygons that extend beyond the immediate coastline (i.e., broad flat beaches).

[3] Landi, A. A., Vokoun, J. C., Howell, P., & Auster, P. (2014). Predicting use of habitat patches by spawning horseshoe crabs (*Limulus polyphemus*) along a complex coastline with field surveys and geospatial analyses. Aquatic Conservation: Marine and Freshwater Ecosystems, 25, 380-395.

Frequency of projected bottom water temperatures

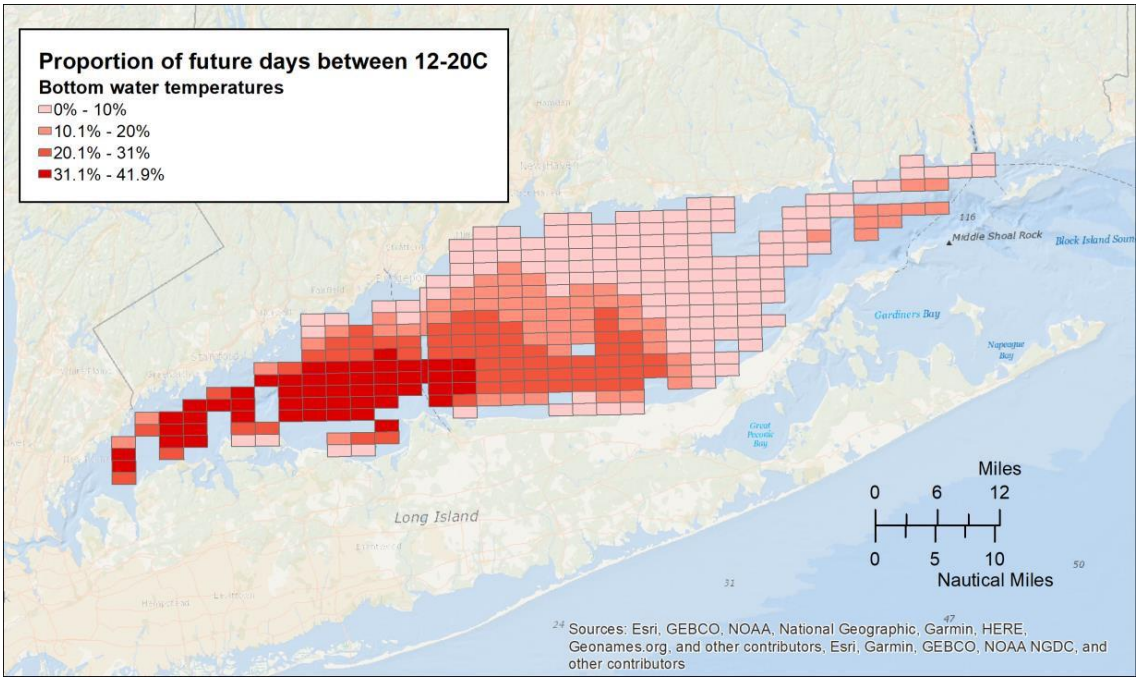

Figure 64. Proportion (frequency) of future (projected) bottom water temperatures; Stevens Institute, CT DEEP Marine Fisheries

Source – Stevens Institute, CT DEEP Marine Fisheries

In the Blue Plan Resource and Use Inventory – yes

Summary – Provided by CT DEEP Marine Fisheries, this layer represents the frequency or percentage of projected future days when bottom water temperatures remain within American lobsters' tolerance (between 12-20°C) from July to September. This map was developed from a projected temperature layer that corresponded to the Long Island Sound Trawl Survey (LISTS) grid, developed by the Stevens Institute. The EEG considered any LISTS grid cell with frequencies greater than 31% to be ESA. This threshold was chosen because between 2002-2012 temperatures remained between 12-20°C from July to September for ~32% of the time and allowed for some American lobster survival.

Status/comments – Generally good coverage of the Blue Plan planning area (all locations where the LISTS can access). CT DEEP has used these data to identify places in Long Island Sound where American lobster habitat may exist under future warming scenarios.

12. Sessile-mollusk-dominated communities

Natural shellfish (bivalve) aggregations

Source – CT Bureau of Aquaculture, CT Sea Grant

In the Blue Plan Resource and Use Inventory – no; added to the EC Summary by the EEG

Summary – Locations of non-harvested, non-managed shellfish beds

Status/comments – These data not yet available, but are being collected as one part of an ongoing project. The EEG intends to incorporate these data into this criterion when they are available.

Sessile-mollusk-dominated communities occurrence

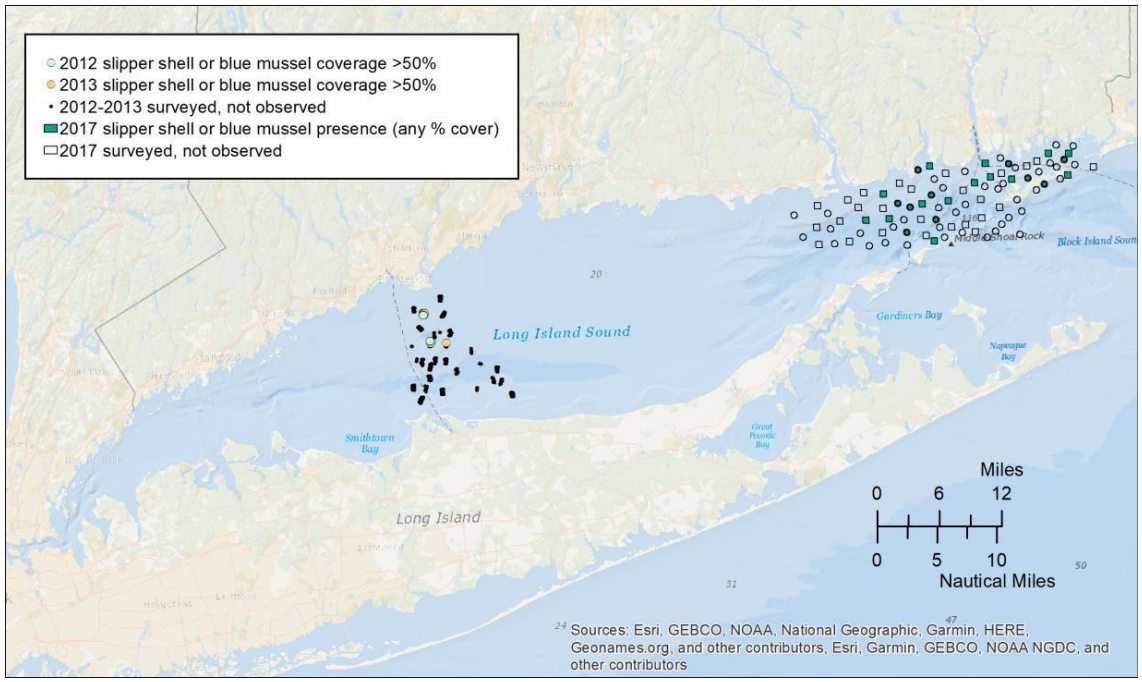

Figure 65. Sessile-mollusk-dominated communities occurrence; University of Connecticut

Source – University of Connecticut, Long Island Sound Mapping and Research Collaborative, Long Island Sound Seafloor Mapping Project

In the Blue Plan Resource and Use Inventory - yes

Summary – Observations of percent cover (2012 and 2013) and presence/absence (2017) of slipper shells (*Crepidula fornicata*) and blue mussels (*Mytilus edulis*) from 2012, 2013, and 2017 SEABOSS surveys near Stratford Shoals and in eastern Long Island Sound. The EEG considered percent cover >50% in 2012 and 2013 and presence in 2017 to be ESA.

Stratford Shoals data (2012, 2013) are published in the Long Island Sound Cable Fund Steering Committee Seafloor Mapping report (2015)[4]§. Eastern Long Island Sound data were

[4] Long Island Sound Cable Fund Steering Committee. (2015). Seafloor mapping of Long Island Sound – Final report – Phase 1 Pilot Project. Stamford, CT: US Environmental Protection Agency Long Island Sound Study. http://longislandsoundstudy.net/wp-content/uploads/2010/02/LISCF_PilotMappingProject_Report_Final_June2015-reduced-file-size.pdf

collected in 2017, are still being fully analyzed, and were provided in unpublished form by EEG members Chris Conroy and Peter Auster.

Status/comments – Spatially limited to Stratford Shoals and eastern Long Island Sound.

Expert participatory mapping for sessile-mollusk-dominated communities

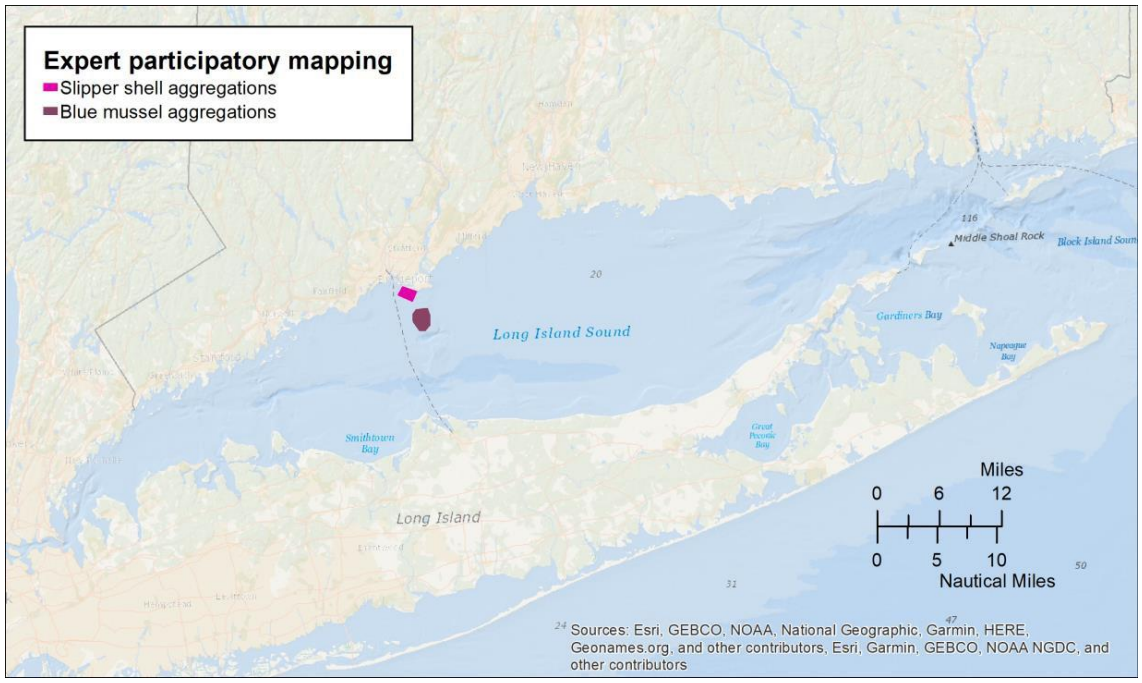

Figure 66. Area representing aggregations of slipper shells and blue mussels for Long Island Sound, delineated through expert participatory mapping.

Source – Patrick Comins, Executive Director, Connecticut Audubon Society

In the Blue Plan Resource and Use Inventory – no; added to the EC Summary by the EEG

Summary – On January 3, 2019, Patrick Comins delineated additional areas of sessile-mollusk-dominated communities in Long Island Sound that were not reflected in the observed data products described above. The delineated areas represent aggregations of slipper shells and blue mussels. These areas were included in the final map of ESA for this criterion.

Status/comments – Noted in the ESA documentation as expert participatory mapping

13.Managed shellfish beds

Connecticut managed shellfish beds

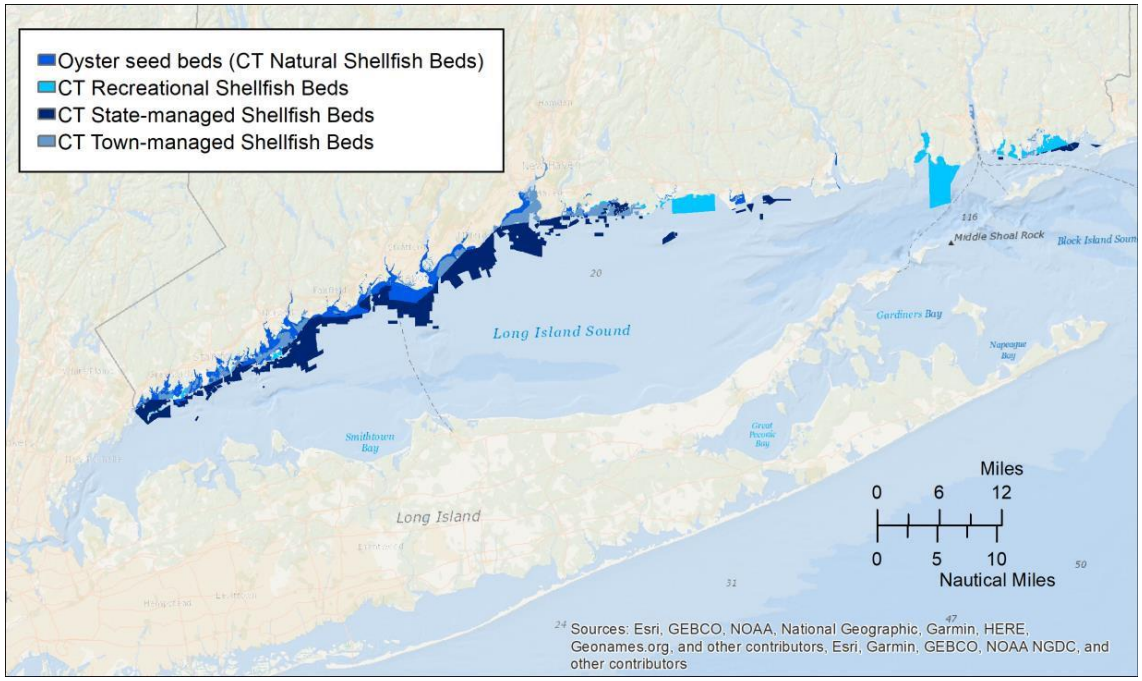

Figure 67. Connecticut managed shellfish beds; CT Bureau of Aquaculture

Source – CT Bureau of Aquaculture

In the Blue Plan Resource and Use Inventory – yes

Summary – Includes oyster seed beds (also called "Natural beds"), recreational shellfish beds, state-managed shellfish beds, and town-managed shellfish beds. All four layers were considered by the EEG to be ESA.

Status/comments – These four layers together comprise the majority of the known locations for shellfish management in Connecticut, including aquaculture and harvesting. The state of New York does not maintain comparable spatial information for managed shellfish beds.

14.Soft-bottom benthic communities

Although none of the maps identified in this section were used by the EEG to identify ESA for soft-bottom benthic communities (see Blue Plan ESA Methods Appendix for details), the EEG includes representations of these data in this document to help advance the discussion on this topic. Below are datasets characterized by the EEG as promising examples of data products that could be used in the future to identify ESA for this criterion.

Integrated habitat map

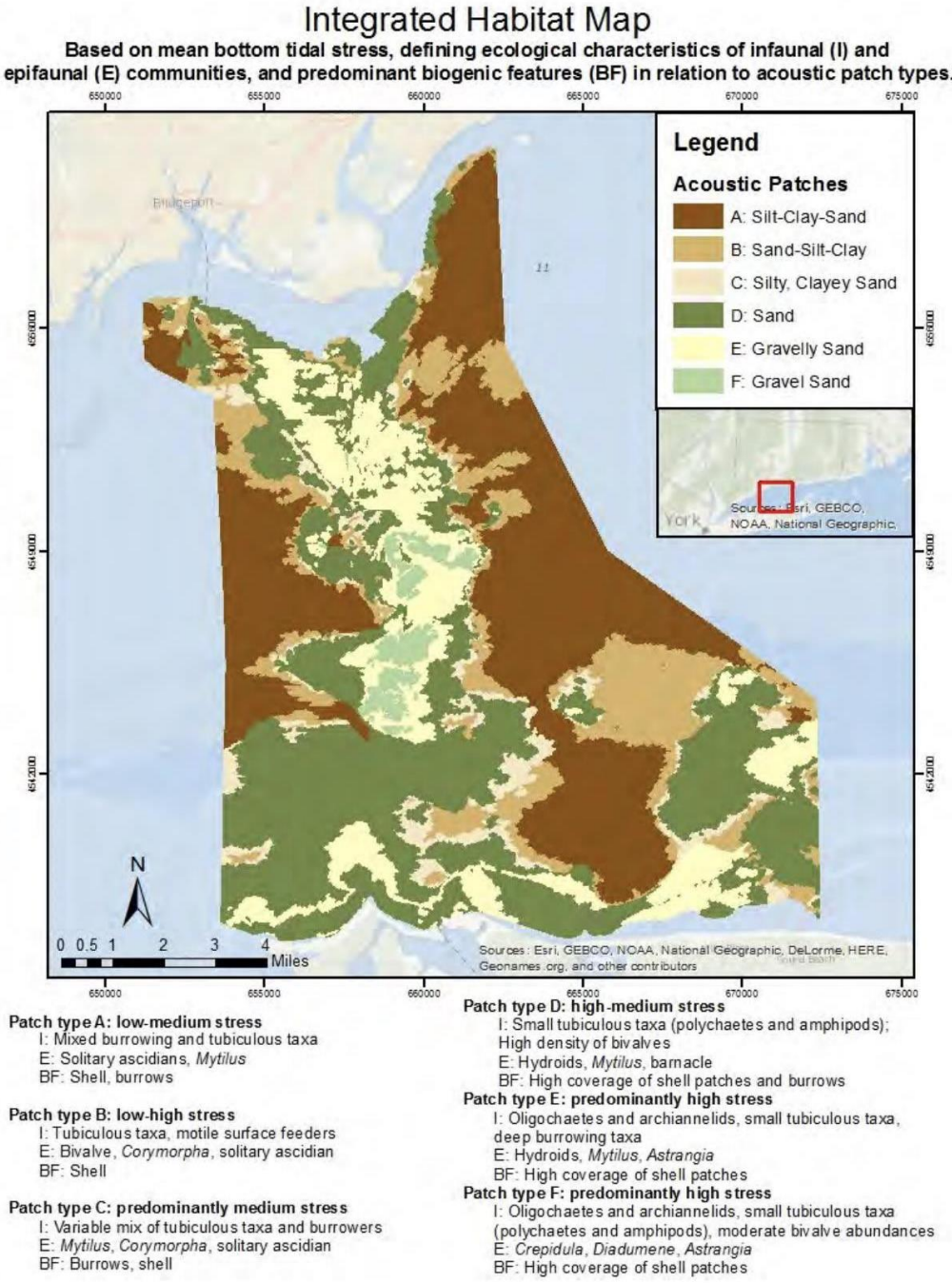

Figure 68. Integrated habitat map for the Stratford Shoals of Long Island Sound. This figure appears in the 2015 Phase 1 seafloor mapping Figure 5.6-5.

Source – University of Connecticut, Long Island Sound Mapping and Research Collaborative, Long Island Sound Seafloor Mapping Project

In the Blue Plan Resource and Use Inventory – yes

Summary – The integrated habitat map merges benthic physical and biological data to holistically characterize habitats. This map was developed for the Stratford Shoals area only, using data derived from the Phase I mapping effort. If comparable data were available for all of Long Island Sound (i.e., full seafloor coverage), the EEG indicated that it would likely be able to use the layer to identify ESA for soft-bottom benthic communities.

However, these data were not used by the EEG to identify ESA for soft-bottom benthic communities.

Stratford Shoals data are published in the Long Island Sound Cable Fund Steering Committee Seafloor Mapping report (2015)[5].

Status/comments – Spatially limited to Stratford Shoals.

Habitat optimization analysis

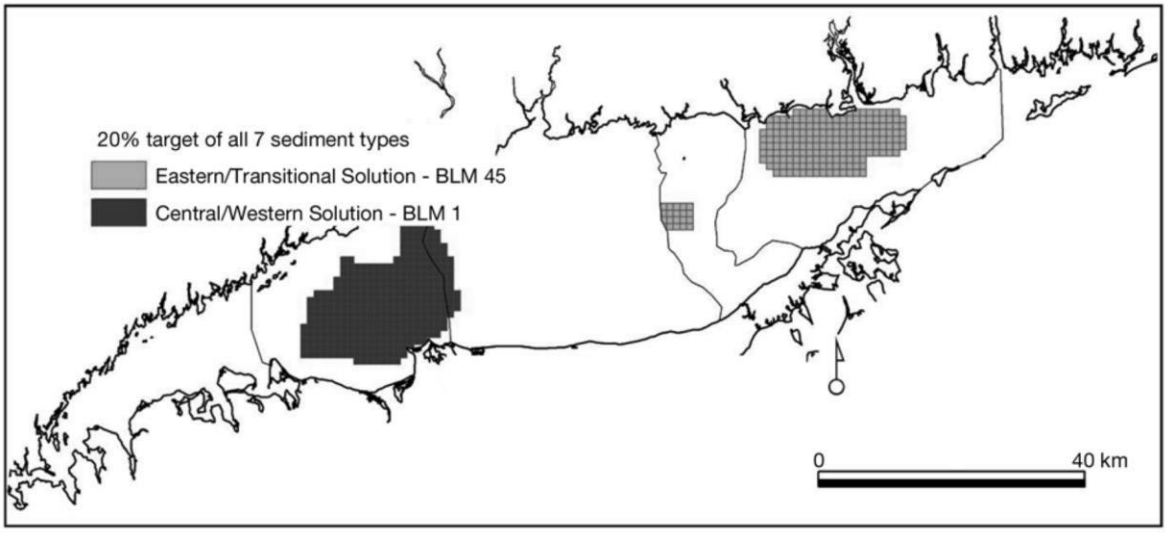

Figure 69. Map from Neely and Zajac (Figure 7) that shows areas representative of at least 20% of each of the 7 sediment/habiat types that exist in all of Long Island Sound.

Source – Neely and Zajac 2008[6]

[5] Long Island Sound Cable Fund Steering Committee. (2015). Seafloor mapping of Long Island Sound - Final report: Phase 1 Pilot Project. Stamford, CT: US Environmental Protection Agency Long Island Sound Study. http://longislandsoundstudy.net/wp-content/uploads/2010/02/LISCF_PilotMappingProject_Report_Final_June2015-reduced-file-size.pdf

[6] Neely AE, and Zajac RN. 2008. Applying marine protected area design models in large estuarine systems. Marine Ecology Progress Series 373: 11-23.

In the Blue Plan Resource and Use Inventory – no; added to the EC Summary by the EEG

Summary – This dataset is the result of research at the University of New Haven, published in a peer-reviewed journal. The software MARXAN was used to identify areas within regions of Long Island Sound where at least 20% of each sediment texture type (used as a proxy for habitats) was represented. The eastern region in Figure 61 is characterized by heterogenous seafloor and higher species richness than the western/central region, which had more uniform community types and lower species richness.

It was not established by the EEG how these data would apply to identification of ESA for soft-bottom benthic communities, and therefore, these data were not used by the EEG.

Status/comments – Under consideration for applicability to the ESA

Appendix

Datasets relevant to identifying Ecologically Significant Areas considered by the EEG.

Parameter	Source	Summary	Status/comments	Final usage
Hard bottom points	The Nature Conservancy Long Island Sound Ecological Assessment (TNC LISEA)	Points described as "bedrock", "boulders", "rock", or "rocky" from two USGS databases (usSEABED and East Coast Sediment Texture Database) and from NOAA Electronic Nautical Charts	Preferred use of the known hard bottom points versus the conservative hard bottom model presented in the TNC LISEA.	Yes
Sediment classes	TNC LISEA	Grain size thresholds were determined by recursive partitioning to best reflect differences in benthic community types	Corresponded closely to USGS surficial sediment map.	No
Bathymetric complexity	TNC LISEA	Weighted standard deviation of slope within 1 km	Preferred other complexity metric.	No
Ecological marine unit richness	TNC LISEA	Number of Ecological Marine Units (EMUs) within 1 km. EMUs are combinations of depth, sediment, and seabed forms.		No
Long Island Sound surficial sediment map	USGS, Poppe et al., 2000	The USGS Coastal and Marine Geology Program, in cooperation with CT DEEP, produced detailed geologic maps of the seafloor in Long Island Sound. The maps define the geological variability of seafloor, on the primary controls of benthic habitat diversity, improve understanding of the processes that control the distribution and transport of bottom sediments, benthic habitats, and associated infaunal community structures.	Interpretations integrate thousands of available samples, analyses, and descriptions.	Yes

Parameter	Source	Summary	Status/comments	Final usage
Terrain ruggedness index (TRI), 8m composite	EEG	The TRI metric reflects the difference between the depth at each point on the seafloor and the depth of the points surrounding it. A composite bathymetry dataset with a horizontal resolution of 8 meters was created for Long Island Sound by mosaicking the most recent federal and local datasets from the NOAA National Ocean Service. TRI was calculated at the scale of a single pixel (8m).	Highest resolution bathymetry and complexity dataset available.	Yes
Wrecks and obstructions	NOAA Office of Coast Survey Automated Wreck and Obstruction Information System (AWOIS)	Contains information on over 10,000 submerged wrecks and obstructions in US coastal waters. However, the Office of Coast Survey stopped updating AWOIS.	Authoritative resource on locations of wrecks and obstructions.	Yes
Eelgrass	Bradley and Paton 2018, Tier 1 mapping of Zostera marina in Long Island Sound and change analysis	Aerial photography eelgrass mapping with field verification, conducted by the University of Rhode Island, the USFWS, and the USGS.	Authoritative eelgrass maps used by the state of Connecticut.	Yes
	Tiner et al. 2013, 2012 Eelgrass Survey for Eastern Long Island Sound, Connecticut and New York. USFWS National Wetlands Inventory Program	Aerial photography eelgrass mapping with field verification, conducted by the National Wetlands Inventory Program.	Authoritative eelgrass maps used by the state of Connecticut.	Yes

Parameter	Source	Summary	Status/comments	Final usage
	Tiner et al. 2010, 2009 Eelgrass Survey for Eastern Long Island Sound, Connecticut and New York. USFWS National Wetlands Inventory Program	Aerial photography eelgrass mapping with field verification, conducted by the National Wetlands Inventory Program.	Authoritative eelgrass maps used by the state of Connecticut.	Yes
	Tiner 2006, Delineations of 2006 eelgrass beds, eastern Connecticut to Rhode Island border, USFWS National Wetlands Inventory Program	Aerial photography eelgrass mapping with field verification, conducted by the National Wetlands Inventory Program.	Authoritative eelgrass maps used by the state of Connecticut.	Yes
	Tiner 2002, Interpretation and identification of Eelgrass beds located in the Long Island Sound Eastern Connecticut shoreline, Fishers Island NYS and the Northshore of Long Island NYS, USFWS National Wetlands Inventory Program	Aerial photography eelgrass mapping with field verification, conducted by the National Wetlands Inventory Program.	Authoritative eelgrass maps used by the state of Connecticut.	Yes
Sturgeon gear restriction areas	CT DEEP Marine Fisheries	Endangered species; Areas where certain fishing gear is prohibited to protect sturgeon species	Recommended for inclusion by CT DEEP Marine Fisheries	Yes
Sturgeon (Atlantic and shortnose) use classes	CT DEEP Marine Fisheries	Endangered species; Use classifications based on Long Island Sound Trawl Survey data	Recommended for inclusion by CT DEEP Marine Fisheries	Yes

Parameter	Source	Summary	Status/comments	Final usage
Sturgeon migratory corridor	CT DEEP Marine Fisheries	Endangered species; Shapefile provided by CT DEEP Marine Fisheries	Recommended for inclusion by CT DEEP Marine Fisheries	Yes
Roseate tern summer occurrence	University of Connecticut, Steen & Elphick	Endangered species; Occurrence models developed from eBird observations and environmental covariates including depth, distance to shore, and presence of eelgrass.	Best available representation of roseate tern occurrence.	Yes
Connecticut Natural Diversity Database (NDDB)	CT DEEP	Maps that represent approximate locations of endangered, threatened and special concern species and significant natural communities in Connecticut, compiled from CT DEEP staff, scientists, conservation groups, and landowners.	While not detailed or specific, these are the data that a project proponent or applicant may be directed to consult by the state.	Yes
Connecticut critical habitats	CT DEEP	Identification and distribution of a subset of important wildlife habitats identified in the Connecticut Comprehensive Wildlife Conservation Strategy.	Represents features that may be captured via other datasets such as coastal wetlands and NDDB, but included for completeness.	Yes
New York rare animals and rare plants	NY DEC	Analogous to the CT NDDB, maps that represent approximate locations of rare species, including endangered, threatened, and species of concern in New York.	While not detailed or specific, these are the data that a project proponent or applicant may be directed to consult by the state.	Yes
New York significant natural communities	NY DEC	Database of New York locations of rare or high-quality wetlands, forests, grasslands, ponds,	While not detailed or specific, these are the data that a project proponent or applicant may be	Yes

Parameter	Source	Summary	Status/comments	Final usage
		other types of habitats, ecosystems, and ecological areas.	directed to consult by the state.	
New York significant coastal fish and wildlife habitats	NY DEC and DOS	Habitats in New York that: are essential to the survival of a large portion of a particular fish or wildlife population; support populations of species which are endangered, threatened or of special concern; support populations having significant commercial, recreational, or educational value; or exemplify a habitat type which is not commonly found in the State or in a coastal region	Included since these areas were identified from a similar criteria-based process for NY coastal habitats in the 1980s.	Yes
US Endangered Species Act Critical Habitats	NOAA GARFO	Spatially defined Critical Habitats for Atlantic sturgeon	This is the only federal Critical Habitat defined within Long Island Sound	Yes
Endangered, threatened, species of concern, or candidate species occurrence or abundance maps	EEG unable to find adequate data for all relevant species		EEG unable to find adequate data	No
Cold water coral presence	University of Connecticut	Observed presence of cold water corals within two discrete study areas – Stratford Shoals and eastern Long Island Sound	Incomplete coverage of the Blue Plan planning area.	Yes
Cold water coral habitat suitability	EEG unable to find adequate data		EEG unable to find adequate data	No
Coastal wetlands	NOAA Environmental Sensitivity Index	Developed to support oil spill/disaster response nationally, with maps available for Connecticut and New York.	Does not reflect the most recent National Wetlands Inventory data for CT and NY.	No

Parameter	Source	Summary	Status/comments	Final usage
Coastal wetlands	USFWS National Wetlands Inventory	Delineation of coastal wetlands for Connecticut and New York, clipped to the boundary of the Long Island Sound Study	Reflects the most recent and comprehensive data.	Yes
Predicted cetacean density	Duke University Marine Geospatial Ecology Lab, Marine-life Data and Analysis Team, Northeast Ocean Data Portal	Predicted density maps for eleven cetacean species or species guilds with coverage in Long Island Sound. Several maps of annual averages and others of monthly predictions.	Data products fully cover the Blue Plan planning area, were updated in 2018, and have been used in the Northeast and Mid-Atlantic regional planning processes.	Yes
Cetacean strandings	Mystic Aquarium	Strandings on the Connecticut shore 1997-2017	Locations of strandings do not adequately reflect cetacean habitat use.	No
Seal concentration areas	EEG	NOAA Environmental Sensitivity Index delineation of seal concentration areas in Long Island Sound, augmented by expert participatory mapping.	Depicts haul-out locations but does not reflect all areas important for in-water behaviors.	Yes
Seal strandings	Mystic Aquarium	Strandings on the Connecticut shore 1997-2017	Locations of strandings do not adequately reflect pinniped habitat use.	No
Sea turtle occurrence and abundance	EEG unable to find adequate data		EEG unable to find adequate data	No
Sea turtle live strandings and in-water observations	Riverhead Foundation for Marine Research and Preservation	Locations of recent observations of live sea turtles, stranded or in-water near New York coast In Long Island Sound.	Very few but verified records of live sea turtle habitat use.	Yes
Sea turtle live strandings and in-water observations	Mystic Aquarium	Locations of recent observations of live sea turtles, stranded or in-water near Connecticut coast In Long Island Sound.	Very few but verified records of live sea turtle habitat use.	Yes

Parameter	Source	Summary	Status/comments	Final usage
2018 coastal Connecticut sea turtle mortality events	EEG	Locations of 2018 mortality events at Silver Sand State Park, Long Beach, and Sheffield Island	Reflect recent trends in sea turtle habitat use.	Yes
Northern diamondback terrapin occurrence	Conserve Wildlife Foundation of NJ	Predicted probability of occurrence of diamondback terrapins from a Maxent model using documented observations between 2000-2012.	Data are used/hosted by USGS.	Yes
Important Bird Areas	Audubon Society	Sites known or thought to regularly hold significant numbers of a globally threatened species; sites known or thought to hold a significant component of a group of species whose breeding distributions define an Endemic 47 Bird Area or Secondary Area; sites known or thought to hold a significant component of the group of species whose distributions are largely or wholly confined to one biome; sites known or thought to hold congregations of ≥ 1% of the global population of one or more species on a regular or predictable basis.	Locations specific to Long Island Sound can be better represented by using species distribution data.	No
Migratory waterfowl concentration areas	CT DEEP	Locations specific to approximately 20 species, derived from a 1991 USFWS report.	Could be considered outdated; locations specific to Long Island Sound can be better represented by using species distribution data.	No

Parameter	Source	Summary	Status/comments	Final usage
Bird special use areas	NOAA Environmental Sensitivity Index	Locations of migratory or wintering areas, nesting sites, concentration areas, roosting areas, and vulnerable occurrences for several types of seabirds, shorebirds, and waterfowl.	Locations specific to Long Island Sound can be better represented by using species distribution data.	No
Seabird occurrence	University of Connecticut	Long Island Sound seabird predicted occurrence models using eBird records and environmental variables from the Blue Plan Inventory for 7 species in summer and 23 species in winter.	Not peer-reviewed (except by the EEG) or published, but the most comprehensive set of species-level bird data products specifically developed for Long Island Sound. During informal review by birders with expertise in Long Island Sound, a few places were identified where model results seemed somewhat incorrect, but no major prediction errors were identified.	Yes
Fish persistence	TNC LISEA	Long Island Sound Trawl Survey (LISTS) grid cells having the highest number of species that have persisted for the longest period (i.e., throughout each period of the LISTS, or 3 periods totaling 26 years at the time of the assessment, 1984- 2009) and each of these species have been detected at a frequency higher than expected, from just under 1 standard deviation to over 2 standard deviations above the mean.	Generally good coverage of the Blue Plan planning area (all locations where the LISTS can access). The persistence metric provides a good "historical" perspective on fish distribution in Long Island Sound. The LISEA analysis integrates many years of data on many species. This layer should be used in a complementary way with additional depictions of more recent fish community distribution and abundance.	Yes

Parameter	Source	Summary	Status/comments	Final usage
Fish and mobile invertebrate abundance	CT DEEP Marine Fisheries	Natural-log mean abundance or biomass for species caught in >5 tows, spring and fall, 1995- 2004 and 2005-2014.	Important to show abundance patterns in both fall and spring and within the two time windows to capture the major changes in fish communities in the Sound.	Yes
Essential fish habitat	NOAA GARFO	Locations of Essential Fish Habitat (EFH) defined in the NEFMC Omnibus Habitat Amendment 2. The EEG developed an EFH overlay map to understand where EFH for various species was most concentrated. Twelve fish species have EFH defined in Long Island Sound, and a maximum of 8 species' EFH overlaps in the Sound.	The 10-minute grid on which EFH is mapped is very large at the scale of Long Island Sound (the Sound is about 10 grid cells wide). As a result, the spatial information provided by the EFH overlay did not contribute enough to merit its inclusion in the delineation of ESA for fish.	No
Predicted horseshoe crab nesting beach use	CT DEEP	Predicted horseshoe crab spawning use classifications for Connecticut beaches.	These data were included in Connecticut's 2015 Wildlife Action Plan Key Habitats and Communities. These data are delineations of beaches, so clipping to the Blue Plan planning area omits many features and retains parts of polygons that extend beyond the immediate coastline (i.e., broad flat beaches).	Yes
Horseshoe crab high use areas	CT DEEP	Predicted use classifications for horseshoe crabs from a resource selection function model.	These data were included in Connecticut's 2015 Wildlife Action Plan Key Habitats and Communities; superseded by the analysis of LISTS data for Mobile Invertebrates ESA.	No

Parameter	Source	Summary	Status/comments	Final usage
Horseshoe crab offshore hotspots	CT DEEP	Significant high concentrations of horseshoe crabs between 1992-2008, identified using the Hot Spot Analysis Tool in ArcGIS.	These data were included in Connecticut's 2015 Wildlife Action Plan Key Habitats and Communities; superseded by the analysis of LISTS data for Mobile Invertebrates ESA.	No
Frequency of projected bottom water temperatures	Stevens Institute, CT DEEP	The projected number of days at various bottom water temperature ranges that are relevant to American lobster growth and survival. Data are reported for each LISTS grid cell.	Generally good coverage of the Blue Plan planning area (all locations where the LISTS can access). CT DEEP has used these data to identify places in Long Island Sound where American lobster habitat may exist under future warming scenarios. The EEG calculated frequencies of the optimal temperature range for lobster from these data.	Yes
Natural shellfish (bivalve) aggregations	CT Bureau of Aquaculture, CT Sea Grant	Locations of non-harvested, non-managed shellfish beds	These data are being collected as one part of an ongoing project and are not yet available to the EEG as of January 2019.	Yes, when available
Natural shellfish occurrence	University of Connecticut	Observations of percent cover of shellfish or shellfish presence/absence from the Long Island Sound Seafloor Mapping Initiative SEABOSS surveys. These are observations of non-managed shellfish aggregations.	Spatially limited to Stratford Shoals and eastern Long Island Sound.	Yes

Connecticut managed shellfish beds	CT Bureau of Aquaculture	Includes oyster seed beds (also called "Natural beds"), recreational shellfish beds, state-managed shellfish beds, and town-managed shellfish beds.	These four layers together comprise the majority of the known locations for shellfish management, including aquaculture and harvesting.	Yes

Parameter	Source	Summary	Status/comments	Final usage
New York managed shellfish beds	EEG unable to find adequate data		EEG unable to find adequate data	No
Benthic infaunal and epifaunal data	University of Connecticut	Observations of abundance, richness, and diversity from the Long Island Sound Seafloor Mapping Initiative.	Spatially limited to Stratford Shoals. Additional data from eastern Long Island Sound should become available within the next few years. These data were difficult to extrapolate beyond the small survey footprint.	No
Benthic communities	Pelligrino and Hubbard 1983	Benthic community composition in Connecticut waters	Spatial coverage is limited and difficult to extrapolate beyond the survey boundaries.	No
Integrated habitat map for Stratford Shoals	University of Connecticut	Integration of benthic physical and biological data to holistically characterize habitat types	Spatially limited to Stratford Shoals, but concept and methodology is promising for application to all of Long Island Sound when data are available.	No
Habitat optimization analysis for Long Island Sound	Neely and Zajac 2008, Marine Ecology Progress Series	Identification of two areas in Long Island Sound that contain at least 20% of each of seven benthic habitat types	Concept is promising for application to identification of ESA, but methods to do so not yet established.	No
Phytoplankton abundance/biomass	CT DEEP Long Island Sound Water Quality Monitoring Program	Quantifies primary productivity, the foundation of the Long Island Sound food web, monthly since 1994.	Difficult to meaningfully summarize, given the spatial and temporal variability in primary productivity. Long Island Sound exhibits a high degree of seasonal variation in primary productivity, as well as longer-term variability. High rates	No

Parameter	Source	Summary	Status/comments	Final usage
			of primary productivity can also be associated with nutrient enrichment, so an optimal threshold is difficult to apply uniformly.	
Zooplankton abundance/biomass	EEG unable to find adequate data		EEG unable to find adequate data	No
Restoration sites		Areas that have been subject to habitat enhancement or restoration	Further discussion needed about how to prioritize/rank sites or present this information in the context of Ecologically Significant Areas.	No
Macroalgae	EEG unable to find adequate data		EEG unable to find adequate data	No