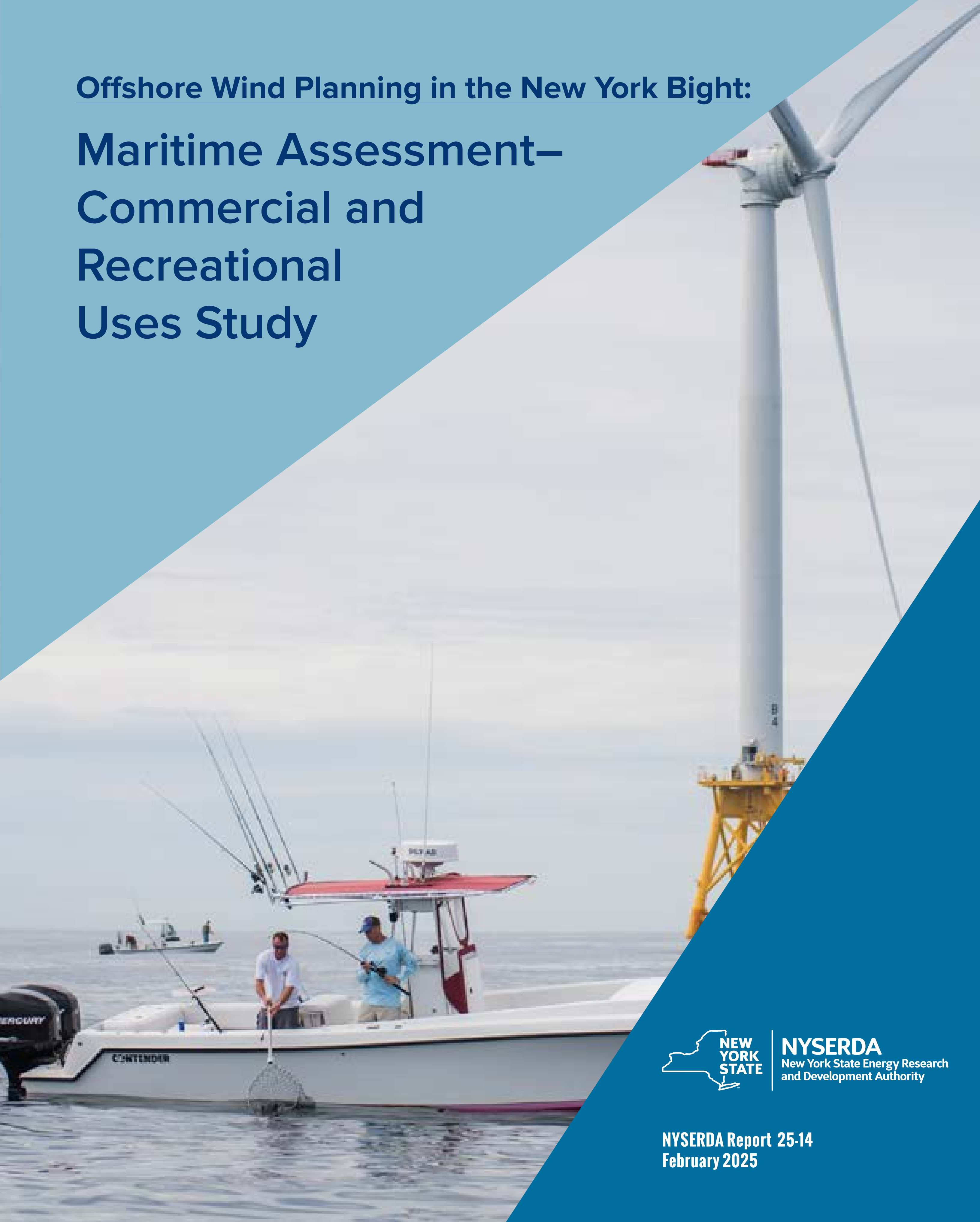
Offshore Wind Planning in the New York Bight:

Maritime Assessment–Commercial and Recreational Uses Study



NEW YORK STATE

NYSERDA
New York State Energy Research and Development Authority

NYSERDA Report 25-14
February 2025

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NYSERDA provides resources, expertise, and objective information so New Yorkers can make confident, informed energy decisions.

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Our Mission:

Advance clean energy innovation and investments to combat climate change, improving the health, resiliency, and prosperity of New Yorkers and delivering benefits equitably to all.

Cover Image Source: Deepwater Wind

Offshore Wind Planning in the NY Bight: Maritime Assessment–Commercial and Recreational Uses Study

Final Report

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Abstract

The objective of this Maritime Assessment–Commercial and Recreational Uses Study is to assess marine activity in offshore wind (OSW) lease areas beyond the 60-meter depth contour on behalf of New York State Energy Research and Development Authority (NYSERDA). The study reports on commercial, recreational, and other activities in the Area of Analysis (AoA) based on historical and current data and makes a projection on future activity. As this AoA is farther offshore and is situated in water deeper than New York State's previous OSW assessment area, all marine uses take place from vessels, which is key to understanding activity in the area.

Investigative methods include gathering, analyzing and reporting on data from regional online portals; historical vessel traffic positions and projections; boating statistics; offshore weather/sea state buoys; economic assessments and projections; previous NYSERDA studies; domestic and international regulatory guidance for OSW; marine safety considerations; U.S. Gulf oil and gas experience; publicly available online research; scholarly sources; and project based information from an OSW site being constructed in U.S. waters. Projections on both offshore and non-offshore marine traffic growth are incorporated.

The study concludes the following:

- Marine uses in the AoA are classified according to their relative influence on the region in terms of presence and persistence.
- Commercial marine traffic historically follows established traffic patterns and is expected to continue to do so; growth is centered in Zone 1 of the AoA.
- There is a well-developed knowledge reservoir from which to inform safe navigation of marine traffic near offshore fixed structures such as wind turbines.
- Few mapped recreational uses exist in the AoA. Those that do are primarily found in Zone 1 and some of Zone 2.
- Other activities include military uses and disposal sites, and activities supporting commercial and recreational uses such as law enforcement, search and rescue, piloting, and dredging.
- Further work implied by this study could:
  - Investigate remotely sensed vessel position data in greater detail in and around the AoA.
  - Continue collection of Vineyard Wind 1 actual support vessel deployments for use in parametric estimation of marine traffic related to OSW.
  - Survey the recreational boating community in the region to collect information of the detailed characteristics of use and the resulting marine traffic.
  - Develop more robust econometric modeling of commercial marine traffic growth in the region.

Keywords

marine uses, maritime uses, marine commercial uses, marine recreational uses, vessel traffic, marine traffic, vessel presence, vessel persistence, regional economic activity, marine traffic growth, historical marine traffic, marine safety, marine safety considerations, ais data, sea state conditions, sea state availability, ocean metadata, marine activity, marine commercial activity, marine recreational activity, other marine uses.

Acknowledgments

We thank the New York State Maritime Technical Working Group, the Project Advisory Committee (PAC), and all Maritime Assessment–Commercial and Recreational Uses Study reviewers for volunteering their time toward providing advice on data sources and study review.

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Acronyms & Abbreviations

ABSG	American Bureau of Shipping Group
AIS	Automatic Identification System
AAIS	Aggregated AIS (vessel type)
ALIQUOT	A portion of a larger whole
AOA	Area of Analysis
AVIS	Authoritative Vessel Identification Service
AWOIS	Automated Wreck and Obstruction Information System
BEA	Bureau of Economic Analysis
BMP	best management practice
BOEM	Bureau of Ocean Energy Management
BRM	Bridge Resource Management
CFR	Code of Federal Regulations
COLREGS	Convention on the International Regulations for Preventing Collisions at Sea
CPA	Closest Point of Approach
CSC	Coastal Services Center (NOAA)
CTV	crew transfer vessel
CVOW	Coastal Virginia Offshore Wind Project
CWF	Coastal Waters Forecast
DOE	Department of Energy
DOS	New York State Department of State
ENC	Electronic Navigational Charts
EU	European Union
FOSW	floating offshore wind
FR	Federal Register
GDP	Gross Domestic Product
GIS	Geographic Information System
GPS	global positioning system
GW	gigawatt
HSC	high-speed craft
HSF	High Seas Forecasts
IEA	International Energy Agency
IMF	International Monetary Fund
IMO	International Maritime Organization
IPS	Intermediate Peripheral Structure
LOA	length overall
MAPC	Marine Applied Physics Corporation

MARCO	Mid-Atlantic Regional Council on the Ocean
Master Plan	New York State Offshore Wind Master Plan
MCA	Maritime and Coastguard Agency (UK)
MGN	Marine Guidance Note
MMSI	Maritime Mobile Service Identity, Unique vessel ID used in AIS data
MRIP	Marine Recreational Information Program
M-TWG	New York State Offshore Wind Maritime Technical Working Group
MW	megawatt
nm	nautical mile
NOAA	National Oceanic and Atmospheric Administration
NNYBPARS	Northern New York Bight Port Access Route Study
NRBSS	National Recreational Boating Safety Survey
NSH	Nearshore Marine Forecast
NVIC	Navigation and Vessel Inspection Circular
NWS	National Weather Service
NYSERDA	New York State Energy Research and Development Authority
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OECD	Organization for Economic Co-operation and Development
O&M	operations and maintenance
OREI	Offshore Renewable Energy Installation
OSTAR	Original Single-handed TransAtlantic Race
OSW	Offshore Wind
PARS	Port Access Route Study
P.L.	Public Law
PWC	personal watercraft
PWSA	Ports and Waterways Safety Act
R^2	correlation coefficient
RI OSAMP	Rhode Island Ocean Special Area Management Plan
SAR	search and rescue
SBNMS	Stellwagen Bank National Marine Sanctuary
SCA	Small Craft Advisory
SMA	Seasonal Management Area
SOLAS	International Convention for the Safety of Life at Sea
SOV	service operation vessel
SPS	Significant Peripheral Structures
SQL	Structured Query Language
SRWF	Sunrise Wind Farm Project
STCW	Standards of Training, Certification and Watchkeeping for Seafarers

Study	Maritime Assessment–Commercial and Recreational Uses Study
TPA	Tradepoint Atlantic
TSS	Traffic Separation Schemes
TWG	Technical Working Group
TWOSTAR	Two-handed TransAtlantic Race
UNCTAD	United Nations Conference on Trade and Development
U.S.C.	United States Code
USCG	United States Coast Guard
VHF	very high frequency
VMS	Vessel Monitoring System
VTR	Vessel Trip Report
VTS	Vessel Traffic Services
WEA	Wind Energy Area
WEO	World Economic Outlook
WFO	Weather Forecast Office
WIG	wing-in-ground
WMO	World Meteorological Organization

Summary

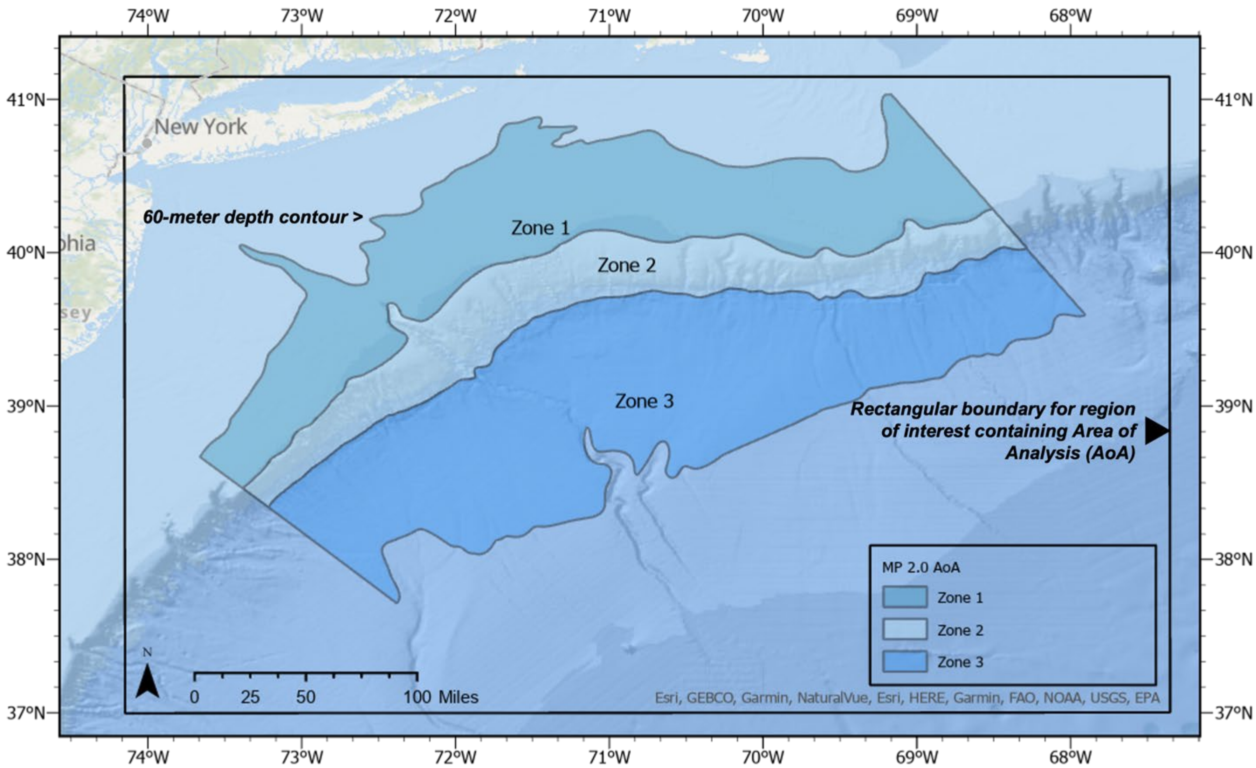
This Maritime Assessment–Commercial and Recreational Uses Study considers marine activity for offshore wind (OSW) lease areas beyond the 60-meter depth contour. It provides an updated perspective on the maritime uses in the relevant offshore region addressing maritime commercial, recreational, and other marine activity in waters 60 meters and deeper, based on both historical data as well as projected activity into the future. The development of this study followed several guiding principles:

- Given the body of previous work conducted for New York State Energy Research and Development Authority (NYSERDA) Master Plan, and subsequent studies and the efforts on the State and national scale to make planning information available, leverage previous work.
- Use actual data in analysis and evaluation for developing observations, findings, conclusions, and recommendations.
- Use marine operation and navigation safety considerations to inform realistic operational parameters for commercial traffic and for recreational use.
- In and around this Area of Analysis (AoA), all marine uses originate from vessels, and understanding marine traffic is a key to understanding marine uses in this region.
- Planning processes for offshore wind are a collaborative, multidisciplinary effort, the result of which will ultimately involve a large heterogenous population of stakeholders, and it is important that the project employ a process to acquire, evaluate and incorporate stakeholder feedback.

The AoA for this study is an irregular rectangular polygon encompassing approximately 35,670 square miles south and southeast of Long Island. It is divided into three zones from north to south beginning at the 60-meter (approximately 200-foot) depth contour and extending southerly out to the 3,000-meter (9,840-foot) depth contour (New York State Marine Technical Working Group [M-TWG] 2023a; M-TWG 2023b). For this study, a regular rectangular polygon was defined that bounds the AoA and the adjacent region of interest around the AoA with regard to marine uses, specifically the acquisition of vessel position data during the 2017–2022 period (Figure S-1).

Figure S-1. Region of Interest and Area of Analysis

Source: NYSERDA, McQuilling Renewables



S.1 Characteristics of Marine Use and Traffic

In this region, all commercial and recreational marine uses originate from vessels, which informs the classification of uses and the associated marine traffic. Cruise ship tourism, whale watching, charter/for-hire fishing and underwater activities are all considered commercial uses driving commercial marine traffic. To provide a framework to qualitatively understand the influence of marine traffic, identifying use characteristics is a worthwhile effort. When considering regional influence, characteristics such as persistence, density, navigational flexibility, maneuverability, economic effect, regulatory oversight, and purpose are useful descriptors. While uses with the extremes of each characteristic are easily grouped into commercial and recreational categories, each marine use will have different assessments of these characteristics, but in general, can be associated with either a commercial or recreational activity for the purposes of this study (Table S-1).

Table S-1. Marine Use and Traffic Characteristics and Intensity

Source: McQuilling Renewables

Vessel Type Description – AAIS Code

		Cargo - 1	Tanker - 2	Tug / Barge - 3	Passenger / Cruise, Excursion[a] - 4	Offshore Wind - 10	Underwater Activities[b] - 8	Commercial Fishing[c] - 6	Sailing - 5		Law Enforcement - 7	
		Commercial							Recreational		Other	
	Intensity >	H – High | M – Medium | L - Low										
Persistence Consistency and ratability of marine traffic; seasonality	Continuous (H) – Seldom (L)	H	H	H	H-M	M	M	H	L	M	L	L
Density Volume of marine traffic	Congested (H) – Sparse (L)	H	H	H	M	L	L	M	L	L	L	L
Navigationally Constrained Ability to change voyage routing; offshore destination	Constrained (H) - Discretionary (L)	H	H	H	H-M	M	M	H	L	L	L	L
Limited Maneuverability Ability to change speed and direction to avoid obstacles	Constrained (H) - Nimble (L)	H	H	H	M	H-M	L	H	L	L	M	H-M-L
Economic Effect The magnitude of the total direct and indirect economic contribution	Broad (H) – Narrow (L)	H	H	H	H	H	H	H	L	L	-	-
Regulatory Oversight The degree of operational discretion after compliance with operational requirements	Highly Regulated (H) – Nearly Unregulated (L)	H	H	H	H	H	M	H	L	L	-	-
Purpose To what extent the marine traffic represents a livelihood	Professional (H) – Leisure (L)	H	H	H	H	H	H	H	L	L	-	-

[a] Passenger type vessels include large cruise ships, ferries, and excursions vessels.

[b] Underwater activities include wreck and reef diving.

[c] Commercial fishing vessels include charter/for-hire fishing boats in this study.

[d] Other includes: Wing-in-ground (WIG), high speed craft (HSC), dredging, diving, pilot, search and rescue (SAR), port tender, oil recovery, research vessel, and school ship.

Commercial fishing, charter/for-hire fishing, and recreational fishing are commercial and recreational uses in and around the AoA. This study provides historical marine traffic resulting from these uses as available from Automatic Identification System (AIS) remotely sensed vessel position data, along with qualitative discussion of these uses. Other NYSERDA studies, such as the Fish and Fisheries Data Aggregation Study (NYSERDA, 2025), provide in-depth analyses of these uses, and reports should be reviewed collectively for full analysis of relevant deepwater uses.

S.2 Presence and Persistence of Uses and Marine Traffic

To evaluate marine uses in and around the AoA, remotely sensed vessel position data was analyzed for the years 2016 through 2022. AIS data was selected from several electronic data alternatives and obtained from MarineCadastre.gov. This data is well-structured, readily available, and through the use of geographic information system (GIS) tools and relational databases, provides a trove of logistics intelligence about the presence and persistence of vessels in and around the AoA. AIS position data analysis was supplemented with qualitative information and research from numerous sources further characterizing marine uses and traffic.

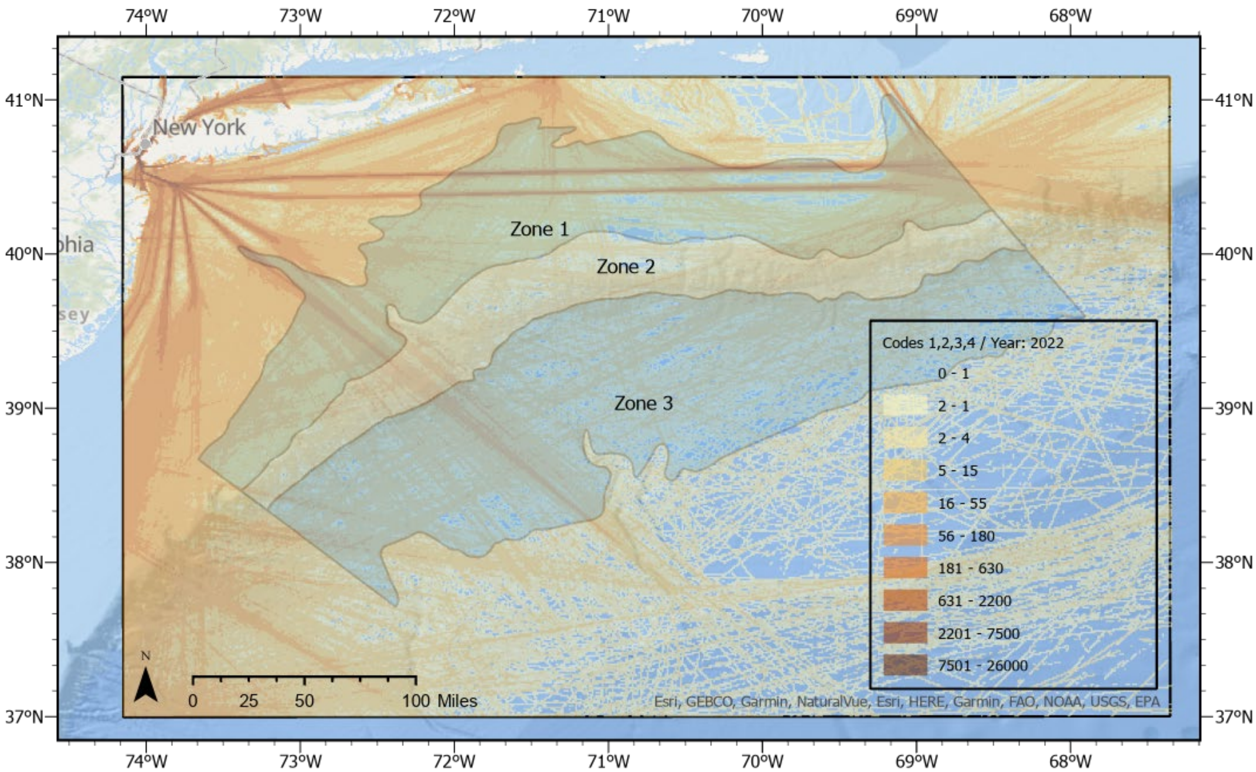
Most commercial marine traffic consists of vessels carrying cargo or passengers *transiting* from port to port. The exceptions are commercial fishing and activities such as wildlife viewing (whale watching) or undersea activities (diving) that are *destinational*, traveling from ports ashore to destinations offshore and back. Commercial marine traffic associated with OSW development is also *destinational*. Figure S-2 illustrates the density of commercial marine *transiting* traffic spatially for the region of interest in this study. Cargo vessels and tankers make up 95% of the presence of commercial *transiting* vessels in the AoA (2017–2022 average).

Commercial marine *transiting* traffic is concentrated in several transport corridors or fairways, as visible in Figure S-2. These represent the areas of most traffic density in the region. The balance of the region sees vessel traffic during the year, but it is spread out spatially and far less frequently. Based on traffic patterns, the United States Coast Guard (USCG) establishes traffic separation schemes (TSS) and safety fairways with input from stakeholders and collaboration with the International Maritime Organization (IMO) and other agencies to inform on navigational safety in the region. A substantial knowledge and experience base exists domestically in the U.S. from over half a century of offshore oil and gas industry experience navigating near fixed offshore structures in the U.S. Gulf to inform this activity. This is supplemented by a growing body of international experience operating vessels in and around wind fields.

Figure S-2. Commercial Vessels Transiting Carrying Cargo or Passengers (2022)

AAIS Codes 1-Cargo, 2-Tankers, 3-Tug/Barge, 4-Passenger—Vessels that transit the region carrying cargo or passengers from port to port.

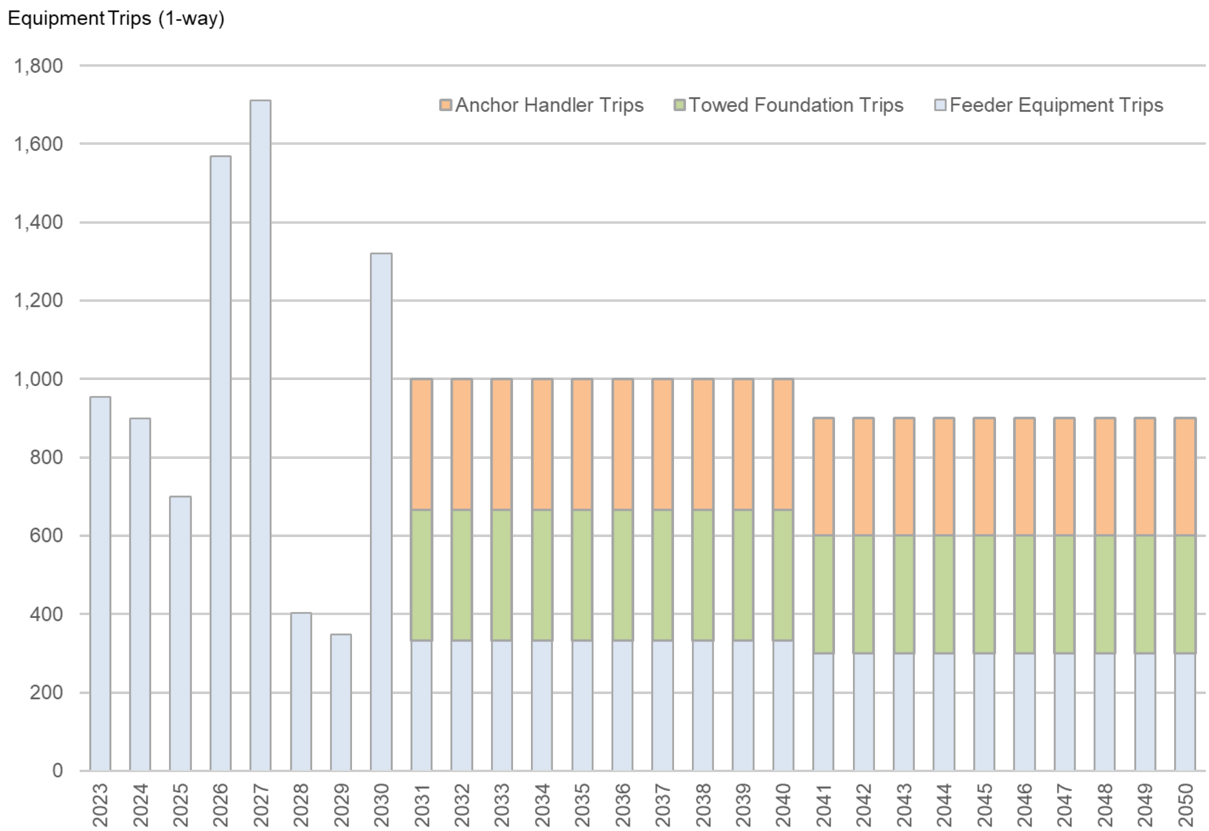
Source: Marine Cadastre



Following an economic slowdown into 2018, commercial marine traffic in and around the AoA has been on an upward trend through the 2018 to 2022 period. Econometric modeling conducted for this study suggests forecasted non-OSW growth through 2050 is positive overall with underlying cargo transport demand across shipping sectors ranging between 1.71% and minus 1.44%, averaging 0.64% per annum. Traffic patterns are expected to remain consistent with the past based on analysis of vessel positions in the region from 2017 to 2022.

Figure S-3. Major Offshore Wind Marine Traffic (2024–2050)

Source: McQuilling Renewables

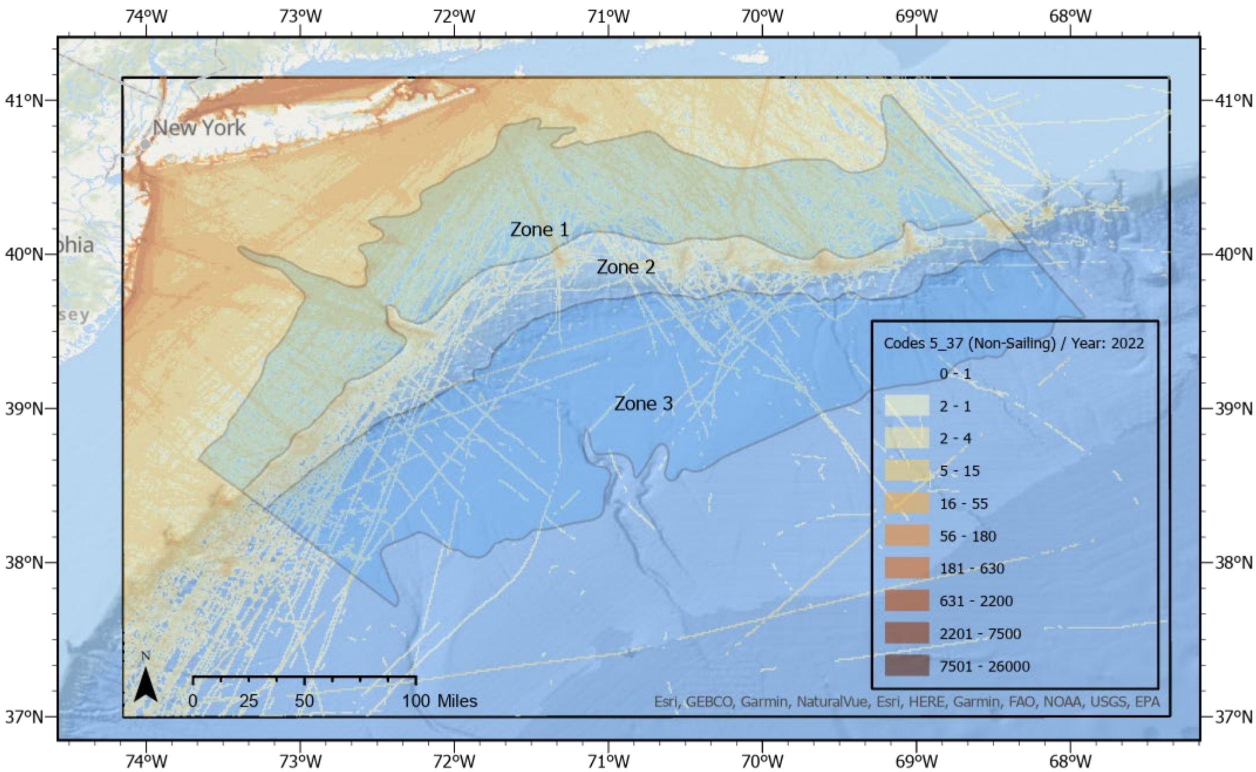


OSW-related marine traffic will grow as OSW projects are developed and installed. The most relevant activity will come from larger vessels and marine equipment engaged in the transport and installation of foundations and turbine components (towers, nacelles, blades). Figure S-3 displays an estimate of marine equipment trips developed in this Study in and around the AoA on an annual basis to 2050, based on offshore-energy-capacity forecasts, equipment specification forecasts, assumptions of transport logistics, and installation processes. Estimates of OSW marine traffic in future years are based on many assumptions and as a result imprecise; nonetheless, they are useful for comparative purposes. At almost 1,000 trips annually, the transport demand is material, but spread out spatially across the region.

Figure S-4. Remotely Sensed Recreational (Non-Sailing) (2022)

AIS Code 37—Pleasure Craft (Non-Sailing)

Source: Marine Cadastre

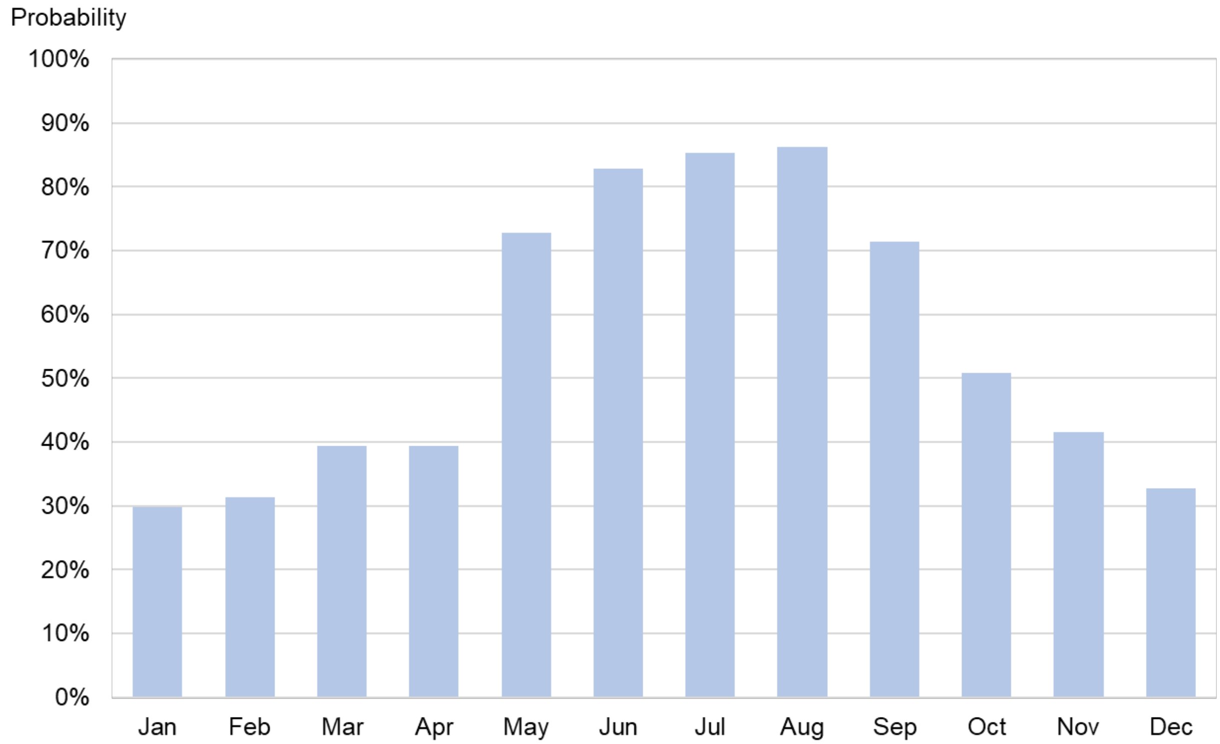


Recreational marine traffic consists of sailing, recreational fishing, and transits to or through the region. In Figure S-4, the intensity of activity for non-sailing recreational vessels can be seen primarily in Long Island Sound and along the southern Long Island coast and New Jersey coast. Notable exceptions are the density lines showing frequently transited corridors from ports on the southern shore of Long Island and New Jersey to positions along the rim of the continental shelf, where Zone 2 of the AoA begins. These are highly likely recreational fishermen, an observation corroborated by inspection of commercial fishing density contained in this study.

Figure S-5. Availability of the Region for Recreational Boating throughout the Year by Month (2000–2022)

Availability at Buoy 44008, Basis Sea State

Source: McQuilling Renewables



Most recreational vessels, according to USCG boating statistics, are small craft, which can be considered vessels under 65 feet, and weather and sea state conditions limit availability of the AoA to these vessels, as shown in Figure S-5, limiting their presence and persistence in the region. For these vessels, the region's availability may be reduced to as little 30% during winter months and even during summer months, is likely unavailable 15% of the season. (USCG Office of Auxiliary and Boating Safety 2021). State boater registration data reveals over half of recreational boats in the region typically do not go out on water on an annual basis. When they do, the average outings are relatively short (3 to 5 hours) and not far from shore (3 nautical miles [nm]). These discretionary use statistics further reduce the expected presence and persistence of recreational boats in and around the AoA (Duffy, et al. 2020).

S.3 Recommendations for Further Work

- The availability of long-series data sets of remotely sensed vessel position data compels further analysis of this information in the region. There are acknowledged limitations to the data in terms of inaccuracies and completeness, but these data sets represent large repositories of actual observations and could be more deeply mined for marine logistics intelligence. Acquiring commercial satellite AIS data would help solve issues of completeness and technology can be employed to address inaccuracies.
- Vineyard Wind 1 marine logistics data is another source of actual observations of what marine equipment is required to construct a wind field project. Collection of marine logistics data should continue through installation of turbine components and into other operations and maintenance stages. This information will provide robust parameters for use in estimating future OSW field development.
- The recreational boating statistics used in this study are from one of few sources of recreational boating information. Additional surveying of this community that segments recreational traffic into logical use cases is suggested to provide more specific intelligence on how different segments of the community use the region.
- Relatively simple economic modeling was carried out in this study to project marine traffic growth through 2050. More sophisticated econometric models may be employed for a more rigorous treatment of marine traffic growth forecasting.

1 Introduction

1.1 NYSERDA Introduction

In 2019, New York's historic Climate Leadership and Community Protection Act (Climate Act) was signed into law, requiring the State to achieve 100% zero-emission electricity by 2040 and to reduce greenhouse gas emissions 85% below 1990 levels by 2050. The law specifically mandates the development of 9,000 megawatts (MW) of offshore wind energy by 2035, building upon its previous goal of 2,400 MW of offshore wind energy by 2030. The New York State Energy Research and Development Authority (NYSERDA) is charged with advancing these goals.

Since the early 2000s, offshore wind development off New York's coast has advanced in relatively shallow areas in the New York Bight, on the Outer Continental Shelf (OCS). As offshore wind (OSW) development continues to mature and offshore wind leases are developed in deeper waters, the size and type of the offshore wind components are likewise expected to grow, and the project footprint will change as the use of floating OSW technology begins to be deployed. This may result in changes in the types of potential effects and interactions seen to date for fixed-bottom offshore wind projects. NYSERDA is conducting studies to investigate the implications of developing floating offshore wind in deeper waters. Findings from the studies will be used to support the identification of areas that present the greatest opportunities and least risk for siting deepwater offshore wind projects, and other workstreams designed to help assure the continued responsible siting and development of offshore wind energy.

For more than a decade, New York State has been conducting research, analysis, and outreach to evaluate the potential for offshore wind (OSW) energy. New York State Energy Research and Development Authority (NYSERDA) led the development of the New York State Offshore Wind Master Plan (Master Plan), a comprehensive roadmap and suite of more than 20 studies for the first 2,400 megawatts (MW) of OSW energy. The Master Plan encourages the development of OSW in a manner that is sensitive to environmental, maritime, economic, and social issues while addressing market barriers and aiming to lower costs. The Master Plan included spatial studies to inform siting of offshore wind energy areas. Now, NYSERDA is undertaking new spatial studies to review the feasible potential for deepwater OSW development at or exceeding depths of 60 meters in the New York Bight.

Planning processes considering the development of offshore wind in the deepwater areas examined in each of NYSERDA's spatial studies must consider these studies in the context of one another. Decision making must additionally consider different stakeholders and uses, and will require further adjusted approaches and offshore wind technologies to ensure the best outcome. Globally, floating offshore wind (FOSW) technology is less mature and primarily concentrated on floating designs at the depth ranges being assessed through these spatial studies, while deepwater fixed-bottom foundations are at their upper technical limit within areas of the Area of Analysis (AoA). Therefore, floating designs were predominantly considered as most, if not all, of the AoA would likely feature FOSW. NYSERDA, along with other state and federal agencies, is developing research and analysis to take advantage of opportunities afforded by deepwater OSW energy by assessing available and emerging technologies, and characterizing the cost drivers, the benefits, and risks of FOSW. Findings from these studies and available datasets will be used to support the identification of areas that present the greatest opportunities and least risk for siting deepwater OSW projects.

1.1.1 Benefits and Cost-Reduction Pathways

The State's Master Plan analysis concluded that OSW development will enhance the State's job market, supply chain, and economy; reduce the use of fossil fuels; and provide other public health, environmental, and societal benefits. While the State plans to continue procuring offshore wind projects within the existing lease areas, the timing is right to build a better understanding of the opportunities and challenges of projects farther offshore A focused study on the cost landscape and technological readiness for deepwater offshore wind of 60 to 3,000 meters in water depths in the AoA was conducted to help the State understand how floating offshore wind may fit in New York's renewable energy portfolio. Additional discussion of costs and cost-reducing strategies focusing on State options for contracting related to deepwater OSW, job-training programs, and infrastructure investments will also be developed as part of future planning efforts.

The State will continue to undertake research and engage its established Technical Working Groups (TWGs) on key subjects of fishing, maritime commerce, the environment, workforce, environmental justice, the supply chain, and the implications of floating offshore wind. The TWGs will continue to inject expert perspectives and the most recent information as an integral part of future decision making.

Taken together, the information assembled in these studies will empower New York State and its partners to take the informed steps needed to continue to capitalize on the unique opportunity presented by offshore wind energy.

1.1.1.1 Spatial Studies to Inform Lease Siting

- Benthic Habitat Study
- Birds and Bats Study
- Deepwater Wind Technologies – Technical Concepts Study
- Environmental Sensitivity Analysis
- Fish and Fisheries Data Aggregation Study
- Marine Mammals and Sea Turtles Study
- Maritime Assessment – Commercial and Recreational Uses Study
- Offshore Wind Resource Assessment Study Zones 1 and 3
- Technology Assessment and Cost Considerations Study

Each of the studies was prepared in support of a larger planning effort and shared with relevant experts and stakeholders for feedback. The State addressed comments and incorporated feedback received into the studies. Feedback from these diverse groups helps to strengthen the studies and also helps ensure that these work products will have broader applicability and a comprehensive view. Please note that assumptions have been made to estimate OSW potential and impacts in various methodologies across the studies. NYSERDA does not necessarily endorse any underlying assumptions in the studies regarding technology and geography, including but not limited to turbine location, turbine layout, project capacity, foundation type, and point of interconnection.

The Energy Policy Act of 2005 amended Section 8 of the Outer Continental Shelf Lands Act (OCSLA) to give the Bureau of Ocean Energy Management (BOEM) the authority to identify OSW development sites within the Outer Continental Shelf (OCS) and to issue leases on the OCS for activities that are not otherwise authorized by the OCSLA, including wind development. The State recognizes that all development in the OCS is subject to review processes and decision-making by BOEM and other federal and State agencies. This collection of spatial studies is not intended to replace the BOEM Wind Energy Area (WEA) identification process and does not commit the State or any other agency or entity to any specific course of action with respect to OSW energy development. Rather, the State's intent is to facilitate the principled planning of future offshore development off the New York coast, provide a resource for the various stakeholders, and encourage the achievement of the State's OSW energy goals.

1.1.2 Scope of Study

The spatial studies will evaluate potential areas for deepwater OSW development within a specific geographic AoA of approximately 35,670 square miles of ocean area, extending from the coast of Cape Cod south to the southern end of New Jersey. It includes three zones extending outward from the 60-meter depth contour, which ranges between 15 and 50 nm from shore to the 3,000-meter contour, which ranges from 140 to 160 nm from shore.

The eastern edge of the AoA avoids Nantucket Shoals and portions of Georges Bank, since those areas are well known to be biologically and ecologically important for fish and wildlife, fisheries, and maritime activity. The AoA does include areas such as the Hudson Canyon, which is under consideration to be designated as a National Marine Sanctuary and thus unlikely to be suitable for BOEM site leases.

While OSW infrastructure will not be built across the entire AoA, the spatial studies analyze this broad expanse to provide a regional context for these resources and ocean uses.

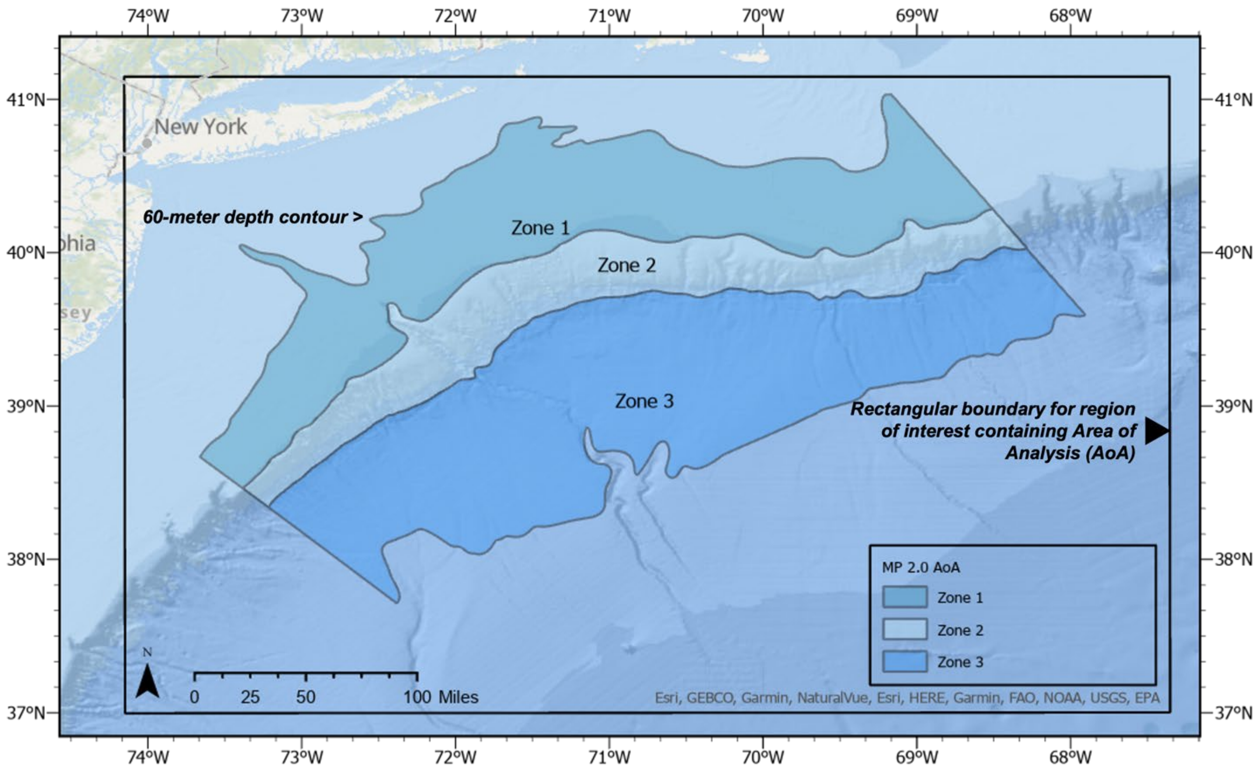
- Zone 1 is closest to shore and includes a portion of the OCS. It extends from the 60-meter contour out to the continental shelf break (60 meters [197 feet] to 150 meters [492 feet] deep). Zone 1 is approximately 12,040 square miles.
- Zone 2 spans the steeply sloped continental shelf break, with unique canyon geology and habitats (150 meters [492 feet] to 2,000 meters [6,561 feet] deep). Zone 2 is approximately 6,830 square miles.
- Zone 3 extends from the continental shelf break out to 3,000 meters (9,842 feet) depth. Zone 3 is approximately 16,800 square miles.

1.2 Background

This study is one of a collection of studies prepared on behalf of the State to provide information on a variety of potential environmental, social, economic, regulatory, and infrastructure-related issues associated with the planning for future OSW energy development off the coast of the State. When the State embarked on these studies, it began by looking at a study area larger, farther from shore and into waters deeper than the area of ocean originally considered for the Master Plan in 2017. In this study and other spatial studies, the AoA was identified and situated as shown in Figure 1. It is located at least 15 nautical miles (nm) offshore and extends into waters beyond the continental shelf to depths of 2,000 meters or 6,561 feet.

Figure 1. Spatial Studies Area of Analysis

Source: NYSERDA



The State envisions that the collection of spatial studies will serve as a knowledge base about the region off the coast of New York and will (1) provide current information about potential environmental and social sensitivities, economic and practical considerations, and regulatory requirements associated with any future OSW energy development; (2) identify measures that could be considered or implemented with OSW projects to avoid or mitigate potential risks involving other uses and/or resources; and (3) inform the preparation of an updated Master Plan to articulate New York State's vision of future OSW energy development.

1.3 Composition of Report and Supporting Documents

This report is comprised of several elements that address the needs of different readers. The body of the report, beginning with this section 1 along with the list of figures, list of tables, and acronyms and abbreviations, provide a comprehensive narrative for the analyst who needs to understand what was done, how it was accomplished, and the results. Support for the body of the report is contained in the References section, which provides a trail back to the sources of material comprising the report. Preceding the body is the Executive Summary, which consolidates the highlights and key points of the report and is useful for managers to review and understand the scope, findings, and results of the work carried out. A set of appendices contain key data and additional information that are integral to the report and will be useful to the analysts continuing the work conducted under this report but represent detail that is too dense for the report body. Lastly, there are several data sets that were established to produce the report. These are typically in electronic database format and not included with the report but are available upon request. Specifically, the four data sets created in this study are:

- Regional marine traffic Automatic Identification System (AIS) data set 2017–2022, Sequel Query Language (SQL) format.
- Ocean metadata buoy observations (National Oceanic and Atmospheric Administration [NOAA] Buoy 44008, 44066), 2000–2022, Microsoft Excel format.
- Global, regional historical and forecast economic activity data set–through 2050–Microsoft Excel format.
- Vineyard Wind 1 case study offshore wind mariner's update data set–Microsoft Excel format.

2 Study Overview

2.1 Objective of Study

For this study, the objective was to address marine activity for OSW lease areas beyond the 60-meter depth contour. Specifically, to provide an updated perspective on the maritime uses in the relevant offshore region—one that addresses maritime commercial and recreational activity beyond the 60-meter depth contour based on both historical data as well as projected activity into the future.

Commercial fishing, charter/for-hire fishing and recreational fishing are commercial and recreational uses in and around the AoA. This study provides historical marine traffic resulting from these uses as available from AIS remotely sensed vessel position data, along with qualitative discussion of these uses. Other NYSERDA studies, such as the Fish and Fisheries Data Aggregation Study (NYSERDA, 2025), provide in-depth analyses of these uses and reports should be reviewed collectively for full analysis of relevant deepwater uses.

2.2 Guiding Principles

Given the large inventory of relevant studies conducted for the Master Plan and subsequent supplemental studies and the efforts on a state and national scale to make planning information available, a priority for this study is to leverage previous work. This is accomplished by building on previous findings and observations of those studies or comparing the results contained in this study to previous results and understanding the similarities and differences. Individual citations are made throughout this report and selected previous studies and sources of information are referenced in Table 1—Selected Previous Studies and included in the References section of this report.

A multi-disciplinary approach, such as the one taken for the creation of the Master Plan, involves numerous perspectives and approaches that must combine in a logical progression to produce a cogent roadmap going forward. Key to this consolidation and distillation of information is to use actual data in analysis and evaluation for developing observations, findings, conclusions, and recommendations. This study depends heavily on historical marine traffic information derived from actual vessel position reports in and around the AoA; over 20 years of weather and sea state data for the offshore region in which the AoA is contained; data sets of historical and projected economic and trade parameters; and actual vessel activities from the first large-scale commercial wind energy project infrastructure being installed offshore on the U.S. East Coast.

Both domestically and internationally, there is a wealth of experience in the design, development, and application of regulations and recommendations for the safe operation and navigation of vessels offshore, particularly in the vicinity of fixed and floating offshore wind (FOSW) projects. U.S. experience in developing and implementing traffic separation schemes and safety fairways in support of the offshore oil and gas industry in the U.S. Gulf spans over 50 years. A growing base of experience in Europe and elsewhere related to safe operation and navigation in and around OSW installations is approaching two decades of development. Use of marine operation and navigation safety considerations to inform realistic operational parameters for commercial traffic and for recreational use is essential.

The AoA for the spatial studies is farther offshore, in water much deeper and an area twice as large as the AoA for the Master Plan. In and around this AoA, all marine uses originate from vessels and understanding marine traffic is a key to understanding marine uses in this region. Marine uses are grouped and differentiated by their characteristics.

Ultimately, a wide range of stakeholders will be involved in the collaborative, multidisciplinary planning process for deepwater OSW development. It is imperative that planning processes continues to encompass the gathering, assessing, and integrating of stakeholder input. For this study, multiple presentations were given to the members of the New York State Offshore Wind Maritime Technical Working Group. This form of collaboration builds upon years of coordination with maritime industries as exemplified in the Master Plan.

2.3 Data Sources

The following are the primary data sources used in this study.

2.3.1 Regional Vessel Position Data

Vessel position data, whether automatically generated electronically or manually advised, is extremely useful in understanding marine traffic activities. In U.S. waters, several sources of vessel position data are available:

- **Automatic Identification System (AIS)**—International maritime navigation safety system that transmits detailed vessel information to land-based receivers and satellites as method of tracking marine activity on a global basis, particularly in areas outside port limits and further from shore.
- **Vessel Traffic Services (VTS)—**Positions for commercial marine traffic in a specific near-shore port region. VTS stations are operated by or in partnership with the U.S. Coast Guard (USCG) to provide real time monitoring and guidance to vessels in congested ports and waterways: New York Harbor is a participating VTS port.
- **Vessel Trip Report (VTR)**—Position information for vessels specific to the fishing industry— Aggregated by the National Oceanic and Atmospheric Administration (NOAA) Fisheries group, this data tracks landed catches of various species by the commercial fishing industry.
- **Vessel Monitoring System (VMS)—**Position information for vessels specific to the fishing industry—Controlled by the NOAA Fisheries group, this system is installed on commercial fishing vessels and its data is used to monitor the locations of vessel activity via global positioning system (GPS).

2.3.1.1 Study Preference for Automatic Identification System Remotely Sensed Position Data

AIS data was selected from several electronic data alternatives and obtained from MarineCadastre.gov. This data is well-structured, readily available, and allows comparison of marine traffic intensity across multiple vessel types. With the use of geographic information system (GIS) tools and relational databases, AIS data provide a trove of logistics intelligence about the presence and persistence of many types of vessels in and around the AoA. Robust annual data sets recording vessel position data multiple times per hour were accessed for the years 2017 through 2022 for vessels present in and around the AoA. This information provides a rich chronology of vessel historical positions that inform marine use activity and traffic data. MarineCadastre.gov is a collaboration between NOAA and BOEM that provides AIS vessel position data obtained from land-based receivers to users in a curated form. AIS vessel position data provide a good historical summary of actual marine traffic for many vessel types in a standardized, consistent format. This data is easily aggregated to establish the particulars of commercial and recreational marine use.

For this study, vessel position data for the years 2017 through 2022 were obtained from Marine Cadastre.gov from transmissions of AIS data received from vessels of both commercial and recreational deployment that carry and transmit such data. AIS is an international maritime navigation safety system that transmits detailed vessel information to land-based receivers and satellites and is the preferred method of tracking marine activity on a global basis, particularly in areas outside port limits and further from shore. The USCG and International Maritime Organization

(IMO) both list requirements for the carriage of AIS systems aboard vessels engaged in seagoing voyages. The USCG requires all commercial vessels of 65 feet or more in length as well as all towing vessels 26 feet or more in length to carry an operating AIS system on board (USCG Navigation Center n.d.b). The IMO, under International Convention for Safety of Life at Sea (SOLAS) regulation V/19, requires AIS to be fitted aboard all ships of 300 gross tonnage and upwards engaged on international voyages, cargo ships of 500 gross tonnage and upwards not engaged on international voyages, and all passenger ships irrespective of size. The requirement became effective for all ships by December 31, 2004. Ships fitted with AIS are required to maintain AIS in operation at all times except where international agreements, rules or standards provide for the protection of navigational information. (IMO 2019a).

As technology and safety measures at sea increase in both accessibility and ease of use, additional, and more than likely smaller vessel classes that are not defined by the listed guidelines of the USCG or IMO are increasingly more likely to participate in using AIS systems and providing vessel data and information transmissions, thus improving data frequency and quality for all types of marine craft moving forward. AIS data from MarineCadastre.gov may not be available in waters beyond 40 to 50 miles off the coast, or foreign waters. Vessel traffic in these areas could be under-represented by the land-based receivers. Available satellite data (which the MarineCadastre.gov does not maintain) could assist with assessing coverage in these areas. AIS data are a less effective means of position reporting for fishing operations since AIS is generally required for larger commercial vessels and can also be turned off. Because of these limitations, AIS data do not provide comprehensive representation of marine traffic related to fishing. For more accurate tracking of fishing vessels, reliance should be placed upon VMS data as the primary source of information. All things considered, this study assumes AIS data as the best data source for the activities undertaken herein.

2.3.2 Ocean Metadata

Twenty-two years of ocean metadata for two strategically located offshore NOAA weather buoys were sampled and analyzed to evaluate weather, sea state, and the availability of the AoA for recreational vessels. Wind speed, wave height, and wave period data from the years 2000 through 2022 were obtained and distilled from Buoy 44066, located in the northwest area of the AoA, along with Buoy 44008, situated in the northeast area of the AoA. This information serves as a source of actual historical data to provide feasibility boundaries to determine the potential presence and persistence of marine use in and around the AoA. These data sets are in Microsoft Excel format.

2.3.3 Regional Data Portals

- **Marine Cadastre—**A joint initiative between BOEM and NOAA to provide authoritative data to meet the needs of the offshore energy and marine planning communities (BOEM and NOAA, last modified September 15, 2023).
- **Northeast Ocean Data Portal—**Established in 2009, the Northeast Ocean Data Portal provides free, user-friendly access to expert-reviewed interactive maps and data on the ocean ecosystem, economy, and culture of the northeastern United States. The portal's maps show the richness and diversity of the ecosystem and illustrate the many ways that humans and environmental resources interact (Northeast Ocean Data n.d.).
- **Mid-Atlantic Regional Council on the Ocean Data Portal**—To address this new era of ocean challenges and opportunities, the governors of New York, New Jersey, Delaware, Maryland, and Virginia in 2009 signed the Mid-Atlantic Governors' Agreement on Ocean Conservation. The Agreement established the Mid-Atlantic Regional Council on the Ocean (MARCO) as a partnership to address shared regional priorities and provide a collective voice for a healthy ocean (MARCO n.d.).
- **New York Geographic Information Gateway**—The Geographic Information Gateway provides public access to data, real-time information, interactive tools and expert knowledge relevant to the Office of Planning, Development & Community Infrastructure activities throughout New York. The concept of the gateway was first required in a 2006 law as a means to empower the people of New York State by putting information in the hands of decision-makers and the public. This system has grown from a data inventory to a fully integrated, ArcGIS Hub site with a data catalog, mapping capabilities, tools and stories (New York State Department of State [DOS] n.d.).

2.3.4 Economic Historical and Forecast Data

Non-OSW industrial trade growth and associated marine traffic has been assessed through the year 2050 for the U.S. East Coast areas that would influence marine traffic in and around the AoA. Several long term historical and forecast data series were accessed for this study from the following entities:

- Organization for Economic Co-operation and Development (OECD)
- International Monetary Fund (IMF)
- United Nations Conference on Trade and Development
- U.S. Bureau of Labor Statistics
- Port Authority of New York and New Jersey—Port Statistics

Offshore wind industry traffic growth has been assessed using wind field project information from developers, the BOEM, industry associations, news reports and company announcements to estimate number, size, and type of turbines to be installed and the manufacturing and staging areas associated with this activity through 2050.

2.3.5 Vineyard Wind 1 Offshore Wind Mariner's Updates

A logistics case study focused on marine traffic generated by the Vineyard Wind 1 project (OCS-A-0501) was carried out for validating OSW marine traffic demand and growth. The data set of Offshore Wind Mariner Updates released by the project have been inventoried, studied, and distilled. In summary, 95 total updates have been sampled and reviewed, resulting in 186 vessel deployments, where vessel deployments have been categorized by their influence on marine traffic.

2.4 Regulatory Guidance

For the review of marine traffic patterns and regional usage in this study, regulatory guidance has been taken from the following agencies who provide both best management practices (BMPs) and legislative oversight to the navigable waters of the AoA.

2.4.1 The United States Coast Guard

The USCG presides as the regulatory body for marine traffic and navigable waterways in and around the U.S. and specifically provides planning and risk mitigation measures to the offshore renewable energy installation (OREI) process. According to Navigation and Vessel Inspection Circular No. 01-19, dated August 1, 2019, the USCG has issued guidance on its roles and responsibilities for OREIs. According to this circular, a concern with the construction and location of OREIs is related to their potential influences on marine navigation safety. The Coast Guard authority for OREIs, under the Ports and Waterways Safety Act (PWSA*)* (Public Law 92-340, 86 Stat. 424, as amended), requires the USCG to conduct studies necessary to provide safe access routes for vessel traffic in the waters under the jurisdiction of the United States (USCG 2019).

2.4.2 The International Maritime Organization

The International Maritime Organization (IMO) is a United Nations specialized agency with responsibility for the safety and security of shipping and the prevention of marine and atmospheric pollution from ships. There are currently 175 member states that form the body of the IMO with the U.S. maintaining membership since joining in 1950. The organization consists of an assembly, a council, and five main Committees: the Maritime Safety Committee; the Marine Environment Protection Committee; the Legal Committee; the Technical Cooperation Committee, and the Facilitation Committee and a number of Sub-Committees support the work of the main technical committees. The IMO's responsibility for ships' routing is enshrined in SOLAS chapter V, which recognizes the organization as the only international body for establishing such systems (IMO 2019b).

Rule 10 of the Convention on the International Regulations for Preventing Collisions at Sea (COLREG) prescribes the conduct of vessels when navigating through traffic separation schemes adopted by the IMO. The IMO's responsibilities are also determined under the United Nations Convention on Law of The Sea, which designates IMO as "the competent international organization" in matters of navigational safety, safety of shipping traffic and marine environmental protection. (IMO 2019b).

Governments intending to establish a new routing system for IMO's adoption, or amend an existing one, should submit proposed routing measures to the IMO's Sub-Committee on Navigation, Communications and Search and Rescue, which will then evaluate the proposal and make a recommendation regarding its adoption by the Maritime Safety Committee (IMO 2019b).

Routing measures adopted by the IMO to improve safety of navigation include (IMO 2019b):

- Traffic separation schemes
- Recommended tracks
- Deepwater routes specifically for vessels whose ability to maneuver is constrained by their draft
- Precautionary areas
- Areas to be avoided due to exceptional danger or especially sensitive ecological and environmental factors

2.5 Workflow and Methodology

The following workflow was employed to develop conclusions and recommendations provided in this study:

- **Literature review**—Review previous studies carried out in support of the Master Plan and related follow-on studies; research new studies not previously identified.
- **Characteristics of AoA and implications—**Identify AoA and region of interest surrounding it. Highlight the substantial differences between the current AoA for the spatial studies and the previous AoA for the Master Plan.
- **Alignment of marine use classifications with AoA—**Identify the attributes or characteristics of commercial use and recreational use. The location and configuration of the AoA drives a reclassification of several marine uses from recreational to commercial.
- **Acquire regional historical vessel positions**—Acquire electronic historical vessel position data for the region including the AoA for the period from 2017 through 2022.
- **Assess historical marine traffic using existing and new research –** Distill, analyze and evaluate vessel position data; supplement this information with qualitative assessments of marine use from publicly available information sources.

- **Estimate non-**OSW **marine traffic growth**—Using global and regional economic and trade information, assess marine traffic growth for various shipping sectors in the region including the AoA for the period through 2050.
- **Estimate OSW marine traffic growt**h—Using existing OSW project data and assessments of existing and new OSW technologies and installations offshore the U.S. East Coast, assess marine traffic growth for the OSW sector in the region including the AoA for the period through 2050.
- **Investigate marine safety considerations**—Survey U.S. and international OSW and related experience of government regulatory authorities and competent non-governmental organizations to suggest realistic operational parameters for commercial and recreational marine navigation offshore and in and around OSW installations.
- **Establish expected presence and persistence of vessels in and around AoA**—Refer to marine safety considerations, combined with historical quantitative assessments of weather and sea state in and around the AoA. Assess discretionary use of recreational vessels and practical limits imposed by the marine logistics of getting to and from the AoA.

2.5.1 Literature Review

The New York State Offshore Wind Master Plan and key supporting studies for 2.4-gigawatt (GW) offshore energy capacity were reviewed for methodology, assumptions, context, and results. Additional maritime studies supporting NYSERDA's 9-GW offshore energy capacity objectives were also reviewed. The four public data portals used to access geospatial data were heavily relied on and recent updates for marine use incorporated from these sources (Table 1).

Table 1. Selected Previous Studies

Source: NYSERDA website

Maritime Studies (to 9-GW)
Offshore Wind Ports: Cumulative Impacts Study (22-10)
Offshore Wind Ports: Cumulative Vessel Traffic (22-11)
Offshore Wind Ports: Vessel Traffic Risk Assessment Supplement (22-31)
Consolidated Port Approaches and International Entry and Departure Transit
Areas Port Access Route Studies (PARS)
Maritime Technical Working Group Support
Master Plan (2.4-GW Studies)
New York State Offshore Wind Master Plan
Shipping and Navigation Study (17-25q)
Marine Recreational Uses Study (17-25m)
Assessment of Ports and Infrastructure (17-25b)
US Jones Act Compliant WTIV Study (17-13)
Data Portals
Mid-Atlantic Regional Council on the Ocean Data Portal
Northeast Ocean Data Portal
Marine Cadastre
New York Geographic Information Gateway

A web-based literature search was conducted to identify research and information on commercial and recreational marine activities, including wildlife viewing (whale watching), underwater activities (wreck/reef diving), recreational fishing, sailing and related topics. The USCG- Port Access Route Studies (PARS) were reviewed for safety and navigation guidance offshore and newly proposed marine traffic routing recommendations. European regulatory guidelines were accessed. The U.S. Code of Federal Regulations (CFRs) and the U.S. National Weather Service (NWS) marine advisory system were researched to support guidelines for the safe operation of recreational vessels offshore. Recreational boating statistics generated by USCG affiliated associations were sourced to identify numbers of vessels and use behavior for these vessels.

Economic and marine trade historical and forecast information from global, national, and regional governmental and non-governmental sources were reviewed and modeled to produce commercial marine trade growth for non-OSW in the region of the AoA. U.S. OSW industry information on wind projects was reviewed and used to develop project data and statistics for ongoing and emerging projects and associated marine traffic growth. Several technical papers were reviewed related to assessments for evolving OSW equipment characteristics over time and OSW marine traffic growth assumptions going forward. Vineyard Wind 1 Mariner Updates were collected and quantified to establish actual marine traffic during the initial project evaluation and installation stages.

2.5.2 Characteristics of Area of Analysis and Implications

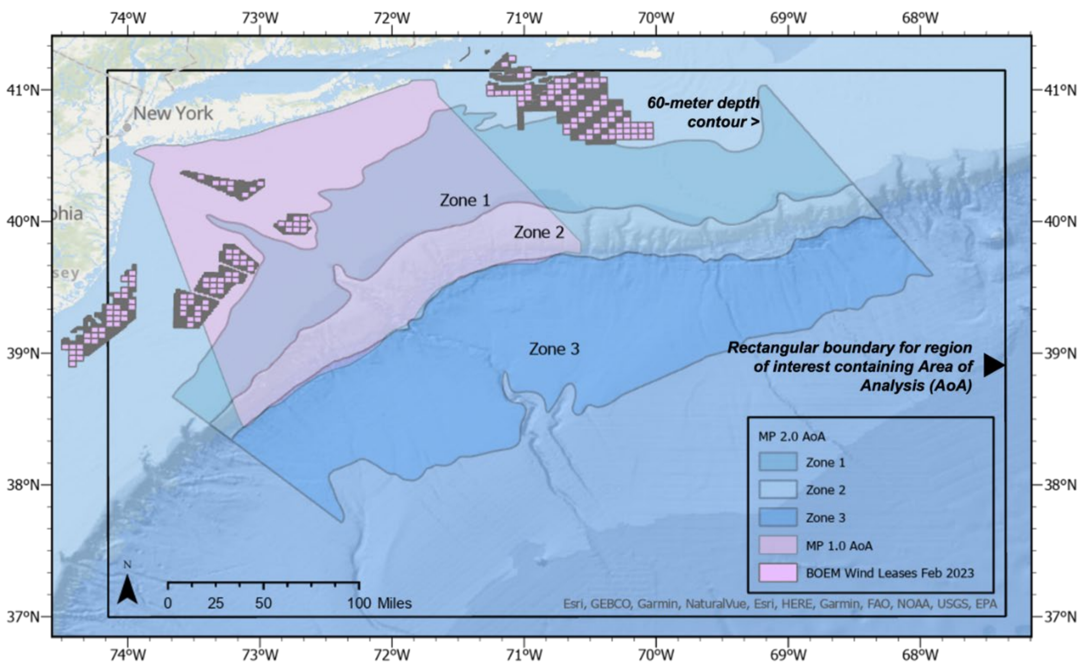
The AoA for this study is illustrated Figure 2. It is an irregular rectangular polygon with four vertices located at latitude and longitude (38.67 N, 73.70 W); (41.04 N, 69.17 W); (39.59 N, 67.90 W); and (37.71 N, 72.38 W). This area encompasses approximately 35,670 square miles south and southeast of Long Island. It is divided into three zones from north to south where Zone 1 beginning at the 60-meter (approximately 200-foot) depth contour and extending southerly to the continental shelf break at a depth of around 90 meters (approximately 300 feet) comprises about 12,040 square miles of ocean environment. Zone 2 spans the steeply sloped continental shelf break and the unique canyon habitats located there from 90-meters (approximately 300-foot) depth to about 180-meters (approximately 600-foot) depth and occupies approximately 6,830 square miles. Zone 3 extends from the continental shelf break out to the 3,000-meter (9,840-foot) depth contour representing about 16,800 square miles of ocean environment. (M-TWG 2023a; M-TWG 2023b).

For this study, a regular rectangular polygon with vertices (41.15 N, 74.15 W); (41.15 N, 67.35 W); (37.00 N, 67.35 W); and (37.00 N, 74.15 W) bounds the region of interest in and around the AoA with regard to marine uses, specifically the acquisition of vessel position data during the 2017–2022 period (Figure 2).

The AoA's nearest distance to shore in Zone 1 is approximately 15 nm from the south coast of Long Island. The farthest distance from shore in Zone 3 is approximately 160 nm. From a southwest to northeast direction, the AoA spans approximately 360 nm.

Figure 2. Comparison of Master Plan and Spatial Studies Areas of Analysis

Source: NYSERDA; BOEM and NOAA n.d.c



In comparison to the AoA for the Marine Recreational Uses Study (NYSERDA 2017b) conducted in support of the Master Plan, which represented an area of 17,200 square miles, the AoA for the spatial studies is twice as large, located significantly farther offshore, and in much deeper waters. An important result is that all marine uses and activities in this region are carried out from vessels. This contrasts with the findings of NYSERDA report 17–25m (NYSERDA 2017b) conducted in support of the Master Plan that found uses for that area, including shore-based snorkeling and surface water recreational activities such as swimming, windsurfing, surfing, kayaking and paddleboarding. Marine traffic, manifested in the number, types, presence, and persistence of vessels in and around the AoA provides the greatest utility in informing the marine uses in the region (Figure 2).

2.5.3 Alignment of Marine Use Classifications with Area of Analysis

Since all marine uses in and around the AoA originate from vessels, marine traffic is a key parameter for understanding the influence of uses in the region. Different uses influence the region differently. Marine uses that have characteristics with comparatively higher effect on the region need to be well-understood and comprehensively planned for as the resulting marine traffic may influence decision-making about siting offshore energy installations; those with comparatively less effect on the region also need to be understood and considered to help ensure compatible coexistence with offshore energy installations.

To provide a framework to qualitatively understand the influence of marine traffic, identification of use characteristics is a worthwhile effort. When considering influence, characteristics such as persistence and density, flexibility in terms of navigation, and maneuverability are useful descriptors, as are economic effect, regulatory oversight, and purpose. These terms are further described in Table 2.

Table 2. Characteristics of Marine Uses

Source: McQuilling Renewables

Characteristic	Extremes	Description
Persistence	Continuous—Seldom	Consistency and ratability of marine traffic, seasonality.
Density	Congested—Sparse	Volume of marine traffic
Navigational Flexibility	Constrained—Discretionary	Ability to change voyage routing, fixed offshore destination.
Maneuverability	Constrained—Nimble	Ability to change speed and direction to avoid obstacles.
Economic Effect	Broad—Narrow	The magnitude of the total direct and indirect economic contribution.
Regulatory Oversight	Highly Regulated—Unregulated	The degree of operational discretion after compliance with operational requirements.
Purpose	Professional—Leisure	To what extent the marine traffic represents a business purpose or a livelihood.

From Table 2, the extremes of each of these characteristics represent broadly a commercial use or a recreational use. To the extent that a use drives marine traffic that is continuous, congested, navigationally constrained, highly regulated, professional, and of high economic consequence, it can be classified as commercial marine traffic. Conversely, a use that occurs infrequently or seasonally, with low volume and economic contribution, for leisure purposes on vessels that are highly maneuverable, vessels with flexibility in their voyage routing, and minimally regulated can be classified as recreational marine traffic.

While uses with the extremes of each characteristic are easily grouped into commercial and recreational categories, each marine use will have different assessments of these characteristics but in general can be associated with either a commercial or recreational activity for the purposes of this study.

Using this context for identifying commercial or recreational uses, and their underlying marine traffic, led to a reclassification of several recreational uses from earlier studies, namely, NYSERDA Report 17–25m, the Marine Recreational Uses Study (NYSERDA 2017b). In the previous study, cruise ship tourism, whale watching, and underwater activities were all considered recreational activities. In the new AoA, they are considered commercial activities driving commercial marine traffic. The vessels that carry these passengers represent for-hire commercial enterprises and the resulting marine traffic can be considered commercial. Cruise ships regularly transit through the AoA, including those originating from the Port of New York and New Jersey, and utilize the inbound and outbound designated shipping lanes that intersect the AoA. Within these discrete routes, the level of cruise ship traffic is low compared with other vessel densities in the region. However, cruise ships carry passengers for hire, are subject to regulation by the USCG, and are generally larger, less maneuverable vessels. Cruise ship activity occurs year-round but increases in May and the summer months and peaks in September and October. (NYSERDA 2017b). The general and dominant use whale watching areas are present north of the AoA while infrequent specialty trips are taken as far south as Zone 2 of the AoA between approximately 70.6 W and 72.4 W longitude. Whale watching occurs from spring through fall and peaks in July and August (NYSERDA 2017b). Underwater activities, specifically scuba diving, occur mainly to the north of the AoA but some dive sites are located in Zone 1 and one in Zone 2. Diving activity occurs year-round but is concentrated during the months of May through October. Depth of water is a limiting factor for scuba diving—beyond 40-meters (130-foot) depth, a complex mixed gas breathing apparatus is required. This increases the competency requirements and reduces the applicable population of technical divers, and therefore, presence and persistence of these vessels.

While recreational fishing clearly represents a recreational use and recreational marine traffic, the designation is less clear for charter/for-hire fishing boats. In this study, these fishermen are not classified as commercial fishing, although many carry commercial fishing documentation. They also do not fall under the recreational definition described by the characteristics in Table 2. For the purposes of this study, vessels used for charter/for-hire fishing are classified as non-recreational and are reported along with other commercial marine traffic because of the purpose and economic contribution of their operations, but they are not commercial fishermen and are regulated under a different framework of permits, limits, etc.

2.5.4 Acquire Regional Historical Vessel Positions

There are several sources for historical vessel position data available. Section 2.3.1 of this report identifies and describes the different sources and highlights the selection of AIS data as the preferred source of vessel position information for this study. The USCG's ocean vessel position data represents AIS data for all applicable vessels collected from terrestrial receivers. MarineCadastre.gov curates the raw AIS data to make it easier to use. The MarineCadastre.gov portal is a cooperative effort between BOEM and NOAA. MarineCadastre.gov AIS data are intended for coastal and ocean planning. With over 300 data layers from numerous sources, MarineCadastre.gov is an authoritative source and toolkit for vessel position data. (BOEM, NOAA, and Marine Cadastre n.d.).

Electronic vessel position data for the years 2017 through 2022 were downloaded from the MarineCadastre.gov portal. Position records were filtered to include only those falling within a region of consideration encompassing the spatial studies AoA. (BOEM, NOAA, and Marine Cadastre n.d.).

2.5.5 Assess Historical Marine Traffic Using Existing and New Research

Electronic vessel position information was ingested and distilled into McQuilling data sets and grouped according to the type of vessel, date, vessel parameters such as length overall (LOA), and other characteristics of the vessel position. A typical vessel position record consists of the information identified in Table 3. Using vessel type, marine traffic was classified as either commercial, recreational or other, where other represents marine traffic originating from military, law enforcement, and other utility uses. For commercial and recreational marine traffic, vessel position data was used to create vessel tracks and density of marine traffic in and around the AoA. AIS vessel position data for each year 2017 through 2022 was analyzed and evaluated for number of vessels and voyages, annual trend, seasonality, spatial variation and density for vessel classes.

To supplement electronic position data, qualitative sources of vessel position information and vessel activity were investigated to inform on commercial and recreational uses in and around the AoA. Recreational boating statistics were used to condition vessel use.

Table 3. Automatic Identification System Vessel Position Data Elements

Source: BOEM and NOAA 2022

Name		Description	Example	Units	Resolution	Type	Size
1	MMSI	Marine Mobile Service Identity value	477220110	-	-	Text	8
2	Base Date Time	Full UTC date and time	2017-02-01 T20:05:07	-	YYY-MM-DD: HH-MM-SS	Datetime	-
3	LAT	Latitude	42.35137	decimal degrees	XX.XXXXX	Double	8
4	LON	Longitude	-71.04182	decimal degrees	XXX.XXXXX	Double	8
5	SOG	Speed Over Ground	5.9	knots	XXX.X	Float	4
6	COG	Course Over Ground	47.5	degrees	XXX.X	Float	4
7	Heading	True heading angle	45.1	degrees	XXX.X	Float	4
8	Vessel Name	Name as shown on the station radio license	OOCL Malaysia	-	-	Text	32
9	IMO	International Maritime Organization vessel number	IMO9627980	-	-	Text	16
10	Call Sign	Call sign as assigned by FCC	VRME7	-	-	Text	8
11	Vessel Type	Vessel type as defined in NAIS specifications	70	-	-	Integer	short
12	Status	Navigation status as defined by Convention on the International Regulations for Preventing Collisions at Sea (COLREGS)	3	-	-	Integer	short
13	Length	Length of vessel (see NAIS specifications)	71.0	meters	XXX.X	Float	4
14	Width	Width of vessel (see NAIS specifications)	12.0	meters	XXX.X	Float	4
15	Draft	Draft depth of vessel (see NAIS specifications)	3.5	meters	XXX.X	Float	4
16	Cargo	Cargo type (see NAIS specifications and codes)	70	-	-	Text	4
17	Transceiver Class	Class of AIS transceiver	A	-	-	Text	2

2.5.6 Estimate Non-Offshore Wind Marine Traffic Growth

Using global and regional economic and trade information, marine traffic growth was assessed for various shipping sectors in the region, including the AoA for the period 2024 through 2050. Links were established between global economic activity and global maritime transport to demonstrate economic activity drives cargo movement at a global level. Global and U.S. gross domestic product (GDP) figures were used to derive regional economic activity for the New York/New Jersey area. Relationships were established between New York/New Jersey economic activity and regional maritime activity to generate forecasted economic growth for the New York/New Jersey region, utilizing long term growth forecasts to 2050. The economic models developed in these steps were used to produce estimates of future marine trade growth. Analysis of cargo activity across general cargo, bulk cargo, oil and gas carrier, cruise ships, and automotive segments examined the historical relationship between marine traffic activity for various vessel segments in the New York/New Jersey region and derived regional economic activity measurements. A matrix of future growth for each vessel segment utilizing the historical relationship observed was derived.

2.5.7 Estimate Offshore Wind Marine Traffic Growth

Capacity, capability, and transport logistics assumptions for U.S. East Coast OSW development through 2050 was established. Using existing OSW project data and assessments of existing and new OSW technologies and installations offshore the U.S. East Coast, marine traffic growth was assessed for the OSW sector in the region, including the AoA for the period through 2050. Existing projects were identified for 2023–2030, including number of turbines to be installed and estimate of when. The number of turbines implied for each year from 2030 through 2050 located offshore U.S. East Coast was estimated. Known manufacturing and staging areas shoreside and representative targets offshore for field development based approximately on lease, call area, and WEA locations (nodes) were identified to generate routes between all nodes and allocate number of equipment trips across this network of tracks uniformly. Marine traffic activity during the period was forecast.

2.5.8 Assess Marine Traffic Growth for Offshore Wind and Non-Offshore Wind

OSW and non-OSW marine traffic growth forecasts were investigated and increases in marine traffic in 2030, 2040 and 2050 assessed. These increases were applied to 2022 actual marine traffic measurements in terms of tracks and densities for individual vessel types and results compared to previous studies and trends implied by AIS historical data.

2.5.9 Investigate Marine Safety Considerations

U.S. and international OSW and related experience of government regulatory authorities and competent non-governmental organizations was reviewed. The process and results of establishing traffic separation schemes and safety fairways in the U.S. Gulf in support of the oil and gas industries historically was investigated. European and other global experience in establishing guidelines for safe navigation in and around fixed and floating offshore installations, especially OSW equipment and structures was considered, along with recent recommendations by regulatory authorities. Realistic and pragmatic operational parameters for commercial and recreational marine navigation in and around OSW installations were suggested and best practices highlighted. Marine advisory systems for smaller vessels about sea state and weather conditions were considered and practical limits for operation of recreational vessels based on these systems suggested.

2.5.10 Establish Expected Presence and Persistence of Vessels in and around Area of Analysis

Historical electronic vessel position data for all detected vessels and forecasted growth assessments for commercial marine traffic for non-OSW and OSW activities were produced. Qualitative assessments of marine safety considerations, combined with historical quantitative assessments of weather and sea state in and around the AoA were considered and discretionary use of recreational vessels and practical limits imposed by the marine logistics of getting to and from the AoA assessed.

2.5.10.1 Measurement of Presence and Persistence

Presence and persistence are spatial and temporal concepts. To assess presence and persistence in and around the AoA, a measurement approach is in order. Several qualitative and quantitative methods are available, and a combination of both provides a fuller perspective. To support a qualitative assessment of presence and persistence, a measure of density is used to represent these concepts. Remotely sensed AIS data lends itself to this approach by dividing a region up into a grid of *aliquots* and then counting the vessel tracks that pass through the aliquot over a given period of time. This approach allows for the production of heat maps that visually indicate variations in the activity inside the aliquots. This visualization allows the viewer to see the areas of the region with the highest and lowest levels of marine traffic activity and provides good spatial information on presence and persistence. For this study, this approach is employed to examine activity across different vessel types and over time, in concert with other qualitative information related to marine traffic in the region. Aliquots of dimensions 1,200 by 1,200 meters are used.

Quantitative measurement is also employed by processing AIS statistics related to the tracks of vessels in the AoA. Several choices are available such as number of tracks, number of unique vessels and duration of tracks in the AoA. Duration is a reasonable high-level proxy for presence and persistence that also allows comparison across vessel types. It is particularly useful for informing on the temporal variation of marine activity.

3 Study Findings

3.1 Marine Uses in and around Area of Analysis

In Table 2 in section 2.5.3 of this study, marine uses are grouped broadly into commercial and recreational uses using criteria based on the characteristics of the use. Because all marine uses originate from vessels regarding activity in and around the AoA, marine traffic is informed by the marine use characteristics. Table 4 lists marine use characteristics.

Table 4. Marine Use Characteristics

Source: McQuilling Renewables

Characteristic	Description
Persistence	Consistency and ratability of marine traffic, seasonality.
Density	Volume of marine traffic.
Navigational Flexibility	Ability to change voyage routing, fixed destination offshore.
Maneuverability	Ability to change speed and direction to avoid obstacles.
Economic Effect	The magnitude of the total direct and indirect economic contribution.
Regulatory Oversight	The degree of operational discretion after compliance with operational requirements.
Purpose	To what extent the marine traffic represents a livelihood.

Persistent uses occur with a regular frequency. Examples include cargo transport between ports, cruise ship itineraries, and commercial fishing. Seasonal activities and project-related uses occur less regularly and unpredictably. Examples include recreational boating and OSW marine transport logistics. Density is related to the volume or occurrence of uses and their related marine traffic. Many trips through the region in a given timeframe or large duration of time spent in the region indicate higher density levels. Navigational flexibility addresses the ability to easily change vessel routing—or not. Larger cargo vessels are generally compelled to stay in traffic lanes while smaller more maneuverable vessels may depart from these guidelines. This characteristic also considers the voyage itself. Most cargo and passenger vessels transit from port to port, and therefore, their routing can change enroute to their destination. For a specific voyage, fishing vessels, wildlife viewing vessels, diving vessels, and vessels supporting OSW installations have voyages that terminate at sea at a specific location and do not travel port to port. This can limit navigation flexibility as compared to vessels *transiting* the region. Maneuverability is a measure of the speed at which vessels can change their velocity and direction to avoid obstacles. Marine uses arising from business endeavors (cargo transport, commercial fishing, etc.) are income generating entities and represent livelihoods of the owners and operators of the vessels and crew that leverage marine use with positive economic consequence. Uses for recreation, leisure, or sport have an economic effect from purchases of vessels, fuels, outfitting, etc., but to a much lesser extent. Different uses have different degrees of regulatory oversight. The marine transport of hazardous cargos such as hydrocarbons, or the transport of passengers, is regulated by the USCG and other agencies by a dense fabric of requirements for the construction and safe operation of the vessels, especially larger vessels. Small recreational craft are guided by navigational rules and a much less imposing regulatory framework. Finally, the purpose of the use characterizes its activity in terms of its persistence and density in the regions along the spectrum of discretionary to mandatory.

3.1.1 Commercial Uses

To the extent that a use drives marine traffic that is to some degree continuous, congested, navigationally constrained, highly regulated, professional, and of high-economic consequence, it can be classified as commercial marine traffic. USCG requirements contained in 33 CFR Section 164 state that certain vessels must have properly installed, operational USCG-approved AIS devices. These are primarily commercial vessels, as described below (Navigation Safety Regulations, 33 C.F.R. § 164 2023):

- A self-propelled vessel of 65 feet or more in length, engaged in commercial service.
- A towing vessel of 26 feet or more in length and more than 600 horsepower, engaged in commercial service.
- A self-propelled vessel that is certificated to carry more than 150 passengers.
- A self-propelled vessel engaged in dredging operations in or near a commercial channel or shipping fairway in a manner likely to restrict or affect navigation of other vessels.
- A self-propelled vessel engaged in the movement of certain dangerous cargo or flammable or combustible liquid cargo in bulk.

The following self-propelled vessels must comply with the IMO SOLAS, provision for an AIS system (Navigation Safety Regulations, 33 C.F.R. § 164 2023):

- A vessel of 300 gross tonnage or more, on an international voyage.
- A vessel of 150 gross tonnage or more, when carrying more than 12 passengers on an international voyage.

The above regulatory requirements for AIS result in the establishment of large data sets of vessel position information for commercial vessels. This information provides a rich chronology of vessel historical positions that inform marine use activity and traffic data. MarineCadastre.gov is a collaboration between NOAA and BOEM that provides AIS vessel position data obtained from land-based receivers to users in a curated form. Vessel position data from MarineCadastre.gov provides a good historical summary of actual marine traffic as vessels positions, tracks, and density in and around the AoA. This data can be aggregated to establish the particulars of marine use by different vessel types, which, in general, correspond to different commercial marine uses. Table 5 illustrates the aggregation of detail AIS codes from the MarineCadastre data into a set of 10 summary types of marine traffic used in this study, where aggregated codes 1, 2, 3, 4 and 6 capture commercial marine traffic (appendix A).

Table 5. Aggregated Automatic Identification System Codes (AAIS)

Source: Marine Cadastre, McQuilling Renewables

Aggregated Code (AAIS)	Detail Codes	Vessel Type	Description
1	AIS 70-79; AVIS[1] 1003-1005, 1016	Cargo	Public Freight, Industrial Vessel, Cargo Vessel
2	AIS 80-89; AVIS 1017, 1024	Tanker	Carriage of crude oil, fuel oils, gasoline, jet fuel
3	AIS 31, 32, 52; AVIS 1023, 1025	Tug & Towing	Tug, tank barge, towed cargo barge
4	AIS 60-69; AVIS 1012-1015	Passenger	Cruise ships, ferries, excursion vessels
5	AIS 36, 37; AVIS 1019	Recreational	Pleasure craft, recreational fishing, sailboat
6	AIS 30; AVIS 1001, 1002	Fishing	Commercial fishing vessel, fish processing vessel
7	AIS 35, 55, 58, 59	Military / USCG / Law Enforcement	Military operations, law enforcement, medical transport
8	AIS 20-29, 33,34, 40-51, 53, 54, 90-99; AVIS 1006-1009, 1011, 1018, 1020-1022	Other	Wing-in-ground (WIG), high speed craft (HSC), dredging, diving, pilot, search and rescue (SAR), port tender, oil recovery, research vessel, school ship
9	AIS 0, 1-19, 38, 39, 56, 57	Empty, not assigned	Not applicable
10	AVIS 1010	Offshore Supply Boat	

[a] Authoritative Vessel Identification Service (AVIS) codes used prior to 2018.

While the vessel position AIS data is a powerful tool to assess marine traffic and use, the system has limitations and there is additional data available from other sources which contributes to a more fully informed study result. Certain types of commercial use such as wildlife viewing (primarily whale watching) and underwater activities (such as wreck and reef diving) are not differentiated in AIS data, but information can be found from the geospatial portals as well as from qualitative research.

In this study, charter/for-hire vessels deployed for fishing are considered non-recreational because their use and traffic attributes more closely resemble characteristics of commercial activity and so are included in the commercial category of marine uses. For the purposes of this study, charter/for-hire fishing boats are classified as non-recreational because of the purpose and economic contribution of their operations; however, they are not commercial fishermen and are regulated under a different framework of permits, limits, etc.

3.1.2 Recreational Uses

A marine use on a vessel that occurs infrequently; with low relative volume and economic contribution; for leisure purposes on vessels that are highly maneuverable; on vessels with flexibility in their voyage routing; and minimally regulated can be classified as recreational marine traffic. Three primary types of recreational marine traffic are identified:

- Sailing—For leisure as well as regional and long-distance sailing races.
- Recreational fishing—not for-hire or charter fishing.
- Regional transits—Transits can be through or to the AoA, although the latter may be quite limited for reasons discussed later in this study.

Vessel position data from MarineCadastre.gov provides an historical summary of actual recreational marine traffic as vessels positions, tracks, and density in and around the AoA. As can be seen in Table 5 however, only one aggregated code (AAIS Code 5) is established for recreational vessels. Therefore, the detail MarineCadastre codes are of more use in this case as they differentiate between general recreational boating (AIS Code 36) and sailing (AIS Code 37). Unfortunately, within AIS Code 36, further differentiation is not provided so it is not possible to know from this data more specific information about historical voyage activity of recreational fishermen and general recreational boating separately.

This limitation in AIS data demonstrates the value of non-AIS data available from other sources which contributes information about historical recreational vessel activity. Information located on the geospatial portals as well as from qualitative research helps to provide additional perspective to recreational uses. Unfortunately, most of the data on recreational boating is out of date, reducing its overall usefulness. As a way to address this information shortcoming, in this study recreational boating registration data and boating use statistics, in addition to weather and sea state data, are used to assess presence and persistence of recreational marine traffic in and around the AoA.

3.1.3 Other Uses

AAIS codes 7, 8, 9, and 10 provide historical vessel position, track and density information for other uses such as military, law enforcement, offshore supply boats and uses originating on other vessel types such as wing-in-ground (WIG), high speed craft (HSC), dredging, commercial diving, pilot, search and rescue (SAR), port tender, oil spill recovery, research, and training ships. These activities, in general, are support activities to commercial and recreational uses and are driven by marine traffic in these categories, rather than driving marine traffic demand.

3.2 Presence and Persistence of Commercial Uses

A combination of electronic historical AIS vessel position information and qualitative research inform commercial use and marine traffic in and around the AoA. As discussed in section 3.1 of this study, USCG and international requirements for AIS vessel position indicating systems create a trove of historical position data for commercial vessels. However, there are limitations to this remotely sensed data for commercial fishing vessels. Significantly, AIS may not be the best primary source for informing on commercial marine fishing activities (AAIS Code 6). The VTR, managed by the NOAA Fisheries group, and the VMS), also managed by NOAA, provide a more complete picture of commercial fishing activities in and around the AoA.

The following sections highlight available historical AIS position data for commercial vessels, address marine safety considerations for navigation in and around fixed offshore structures, discuss non-AIS commercial use indications, and then provide a methodology to assess future commercial marine traffic growth from OSW activity and non-OSW activity.

3.2.1 Historical Commercial Marine Traffic

Remotely sensed AIS vessel position data was processed into vessel tracks and ultimately densities using ArcGIS tools and SQL vessel data sets. Transformation into these data sets included aggregation of BOEM/NOAA vessel types into 10 main classes of vessels. Commercial cargo or passenger vessels are represented by four of these aggregated codes, one for general cargo vessels (AAIS Code 1), including containerships, bulk carriers, multipurpose cargo carriers, vehicle carriers and similar vessels. AAIS Code 2 includes all liquid bulk carriers, commonly referred to as tankers or tankships. These include crude oil carriers, distilled petroleum product (diesel, gasoline, jet fuel, etc.) carriers, chemical carriers, and vessels transporting other liquid cargos in bulk. Tugs and barges, a popular form of offshore cargo transport in U.S. coastal waters because of their cost structure, comprise AAIS Code 3. Many of these units, especially offshore Long Island, carry petroleum cargoes in bulk and are often referred to as tank barges. As such, they are better considered as part of the tanker traffic. AAIS Code 4 is used to describe passenger vessels and includes cruise ships, ferries, excursion vessels, and other vessels identified and regulated by the USCG as approved to carry passengers on board for hire. Commercial fishing vessels, AAIS Code 6, are discussed in this section as well although they have a different operation profile with destinations offshore rather than port to port.

3.2.1.1 Automatic Identification System 2017–2022 Commercial Marine Traffic in and around Area of Analysis

To make quantitative assessments of marine traffic in the AoA, statistical information must be extracted and distilled from remotely sensed vessel position records. Display of vessel tracks is of poor utility in illustrating the intensity of marine use as it is visually overwhelming. However, track statistics can provide quantitative data that informs on the intensity of marine traffic across vessel types and across time periods. Visual density plots yield much better qualitative indications of the comparative spatial and temporal intensity of marine uses. In the following figures a uniform traffic density scale and coloration is employed across vessel types/AAIS codes to enable direct comparison of marine traffic density. Both approaches are used in concert to highlight commercial marine traffic in and around the AoA.

An important consideration is to define what degree of marine traffic intensity influences decisions regarding marine use of the region. Research into this subject did not uncover specific guidelines. For marine uses of commercial and recreational vessels, density thresholds that are a function of vessel length (and generally maneuverability and navigational flexibility) could be a pragmatic yet prudent approach. Table 6 illustrates this point.

Table 6. Possible Density Thresholds by Length Overall (Number of Trips)

Table 6 illustrates number of vessels per time period that may be considered as a density threshold between high and low density as a function of vessel length overall (LOA).

Source: McQuilling Renewables

LOA(m)	LOA(ft)	Per Hour	Per Day	Per 180 days	Per Year
~ 100m	~ 330	1	24	4,380	8,760
~ 30m	~ 165	2	48	8,760	17,520
~ 20m	~ 65m	4	96	17,520	35,040

For smaller, more maneuverable and navigationally flexible vessels (approximately 20-meter / approximately 65-feet LOA), the density threshold could be as much as a transit frequency of four vessels per hour. This frequency produces a result of 35,000 vessels per year, a seemingly large number annually, but one smaller vessel transiting through an aliquot (see Section 2.5.10.1) every 15 minutes can be considered comparatively sparse. For larger vessels (approximately 100 meters in length and greater), transits occurring more frequently than every hour may be considered as a density threshold, or 8,700 vessels per year. This figure is not unreasonable from a marine operator's standpoint. Weather, sea state, and other event-specific factors may influence the applicability of these thresholds.

General Cargo Vessels

Available AIS vessel position information was acquired for the period 2017 through 2022 for general cargo vessels (AAIS Code 1) and consolidated into vessel tracks. Table 7 summarizes the presence and persistence of general cargo vessels in the region for this period quantitatively and Figure 3 illustrates remotely sensed general cargo vessel density in 2022. In this study, total track duration in the AoA is the proxy for marine traffic density.

Table 7. General Cargo Vessel Activity 2017–2022

Source: Marine Cadastre

	2017	2018	2019	2020	2021	2022
Unique Vessels	1,409	1,252	1,115	1,057	1,329	1,542
Total Duration (Hours)	251,861	147,212	125,500	150,282	200,688	238,908

Figure 3. General Cargo Vessel Density (2022)

AAIS Code 1

Source: Marine Cadastre

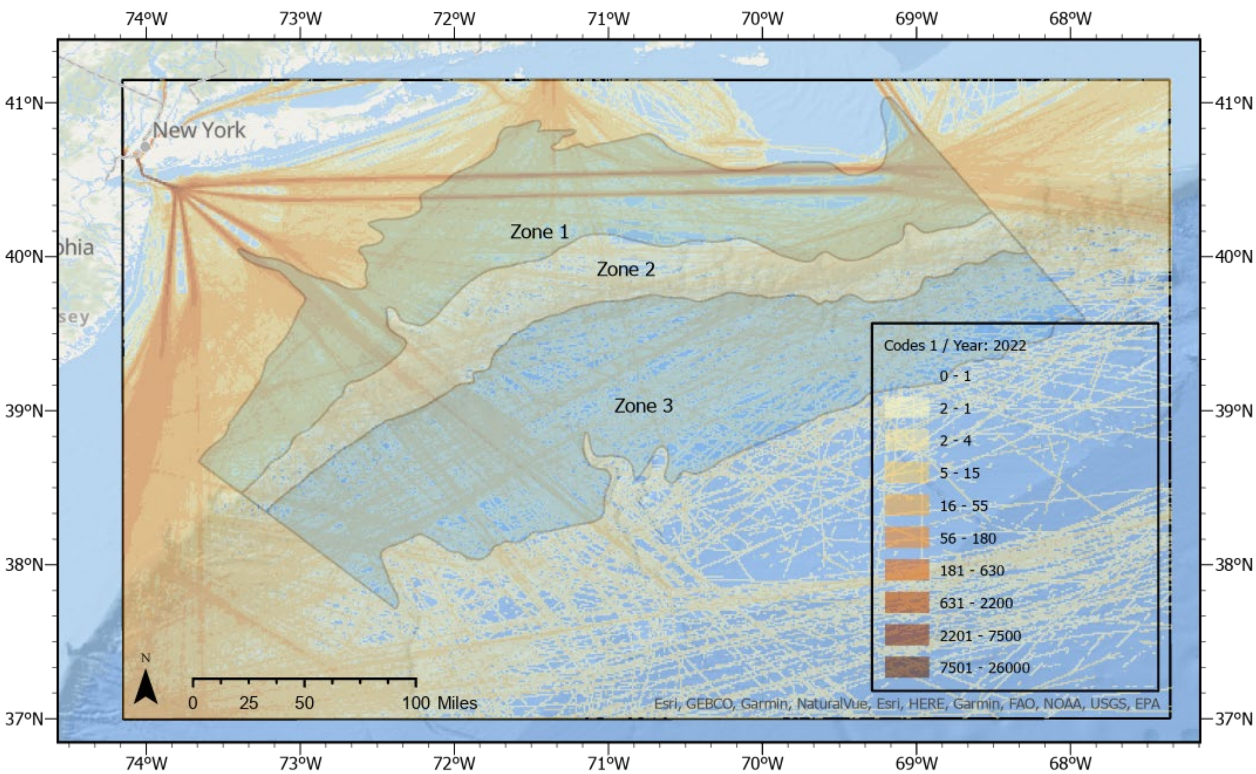


Figure 3 shows vessel transits occurring across the whole of the AoA. However, the density plot reveals almost all this activity is sparse and infrequent. The legend indicates the track density in the aliquots (see section 2.5.10.1 for a discussion on aliquots) in most of the AoA is below 50 tracks per year, which translates into one vessel transit between 7 and 8 days. The exception to this activity level is the traffic occurring in some of the safety fairways, clearly shown in orange in the figure from the northwest to the southeast (proposed Hudson Canyon to Ambrose Southeastern Fairway) and to the north and northeast of the AoA (Nantucket to Ambrose Fairway and the traffic separation schemes [TSS] directly to the east). This pattern repeats in the figures that follow for other commercial vessel types.

Tankers

Available AIS vessel position information was acquired for the period 2017 through 2022 for tankers (AAIS Code 2) and consolidated into vessel tracks. This data includes all self-propelled liquid bulk carriers. Table 8 summarizes the presence and persistence of tankers in the region for this period quantitatively and Figure 4 illustrates remotely sensed tanker traffic density in 2022.

Table 8. Tanker Activity 2017–2022

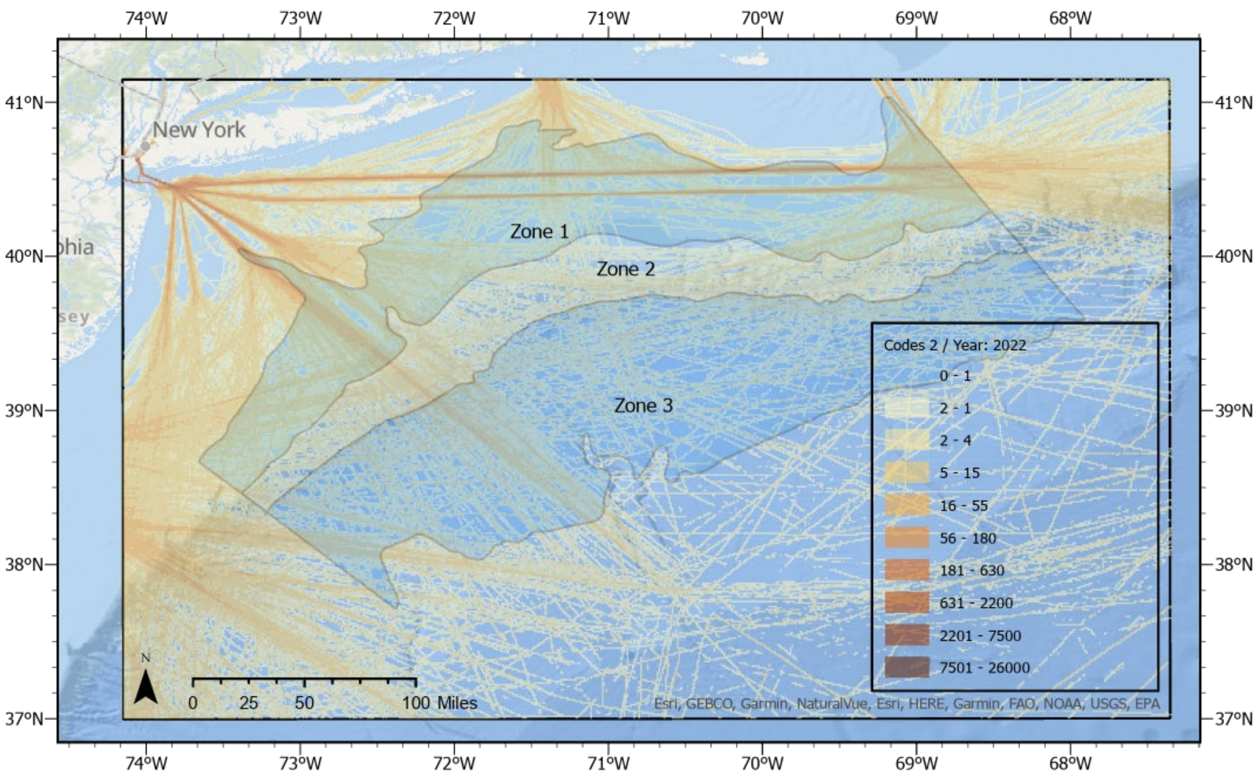
Source: Marine Cadastre

	2017	2018	2019	2020	2021	2022
Unique Vessels	789	772	721	621	873	755
Total Duration (Hours)	129,118	88,002	89,872	86,167	119,445	89,706

Figure 4. Tankers Density (2022)

AAIS Code 2

Source: Marine Cadastre



Traffic density for tankers is concentrated around the same traffic patterns as cargo vessels. Figure 4 shows the highest presence of tankers occurs in the safety fairways and traffic separation schemes currently in place. There is also a noticeable "funnel effect" that can be observed as high-density vessel activity as traffic converges into these areas and diverges from these areas.

Tug/Barges

Available AIS vessel position information was acquired for the period 2017 through 2022 for tugs/barges (AAIS Code 3) and consolidated into vessel tracks. This data includes all tug and barge units but also reports on the position tugs only, which introduces a slight, but not material, over-reporting of cargo transits. Table 9 summarizes the presence and persistence of tugs/barges in the region for this period quantitatively and Figure 5 illustrates remotely sensed tug/barge traffic density in 2022.

Table 9. Tug/Barge Activity 2017–2022

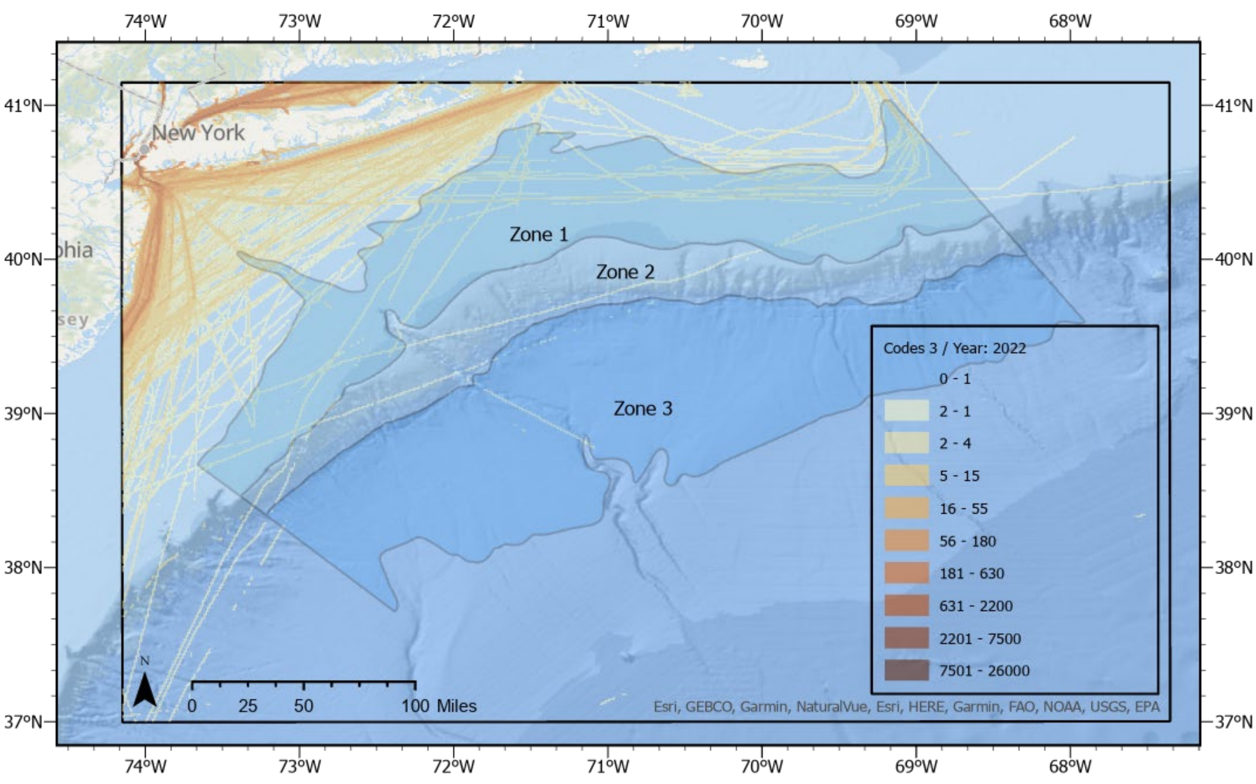
Source: Marine Cadastre

	2017	2018	2019	2020	2021	2022
Unique Vessels	40	47	3	27	31	37
Total Duration (Hours)	10,041	7,093	8,039	4,524	4,710	6,610

Figure 5. Tug/Barge Density (2022)

AAIS Code 3

Source: Marine Cadastre



As seen in Figure 5, tug/barge presence around the AoA is focused to the north of the AoA and along the coasts, as well as in Long Island Sound. It impinges only slightly on the AoA's northern boundary of Zone 1. Tug/barge traffic levels are far below the volume of traffic experienced by cargo and tanker vessels.

Passenger Vessels

Available AIS position information was acquired for the period 2017 through 2022 for passenger vessels (AAIS Code 4) and consolidated into vessel tracks. This data includes all vessels approved to transport passengers for hire, including cruise ships, ferries, excursion vessels, and other vessels approved to carry passengers. Table 10 summarizes the presence and persistence of passenger vessels in the region for this period quantitatively.

Figure 6 displays passenger vessel density in 2022.

Table 10. Passenger Vessel Activity 2017–2022

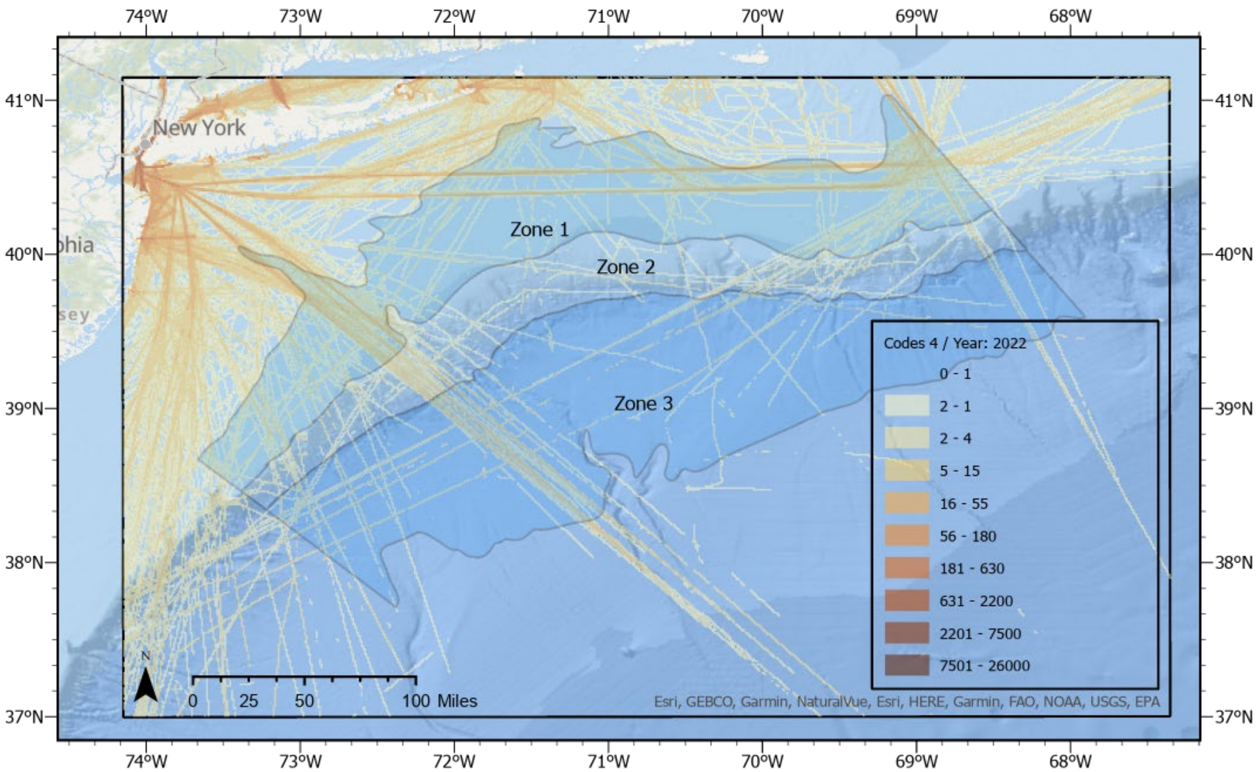
Source: Marine Cadastre

	2017	2018	2019	2020	2021	2022
Unique Vessels	92	73	20	36	40	86
Total Duration (Hours)	15,301	6,897	9,139	2,412	3,043	12,493

Figure 6. Passenger Vessel Density (2022)

AAIS Code 4

Source: Marine Cadastre



Traffic levels for passenger vessels are on the same order of magnitude as tug/barge activity. Since the category is composed of a variety of vessel types transporting passengers for hire such as cruise liners, ferries and excursion vessels (whale watching), the density signature is somewhat more varied, but still very low across the AoA.

Figure 6 illustrates higher density levels can be detected entering and exiting New York Harbor as these vessels converge for the passage through the narrows. Low-level activity is seen in a northwest/southeast direction farther southeast of New York Harbor, probably cruise ships enroute to/from Bermuda and the Caribbean.

Commercial Vessels Transiting Carrying Cargo or Passengers

This section summarizes the previous sections highlighting cargo vessels, tankers, tug/barges and passenger vessels, commercial vessel traffic carrying cargo or passengers and *transiting* the regions to load or discharge (AAIS codes 1-Cargo, 2- Tankers, 3-Tug/Barge and 4-Passengers). The density of vessel traffic created by these types of vessels is measured over the period 2017 through 2022. This visualization provides an indication of the change of spatial distribution of this traffic in the region over time. Figure 7 illustrates this data for 2017. The familiar traffic patterns emerge with the highest densities occurring in the traffic lanes where safety fairways are in place. This denser traffic is most prevalent in Zone 1 of the AoA at the Nantucket to Ambrose Fairway with some high-density presence in Zone 2 and Zone 3 in the location where the USCG PARS recommended Hudson Canyon to Ambrose Southeastern Fairway is proposed. To compare, the density of traffic in the Nantucket to Ambrose Fairway in 2017 was in excess of 8,000 transits annually or approximately once per hour on average through aliquots located there. In contrast, Zone 3 of the AoA registered density levels in aliquots there from zero vessels present to less than 10 vessels per year.

Figure 8 illustrates marine traffic for the same four vessel types in 2022. The general spatial distribution of traffic remains the same, as it also does in the intervening years 2018–2021 and suggests that commercial marine traffic growth occurs along established traffic patterns. Further, these patterns are where the safety fairways are in place or proposed to be extended.

Observation of Figure 7 and Figure 8 reveal that 2022 traffic intensity was less than 2017. This is as a result of the economic slowdown in 2018 and ongoing recovery since then. Figure 10 in section 3.2.1.2 more clearly illustrates this observation.

As the area taken by safety fairways and TSSs increases, more recreational vessels will be navigating in and through them. Adherence to navigational rules of the road by those vessels continues to be an important risk reduction factor.

Figure 7. Commercial Vessels Transiting Carrying Cargo or Passengers (2017)

AAIS Codes 1-Cargo, 2-Tankers, 3-Tug/Barge, 4-Passenger

Source: Marine Cadastre

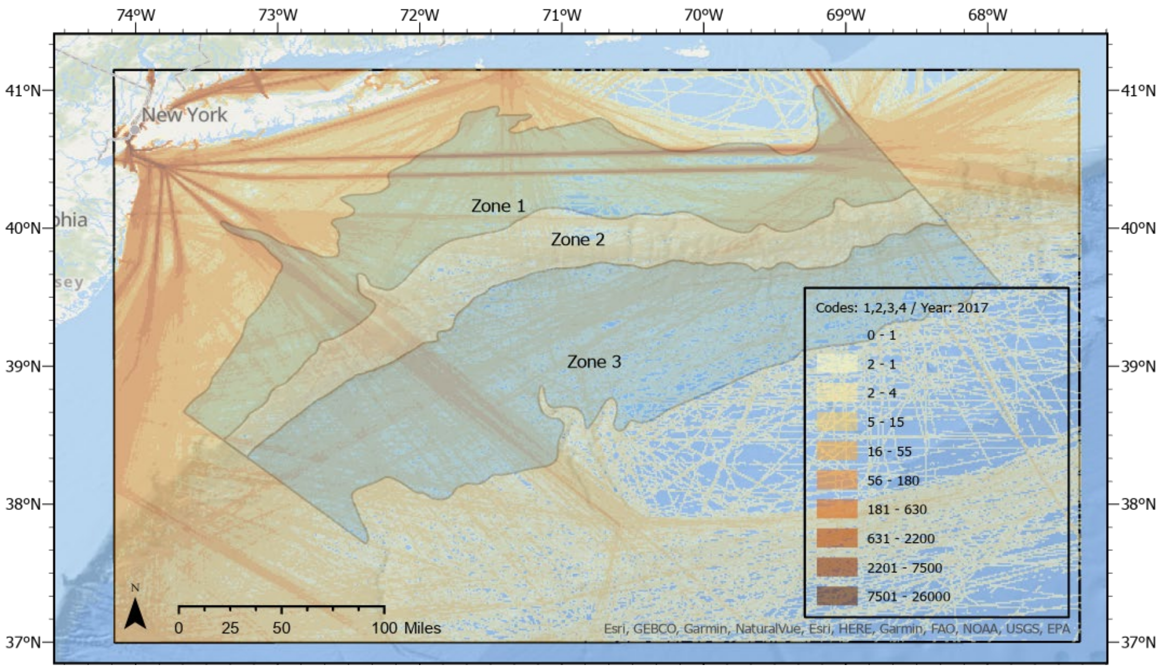
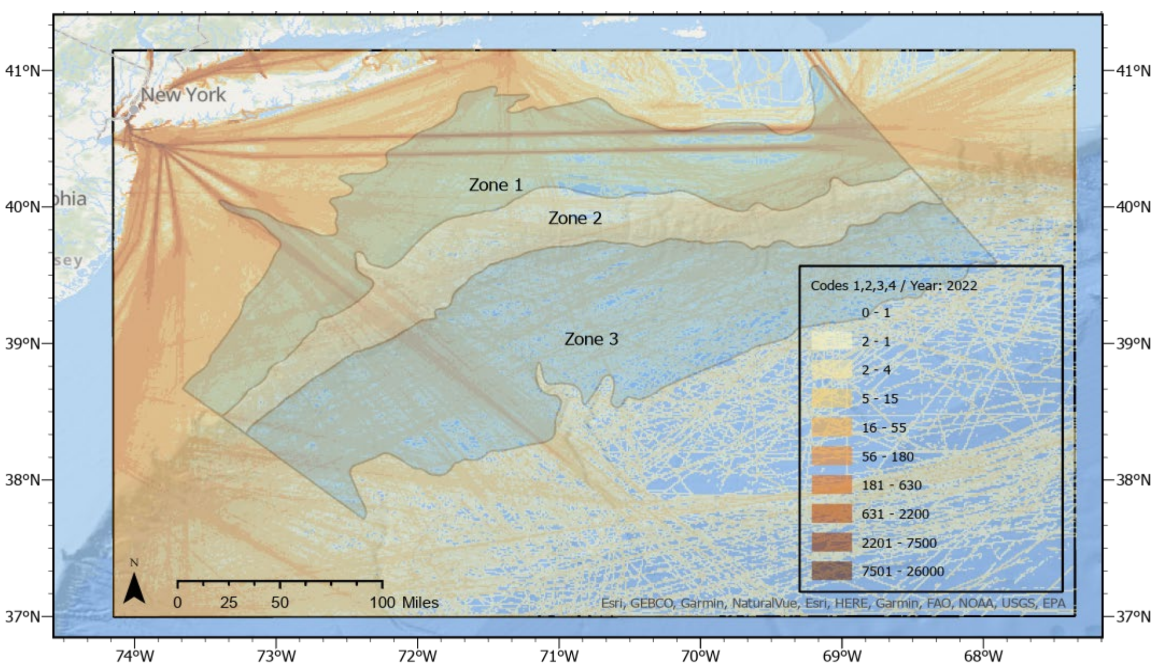


Figure 8. Commercial Vessels Transiting Carrying Cargo or Passengers (2022)

AAIS Codes 1-Cargo, 2-Tankers, 3-Tug/Barge, 4-Passenger

Source: Marine Cadastre



Commercial Fishing Vessels

According to Shumchenia, et al. (2022Available AIS vessel position information was acquired for the period 2017 through 2022 for Commercial Fishing Vessels (AAIS Code 6) and consolidated into vessel tracks. This data is included here for informational purposes only. Per stakeholder feedback, AIS data available is not a good proxy for fishing operations because AIS is only required for larger vessels and is often turned off after 12 miles from shore. Because of these limitations, AIS data may not be representative of all fishing locations further offshore and should not be used as a primary source of commercial fishing use in and around the AoA. Other spatial studies are more focused on commercial fishing and should be the primary reference for this use. Nonetheless, available AIS data for commercial fishing vessels is summarized below and is useful to observe along with other vessel codes and marine traffic types. Table 11 provides a sample of the presence and persistence of commercial fishing vessels in the region for this period, quantitatively, and Figure 9 illustrates remotely sensed commercial fishing vessel traffic density in 2022.

Table 11. Commercial Fishing Vessel Activity 2017–2022

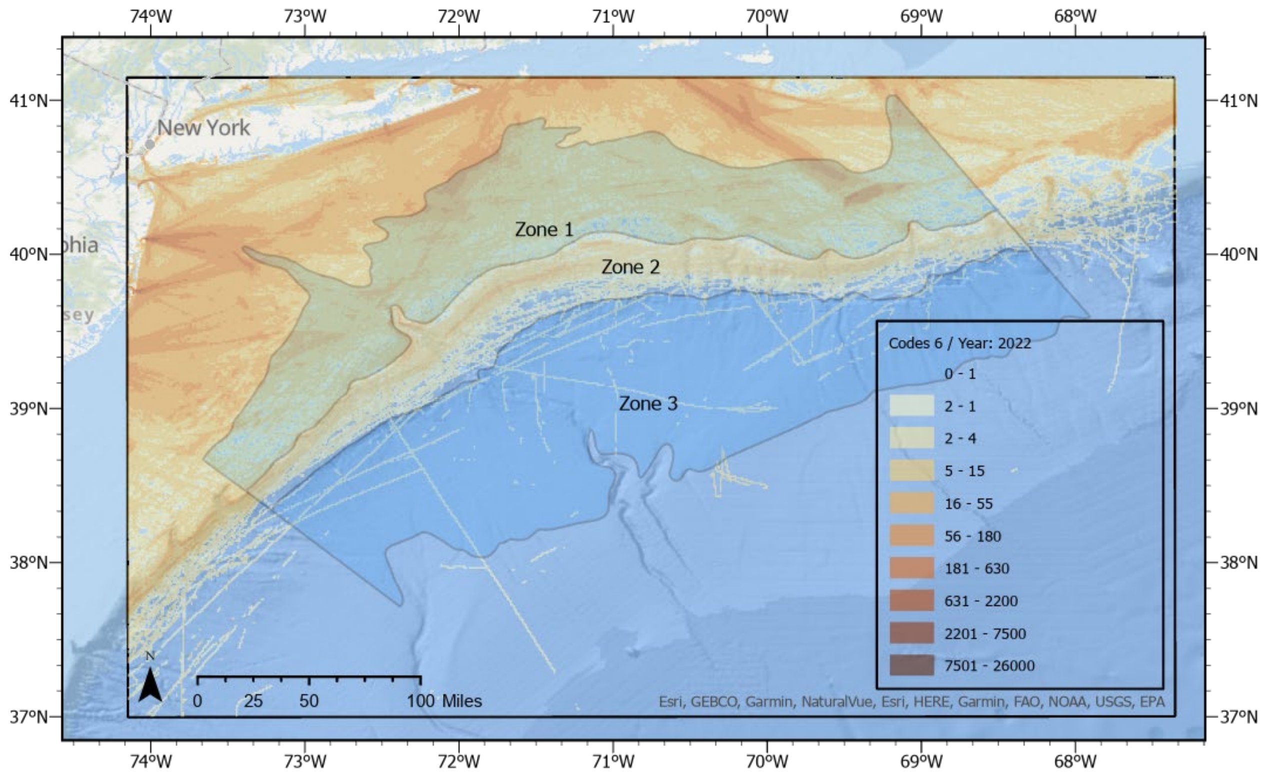
Source: Marine Cadastre

	2017	2018	2019	2020	2021	2022
Unique Vessels	523	580	84	607	624	574
Total Duration (Hours)	188,534	181,819	216,166	191,955	170,985	110,187

Figure 9. Commercial Fishing Vessel Density (2022)

AAIS Code 6

Source: Marine Cadastre



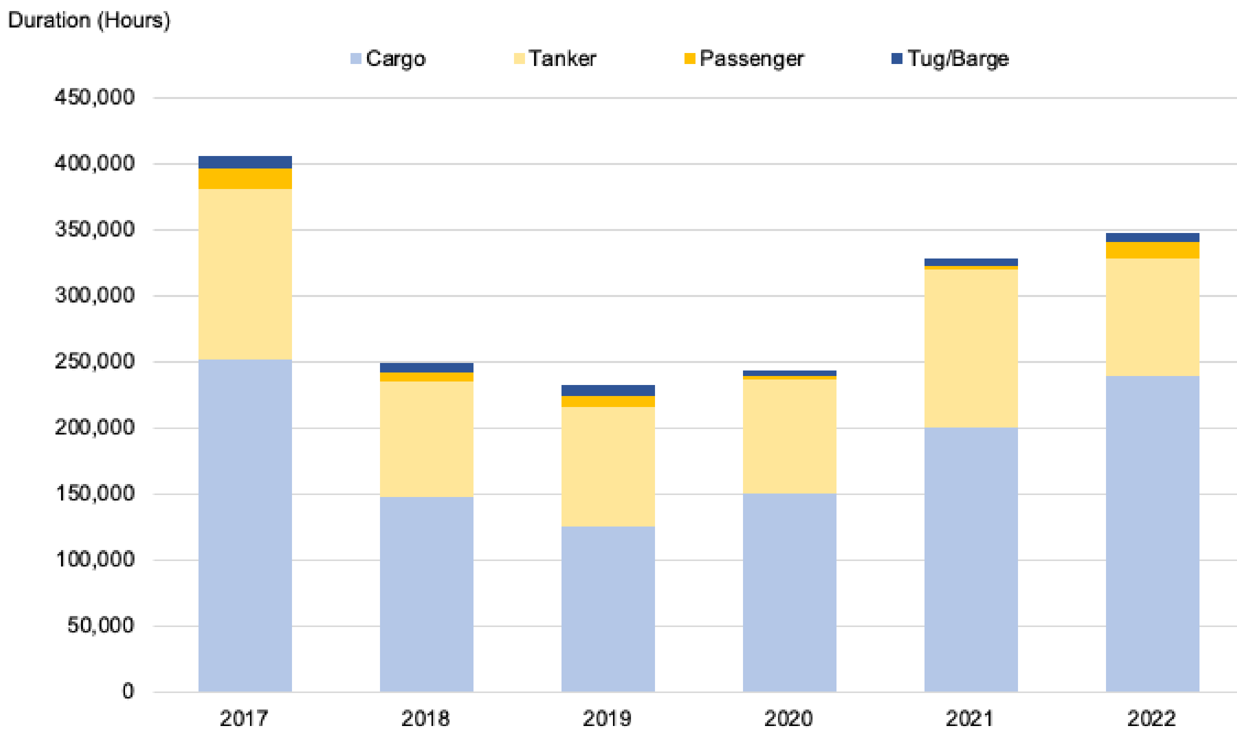
Density levels for commercial fishing vessels reveal a more amorphous spread of activity in and around the AoA as compared to commercial *transiting* vessels and is centered mainly in AoA Zones 1 and 2, although this may be an incomplete picture if AIS data for these vessels is missing. Nonetheless, three observations are taken from Figure 9: Higher densities of fishing vessels are observed north of the AoA with significant portions of Zone 1 and 2 having commercial fishing vessels present. Activity abruptly falls off beyond Zone 2 and the traffic pattern is considerably different than for the *transiting* cargo- or passenger-carrying commercial traffic.

3.2.1.2 2017–2022 Growth Trend Implied by Remotely Sensed Data

Figure 10 summarizes the presence and persistence of commercial marine transit traffic for the years 2017 through 2022. Remotely sensed AIS data was acquired for these years and recorded in terms of total hours per year in the AoA for the four cargo/passenger carrying vessel types.

Figure 10. Presence and Persistence of Commercial Marine Traffic in the Area of Analysis (2017–2022)

Source: McQuilling Renewables



The table illustrates that the primary commercial marine traffic in the AoA is created by cargo vessels and tankers. Historical AIS marine traffic data was analyzed to forecast future trendlines for the four AAIS commercial vessel codes related to the transport of cargo (AAIS codes 1, 2, 3, 4), based on a simple regression model. These trends lines were used to project the 2024 starting point for future assessments of non-OSW marine traffic growth estimated in section 3.2.4 of this study. Table 12 contains the actual marine traffic observed for each AAIS code for the period 2017 through 2022 and the results of the extrapolation to 2023 and 2024 for the estimated traffic in those years based on simple regression models illustrated in Figure 11.

Table 12. Marine Traffic Actuals (2017-2022) and Estimates (Total Duration in Hours)

Illustrates short-term, next-year and year-after mathematical extrapolations for 2023 and 2024 based on simple regression models of actual results from 2017-2022 to obtain a starting point (2024) for future long-term forecasts later in this report.

AAIS Code 1—Cargo Vessels, AAIS Code 2—Tankers, AAIS Code 3—Tug/Barges, AAIS Code 4—Passenger Vessels

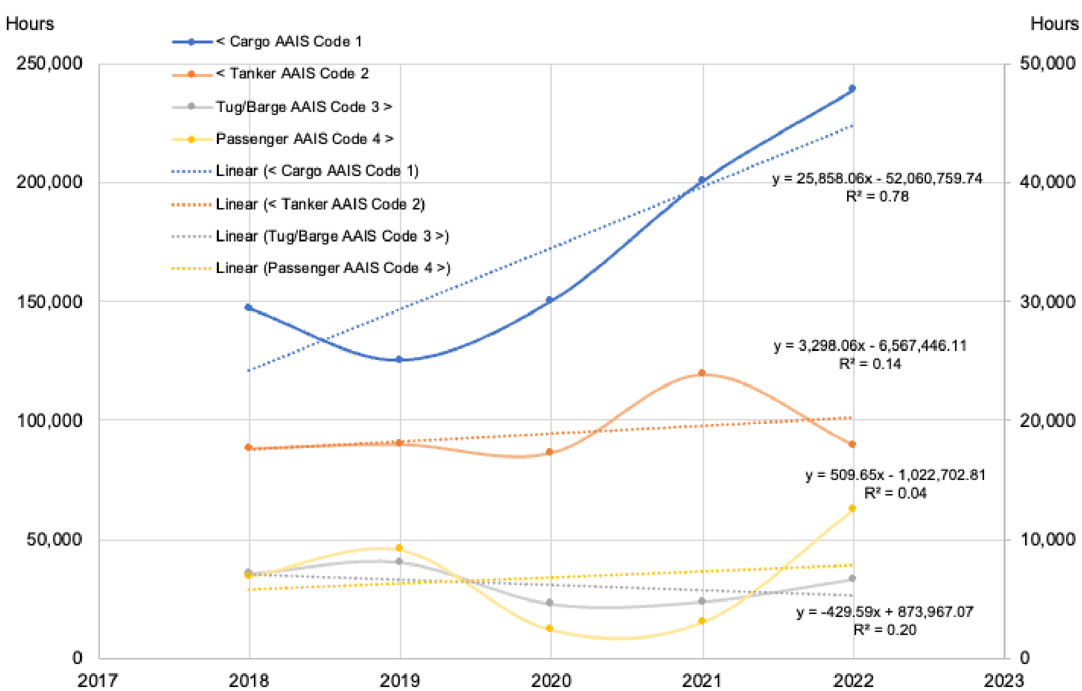
Source: McQuilling Renewables

Year	Cargo AAIS Code 1	Tanker AAIS Code 2	Tug/Barge AAIS Code 3	Passenger AAIS Code 4
2017	251,861	129,118	10,041	15,301
2018	147,212	88,002	7,093	6,897
2019	125,500	89,872	8,039	9,139
2020	150,282	86,167	4,524	2,412
2021	200,688	119,445	4,710	3,043
2022	238,908	89,706	6,610	12,493
2023 (est)	*249,974*	*104,408*	*4,077*	*9,027*
2024 (est)	*275,832*	*107,706*	*3,647*	*9,537*

Figure 11. Marine Traffic Estimation Model (Total Tracks Duration in Minutes)

AAIS Code 1—Cargo Vessels, AAIS Code 2—Tankers, AAIS Code 3—Tug/Barges, AAIS Code 4—Passenger Vessels

Source: McQuilling Renewables



If these AAIS-based trend lines were extrapolated further into the future, the results for the years 2030, 2040 and 2050 would be as listed in Table 13. This discussion is revisited later in this study in Section 3.2.6.

Table 13. Aggregated Automatic Identification System-Based Marine Traffic Growth Projection—Hours

Source: McQuilling Renewables

Year	Cargo	Tanker	Tug/Barge	Passenger
	AAIS Code 1	AAIS Code 2	AAIS Code 3	AAIS Code 4
2024	275,832	107,706	3647	9,537
2030	430,980	127,494	1067	12,597
2040	689,560	160,474	0 [1]	17,697
2050	948,140	193,454	0 [1]	22,797

[a] Calculated trend lines for AAIS Code 3 have a negative slope, implying declining marine traffic in this sector over time. Negative traffic amounts are a mathematical result and not realistic, these entries therefore carry a zero value.

Both tug/barge and passenger vessel traffic models are poorly correlated to the data, which is partly a function of a limited data set. It is assumed that the general behavior of the trend for AAIS Code 4—Passenger Vessels, may approximate reality going forward: passenger traffic may continue to grow into the future. The mathematical projections for tug/barge traffic (AAIS Code 3) are less convincing, where the data implies a disappearance of this trade going forward. However, for both codes, the volume of traffic is 1 to 2 orders of magnitude less than for cargo vessels or tankers, and projections do not alter future non-OSW marine traffic results in a material way.

3.2.2 Marine Safety Considerations

Maritime traffic safety remains an important issue due to the increasing number of vessels with larger capacities and higher transit speeds involved in both domestic and international trade. The OSW industry benefits from the ability to draw experiences and BMPs from both existing and legacy industries such as oil and gas exploration on the U.S. OCS as well from similar OSW energy-generating projects located in other regions of the globe. As the development of OSW energy areas is a fact of navigational safety for waterway users, it is important to plan how these interactions with the maritime community may affect the safe co-existence of industry, commerce, recreation, and other uses as identified within this study.

The information contained in this report does not serve as a formal navigational planning guideline but can be referenced as insight and BMPs for industry stakeholders to plan and interact with maritime stakeholders to accommodate for the safe and efficient marine traffic flows during all phases of the OSW energy project life cycle.

3.2.2.1 United States Coast Guard Port Access Route Study Process and Findings

A beneficial and commonly utilized process that the USCG carries out to ensure safe and navigable waters throughout ports and approaches in the United States is a PARS. The PWSA (Public Law [P.L.] 95-474, 33 United States Code [U.S.C.] 1223(c)) requires the USCG to conduct a PARS before establishing new or adjusting existing fairways or TSSs. A central focus of the PARS process is to account for the need of safe access routes with other reasonable waterway uses, which for the case of this study, includes primarily renewable energy sites. PARS also seeks to reduce the risk of marine casualties and increase the efficiency of vessel traffic in the study area. It is common practice that recommendations from a PARS may lead to future rulemaking action or appropriate international agreements with the appropriate governing bodies. The PARS process may also be used to define and enhance safety and security zones, recommended routes of passage, regulated navigational areas, and other overall ship and vessel routing measures (USCG n.d.c).

PARS overall objectives include the following for analysis and synthesis (USCG n.d.c):

- Determine *present* vessel traffic density.
- Determine present vessel traffic movement.
- Determine *potential* vessel traffic density.
- Determine if existing vessel routing measures are adequate.
- Determine if existing vessel routing measures require modifications.
- Determine the type of modifications.
- Define and justify the needs for new vessel routing measures.
- Determine the type of new vessel routing measures.
- Determine if the usage of the vessel routing measures must be mandatory for specific classes of vessels.

While there are no international standards that specify minimum distances between routes and structures, PARS are carried out by the USCG in the U.S. prior to establishing the location for structures such as wind turbines to analyze safe access routes for marine traffic. Safety fairways and Traffic Separation Schemes (TSS) are then designated and implemented to guide and inform the marine community.

- A ***Shipping Safety Fairway or Fairway*** means a lane or corridor in which no artificial island or fixed structure, whether temporary or permanent, will be permitted. Aids to navigation approved by the USCG may be established in a fairway (Shipping Safety Fairways: Definitions, 33 C.F.R § 166.105 1983).
- ***Traffic Separation Schemes***—Planning Guideline for the location of structures: 2 nm from the parallel outer or seaward boundary of a traffic lane (Assumes 300-400 meters LOA); 5 nm from the entry/exit (terminations) of a TSS (USCG 2021b).

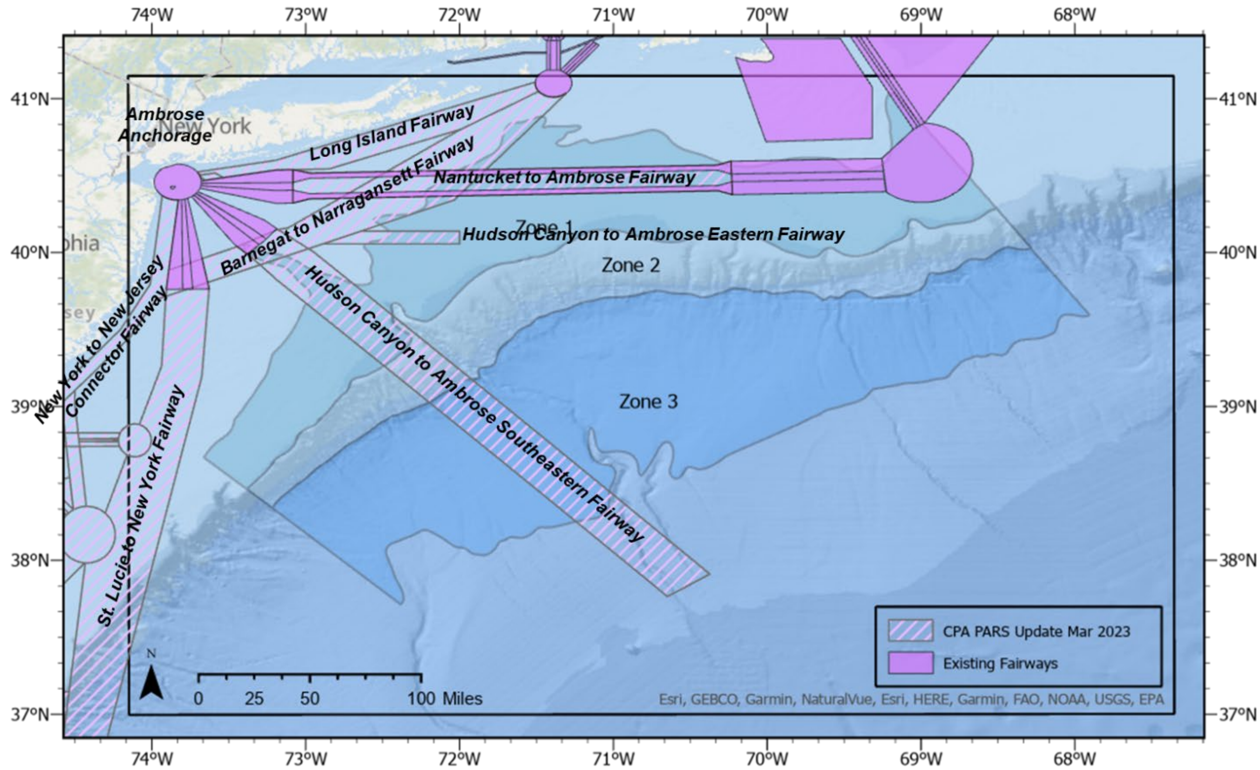
A PARS process for the Northern New York Bight was completed in January 2022 whereby the following planning guidelines were incorporated for analysis and further recommendation in developing safe marine traffic transit routing in the proximity of the AoA of this study (USCG 2021b):

- Identify a navigation safety corridor to ensure adequate sea area for vessels to transit safely.
- Provide inshore corridors for coastal ships and tug/barge operations.
- Minimize displacement of routes further offshore.
- Avoid displacing vessels where it will result in mixing vessel types.
- Identify and consider cumulative and cascading influences of multiple offshore renewable energy installations, such as wind farms.

On January 3, 2022, the First Coast Guard District announced the completion of the Northern New York Bight Port Access Route Study (NNYBPARS) in the Federal Register (87 FR 107). The First Coast Guard District analyzed all available sources of data relevant to this process, including existing and potential traffic patterns, existing regulations, public comments made in response to the draft NNYBPARS, and other factors. These factors went into considering whether the USCG should revise existing regulations to improve navigation safety in the NNYBPARS due to vessel traffic density, vessel traffic patterns, weather conditions, or navigation challenges in the study area. The results from this study led to the following assessment and recommendations, portrayed in Figure 12.

Figure 12. Northern New York Bight Port Access Route Study Recommendations

Source: BOEM and NOAA n.d.a; BOEM and NOAA n.d.b



United States Coast Guard Northern New York Bight Port Access Route Study Assessment (2021a):

- Coastwise shipping routes are needed to organize traffic through the Northern New York Bight along the coast of New Jersey and Long Island.

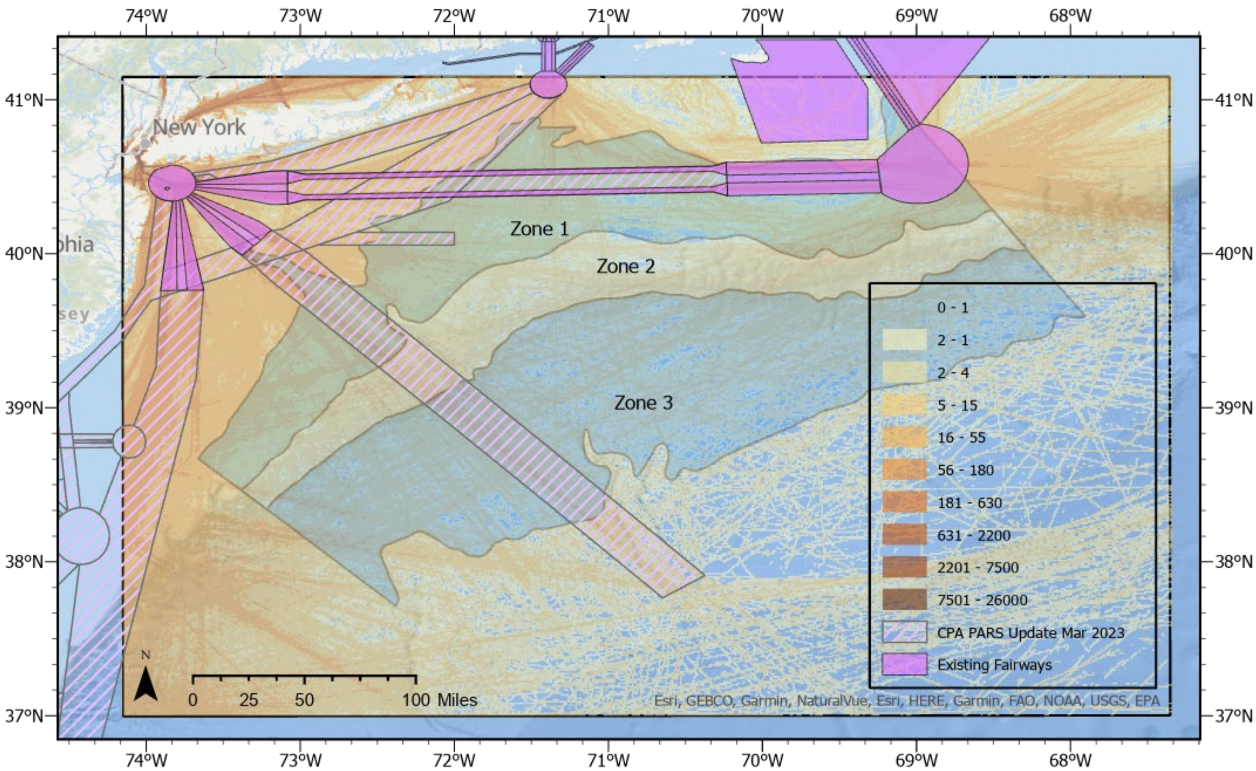
United States Coast Guard Northern New York Bight Port Access Route Study Recommendations (2021a):

- Establish modified versions of the fairways proposed in the Advance Notice of Proposed Rulemaking.
- Establish a New Jersey to New York Connector fairway.
- Establish a Hudson Canyon to Ambrose Southeastern fairway, a Hudson Canyon to Ambrose Eastern fairway, and a single Nantucket to Ambrose fairway.
- Establish an Ambrose Anchorage and adjust the Long Island fairway to mitigate location conflict.

Figure 13. Northern New York Bight Port Access Route Study Recommendations with Commercial Traffic (2022)

AAIS Codes 1,2,3,4

Source: BOEM and NOAA n.d.a; BOEM and NOAA n.d.b; Marine Cadastre



At the time of this study, the abovementioned recommendations are progressing through the legislative process prior to implementation where the USCG will be completing a final public comment period before moving these modifications through local jurisdictions, where they will be included on navigational charts and publications.

3.2.2.2 Navigation and Vessel Inspection Circular

During the production of this study, Navigation and Vessel Inspection Circular (NVIC) 02-23 was published and signed. This updated document has expanded on the original marine safety circular, titled NVIC 01-19, and contains updated guidance on the USCG's roles and responsibilities for OREI on the OCS, specifically providing instruction and recommendations to members of industry, port safety and security stakeholders, and the public on the USCG's role in OREI leasing and the plan review processes. During the last several years, it has become apparent that U.S. OSW resources are abundant and that potential growth capacity for OSW energy in federal waters as well as the waters of the Great

Lakes may provide for more than 4,000-GW of OSW energy capacity per year. Much of this is driven by the fact that almost half of the U.S. population resides near coastal areas where OSW remains consistent, and it is expected that U.S. wind energy development will follow global growth trends. Based on the current state of play in the wind industry domestically and globally, along with forecast data and potential for substantiated growth in the coming years, the USCG has re-issued its guidance parameters within NVIC 02-23, where the following represent material changes from the prior circular that have direct impact to this study and subsequently effect marine users in the space.

- Detailed explanation of internal USCG roles, responsibilities, and assignment expectations throughout OREI planning, leasing, and development process.
- NVIC 01-19 guidance on conducting and reviewing a navigation safety risk assessment, the checklist for navigation safety risk assessment development and review have been updated and combined into one document—as described within enclosure three of NVIC 02-23.
- Changes to Coast Guard Marine Planning Guidelines reflect updated guidance from the United Kingdom.
- Updates to OREI structure layout recommendations and possible effects on navigation safety, the marine transportation system and Coast Guard SAR.
- Updates to OREI marking, labeling, and signaling guidelines are found separately and within enclosure six of NVIC 02-23 (USCG 2023).

As the number of OREIs on the OCS continues to grow, many of the projects will reside near shipping routes and can pose an increased risk to the safety of navigation, as discussed throughout this study. As the development of OREIs may impair mariners from being able to determine their position, as safe course of action to avoid collision, the USCG has provided revised methods for carrying out proper navigation safety risk assessments for projects. The USCG recommends that a navigation safety risk assessment is carried out in cooperation with a wide range of stakeholders, including federal, state, and local agencies along with the local maritime industry and the public to ensure that all areas and scenarios are properly accounted for and considered. Aspects that should be included in the navigation safety risk assessment include but are not limited to providing site and installation coordinates, facility characteristics and design requirements, information on existing aids to navigation, a traffic survey to make appropriate recommendations on effects to navigations safety, as well as details to the expected effects of installations, facilities, and their structures on the OCS. To account for the influence on USCG and other emergency services in the region, a navigations safety risk assessment should also include an assessment on the influence of a project on both SAR as well as marine environmental protection undertakings.

NVIC 02-23 contains substantial updates to marine planning guidelines for projects and their stakeholders to evaluate all reasonably foreseeable navigational possibilities that may affect navigation or emergency response throughout the life cycle of an OREI. While these guidelines are not regulatory, they have been designed to guide developers on evaluating navigation effects brought on by projects that contain permanent fixed structures. Therefore, the guidelines take into consideration viable sea space needed for ships to maneuver safely to develop satisfactory distances for the locating of offshore structures in relation to shipping routes and other areas used by the maritime community. The marine planning guidelines section of NVIC 02-23 lists the following as methods to assist in allowing for safe navigation in and around OREIs.

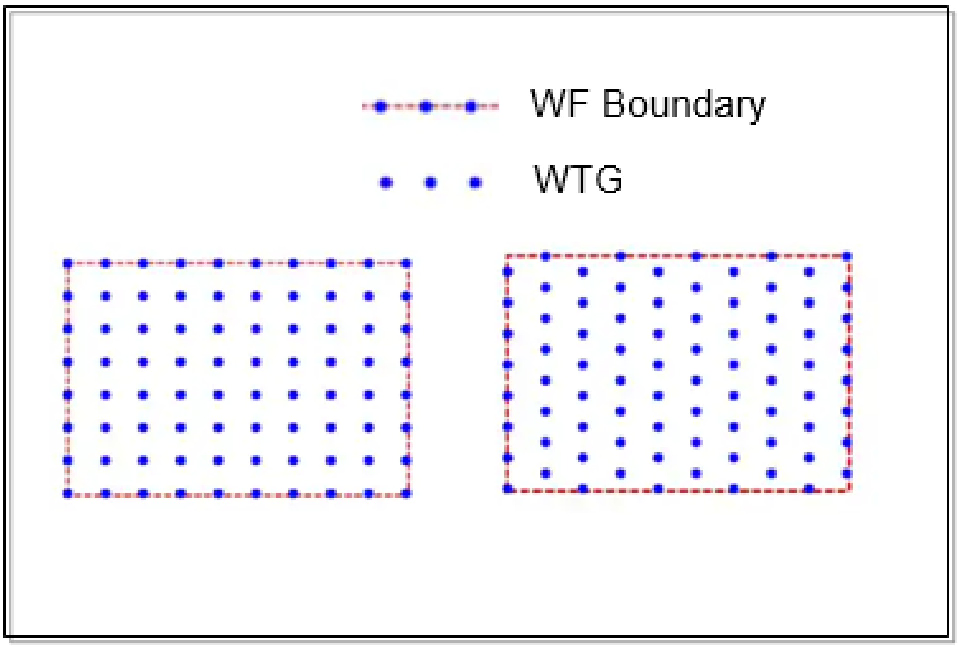
- Identify a navigation safety corridor to ensure adequate sea area for vessels to transit safely.
- Provide inshore corridors for coastal ships and tug and barge operations.
- Minimize displacement of routes further offshore.
- Avoid displacing vessels where it will result in mixing vessel types.
- Identify and consider cumulative and cascading consequences of multiple OREIs (USCG 2023).

High-density traffic areas may present greater risk to navigation specifically where marine traffic may exist with converging or crossing routes. This type of traffic scenario may be experienced in areas of port entrances and may generate complex interfaces between marine assets transiting the area. Other elevated traffic-risk scenarios may exist when there are obstructions or hazards within or adjacent to vessel routes, where severe weather or sea conditions drive close quarters conditions, where there is the mixing of vessel types caused by drastic difference in transiting vessel sizes and speeds due to the nature of their work and cargo, etc. There are several tools and planning mechanisms that can be introduced by way of the marine planning guidelines that can assist in mitigating these marine and navigational risks. Moderating tools may be the institution of fairways, aids to navigation, including marking and lighting of wind field structures, proper pilotage, vessel traffic services, precautionary and areas to be avoided along with the development of suitable anchorages, and limited access areas. Other improvements to navigation in and around OREIs may come by increasing the distances between ports, shoals and navigational pitch points and the control of traffic density in and around OREI areas to where the decrease in traffic density allows for a reduction on vessel interactions and improved space for vessel maneuvering (USCG 2023).

The USCG also has a primary interest in the siting, design, and layout of OREIs as these elements will have a direct effect on navigational safety. Given the fact that various developers will be working within their individual lease areas throughout the greater U.S. OCS, the USCG has furthered its guidance to industry stakeholders on this topic within NVIC 02-23 and has provided direction on preferred wind field configuration. Updated guidance states that each wind field should be organized in straight rows and columns creating a grid pattern, as provided in Figure 14. To account for the potential of shared borders between wind fields, the developers are suggested to adopt common spacing and layout or ensure there is a sufficient gap between different patterns.

Figure 14. Possible Wind Turbine Generator Layout per Navigation and Vessel Inspection Circular 02-23

Source: USCG 2023



To allow for uniformity within visually marking and lighting wind field structures, the USCG has issued specific guidance on structure marking, labeling, and signaling within NVIC 02-23. Within this guidance, developers are instructed to file an application with the appropriate USCG district to establish a private aid to navigation, as stipulated in 33 CFR part 66, and the USCG policy for marking will follow the International Association of Marine Aids to Navigation and Lighthouse Authorities Guideline G1162 on the marking of offshore man-made structures. This section of the circular breaks down the structures into three distinct categories, as outlined in the following descriptions and figures, to assist in marking and placement.

- **Significant Peripheral Structures** (SPS)—A corner point and other significant point on the boundary of the wind field. Eash SPS should be fitted with a quick flashing yellow light (QY, 0.3 seconds on/0.7 seconds off) visible at a minimum of 5 nm and synchronized with all other SPS lights as well as being fitted with a sound signal that produces a 4 second blast every 30 seconds with a rated range of 2 nm when the visibility in any direction is less than 5 nm or when activated by keying marine very high frequency (VHF)-FM Channel 1083 (157.175 megahertz) five times within 10 seconds—Mariner Activated Sound Signal.
- **Intermediate Peripheral Structure** (IPS)—Outer boundary, non SPS structures. IPS should be fitted with a 2.5-second yellow flashing light (FL Y 2.5s, 1.0 second on/1.5-seconds off)
that is visible at least 3 nm away and synchronized with all other IPS lights.
- **Interior Structures**—Structures within the interior of a wind field should be fitted with a 6-second flashing yellow light (FL Y 6s, 1.0 second on/5.0 seconds off) or a 10-second flashing yellow light (FL Y 10s, 1.0 second on 9.1 seconds off) that is visible at least 2 nm away and should be synchronized with all other interior structure lights (Figure 15 and Table 14) (USCG 2023).

Figure 15. Visual of Significant Peripheral Structures, Intermediate Peripheral Structures and Interior Structures per Navigation and Vessel Inspection Circular 02-23

(Not to Scale)

Source: USCG 2023

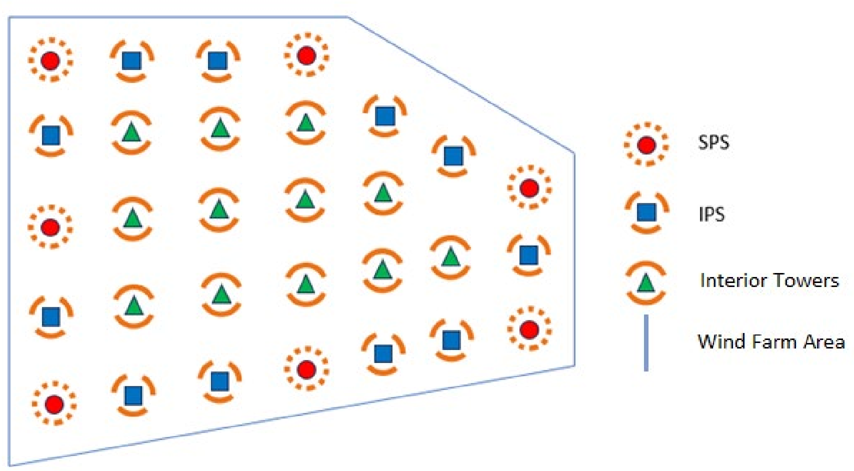


Table 14. Light Characteristics and Ranges for Significant Peripheral Structures, Intermediate Peripheral Structures, and Interior Structures

Source: USCG 2023

Structure	Light Characteristic	Light Range
Significant Peripheral Structure	Quick Flashing Yellow	5 NM
Intermediate Peripheral Structure	Flashing 2.5 Seconds Yellow	3 NM
Interior Structure	Flashing 6-, 10- or 15-Seconds Yellow	2 NM

3.2.2.3 European Wind Field Experience

A legacy industry that can provide additional BMPs and guidelines is the existing OSW industry of Europe. At the close of 2022, OSW accounted for approximately 3% of power demand for the European Union (EU). This includes over 5,700 connected wind turbines spread out over 123 wind fields across 13 countries. The EU plans to add approximately 160-GW of OSW power in the next 2 years to meet EU policies and pledges to climate goals (WindEurope 2023). The United Kingdom's Maritime and Coastguard Agency (MCA) routinely releases guidance notes that highlight potential and inherent issues and risk mitigation procedures to be considered by industry stakeholders when planning and undertaking both voyages in and around OSW energy areas as well as in developing locational and spatial placement of OSW energy projects. An example of this process is described in the MCA's Marine Guidance Note (MGN 372)—Offshore Renewables Energy Installations (OREIs): Guidance to Mariners Operating in the Vicinity of UK OREI's, which was published in 2008 as the European wind industry was beginning to take shape, and further updated in 2022 after the Europe had seen 44 wind fields in their operational phase as of November of that same year (MCA 2022). The key takeaways of these notifications are that OREIs present a series of challenges to safe navigation to where proper voyage planning and review of relevant safety information is critical to ensure that the safety of navigation is not compromised. To assist in mitigating risks to safe navigation the notice further describes the characteristics of wind fields both by their visibility and appearance as well as how they are be visually marked, audibly sounded, and physically charted on the appropriate United Kingdom navigational charts. (MCA 2008). This type of descriptive guidance is critical to area users as it standardizes the way that projects are developed and depicted to the maritime community and provides consistency for users engaged in voyage planning and navigational watchkeeping.

In general, the European industry wind area planning and integration with the maritime community commonly takes on a risk-based approach that identifies the navigational hazards caused by the establishment and erection of an offshore installation and then uses a series of mitigation factors and procedures to test the feasibility of that installation to safely co-exist with the maritime community in a specific region. The wind field "Shipping Route" template (Table 15), which has been taken from MCA Marine Guidance Note (MGN 654), is one example and can be used as general guidance, but it is recommended that the agreement of distances between wind field boundaries and shipping routes be reviewed and determined on a case-by-case basis among relevant navigation stakeholders. It is important to recognize that the template is not a prescriptive tool but needs intelligent application and advice which will be provided on a case-by-case basis.

Table 15. Maritime and Coastguard Agency Shipping Route Template

Source: MCA 2021

Distance of turbine boundary from shipping route (90% of traffic, as per Distance C)*	Factors for consideration	Risk	Tolerability
<0.5nm (<926m)	X-Band radar interference Vessels may generate multiple echoes on shore-based radars.	VERY HIGH	INTOLERABLE
0.5nm to <1nm (926m to <1852m)	Mariners' Ship Domain (vessel size and maneuverability).	HIGH	TOLERABLE IF ALARP
1nm to <2nm 1 (852m to <3704m)	Minimum distance to parallel an IMO routing measure, as per Distance B**.; S-Band radar interference ARPA affected (or other automatic target tracking means).	MEDIUM	Additional risk assessment and proposed mitigation measures required * Descriptions of ALARP can be found in: a) Health and Safety Executive (2001) 'Reducing Risks, Protecting People'; b) IMO (2018) MSC-MEPC.2/Circ.12/Rev.2 dated 9 April 2018, 'Revised Guidelines for Formal Safety Assessment (FSA) in the IMO Rule-Making Process'
2nm to 3.5nm (3704m – 6482m)	Preferred distance to parallel boundary of an IMO routing measure, as per Distance B8 Compliance with COLREG becomes less challenging.	LOW	
>3.5nm (>6482m)	Minimum separation distance between turbines on opposite sides of a route.	LOW	BROADLY ACCEPTABLE
>5nm (>9260m)	Adjacent wind farm introduces cumulative effect. Minimum distance from TSS entry/exit.	VERY LOW	BROADLY ACCEPTABLE

* Distance from an IMO Routing Measure is measured from the routing boundary, i.e., Distance B.

** The Netherlands assessed sea room requirements using data supported by the PIANC assessment for Channel design and the PIANC Interaction Between Offshore Wind Farms and Maritime Navigation (2018) report. In general, they strive for an obstacle free, or buffer, zone of 2nm between wind farms and Shipping routes.

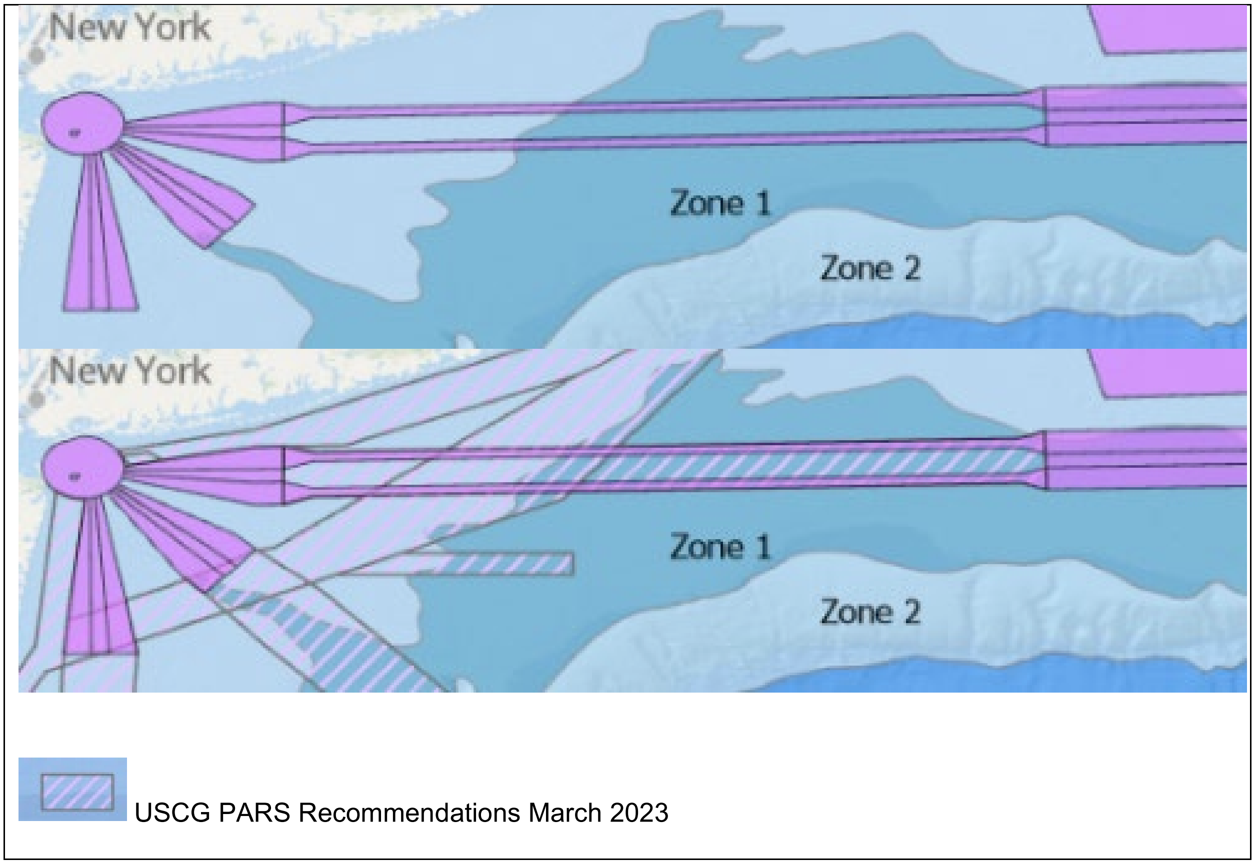
Table 15 provides a framework for project stakeholders to carry out a risk assessment process by providing scenarios and mitigation measures that are used as guiding principles when carrying out spatial planning for structure locations and appropriate setbacks from marine traffic and vessel routing. The framework suggests that turbines located within 0.5 nm of a route will be very high risk for a navigational incident. Thorough analysis and the institution of risk mitigation measures are important to consider where the Closest Point of Approach (CPA) is between 0.5 and 5 nm to ensure risk potential is reduced, particularly when limited to 0.5 nm; 2 nm of separation is considered medium to high risk. At the planning stages of project development, a CPA of greater than 2 nm is generally considered an acceptable and low-risk distance where wind field structures and regular traffic routing are in proximity. Additional and compounding effects may be evident and will need to be analyzed in further detail by stakeholders and users to achieve acceptable CPA tolerances and probabilities. (European Offshore Wind Deployment Centre 2011). Much of the risk to navigation associated with the development of wind areas arise from CPAs that cause close quarters situations and limit vessels maneuverability, increasing marine incident probability. Methods described in recent MCA risk mitigation practices typically include maximizing CPAs between intended shipping routes and energy structures to substantially decrease the risk of allision as well as collision between marine assets in motion.

Many of the updates to MG 372 that were affected in the 2022 release include specific commentary to the technical aspects of wind turbines, weather they contain both fixed or floating foundations, along with guidance on markings, illumination, and identification. One significant addition to guidance information provided in the 2022 release considers the effects of wind fields and wind turbine locations on marine vessel routing options. It is suggested that wind turbines are spaced at least 500 meters (approx. 0.25 nm) apart depending on the size of the actual turbine. Effectively, this would allow smaller craft to safely navigate through the field while larger vessels would navigate clear of the field itself (MCA 2022).

In a similar manner to USCG PARS procedures for locating structures and suggesting marine traffic routing in the absence of international standards, the European wind industry being guided by the MCA will carry out risk mitigation processes as outlined in Marine Guidance Notifications prior to establishing the location for structures such as wind turbines to analyze safe access routes for marine traffic. The results of this process will designate where safety fairways and traffic separation schemes are suggested and included on navigational charts and publications to safely guide and inform the maritime community.

Figure 16. Before and After Northern New York Bight Port Access Route Study Recommendations Ambrose/Nantucket Fairway

Source: BOEM and NOAA n.d.a; BOEM and NOAA n.d.b



Continued utilization of risk mitigation measures and procedures commonly carried out in the existing European OSW energy industry presents stakeholders with the opportunity to incorporate proven methods into local planning for projects in the emerging U.S. OSW space. The effects of this type of risk-based approach to project planning can be seen within recent studies for the U.S. industry with an example of this being the recent NNYBPARS report that has called for a single Nantucket to Ambrose safety fairway, as identified in Figure 16. The suggested modification will allow for a sizable increase in navigable sea room for vessels transiting in east or west directions to and from the port of New York and surrounding areas.

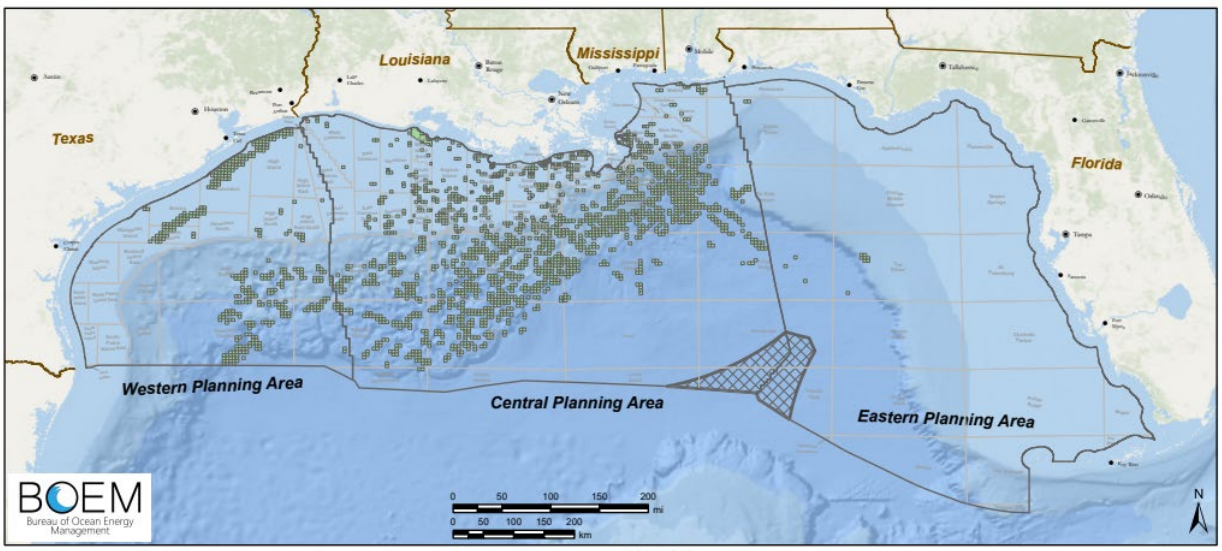
3.2.2.4 U.S. Gulf Coast Oil and Gas Experience

While the first offshore oil well was drilled in the waters off the Santa Barbara pier in California producing oil by 1897, the U.S. Gulf Coast was close behind when the Pure and Superior Oil companies built and commissioned the Creole platform in 1938 and deployed it to drill for offshore energy, approximately 1 mile from the shores of Creole, Louisiana. Since then, the U.S. Gulf Coast has become the predominant area for energy development and remains as the country's main offshore source of oil and gas exploration and production, which generates approximately 97% of all U.S. OCS oil and gas resources and 15% of the nation's oil (IER 2020).

Figure 17. Gulf of Mexico Outer Continental Shelf Region Blocks and Active Leases

BOEM Gulf of Mexico OCS Region Blocks and Active Leases by Planning Area, September 1, 2023

Source: BOEM 2023



Planning Areas	Total Blocks	Total Acres	Number of Leases	Acres Leased
Western	5,240	28,576,813	398	2,188,033
Central	12,409	66,446,351	1838	9,803,076
Eastern	11,537	64,357,859	13	74,880
Sub-Totals	29,186	159,381,023	2,249	12,065,989
CPA / EPA Shared Blocks*	(86)		0	
Totals	**29,100**	**159,381,023**	**2,249**	**12,065,989**

Active Leases
Planning Area Boundary
Extended Continental Shelf (ECS area)

* CPA and EPA contain 86 shared blocks. These blocks are given both a CPA and EPA designation in the data which may account for a higher block total.

The OCS of the Gulf of Mexico is divided into three planning areas, Western, Central, and Eastern, and spans from the Texas/Mexico border in the south and west to the southwestern tip of the Florida peninsula in the southeast. These areas make up approximately 250,000 square miles of OCS territory with the potential to be developed for offshore energy procurement. Per Figure 17, as of September 2023, there exists approximately 19,000 square miles of leased area accounting for 2,249 leases and 29,100 total blocks of operable energy procurement area (BOEM 2023).

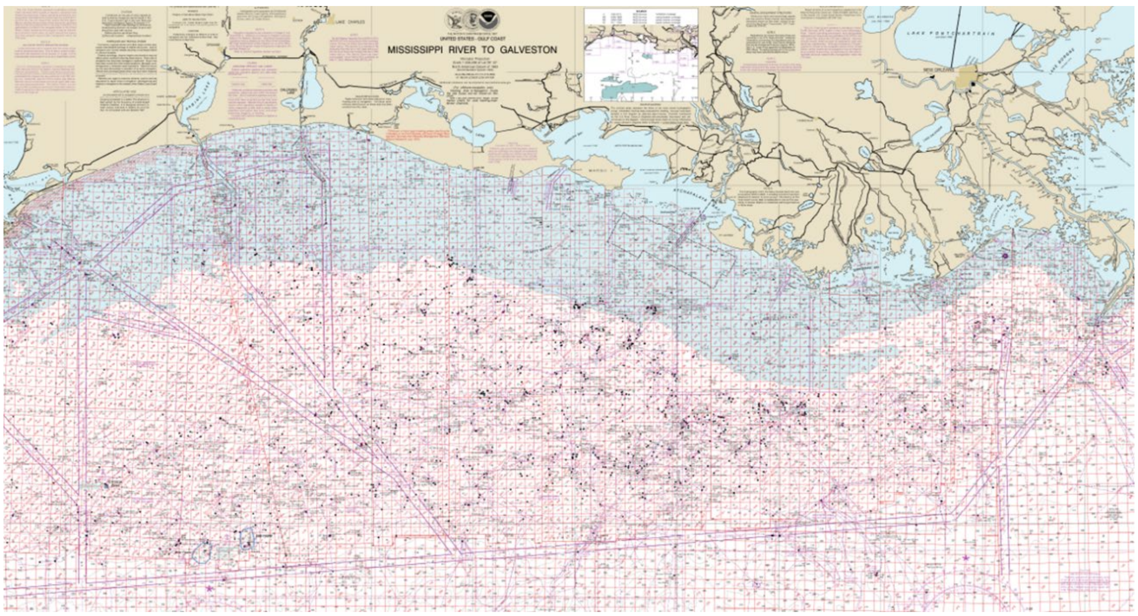
As areas of the U.S. Gulf OCS continue to be explored and developed, risks to navigation arise due to the numerous fixed and floating structures that the infrastructure of this industry requires. While at any given time, there may be approximately 15–20 active oil rigs exploring for oil and gas in the waters, these particular assets are primarily focused on initial exploration and procurement and will often times move on to explore and drill new wells once they have achieved their goals. What remains post exploration and discovery is a series of fixed platforms, pipelines, and subsea structures that blanket the U.S. Gulf OCS that remain installed on station during their production life while adhering to decommissioning practices as required by BOEM. At the time of writing, and according to the U.S. Department. of the Interior Minerals Management Service, there are approximately 2,200 platforms installed within the Gulf of Mexico OCS, which from a marine traffic perspective cause direct risks to navigation. (U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico Region 2023).

The U.S. Gulf Coast also contains multiple import and export terminals for marine commerce with the ports of New Orleans, Houston, Galveston, and Corpus Christi being some of the most active in the nation consisting of terminals and lay berths with cargo handling capabilities capable of accepting numerous types of vessel classes. With the density of structures introduced by the legacy oil and gas industry in the region, marine users are required to plan for and accept various risk mitigation measures to ensure safe navigation in and around the areas densely populated with oil and gas related structures, as commercial uses in the area will remain consistent in the years ahead. A similar method to mitigating risk of collision and marine accidents has been applied to recent oil and gas industry development; however, it is important to note that measures such as PARS and recommended routing and structure setback implementation have primarily been applied after much of the offshore infrastructure has already been deployed. This is mostly due to the historical aspect of offshore oil and gas development in the region being that it is an established and tenured industry.

OSW development on the U.S. East Coast can be guided by similar efforts that Gulf of Mexico OCS projects have undertaken in recent years and can also benefit from the fact that OSW energy in the region is in its nascent stages. Figure 18 represents a navigational block chart of the U.S. Gulf of Mexico extending from Galveston Bay to the Mississippi River and illustrates how the industry has been able to sector off safe navigable fairways on top of an already existing matrix of oil and gas assets while also allowing for the planning of additional assets to be installed into the future.

Figure 18. Lease Block Chart for Mississippi River to Galveston (1116A)

Source: NOAA OCS, Last correction September 11, 2023



This network of safety fairways utilizes guidance and setback distance provided for in U.S. C.F.R. 33 Part 166—Shipping Safety Fairways, the general purpose of which is to provide unobstructed approaches for vessels using U.S. ports by establishing designated shipping safety fairways (previously defined in 3.2.2.1 and repeated below) and fairway ancohorages. These specific navigational boundaries are defined as follows and are subject to modifications in accordance to 46 U.S.C. 70003 (Shipping Safety Fairways, 33 C.F.R. § 166 Last amended September 8, 2023).

- **Shipping Safety Fairway *or* Fairway** means a lane or corridor in which no artificial island or fixed structure, whether temporary or permanent, will be permitted. Temporary underwater obstacles may be permitted under certain conditions described for specific areas in Subpart B. Aids to navigation approved by the USCG may be established in a fairway.
- **Fairway Anchorage** means an anchorage area contiguous to and associated with a fairway, in which fixed structures may be permitted within certain spacing limitations, as described for specific areas in Subpart B.

Specific to areas of the U.S. Gulf OCS, the purpose of safety fairways and anchorage area designations and navigational guidance is to establish a method to control the erection of structures in the waterways and to provide safe approaches through oil fields and into entrances to major ports long the U.S. Gulf Coast. The following special conditions exist for safety fairways and anchored structures in the U.S. Gulf, where temporary anchors, cables, and/or chains being utilized for floating or semisubmersible structures outside of a fairway are in fact situated within a fairway due to the nature of the mooring spread. This situation may exist in areas in and around the AoA of this study due to the physical and technical characteristics of water depth, bottom countour and the need for FOSW structures (Shipping Safety Fairways, 33 C.F.R. § 166 Last amended September 8, 2023).

- Anchors installed within fairways to stabilize semisubmersible drilling rigs shall be allowed to remain 120 days.[1]
- Drilling rigs must be outside of any fairway boundary to whatever distance is necessary to ensure that the minimum depth of water over an anchor line within a fairway is 125 feet.
- No anchor buoys or floats or related rigging will be allowed on the surface of the water or to a depth of at least 125 feet from the surface, within a fairway.
- Aids to navigation or danger markings must be installed as required by 33 C.F.R. Subchapter C.

The U.S. oil and gas industry provides decades of historical experience that can be utilized for spatial planning and the safe co-existence of wind energy projects and marine traffic and commerce. It is recommended that OSW industry and project stakeholders utilize the experience gained from proven oil and gas lease development processes along with relevant PARS processes to de-risk marine traffic hazards that may emerge as wind energy structures are deployed near ports and harbors. Specifically, the U.S. East Coast can be strategically guided by the track record of the U.S. Gulf States offshore energy lease and production history. It is also suggested that applicable measures are taken from U.S. CFRs relating to safety fairway and fairway anchorage developments, which are to be reviewed and utilized in the planning process for OSW area development at its planning stages to ensure limited conflict and mitigated risk for a marine incident to all forms of marine traffic transiting nearby ports and harbors. Designated safety fairway areas can be located on the internet at the following: Shipping Safety Fairways, 33 CFR § 166.[2]

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1 This period may be extended by the U.S. Army Corps of Engineers, as provided by § 209.135(b).

2 Shipping Safety Fairways, 33 CFR § 166, federal code regulation can be found in further detail at https://www.ecfr.gov/current/title-33/chapter-I/subchapter-P/part-166

3.2.2.5 Navigation in the Vicinity of Offshore Wind Fields

To allow for safe navigation in the vicinity of OSW fields during all phases of project development, it is necessary that navigators remain aware of activities that may affect vessel routing and transit through a wind energy area.

Bridge Resource Management

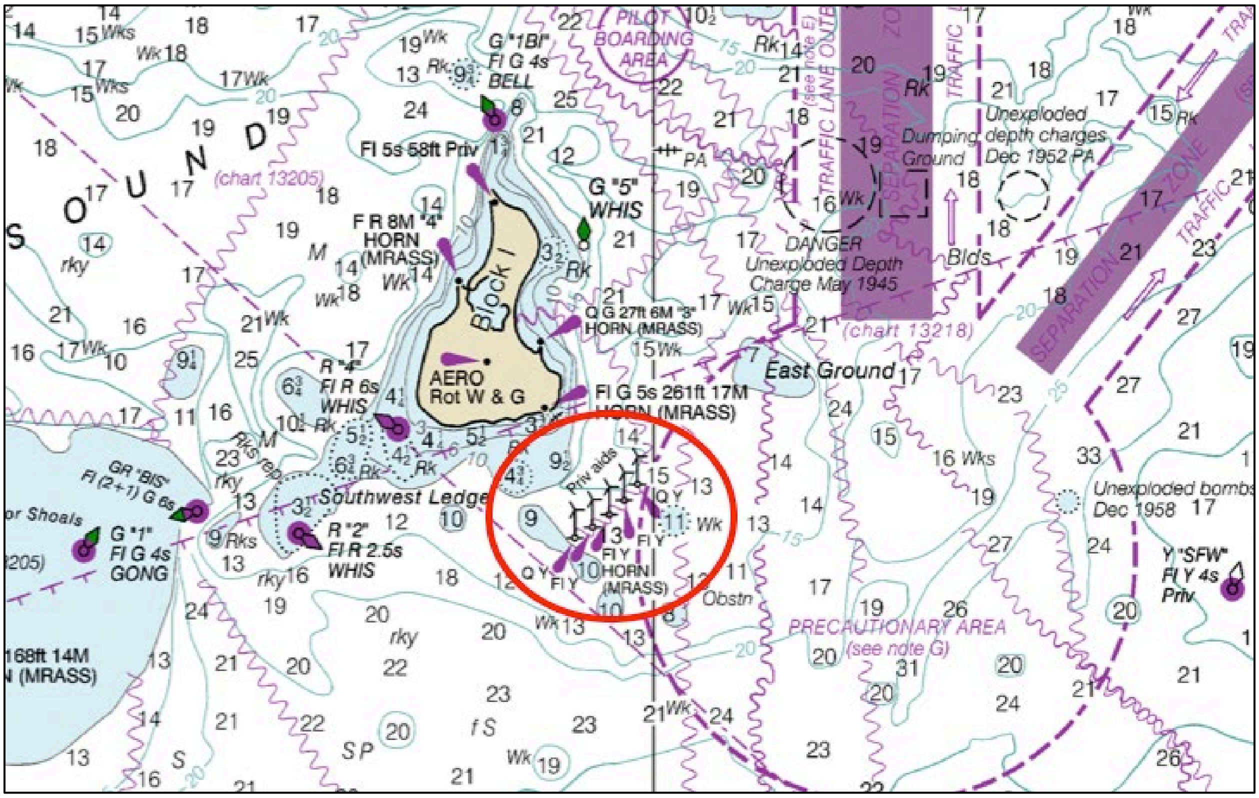
In addition to adherence to the Convention on the International Regulations for Preventing Collisions at Sea (COLREGS), a required practice aboard vessels per the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), is to implement Bridge Resource Management (BRM) decision making practices into watchkeepers standing orders and shipboard culture. These watch-standing practices are commonly found aboard vessels subject to STCW regulations and engaged in commercial trade, which may be larger in size, less maneuverable, and subject to scheduling requirements. The USCG defines BRM as, “The effective management and utilization of all available resources, both human and electronic, by the navigation watch team, to ensure the safe navigation of the vessel” (USCG 2013). Since its inception into the maritime industry as an error management tool in the 1990s, the practice of BRM has become a valuable tool in training and executing navigational duties aboard vessels to help reduce the probability of human error and resulting incidents. Specific BRM practices can vary depending on vessel type, operational region, and variety of cargo carried but, in general, there are critical elements of BRM that are transferable to all vessel operations.

Critical elements of this watch-keeping practice are communication, teamwork, decision making, and situational awareness. (Mukherjee 2021). To avoid accidents and close quarters situations that may present unsafe CPAs between vessels in transit, structures, and vessels employed within the project, it is paramount that sound communication between vessel bridge teams is maintained at all times. Open communication allows for the transfer of real time information to area users, which can then be distilled for substance and criticality and eventually incorporated into the watch standers decision-making process for keeping safe navigational distances and situations. BRM practices should be integrated with the specific OSW field particulars for vessels servicing these projects. Given the nature of operating vessels of any size at sea, it is important and practical to note that the human element will always present risks, even as work processes are put into place to minimize those risks.

To assist in allowing navigators to incorporate project specific occurrences and situational awareness into their overall decision-making processes, the maritime community is guided by navigational announcements and notifications provided by project stakeholders and local jurisdictions once offshore construction has begun. Any urgent information relating to project-based operations that may contain inherently elevated risks to navigation due to the nature of the work being carried out are announced by way of Marine Safety Information Bulletins, Notice to Mariner Updates, and radio broadcasts by local jurisdictions such as the USCG as well as project developers. These notifications, typically prioritized by scope, size, and scale, are designed to ensure that all area users are aware of project activity and informed of the associated marine assets that will be engaged in the described activities to then make the appropriate voyage planning and on the scene navigational decisions for safe passage near or through the area. Once installed in U.S. waters, wind turbine locations are projected onto nautical charts by way of the guidelines set forth in Nautical Publication U.S. Chart No. 1, which itself describes the symbols, abbreviations, and terms that are used on nautical charts for United States chart and publication projections and is produced by NOAA and the National Geospatial-Intelligence Agency. To remain in sequence with project development, USCG Notice to Mariner chart and publication updates are published and available on a weekly basis to assist marine users in updating onboard charting and publication documents and conform with developments in and around associated wind fields. Figure 19 provides an example of a charted visual aid to mariners for the Block Island Wind Farm as projected onto NOAA Chart 12300—Approaches to New York State (Nantucket Shoals to Five Fathom Bank).

Figure 19. National Oceanic and Atmospheric Administration Chart 12300 Block Island Wind Farm Symbols

Source: NOAA OCS Last correction August 30, 2023



Visual and Electronic Aid Guidance for Navigation

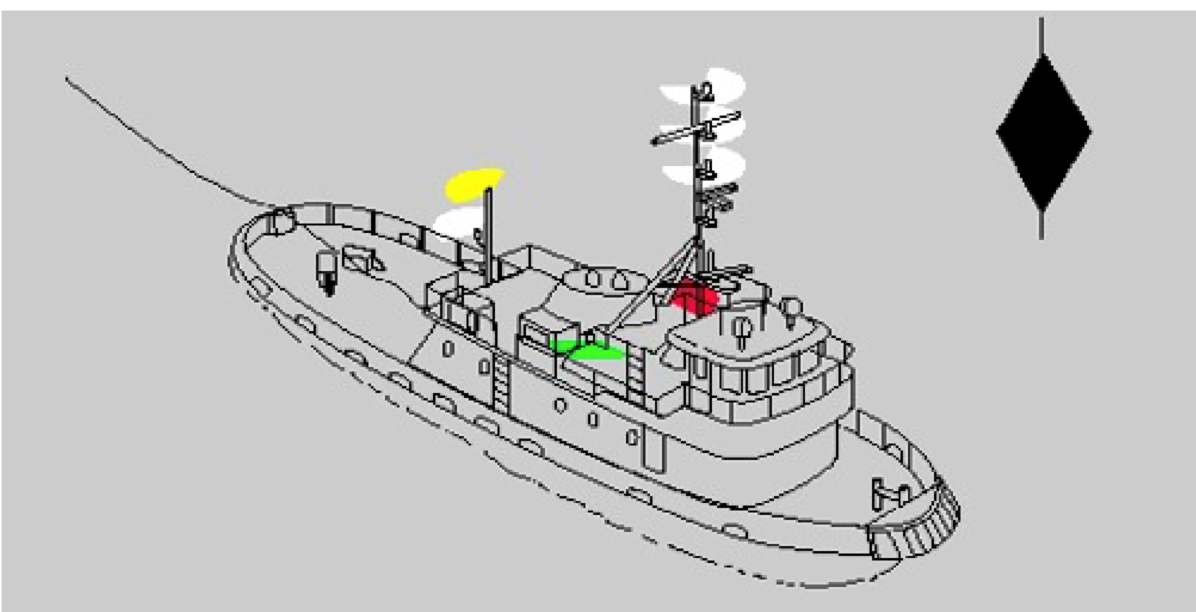
The appearance of OSW structures both visually and electronically is a vital aspect to safe navigation. To enhance their visibility, wind field structures contain inherent markings that allow mariners the ability to detect objects visually and electronically (as onboard systems permit) to then carry out practical navigation decisions based on the location of such structures along with any additional marine traffic that may be present during the time of transit. As an example of their appearance, mostly all wind turbine structures consist of a submerged foundation component secured to the seabed with a transition piece of around 15 to 20 meters in vertical height affixed to the foundation's upper section at sea level that is painted yellow in color and may also contain painted patterns and reflective tape to improve visual appearance to navigators in the area. Lighting systems are also present at the upper limits of the transition pieces designed to assist in navigational decision making from increased ranges. To account for early-stage work during the construction phase of a project, the extremities of a project may be marked with lighted navigational buoys along with the employment of guard vessels to aid in deterring and re-directing marine traffic, keeping CAPs at a maximum for all marine users in the area. The lighting and marking of marine assets and associated guard vessels employed during these periods are required to comply with COLREGS conditions for the lighting and sounding of vessels due to the nature of their work, which serve as a guide to other marine users of the area.

For the purpose of this study, examples of potentially employed marine assets assisting in the development and construction of future wind fields in and around the AoA could be towing vessels and barges laden with turbine foundations or components as well as heavy lift and installation vessels that may or may not be secured to the seabed by way of jack-up systems to where these assets would be restricted by their ability to maneuver due to the nature of their work. Marine users are cautioned to always comply with BMPs for safe navigation and adherence to local rules and regulations for the areas of transit. As an example, Figure 20 represents the visual lighting for vessels engaged in towing within the international waters of the AoA, according to COLREGS Rule 24, which are expected to be prevalent during the construction period of U.S. wind field development.

Figure 20. Navigation Rules of the Road—Rule 24 Towing

Source: USCG n.d.b

Power-driven vessel towing astern—towing vessel less than 50 meters in length; length of tow exceeds 200 meters.



According to European risk mitigation practices enacted during the industry's development, trials have been conducted to assess the influence of wind fields on various ship navigation procedures and systems to assess how these grouped structures may affect navigation measures and commercial passage making. Results of these assessments and studies have shown that onboard systems such as VHF, GPS, and AIS were minimally affected and electronic return from vessels radar systems was strong at sufficient range from the field. As vessels transiting the area closed their range with the wind field, echoes from the multiple structures that make up a wind field become persistent, which in turn may shadow other radar targets that may be within the field. It is common practice in the marine community to incorporate radar performance when considering vessels safe transit speed and adjust speed accordingly due to any effects on navigation systems that may be present when operating in close quarters to OSW energy areas. It is generally considered prudent for vessels to provision for maximum safe clearance of wind fields when passage planning and engaged in active navigation in and around wind fields (Steamship Mutual n.d.).

3.2.2.6 Navigation Emergencies

An inherent aspect of marine traffic is the ever-present risk of accident or emergency. Regional stakeholders have identified various aspects of marine casualties that could result in a marine accident, collisions, or allision within the wind energy areas. Of the potential incident occurrences, the loss of propulsion and the loss of steering by vessels transiting the areas are seen as most prevalent and contain high potential for disruption and damage to life, property, and the environment if experienced in close proximity to a wind energy area (COWI 2020).

To assist in mitigating the risk of a marine casualty, it is prudent for project stakeholders to institute minimum set back distances between navigation routes and WEA structures. While there are no defined international standards that specify minimum distances between routes and structures, industry stakeholders involved in the 2020 M-TWG Summary Report (COWI 2020) focused on OSW area BMPs, suggested that that at the planning stages, a 2 nm minimum setback distance would be acceptable guidance for the initial planning stages of future projects. The eventual setback distances between structures and marine route guidance will vary between projects, regions, and their exposure to nearby port facilities, and should be interpreted on a case-by-case basis to ensure safe coexistence and satisfactory low-risk outcomes. This distance between marine traffic and structures would provide acceptable safe passage sea room given the reduction of steerage that may exist while transiting under speed restrictions due to marine mammal and wildlife guidelines as well as provide a sufficient closest point of approach for vessels that may experience a loss of propulsion or steering while passing wind energy area structures (COWI 2020).

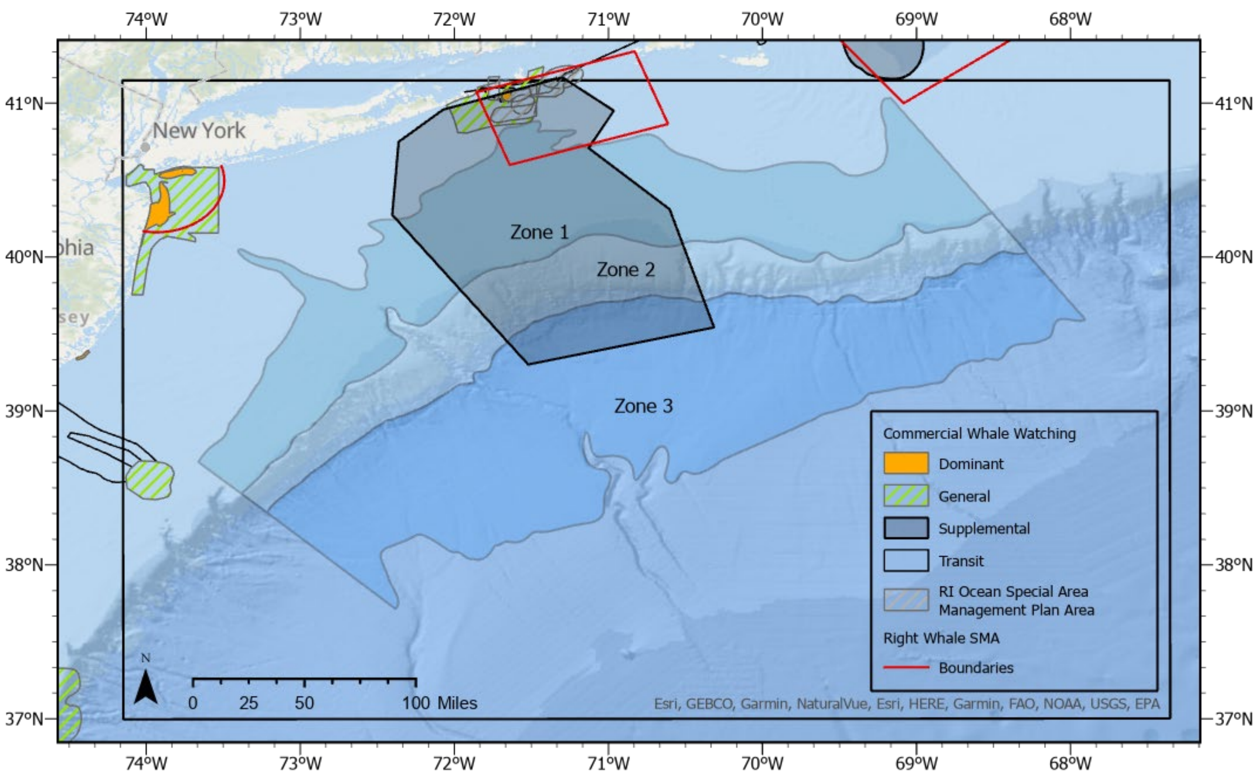
3.2.3 Qualitative Commercial Use Indications

AIS data is distilled and visualized in section 3.2.1. However, not all vessel traffic is captured by this data and supplemental, qualitative data in the form of existing portal layers, report assessments, and other research is used to assess other commercial marine traffic in the AoA.

3.2.3.1 Wildlife Viewing—Whale Watching

Figure 21. Commercial Whale Watching

Source: Northeast Ocean Data Portal Working Group, et al. 2022; NOAA Fisheries GARFO, n.d.



According to Shumchenia, et al. (2022), the Master Plan reported and mapped whale watching from the data collected by Point 97 et al. in the October 2015 study, Characterization of Coastal and Marine Recreational Activity in the U.S. Northeast. Data were collected during in-person workshops, as well as in meetings of the Rhode Island Ocean Special Area Management Plan (RI OSAMP) update process. The layers in ArcGIS were updated by two groups, the Northeast Ocean Data Portal Working Group in 2020, and MARCO in 2021, revealing the latest layers in Figure 21. The Northeast outreach process included webinars in 2020, wherein whale watch vessel owners and operators, as well as naturalists and data managers, reviewed the 2015 data as well as contemporary draft maps based on AIS data capturing whale watching vessels from 2015–2017. In 2021, the MARCO group-initiated efforts to map whale watching areas in its five states: New York, New Jersey, Delaware, Maryland, and Virginia. This process included compiling a list of commercial whale-watching operators in the region and their respective vessels; downloading AIS data from Marine Cadastre for the years 2015–2020; and using various tools in ArcGIS to present the data in the layer (Shumchenia, et al. 2022).

Captured in Table 16 are the 24 whale watching organizations from five states in the Northeast region invited to participate in data development and review webinars in the 2020 mapping effort. Three organizations are located in New York State; two at nearby ports in Nantucket and Menemsha, Massachusetts; and one in Narragansett, Rhode Island. The remaining 18 are located north of Cape Cod, Massachusetts, and therefore, are not relevant regarding the AoA. Additionally, research institutions, conservation organizations, Stellwagen Bank National Marine Sanctuary (SBNMS) staff, and other whale watching related groups were invited to participate (Shumchenia, et al. 2022).

Table 16. Northeast Ocean Data Portal Mapping Effort

Source: Shumchenia, et al. 2022

Organization	State	Location	URL
Al Gauron Deep Sea Fishing and Whale Watching	NH	1 Ocean Blvd, Hampton, NH 03842	https://algauron.com/
American Princess Cruises	NY	2498 Emmons Ave, Brooklyn, NY 11235	https://americanprincesscruises.com/
Bar Harbor Whale Watch Co	ME	1 West St, Bar Harbor, ME 04609	https://www.barharborwhales.com/
Boston Harbor Cruises	MA	1 Long Wharf, Boston, MA 02110	https://www.bostonharborcruises.com/
Cap'n Fish's Whale Watch and Charters	ME	42 Commercial St, Boothbay Harbor, ME 04538	https://www.boothbayboattrips.com/
Cape Ann Whale Watch	MA	415 Main St, Gloucester, MA 01930	https://www.seethewhales.com/
Captain John Boats	MA	10 Town Wharf #3848, Plymouth, MA 02360	https://www.captjohn.com/
Captain Lou Fleet	NY	31 Woodcleft Ave, Freeport, NY 11520	https://www.captloufleet.com/
Captain's Fishing Parties and Cruises	MA	10 82nd St, Newburyport, MA 01950	https://www.captainsfishing.com/
Dolphin Fleet Whale Watch	MA	307 Commercial St #1, Provincetown, MA 02657	https://whalewatch.com/
Eastport Windjammers	ME	104 Water Street Eastport ME 04631	http://www.eastportwindjammers.com/
First Chance Whale Watch	ME	4 Western Ave, Kennebunk, ME 04043	https://firstchancewhalewatch.com/
Frances Fleet	RI	33 State St, Narragansett, RI 02882	http://www.francesfleet.com/
Fundy Breeze Charters	ME	109 Water St, Eastport, ME 04631	http://www.fundybreeze.com/
Granite State Whale Watch	NH	1870 Ocean Blvd, Rye, NH 03870	http://www.granitestatewhalewatch.com /
Hyannis Whale Watching Cruises	MA	269 Millway, Barnstable, MA 02630	https://whales.net/
Isles of Shoals Steamship Company	NH	315 Market Street, Portsmouth, NH. 03801	https://islesofshoals.com/
New England EcoAdventures	ME	8 Western Ave, Kennebunk, ME 04043	https://newenglandecoadventures.com/
Newburyport Whale Watch	MA	54 Merrimac St, Newburyport, MA 01950	https://www.newburyportwhalewatch.com/
Odyssey Whale Watch	ME	170 Commercial St, Portland, ME 04101	https://www.odysseywhalewatch.com/
Red Tail Offshore Fishing Charters	MA	Basin Rd, Menemsha, MA 02552	http://www.redtailfishing.com/
Sea Salt Charters	MA	19 Ryder St E, Provincetown, MA 02657	https://www.seasaltcharters.com/
Shearwater Excursions Inc	MA	Slip 1011 Straight Wharf, Nantucket, MA 02584	https://shearwaterexcursions.com/
Viking Fleet	NY	462 W Lake Dr, Montauk, NY 11954	https://vikingfleet.com/

Table 17. Mid-Atlantic Regional Council on the Ocean (MARCO) Ocean Data Portal Mapping Effort: Vessel List

A commercial whale watch vessel list was compiled for the AIS track density data development process.

Source: Shumchenia, et al. 2022

Vessel	State	Location	URL
American Princess Cruises (vessel 1)	NY	2498 Emmons Ave, Brooklyn, NY 11235	https://americanprincesscruises.com/
American Princess Cruises (vessel 2)			
Seastreak (various)	NJ	326 Shore Drive, Highlands, NJ 07732	https://seastreak.com/
Royal Miss Belmar	NJ	905 NJ-35, Belmar, NJ 07719	https://jerseyshorewhalewatchingtour.com/
Ocean Explorer	NJ	900 River Road Belmar, NJ 07719	https://www.oceanexplorerbelmar.com/
Too Finominal	NJ	905 NJ-35, Belmar, NJ 07719	https://finominalcharters.com/
Atlantic Star	NJ	6200 Park Boulevard, Wildwood Crest, NJ, 08260	https://www.starlightfleetnj.com/
Cape May Whale Watcher	NJ	1218 Wilson Drive Cape May NJ 08204	https://jerseyshorewhalewatchingtour.com/
Atlantis			
American Star	NJ	1231 Route 109, Cape May, NJ	http://www.capemaywhalewatch.com/
Thelma Dale IV	DE	107 Anglers Rd, Lewes, DE 19958	https://fishlewes.com/
Rudee Whaler	VA	200 Winston Salem Ave, Virginia Beach, VA 23451	https://www.rudeetours.com/
Rudee Flipper			
Atlantic Explorer	VA	717 General Booth Blvd., Virginia Beach, VA 23451	https://www.virginiaaquarium.com/
Southern Belle	VA	524 Winston Salem Ave, Virginia Beach, VA 23451	https://www.vbfishingcharters.com/

Also shown in Figure 21 in red boxes are Seasonal Management Areas (SMAs), one of which overlaps with a small portion of Zone 1 of the AoA. North Atlantic right whales are protected under both the Marine Mammal Protection Act and the Endangered Species Act and the SMAs are in place to reduce the likelihood of deaths and serious injuries of this species from vessel strikes (NOAA Southeast Regional Office 2019). When in the geographic boundaries and seasonal range of the SMAs as determined by 79 CFR 34245, vessels over 65 feet in length (with some exceptions) are required to slow to a speed of 10 knots or less (NOAA 2014).

Table 18. Commercial Whale Watching Use Areas in Figure 21

Source: Schumchenia et al. 2022; Northeast Ocean Data Portal Working Group, et al. 2022

Use Areas	Description
General use areas	Includes the full footprint of whale watch activity in the last three to five years, regardless of frequency or intensity; does not include areas where the use may occur once or twice or where it might conceivably occur now or in the future.
Dominant use area	Includes all areas routinely used by most users most of the time, within seasonal patterns for that use; must be within the general use area.
Transit routes	Includes areas used for transit to and from general or dominant use areas.
Supplemental use areas	Includes areas used for closely related activities (e.g. lighthouse tours), and infrequent specialty trips (e.g. multi-day offshore excursions) or historical uses.

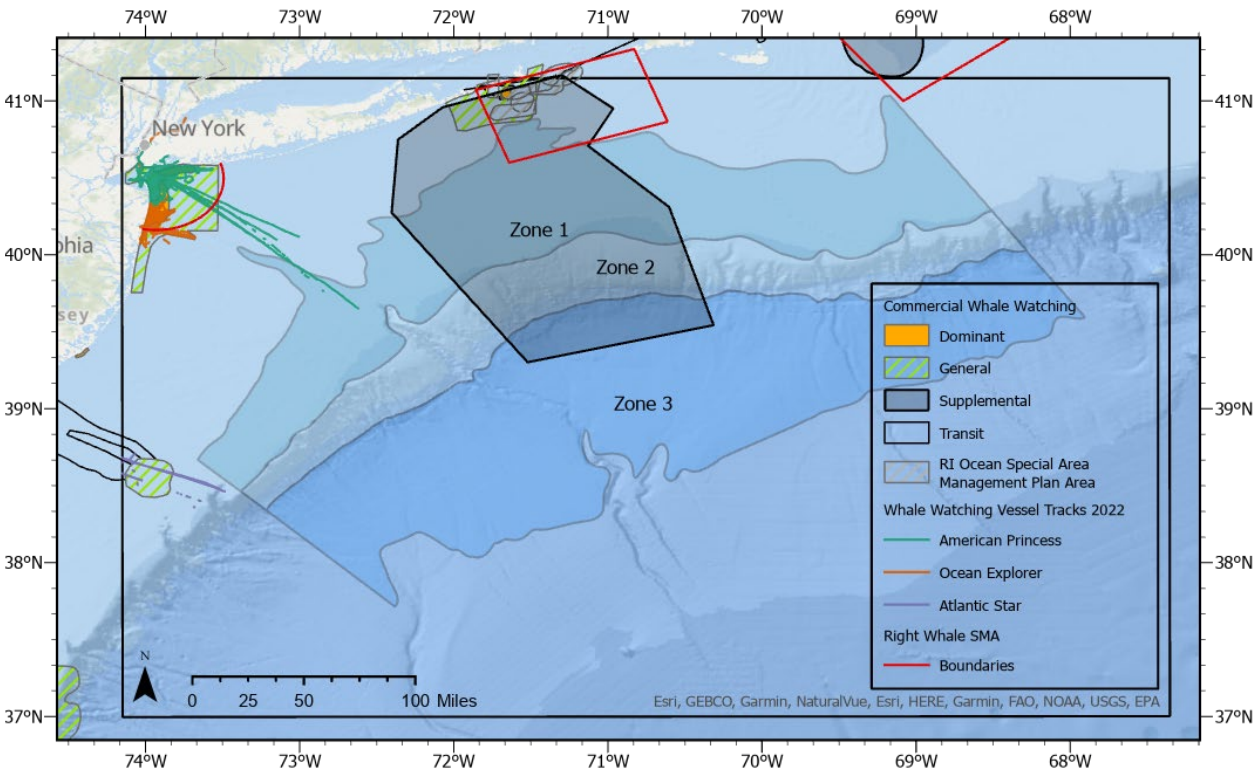
Figure 21 and Table 18 show areas of differing intensity of whale watching activities. The only type of use area found in the AoA is the supplemental use area consisting of historical uses, and infrequent specialty trips. Whale watching is infrequent in this supplemental area.

Whale watching occurs primarily in July and August but may span from spring through fall (Point 97, Surfrider Foundation & SeaPlan 2015). Shumchenia, et al. (2022) explain that this relativity short operating season is dependent on variations in weather, the presence and activities of marine mammals, fuel costs, and other economic indicators impact the industry from year to year. Although whale watch sightings are highly variable, this industry is rapidly growing with multiple new tour operations having been launched in the last decade (Shumchenia, et al. 2022).

Commercial whale watching vessels (as opposed to vessels that offer whale watching among other activities) are typically more than 65 feet in length and hold at least 100 passengers, with some holding more than 300 passengers (Shumchenia, et al. 2022). As such, they are required to have AIS transponders on board. For the 15 whale watching vessels listed in Table 17, a search for Maritime Mobile Service Identity (MMSI) number was conducted on MarineTraffic.com. Any MMSI numbers found were then searched in AIS vessel track data. Figure 22 shows the tracks for the following vessels and respective MMSI numbers: New York State-based American Princess (367124840), and New Jersey-based Ocean Explorer (367709770) and Atlantic Star (368146270). These vessel tracks support the research conducted by Northeast Ocean Data Portal Working Group, et al. showing whale watching activity in "general use areas," including outside of New York Harbor and in southern sections of the Jersey Shore. Commercial whale watching vessels represent low levels of marine traffic intensity in the AoA.

Figure 22. Automatic Identification System-Identified Whale Watching Vessels

Source: Marine Cadastre; Northeast Ocean Data Portal Working Group, et al. 2022; NOAA Fisheries GARFO, n.d.



In a survey and subsequent report on the economic contributions of whale watching activities in the SBNMS (located east of Boston, Massachusetts, between Cape Ann and Cape Cod), Schwarzmann and Shea found that $76.1 million in labor income, $107.2 million in value added, $182.1 million in output, and about 1400 jobs, are supported by these activities each year, showing the economic and cultural importance of this activity (2020).

Whale watching activities from vessels are found closer to shore, and therefore, infrequently in the AoA. One seasonal management area does overlap with Zone 1 of the AoA and should be taken into account for OSW field planning purposes.

3.2.3.2 Underwater Activities

Underwater activities in the new AoA include wreck and reef diving done from vessels. Metadata from the NY State Geographic Information Gateway's Wreck Diving—NY, Atlantic Ocean layer was used as a basis to assess sites in the AoA, which is limited to wreck sites in State waters. To get a comprehensive picture, the sites in New York waters were compared to the Northeast Ocean Data Portal's Recreational SCUBA Diving Area layer. Additional sites in the AoA were found and their approximate coordinates were used to identify the additional wreck sites. This resulted in a list of approximately 80 total shipwreck sites, found in appendix B.

The dive sites in the Wreck Diving—NY, Atlantic Ocean of the New York State Geographic Information System portal were developed by DOS in collaboration with other partners to gather information on offshore recreational uses in New York in support of its marine spatial planning efforts. DOS and NOAA's Coastal Services Center (CSC) designed and developed a mapping process conducted over multiple workshops in 2011 in which data was collected on charts and tables and then digitized. (DOS and NOAA CSC 2023).

The dive sites in the Northeast Ocean Data Portal were identified by the outreach process in the Northeast Coastal and Marine Recreational Use Characterization Study by SeaPlan, Surfrider Foundation, and Point 97, under the direction of the Northeast Regional Planning Body, starting in the spring of 2015. The process involved collaborating with scuba diving experts such as dive club members, dive shop owners and instructors, and charter operators. The multi-faceted data collection process included an online survey and the use of SeaSketch, where users interact with mapped ocean data; meetings, webinars and in-person workshops using the eBeam tool, which uses a stylus, software, and a projector to map sites; and additional research from print and online sources. For sensitive sites such as historic or culturally important wrecks, a 5-kilometer buffer was used to protect information on the exact locations. (Longley-Wood 2015b).

These two portals also contain layers on natural and artificial reef diving areas. However, natural reefs were closer to shore and not found in the AoA and were not included here. Most artificial reefs were at joint locations already accounted for in the wreck diving sites. For example, the artificial Shark River Reef Site contains the deliberately sunk Algol, Alan Martin, and the Coney Island, which were accounted for in the wreck diving layer. One additional site just southwest of the AoA is indicated as artificial reef "14" in the Marine Cadastre Artificial Reefs layer (Marine Cadastre 2023b) and was included in the wreck site list.

From various online sources provided by the dive community, a list of dive boats was established, totaling 16 vessels. Sources include the Long Island Divers Association (Long Island Divers Association n.d.), the Big Apple Divers (Big Apple Divers n.d.) and New Jersey Scuba Diving (Galiano, Directory

2022). These vessels hail from eight port locations in New York and New Jersey. Internet and social media searches of publicly available information were conducted to further clarify the status of the vessels and their home ports. Some vessels listed in these source websites appear to be retired, moved, or operating in areas unrelated to the AoA. These were not included in Table 19. Further internet searches revealed an additional vessel, the Sea Turtle (Divers Two n.d.).

Table 19. Ports of Departure

Vessels identified from various diving websites supporting the New York State and New Jersey area.

Source: McQuilling Renewables

Vessel	Port
Miss Atlantic City	Atlantic City, NJ
Dina Dee II	Barnegat Light, NJ
Sea Hag	
Gypsy Blood	Point Pleasant/Brielle, NJ
Tuna Seazure	
Independence II	
Sea Lion	
Ol' Salty II	Belmar/AVON-BY-THE-SEA, NJ
Venture III	
Sea Eagle	
Sea Hawk	Freeport, NY
Tempest	
Fish-On	Moriches/East Moriches, NY
Sidekick	
Halftime	Hampton Bays, NY
Sea Turtle	Montauk, NY

A search for the MMSI number of the dive vessels was conducted. Two MMSI numbers were found and compared against AIS data. Only one had visible tracks in the year 2022 and these were for areas inshore, not in the AoA.

Figure 23 illustrates the location of the eight origin ports-of-call and offshore dive sites. Diving in the Northeast U.S. occurs year-round but is concentrated in the months of May through October (Longley-Wood 2015b). Note in Figure 23 the 60-meter (197-feet) depth contour which defines the northern boundary and shallowest water of the AoA is over 20-meters (67-feet) deeper than the depth limit for recreational diving of 40-meters (130-feet), beyond which the more difficult technical diving using a mixed gas breathing apparatus is employed. Technical diving involves more training and equipment and is generally limited to a smaller sub-population of divers. This naturally limits the presence of underwater activities beyond 40-meter water depth.

Figure 23. Diving Sites and Ports of Departure

Source: McQuilling Renewables

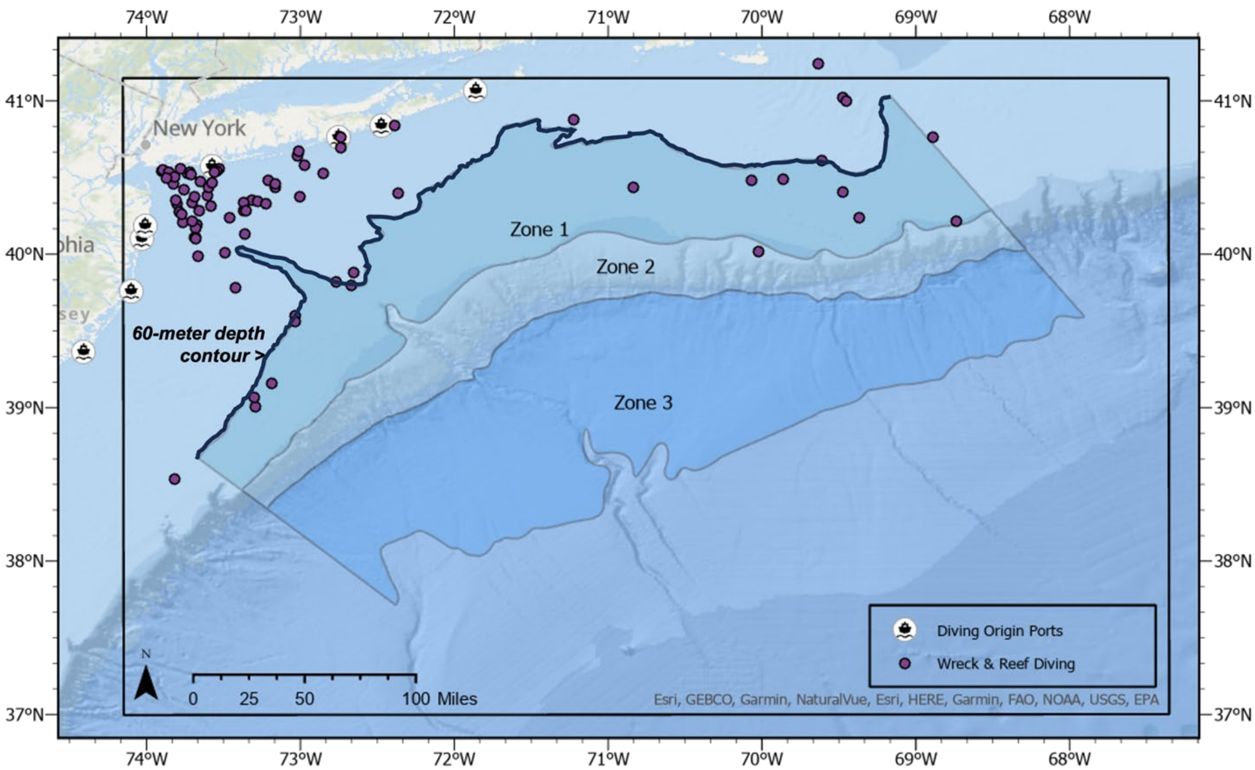
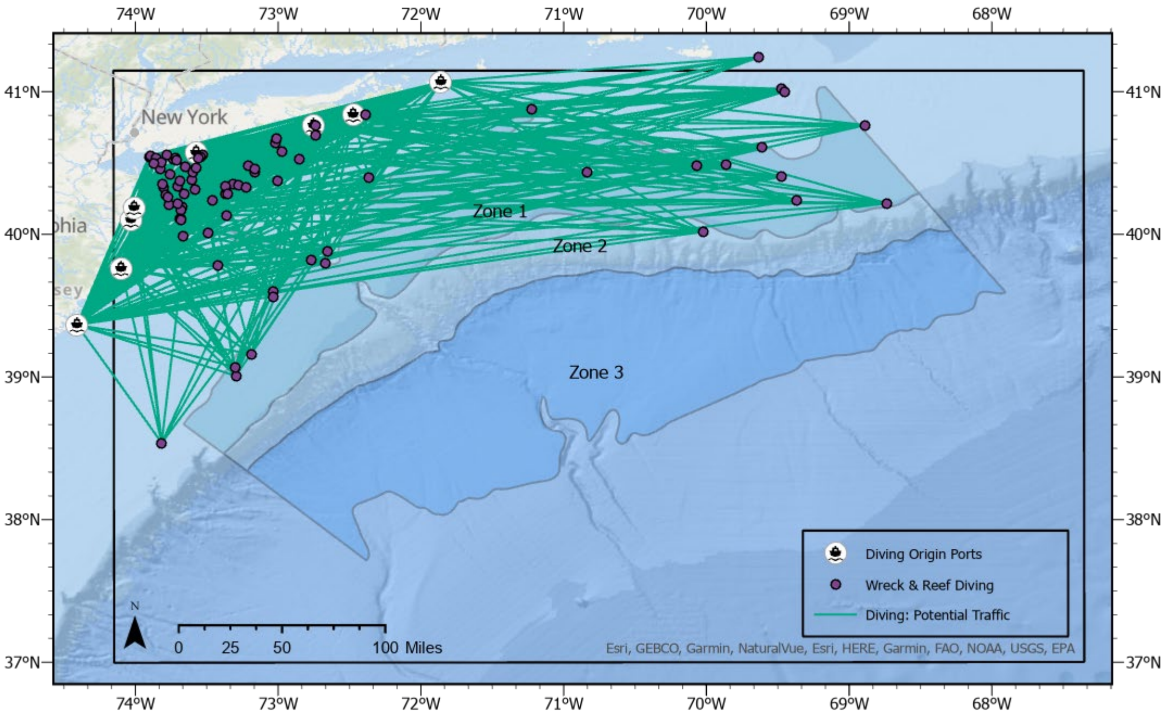


Figure 24 illustrates a type of boundary test. It is a theoretical representation of the routes of all dive boats visiting all shipwreck sites from their ports-of-call. This shows the traffic footprint of the maximum number of routes possible between dive vessels' ports-of-call and diving sites. It is improbable that each boat will call at each dive location, therefore, actual traffic will be less than what is illustrated here by definition.

An assessment of the locations and depths of dive sites, a limited number of dive vessels, and the use of boundary test shows limited to no vessel traffic in and around the AoA.

Figure 24. Boundary Case—Maximum Number of Diving Routes

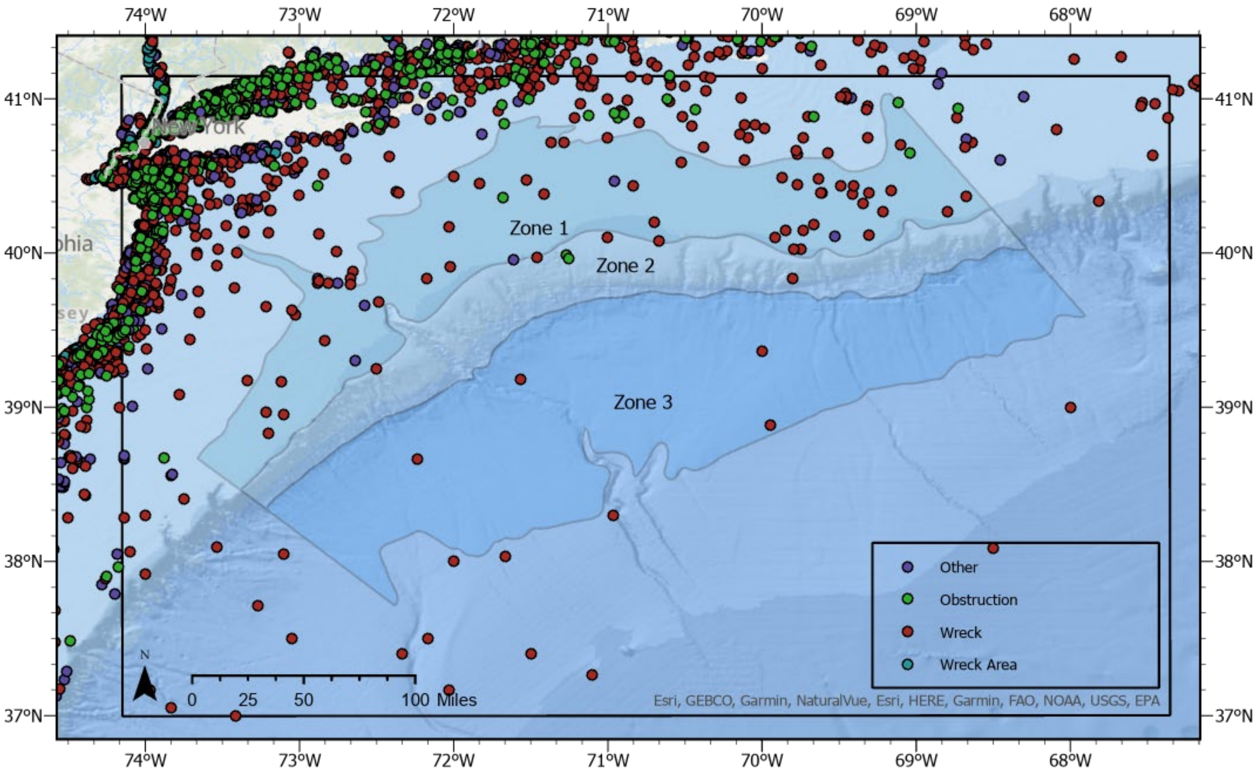
Source: McQuilling Renewables



Additional shipwrecks not identified as diving sites in the outreach activities can be found in the Marine Cadastre Wrecks and Obstructions layer. The data is from two sources: NOAA's Office of Coast Survey's Automated Wreck and Obstruction Information System (AWOIS) and NOAA's Electronic Navigational Charts or ENC (Marine Cadastre 2023c). AWOIS data collection began in 1981 to assist in planning hydrographic survey operations and to catalog reported wrecks and obstructions considered navigational hazards within U.S. coastal waters (Private Member, DOS 2023). The data set supports coastal and ocean planning and other activities pursuant to the Coastal Zone Management Act, Energy Policy Act, Magnuson-Stevens Fishery Conservation and Management Act, National Environmental Policy Act, Rivers and Harbors Act, and the Submerged Lands Act (Private Member, DOS 2023). The AWOIS database contains over 10,000 submerged wrecks in the coastal United States (though NOAA's Office of Coast Survey stopped updating it in 2016) (NOAA OCS n.d.b). Ownership and control over wrecks and obstructions is governed by a collection of state and federal regulations, the Abandoned Shipwreck Act, the National Historic Preservation Act, and the National Marine Sanctuaries Act (Marine Cadastre 2023c).

Figure 25. Wrecks and Obstructions

Source: Marine Cadastre 2023c



NOAA's Electronic Navigational Charts are vector data sets that support all types of marine navigation. They were designed for use by commercial vessels using a sophisticated navigational computer but are now also used on simpler electronic chart systems and chart plotters by commercial and recreational boaters (NOAA OCS n.d.a). The combined data sets from AWOIS and ENC reveal more than 40,000 records of wrecks, wreck areas, obstructions or unknowns (Marine Cadastre 2023c). Wrecks and obstructions relevant to the AoA are found in Figure 25.

Although the AWOIS data has limitations in comprehensiveness and a focus on wrecks that may only be navigational hazards, unknown wrecks listed in database may be of interest to divers (Galiano, AWOIS Database 2023). The location of the wrecks and obstructions will also be of interest in siting decisions for new OSW lease areas.

3.2.3.3 Charter/For-Hire Fishing

This study acquired raw data from Marine Cadastre. A comparison to the Northeast Ocean Data Portal's 2022 Fishing Vessel Transit Counts layer, covering fishing vessels under BOEM-NOAA Code 30 or AIS aggregated Code 6, shows identical tracks to the AIS layer for fishing in Figure 9.

Similarly, the Northeast Ocean Data Portal's 2022 Pleasure Craft-Sailing Vessel Transit Counts layer showing AIS data for BOEM-NOAA codes 36 (sailing) and 37 (pleasure craft) is identical to the tracks in Figure 40 and Figure 42 developed from Marine Cadastre raw data.

3.2.4 Forecasted Commercial Marine Traffic

This section focuses on forecasting transiting marine traffic originating from cargo or passenger carrying commercial vessels transiting between ports and excludes forecasts for commercial fishing marine traffic growth and recreational vessel traffic. As discussed, fishing is a destinational activity and forecasting parameters and methods are different than econometric modeling for the transport of people and goods. Other spatial studies such as the Fish and Fisheries Data Aggregation Study (NYSERDA 2025) should be consulted for a more complete treatment of historical and forecasted fishing traffic. Recreational traffic is sparse compared to commercial transiting traffic in and around the AoA and recreational traffic forecasts are also excluded from this study.

Electronic vessel position data is a good way to inform on historical marine traffic to date, but assessing future marine traffic conditions requires a forecasting exercise. On a global scale, economic activity provides good utility in explaining the variation in international trade, a major component of which is transported by ships. The *Review of Maritime Transport* is a recurrent publication prepared by the United Nations Conference on Trade and Development (UNCTAD) secretariat since 1968 to foster transparency of maritime markets. The experience and extensive data sets generated since then make the review a comprehensive source from which to evaluate the relationship between global economic activity and world marine traffic.

What follows is a simplified method for assessing commercial *transiting* marine traffic growth in and around the AoA through 2050. Global, national and regional (New York State/New Jersey) econometric parameters and cargo movements are modeled and the relationships used to forecast marine traffic growth. Cargo movements into and out of the port of New York and New Jersey are assumed a proxy for marine traffic in and around the AoA given the number and proximity of these movements. References to "region" or "regional" in this section correspond to the region of interest in and around the AoA regarding marine uses as defined in section 2.5.2.

The Port of New York and New Jersey has over 240 miles of navigational channels and more than 50 marine terminals. It is the third largest port in the nation after the Port of Los Angeles and the Port of Long Beach, and the largest container port in the United States. Operations include container handling, cargo processing, warehousing, and distribution. The port has more cargo handling capacity than any other port on the U.S. East Coast. The port's terminals vary, each having been equipped to accommodate specific types of cargo. There are container terminals; bulk cargo terminals for ships carrying loose cargo such as grain, gravel, cocoa; general cargo terminals for cargo that is shipped on wooden pallets; fuel handling terminals; and other liquid handling terminals for products like orange juice. There is also an Auto Marine Terminal for loading and unloading automobiles and other vehicles (New Jersey Sea Grant Consortium n.d.).

To derive a future economic growth matrix for each vessel segment, the Port Authority of New York and New Jersey economic and cargo data were used for the Port Authority of New York and New Jersey's six cargo and passenger terminals to estimate overall regional activity in the New York/New Jersey region. Testing sufficient representation of regional cargo activity, correlations with the Port Authority of New York and New Jersey annual figures and the regional economic activity figures were carried out with positive results. Forecasted annual growth figures for the various cargo types/vessel segments utilizing future forecasted economic growth rates were generated. The net output was a regional economic growth rate per cargo/vessel segment rather than forecasted absolute cargo quantities.

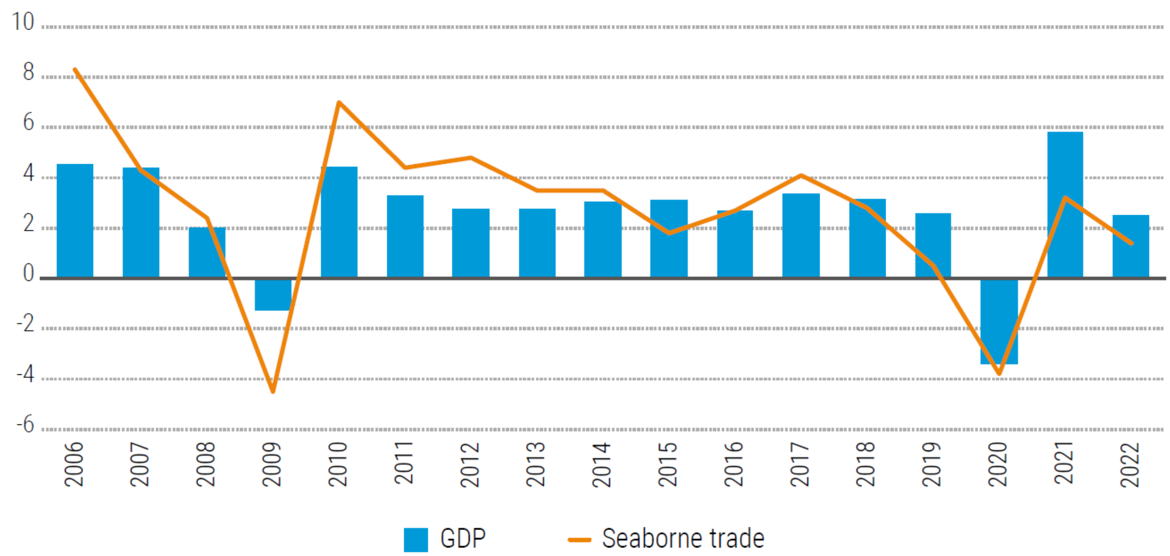
Recently, following a 3.8% decline in 2020, international maritime trade increased in 2021 with an estimated growth of 3.2%, and overall shipments of 11 billion tons. Slightly below pre-COVID-19 levels, trade was still hampered by the prolonged pandemic, and challenging global logistics affected by a large upswing in demand and acute shortages of capacity on the supply side. Globally, recent growth was driven primarily by increases in demand for containerized cargo. Gas and dry bulk shipping also increased while shipments of crude oil declined. Figure 26 illustrates the strong correlation between global GDP and international maritime trade over several decades (UNCTAD 2022).

A similar relationship can be demonstrated at the regional level, and this was done as part of the study to provide the scaffolding for long-term marine traffic growth projection in the region of the spatial studies AoA.

Figure 26. International Maritime Trade and World Gross Domestic Product—Selected Years (Percent Annual Change)

GDP figure for 2022 based on table 1.1, World Output Growth, 1991–2023, UNCTAD Trade and Development Report 2022. P.15.

Source: UNCTAD secretariat, based on UNCTADstat data and Review of Maritime Transport, various issues. (UNCTAD 2022, and various issues). From Review of Maritime Transport: Navigating Stormy Waters, by UNCTAD. © United Nations 2022. Reprinted with permission of the United Nations.



3.2.4.1 Global Gross Domestic Product as a Driver for Maritime Trade and Marine Traffic

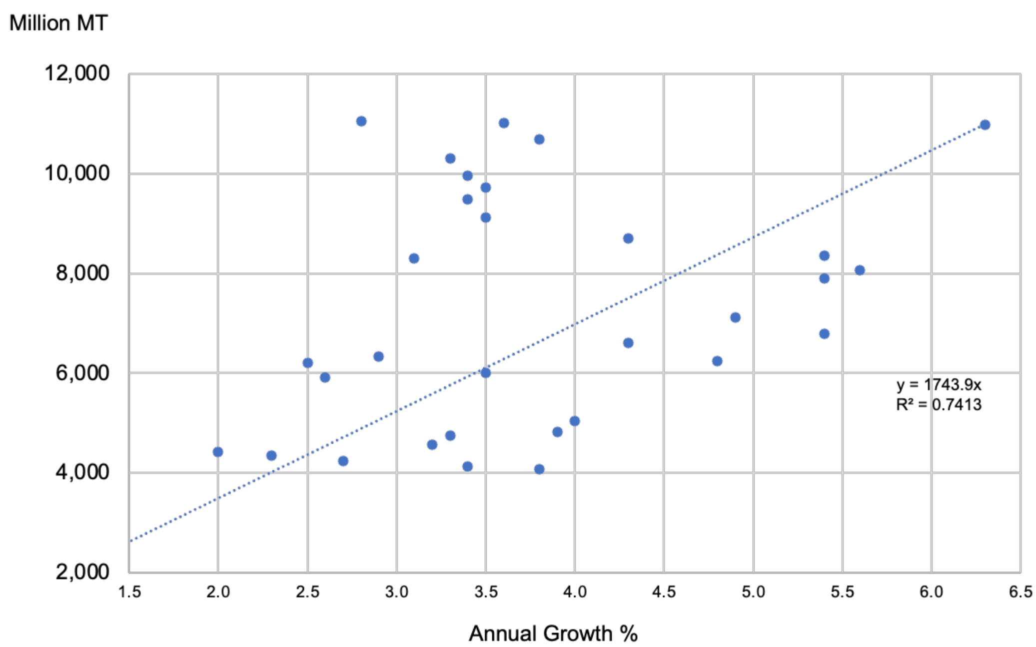
Figure 26 illustrates by observation qualitatively the relationship between economic activity represented by annual GDP and the change in seaborne trade globally each year. Regression analysis demonstrates a quantitative relationship between these data, the strength of which can be assessed using the correlation coefficient, R.[2] The correlation coefficient, also known as the coefficient of determination is a number between 0 and 1 that measures how well a statistical model predicts an outcome. R^2 can be interpreted as the proportion of variation in the dependent variable that is predicted in the statistical model by the behavior of the independent variable.

World GDP figures, as measured in the *World Economic Outlook (WEO)* from the IMF (2023), were evaluated to measure the utility of GDP in explaining the observed behavior of seaborne trade represented by UNCTAD data set, “World seaborne trade by types of cargo.” This data set consisted of totals of transported volumes of different types of cargo (crude, dry, other) by millions of metric tons on an annualized basis. A simple linear regression was conducted on the behavior of the dependent variable, the aggregate of all goods discharged annually (“Total goods discharged,” measured in millions of metric tons), to determine if there was a statistically significant relationship with the independent variable, world GDP. In other words, what was the utility of world GDP in predicting the amount of total goods transported by sea and discharged annually?

For the period 1989 through 2021, the R^2 correlation coefficient was 0.7413, which can be interpreted as meaning 74% of the behavior of global seaborne transport can be explained by world GDP. In general, an R^2 above 70% in finance and economics is a high level of correlation, whereas a measure below 40% would show a low level of correlation[3] (Fernando 2023). (Figure 27).

Figure 27. World Gross Domestic Product and Total Goods Discharged (1989–2021)

Source: UNCTAD 2022; IMF 2023

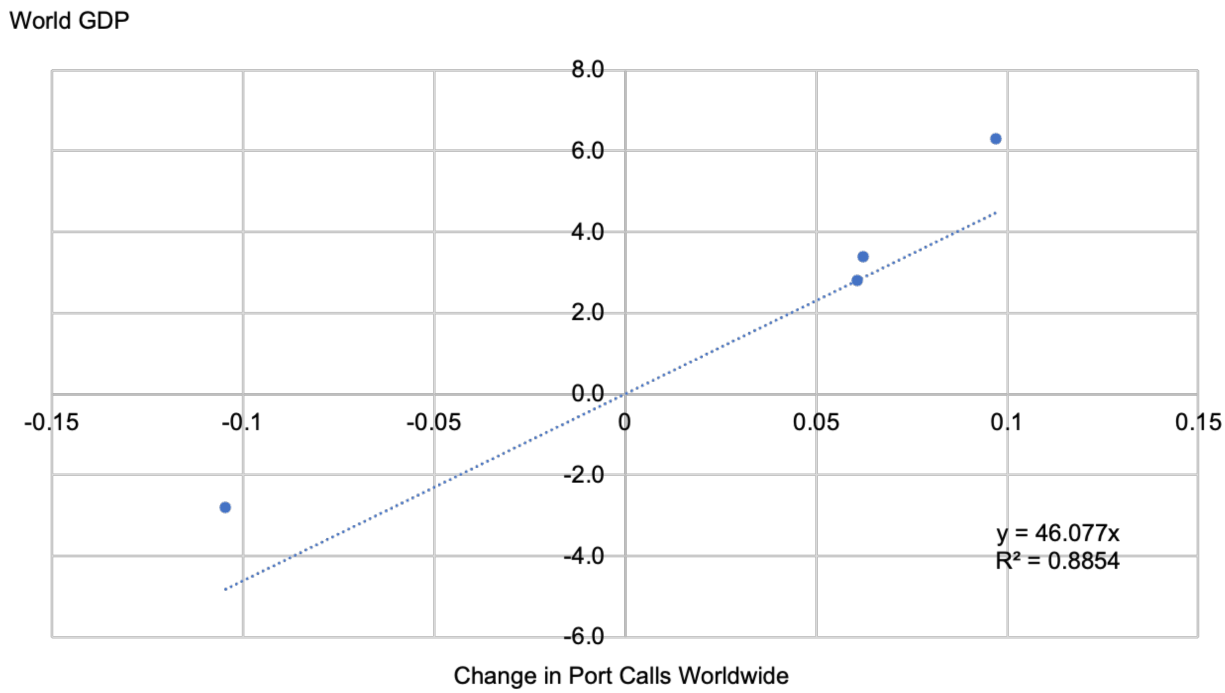


3 The fundamental understanding of how r-squared calculations are defined, in addition to their calculation formula, uses and limitations are defined within https://www.investopedia.com/terms/r/r-squared.asp.

To further test this relationship between maritime transport and economic output, a similar regression analysis was run using the number of annual port calls as measured in the UNCTAD study with annual GDP figures from the IMF *WEO* report (Figure 28). Measuring the percent change in port calls with GDP figures during the period 2018–2022, yielded an R^2 coefficient of 0.8854, or 88.5%, demonstrating a very strong relationship between the two data series and the high utility of GDP in predicting maritime trade.

Figure 28. World Gross Domestic Product and Annual Change in the Number of Port Calls (2018–2022)

Source: UNCTAD 2022; IMF 2023

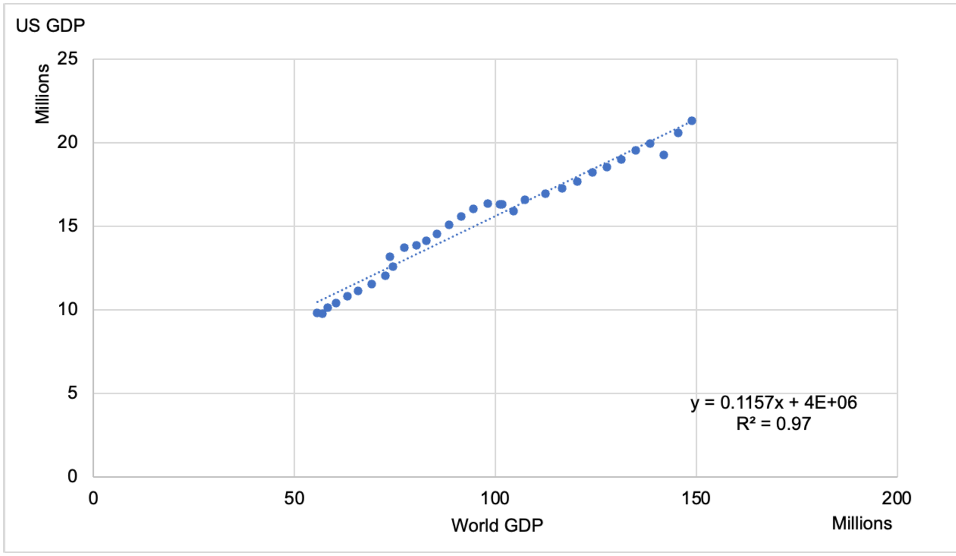


3.2.4.2 Regional Economic Activity

The objective was to determine that the GDP/Seaborne trade relationship holds at a regional level. Again, using simple linear regression, the first step was to demonstrate the strong correlation between U.S. economic output (measured in GDP) as a function of world economic output. As evidenced in Figure 29, a strong relationship is observed between U.S. and World GDP. According to the OECD, U.S. GDP on average has represented 16.1% of total World GDP output from the years 1980–2022.

Figure 29. World Gross Domestic Product and United States Gross Domestic Product (1980–2022)

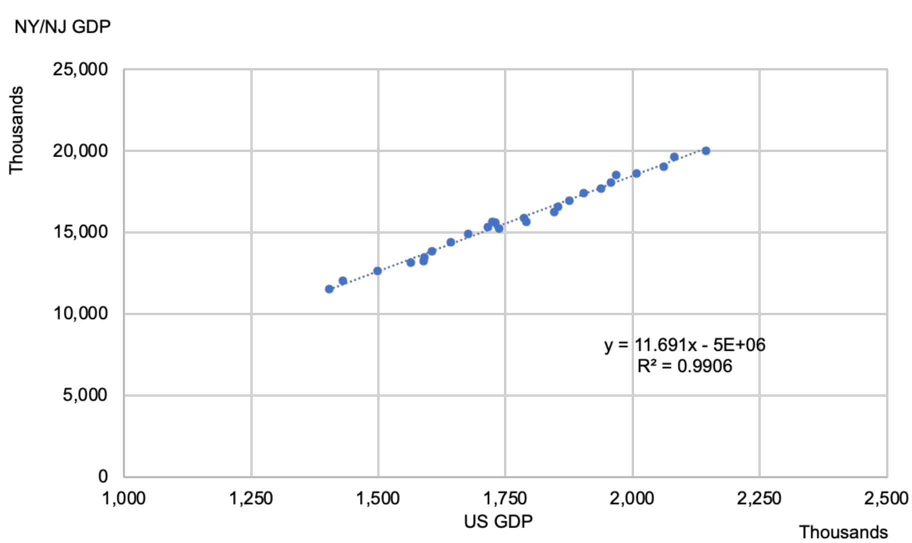
Source: OECD, n.d.



Next is to derive the relationship for the relevant region, for this study (New York and New Jersey), and determine the historical proportion of the region's output to total U.S. GDP. Analyzing Data from the Bureau of Economic Analysis (BEA), GDP output from New York and New Jersey was combined in relation to total U.S. GDP output. For the years 1997 through 2022, New York State/New Jersey total GDP averages 11.3% of total U.S. GDP output (BEA n.d.). (Figure 30).

Figure 30. United States Gross Domestic Product and New York/New Jersey Gross Domestic Product (1997-2022)

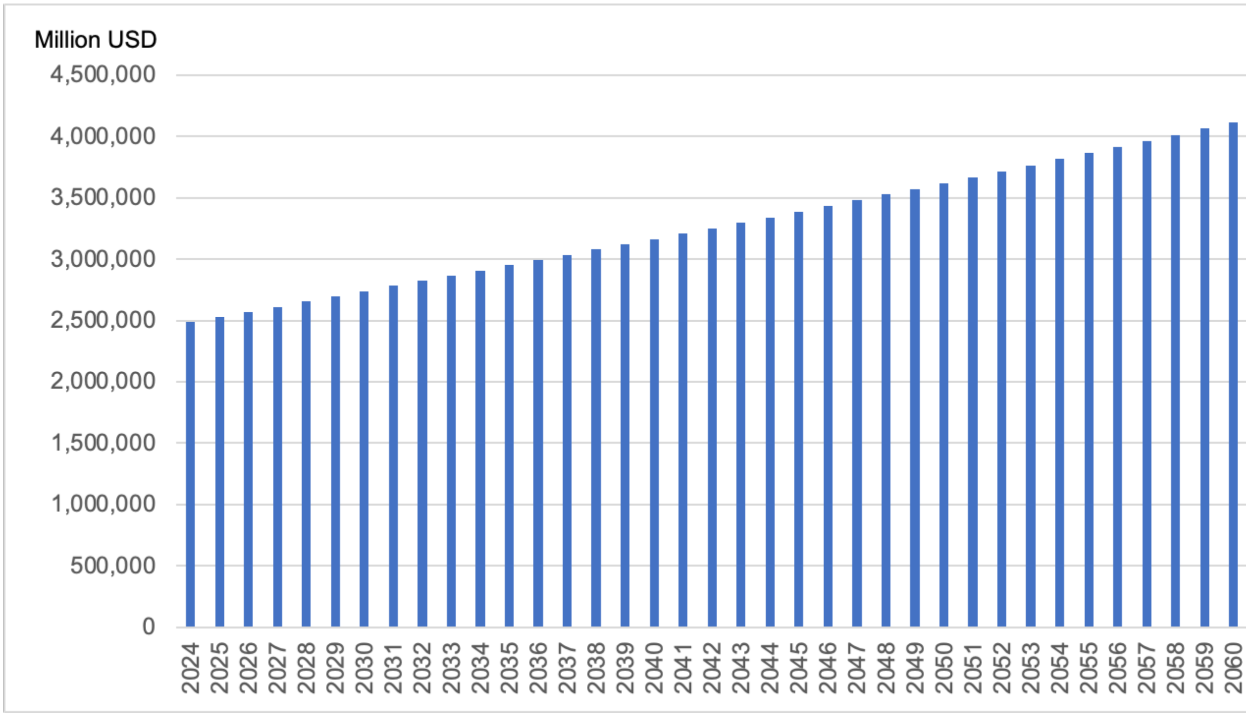
Source: BEA, n.d.



In the next step, these historical percentages are employed to estimate New York State/New Jersey combined GDP using OECD forecasts for U.S. GDP forward to 2060. This helps determine potential growth rates for growth in cargo activity for this forecast period (Figure 31).

Figure 31. United States Gross Domestic Product and New York/New Jersey Gross Domestic Product (2024-2060)

Source: BEA, n.d.; OECD, n.d.



3.2.4.3 Regional Economic Activity and Marine Activity

New York State/New Jersey combined GDP figures (Millions U.S. Dollars) showed a high degree of utility in explaining the behavior of cargo activity. In separate simple linear regressions for containerized cargo activity (twenty-foot equivalent units) and general cargo activity (metric tons) as the independent variable for regional total imports and exports during the period 2005–2016, result showed an R^2 coefficient of 90.5% and 72.7%, respectively (Figure 32 and Figure 33).

Figure 32. Port Authority of New York and New Jersey Containerized Cargo and New York/New Jersey Gross Domestic Product (2005–2016)

Source: BEA, n.d.; Port Authority of New York and New Jersey 2017

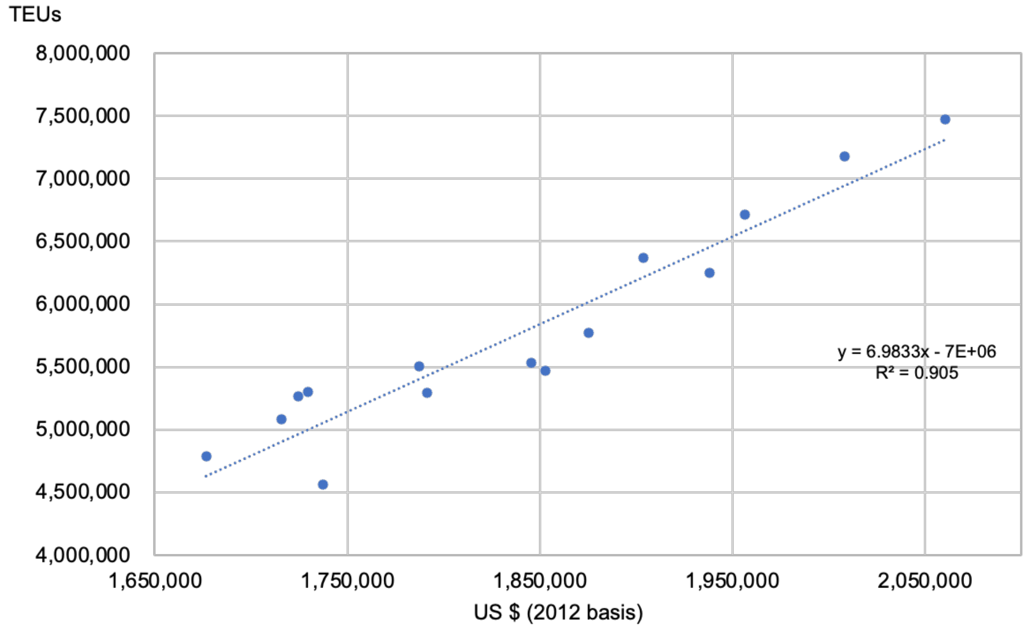
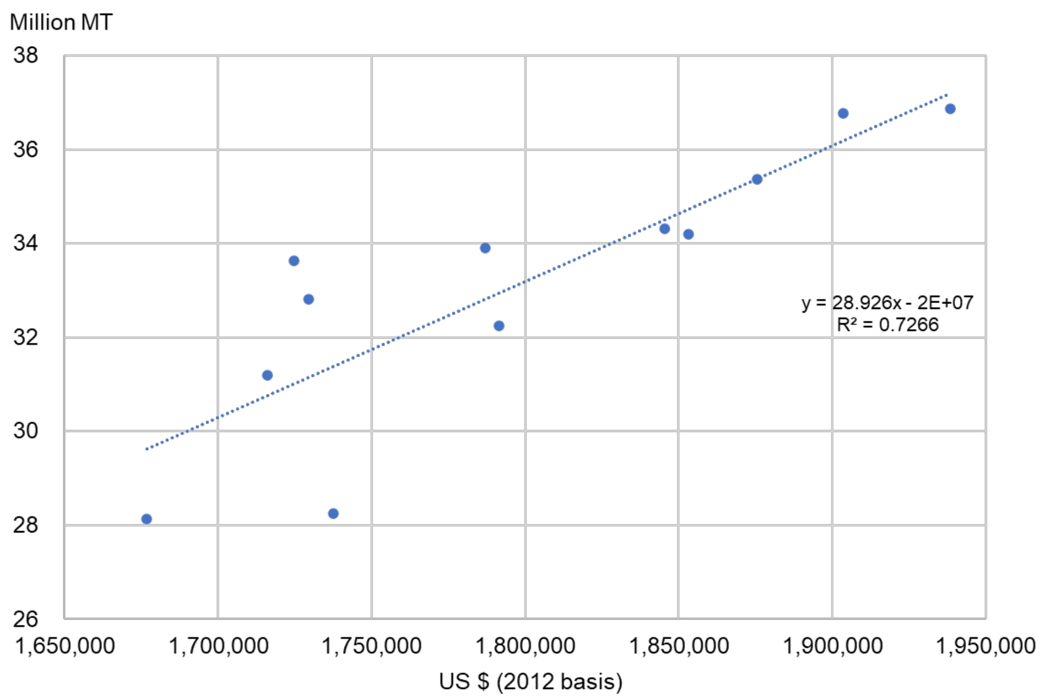


Figure 33. Port Authority of New York and New Jersey General Cargo and New York/New Jersey Gross Domestic Product (2005–2016)

Source: BEA, n.d.; Port Authority of New York and New Jersey 2017

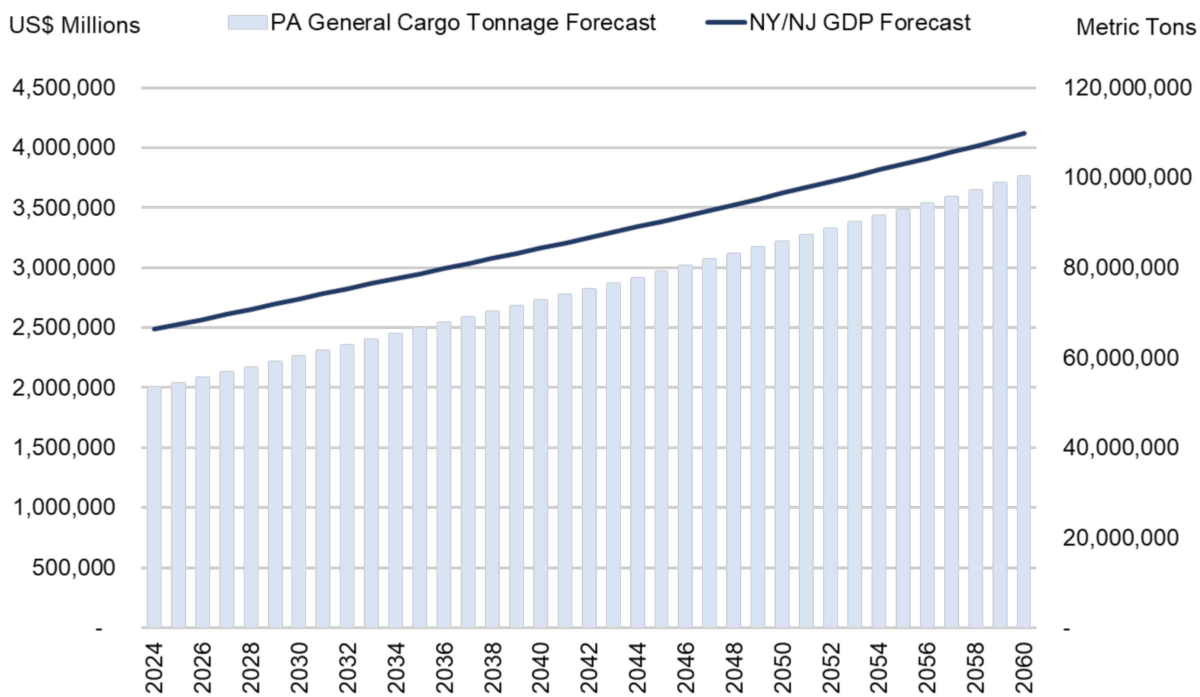


3.2.4.4 Future Regional Marine Activity

New York State/New Jersey GDP forecasts from 2024–2060 (derived from analyzing historical BEA data from analyzing the historical relationship between the U.S. and New York/New Jersey states) were used to forecast general cargo tonnage for the Port Authority of New York and New Jersey (Figure 34). Logically, there will be a physical capacity limit to the amount of cargo volume the port can handle so a logarithmic function was applied to dampen growth at the back end of the forecast. This is a conservative assumption—infrastructure development increases capacity as increased demand for that capacity warrants. The argument that growth must slow down over time could be challenged.

Figure 34. Port Authority of New York and New Jersey General Cargo Tonnage Forecast and New York/New Jersey Gross Domestic Product Forecast (2024–2060)

Source: BEA, n.d.; Port Authority of New York and New Jersey 2017



3.2.4.5 Growth in Marine Activity for Selected Shipping Segments

The Port Authority of New York and New Jersey historical data from 2016 trade statistics for the years 2005 through 2016 and BEA GDP data were used to establish the breakdown of cargo by type which was then applied to suggest forecasted marine traffic growth by vessel type. The result is shown in Figure 35 for general cargo carriers, oil and gas tankers, container ships, cruise ships, bulk carriers, and auto carriers. Implicit in these growth rates is that increased cargo volumes will generally lead to increases in marine traffic. This assumption means that the introduction of larger vessels as technology develops that may drive fewer voyages is assumed a second order effect superseded by the absolute growth rate.

Figure 35. Regional Cargo Growth Forecast (2024–2050)

Source: Port Authority of New York and New Jersey 2017; McQuilling Renewables

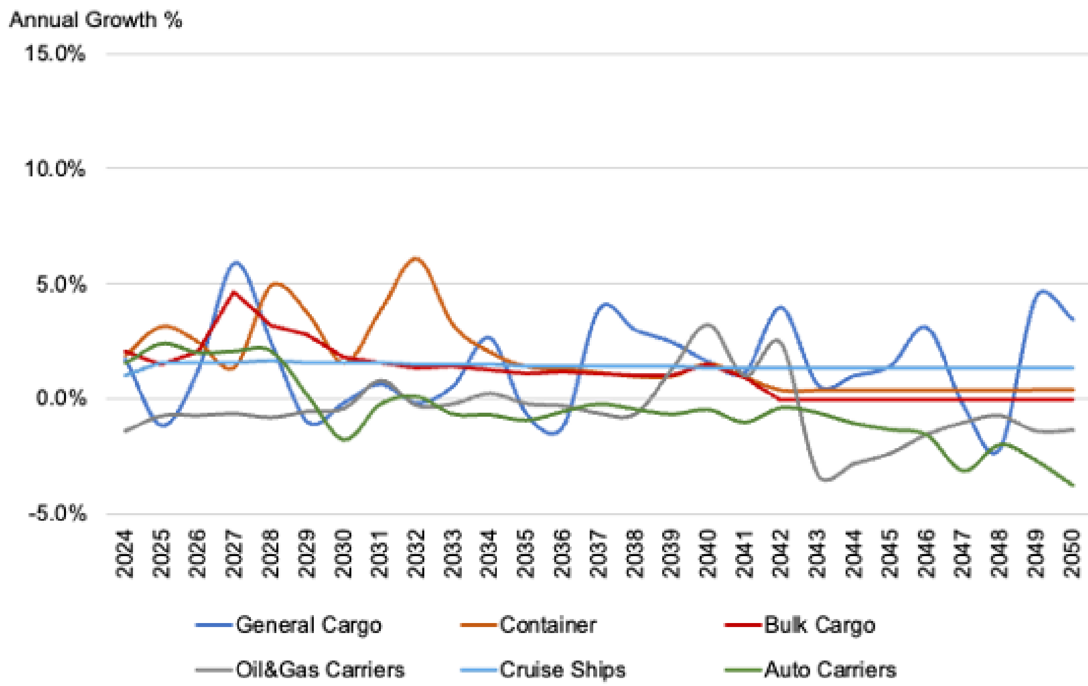


Figure 35 illustrates variation in growth across shipping sectors. These differences are not surprising when considering the underlying cargo demand: oil and gas volumes are expected to decline with time as other energy sources develop and cruise ship tourism remains a popular activity for individual recreation. Containerized trade continues to grow with globalization, even with recent localization trends. For the U.S. eastern seaboard, this has been forecast for some time. Commenting in 2015 on the upcoming completion of the Panama Canal expansion, Field and Longley-Wood (2015) noted that ports along the Atlantic seaboard have been preparing for the expansion by addressing dredging and other infrastructure needs. Various assessments of the potential impacts of the Panama Canal have identified various outcomes in specific ports either as a direct result of ships with increased capacity or resulting from secondary or “feeder” traffic. While the feeder component has not materialized, this trade dynamic was further boosted in 2020 and subsequently as U.S. West Coast ports experienced massive backlogs and long delays unloading containerships, and the industry has worked to diversify the supply chain since then. Increased direct containerized trade to U.S. East Coast ports is one important result.

Table 20 illustrates the annual growth rates resulting from the analysis described in the previous sections. Overall, the regional marine traffic growth rate averages about 0.64% per annum across shipping sectors for the forecast period 2024–2050. This compares to an aggregate number of 0.8% suggested in the *Offshore Wind Ports: Cumulative Vessel Traffic Assessment* study (NYSERDA 2022a). Positive average annual growth rates for general cargo vessel traffic (1.40%), bulk cargo carriers (1.17%), container ships (1.71%), and cruise ships (1.44%) are suggested for the forecast period. Oil and gas tankers (-0.44%) and auto carriers (-1.44%) are expected to see negative average annual growth over the period.

Table 20. Regional Marine Traffic Growth Matrix (2024–2050)

Source: McQuilling Renewables

	General Cargo	Container	Bulk Cargo	Oil & Gas Carriers	Cruise Ships	Auto Carriers
2024	1.70%	1.90%	2.10%	-1.34%	1.06%	1.60%
2025	-1.18%	3.16%	1.50%	-0.68%	1.57%	2.44%
2026	1.24%	2.46%	2.10%	-0.67%	1.61%	2.05%
2027	5.88%	1.38%	4.63%	-0.60%	1.63%	2.12%
2028	2.43%	4.93%	3.17%	-0.76%	1.63%	2.12%
2029	-1.02%	3.74%	2.81%	-0.50%	1.62%	-4.68%
2030	-0.20%	1.56%	1.86%	-0.38%	1.59%	-1.74%
2031	0.62%	3.83%	1.60%	0.85%	1.56%	-0.19%
2032	-0.21%	6.10%	1.37%	-0.25%	1.53%	0.13%
2033	0.55%	3.21%	1.42%	-0.17%	1.50%	-0.63%
2034	2.61%	2.05%	1.30%	0.29%	1.47%	-0.65%
2035	-0.67%	1.40%	1.13%	-0.17%	1.45%	-0.88%
2036	-1.26%	1.30%	1.15%	-0.26%	1.43%	-3.01%
2037	3.86%	1.14%	1.09%	-0.58%	1.41%	-0.19%
2038	2.96%	0.97%	1.02%	-0.60%	1.40%	-0.42%
2039	2.43%	0.98%	1.01%	1.33%	1.39%	-0.63%
2040	1.60%	1.52%	1.50%	3.27%	1.38%	-0.43%
2041	1.13%	0.95%	0.92%	1.03%	1.38%	-0.97%
2042	3.94%	0.38%	-0.02%	2.44%	1.38%	-0.35%
2043	0.59%	0.38%	-0.02%	-3.25%	1.38%	-6.66%
2044	0.97%	0.38%	-0.02%	-2.77%	1.37%	-6.25%
2045	1.40%	0.39%	-0.02%	-2.31%	1.37%	-5.84%
2046	3.07%	0.39%	-0.02%	-1.49%	1.36%	-4.25%
2047	-0.31%	0.39%	-0.02%	-0.98%	1.36%	-3.10%
2048	-2.18%	0.39%	-0.02%	-0.68%	1.35%	-1.95%
2049	4.41%	0.40%	-0.02%	-1.35%	1.34%	-2.66%
2050	3.43%	0.40%	-0.02%	-1.31%	1.34%	-3.73%
Average						
0.64%	1.40%	1.71%	1.17%	-0.44%	1.44%	-1.44%

Applying annual growth estimates in Table 20 across the vessel types yields the following increase in non-OSW marine traffic in selected future years (Table 21):

Table 21. Regional Marine Traffic Growth Estimated From 2023—Selected Years (2030/2040/2050)

Source: McQuilling Renewables

	General Cargo	Container	Bulk Cargo	Oil & Gas Carriers	Cruise Ships	Auto Carriers
2030	9.2%	18.9%	17.4%	-4.5%	9.5%	5.6%
2040	21.3%	48.4%	33.5%	-4.4%	26.7%	-2.8%
2050	40.0%	56.9%	36.6%	-10.3%	45.1%	-30.3%

3.2.5 Estimated Offshore Wind Marine Traffic Growth

A long-term forecast of marine traffic growth associated with OSW is composed of assumptions related to: (1) capacity required to meet demand in GW; (2) turbine size in megawatts; (3) the timing of projects; (4) evolving equipment technology; and (5) the transport logistics related to getting turbine foundations and components from supply bases and staging areas to the field locations.

3.2.5.1 Offshore Wind Energy Capacity Growth

Several sources estimate long-term OSW energy generation capacity requirements to meet demand. The 2022 report from the U.S. Department of Energy (DOE) “Offshore Wind Market Report” indicates that U.S. domestic OSW energy deployment is expected to follow global growth trends, driven by robust state-level procurement targets, and a national target of 30-GW of OSW energy by 2030, set in March 2021. (DOE 2022, x-xi). The International Energy Agency (IEA) in their “World Energy Outlook Special Report: Offshore Wind Outlook 2019” projects that OSW commitment increases significantly in the United States over the next two decades. In their Stated Policies Scenario, the EIA sees the United States add nearly 40-GW of OSW capacity by 2040, and US $100 billion in related investment over this period. In the Sustainable Development Scenario, capacity nears 70-GW by 2040 (IEA 2018, 32).

The Biden administration’s 30-GW-by-2030 goal suggests a strong pace of development and establishes a pathway to deploy 110-GW or more of OSW energy in the United States by 2050 (The White House 2021). Further research is needed to determine the extent of OSW energy’s role in a decarbonized energy future, but OSW energy market indicators suggest it will be a substantial part of a comprehensive U.S. decarbonization strategy (DOE 2022, x-xi).

Going forward, national leasing plans call for new OSW energy lease area auctions in the Gulf of Mexico, Pacific, South Atlantic, and the Gulf of Maine by 2024, which would allow commercial development in these regions as early as 2030. The DOE states the actual size and speed of U.S. OSW buildout will depend on continued regulatory efficiency, the availability of installation vessels and port infrastructure, proactive onshore and offshore grid planning and upgrades, the successful commercialization of the 15-MW wind turbine platforms, and sustained market demand. In the DOE report, third party forecasts predict that most of the future OSW energy deployment out to 2031 will occur on the East Coast in states with existing OSW energy procurement goals (DOE 2022, 20).

This study assumes U.S. OSW energy generating capacity increases 30-GW by 2030, another 40-GW by 2040 and an additional 40-GW by 2050. U.S. East Coast capacity grows 30 MW by 2030, another 30-GW by 2040 and an additional 30-GW by 2050.

3.2.5.2 Offshore Wind Turbine Capacity

Turbine capacity continues to rapidly increase on the drawing board and in the water for offshore installations. However, the latest designs representing the largest capacity turbines will not be installed in great numbers for some time. Nonetheless, the average turbine capacity of installed equipment will continue to increase as larger and larger turbines are manufactured and installed. It should be noted that currently in the U.S., the maximum operating turbine capacity installed by mid-2023 is 6 MW per turbine off Block Island and offshore Virginia. For forecast purposes, it is important that the spatial studies align key assumptions related to OSW energy capacity and generation

3.2.5.3 Forecast Projects Timing

Assumed timing of OSW energy capacity coming online is also necessary to project future marine traffic related to OSW. The study assumes that project timelines for fields installed to 2030 offshore the U.S. East Coast are as reported in individual wind field project documents. For turbines installed from 2030 to 2050, operating capacity is assumed evenly spread over the time period, taking the ratio of the expected incremental gigawatts installed and turbine capacity applicable to each forecast period.

3.2.5.4 Evolving Equipment Technology

Developers are installing turbines in deeper waters, through improved construction techniques as a result of learning from earlier projects. The use of relatively low-cost monopile foundations has been the industry standard for most of the projects installed in water depths of less than 50 meters. Projects located in waters 50- to 60-meter in depth are pushing for the use of such foundations in favor of higher cost jacket and floating foundations. (IEA 2018, 76). This study assumes any OSW structures installed offshore beyond the 60-meter depth contour are *floating structures.* Therefore, for installations in the AoA, turbines are assumed to be floating and anchored.

FOSW technology represents many new design concepts, features and project proposals at various levels of maturity. In 2021, the American Bureau of Shipping Group (ABSG) Consulting advised there was one installed FOSW project and 10 planned projects in the United States. The first operational FOSW project installed and connected to the grid was developed by the University of Maine. Several FOSW projects are in the planning and development pipeline in the U.S., most offshore the U.S. West Coast and Hawaii and a demonstration FOSW project has been discussed for offshore Massachusetts (ABSG). Since 2016, the BOEM has published four wind energy call areas on the OCS for FOSW in federal waters and several projects have been proposed in these call areas (BOEM 2021). The AoA represents a large deepwater region off the U.S. East Coast where FOSW technology would be deployed.

ABSG produced the report "Floating Offshore Wind Turbine Development Assessment—Final Report and Technical Summary" for BOEM in March of 2021 (BOEM 2021). In it, they reference Barter, et al. in 2020 who state that FOSW plants have the potential to be cost-competitive with fixed-bottom installations. This can occur with a critical mass of FOSW project and purpose designed and built FOSW. At present, wind turbines on floating sub-structures are identical to fixed-bottom systems, because purpose-built FOSW structures have not yet been designed or built. The development of a purpose-built FOSW structures is not expected until there is sufficient market certainty to justify the development risk to original equipment manufacturers.

ABSG further summarizes Barter et al. stating platform technology is generally based on three classical designs: the spar, semi-submersible, and tension-leg platform, which are all derived from the oil and gas industry. Many new platform designs seek cost savings by hybridizing of the classical designs to achieve more optimal characteristics. Hybrid concepts may represent a future class of FOSW platforms with transformable configurations adapted to perform under multiple states, including assembly, construction, load-out, and operation on the station. For all floating substructure designs, a mooring and anchoring system is used to keep the substructure on the station. Mooring technology solutions that can address the transitional depths are critical for FOSW adoption since many existing nearshore lease areas in the North Atlantic Planning Area of the Atlantic OCS extend into these depths already (BOEM 2021, 37).

3.2.5.5 Equipment Transport Logistics

A substantial amount of incremental marine traffic will be generated by the installation of 90-GW of OSW energy capacity by 2050. This traffic will be composed of several different vessel types employed in different activities at contrasting times in each project installation and operation life cycle. While all this traffic is commercial, the characteristics of many of these uses to support OSW development will be on smaller, more maneuverable vessels, on deployments that are project related and intermittent rather than continuous, less constrained to traffic lanes and separation schemes and more discretionary voyage routing to destinations offshore. Examples include crew transfer vessels (CTVs) and Service Operation Vessels (SOVs) deployed during installation stages whose numbers will be fewer with greater routing flexibility. Traffic arising from these relatively smaller, more maneuverable, less persistent and less constrained commercial vessels is not quantified in this Study. This is due in part to lower relative intensity of these activities, as well as the fact this traffic arises from wind field project activity as compared to other marine uses that must co-exist with them. This marine activity may be the subject for future work in this area. Different than recreational activity from smaller, more maneuverable, less persistent and less constrained vessels where these exists usage statistics and also remotely sensed historical data, this commercial traffic activity will be better informed as actual vessel deployment data is collected from ongoing offshore wind projects.

Further, operations and maintenance (O&M) activities, while somewhat predictable are still of relatively low density as compared to installation activities. *The Offshore Wind Ports: Cumulative Vessel Traffic Assessment* study estimated 106 voyages per year in 2024 increasing to 416 trips in 2035 to support 9.3 GW of OSW energy capacity installed for SOV and CTV operations (NYSERDA 2022a). These numbers translate into an average of two trips per day on smaller, maneuverable vessels across a network of different routes.

This study focuses on the marine traffic servicing FOSW installation that occurs on larger, less maneuverable vessels. In general, these are the movements related to FOSW foundation towing, anchor handling and feeder equipment transits. In this study, the marine logistics assumptions underlying the quantitative estimates for increased marine traffic related to OSW are:

- All turbines installed offshore through 2030 are fixed to the seafloor, and monopile foundations are transported by U.S. flag Jones Act compliant feeder equipment (2 monopiles per trip) from staging areas along the U.S. East Coast to the offshore locations and installed by foreign flag installation equipment on site.

- Through 2030, turbine components are transported by U.S. flag Jones Act compliant feeder equipment (1 set turbine components per trip) from staging areas along the U.S. East Coast to the offshore locations and installed by foreign flag installation equipment on site.
- Beyond 2030, floating foundations are fabricated and assembled ashore and towed to offshore locations and then anchored in place.
- Beyond 2030 FOSW components are transported by U.S. flag Jones Act compliant feeder equipment (1 set turbine components per trip) from staging areas along the U.S. East Coast to the offshore locations and installed by foreign flag installation equipment on site.
- FOSW foundations are assumed anchored with three anchors utilizing anchor handing vessels to set the anchors on one trip and attach chains to the foundations during the foundation tow voyage.
- Marine traffic underlying imports of turbine components from abroad is assumed incorporated into the growth rates projected for non-OSW marine traffic establish in section 3.2.4 of this study.

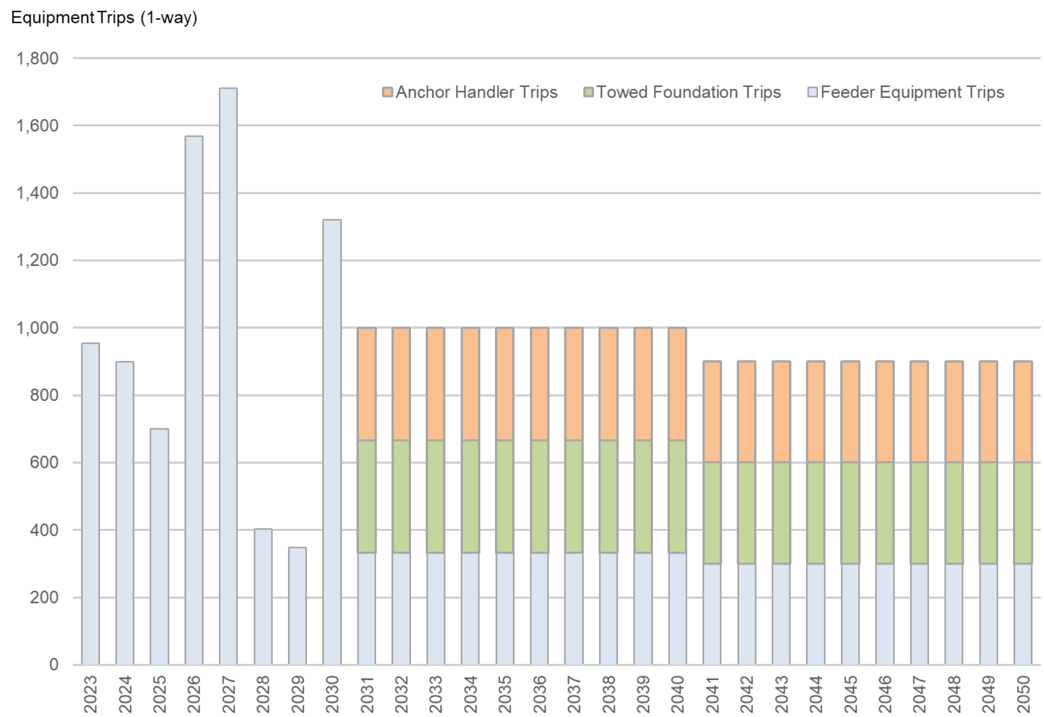
These assumptions are for planning purposes and not a claim of how the OSW marine logistics will be configured in the future. They support the process for developing estimates of future marine traffic originating from OSW.

Given the length of the forecast period, there may be more optimal logistics that emerge going forward as a primary transport mode with technology development of the transport equipment and other logistics advances. For example, instead of turbine components being imported to U.S. shoreside facilities for staging and then reloaded for transit on Jones Act feeder equipment to the OSW locations, direct delivery from Europe or other locations to the U.S. OSW location may become prevalent as the logistics of choice.

Using these assumptions, estimates from 2024 through 2050 of the number of feeder equipment trips were developed (Figure 36), along with foundation towing voyages and anchor handling vessel activities. These are assumed to occur along the timeline to 2050. Note that anchor handling vessels make one round trip to set anchors and a second round-trip, towing the floating foundation to the site and attaching the previously set anchors to it.

Figure 36. Major Offshore Wind Marine Traffic (2024–2050)

Source: McQuilling Renewables



To estimate marine traffic resulting from these activities, representative manufacturing locations or staging/supply bases were identified along with selected OSW areas as nodes described below and in Table 22.

Marmen/Welcon Tower Facility Albany, NY—Departure point to the market would be Lower New York Harbor, The Narrows—Ambrose Channel—40° 27.462' N / 073° 50.200' W—Marmen, Welcon, and the Port of Albany to develop a wind tower and transition piece fabrication facility with wind tower production set for 2025. Initially used to support the Equinor offshore New York wind projects followed by the larger market (Marmen Inc. 2021).

South Brooklyn Marine Terminal, Brooklyn, New York—Departure point to the market would be Lower NY Harbor, The Narrows—Ambrose Channel—40° 27.462' N / 073° 50.200' W—Equinor and the New York City Economic Development Corporation will upgrade the terminal as an O&M base to support regional OSW projects starting with Equinor's Empire Wind 1. The terminal will also have heavy lift and staging capabilities that will be built on the nearby 39th Street pier which will serve as staging and installation hub for Equinor and other developers (New York City Office of the Mayor 2022).

NJ Wind Port—EEW AOS Plant Paulsboro, New Jersey—Departure Point from the lower Delaware Bay—38° 46.232' N / 075° 01.314' W—First and largest facility for the production of monopiles in the USA with a full production capacity of 100 monopiles per year to be reached by the second project development phase scheduled for 2024 (State of New Jersey 2023).

Sparrows Point Steel, Baltimore, Maryland—US Wind & Trade Point Atlantic to develop a long-term monopile production facility. Departure point from within Delaware Bay—38° 46.232' N / 075° 01.314' W or Lower Chesapeake Bay—36° 56.130' N / 075° 57.442' W—US Wind is establishing a long-term monopile production facility called Sparrows Point Steel at Sparrows Point in Baltimore. This site was once the home of Bethlehem Steel, when it was the largest steel production facility in the world. US Wind proposes to facilitate the investment of an incremental $150 million in this new facility, which builds on the critical investments of $77 million that will be made to the site at Tradepoint Atlantic (TPA) via the MarWin project. US Wind has already entered into an agreement with TPA for site control of over 90 acres at Sparrows Point and intends to upgrade land and buildings, construct new facilities, and purchase state-of-the-art welding and coating equipment for the site (US Wind 2023).

Norfolk Harbor Staging Area (Ørsted Lease), Virginia—Departure Point to the market from Lower Chesapeake Bay—36° 56.130' N / 075° 57.442' W—With parcels originally leased by Ørsted in 2020 for a period of six years as well as Dominion in 2021 for a period of 10 years, this location is being developed to initially support the build out of the Coastal Virginia Offshore Wind Project (CVOW). Engineering company Skanska has been selected by the state of Virginia to redevelop the area which will initially be used as a staging port for CVOW. Modifications and upgrades to the facility include the construction of heavy lift berths, dredging of channels and channel access to support larges vessels and multiple mooring configurations, as well as installing upgraded lighting and sub structure to accommodate heavy surface loading operations (Chesapeake Bay Magazine, Bay Bulletin 2020); (Schulte 2021).

SGRE Blade Facility, Portsmouth Marine Terminal, Virginia—Departure Point from Lower Chesapeake Bay - 36° 56.130' N / 075° 57.442' W—First OSW turbine OEM blade facility in the U.S. with a long-term lease signed with the Virginia Port Authority for more than 80 acres at the Portsmouth Marine Terminal. The facility will support the supply of patented Siemens Gamesa OffshoreIntegralBlades (SIEMENS Gamesa 2021).

Nexans High-Voltage Subsea Cable Plant, Charleston, South Carolina—Departure Point EX Charleston Harbor—32° 37.092' N / 079° 35.460' W—In Q4 2021 Nexans officially opened its transformed high-voltage subsea cable plant in Charleston, South Carolina on the Cooper River to supply the rapidly expanding U.S. OSW market with potential growth of 13% annually by 2030. Approximately 1,000 km of cables can be delivered form the facility to Ørsted and Equinor wind fields up to the year 2027 and can support the U.S. market with further energy transition projects. Nexans has also commissioned the cable laying vessel CLV NEXANS AURORA in Sept. 2022 that will install the subsea cables that are manufactured at the Nexans South Carolina and Halden Norway facilities for projects ranging from Scotland to the U.S. East Coast (Nexans 2021).

Various U.S. Gulf Fabrication Facilities—Expected Builders of Sub Stations, Foundations, Secondary Steel Etc.—Departure Point from Florida Straits North of the Bahamas—27° 30.500' N / 079° 28.859' W—The U.S. Gulf has been supporting the emerging U.S. OSW industry since its inception where Gulf Island Fabrication of Houma, Louisiana constructed and delivered the five 400-ton foundations along with five transition pieces for the USA's first ever OSW field offshore Block Island, Rhode Island. The substation for the South Fork Wind project has been built at the Kewit OffshoreServices, LTD. facility in Ingleside, Texas, where it was delivered from the yard in late May 2023. Due to the fabrication experience and depth of facilities along the U.S. Gulf Coast that have supported the oil and gas industry for decades, more equipment is expected to be fabricated and delivered from these facilities to various locations in the support of the OSW industry (Gulf Island Fabrication, Inc. 2023; South Fork Wind 2021).

New Bedford, Massachusetts—Departure Point EX Buzzards Bay—41° 29.075’ N / 070° 57.019’ W— The port of New Bedford has completed a two-year re-construction campaign on the Marine Commerce Terminal to transform the 29-acre facility into a hub for the construction, assembly, marshalling and installation of OSW turbines and project components. Vineyard Wind is currently utilizing the facility to stage and construct the Vineyard Wind 1 project. FOSS Offshore Wind is also constructing a facility nearby called the New Bedford FOSS Marine terminal, which will also be assisting in marine and intermodal logistics to support the development of the industry (Port of New Bedford 2023).

Bridgeport, Connecticut—Departure Point EX Montauk Point—East—41° 13.074’ N / 072° 04.432’ W—Portions of the waterfront at the port of Bridgeport, Connecticut, are to be redeveloped to support Avangrid Renewables and the Park City wind project in both its construction and O&M stages (Durakovic 2021).

New London, Connecticut—Departure Point EX Montauk Point—East—41° 13.074’ N / 072° 04.432’ W—The State Pier in New London, Connecticut, has been redeveloped to serve as a delivery, assembly, and marshalling port for nearby wind field projects with Ørsted and Eversource’s South Fork Wind being the first as offshore construction began in the spring season of 2023. Staging and assembly support for two additional Ørsted & Eversource projects—Revolution Wind & Sunrise Wind are scheduled to follow in the years ahead. The terminal will contain two heavy lift platforms designed to handle both OSW components along with a varied range of seaborne cargoes (Connecticut Port Authority n.d.).

Salem, Massachusetts—Departure Point EX Nantucket Shoals TSS—40° 45.146’ N / 069° 00.0’ W— Salem Offshore Wind Terminal is being developed by Crowley and Avangrid along with the city of Salem, Massachusetts and is being designed to be used as a staging and partial assembly point for turbine components. The terminal expects turbine components to be shipped from global manufacturing locations where they can be loaded onto vessels for offshore project installation. The terminal expects construction in Fall 2023 and to open for operations at the end of 2025 or early 2026 (Salem Offshore Wind n.d.).

Providence, Quonset Point Development Corp., Rhode Island—Departure Point EX Narragansett Bay Traffic Lane (Out)—41° 10.0’ N / 071° 25.467’ W—Quonset Development Corporation is currently planning and designing a multi-modal OSW transportation center to the south of Providence, Rhode Island, at Quonset Point. This location will serve as a hub to support the development and operations and maintenance of OSW fields and allow for the configuration of various OSW turbine components and the docking of vessels (King 2023).

Table 22. Representative Port Facilities and Offshore Points

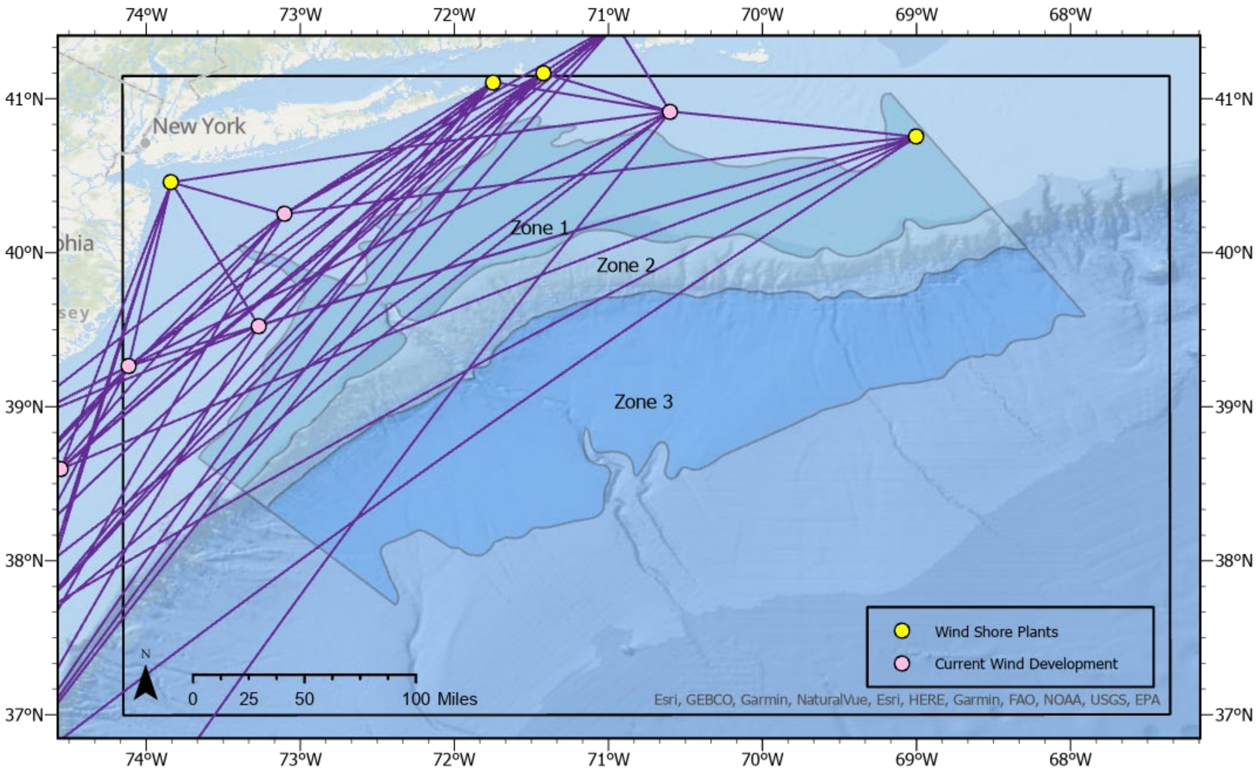
Source: McQuilling Renewables

Port Facilities - Manufacturing & Staging	Geo-Reference	LAT	LONG
Marmen/Welcon Tower Facility Albany NY	The Narrows - Ambrose Channel	40.457700	-73.836667
South Brooklyn Marine Terminal, NY	The Narrows - Ambrose Channel	40.457700	-73.836667
NJ Wind Port - EEW AOS Plant Paulsboro, NJ	Delaware Bay	38.839499	-74.947674
Sparrows Point Steel, Baltimore, MD	Lower Chesapeake Bay	36.935500	-75.957367
Norfolk Harbor Staging Area (Ørsted Lease), VA	Lower Chesapeake Bay	36.935500	-75.957367
SGRE Blade Facility, Portsmouth Marine Terminal, VA	Portsmouth, VA	36.935500	-75.957367
Nexans High Voltage Subsea Cable Plant, Charleston, SC	Charleston, SC	32.730147	-79.846279
Various US Gulf Fabrication Facilities	Florida Straits N of Bahamas	27.508333	-79.480983
New Bedford, MA	Entrance to Buzzards Bay	41.484588	-70.950322
Bridgeport, CT	Montauk Point - East	41.229070	-72.073883
New London, CT	Montauk Point - East	41.229070	-72.073883
Salem, MA	Nantucket Shoals TSS	40.752433	-69.000000
Providence, Quonset Point Development Corp. RI	Narragansett Bay Traffic Lane (Out)	41.166667	-71.424450
Offshore Points - Wind Field Locations	**Geo-Reference**	**LAT**	**LONG**
Northeast Cluster	N/A	40.917000	-70.599000
New York Bight	N/A	40.250000	-73.104000
Offshore New Jersey (North)	N/A	39.525000	-73.269000
Offshore New Jersey (South)	N/A	39.262000	-74.115000
Delaware Bay	N/A	38.595000	-74.554000
Offshore DelMarVa Peninsula	N/A	37.644000	-74.719000
Offshore Virginia	N/A	36.462889	-75.038018

Using a boundary condition approach, the shore facilities or waypoints to get to/from these offshore locations were connected to each of the offshore locations identified with routes, creating a fabric of the maximum number of routes representing major vessel movements of FOSW foundations and components (Figure 37). The number of feeder trips was spread uniformly across this network, resulting in a relatively sparse marine traffic profile over time. It is improbable that every equipment supply location will deliver FOSW equipment to every offshore area so therefore the actual number of routes will be less than what is illustrated here, and some routes will see heavier traffic than others. In the absence of the knowledge of the actual supply chains for individual OSW projects in the period 2024 through 2050, this approach provides a starting point to assess the spatial distribution and intensity of future OSW-related traffic.

Figure 37. Boundary Case—Maximum Routes

Source: McQuilling Renewables



In Figure 37, a vessel route is established between every manufacturing/staging port facility or waypoint and every OSW area. The specific locations are arbitrary but generally located in the regions of OSW development. The exercise shows where the potential presence of this activity is, and importantly, where it is not. From the calculations yielding Figure 36, about 950 voyages per year are required for feeder equipment, anchor handling vessels and towed FOSW foundations to install the OSW energy capacity forecasted. This demand is spread across the fabric of routes illustrated in Figure 37. Ten unique geo-referenced equipment sourcing locations and seven distinct OSW areas create a total of 70 unique routes. Nine-hundred-fifty voyages per year on marine logistics equipment is allocated on these routes, or about 14 voyages per year per route (three voyages per summer months). Fourteen voyages per year from each location yields 140 voyages from each port facility or waypoint. These numbers represent very low route activity as well as low traffic levels originating from the ports or waypoint. This is an example of commercial activity that is characterized as project-related, seasonal persistence rather than continuous voyage activity, sparse in density, but on vessels that have limited maneuverability and constrained navigational flexibility.

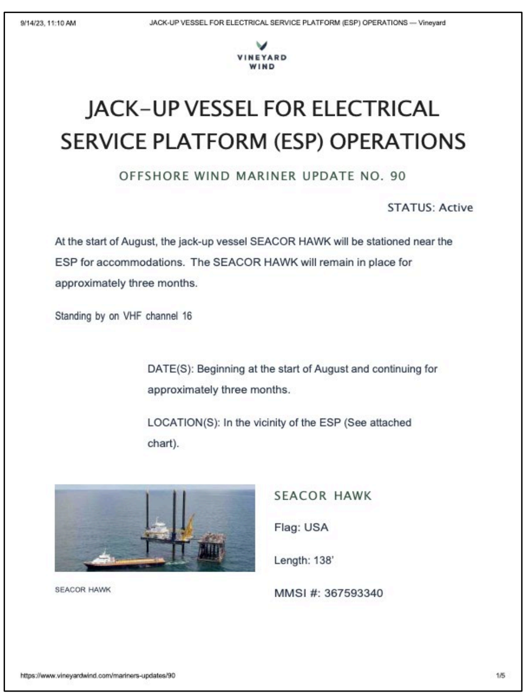
3.2.5.6 Vineyard Wind 1 Case Study

To serve as an independent approach for validating U.S. East Coast OSW marine traffic growth, a marine traffic case study for the ongoing Vineyard Wind 1 OSW project was initiated. The Vineyard Wind 1 project is one of the nation's first large-scale OSW projects to date, located approximately 15 miles from the southern coast of Martha's Vineyard Island in lease area OCS-A-0501, and with approximately 65 miles of navigable waterway distance from the marshaling and O&M port of New Bedford, Massachusetts. The port of New Bedford is designated to support much of the construction and service efforts for the project's life cycle. 62 GE Haliade-X wind turbines and one offshore substation are currently being constructed and installed on site to generate 800 megawatts of project power and generate electricity for more than 400,000 homes and businesses within the Commonwealth of Massachusetts (Vineyard Wind 2023b).

To analyze information related to marine traffic movement for this project to date, the study used Offshore Wind Mariner Updates released by the project developers which serve as notices to the maritime community for events impacting safe navigation and voyage planning, typically advising on marine assets to be deployed for various phases of the project with vessel particulars, location, scope of work and duration defined as applicable (Figure 38).

Figure 38. Vineyard Wind 1 Mariner Update (Example)

Source: Vineyard Wind 2023a


9/14/23, 11:10 AM JACK-UP VESSEL FOR ELECTRICAL SERVICE PLATFORM (ESP) OPERATIONS — Vineyard

VINEYARD WIND

JACK–UP VESSEL FOR ELECTRICAL SERVICE PLATFORM (ESP) OPERATIONS

OFFSHORE WIND MARINER UPDATE NO. 90

STATUS: Active

At the start of August, the jack-up vessel SEACOR HAWK will be stationed near the ESP for accommodations. The SEACOR HAWK will remain in place for approximately three months.

Standing by on VHF channel 16

DATE(S): Beginning at the start of August and continuing for approximately three months.

LOCATION(S): In the vicinity of the ESP (See attached chart).

SEACOR HAWK

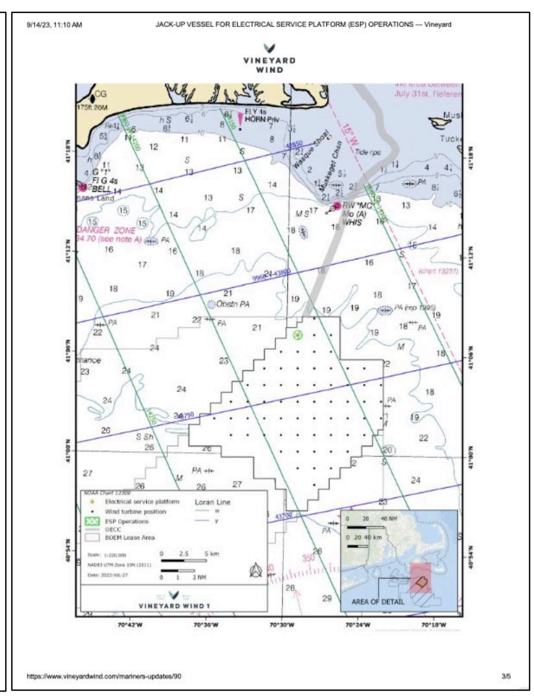
Flag: USA

Length: 138'

MMSI #: 367593340

SEACOR HAWK

https://www.vineyardwind.com/mariners-updates/90 1/5



Ninety-five OSW Mariner's Updates were recorded according to vessel type and deployment particulars, commencing September 2016, and through early September 2023 as of the writing of this report. To assess the overall effect on marine traffic in and around the location of the project, further parameters such as vessel size, location and nature of the assets work are considered. To date there have been approximately 186 vessel deployments completed or in progress which encompasses all phases and equipment types deployed under various work scopes. Larger vessels influence marine traffic to a greater extent due to less maneuverability and the expected nature of their work. Vessels less than 65 feet in length are generally servicing nearshore and very shallow water work scopes and therefore their expected effect on general marine traffic flows within the lease area is assumed limited. Of the 186 approximate deployments, 124 have been carried out by vessels greater than 65 feet in length. Marine deployments have been further grouped by project phase beginning with site assessment and survey operations, which commenced for the project in September 2016 and the construction and installation phase of the project, which began with electrical conduit installation operations in December 2021.

By the end of the third quarter 2023, fewer than 20 foundations were installed with marine logistics support from approximately 59 vessel deployments during the site assessment and survey phase (roughly 3:1 support-vessel deployments per turbine foundation) with 65 vessel deployments to date in support of construction and installation activities (also roughly 3:1 support-vessel deployments per turbine foundation). As the first U.S. large-scale OSW project, there were undoubtedly logistics inefficiencies that will be reduced or eliminated as more installation experience is gained. In the meantime, these figures help to inform the general levels of presence and persistence of OSW support vessels during the early periods of field development. Additional vessel deployment data should continue to be acquired as offshore construction on the Vineyard Wind 1 project progresses toward commissioning and commercial operation. The data for marine vessel deployments for foundations installation, and the data to be acquired for turbine components installation can be used to assess marine traffic intensity resulting from these activities for fixed-bottom foundation OSW turbine projects.

As the technology of wind turbine generators continues to progress and their generation power increases as projected in this study, industry stakeholders can expect that less overall structures will be required to be installed to provide desired project energy output. This will directly affect the quantity of vessel deployments, mostly in the construction and installation phase of the project, when the demand for feedering services will be reduced as the quantity of installable foundations and wind turbine generators decreases. The industry would be well-served if future data collection and distillation is carried out to analyze and assess marine traffic growth as Vineyard Wind 1 and additional projects are surveyed, constructed, and put into service. The aggregated data will serve as a benchmark for projecting offshore marine traffic driven by the ongoing U.S. OSW field development. appendix C captures the Vineyard Wind 1 Mariner Updates through the present.

3.2.6 Future Non-Offshore Wind and Offshore Wind Marine Traffic

3.2.6.1 Future Non-Offshore Wind Marine Traffic

In section 3.2.4.5 annual growth estimates for non-OSW cargo demand through 2050 were established for six cargo types. This annual growth from 2024 through 2030, 2040 and 2050 is illustrated in Table 23.

Table 23. Regional Marine Traffic Growth Estimated From 2023—Selected Years (2030-2040-2050)

Values in the Table repeated from Table 21 in section 3.2.2.1 for reference.

Source: McQuilling Renewables

	General Cargo	Container	Bulk Cargo	Oil & Gas Carriers	Cruise Ships	Auto Carriers
2030	9.2%	18.9%	17.4%	-4.5%	9.5%	5.6%
2040	21.3%	48.4%	33.5%	-4.4%	26.7%	-2.8%
2050	40.0%	56.9%	36.6%	-10.3%	45.1%	-30.3%

To establish growth estimates for marine traffic consistent with historical AIS tracks, the figures in Table 23 (reproduced from Table 21 in section 3.2.2.1) are apportioned to the four commercial AAIS vessel types (AAIS codes 1, 2, 3, 4) that describe commercial marine transiting traffic in and around the AoA as shown in Table 24. The resulting growth from 2024 through 2030, 2040, and 2050 for the four commercial AAIS codes relating to cargo transport is illustrated in Table 25.

Table 24. Cargo Transport Demand by Automatic Identification System Vessel Type

Source: McQuilling Renewables

	AAIS Code 1 Cargo	AAIS Code 2 Tanker	AAIS Code 3 Tug/Barge	AAIS Code 4 Passenger
General Cargo	10%			
Container	50%		20%	
Bulk Cargo	20%		20%	
Oil & Gas Carriers		100%	60%	
Cruise Ships				100%
Auto Carriers	20%			
Total	100%	100%	100%	100%

Table 25. Marine Traffic Growth Percentage from 2024 by Automatic Identification System Vessel Type (2023-2040-2050)

Source: McQuilling Renewables

	AAIS Code 1 - Cargo	AAIS Code 2 - Tanker	AAIS Code 3 - Tug/Barge	AAIS Code 4 - Passenger
2030	15.0%	-4.5%	4.6%	9.5%
2040	32.5%	-4.4%	13.7%	26.7%
2050	33.7%	-10.3%	12.5%	45.1%

Recall in Section 3.2.1.2 - 2017-2022 Growth Trend Implied by Remotely-Sensed Data, AAIS-based traffic growth was extrapolated to 2024 (Table 12). The 2024 traffic estimates for the four AAIS vessel classes in that table represent the starting point to assess non-OSW marine traffic intensity (density) in 2030, 2040 and 2050 from an economic growth perspective. Applying the growth rates in Table 25 to the 2024 starting estimates from Table 12 produces forecasted presence in future years as shown in Table 26.

Table 26. Marine Traffic Growth Projection—Economic Basis (2024-2030-2040-2050)

Total annual presence (hours) in AoA for AAIS codes 1, 2, 3, 4 suggested by economic parameters associated with modeling trade growth as a function of economic activity

Source: McQuilling Renewables

	AAIS Code 1 - Cargo	AAIS Code 2 - Tanker	AAIS Code 3 - Tug/Barge	AAIS Code 4 - Passenger	Total
2024	275,832	107,706	3,647	9,537	396,722
2030	317,085	102,895	3,992	9,974	434,035
2040	365,391	102,931	4,621	10,846	483,909
2050	368,725	96,645	5,293	10,731	481,421

The AAIS trend lines used in Section 3.2.1.2 produced estimated 2024 densities for the four commercial vessel transit types from historical AAIS data that were used to extrapolate densities to 2030, 2040 and 2050. This result is reproduced in Table 27. The mathematical trend line for Tug/Barge traffic observed in the AAIS historical data, produces a negative traffic result in 2040 and 2050 and is zeroed-out in Table 27. The declining nature of this trade, its insignificant share of the total traffic observed in the 2017-2022 period as discussed in section 3.2.1.2, and is spatial location north of the AoA make it immaterial in long term forecasts of marine traffic in the AoA. The relevant numbers for the longer-term projections are the aggregate growth estimated in the last column of both Table 26 and Table 27.

Table 27. Marine Traffic Growth Projection—Aggregated Automatic Identification System Trend Basis (2030-2040-2050)

Total annual presence (hours) in AoA for AAIS codes 1, 2, 3, 4 suggested by trend line analysis of historical remotely sensed data for the period 2017 through 2022.

Source: McQuilling Renewables

	AAIS Code 1 Cargo	AAIS Code 2 Tanker	AAIS Code 3 Tug/Barge	AAIS Code 4 Passenger	Total
2024	275,832	107,706	3647	9,537	396,722
2030	430,980	127,494	1067	12,597	572,138
2040	689,560	160,474	0 [1]	17,697	864,498
2050	948,140	193,454	0 [1]	22,797	1,156,858

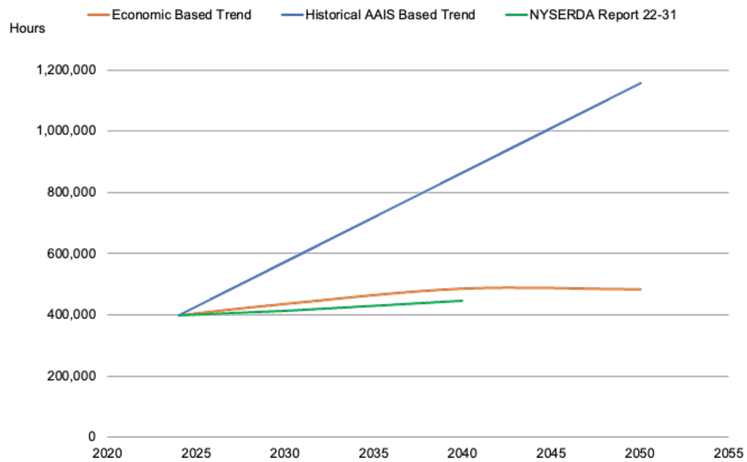
* Calculated trend lines for AAIS Code 3 have a negative slope, implying declining marine traffic in this sector over time. Negative traffic amounts are a mathematical result and not realistic, these entries therefore carry a zero value.

Table 26 and Table 27, provide two projections of non-OSW marine traffic density growth based on two different forecasting approaches, suggesting upper and lower bounds for non-offshore marine traffic growth. NYSERDA Report 22-31 issued August 2022, estimated future large vessel (>60 meters) traffic through Ambrose Channel in 2025, 2030 and 2040 at 10,777, 11,215 and 12,145 passages, respectively, or growth over those periods of 4.2% and 8.3% (NYSERDA 2022b). As a broad comparison of estimated future non-OSW marine traffic in and around the AoA, this study used these growth rates to apply to the 2024 traffic presence figures in hours estimated in Table 12 in section 3.2.1.2. and shown in Table 26 and Table 27. The plot of this forecast is illustrated as a green line in Figure 39.

Figure 39. Non-Offshore Wind Marine Traffic Growth Projections (2025-2050)

Total estimated hours in AoA for four AAIS vessel codes representing commercial marine transit traffic.

Source: McQuilling Renewables



Considering Figure 39, the upper bound of non-OSW marine traffic presence defined by a linear extrapolation of AAIS historical data appears too aggressive in terms of the annual growth rate. A more realistic growth assumption to 2050 may be closer to the lower boundary growth projections based on econometric data and traffic presence over the forecast period in the 400,000-to-600,000-hour range may be a more representative outlook.

3.2.6.2 Future Offshore Wind Marine Traffic

OSW marine traffic growth for the period 2024 through 2050 was considered in section 3.2.5.5. The methodology estimated trips on larger marine equipment for existing fixed-bottom foundation projects through 2030 and floating structures after 2030 to 2050. The main equipment considered was Jones Act compliant feeder equipment transporting fixed-bottom foundations and turbine components, and anchor handling tugs installing anchors and then towing floating foundations to offshore sites. A planning figure of 950 one-way trips on average was the result, assumed spread over a network of routes connecting shoreside manufacturing or staging facilities to an arbitrary array of offshore locations. On this basis, marine traffic from this activity can be considered sparse and seasonal. The initial marine logistics data collected for the Vineyard Wind 1 project identifies additional support vessels during the installation and construction stage that generate approximately six one-way trips per turbine install on larger vessels. In all, the traffic densities implied do not approach the activity levels seen in traffic lanes from commercial marine transit traffic; however, to the extent projects are sited in the AoA, traffic from OSW will increase proximate to these locations.

3.3 Presence and Persistence of Recreational Uses

A combination of electronic historical AIS vessel position information and qualitative research inform on recreational use and marine traffic in and around the AoA. As discussed in section 3.1 of this study, the USCG and international requirements for AIS vessel position indicating systems creates a trove of historical position data for commercial vessels. AIS position reporting provides for classification of signals from recreational vessels as well (AIS aggregated Code 5, detail codes 36 and 37) but there is no requirement for recreational vessels to have these systems installed. Nonetheless, many recreational boaters do install AIS systems as an additional safety feature on board. As a result, AIS data sets for recreational vessels are available, but are an incomplete representation of presence and persistence and can only be interpreted as a sample of the spatial and temporal position of the recreational vessel fleet. Further, AIS transmitters are generally mounted lower in elevation on recreational vessel than commercial vessels and recreational vessels typically use AIS equipment with lower transmitting power (2–5 watts versus 12.5 watts for commercial vessels). (USCG Navigation Center n.d.a). This results in loss of position data the farther from shore the vessel is located, specifically in this study, in Zone 3.

The following sections highlight available historical AIS position data for recreational vessels, discuss non-AIS recreational use indications and then provide a methodology using weather and sea state information, combined with discretionary use statistics of recreational vessels to inform on their presence and persistence in and around the AoA.

3.3.1 Historical Recreational Marine Traffic

Vessel position data was processed into vessel tracks and ultimately densities using ArcGIS tools on SQL vessel data sets. Recall that for the purposes of this study there are three recreational uses for the AoA: sailing, recreational fishing and general recreational boating. While remotely sensed vessel position reporting is incomplete, AIS vessel position data can still inform on marine uses in the region of the AoA as one of the sources of information, keeping these limitations in mind.

3.3.1.1 Automatic Identification System 2017–2022 Recreational Marine Traffic in and around Area of Analysis

Similar to understanding commercial uses of the region quantitatively, statistical information must be extracted and distilled from remotely sensed recreational vessel position records. Display of vessel tracks is visually overwhelming. However, track statistics can provide quantitative data that informs on the intensity of marine traffic across vessel types and across time periods. Visual density plots yield good qualitative indications of the comparative spatial and temporal intensity of marine uses. Both of these approaches are used in this section to highlight recreational marine traffic in and around the AoA.

Sailing

Available AIS vessel position information was acquired for the period 2018 through 2022 for sailboats (AIS Code 36) and consolidated into vessel tracks. The 2017 data was combined with general recreational use and was not able to be parsed. Table 28 summarizes the presence and persistence of sailboats in the AoA for this period quantitatively and Figure 40 illustrates remotely sensed sailing activity in 2022.

Table 28. Sailing Activity 2018-2022

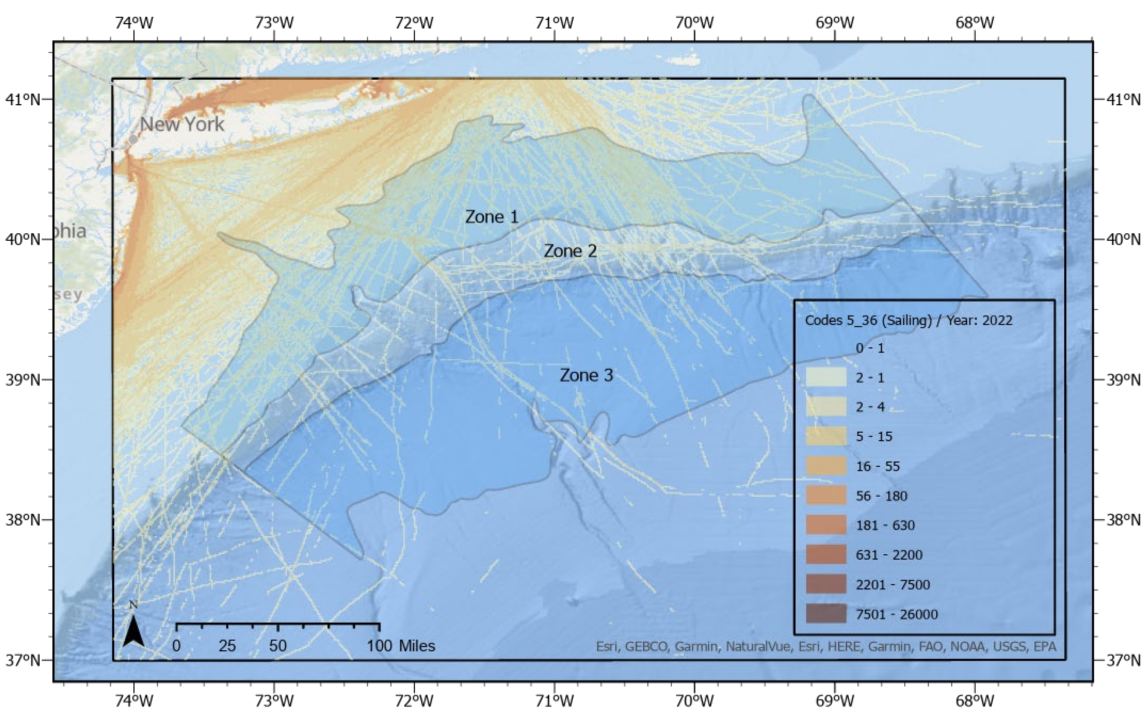
Source: Marine Cadastre

	2018	2019	2020	2021	2022
Unique Vessels	167	182	170	255	348
Total Duration (Hours)	812	848	788	918	891

Figure 40. Remotely Sensed Sailing Activity (2022)

AIS Code 36

Source: Marine Cadastre

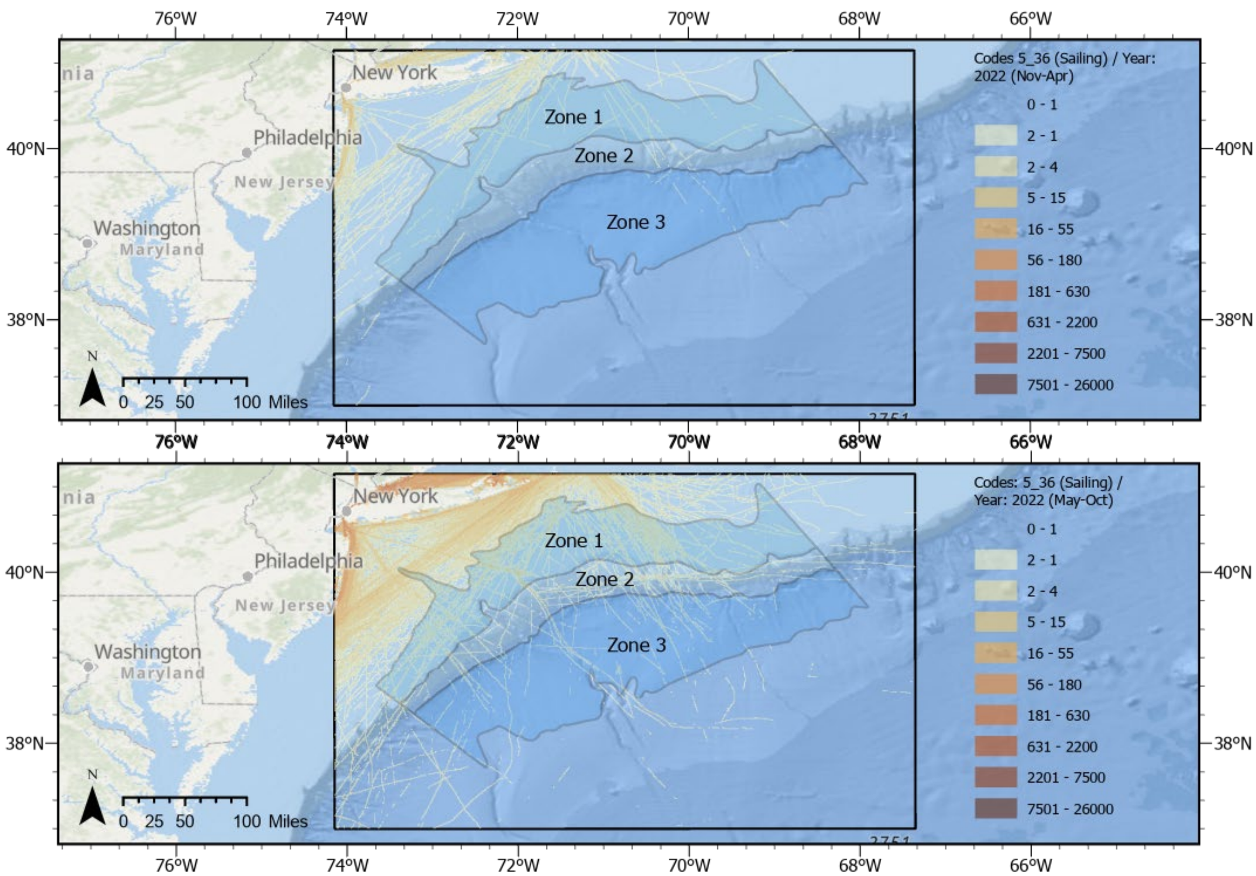


The figure illustrates recreational sailing is centered largely north of the AoA and is of very low density as compared to commercial traffic. In this area northeast to southwest activity is observed, likely seasonal traffic from repositioning boats for the summer and winter. Activity is observed traveling through the eastern side of all three zones of the AoA north-to-south – perhaps transits to/from Bermuda and the Caribbean. Comparing activity levels during the winter (November-April) to Summer (May-October), a stark reduction in activity is observed during the winter months in Figure 41.

Figure 41. Remotely Sensed Sailing Activity (Winter–Summer 2022)

AIS Code 36—Top-Winter, Bottom-Summer

Source: Marine Cadastre



Recreational Boating Other Than Sailing

Available AIS vessel position information was acquired for the period 2018 through 2022 for other recreational boats (AIS Code 37) and consolidated into vessel tracks. This data includes both recreational fishing vessels and general recreational boaters. The 2017 data was combined with sailing use and was not able to be parsed. Table 29 shows a sample of the presence and persistence of other recreational boats in the region for this period quantitatively and Figure 42 illustrates remotely sensed recreational boating for AIS Code 37 density in 2022.

Table 29. Recreational (Non-Sailing) Activity 2017–2022

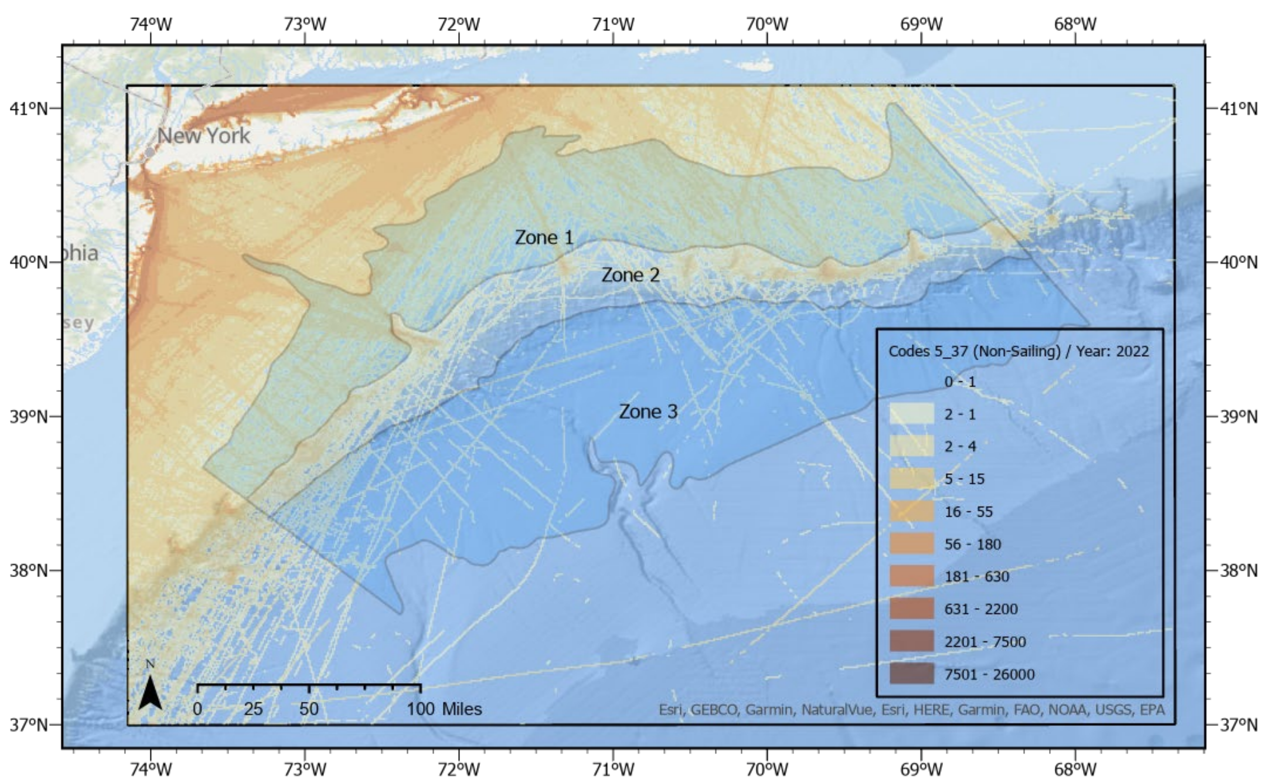
Source: Marine Cadastre

	2018	2019	2020	2021	2022
Unique Vessels	812	848	788	918	891
Total Duration (Hours)	27,849	30,163	33,679	34,225	35,767

Figure 42. Remotely Sensed Recreational (Non-Sailing) (2022)

AIS Code 37

Source: Marine Cadastre



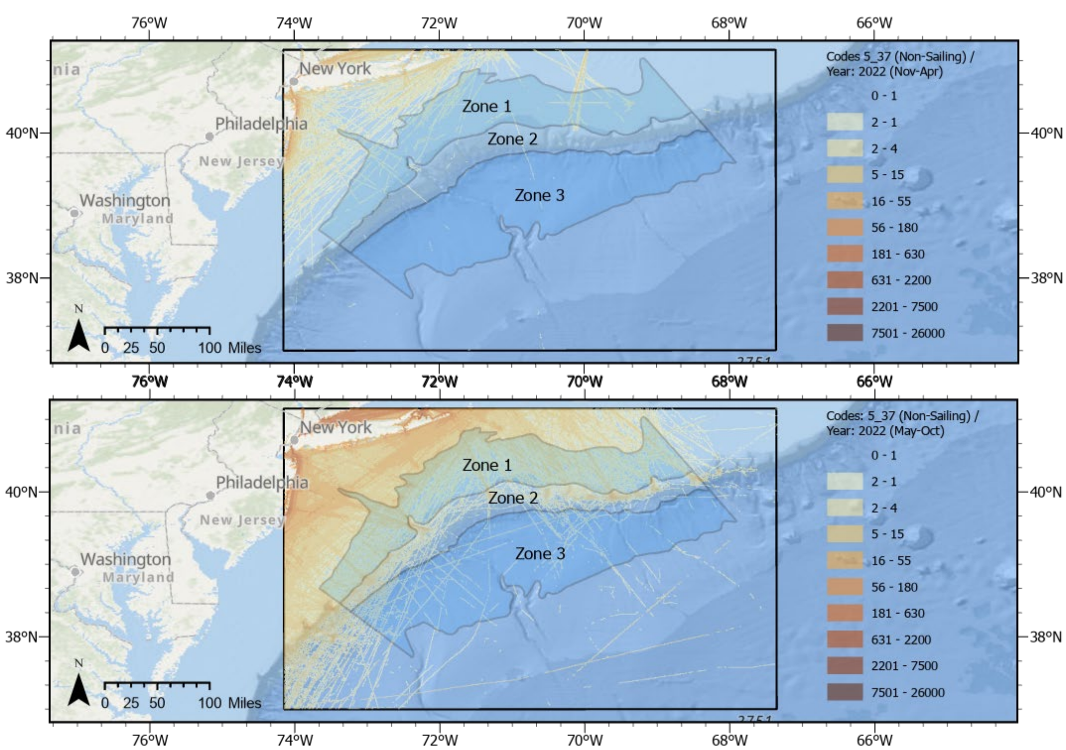
With one notable exception the sampled AIS data show that non-sailing recreational boating is mainly located north and west of the AoA in shallower waters closer to shore. High levels of activity are seen along the coasts of New York State and New Jersey and in Long Island Sound. The exception seems to be the voyages to and from the rim of the canyons marking the beginning of Zone 2 of the AoA. These clusters are most likely recreational fishermen (and perhaps charter/for-hire fishing boats) and this activity level is unique in this region for recreational boaters. The transits to and from these areas are fairly concentrated and distinct from locations ashore in New York State, New Jersey, and other northeast states. Consideration should be given in subsequent planning stages to these corridors remembering though that these transits are occurring on maneuverable vessels which could likely transit through wind fields without incident. A more in-depth look at recreational fishing can be found in the Fish and Fisheries Data Aggregation Study (NYSERDA, 2025).

Figure 43 illustrates the comparative activity levels during the winter (November-April) and Summer (May-October) months, also a stark reduction observed.

Figure 43. Remotely Sensed Recreational (Non-Sailing) (Summer–Winter 2022)

AIS 37—Top-Winter, Bottom-Summer

Source: Marine Cadastre



3.3.2 Qualitative Recreational Use Indications

3.3.2.1 Recreational Fishing and Transits

Limited data on recreational fishing is available from the portals. The Northeast Ocean Data portal recently added a layer called 2022 Fishing Vessel Transit Counts (also discussed in section 3.2.3.3), which captures tracks of fishing vessels that have AIS transponders. While all recreational fishermen may not have AIS transponders some do and may make up part of this layer. It is reasonable to assume that recreational fishing vessels may have similar deployments to commercial fishermen, where the regional weather, sea states and logistics support this activity.

Additional sources of data must be assessed to get a full picture of recreational fishing. One source is the NOAA Fisheries Marine Recreational Information Program (MRIP) as described in the Sunrise Wind Farm Project (SRWF) Appendix V, Commercial and Recreational Fisheries Data Report. The MRIP data, provided by NOAA, consists of coast-wise angler-intercept surveys as boats return to shore and consist of series of surveys providing "estimates of marine recreational catch, effort, and participation across states, fishing locations, and fishing modes" (INSPIRE Environmental 2022). Because the only location data is a general categorization of fishing location in state or federal waters, and because the survey is only designed to estimate fishing efforts at the state level, stakeholder input was also relied on to supplement the SRWF fisheries data report from both the RI OSAMP (Rhode Island Coastal Resources Management Council 2010), and through Sunrise's own outreach program (INSPIRE Environmental 2022).

The data collected by Sunrise from NOAA for the span of 2015 through 2019 in Connecticut, Massachusetts, New Jersey, New York State, and Rhode Island showed relatively little activity in federal waters in this qualitative overview (INSPIRE Environmental 2022). Fishing in federal waters peaked at about a million average angler trips in July/August, compared to state waters (up to three miles offshore) at about three million, and inshore at a peak of about 10 million for that time period. Most trips to federal waters from these five states occurred on private vessels as opposed to charter vessels. (INSPIRE Environmental 2022).

A qualitative assessment of recreational fishing in the AoA can be used to supplement the data. It is well known in the Gulf of Mexico that reefs are formed along oil and gas structures, which are desirable fishing locations. This is known as the reef effect, which can have both positive and negative ecological effects that influence recreational fishermen (NYSERDA 2017a). For example, the new reefs could support biodiversity and species abundances, but also may introduce non-native species or be detrimental to certain species (NYSERDA 2017a). An assessment of scholarly articles also shows a mix of perceptions of OSW fields on recreational fishing activities.

Based on a stated preference survey of recreational vessel owners using the waters in and around Rhode Island conducted in 2018, Dalton et al. (2020) concluded that the value of a recreational boating experience is considerably reduced in areas with OSW fields. However, these recreational users were not necessarily engaged in fishing. Further, the study cites to other research showing some boaters may prefer fishing around wind turbine structures, including previous work by authors Dalton and ten Brink, "Perceptions of Commercial and Recreational Fishers on the Potential Ecological Impacts of the Block Island Wind Farm" (Dalton et al. 2020). Similarly, in a mixed-method study including interviews and surveys, authors Smythe et al. assessed impacts of the Block Island Wind Farm in Rhode Island on recreational fishing and similarly found that it is an overall appealing fishing destination to many anglers (Smythe, Bidwell and Tyler 2021).

It is likely that OSW turbines installed in the AoA will develop into reefs and create productive fishing grounds. The 2017 Fish and Fisheries Study explains that site-specific factors would influence ecological changes but anticipated that the reef effect resulting from the construction of OSW fields in the Master Plan AoA could enhance species diversity and abundance (NYSERDA 2017a). Experiences from other wind fields show that wind turbines will most likely have a neutral or slightly positive effect on recreational fishing activity while in operation, in both the short and long term (Kirkpatrick, et al. n.d.). However, these experiences are likely based on European wind fields which will differ from U.S. sites in grid-arrangement and spacing.

Fishermen in the stakeholder assessment of the 2017 Fish and Fisheries Study for the Master Plan (for the original AoA) indicated that that turbines would increase and improve fishing opportunities, despite some other concerns such as access to fishing grounds, cumulative influence of multiple wind farms, and challenges regarding the feasibility of fishing among the turbine towers (NYSERDA 2017a).

3.3.2.2 Sailing

To support AIS sailing data shown in section 3.3.1.1, this section addresses sail races. Table 30 illustrates the eight global and regional sailing races which transit or potentially transit the AoA.

Table 30. Distance Sailing Races

Source: SeaPlan, Surfrider, and Point 97 n.d.; McQuilling Renewables

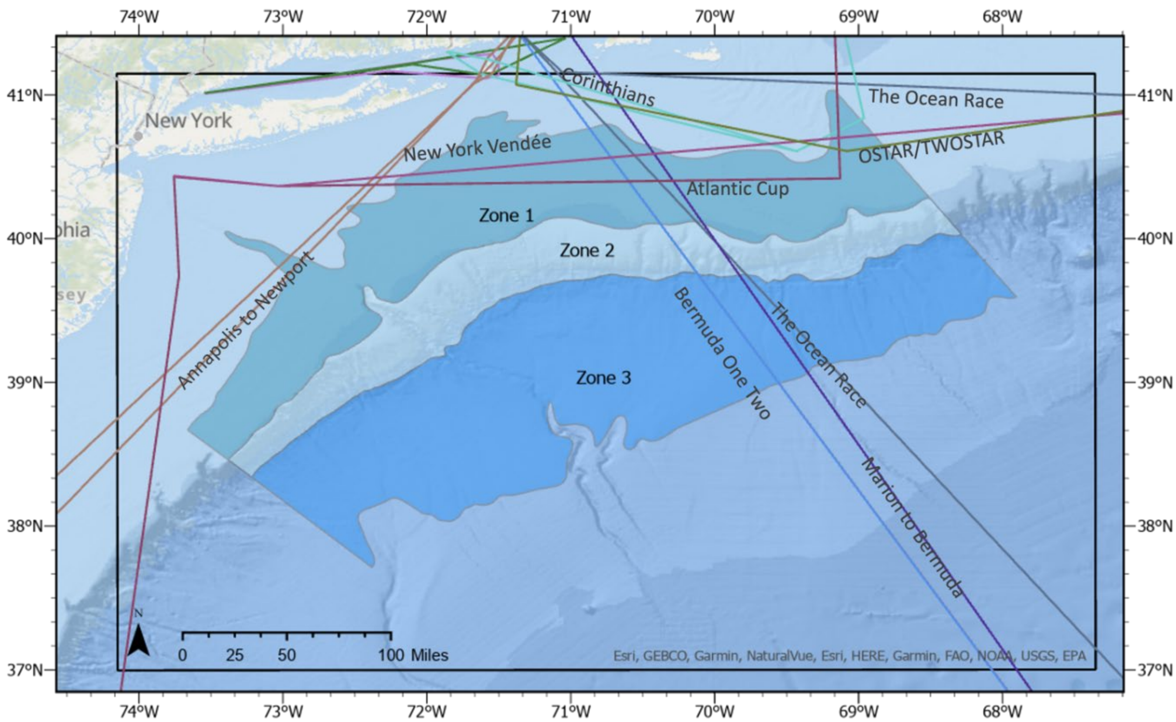
Race	Frequency	Month in AoA	Relevant portion in AoA	No. of Participants/ Vessels (Approximate)
Annapolis to Newport	Every 2 years	June	Annapolis MD to Newport RI	60 vessels
Bermuda One Two	Every 2 years	June	Newport RI to St. Georges Bermuda	170 participants
Corinthians	Every 2 years	July	Stonington, CT to Boothbay Harbor, ME	
Marion to Bermuda	Every 2 years	June	Marion MA to Bermuda	100–-200 participants
The Ocean Race (formerly Volvo Ocean Race)	Every 3 years	May	Brazil to Newport, RI; Newport, RI to The Hague, Netherlands	11 teams
Atlantic Cup	Every 2 years	May	Charleston, SC to NYC; NYC to Portland, ME	10 teams
New York Vendée	Every 4 years	May	NYC to Les Sables d'Olonne, France	14 teams
OSTAR/TWOSTAR	Every 4 years	May	Plymouth, England to Newport, RI	10 teams

For the data set collected in the original layer of sail races, a distance race was defined as "1) an offshore race starting at one port and ending in another, or 2) an offshore race which begins at a port, has a turning point at a single location, and ends at the same port." This data was collected for the Northeast Coastal and Marine Recreational Use Characterization Study by SeaPlan, the SurfRider Foundation, and Point97 as part of the larger goal of understanding the spatial use of waters in New England for recreational activities, and although data was also collected on one-time race events, the layer included recurring events only. Data was collected through online research and then refined using GPS data from Yellowbrick Tracking to provide more refined information on typical routes taken by participants. Further editing and annotation was done via webinar with industry experts using the SeaSketch tool, and feedback from an online survey tool regarding more localized buoy races provided additional distance race data (Longley-Wood 2015a).

Relevant to the new AoA from the existing layer of distance sailing races were the Bermuda One Two, the Volvo Ocean Race, the Marian to Bermuda Race, Corinthians, and the Stamford Vineyard Race. The Volvo Ocean Race is now known as The Ocean Race. Newly mapped distance sailing races that potentially transit the AoA include the Original Single-handed TransAtlantic Race and the Two-handed TransAtlantic Race (OSTAR/TWOSTAR); the Vendée Global; and the Atlantic Cup. The new sail races depicted in Figure 44 are plotted using coordinates that provide for safe routing as vessels are entering and leaving ports during the races.

Figure 44. Sail Races

Source: SeaPlan, Surfrider, and Point 97 n.d.; McQuilling Renewables



Despite the races appearing to be linear, chosen sailing routes are dependent on wind and other variables such as sea state. Sample GPS tracking data of the races available online from the Atlantic Cup 2018 results from Yellowbrick Tracking show a wide band of travel among the participants, as shown in |Figure 45. This shows the potential for the races to transit the AoA.

Figure 45. Atlantic Cup 2018 Leg 1 and Atlantic Cup 2018 Leg 2

Source: Atlantic Cup n.d.

Not mapped in Figure 44 but possibly affected by vessel traffic during construction of wind fields are the Around Long Island Regatta; the Block Island Race running from Long Island Sound around Block Island and back; and the Stamford Yacht Club's Vineyard Race. One additional race, Clipper Round the World, may stop in a different east coast city each race. For example, it stopped in New York State in its 2017–2018 race, and the last leg of the 2024 race will be from Washington, D.C. to the United Kingdom.

These races are seldom—with some occurring annually and others occurring every other year or after multiple years—sparse in terms of density and have only localized economic effects. Having relative navigational flexibility, race organizers and participants may decide to route through or around wind field sites.

3.3.3 Marine Safety Considerations for Recreational Use

A foundational element of assessing the presence and persistence of recreational vessels in and around the AoA is understanding the weather and sea conditions that would preclude recreational activity in the region. Recreational boaters are assisted by regulatory and advisory agencies with guidance as to weather and sea state conditions existing offshore. A focus of these advisories is on "small craft" although the agencies do not provide a specific definition of this term.

3.3.3.1 Weather and Sea State Guidance

A global network of National Meteorological and Hydrological Services working under the World Meteorological Organization (WMO) provides real or near real-time weather information by way of land, sea, and space. The NWS and NOAA Weather Radio continuously broadcast local and coastal marine forecasts produced by local Weather Forecast Offices (WFOs)—typically extending to 25 nm offshore. The USCG disseminates marine safety messages, including marine weather forecasts and warnings, to mariners in and around the U.S. coastline. It also retrieves and forwards observational data to the NWS. National, regional, and local level NWS managers work closely with their USCG counterparts to ensure the most effective level of service is provided (NWS 2022).

Several forecast products are produced by the NWS. The Nearshore Marine Forecast (NSH) is a marine forecast for an area of the Great Lakes from a line approximating mean low-water datum along the coast or an island, including bays, harbors, and sounds, out to 5 nm. The Coastal Waters Forecast (CWF) is a marine forecast for areas, including bays, harbors, and sounds, from a line approximating the mean high-water mark (average height of high water over a 19-year period) along the mainland or nearshore islands extending out to as much as 100 nm. Marine forecasts for the major oceans of the world are referred to as High Seas Forecasts (HSFs). In this context, major water bodies (e.g., the Gulf of Mexico or the Bering Sea) are included within these forecast areas. Areas of responsibility for the United States are determined by international agreements under the auspices of the WMO. The NWS provides HSFs for large areas of the Atlantic and Pacific oceans with the AoA located within the North Atlantic region—North of latitude 31N to 67N and West of 35W longitude (NWS 2022).

A Small Craft Advisory (SCA) is an advisory issued by coastal and Great Lakes WFOs for areas included in the CWF of NSH products. Thresholds governing the issuance of small craft advisories are specific to geographic areas. In the relevant geographic region for the AoA, the thresholds for issuance of a small craft advisory are defined as sustained winds or frequent gusts ranging between 25 and 33 knots (except 20 to 25 knots, lower threshold area dependent, to 33 knots for lakes, harbors, bays, etc.) and/or seas or waves 4 to 7 feet and greater (area dependent 4 feet on the Chesapeake Bay) (NWS 2022).

3.3.3.2 Small Craft Characteristics

While there are no stated definitions of "small craft," the agencies do note that a small craft is any vessel that may be adversely affected by SCA weather criteria. From a review of various federal and state regulations related to vessels and marine safety a small craft description can be implied, as described in the following.

For guidance to boaters and commercial mariners, regulatory groups at various levels provide designations for requirements of carriage and design primarily by capacity weight (tonnage) and size (LOA). Rules and regulations for safe navigation, life-saving appliances as well as firefighting vary by vessel size and type. Based on these guidelines, vessels below 65 feet LOA are typically considered small craft and carry with them requirements that correspond with their expected use and passage making capabilities. Several federal and State examples follow:

State Level

- Life jackets mandatory for all persons under 12 years of age on vessels *less than 65 feet* in length.
- Small vessels at anchor (*less than 65 feet*) anchored in an approved anchorage and when in restricted visibility are required to ring the vessels bell rapidly for a period of five seconds every minute.
- Fire Extinguishers—vessels 26-40 feet require two B-I Class Extinguishers & vessels *40-65 feet* require three B-I Class Extinguishers (New York State Office of Parks, Recreation, and Historic Preservation: Marine Services Bureau 2017).

Federal Level

- Narrow Channels**—**A vessel of less than 20 meters in length (*65 feet*) or a sailing vessel shall not impede the passage of a vessel that can safely navigate only within a narrow channel or fairway.
- Traffic Separation Schemes—A vessel shall not use an inshore traffic zone when she can safely use the appropriate traffic lane within the adjacent traffic separation scheme. However, vessels of less than 20 meters in length (*65 feet*), sailing vessels, and vessels engaged in fishing may use the inshore traffic zone.
- A vessel of less than 20 meters in length (*65 feet*) or a sailing vessel shall not impede the safe passage of a power-driven vessel following a traffic lane.
- Visibility of Lights**—**In a vessel of 12 meters or more in length but less than 50 meters (164 feet) in length; A masthead light, 5 miles; except that where the length of the vessel is less than 20 meters (*65 feet*), 3 miles (Navigation Rules, 33 C.F.R. 83).
- Radio Regulations—Most recreational vessels less than *65 feet* in length are not required to carry a marine radio. Recreational vessels that may require to be licensed—Power driven vessels more than *65 feet* in length (USCG n.d.a).

The regulatory narrative at both federal and state level in the U.S. repeatedly references 65 feet (20 meters) as the breakpoint between small craft and larger vessels.

3.3.4 Historical Availability of Region for Recreational Boating

Availability of the AoA region for marine uses from recreational vessels is suggested by prevailing weather and sea state conditions that may preclude these vessels from positioning there. Section 3.3.3 quantified weather and sea state conditions that give rise to small craft advisories issued by the NWS and distributed by the USCG.

As indicated in section 3.3.3.1, a SCA is an advisory issued by coastal and Great Lakes WFOs for areas included in the CWF of NSH products. Thresholds governing the issuance of small craft advisories for the region containing the AoA are defined as sustained winds or frequent gusts ranging between 25 and 33 knots and/or seas or waves 4 to 7 feet and greater.

Further, as will be seen in section 3.3.5 the vast majority of recreational vessels are under 65 feet in length and classified as small craft based on the methodology identified in section 3.3.3.2.

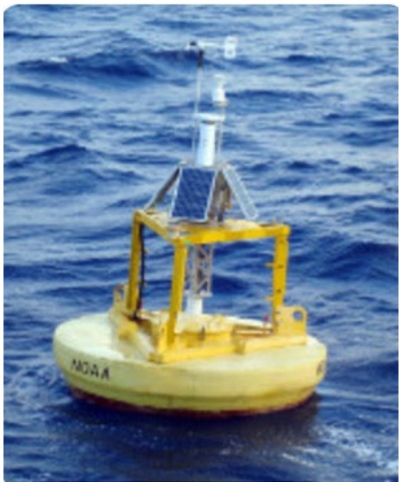
3.3.4.1 Sea State and Weather Conditions in and around Area of Analysis

To establish probabilistic expectations of prevailing weather and sea states in and around the AoA ocean metadata data sets are required. Equinor installed buoys in the Empire Wind 1 and Beacon fields in 2018 and collected data until 2023. In 2019 NYSERDA contracted for the installation of two floating LiDAR (light detection and ranging) buoys in the New York Bight at locations northwest of the AoA, which collected weather and sea state data until 2023. In this study, a longer time series of data was desired from locations that were representative of the AoA as a whole. Two NOAA weather buoys were accessed for the two-decade period 2000 through 2022 to acquire, clean and distill and analyze weather and sea state data. These two buoys (Figure 46) are located in the eastern and western ends of the AoA in Zone 1 (Figure 47) and are further described in Table 31.

Figure 46. National Oceanic and Atmospheric Administration Weather Buoys 44008 and 44066

Source: National Data Buoy Center n.d.b; National Data Buoy Center n.d.a

Station 44066—Texas Tower No. 4



Station 44008—Nantucket

Figure 47. National Oceanic and Atmospheric Administration Weather Buoys 44008 and 44066

Source: National Data Buoy Center n.d.a; National Data Buoy Center n.d.b

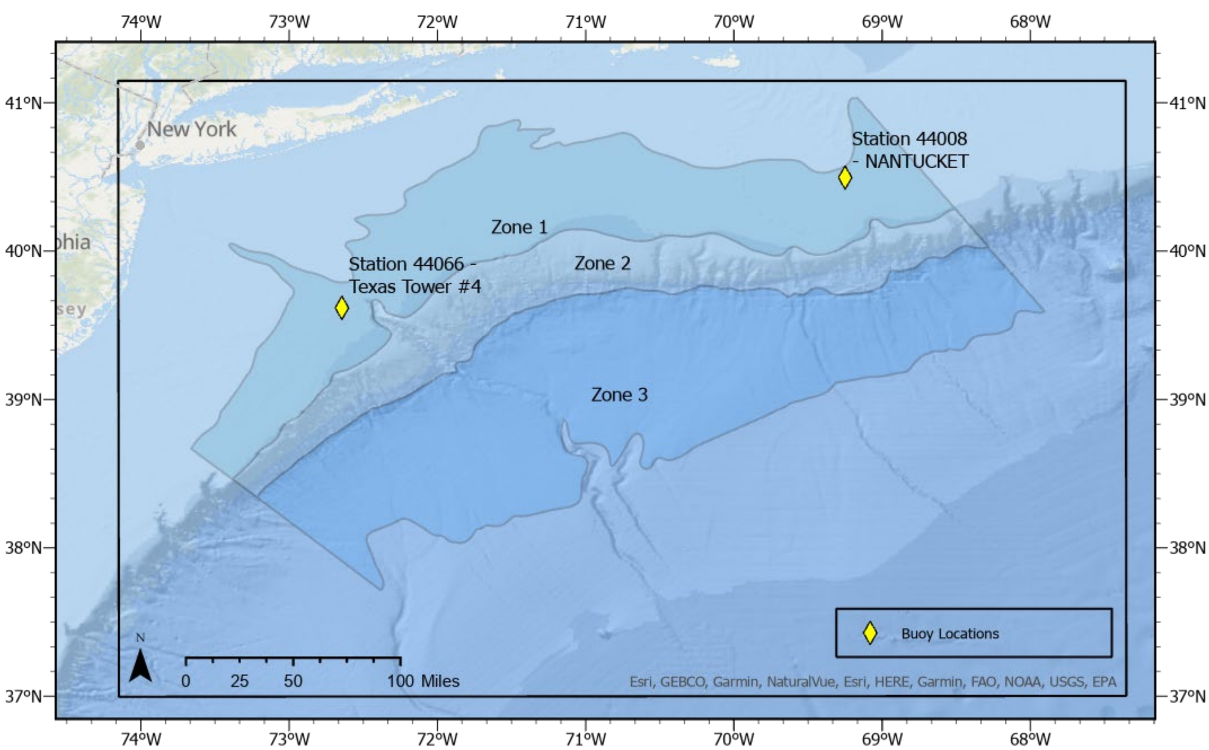


Table 31. National Oceanic and Atmospheric Administration Weather Buoys 44008 and 44066

Source: National Data Buoy Center n.d.a; National Data Buoy Center n.d.b

Description	Station 44008 (LLNR 827) - NANTUCKET 54 NM Southeast of Nantucket	Station 44066 (LLNR 3) - Texas Tower No.4—75 NM East of Long Beach, NJ
Name	Nantucket Shoals LB "N"	N/A
Owner	Owned and maintained by National Data Buoy Center	Owned and maintained by National Data Buoy Center
Type	3-meter discus buoy	3-meter foam buoy
Payload	SCOOP payload	SCOOP payload
Location	40.496 N 69.250 W (40°29'44" N 69°15'1" W)	39.618 N 72.644 W (39°37'6" N 72°38'40" W)
Site elevation	Site elevation: sea level	Site elevation: sea level
Air temperature height	Air temp height: 3.4 m above site elevation	Air temp height: 3.7 m above site elevation
Anemometer height	Anemometer height: 3.8 m above site elevation	Anemometer height: 4.1 m above site elevation
Barometer elevation	Barometer elevation: 2.4 m above mean sea level	Barometer elevation: 2.7 m above mean sea level
Sea temperature depth	Sea temp depth: 2 m below water line	Sea temp depth: 1.5 m below water line
Water depth	Water depth: 72 m	Water depth: 77 m
Watch circle radius	Watch circle radius: 142 yards	Watch circle radius: 155 yards

Data from Buoys 44066 and 44008 was distilled into a data set of observations of wind speed, wave height, and wave period. Programming was applied to allow for a variety of queries related to the periods of observation requested and the resulting probabilities of occurrence. For example, Table 32 illustrates the probability matrix for the total observational period from 2000 through 2022 of wave heights and wave periods collected by NOAA buoy 44008.

Similar results were obtained for buoy 44066 and for brevity only buoy 44088 results are shown in this study. Distilled data for both buoys is available on request. The weather and sea state statistics observed from these buoys are assumed to represent conditions for the region in and around the AoA. In Table 32, each cell represents the probability of observation of a specific wave height/wave period combination for the total observation period, in this example, 2000 through 2022. The shaded region was applied manually to reflect an assessment of sea states where small craft operations were precluded based on conditions identified in section 3.3.3.1 of this study. In general, the higher the wave, the longer the wave periods for small craft (less than 65-feet) to be present.

Table 32. National Oceanic and Atmospheric Administration Weather Buoys 44008 Observations 2000–2022

Wave height and wave period probability matrix with conditions precluding recreational boating operations shaded (42% of the time)—Conditions observed at the buoy are assumed representative of the conditions in and around the AoA.

Source: National Data Buoy Center n.d.a

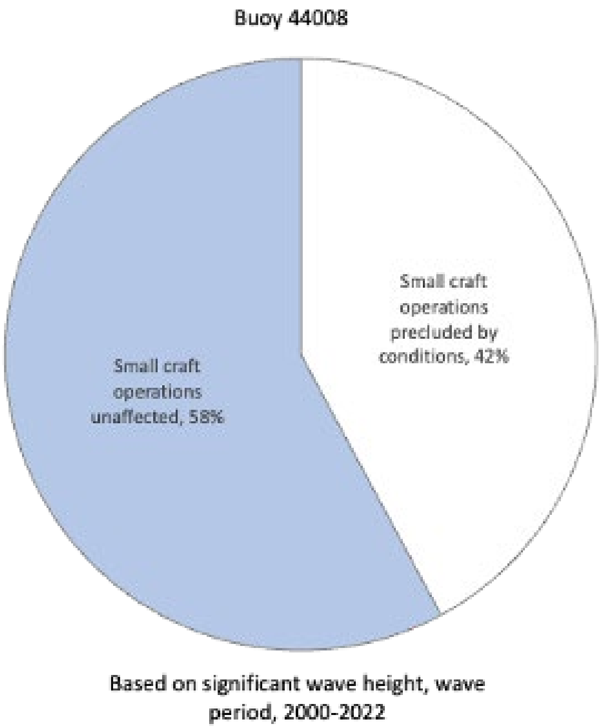
	Wave Period (s)	**0 to 4**	**4.01 to 6**	**6.01 to 8**	**8.01 to 10**	**10.01 to 12**	**12.01 to 14**	**14.01 to 16**
	Center Period	**4**	**6**	**8**	**10**	**12**	**14**	**16**
Wave Ht Range (m)	**Wave Height Center Ht**							
0.00-0.25	0.25	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
0.26-0.50	0.50	0.04%	0.11%	0.38%	0.54%	0.06%	0.12%	0.03%
0.51-0.75	0.75	0.36%	1.80%	2.87%	3.09%	0.44%	0.38%	0.24%
0.76-1.00	1.00	0.46%	3.98%	4.88%	4.11%	0.71%	0.50%	0.23%
1.01-1.25	1.25	0.19%	3.74%	5.40%	3.80%	0.71%	0.41%	0.12%
1.26-1.50	1.50	0.04%	2.78%	5.22%	3.43%	0.69%	0.36%	0.06%
1.51-1.75	1.75	0.00%	1.61%	4.30%	2.77%	0.59%	0.32%	0.05%
1.76-2.00	2.00	0.00%	0.85%	3.50%	2.36%	0.51%	0.29%	0.06%
2.01-2.25	2.25	0.00%	0.42%	2.75%	2.11%	0.44%	0.26%	0.06%
2.26-2.50	2.50	0.00%	0.17%	2.04%	1.94%	0.36%	0.21%	0.05%
2.51-2.75	2.75	0.00%	0.07%	1.44%	1.72%	0.32%	0.20%	0.04%
2.76-3.00	3.00	0.00%	0.02%	1.06%	1.62%	0.28%	0.16%	0.02%
3.01-3.25	3.25	0.00%	0.00%	0.67%	1.43%	0.31%	0.13%	0.02%
3.26-3.50	3.50	0.00%	0.00%	0.40%	1.20%	0.32%	0.12%	0.02%

Summing up the probabilities in the non-shaded cells, Table 32 yields an overall availability of the region in and around the AoA a little over half of the time, at 58% based on the observation period of 2000–2022. Figure 48 illustrates this result.

Figure 48. Average Availability of the Region for Recreational Boating throughout the Year

Availability in and around the AoA

Source: McQuilling Renewables

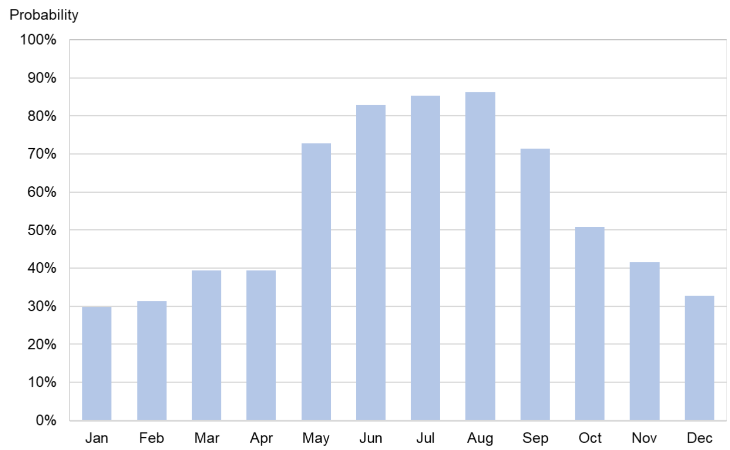


By selecting monthly periods of observation throughout the year, availability of the region in and around the AoA for recreational boating can be assessed on a monthly basis. This result is summarized in Figure 49 that displays results for Buoy 44008. Sea states during the winter months of the year drive region availability for recreational vessels as low as 30% in December, January, and February. Conversely, availability as high as 85% is observed during the summer months of July and August. These results indicate that on average, the region in and around the AoA is likely to be unavailable for recreational marine traffic 42% of the time. Seasonally, during the summer months, sea states still limit availability, and therefore presence and persistence of recreational vessels by at least 15% and as much as 70% during the winter months.

Figure 49. Average Availability of the Region for Recreational Boating throughout the Year by Month (2000–2022)

Availability in and around the AoA based on wave height and wave period.

Source: McQuilling Renewables



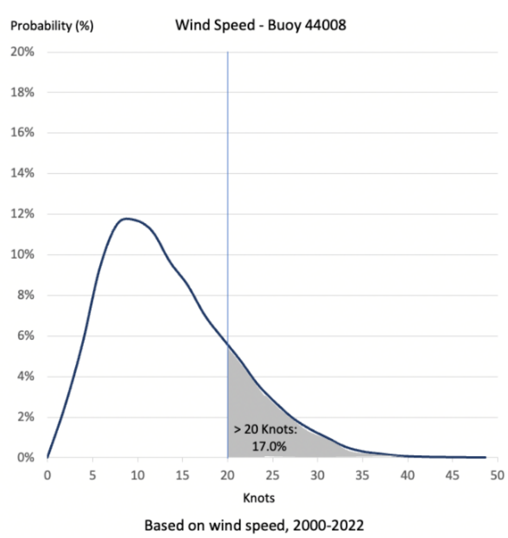
Investigation of wind speed observations from the sea buoys yielded results generally more favorable to availability of the region for recreational vessels and is therefore not considered limiting in terms of recreational vessel presence and persistence. Figure 50 displays representative wind speed results.

Figure 50. Average Availability of the Region for Recreational Boating throughout the Year (2000-2022)

Availability in and around the AoA based on windspeed results for the period 2000 through 2022 with conditions precluding recreational boating operations shaded (17% of the time).

Source: McQuilling Renewables

Wind Speed Range (m/s)	Wind Speed Center		KTS
	0.00	0.00%	0.00
0.01-1.00	1.00	2.53%	1.94
1.01-2.00	2.00	5.61%	3.89
2.01-3.00	3.00	9.38%	5.83
3.01-4.00	4.00	11.54%	7.78
4.01-5.00	5.00	11.72%	9.72
5.01-6.00	6.00	11.15%	11.66
6.01-7.00	7.00	9.65%	13.61
7.01-8.00	8.00	8.51%	15.55
8.01-9.00	9.00	6.99%	17.49
9.01-10.00	10.00	5.88%	19.44
10.01-11.00	11.00	4.81%	21.38
11.01-12.00	12.00	3.61%	23.33
12.01-13.00	13.00	2.72%	25.27
13.01-14.00	14.00	1.95%	27.21
14.01-15.00	15.00	1.39%	29.16
15.01-16.00	16.00	0.96%	31.10
16.01-17.00	17.00	0.52%	33.05
17.01-18.00	18.00	0.29%	34.99
18.01-19.00	19.00	0.18%	36.93
19.01-20.00	20.00	0.08%	38.88
20.01-21.00	21.00	0.04%	40.82
21.01-22.00	22.00	0.02%	42.76
22.01-23.00	23.00	0.01%	44.71
23.01-24.00	24.00	0.00%	46.65
24.01-25.00	25.00	0.00%	48.60



3.3.5 Discretionary Use from State Boater Registration Statistics

3.3.5.1 Regional Small Craft Fleet

To estimate the size and characteristics of the fleet of recreational vessels located in the northeast of the United States the *2022 Recreational Boating Statistics* report from the USCG—Office of Auxiliary and Boating Safety was accessed. This report contains statistics on registered recreational vessels during the calendar year 2022. The data in this publication reflects a collaboration of state and USCG efforts. After reports are submitted, the USCG reviews them and standardizes the data so that it can be used for national comparison. The data in this publication reflects USCG standardized values, which may be different from the state's original submission (USCG Office of Auxiliary and Boating Safety 2023).

Recreational boating statistics in the United States indicate 20+ million recreational boats in the United States in 2022. This includes the largest ocean-going yachts to the smallest kayaks and canoes. About half are motorized and in general these are the boats requiring state registration. Most motorized recreational boats registered in the United States are below 65 feet LOA as illustrated in Table 33.

Table 33. Recreational Boating Statistics (2021)

Recreational vessel registration by length and means of propulsion—United States (number of vessels).

Source: USCG Office of Auxiliary and Boating Safety 2023

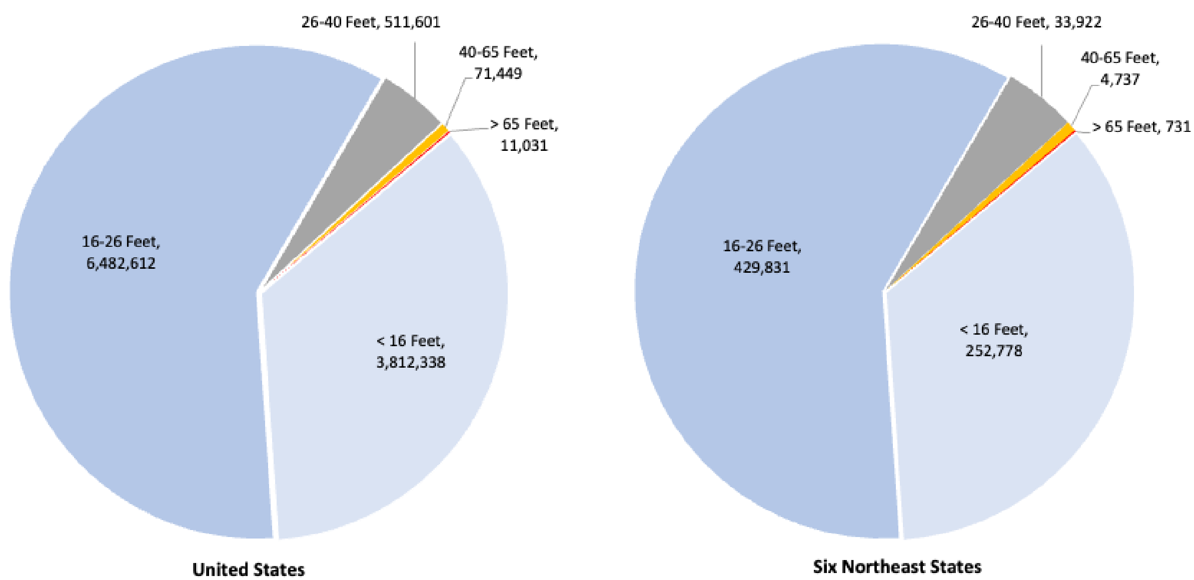
MECHANICALLY PROPELLED	
Less than 16 feet	3,812,338
16 feet to less than 26 feet	6,482,612
26 feet to less than 40 feet	511,601
40 feet to 65 feet	71,449
Over 65 feet	11,031
Subtotal Mechanically Propelled	10,889,031
NOT MECHANICALLY PROPELLED	
Rowboats	44,596
Sailboats	88,365
Paddlecraft	613,426
Other	134,965
Subtotal Not Mechanically Propelled	881,352
Total	11,770,383

State-by-state boat registration information was accessed to recast national data in Table 33 to the population of recreational boats in the northeast region in proximity to the AoA (Duffy, et al. 2020). By applying this breakdown to the six northeastern states in the region of the AoA (Connecticut, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island), the quantity of registered, motorized, recreational boats in the region can be estimated. Given the relative levels of affluence in the northeast portion of the United States as compared to the country as a whole, this approach may underestimate somewhat the actual numbers of larger recreational vessels in the northeast region. Figure 51 illustrates the breakdown of motorized recreational boats registered in the United States and these six states.

Figure 51. Recreational Boating Statistics (2021)

Motorized recreational vessel registration by length (United States and Six Northeast States).

Source: USCG Office of Auxiliary and Boating Safety 2021; Duffy, et al. 2020



This data implies most recreational vessels registered in states proximate to the AoA have a LOA of less than 65 feet and therefore classify as “small craft” as developed in section 3.3.3.2 of this study. For these vessels, the small craft advisories issued by the NWS and distributed by the USCG will negatively influence presence and persistence in the region. Less than 1,000 recreational vessels (less than 1%) in this region have a LOA over 65 feet.

3.3.5.2 Discretionary Use of Recreational Vessels

For recreational vessels, discretionary use is a key characteristic for determining the presence of persistence in the region of the AoA. Statistics from the "2018 National Recreational Boating Safety Survey" (NRBSS) were accessed and evaluated. The purpose of the NRBSS includes producing scientific estimates of the number of different types of recreational boats that are owned and operated, and the amount of exposure (Duffy, et al. 2020). For NRBSS objectives, exposure is a variable key to understanding casualty statistics—for the purposes of this study, exposure can be interpreted as a recreational use measure. The NRBSS report focuses on boat ownership and use and different estimates of exposure. Recreational boating exposure rates can be calculated in several ways. Boat days – any day in which a boat is used on the water, regardless of how long it is utilized – and boat hours – the total number of hours a boat is utilized on the water throughout a specific time of day, are significant to this study.

The NRBSS Exposure Survey collected data monthly during 2018. The primary intent of this survey was to collect valid data necessary to produce different measures of recreational boating exposure hours reliably. Estimating exposure rates requires different data including (1) the number of different types of registered and unregistered boats, state of ownership, (2) the number of these boats that were operated out on the water, (3) the number of days/hours that these different types of boats were operated, and (4) the number of persons who were aboard when these boats were operated out on the water (Duffy, et al. 2020).

Information was collected about whether and on how many days boats were operated during the reference month and about the last outing on the last day that boats were taken out on the water in the reference month. For this study, exposure data about how many hours was the boat out on the water during last outing was relevant (Duffy, et al. 2020).

In total, 213,659 addresses across the 50 United States and the District of Columbia were sampled and invited to participate in the Exposure Survey. A total of 44,422 households returned the Exposure Surveys. This is 21.9% of the sample excluding undeliverables and ineligibles, which were 5.2% of the total sample of 213,659 households. A respondent is a returned survey with enough completed survey items to be kept for weighting and estimation, in this case, sufficient completed items to definitively determine if the household owned at least one boat (Duffy, et al. 2020).

The NRBSS Exposure Survey collected detailed information about how many and what types of boats were owned by households in 2018. This information included boats that were required and not required to be registered by the state where they were kept and operated. Note that the states differ in the types and sizes of boats that are required to be registered. The NRBSS Study identified about 25 million boats in the United States in total. This data is roughly consistent with *2022 Recreational Boating Statistics* (USCG Office of Auxiliary and Boating Safety 2023). There were about 11.82 million boats registered in the 50 states and the District of Columbia in 2018, including about 7.76 million open power boats, 1.38 million personal watercrafts (PWCs), and 989,000 pontoon boats. In general, registration is required for all motorized watercraft (Figure 52) (Table 34).

Figure 52. Number of Registered Boats by Boat Type and by State of Registration, 2018 (Thousands)

Source: Duffy, et al, 2020

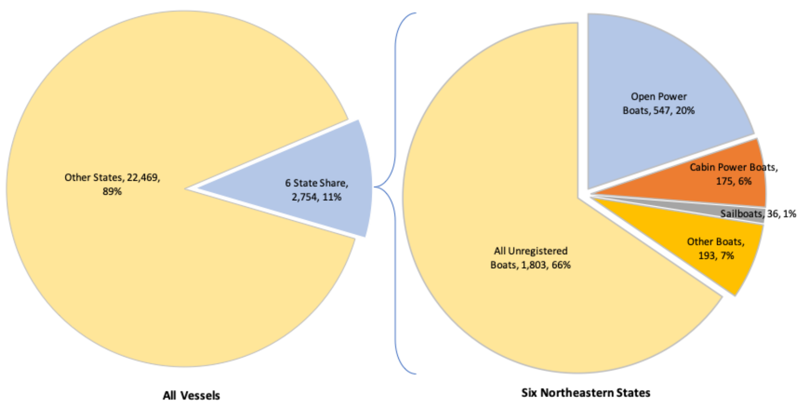


Table 34. Number of Registered Boats by Boat Type and by State of Registration, 2018 (Thousands)

Source: Duffy, et al. 2020

State	All Registered Boats	Open Power Boats	Cabin Power Boats	Sailboats	Other Boats	All Unregistered Boats	All Boats
Connecticut	91	53	19	4	15	249	340
Massachusetts	132	105	11	5	11	100	232
New Hampshire	95	58	9	5	23	310	405
New Jersey	150	76	29	6	39	184	334
New York	444	236	94	13	101	884	1,328
Rhode Island	39	19	13	3	4	76	115
Subtotal 6 States	951	547	175	36	193	1,803	2,754
6 State Share	8.0%	7.1%	21.9%	15.3%	6.4%	13.5%	10.9%
Other States	10,873	7,211	623	200	2,839	11,596	22,469
Total	11,824	7,758	798	236	3,032	13,399	25,223

Examples of open power boats are bass boats, ski boats, and center console boats. Cabin power boats typically have an enclosed space on board for navigation, etc. Sailboats can be powered only by sails or auxiliary power. Other boats include pontoon boats, air boats, houseboats, PWCs such as WaveRunners, Sea-Doos, etc., canoes (including inflatable canoes), kayaks (including inflatable kayaks), paddleboards, and rowed boats (e.g., jon boats, shells, sculls, and inflatable boats).

The six northeastern states represent about 2.7 million boats or 11% of the national total. About one million of these are registered and half of which are open power boats including center-hull console boats, the most popular configuration in the United States today. In general, due to weather and sea state considerations, boats with some type of enclosure (Cabin Power) are more suitable for sustained offshore activities, especially those in waters 15–150 nm offshore, the location of the AoA. Cabin Power boats represent about 6% of the total recreational fleet registered in the six northeastern states or approximately 175,000 vessels.

In the NRBSS survey, boaters were asked how many times per year boats were taken out on the water. The responses were summarized into three boat categories: all boats, motorized boats, and human-powered boats. The “Motorized Boats” category included open power boats, cabin power boats, pontoon boats, and PWCs; the “Human-Powered Boats” category includes kayaks, canoes, paddleboards, and rowed boats. The “All Boats” category includes motorized boats, human-powered craft and sailboats, and other types of boats.

Just over a third (36.3%), 9.15 million, of recreational boats were taken out on the water at least once during 2018 in the United States. Almost half (45.3%) of motorized boats were operated out on the water at least once compared with just 29.5% of human-powered craft. For many states, fewer than a quarter of the human-powered boats that were owned were taken out on the water in 2018. Figure 53 displays the percentage of motorized boats taken out on the water at least once in the surveyed year for each of the six northeastern states. On average, less than half (43.2%) made it out on the water. Use of boats registered in New York State was slightly higher than this average at 44.2% but lower than the national average of 48.9% (Table 35). The implication of these results is that lack of sustained use of recreational vessels may significantly limit their presence and persistence in and around the AoA.

Figure 53. Percentage of Motorized Boats That Were Taken Out on the Water at Least Once by Aggregated Boat Type and by State of Registration or Storage, 2018 (Thousands)

Source: Duffy, et al. 2020

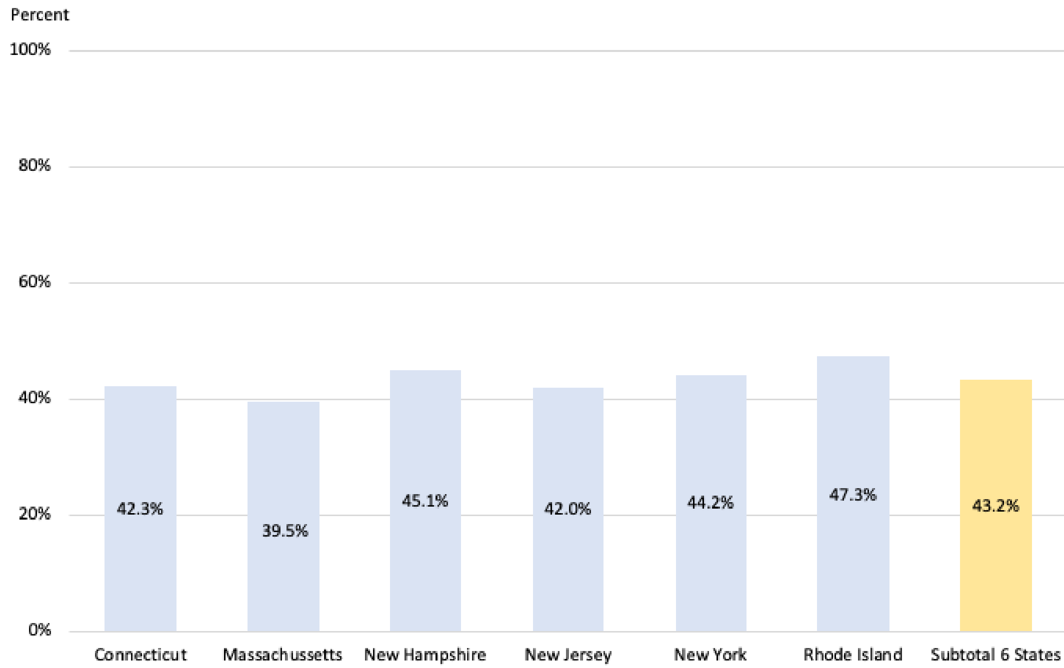


Table 35. Number and Percentage of Boats that were taken out on the water at least once by Aggregated Boat Type and by State of Registration or Storage, 2018 (Thousands)

Source: Duffy, et al. 2020

State	Motorized Boats	Motorized %	Human Powered Boats	Human Powered %	All Boats	All Boats %
Connecticut	36	42.3%	51	22.2%	94	27.7%
Massachusetts	50	39.5%	81	28.1%	139	31.5%
New Hampshire	41	45.1%	82	27.4%	127	31.3%
New Jersey	58	42.0%	57	32.0%	120	35.9%
New York	189	44.2%	225	27.7%	434	32.7%
Rhode Island	17	47.3%	15	20.1%	34	29.5%
Subtotal 6 States	391	43.2%	511	27.1%	948	32.0%
6 State Share	7.9%		13.0%		10.4%	
Other States	4,950	45.3%	3,927	29.5%	9,151	36.3%
Total	5,341	48.9%	4,438	33.3%	10,099	40.1%

Responses to the survey also indicated the number and percentage of boats operated more than 3 nm from shore. About 647,000 boats in coastal and Great Lakes states were operated at least once over 3 miles from shore. About half of those (314,000) were motorized. For the six northeastern states, the total number of motorized boats operated at least once 3 nm from shore was 76,400 or about 20%.

Respondents were asked how many hours the boat was out on the water during the last outing in the target month. Outings, meaning different occasions that boats were operated out on the water, lasted an average of 3.8 hours. This is the time that a boat remained out on the water away from a dock, mooring, or launch site. Half of all outings lasted 4 or fewer hours. Motorized boats were out on the water more time per outing, an average of 4.4 hours, compared with 3.2 hours for human-powered boats. Table 36 illustrates mean and median hours per outing for motorized boats for each of the six northeastern states selected.

Table 36. Hours per Boat on Last Outing in the Target Month for Operated Boats—Median and Mean by Aggregated Boat Type by State of Operation, 2018

Source: Duffy, et al. 2020

Hours	All Boats	All Boats	Motorized	Motorized	Other	Other
State	Mean	Median	Mean	Median	Mean	Median
Connecticut	3.0	3.4	4.0	3.9	3.0	3.1
Massachusetts	3.0	3.2	4.0	3.8	2.0	2.9
New Hampshire	2.0	2.7	3.0	3.4	2.0	2.3
New Jersey	3.0	2.7	3.0	3.4	2.0	2.3
New York	3.0	3.5	4.0	4.0	2.0	3.1
Rhode Island	3.0	3.8	5.0	5.0	2.0	2.6

The average outing duration was about 3–5 hours depending on the survey results in each of the six states. In Table 37 the logistics of getting to and from a location in the AoA are displayed. Zone 1 is the closest to the southern shore of Long Island at about 16 nm and extends southward for 50 nm. Zone 2's nearest distance to land is about 63 nm, with the zone extending about 26 miles southerly. Zone 3 begins at about 83 nm offshore all the way out to 157 miles offshore. A 20-knot transit speed is assumed representative of recreational traffic. The duration of a round trip to and from the boundaries of the zones in the AoA at this speed is displayed in the table. When this elapsed time is added to the mean outing duration, Zone 1 can be viewed as accessible with good weather and sea state conditions, but only just. Zone 2 and Zone 3 may be too far from land to make these regions feasible for an outing as it takes too much time to get there and back.

Table 37. Transit Logistics to/from the Area of Analysis

Source: McQuilling Renewables

	Zoone 1: 50nm Span			Zone 2: 26nm Span			Zone 3: 75 nm Span		
	Near		**Far**	**Near**		**Far**	**Near**		**Far**
Distance 1-Way (nm)	16		66	63		89	82		157
Distance RT (nm)	32		132	126		178	164		314
Transit Hours at 20 kts (1-Way)	0.8	✓	3.2	3.2	✗	4.5	4.1	✗	7.8
Transit Hours at 20 kts (RT)	1.6	✓	6.6	6.3	✗	8.9	8.2	✗	15.7

As a result of these logistics, most of the AoA may not be a destination for recreational boaters. The primary presence and persistence of recreational marine traffic in the region is represented by the exceptions: recreational fishermen, who are shown in Figure 42 in section 3.3.1.1 to regularly gather at the edge of the canyons and may spend several days there and recreational boaters that are *transiting* the region. These will likely be seasonal boaters repositioning from the northeast to points south in the fall months and from the south to the northeast in the spring. In any case, the density and intensity of these uses is likely sparse and transitory.

3.3.6 Summary

Electronic position data provides an incomplete assessment of recreational marine traffic in and around the AoA. This is because: (1) not all recreational vessels are equipped with AIS transmitters, (2) those that are have less powerful transponders and mounted lower than commercial vessels and some signals are not received by terrestrial stations, the source of MarineCadastre AIS data, and (3) few codes are used to differentiate types of recreational vessels—only two detail codes are assigned, one for sailboats and one for all other recreational boats are used. Even with these limitations, AIS data for recreational vessels provides multi-year historical sampling of presence and persistence information about recreational vessels in and around the AoA and is still a valuable tool to understand marine uses in the region. Non-AIS information on recreational marine traffic is dated nonetheless, ArcGIS layers of this information are useful for a general appreciation of this traffic as well.

Most recreational vessels according to USCG boating statistics (USCG Office of Auxiliary and Boating Safety 2021) are small craft which are vessels under 65 feet, and weather and sea state conditions limit availability of the AoA to these vessels, negatively influencing their presence and persistence in the region. State boater registration data (Duffy, et al. 2020) reveals over half of recreational boats in the region typically do not go out on water. When they do, the average outings are relatively short and not far from shore. These discretionary use statistics further reduce the expected presence and persistence of recreational boats in and around the AoA. Exceptions include a population of recreational fishermen who regularly travel into the AoA to the rim of the canyons and elsewhere, and transit boaters crossing through the region.

3.4 Other Uses

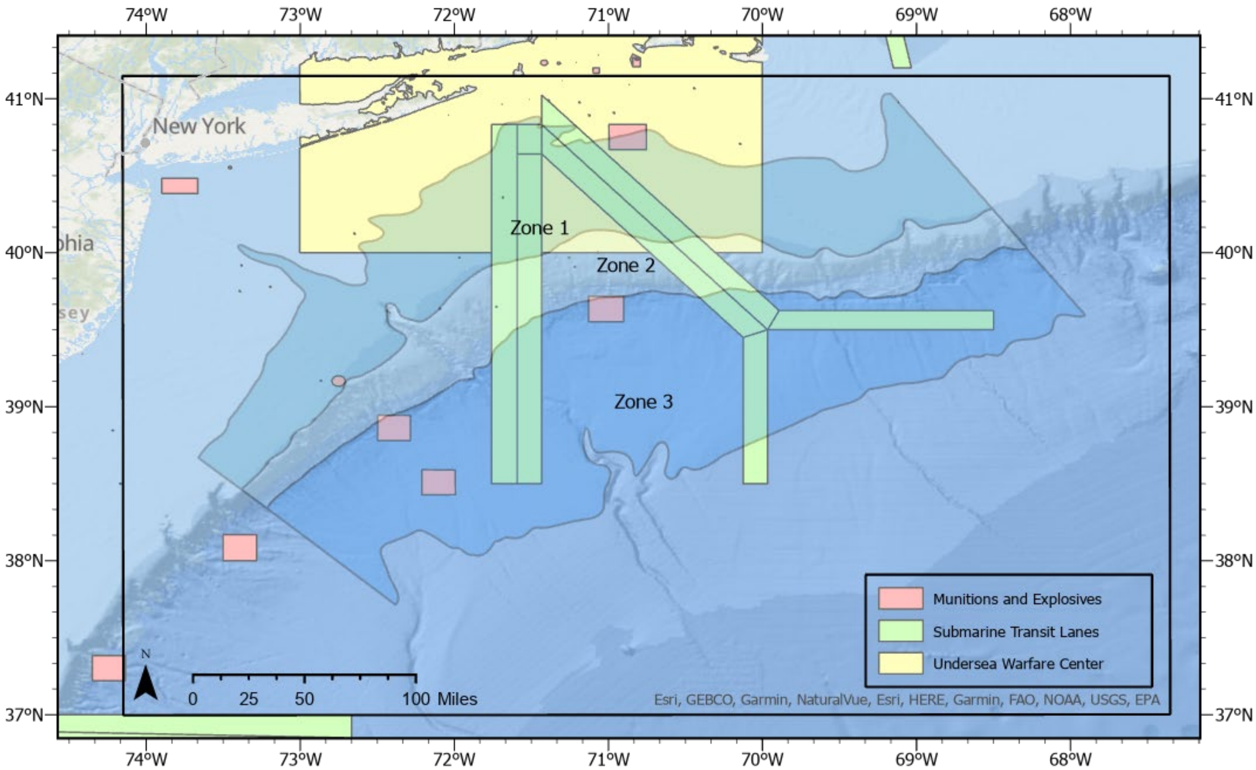
In addition to commercial and recreational use and marine traffic, other uses exist in and around the AoA. Some of these uses are carried out from vessels and some uses do not create marine traffic but the existence may influence commercial or recreational traffic in the region. These uses are included in this section for reference at the request of NYSERDA. Further investigation of the effect of these uses and marine traffic on siting of wind energy areas may be warranted at subsequent stages of project planning.

3.4.1 Military and Law Enforcement

Military uses exist in and around the AoA and should be considered when evaluating use and future siting of wind energy areas. One military use that should be taken into account is the designated area for submarine transit corridors shown in Figure 54. The data in the Northeast Ocean Data Portal's Submarine Transit Lanes layer was created at the direction of the Naval Facilities Engineering Command to assist the Navy in analysis, planning, and decision making. These submarine lanes are found within all three zones of the AoA and should be considered when planning wind field areas (Ecology and Environment, Inc. 2016c).

Figure 54. Military Uses Not Creating Marine Traffic

Source: Marine Cadastre 2023b; U.S. Navy n.d.c; U.S. Navy n.d.b



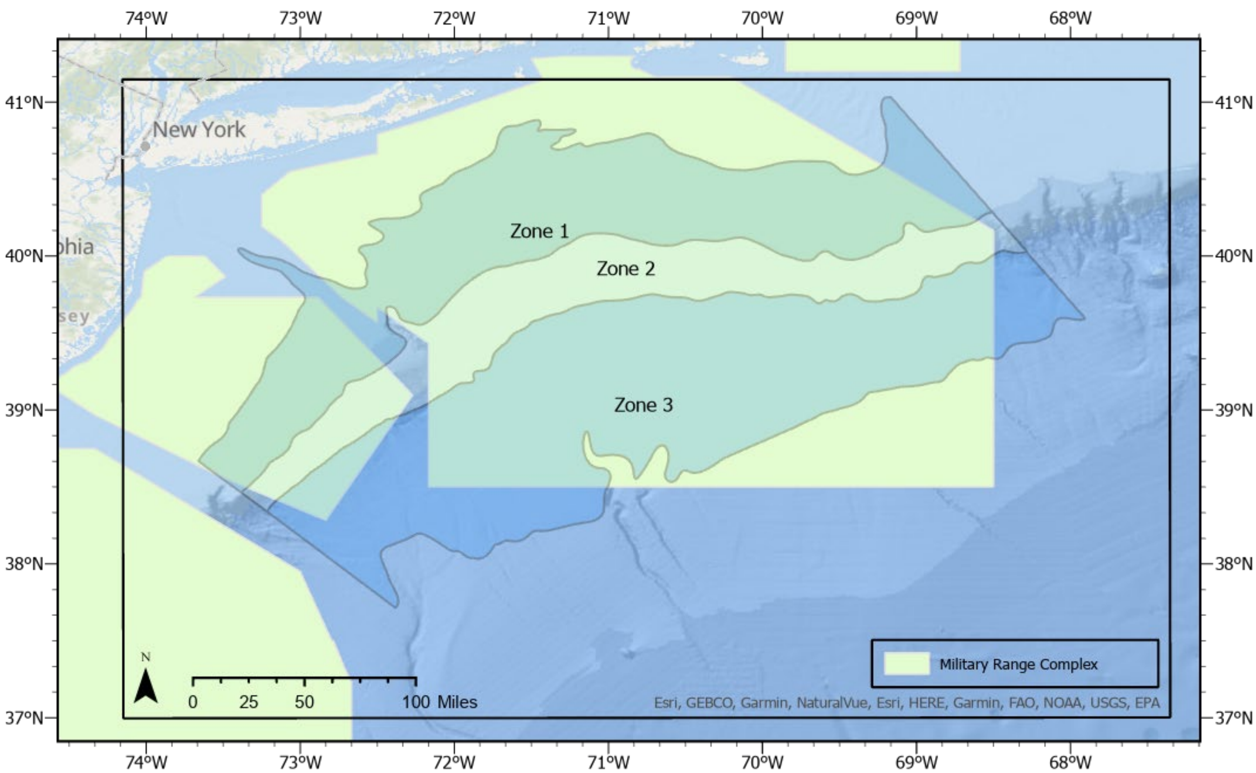
Another use to be noted is the Naval Undersea Warfare Testing Range data, which assists the Navy in analysis, planning, and decision-making purposes and depicts an area used for research, development, test, and evaluation of undersea warfare systems, as well as other Navy and Department of Defense operations when needed. The layer exhibits an area focused on undersea aspects of warfare, where testing systems such as torpedoes and unmanned underwater vehicles occurs—containing several sea space restricted areas. This area overlaps with north and northeast portions of the AoA in Zones 1 and 2 (Ecology and Environment, Inc. 2016b).

Finally, Figure 54 also shows Munitions and Explosives of Concern, which had been deposited on the seabed (mostly by the U.S. Armed Forces) since World War I. These include unexploded ordnances, discarded military munitions, and munition constituents in high enough concentrations to pose an explosive hazard. Ocean disposal of munitions was banned in 1972 by the Ocean Dumping Act; federal and state efforts to mitigate and sometimes remove them are ongoing. A few sites are in the AoA in all three zones (Marine Cadastre 2023b).

Other examples of military activity in the AoA include military range complexes. These are designated sets of geographic areas encompassing a water component (both above and below the surface), airspace, and possibly land, where training and testing of military systems occur. Figure 55 shows the Offshore Narragansett Bay Complex and the Offshore Atlantic City Range Complex overlapping with the AoA (Ecology and Environment, Inc. 2016a).

Figure 55. Military Range Complexes Not Creating Marine Traffic

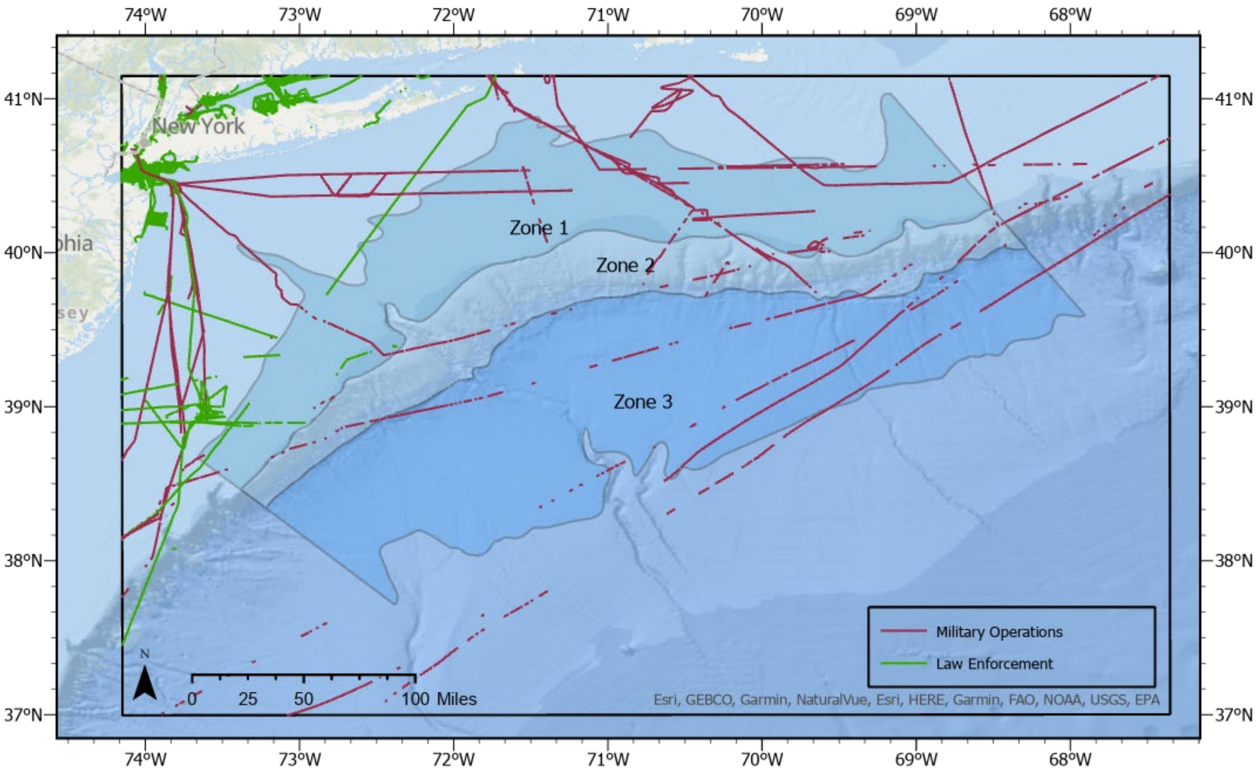
Source: U.S. Navy n.d.a



Other marine uses that do result in marine traffic are described in AAIS Code 7—Law Enforcement including military operations from vessels and the USCG. Figure 56 displays military and law enforcement tracks in 2022 in and around the region—note these represent a very small footprint in and around the AoA.

Figure 56. Military and Law Enforcement Marine Traffic (2022)

Source: Marine Cadastre

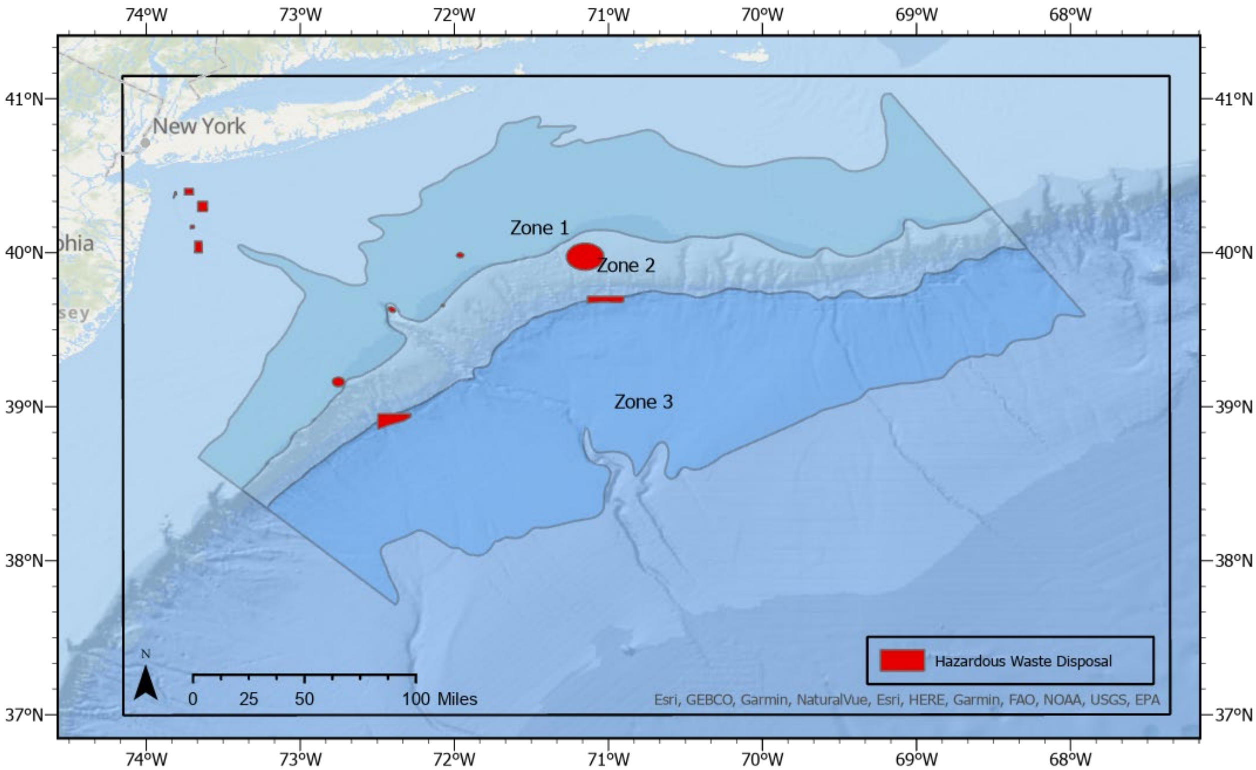


3.4.2 Disposal Sites

Another use of the space that does not generate marine traffic can be found in the Hazardous Waste Disposal Areas Atlantic Offshore Study Area layer, which contains information gathered by DOS to identify hazardous waste disposal sites that should be excluded from OSW projects. One dozen sites are found in this layer in total ranging from 1 square mile to 122 square miles, seven of which are found in the AoA and in all three zones. These areas should be avoided when planning OSW sites (DOS and Ocean Study 2023) (Figure 57).

Figure 57. Hazardous Waste Disposal Sites

Source: DOS and Ocean Study 2023



3.4.3 Hudson Canyon Sanctuary

Included here for reference is information on Hudson Canyon, which is located within the AoA and is in the process of being designated a national marine sanctuary by NOAA. Hudson Canyon is one of the largest submarine canyons in the world at about 350 miles long, 2.5 miles deep, and 7.5 miles wide, with features such as steep slopes, diverse sediments, and fluxes of nutrients that make it an ecological hotspot. It provides habitat for several protected and sensitive species such as sperm whales, sea turtles, and deep-sea corals. This rich biodiversity provides economic benefits to the area through commercial and recreational fisheries, whale watching and birding. The primary goals of this sanctuary designation are: supporting conservation; identifying and raising awareness of Indigenous connections to the area; highlighting and promoting sustainable uses; expanding ocean science, monitoring and education; and providing a platform for collaborative and diverse partnerships that will support long-term management of the area. (NOAA, Office of National Marine Sanctuaries n.d.). Further information on the sanctuary is addressed in the Fish and Fisheries Data Aggregation Study (NYSERDA 2025).

3.4.4 Other

AIS data (AAIS Code 8) is collected on numerous other types of vessels not falling into any of the other aggregate codes or of a much smaller presence and/or persistence intensity (Table 38). These vessels, and their uses are present in and around the AoA, and they represent light density marine traffic. For example, AIS Code 34—Diving Operations collects vessel positions from what appear to be commercial diving vessels. These are currently centered mainly around the wind field developments of Rhode Island and Massachusetts but are otherwise sparse and of low density (Table 39). AAIS Code 8 is comprised of the following BOEM/NOAA codes and vessel types.

Table 38. Vessel Automatic Identification System Code 8—Other

Source: Marine Cadastre

BOEM/NOAA AIS Code	Vessel Type Description
20-29	Wing-in-ground (WIG), all ships of this type
33	Dredging or underwater operations
34	Diving operations
40-49	High speed craft (HSC), all ships of this type
50	Pilot Vessel
51	Search and Rescue vessel
53	Port Tender
54	Anti-pollution equipment
90-99	Other Type, all ships of this type

Table 39. Vessel Automatic Identification System Code 8—Density (Hours)

Annual durations in hours of AAIS Code 8 vessels in the AoA (2018–2022)

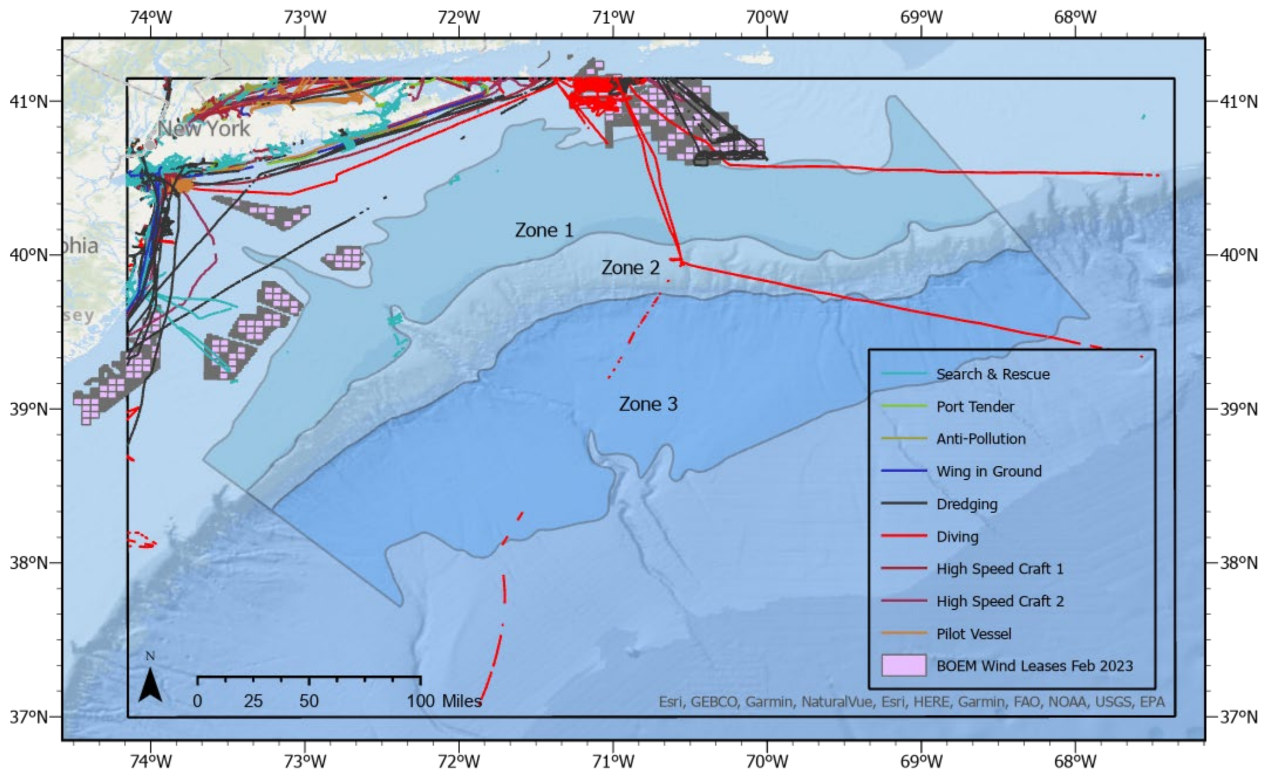
Source: Marine Cadastre

AAIS	Description	AIS	2018	2019	2020	2021	2022
8	Wing-in-ground (WIG)	27	117	0	0	0	0
8	Dredging or underwater operations	33	0	0	0	500	29
8	Diving operations	34	0	0	14	608	366
8	High speed craft (HSC)	40	627	0	0	58	0
8	High speed craft (HSC)	47	58	0	0	0	0
8	Pilot Vessel	50	0	11	0	0	0
8	Port Tender	53	0	0	0	0	0
	Hours		**803**	**11**	**14**	**1,166**	**395**

The red and black vessel tracks in Figure 58 indicate commercial OSW marine traffic activity. Underwater activity related to dredging (cabling) and diving are being carried out in support of early stages of the wind field installations in the northeast cluster.

Figure 58. Vessel Automatic Identification System Code 8—Other Tracks (2022)

Source: BOEM and NOAA n.d.c; Marine Cadastre



There are a relatively large number of transits captured in the region for vessels whose type are classified as "Other" or Reserved." Total hours duration of these vessels (an average of 115 vessels) spent in the AoA each year are summarized in Table 40 averaging 23,500 hours each year. This data cannot be further distinguished with information available and further investigation is warranted.

Table 40. Vessel Automatic Identification System Code 8—Other Tracks

Source: Marine Cadastre

AAIS 8 / 9	Description	AIS	2018	2019	2020	2021	2022
MMSI	Other or Reserved	Various	116	128	98	117	119
Hours	Other or Reserved	Various	16,663	25,418	25,251	20,159	29,598

4 Conclusions

This study investigated marine activity for a region where OSW lease areas beyond the 60-meter depth contour could be sited, providing an updated perspective on the maritime uses in and around the AoA. Quantitative historical vessel position data for the years 2017 through 2022 was acquired, distilled, evaluated, and combined with qualitative information relating to marine activities, uses and traffic. Growth in commercial marine traffic was assessed to evaluate future influences. Driven by limitations in quantitative data (AIS) availability for certain types of vessels, a method of conditioning presence and persistence of recreational vessels was developed to inform on expected marine traffic from these vessels in and around the AoA.

4.1 Study Classification of Marine Uses for the Area of Analysis

In the region encompassing the larger, more distant AoA located in water deeper than the region studied for the Master Plan, all activity is carried out on or from vessels and marine traffic is an important parameter to inform on marine uses. Different uses influence the region differently. Marine uses that have characteristics with comparatively higher presence and persistence in the region need to be well-understood and comprehensively planned for as the resulting marine traffic may influence decision-making about siting offshore energy installations; those with comparatively less effect on the region also need to be understood and considered to help ensure compatible coexistence with offshore energy installations.

Defining the characteristics of commercial and recreational uses to identify similarities and differences between the two, and how these influence the region in and around the AoA, compelled the reclassification of several marine uses from earlier studies and the marine traffic resulting therefrom. In this study, cruise ship tourism, wildlife viewing (primarily whale watching), underwater activity and charter/for-hire fishing are all considered as commercial marine traffic because the characteristics of vessel deployment for these activities are generally consistent with other commercial activities. Namely, cruise ship tourism typically occurs on larger vessels, regulated by the USCG or other flag states to carry passengers for hire. This traffic, while seasonal, is persistent as is charter/for-hire fishing, and this traffic, along with wildlife viewing (another form of passenger for-hire transport) and underwater activities has direct economic contributions and represent a business purpose or livelihood. These commercial and recreational uses of recreational fishing, sailing, and recreational transits to or through the region, make up the majority of the marine practices and observed marine traffic in the region. Table 41 provides a summary of the various uses relating to traffic in and around the AoA and their diverse characteristics.

Table 41. Marine Use and Traffic Characteristics and Intensity

Source: McQuilling Renewables

Vessel Type Description – AAIS Code		Cargo - 1	Tanker - 2	Tug / Barge - 3	Passenger / Cruise, Excursion[a] - 4	Offshore Wind - 10	Underwater Activities[b] - 8	Commercial Fishing[c] - 6	Sailing - 5		Law Enforcement - 7	
		Commercial							Recreational		Other	
	Intensity >	**H – High | M – Medium | L - Low**										
Persistence Consistency and ratability of marine traffic; seasonality	Continuous (H) – Seldom (L)	H	H	H	H-M	M	M	H	L	M	L	L
Density Volume of marine traffic	Congested (H) – Sparse (L)	H	H	H	M	L	L	M	L	L	L	L
Navigationally Constrained Ability to change voyage routing; offshore destination	Constrained (H) - Discretionary (L)	H	H	H	H-M	M	M	H	L	L	L	L
Limited Maneuverability Ability to change speed and direction to avoid obstacles	Constrained (H) - Nimble (L)	H	H	H	M	H-M	L	H	L	L	M	H-M-L
Economic Effect The magnitude of the total direct and indirect economic contribution	Broad (H) – Narrow (L)	H	H	H	H	H	H	H	L	L	-	-
Regulatory Oversight The degree of operational discretion after compliance with operational requirements	Highly Regulated (H) – Nearly Unregulated (L)	H	H	H	H	H	M	H	L	L	-	-
Purpose To what extent the marine traffic represents a livelihood	Professional (H) – Leisure (L)	H	H	H	H	H	H	H	L	L	-	-

Table notes are on the next page

[a] Passenger type vessels include large cruise ships, ferries and excursions vessels.

[b] Underwater activities include wreck & reef diving.

[c] Commercial fishing vessels include charter / for-hire fishing boats in this study.

[d] Other includes: Wing-in-ground (WIG), high speed craft (HSC), dredging, diving, pilot, search and rescue (SAR), port tender, oil recovery, research vessel, school ship.

4.2 Commercial Marine Traffic Follows Established Traffic Patterns

Year-on-year results for commercial traffic patterns where cargo or passengers are transported regularly between loading ports and discharging ports show a tendency to follow an established routing. Indeed, the purpose of USCG PARS is to recommend additions or modifications to existing routing solutions such as TSS or safety fairways to aid in safe navigation of vessels as traffic increases along these routes. Remotely sensed vessel position data for the years 2017 through 2022 indicate that increases in cargo or passenger transport traffic (AIS aggregate codes 1, 2, 3, 4) generally occur along existing routing solutions. Going forward, non-OSW traffic growth is relatively small annually but over three decades the increased activity is significant. Existing cargo and passenger traffic corridors will likely see most of the increase in volume and density related to the growth of commercial transit traffic. Most of these areas are to the north of and outside of the AoA. Zone 1 of the AoA is most heavily occupied by these traffic corridors, Zone 2 is only bisected by the proposed Hudson Canyon to Ambrose Southeastern Fairway Extension and Zone 3 is undisturbed.

There are exceptions to this observation driven by new trades and new ports and the OSW industry is one of these exceptions. Marine traffic arising from OSW activities is destinational, originating in port and traveling to destinations at sea. Installation activities to create 90-GW of OSW energy production capacity by 2050 produce a higher intensity traffic profile than operation and maintenance marine traffic supporting OSW. This is because FOSW installation activities are—while project-oriented and seasonal rather than continuous—still numerous and centered around less maneuverable, navigationally constrained vessels such as offshore tugs towing large equipment transport deck barges. OSW activities may, over time, extend into Zone 3, but overall are still less dense than commercial marine *transiting* traffic generated by commercial cargo and passenger transport.

Fishing activity and associated marine traffic is also an exception. Fishing is *destinational*: departing from ports to destinations at sea. These destinations vary and so the traffic is more distributed across the region instead of concentrating in lanes. It does appear that recreational fishermen (and likely charter/for-hire fishing boats do frequent regular destinations offshore along the rim of the continental shelf. While this type of vessel is less navigationally constrained and more maneuverable, these lanes should be considered in siting discussions.

4.3 Knowledge Base Informs on Safe Navigation in and around Fixed Installations at Sea

As described in section 3.2.2, the safety of the marine community with regards to mitigation of risk of collision, allision or other marine incident is paramount in the offshore energy industry. In addition to strict adherence to navigational rules of the road, safe bridge watch—standing procedures for commercial vessels and prudent mariner decisions by the recreational community, many of the planning tools and risk mitigation measures for U.S. OSW projects can be traced to existing offshore marine and energy industries such as U.S. oil and gas as well as European OSW. The PWSA (P.L.95-474, 33 U.S.C. 1223(c)) requires the Coast Guard to conduct a PARS before establishing new or adjusting existing fairways or TSSs. The PARS process may also be used to define and enhance safety and security zones, recommended routes of passage, regulated navigational areas and other overall ship and vessel routing measures. Recent PARS recommendations for the northern New York Bight area include the following modifications and additions to established traffic safety fairways and separation zones in and around the port of New York and the AoA of this study:

- To establish modified versions of the fairways proposed in the Advance Notice of Proposed Rulemaking.
- To establish a New Jersey to New York Connector fairway.
- To establish a Hudson Canyon to Ambrose Southeastern fairway, a Hudson Canyon to Ambrose Eastern fairway, and a single Nantucket to Ambrose fairway.
- To establish an Ambrose Anchorage and adjust the Long Island fairway to mitigate location conflict (USCG 2021a).

Combining USCG approaches to developing safe navigation guidance with proven European risk mitigation practices to assist the maritime and project planning communities in spatially planning projects is recommended. Distances between wind field structure boundaries and maritime traffic should be reviewed and determined on a case-by-case basis among relevant navigation and project participants.

While there are no international standards that specify minimum distances between routes and structures a planning guideline for stakeholders is to keep wind energy structures at 2 nm from the boundary of a marine traffic lane to where case by case review can be carried out using the methods described on an as needed basis for projects and regional locations that require further vetting and discussion.

Risk mitigation measures should be considered where the CPA is between 0.5 and 5 nm to ensure risks potential is reduced, particularly when limited to 0.5 and 2 nm of separation, which is considered medium to high risk. It is generally considered that a CPA of greater than 2 nm is an acceptable and low-risk distance for the placement of structures with marine traffic routing although where the wind field or TSS are within proximity to each other. Additional and compounding effects if present will need to be analyzed in further detail by stakeholders to achieve acceptable CPA tolerances and probabilities.

Furthermore, the result of U.S. East Coast stakeholder engagements and discussions to prevent marine casualties and analyze the probability of marine incidents in the area corroborates a minimum setback distance as acceptable *planning* guidance for projects. This distance between marine traffic and structures would provide acceptable safe passage sea room given the reduction of steerage that may exist while transiting under speed restrictions due to marine mammal and wildlife guidelines as well as provide a sufficient closest point of approach for vessels that may experience a loss of propulsion or steering while passing wind energy area structures (COWI 2020).

4.4 Few Recreational Uses in and around the Area of Analysis are Implied by the Data

Classification of marine uses driven by the location of the AoA reduced relevant recreational marine traffic in the region to recreational fishing, sailing and recreational transits. AIS data suggests recreational fishermen follow commercial fishing operations and there is evidence of fishing destinations along the shelf rim (beginning of Zone 2) where recreational fishermen cluster. A more detailed look at recreational fishing can be found in the Fish and Fisheries Data Aggregation Study (NYSERDA, 2025). Remotely sensed data also indicate high densities of recreational boaters transiting close to shore along the U.S. East Coast. Less dense recreational boating activity is detected in the AoA, moving northeast to southwest or vice versa— these likely consist mainly of positioning transits in spring and fall, and mainly are found in Zone 1 with decreasing density in Zone 2 and even less in Zone 3. Sailboat track data show southerly routes likely to or from Bermuda crossing through the AoA as well as the northeast to southwest or vice versa, also probably season positioning. This traffic can be considered sparse as compared to commercial traffic in the region. However, remotely sensed vessel position data for this type of marine traffic is incomplete due to lack of AIS equipment on board and weaker transmitters for those boats having AIS equipment.

Given the shortcomings in regard to completeness in remotely sensed data, qualitative sources of data were also used to inform on recreational uses in the region. State boater registration data reveals many recreational vessels are less than 65 feet (20 meters) in length and are considered “small craft” by the USCG, NWS, and other government agencies. Application of weather and sea state observations, along with the NWS small craft advisory system, suggest limited presence and persistence of the smaller recreational vessels. Results imply the region is unavailable to small craft at least 15% of the time during summer months and as much as 70% during winter months in and around the AoA. State registration statistics imply discretionary use influences presence and persistence substantially. These show less than half of registered motorized recreational vessels are taken out on the water annually. Most remain close to shore. Average outing durations when boats are taken out, combined with the time and fuel expense getting to and from the AoA suggests low or no presence and persistence on smaller recreational vessels in and around the AoA. The exceptions are recreational fishermen reaching the beginning of Zone 2 and (larger) recreational vessels transiting the region on positioning voyages north to/from south. In both cases, the implied densities are low.

4.5 Other Non-Commercial or Non-Recreational Uses and Traffic are Present in the Region of the Area of Analysis

Non-commercial or non-recreational uses exist in and around the AoA. These can be vessel dependent and create marine traffic or not. Examples of uses that don't create marine traffic include military uses (military range complexes, munitions disposal sites and submarine transit corridors), hazardous material disposal sites and proposed or existing underwater sanctuaries such as the Hudson Canyon. These were highlighted in this study and should be considered in further studies and site planning activities.

Other marine uses that do result in marine traffic are described in aggregate AIS Code 7–Law Enforcement including military operations from vessels and the U.S. Coast Guard, and AIS Code 8–Other, which includes a collection of vessels, the traffic from which is utilitarian in nature (dredging, oil recovery) or driven by commercial or recreational uses (pilot, SAR, diving). These were highlighted in this study and should be considered in further studies. In all cases for these codes, traffic density is comparatively sparse.

4.6 Areas of Further Study

- The availability of long-series data sets of remotely sensed vessel position data compels further analysis of this information in the region. There are acknowledged limitations to the data in terms of inaccuracies and completeness, but these data sets represent large repositories of actual observations and could be more deeply mined for marine logistics intelligence. Acquiring commercial satellite AIS data would help solve issues of completeness and technology can be employed to address inaccuracies.

- Vineyard Wind 1 marine logistics data is another source of actual observations of marine equipment required to construct a wind field project. Collection of marine logistics data should continue through installation of turbine component and into the O&M stages. This information will provide robust parameters for use in estimating future OSW field development.
- The recreational boating statistics used in this study were from one of few sources of recreational boating information. Additionally, the survey of this community that segments recreational traffic into logical use cases is suggested to provide more specific intelligence on how different segments of the community use the region.
- Relatively simple economic modeling was carried out in this study to project marine traffic growth through 2050. More sophisticated econometric models may be employed for a more rigorous treatment of marine traffic growth forecasting.

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Appendix A. Bureau of Ocean Energy Management / National Oceanic Atmospheric Administration Automatic Identification System Vessel Codes

Source: USCG, NOAA, BOEM 2018

Vessel Group (2018) key

- Cargo
- Fishing
- Military
- Not Available
- Other
- Passenger
- Pleasure Craft/Sailing
- Tanker
- Tug Tow

AIS Vessel Type and Group Codes used by the Marine Cadastre Project
2018 -05-23

sources: U.S. Coast Guard, NOAA, BOEM

Vessel Group (2018)	Vessel Type (2018)	AIS Vessel Code	AIS Ship & Cargo Classification
Not Available	0	0	Not available or no ship, default
Other	1-19	1-19	Reserved for future use
Other	20	20	Wing in ground (WIG), all ships of this type
Tug Tow	21	21	Wing in ground (WIG), hazardous category A
Tug Tow	22	22	Wing in ground (WIG), hazardous category B
Other	23	23	Wing in ground (WIG), hazardous category C
Other	24	24	Wing in ground (WIG), hazardous category D
Other	25	25	Wing in ground (WIG), reserved for future use
Other	26	26	Wing in ground (WIG), reserved for future use
Other	27	27	Wing in ground (WIG), reserved for future use
Other	28	28	Wing in ground (WIG), reserved for future use
Other	29	29	Wing in ground (WIG), reserved for future use
Fishing	30	30	Fishing
Tug Tow	31	31	Towing
Tug Tow	32	32	Towing: length exceeds 200m or breadth exceeds 25m
Other	33	33	Dredging or underwater operations
Other	34	34	Diving operations
Military	35	35	Military operations
Pleasure Craft/Sailing	36	36	Sailing
Pleasure Craft/Sailing	37	37	Pleasure Craft
Other	38	38	Reserved
Other	39	39	Reserved
Other	40	40	High speed craft (HSC), all ships of this type
Other	41	41	High speed craft (HSC), hazardous category A
Other	42	42	High speed craft (HSC), hazardous category B
Other	43	43	High speed craft (HSC), hazardous category C
Other	44	44	High speed craft (HSC), hazardous category D
Other	45	45	High speed craft (HSC), reserved for future use
Other	46	46	High speed craft (HSC), reserved for future use
Other	47	47	High speed craft (HSC), reserved for future use
Other	48	48	High speed craft (HSC), reserved for future use
Other	49	49	High speed craft (HSC), no additional information
Other	50	50	Pilot Vessel
Other	51	51	Search and Rescue vessel
Tug Tow	52	52	Tug
Other	53	53	Port Tender
Other	54	54	Anti-pollution equipment
Other	55	55	Law Enforcement
Other	56	56	Spare - for assignment to local vessel
Other	57	57	Spare - for assignment to local vessel
Other	58	58	Medical Transport
Other	59	59	Ship according to RR Resolution No. 18

	Passenger	60	60	Passenger, all ships of this type
	Passenger	61	61	Passenger, hazardous category A
	Passenger	62	62	Passenger, hazardous category B
	Passenger	63	63	Passenger, hazardous category C
	Passenger	64	64	Passenger, hazardous category D
	Passenger	65	65	Passenger, reserved for future use
	Passenger	66	66	Passenger, reserved for future use
	Passenger	67	67	Passenger, reserved for future use
	Passenger	68	68	Passenger, reserved for future use
	Passenger	69	69	Passenger, no additional information
	Cargo	70	70	Cargo, all ships of this type
	Cargo	71	71	Cargo, hazardous category A
	Cargo	72	72	Cargo, hazardous category B
	Cargo	73	73	Cargo, hazardous category C
	Cargo	74	74	Cargo, hazardous category D
	Cargo	75	75	Cargo, reserved for future use
	Cargo	76	76	Cargo, reserved for future use
	Cargo	77	77	Cargo, reserved for future use
	Cargo	78	78	Cargo, reserved for future use
	Cargo	79	79	Cargo, no additional information
	Tanker	80	80	Tanker, all ships of this type
	Tanker	81	81	Tanker, hazardous category A
	Tanker	82	82	Tanker, hazardous category B
	Tanker	83	83	Tanker, hazardous category C
	Tanker	84	84	Tanker, hazardous category D
	Tanker	85	85	Tanker, reserved for future use
	Tanker	86	86	Tanker, reserved for future use
	Tanker	87	87	Tanker, reserved for future use
	Tanker	88	88	Tanker, reserved for future use
	Tanker	89	89	Tanker, no additional information
	Other	90	90	Other Type, all ships of this type
	Other	91	91	Other Type, hazardous category A
	Other	92	92	Other Type, hazardous category B
	Other	93	93	Other Type, hazardous category C
	Other	94	94	Other Type, hazardous category D
	Other	95	95	Other Type, reserved for future use
	Other	96	96	Other Type, reserved for future use
	Other	97	97	Other Type, reserved for future use
	Other	98	98	Other Type, reserved for future use
	Other	99	99	Other Type, no additional information
	Other	100 to 199	100 to 199	Reserved for regional use
	Other	200 to 255	200 to 255	Reserved for future use
	Other	256 to 999	256 to 999	No designation

	Vessel Group (2018)	VesselType (2018)		AVIS Vessel Service
	Other	-	-	null
	Fishing	1001	-	Commercial Fishing Vessel
	Fishing	1002	-	Fish Processing Vessel
	Cargo	1003	-	Freight Barge
	Cargo	1004	-	Freight Ship
	Other	1005	-	Industrial Vessel
	Other	1006	-	Miscellaneous Vessel
	Other	1007	-	Mobile Offshore Drilling Unit
	Other	1008	-	Non-vessel

	Other	1009	-	NON-VESSEL
	Other	1010	-	Offshore Supply Vessel
	Other	1011	-	Oil Recovery
	Passenger	1012	-	Passenger (Inspected)
	Passenger	1013	-	Passenger (Uninspected)
	Passenger	1014	-	Passenger Barge (Inspected)
	Passenger	1015	-	Passenger Barge (Uninspected)
	Cargo	1016	-	Public Freight
	Tanker	1017	-	Public Tankship/Barge
	Other	1018	-	Public Vessel, Unclassified
	Pleasure Craft/Sailing	1019	-	Recreational
	Other	1020	-	Research Vessel
	Military	1021	-	SAR Aircraft
	Other	1022	-	School Ship
	Tug Tow	1023	-	Tank Barge
	Tanker	1024	-	Tank Ship
	Tug Tow	1025	-	Towing Vessel

Appendix B. Dive Site Coordinates

Source: McQuilling Renewables

Count	Site Name	Latitude	Longitude
1	3 Sisters	40.38425821	-73.6014013
2	3 Fairs	40.34949121	-73.3137842
3	59 Pounder	40.34630821	-73.27423419
4	Ajace (Italian Barque)	40.54344123	-73.90450141
5	Arundo	40.19430817	-73.67033431
6	Asfalto	40.33824119	-73.70056833
7	Ayuruoca Shipwreck (Oil Wreck)	40.20979117	-73.76545134
8	BA Wreck	40.32710819	-73.79826836
9	Bacardi Wreck	39.87800814	-72.65076797
10	Balaena Shipwreck	40.17295816	-73.68308431
11	Bald eagle	40.3723582	-73.68973433
12	Bidevind Shipwreck	39.81645812	-72.769668
13	Black Warrior	40.54595823	-73.8878184
14	Catamount	40.13229116	-73.36445121
15	Carolina Shipwreck	39.00710794	-73.29603412
16	Choapa Shipwreck	40.27975818	-73.78998435
17	Coal Wreck	40.43570822	-73.5958183
18	Continent Wreck	40.35582519	-73.81033436
19	Cornelia Soule	40.55194123	-73.8918684
20	Dodger Shipwreck	40.48225824	-73.20943418
21	Durley Chine (Bacardi)	40.23454118	-73.45615124
22	Edwin Duke	40.55714124	-73.52716829
23	Eureka Shipwreck	40.31417519	-73.58066829
24	Fran S Shipwreck	40.52742523	-73.73016835
25	G&D (Yankee)	40.28684119	-73.37191822
26	Ioannis P. Goulandris	40.25752517	-73.77416835
27	Happy days	40.3388912	-73.36616822
28	Immaculata	40.28014118	-73.65500131
29	Irma c	40.2855252	-73.35091821
30	Jacob M Haskell	39.60267507	-73.03066807
31	Kenosha	40.43624123	-73.16283416
32	Larsen Tanker	40.21380817	-73.70106832
33	Lizzie D (Rumrunner)	40.47200822	-73.65316832
34	Margret	40.56062523	-73.77566837

Table B-1 continued

Count	Site Name	Latitude	Longitude
35	Mistletoe	40.53705823	-73.85183439
36	Pilot Boat Sandy Hook	40.46050821	-73.82550138
37	Pipe Barge	40.53700823	-73.71766835
38	RC Mohawk	40.41752521	-73.75333435
39	RP Resor Shipwreck	39.77894109	-73.42133421
40	Reggie Shipwreck	40.46180824	-73.16566816
41	Ricksneckers	40.50595822	-73.81978438
42	San Diego	40.63760828	-73.02176813
43	Stolt Dagali	39.98892513	-73.6655683
44	Stone Barge	40.54070824	-73.54066829
45	Tarantula	40.32700821	-73.22400118
46	Texas Tower #4	39.79682512	-72.67066797
47	Texel Shipwreck	39.06844095	-73.30185113
48	USS Turner	40.49750822	-73.87251839
49	Valerie E	40.51600823	-73.71191834
50	Algol	40.10990815	-73.68500131
51	Alan Martin	40.10610815	-73.67990131
52	Coimbra	40.39870825	-72.3664009
53	Coney Island	40.10420815	-73.68050131
54	Dragger	40.53260824	-73.55870129
55	Gate City	40.76290831	-72.73860104
56	Gluckauf	40.67510828	-73.01080113
57	Isabel B. Wiley	39.16200797	-73.1876011
58	Lillian	40.01280814	-73.49330124
59	Linda	40.37400822	-73.00280111
60	Lizzie D. (Rum Runner)	40.47120822	-73.64810132
61	Oregon	40.53010826	-72.85510107
62	Panther	40.84220834	-72.38580094
63	SeaWolf	40.6935083	-72.73970104
64	Steel Wreck	40.46310822	-73.5775013
65	U-869 (U-Who?)	39.56370806	-73.03440107
66	Wolcott	40.58220827	-72.97530111
67	Suffolk	40.878	-71.223
68	Norness	40.436	-70.838
69	Sebastian	40.482	-70.064
70	Jason	40.017	-70.022
71	Andrea Doria	40.493	-69.863

Table B-1 continued

Count	Site Name	Latitude	Longitude
72	Texas Tower #3	41.242	-69.632
73	Argo Merchant	41.021	-69.473
74	King Phillip	41.002	-69.448
75	Newcastle City	40.614	-69.613
76	Strathdene	40.403	-69.476
77	Pan-Pennsylvania	40.239	-69.369
78	North American	40.766	-68.885
79	Fort Mercer	40.218	-68.737
80	Artificial Reef 14	38.537472	-73.815278

Appendix C. Vineyard Wind 1 Mariner Updates

Source: McQuilling Renewables

Date	Duration	Vessel	Flag	LOA (Ft)	Service	Phase	Notice
Sep-16	1 Mo	R/V SHEARWATER	US	110	Geophysical surveys	S&S	1
Sep-16	1 Mo	R/V SHEARWATER	US	110	Geophysical surveys	S&S	2
Oct-16	2 Mo	R/V SHEARWATER	US	110	Geophysical surveys	S&S	3
Oct-16	1 Wk	R/V OCEAN RESEARCHER	GB	230	Geophysical surveys	S&S	2
Oct-16	2 Wk	R/V SYNERGY	BS	340	Geophysical surveys	S&S	3
Jul-17	3 Wk	R/V SHEARWATER	US	110	Geotechnical surveys	S&S	4
Apr-18	4 Mo	R/V SHEARWATER	US	110	Geophysical Surveys	S&S	5
Apr-18	4 Mo	R/V KOMMANDOR IONA	GB	249	Geophysical Surveys	S&S	5
Apr-18	4 Mo	M/V HORIZON GEOBAY	PA	285	Geophysical surveys	S&S	6, 11
Apr-18	4 Mo	R/V DINA POLARIS	NO	324	Geophysical surveys	S&S	6, 11
Sep-18	1 Wk	F/V JUSTICE	US	82	Fishing video trawl survey	S&S	10
May-19	77 Dy	M/V NEPTUNE	MH	164	Geological Surveys	S&S	13
May-19	77 Dy	M/V GERRY BORDELONE	US	170	Geological Surveys	S&S	13
May-19	77 Dy	M/V HORIZON GEOBAY	PA	285	Geological Surveys	S&S	13
Sep-19	4 Mo	M/V GERRY BORDELONE	US	170	Geological Survey	S&S	19
Oct-19	1 Mo	R/V SHEARWATER	US	110	Geotechnical Surveys	S&S	20
Nov-19	2 Wk	F/V HEATHER LYNN	US	82	Fall fisheries trawl survey plan	S&S	21
Feb-20	1 Mo	F/V HEATHER LYNN	US	82	Winter fisheries trawl survey plan	S&S	23
May-20	6 Wk	M/V GEOQUIP SAENTIS	BS	264	Geotechnical Surveys	S&S	24
Jul-20	10 Dy	F/V COURAGEOUS	US	93	Drop Camera Surveys	S&S	30
Jul-20	3 Dy	S/V LEEWAY ODYSSEY	CA	125	Geotechnical and Geophysical Surveys	S&S	26
Jul-20	5 Mo	M/V DANIELLE MILLER	US	145	Geotechnical and Environmental Studies	S&S	29

Table C-1 continued

Date	Duration	Vessel	Flag	LOA (Ft)	Service	Phase	Notice
Jul-20	3 Dy	S/V EGS VENTUS	MH	164	Geotechnical and Geotechnical Surveys	S&S	26
Jul-20	5 Mo	GEOQUIP SPEER	MH	275	Geotechnical Surveys	S&S	28
Aug-20	5 Mo	S/V LEEWAY STRIKER	CA	72	Geophysical surveys	S&S	27
Oct-20	3 Dy	F/V COURAGEOUS	US	93	Drop camera surveys	S&S	30
Nov-20	2 Wk	F/V HEATHER LYNN	US	82	Fall trawl surveys	S&S	36
Nov-20	2 Mo	DINA POLARIS	NO	324	Geotechnical Surveys	S&S	35
Nov-20	7 Dy	R/V JENNIFER MILLER	US	74	Acquiring Vibracores	S&S	34
Feb-21	3 Wk	F/V HEATHER LYNN	US	82	Fisheries trawl surveys	S&S	37
Mar-21	1 Mo	S/V EGS VENTUS	MH	164	Geotechnical and Geotechnical Surveys	S&S	Unk
May-21	1 Wk	NORTHSTAR VISION	TBD	70	Geological Surveys	S&S	42
May-21	3 Wk	F/V HEATHER LYNN	US	82	Spring trawl survey	S&S	38
May-21	1 Wk	F/V COURAGEOUS	US	93	Drop camera surveys	S&S	41
Jun-21	7 Mo	F/V PROVIDER	US	75	Pre-survey scouting	S&S	43
Jun-21	7 Mo	F/V FLEET KING	US	76	Pre-survey scouting	S&S	43
Jun-21	1 Yr	MINERVA UNO	MH	155	Geophysical surveys	S&S	44
Jul-21	4 Mo	FUGRO EXPLORER	PA	261	Geotechnical surveys	S&S	45
Sep-21	2 Mo	F/V FLEET KING	US	76	Geophysical surveys	S&S	47
Sep-21	1 Wk	SHEARWATER	US	109	Shear Vibracore Acquisition Operations	S&S	49
Sep-21	1 Mo	SHEARWATER	US	109	Geophysical surveys	S&S	50
Sep-21	1 Mo	DANIELLE MILLER	US	145	Benthic habitat data collection	S&S	48
Sep-21	2 Mo	R/V GO PURSUIT	US	164	Geophysical surveys	S&S	47
Sep-21	3 Wk	M/V REGULUS	US	272	Geotechnical site investigation	S&S	51
Oct-21	2 Wk	M/V ARTEMIS ANGLER	NO	217	Geophysical surveys	S&S	53
Nov-21	2 Wk	F/V FLEET KING	US	76	Benthic surveys/ scout vessel	S&S	56
Nov-21	2 Wk	F/V HEATHER LYNN	US	82	Fisheries trawl surveys	S&S	54

Table C-1 continued

Date	Duration	Vessel	Flag	LOA (Ft)	Service	Phase	Notice
Nov-21	2 Wk	R/V GO PURSUIT	US	164	Benthic surveys	S&S	56
Nov-21	3 Wk	M/V HOS MYSTIQUE	US	249	Geotechnical survey	S&S	55
Dec-21	1 Yr	HELEN H	US	85	Avian Surveys	S&S	58
Dec-21	3 Mo	NORTHSTAR CR BARGE	US	140	Conduit installation	C&I	57
Dec-21	3 Mo	CHALLENGER	US	92	Conduit installation	C&I	57
Dec-21	3 Mo	NORTHSTAR INTEGRITY	US	80	Conduit installation	C&I	57
Dec-21	3 Mo	REALIST	US	86	Conduit installation	C&I	57
Dec-21	3 Mo	TYRONE	US	120	Conduit installation	C&I	57
Feb-22	2 Wk	F/V HEATHER LYNN	US	82	Trawl surveys	S&S	59
May-22	5 Dy	F/V HORIZON	US	85	Drop camera surveys	S&S	60
May-22	2 Mo	HOS MYSTIQUE	US	250	UXO/ROV OPS	S&S	61
Jul-22	2 Wk	R/V SHEARWATER	US	109	Export cable pre-lay multibeam survey	S&S	64
Aug-22	10 Dy	F/V HEATHER LYNN	US	82	Summer trawl survey	S&S	65
Aug-22	1 Mo	OSV BERTO L MILLER	US	180	Export cable boulder relocation	C&I	66, 71
Sep-22	2 Wk	R/V BROOKS MCCALL	US	157	Geotechnical operations	S&S	67
Oct-22	1 Mo	F/V FLEET KING	US	76	Offshore cable laying operations	C&I	68
Oct-22	1 Mo	NORNE	NL	112	Offshore cable laying operations	C&I	68
Oct-22	1 Mo	NICOLE FOSS	US	130	Offshore cable laying operations	C&I	68
Oct-22	1 Mo	CABLE ENTERPRISE	GB	408	Offshore cable laying operations	C&I	68
Jan-23	2 Mo	PROVIDER	US	75	Nearshore cable laying operations	C&I	70
Jan-23	2 Mo	HELEN H	US	85	Nearshore cable laying operations	C&I	70
Jan-23	2 Mo	MENA C	GB	87	Nearshore cable laying operations	C&I	70
Jan-23	2 Mo	MARTINE P	GB	87	Nearshore cable laying operations	C&I	70
Jan-23	2 Mo	NICOLE FOSS	US	130	Nearshore cable laying operations	C&I	70

Table C-1 continued

Date	Duration	Vessel	Flag	LOA (Ft)	Service	Phase	Notice
Jan-23	2 Mo	CLB ULISSE	MT	400	Nearshore cable laying operations	C&I	70
Feb-23	2 Wk	HELEN H	US	85	Pre-lay jetting operations	C&I	75
Feb-23	2 Wk	MENA C	GB	87	Pre-lay jetting operations	C&I	75
Feb-23	2 Wk	MARTINE P	GB	87	Pre-lay jetting operations	C&I	75
Feb-23	2 Wk	NICOLE FOSS	GB	130	Pre-lay jetting operations	C&I	75
Feb-23	2 Wk	CLB ULISSE	MT	400	Pre-lay jetting operations	C&I	75
Mar-23	As Nd	JOANNE MARIE	US	69	Cable operations guard vessels	C&I	77
Mar-23	4 Mo	F/V SOCATEAN	US	72	Scour protection/ safety vessel	C&I	76
Mar-23	4 Mo	F/V KATHRYN MARIE	US	74	Scour protection/ safety vessel	C&I	76
Mar-23	4 Mo	F/V BETH ANNE	US	75	Scour protection/ safety vessel	C&I	76
Mar-23	As Nd	NANTUCKET SOUND	US	75	Cable operations guard vessels	C&I	77
Mar-23	4 Mo	F/V TORBAY	US	81	Scour protection/ safety vessel	C&I	76
Mar-23	As Nd	CAPT JOSEPH E PEARCE	US	142	Cable operations guard vessels	C&I	77
Mar-23	4 Mo	FLINTSTONE	NL	507	Scour protection	C&I	76
Apr-23	4 Mo	ANGLER	US	69	Mid-section cable laying safety vessel	C&I	78
Apr-23	4 Mo	NANTUCKET SOUND	US	75	Mid-section cable laying safety vessel	C&I	78
Apr-23	4 Mo	F/W CHICAWA	US	75	Mid-section cable laying safety vessel	C&I	78
Apr-23	4 Mo	HELEN H	US	85	Mid-section cable laying safety vessel	C&I	78
Apr-23	4 Mo	MENA C	GB	87	Mid-section cable laying operations	C&I	78
Apr-23	4 Mo	MARTINE P	GB	87	Mid-section cable laying operations	C&I	78
Apr-23	4 Mo	FINN FALGOUT	US	142	Mid-section cable laying operations	C&I	78
Apr-23	4 Mo	CLB ULISSE	MT	400	Mid-section cable laying operations	C&I	78
May-23	10 Dy	F/V HEATHER LYNN	US	82	Spring trawl survey	S&S	82
May-23	1 Wk	F/V HORIZON	US	85	Drop camera surveys	S&S	79

Table C-1 continued

Date	Duration	Vessel	Flag	LOA (Ft)	Service	Phase	Notice
May-23	8 Mo	F/V SOCATEAN	US	72	MP's, TP's OSSS Support	C&I	83
May-23	8 Mo	F/V KATHRYN MARIE	US	74	MP's, TP's OSSS Support	C&I	83
May-23	8 Mo	F/V BETH ANNE	US	75	MP's, TP's OSSS Support	C&I	83
May-23	8 Mo	F/V TORBAY	US	81	MP's, TP's OSSS Support	C&I	83
May-23	8 Mo	F/V JACK M	US	84	MP's, TP's OSSS Support	C&I	83
May-23	8 Mo	F/V ATLANTIC	US	97	MP's, TP's OSSS Support	C&I	83
May-23	8 Mo	OSV ATLANTIC OCEAN	US	253	MP's, TP's OSSS Support	C&I	83
May-23	8 Mo	NORTHSTAR NAVIGATOR	US	265	MP's, TP's OSSS Support	C&I	83
May-23	8 Mo	ORION	BE	710	MP's, TP's OSSS Installation	C&I	83
May-23	8 Mo	GPO AMETHYST	MH	738	MP's, TP's OSSS Support	C&I	83
Jun-23	3 Mo	ANGLER	US	69	Temporary cable obstructions	C&I	84
Jul-23	5 Dy	GASPEE	US	135	Pre-lay multibeam survey operation	C&I	86
Jul-23	3 Wk	GO AMERICA	US	146	Inter-array cable pre-lay grapnel run	C&I	88
Aug-23	1 Wk	F/V HEATHER LYNN	US	82	Summer trawl survey 2023	S&S	91
Aug-23	3 Mo	SEACOR HAWK	US	138	J/U Electrical Service Platform (ESP) Ops	C&I	90
Aug-23	3 Wk	GO AMERICA	US	146	Buoy based acoustic detection system	C&I	92
Aug-23	2 Wk	CLV GIULIO VERNE	IT	437	(ESP) Export Cable Pull-ins	C&I	89
Sep-23	4 Mo	EARL W REDD	US	89	Tower and WTG Installation/Tug	C&I	93
Sep-23	4 Mo	HAWAII FOSS	US	105	Tower and WTG Installation/Tug	C&I	93
Sep-23	4 Mo	NICOLE FOSS	US	130	Tower and WTG Installation/Tug	C&I	93
Sep-23	4 Mo	MICHELE FOSS	US	130	Tower and WTG Installation/Tug	C&I	93
Sep-23	4 Mo	CADE CANDIES	US	200	Tower and WTG Installation/Crew Transfer	C&I	93
Sep-23	4 Mo	MARMAC 400	US	400	Tower and WTG Installation/Feeder Barge	C&I	93
Sep-23	4 Mo	PREVAILING WINDS	US	400	Tower and WTG Installation/Feeder Barge	C&I	93

Table C-1 continued

Date	Duration	Vessel	Flag	LOA (Ft)	Service	Phase	Notice
Sep-23	4 Mo	SEA INSTALLER	DK	434	Tower and WTG Installation	C&I	93
Sep-23	1 Mo	ISSAC NEWTON	LU	453	Cable Laying (Inter-Array Cables)	C&I	95
Sep-23	1 Mo	F/V SEAFARER	US	76	Safety Vessel - Cable Laying and Tranching	C&I	95
Sep-23	1 Mo	C-PIONEER	US	260	Cable Laying & Pulling Support	C&I	95
Sep-23	1 Mo	ADHEMAR De Saint-Venant	LU	312	Cable Trenching and Burial Works	C&I	95

Flags: US (United States), GB (United Kingdom), BS (Bahamas), PA (Panama), NO (Norway), MH (Marshall Islands), CA (Canada), NL (Netherlands), MT (Malta), BE (Belgium), IT (Italy), DK (Denmark), LU (Luxembourg)

Phase: S&S (Site Assessment & Survey), C&I (Construction & Installation)

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