Sunrise Wind Farm Project

Appendix O1
Marine Mammal, Sea Turtle, and ESA-Listed Fish Assessment

Prepared for:

Sunrise Wind | Powered by Ørsted & Eversource

August 23, 2021

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Marine Mammals, Sea Turtles, and ESA-Listed Fish Species Assessment

Sunrise Wind Farm

August 2022

Prepared for:

Sunrise Wind LLC

Prepared by:

Stantec Consulting Services Inc.

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Abbreviations

AMAPPS	Atlantic Marine Assessment Program for Protected Species
ASMFC	Atlantic States Marine Fisheries Commission
BOEM	Bureau of Ocean Energy Management
CETAP	Cetacean and Turtle Assessment Program
CFCS	Center for Coastal Studies
CFR	Code of Federal Regulations
COP	Construction and Operations Plan
CRESLI	Coastal Research and Education Society of Long Island
dB	decibels
DC	direct current
DP	dynamic positioning
DPS	distinct population segment
EA	environmental assessment
EFH	essential fish habitat
EIS	environmental impact statement
EMF	electric and magnetic fields
EO	Executive Order
EPA	United States Environmental Protection Agency
ESA	*Endangered Species Act*
G&G	geophysical and geotechnical
ft	feet
HF	high frequency
Hz	hertz

ICW	intracoastal waterway
IAC	Inter-Array Cables
IHA	Incidental Harassment Authorization
IPF	Impact-Producing Factor
IUCN	International Union for Conservation of Nature
JASCO	JASCO Applied Sciences
kHz	kilohertz
km	kilometer(s)
kV	kilovolt(s)
kW	kilowatt(s)
LF	low frequency
LOA	Letter of Authorization
m	meter(s)
m/s	meters per second
MA	Massachusetts
MA WEA	Massachusetts Wind Energy Area
mi	statute miles
mm	millimeter(s)
MMPA	*Marine Mammal Protection Act*
MSFCMA	*Magnuson-Stevens Fishery Conservation and Management Act*
μPa	micropascal
NEFSC	Northeast Fisheries Science Center
NEPA	*National Environmental Policy Act*
NHESP	Natural Heritage and Endangered Species Program
nm	nautical miles

NMFS or 'NOAA Fisheries'	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRC	National Research Council
NY	New York
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSERDA	New York State Energy Research and Development Authority
O&M	operations and maintenance
OBIS-SEAMAP	Ocean Biodiversity Information System Spatial Ecological Analysis of Megavertebrate Populations
OCS	outer continental shelf
OCS–DC	Offshore Converter Station
OnCS–DC	Onshore Converter Station
OPA	[New York] offshore planning area
OSAMP	Ocean Special Area Management Plan
PAM	passive acoustic monitoring
PBR	Potential Biological Removal
PSO	Protected Species Observer
PTS	permanent threshold shift
RI	Rhode Island
RI-MA WEA	Rhode Island/Massachusetts Wind Energy Area
rms	root-mean-square
SAMP	Special Area Management Plan
SAR	stock assessment report
SEFSC	Southeast Fisheries Science Center

SEL	sound exposure level
SL	source level
SMA	seasonal management area
SPL	sound pressure level
SRWEC	Sunrise Wind Export Cable
SRWF	Sunrise Wind Farm
TJB	transition joint bay
TTS	temporary threshold shift
US	United States
USFWS	United States Fish and Wildlife Service
WEA	Wind Energy Area
WTG	wind turbine generator

1.0 INTRODUCTION

1.1 PROJECT OVERVIEW

Sunrise Wind LLC (Sunrise Wind), a 50/50 joint venture between Orsted North America Inc. (Orsted NA) and Eversource Investment LLC (Eversource), proposes to construct, own, and operate the Sunrise Wind Farm Project (the Project). The Project will be located in federal waters on the Outer Continental Shelf (OCS) in the designated Bureau of Ocean Energy Management (BOEM) Renewable Energy Lease Area OCS-A 0487[1] (Lease Area) approximately 18.9 statute miles (mi) (16.4 nautical miles [nm], 30.4 kilometers [km]) south of Martha's Vineyard, Massachusetts (MA), approximately 30.5 mi (26.5 nm, 48.1 km) east of Montauk, New York (NY), and 16.7 mi (14.5 nm, 26.8 km) from Block Island, Rhode Island (RI) as measured to the nearest Wind Turbine Generator (WTG). Components of the Project will be located in federal waters on the OCS, in state waters of New York, and onshore in Smith Point and the Town of Brookhaven, Long Island, NY. The Sunrise Wind Export Cable (SRWEC) will traverse both federal waters and state territorial waters of New York (SRWEC–OCS, SRWEC–NYS), illustrated below in Figure 1.1-1 and Figure 1.1-2.

[1] A portion of Lease Area OCS-A 0500 (Bay State Wind LLC) and the entirety of Lease Area OCS-A 0487 (formerly Deepwater Wind New England LLC) were assigned to Sunrise Wind LLC on September 3, 2020, and the two areas were merged and a revised Lease OCS-A 0487 was issued on March 15, 2021. Thus, in this report, the term "Lease Area" is used to refer to the new merged Lease Area OCS-A 0487.

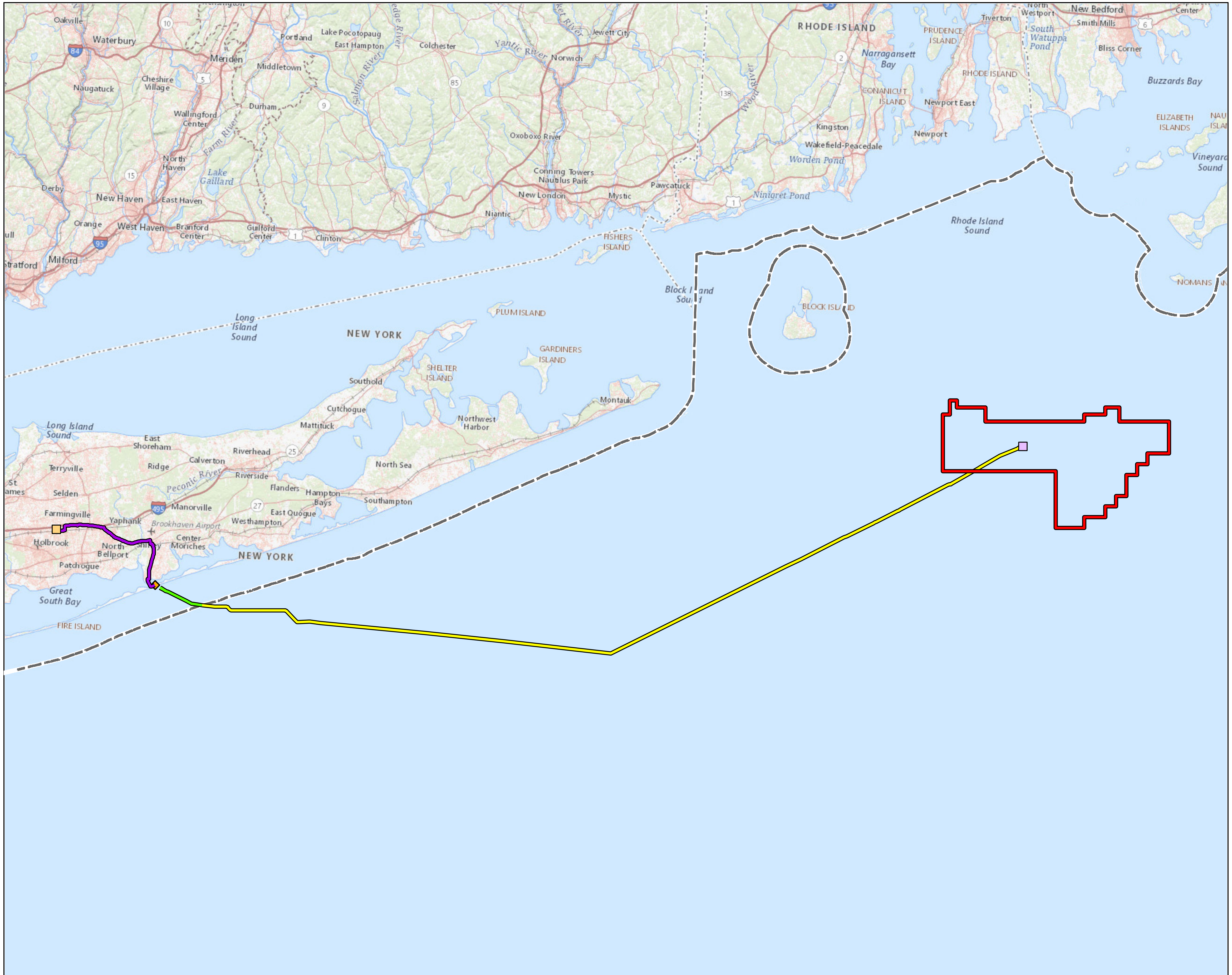

Figure 1.1-1
Project Area Location

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Legend

- Sunrise Wind Farm (SRWF)
- Offshore Converter Station (OCS–DC)
- SRWEC Landfall Location
- Onshore Converter Station (OnCS–DC)
- Sunrise Wind Export Cable (SRWEC–OCS)
- Sunrise Wind Export Cable (SRWEC–NYS)
- Onshore Transmission Cable LIE Service Road Route
- 3-nm State Waters Boundary

Note
Routes are indicative and subject to engineering design changes.

Sources
1. Base map: USGS The National Map

Date	12/18/2020 Revised: 6/1/2021
Project Number	2028113199
Prepared By	GC
Reviewed By	LJ

0 10 miles
0 8 nm
0 16 km

N

Scale at 11x17: 1:676,500
NAD 1983 2011 UTM Zone 19N

REFERENCE MAP

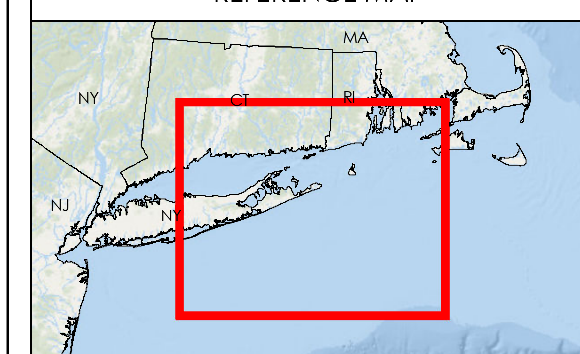

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Figure 1.1-2
Onshore Facilities

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Legend

- Sunrise Wind Farm (SRWF)
- Sunrise Wind Export Cable (SRWEC–OCS)
- Sunrise Wind Export Cable (SRWEC–NYS)
- Landfall HDD A
- Intracoastal Waterway HDD (ICW HDD)
- Onshore Transmission Cable LIE Service Road Route
- Onshore Interconnection Cable Route
- Union Avenue Site / Onshore Converter Station (OnCS–DC)
- Holbrook Substation

Notes
1. Routes are indicative and subject to engineering design changes.

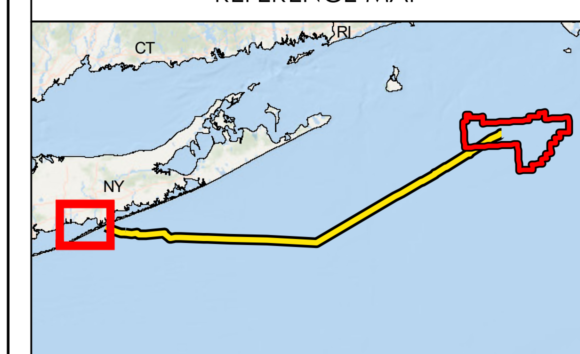
Sources
Base map: USGS The National Map

Date	07/11/2022
Project Number	2028113199
Prepared By	PB
Reviewed By	LJ

0 — 1 mile
0 — 1.5 km
N

Scale at 11x17: 1:63,360
NAD 1983 2011 UTM Zone 18N

REFERENCE MAP



The Project will specifically include the following offshore and onshore components:

- Onshore:
  - Onshore Transmission Cable, transition joint bays (TJBs) and concrete and/or direct buried joint bays and associated components
  - Onshore Interconnection Cable
  - Fiber optic cable co-located with the Onshore Transmission and Onshore Interconnection Cables
  - One Onshore Converter Station (OnCS–DC)
- Offshore:
  - Up to 94 WTGs at 102 potential positions
  - Up to 95 foundations (for WTGs and an Offshore Converter Station [OCS–DC])
  - Up to 180 mi (290 km) of Inter-Array Cables (IAC)
  - One OCS–DC
  - One direct current (DC) SRWEC located within an up to 104.6-mi (168.4-km)-long corridor

The Project's Construction and Operations Plan (COP) summarizes the siting and development process and provides a detailed description of the construction, operations and maintenance (O&M), and decommissioning activities associated with the proposed offshore and onshore Project facilities. It also sets forth analyses of potential environmental, visual, cultural, socioeconomic, and transportation and navigation-related impacts of the Project.

1.2 CONTENTS OF THE TECHNICAL REPORT

This Technical Report is intended to provide additional background information in support of the assessment of marine mammal, sea turtle, and threatened and endangered fish species, as presented in the Project COP. Specifically, this Technical Report provides:

1. A description of the regulatory background surrounding marine mammal, sea turtle, and fish species.
2. An overview of the underwater acoustic environment, its importance to marine animals, and potential impacts of anthropogenic noise on marine wildlife.
3. A detailed description of the life history and documented occurrences of marine mammals, sea turtles, and ESA-listed fish species (i.e., those that are listed under the *Endangered Species Act* of 1973, as amended) with the potential to be present in the Project Area.
4. A summary of proposed avoidance, minimization, mitigation, and monitoring measures to be implemented during Project activities to reduce the potential for impacts to marine mammals, sea turtles, and ESA-listed fish species.

While the Project COP addresses all of the identified impact producing factors (IPFs) associated with the construction and O&M of the Project, the underwater noise IPF is highlighted in this report to allow for a more thorough discussion of the regulatory context and breadth of means by which marine wildlife may be vulnerable to this IPF. Owing to the highly technical nature of the assessment of noise, this discussion is also supported by COP Appendix I1 – *Underwater Noise and Acoustic Exposure* (Denes 2020) and COP Appendix I4 – Underwater Acoustic Modeling of Detonations of Unexploded Ordnance (UXO) (Hannay and Zykov 2022), which present the acoustic regulatory criteria and results of JASCO Applied Sciences (JASCO)'s Project-specific underwater noise modeling. Overall assessment of potential impacts to fish, marine mammals, and sea turtles can be found in COP Sections 4.4.3, 4.4.4, and 4.4.5, respectively. Additionally, two protected species mitigation and monitoring plans were developed for the Project: COP Appendix O2 – *Marine Mammal Protected Species Mitigation and Monitoring Plan* and COP Appendix O3 – *Sea Turtle and ESA-listed Fish Protected Species Mitigation and Monitoring Plan*.

1.3 REGULATORY CONTEXT AND RESOURCE DEFINITION

The Project's COP provides the basis for assessed environmental and socioeconomic effects resulting from the Description of Proposed Activity (Section 3.0 of the COP) during construction and O&M of the Project. The COP is prepared in accordance with 30 Code of Federal Regulation (CFR) § 585, BOEM's *Information Guidelines for a Renewable Energy Construction and Operations Plan* (BOEM 2020a), and other BOEM policy, guidance and regulations (Section 1.4 of the COP). Specific requirements for submittal of marine mammal information within the COP are provided in BOEM's *Guidelines for Providing Information on Marine Mammals and Sea Turtles for Renewable Energy Development on the Atlantic Outer Continental Shelf pursuant to 30 CFR Part 585 Subpart F* (BOEM 2019a). This Technical Report considers these guidelines, which include specific assessment requirements for determining spatial and temporal distribution and abundance of marine mammal species and establishing baseline ambient sound levels and presence of vocalizing marine mammals.

The acoustic modeling presented in Denes 2020 (COP Appendix I1), in combination with the assessment provided in this Technical Report, are intended to provide BOEM with the necessary information to evaluate their permitted actions under the *National Environmental Policy Act* (NEPA), the *Marine Mammal Protection Ac*t (MMPA), and the *Magnuson-Stevens Fishery Conservation and Management Act* (MSFCMA). As discussed in Section 1.4 of the Project's COP, NEPA requires that federal actions undertake an environmental assessment (EA) to produce an Environmental Impact Statement (EIS) to determine impacts to resources.

The resources of interest in this Technical Report include marine mammals, sea turtles, and ESA-listed fish species. All marine mammal species in US waters are protected under the MMPA (16 USC §§ 1361 et seq.), and some are listed under the ESA. All sea turtle and fish species included in this assessment are listed under the ESA. Section 7 of the ESA requires that federal agencies ensure their actions do not destroy or jeopardize the existence of critical habitat of any threatened or endangered species listed under the ESA. To comply with this obligation, BOEM must also consult with National Marine Fisheries Service (NOAA Fisheries) or United States (US) Fish and Wildlife Service (USFWS) for actions that could affect protected marine species under NOAA Fisheries or USFWS jurisdictions (e.g., various marine mammals, sea turtles, and fish). Also included in the below analysis is the current International Union for

Conservation of Nature (IUCN) Red List status for each species to provide a global understanding of populations. However, it should be noted that in the US, species are regulated under their associated ESA-listing status and not their global IUCN Red List status.

The MMPA requires any project activities that may produce noise be assessed for the potential “take” of marine mammals, as defined in the MMPA, and provided to NOAA Fisheries for approval. The MMPA prohibits the “take” of marine mammals, which is defined under the MMPA as the harassment, hunting, or capturing of marine mammals, or the attempt thereof. Under the MMPA, Level A harassment is statutorily defined as any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild; however, the actionable sound pressure level is not identified in the statute. Level B harassment is defined as any act of pursuit, torment, or annoyance that has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.

The ESA and MMPA work to control harm, takes, and harassment of all federally-listed (ESA) threatened and endangered marine mammals, sea turtles or fish or other (MMPA) marine mammals occurring within US Exclusive Economic Zone waters. Potential IPFs associated with the construction and O&M of the Project that could result in “take” of threatened or endangered marine mammals, sea turtles, or fish as defined by the ESA or MMPA include:

- Direct mortality, injury, or disturbance due to vessel movement or vessel strike (i.e., traffic IPF)
- Direct mortality or injury from entanglement (i.e., trash and debris, traffic IPFs)
- Disturbance or displacement of habitat (i.e., seafloor and land disturbance, sediment suspension and deposition, and visible infrastructure IPFs) and associated changes in prey availability
- Direct or indirect effects from changes in water quality due to contamination or spills (i.e., discharges and releases IPF)
- Disturbance or hearing injury from Project-related noise (i.e., noise IPF)
- Direct or indirect effects from Project operation-related electric and magnetic fields (i.e., EMF IPF).

Additionally, the MSFCMA is the primary law governing marine fisheries management in US federal waters. Managed species include marine, estuarine, and anadromous finfish; mollusks; and crustaceans. In the greater Atlantic region, management of certain fisheries with shared coastal resources is coordinated through the Atlantic States Marine Fisheries Commission (ASMFC). The MSFCMA was revised and amended in 1996 with the passage of the *Sustainable Fisheries Act* to strengthen conservation and increase the focus on sustainability, in part by requiring the identification of essential fish habitat (EFH) (16 United States Code [USC] 1801-1884). The MSFCMA was again revised and reauthorized in 2007, with additional conservation and management requirements to further the effort to reduce overfishing, support conservation, and improve fisheries science research (16 USC 1801-1884).

In the Northeastern US, the New England Fishery Management Council and Mid-Atlantic Fishery Management Council, along with NOAA Fisheries, identify and describe EFH in published fisheries management plans. EFH within the Project Area is further assessed in the COP Appendix N – *Essential Fish Habitat Assessment*).

Consultation is required for approval of a COP because the activities described therein may affect listed marine mammal, sea turtle, and fish. Additionally, this assessment is informed by extensive and ongoing engagement with other stakeholders. A summary of agency correspondence is provided in the COP Appendix A – *Agency Correspondence*.

2.0 UNDERWATER NOISE AS AN IPF

Sound is important for marine species' communication, individual recognition, predator avoidance, prey capture, orientation, navigation, mate selection, and mother-offspring bonding. Marine animals can perceive underwater noise over a broad range of frequencies, from about 10 hertz (Hz) to more than 200 kilohertz (kHz). The fact that marine mammals, sea turtles, and fish use sound for social and reproductive communication, foraging, and situational awareness, makes them susceptible to impacts from underwater noise. Where there is an overlap between anthropogenic noise sources and the frequencies of sound used by marine life, there is the potential for noise to interfere with their biological functions.

Various natural and anthropogenic activities contribute sound to the ocean, creating a complex acoustic environment. The acoustic environment is made up of concomitant noises that create regional background, or ambient, noise conditions through which discrete signals must be sent and gathered by animals adapted to living in habitats where visibility is limited, and where they must rely on acoustic cues for survival. Changes in the acoustic environment can therefore change an animal's ability to function within its given habitat.

2.1 MARINE ACOUSTIC ENVIRONMENT

The marine acoustic environment is a product of both natural processes and human activities, and sound sources can typically be divided into three general categories: physical, biological, and anthropogenic.

The prevailing sources of ambient noise in the ocean are largely a result of physical processes occurring at or near the ocean surface in the form of wind and wave activity. Sound produced by wind and waves (i.e., sea state) is generally between 100 Hz and 20 kHz, and sound levels tend to increase with increasing wind speed, wave height, or tidal action (Richardson et al. 1995; Urick 1984). Precipitation falling on the ocean's surface also contributes to natural noise in ocean environments. In general, noise from rain or hail is an important component of total noise at frequencies >500 Hz during periods of precipitation. Rain can increase natural ambient noise levels by up to 35 dB across a broad range of frequencies from several hundred Hz to more than 20 kHz (National Research Council [NRC] 2003; Richardson et al. 1995). Heavy precipitation associated with large storms can generate noise at frequencies as low as 100 Hz and can significantly affect ambient noise levels at considerable distances from the storm's center (NRC 2003). Movement of sediment by ocean currents across the ocean bottom can also be a significant source of ambient noise at frequencies from 1 kHz to more than 200 kHz (NRC 2003).

Biological noise is created by marine animals and can contribute significantly to ambient noise levels in certain areas of the ocean. Using marine autonomous recording units, Kraus et al. (2016) collected acoustic data between 2011 and 2015 within and in the vicinity of the Rhode Island/Massachusetts (RI_MA) and Massachusetts (MA) WEAs (which overlap the SRWF) to characterize the ambient noise environment and biological signals. Fin whales (*Balaenoptera physalus*) were the most commonly detected cetacean species in the RI-MA WEA and MA WEA offshore waters, but humpback (*Megaptera novaeangliae*), minke (*Balaenoptera acutorostrata*), blue (*Balaenoptera musculus*), and North Atlantic right whale (*Eubalaena glacialis*) calls were also detected. Large whale vocalizations were primarily detected in winter and spring, but fin and humpback whales were detected in all seasons, and minke whales showed a peak acoustic presence in May (BOEM 2013; Kraus et al. 2016). Although there were no confirmed acoustic detections during the recording period, visual surveys indicated that sei whales (*Balaenoptera borealis*) were also present in spring and summer, and sperm whales were observed (*Physeter macrocephalus*) in summer and autumn (Kraus et al. 2016).

Marine mammals are major contributors to the underwater soundscape, but some Crustacea (e.g., snapping shrimp [Alpheidae]) and vocalizing fish can also be a substantial source of biological noise (NRC 2003; Richardson et al. 1995). A series of buzzes, grunts, and thumps from unidentified fish species were recorded in this region, primarily between December and February (Martin et al. 2014). The only identifiable fish sounds were detected between June and August, described as a jack-hammer sound, that was thought to correspond to striped cusk eel (*Ophidion marginatum*) vocalizations (Martin et al. 2014). Additional background sound from fish grunting is likely to be present at an active Atlantic cod (*Gadus morhua*) spawning ground identified in a broad geographical area that includes Cox Ledge and surrounding locations (Zemeckis et al. 2014). Male Atlantic cod are known for producing low frequency grunts as part of the courting process. Additional information on cod at Cox Ledge can be found in the COP Section 4.4.3.

Noise generated by human activities, commonly referred to as anthropogenic noise, may be introduced into the environment for a specific purpose, such as navigational sonar and seismic exploration, or as an indirect by-product of activities such as shipping, pile driving, or other industrial activities. The propagation characteristics of these sources through the water column are determined by the local physical and environmental conditions, which influence the regional acoustic environment. Additionally, variations in local background, or ambient, noise levels as a function of frequency can change by as much as 10 to 20 dB from day to day, based on variations in the noise sources (Kraus et al. 2016; Richardson et al. 1995). Large- and small-scale temporal fluctuations (e.g., daily, seasonal) in the acoustic environment and species vocalization patterns may influence or directly affect temporal patterns in an animal’s ability to communicate and detect sounds in their environment.

Vessel noise is a primary source of anthropogenic sound that contributes to ambient ocean noise, predominantly in low-frequency (LF) bands under 500 Hz (Hildebrand 2009; NRC 2003). A large portion of the noise from vessel traffic comes from engine noise and propeller cavitation (Richardson et al. 1995). In the open water, vessel traffic can influence ambient background noise at distances of thousands of kilometers; however, the effects of vessel noise in shallower shelf and coastal waters are more variable due to physical and geological properties of the seabed, sea surface, and water column, which influence reflection, refraction, and absorption of sound in the water.

Underwater noise sources associated with the Project include vessels during all Project phases, impact pile driving during the construction phase, WTG operation during O&M, and HRG surveys prior to and during construction, and to assess cable burial during O&M. Overall, the potential for impacts of underwater noise from these sources on marine species is highly dependent on the equipment and circumstances of each exposure situation. The COP Appendix I1 used site-specific information to predict the distances to regulatory threshold criteria for impact pile driving of monopiles, which assisted in defining the expected impacts specific to this Project.

2.2 POTENTIAL IMPACTS FROM UNDERWATER NOISE

A temporary behavioral response by marine mammals, sea turtles, and fish is the most likely impact from noise introduced during construction and operation of the Project. However, there is a potential for more severe effects (e.g., temporary or permanent hearing loss) if animals are present within areas of elevated noise levels. The occurrence and severity of impacts are uniquely dependent on environmental, physiological, and contextual factors; however, the magnitude and probability of most effects generally decrease with increasing distance from a source, and the potential for more severe impacts is further reduced by the implementation of environmental protection measures such as noise attenuation systems.

The general impacts of hearing impairment, injury, auditory masking, stress and behavioral responses, and reduction in prey availability are discussed in the sections below. While most available references focus on impacts on marine mammal species, the general impact categories also apply to sea turtles and fish.

2.2.1 Hearing Threshold Shifts

The minimum sound level an animal can hear at a specific frequency is called a hearing threshold. Sound levels above a hearing threshold are accommodated until a certain level of sound intensity or duration is reached, after which the ear's hearing sensitivity decreases (i.e., the hearing threshold increases) (Southall et al. 2007, 2019). This process is referred to as a threshold shift, meaning that only sounds louder than this new threshold will be heard within a given frequency range following the shift.

Threshold shifts can be temporary (TTS) or permanent (PTS) and are defined as follows (Au and Hastings 2008; NOAA Fisheries 2018; Southall et al. 2007, 2019):

- **TTS**—also known as auditory fatigue, is the milder form of hearing impairment, or threshold shift, that is non-permanent and reversible. It results from exposure to high intensity sounds for short durations or lower intensity sounds for longer durations. Both conditions are species-specific and lead to an elevation in the hearing threshold, meaning it is more difficult for an animal to hear sounds. TTS can last for minutes, hours, or days; the magnitude of the TTS depends on the level (frequency and intensity), energy distribution, and duration of the noise exposure, among other considerations.

- **PTS**—is a permanent elevation in hearing threshold (i.e., permanent loss of hearing), which is considered an auditory injury. PTS is attributed to exposure to very high zero to peak sound pressure levels ($SPL_{0\text{-}pk}$) and rapid increases in intensity, or very prolonged or repeated exposures to noise strong enough to elicit TTS. Permanent damage to the inner ear such as irreparable damage to sensory hair cells in the cochlea is associated with noise-induced PTS. Because few direct data are currently available regarding noise levels that might induce PTS in marine mammals, sea turtles, and fish, PTS onset thresholds are inferred from TTS onset data (NOAA Fisheries 2018; Popper et al. 2014). For impulsive sources, dual metric criteria, $SPL_{0\text{-}pk}$ and cumulative sound exposure level (SEL_{cum}), are often used to define PTS onsets, as well as the incorporation of applicable frequency weighting functions (e.g., M-weighting for marine mammals) to account for the differential hearing abilities in the different functional hearing groups or species (NOAA Fisheries 2018; Popper et al. 2014).

Acoustic thresholds for evaluating potential injury in marine mammals, sea turtles, and fish are described and assessed in greater detail in Appendix I1 of the COP.

2.2.2 Barotrauma

Barotrauma is the result of rapid and instantaneous changes in the ambient pressure level in the water and within the fluids and tissue of an animal, causing physical injury to soft tissue and organs. Barotrauma injuries involve the swim bladder (fish), lungs (marine mammals and sea turtles), or dissolved gases in the blood and tissues. Depending on the affected tissues or organs, the resulting injuries may be mild (e.g., external fin hematoma; deflated, but not ruptured swim bladder or lung), moderate (e.g., renal, intestinal, muscular hematoma), or lethal (e.g., pericardial or cerebral hemorrhage, gill embolism, ruptured swim bladder or lung) (Brown et al. 2012; Christian 1973; Gaspin 1975; Goertner 1978; Rummer and Bennett 2005; Yelverton et al. 1975).

With the implementation of environmental protection measures (e.g., ramp-up/soft-start procedures, and monitored exclusion zones or safety zones [see Section 4.0]), exposure of marine mammals and sea turtles to impulsive sound levels capable of causing barotrauma is not expected; therefore, barotrauma is only discussed below within the context of potential impacts to fish that are in close proximity to an impulsive noise (Carlson 2012; Halvorsen et al. 2012a, b).

A controlled exposure laboratory study by Halvorsen et al. (2012a) exposed several fish species to an underwater SEL_{cum} ranging from 204 to 216 dB re 1 μPa^2 s (decibels relative to one micropascal squared second). At SEL_{cum} greater than 210 dB re 1 μPa^2 s, lake sturgeon (*Acipenser fulvescens*), whose swim bladder is not involved in hearing like Atlantic sturgeon, experienced recoverable barotrauma injuries characterized by hematomas on the swim bladder, kidney, and intestine, and a partially deflated swim bladder, but showed no external or mortal injuries. Conversely, Nile tilapia (*Oreochromis niloticus*) have a swim bladder that is involved in hearing, and they were shown to be more vulnerable to barotrauma at a relatively lower SEL_{cum}. They exhibited recoverable injuries including gonadal and swim bladder hematoma at 207 to 210 dB re 1 μPa^2 s, and lethal injuries such as a ruptured swim bladder and renal hemorrhage at 213 to 216 dB re 1 μPa^2 s. By contrast, no internal or external barotrauma injuries were observed at any of the SEL_{cum} for hogchoker (*Trinectes maculatus*), a flatfish that lacks a swim bladder

(Halvorsen et al. 2012a). Although this study was conducted in a controlled laboratory setting, it replicated acoustic conditions in the field.

Barotrauma injuries may be more severe for fish exposed to fewer hammer blows at higher energy versus a greater number of hammer blows at lower energy, even when the SEL_{cum} are equivalent. In a study by Halvorsen et al. (2012b), juvenile Chinook salmon (*Oncorhynchus tshawytscha*) were exposed to underwater SEL_{cum} ranging from 204 to 220 dB re 1 μPa^2 s and $SPL_{0\text{-}pk}$ ranging from 199 to 213 dB re 1 μPa. The fish exposed to SEL_{cum} between 213 and 220 dB re 1 μPa^2 s and $SPL_{0\text{-}pk}$ between 210 and 213 dB re 1 μPa exhibited a greater number of barotrauma injuries, specifically those that were classified as moderate or having the potential to cause lethal effects.

2.2.3 Auditory Masking

In addition to affecting hearing through physical injury, noise can partially or completely reduce an individual's ability to effectively transmit and receive acoustic signals important for detecting predator, prey, conspecific signals, and environmental features associated with spatial orientation (Clark et al. 2009). This phenomenon is defined as auditory masking, where a reduction in the detectability of a sound signal of interest (e.g., communication calls, echolocation) occurs due to the presence of another sound, which is usually part of ambient noise in the environment, that often occurs for sounds with similar frequency ranges. Under normal circumstances, in the absence of high ambient noise levels, an animal would hear a sound signal if it is above its absolute hearing threshold. Auditory masking prevents part or all of a sound signal from being heard and decreases the distances over which sounds can be detected by an animal (i.e., reduction in communication space). These effects could cause a long-term decrease in an animal's efficiency at foraging, navigating, or communicating (International Council for the Exploration of the Sea [ICES] 2005).

Empirical evidence from studies of captive bottlenose dolphins, beluga whales (*Delphinapterus leucas*), and killer whales (*Orcinus orca*), confirms that the degree of masking depends strongly on the relative directions at which noise arrives and the characteristics of the masking sound (Bain et al. 1993; Bain and Dahlheim 1994; Dubrovskiy 1990; Penner et al. 1986).

Ambient noise from natural and anthropogenic sources can result in masking for marine animals, effectively interfering with the ability of an animal to detect a sound signal that it otherwise would hear. Spectral, temporal, and spatial overlap between the masking sound and the signal of interest determines the extent of interference: the greater the spectral and temporal overlap, the greater the potential for masking. As discussed in Section 2.1, naturally occurring ambient noise is produced by various sources including environmental noise from wind, waves, and precipitation; thermal noise resulting from molecular agitation (at frequencies above 30 kHz); and biological noise produced by animals (Richardson et al. 1995). Biological sounds are commonly produced by fish, for example, which create LF sounds (50 to 2,000 Hz, most often from 100 to 500 Hz) that can be a significant component of local acoustic environments (Martin et al. 2014; Zelick et al. 1999).

Anthropogenic sources known to contribute to ambient sound levels can include vessels, sonar (military and commercial), geophysical surveys, acoustic deterrent devices, construction noise, and scientific research sensors. Ambient noise is highly variable in the shallower waters over continental shelves where many anthropogenic activities occur, effectively enabling anthropogenic noise to cover a wide range of sound levels and frequencies in these habitats (Desharnais et al. 1999).

In coastal waters, noise from boats and ships, particularly commercial vessels, is the predominant source of anthropogenic noise (MacGillivray et al. 2017; Parks et al. 2011; Wright 2008). Over the past 50 years, commercial shipping, the largest contributor of anthropogenic sound, has increased the ambient sound levels in the deep ocean at LFs by 10 to 15 dB re 1 µPa (McDonald et al. 2008). This increase in LF ambient noise coincides with a significant increase in the number and size of vessels making up the world's commercial shipping fleet (Hildebrand 2009). Tournadre (2014) estimated from satellite altimetry data that, globally, vessel traffic grew by approximately 60 percent from 1992 to 2002 at a nearly constant rate of approximately 6 percent per year; however, after 2002, the rate of increase in vessel traffic rose steadily to more than 10 percent by 2011, except in 2008 and 2009 when traffic remained steady. The highest estimated rate of growth was in the Indian and western North Pacific Oceans, especially in the continental seas along China; the rate of growth in shipping in the Atlantic Ocean and Mediterranean Sea, however, decreased after 2008.

2.2.4 Stress and Behavioral Responses

Stress and behavioral changes are the result of marine animals, sea turtles, and/or ESA-listed fish responding to extreme or excessive disturbances in their environment, either of natural or anthropogenic origin. Stress responses are typically physiological changes in an animal's blood chemistry while behavioral responses involve changes in an animal's normal actions.

2.2.4.1 Marine Mammals

Marine mammals have been shown to respond to environmental stress by releasing biochemicals into their bloodstream, and measuring changes in an animal's blood chemistry can determine if there is a stress response. Stress responses in marine mammals are immediate, acute, and characterized by the release of neurohormones such as norepinephrine, epinephrine, and dopamine (Office of Naval Research 2009). The NRC (2003) examined acoustically induced stress in marine mammals and determined that a one-time exposure to noise was less likely to have detrimental population-level effects than repeated exposure over extended periods. Various researchers have summarized the available evidence regarding stress induced events in marine mammals (e.g., Cowan and Curry 2008; Eskesen et al. 2009; Mashburn and Atkinson 2008; Romano et al. 2004).

Romano et al. (2004) examined the levels of three stress-related blood hormones (norepinephrine, epinephrine, and dopamine) in a beluga whale after exposure to varying $SPL_{0\text{-}pk}$ signals produced by a seismic water gun between 198 and 226 dB re 1 µPa. Hormone levels were measured after a control, low-level sound, and a high-level sound exposure. No significant differences in the hormone blood concentrations were found between the control and low-level sound exposure, but elevated levels of all three hormones were measured in response to the high-level sound exposure. Furthermore, a regression analysis demonstrated a linear trend between increased hormone levels in the blood and sound levels. They also noted that no quantitative approach to estimating changes in mortality or fecundity due to stress has been identified, but qualitative effects may include increased susceptibility to disease and early termination of pregnancy.

Following the terrorist attacks of September 11, 2001, shipping traffic dramatically decreased in the Bay of Fundy, Canada, resulting in a 6-dB decrease in ambient underwater noise levels including a significant reduction in frequencies below 150 Hz associated with vessel traffic. Decreased baseline levels of stress-related hormone metabolites in North Atlantic right whales were also observed during this period, which was thought to be the result of reduced noise levels (Rolland et al. 2012). This reduction in ambient noise levels associated with shipping was the first evidence that exposure to LF noise from shipping may be associated with chronic stress in whales, particularly North Atlantic right whales (Rolland et al. 2012).

Disturbances can also cause subtle to extreme changes in normal behavior of marine mammals, with some behavioral responses resulting in biologically significant consequences. Behavioral responses including startle, avoidance (i.e., changes in swim speed and direction), displacement, diving, and vocalization alterations have been observed in marine animals. In some cases, these have occurred at ranges of tens to hundreds of kilometers from the sound source (Gordon et al. 2004; Miller et al. 2014; Tyack 2008). However, behavioral observations are variable, findings are contradictory, and the biological significance of the effects are not fully quantified (Gordon et al. 2004). Behavioral reactions of animals to noise are difficult to predict because reactions depend on numerous factors including the species being evaluated; the animal's state of maturity, prior experience with or exposure to anthropogenic noises, current activity patterns, and reproductive state; time of day; and weather state (Wartzok et al. 2004). There is also the potential for differences in observed responses among individuals of the same species (Castellote et al. 2014). If a marine mammal reacts to underwater noise by changing its behavior or moving to avoid the sound, the impacts of that change may not be important to the individual, the stock, or the population as a whole. However, if a sound source displaces animals from an important feeding or breeding area, impacts on individuals and the population could be significant.

For marine mammals, assessing the severity of behavioral effects associated with anthropogenic noise exposure presents unique challenges due to the inherent complexity of behavioral responses and the contextual factors affecting them, both within and between individuals and species. Severity of responses can vary depending on characteristics of the sound source including whether it is moving or stationary, the number and spatial distribution of sound source(s), its similarity to predator sounds, and other relevant factors (Barber et al. 2010; Bejder et al. 2009; Ellison et al. 2012; NRC 2005; Richardson et al. 1995; Southall et al. 2007).

Many examples have been reported of individuals of the same species exposed to the same noise reacting differently (Nowacek et al. 2004), as well as different species reacting differently to the same noises (Bain and Williams 2006). Odontocetes appear to exhibit a greater variety of reactions to anthropogenic noise than mysticetes. Odontocete reactions can vary from approaching vessels (e.g., bow riding) to strong avoidance. Richardson et al. (1995) noted that most small and medium-sized odontocetes exposed to prolonged or repeated underwater noises are unlikely to be displaced unless the overall received SPL is at least 140 dB re 1 μPa.

2.2.4.2 Sea Turtles

Limited data exist on sound levels that may induce stress or behavioral changes in sea turtles, and no data exist on population impacts from acoustic disturbance in sea turtles (Nelms et al. 2016). Lavender et al. (2011) collected behavior audiograms from sea turtles and found that loggerheads (*Caretta caretta)* may be more sensitive to behavioral disturbance from underwater sound than electrophysiological studies suggest. Avoidance responses by sea turtles to seismic signals have been observed at received SPL between 166 and 179 dB re 1 µPa (McCauley et al. 2000); however, these studies were done in a caged environment, so the extent of avoidance could not be fully monitored. During experiments using airguns to repel sea turtles from dredging operations, Moein et al. (1995) observed a habituation effect to seismic sounds; the animals stopped responding to the signal after three presentations, although it was not clear whether this was a result of behavioral habituation or physical effects from TTS or PTS.

As a part of the Gulf of Mexico OCS proposed geophysical and geotechnical (G&G) surveys, vessel and equipment noise impacts to sea turtles were assessed. Researchers assumed a conservative approach that noise associated with the G&G survey and support vessels could elicit behavioral changes likely limited to evasive maneuvers including diving, changes in swimming direction, or changes in swimming speeds to vacate the surrounding area (BOEM 2017). These behavioral responses were not expected to adversely affect individuals or populations. Similarly, when assessing potential impacts from the future development of the Vineyard Wind Offshore Wind Farm, it was determined that anthropogenic noise associated with the construction and operation of the project would potentially result in sea turtle altered submergence patterns, short-term disturbances such as startle responses, short-term displacement of feeding and migrating habitat, a temporary stress response, and potential auditory injury (BOEM 2020b; NSF and USGS 2011; Samuel et al. 2005).

2.2.4.3 ESA-Listed Fish

Anthropogenic noise in aquatic environments has also been demonstrated to elicit a stress response in fish. This response has been measured in terms of short-term (i.e., less than 1 hour) indicators such as a startle response, increased gill ventilation, increased heart rate and blood pressure, increased plasma cortisol and glucose levels, and increased oxygen intake, and long-term (i.e., days to months) indicators including reduced foraging, growth and reproductive fitness, diminished immune response, and increased vulnerability to predation (Bruintjes et al. 2016a, b; Sierra-Flores et al. 2015; Simpson et al. 2016; Smith et al. 2004). Temporary stressors such as impact pile driving and vessel noise may cause a short-term stress response in fish, but the potential for these activities to cause longer term growth and fitness consequences has not been demonstrated in a field setting. In general, fish may acclimate to long-term exposure to acoustic stressors (Schreck 2000). Goldfish (*Carassius auratus*) exposed to long-term, continuous sound sources, such as the hum or vibration of vessel traffic at SPLs of 160 to 170 dB re 1 µPa, exhibited a short-term stress response characterized by increased cortisol and glucose levels, but they did not exhibit a long-term physiological stress response (Smith et al. 2004).

Most fish species are relatively insensitive to sound pressure, and hearing frequency range is primarily limited to frequencies between 100 and 800 Hz (Hawkins et al. 2020). These species are also considered to be more sensitive to particle motion than sound pressure; however, there are limited studies on fish responses to particle motion (see Section 4.3 of the COP) and importantly, no criteria have been developed to evaluate impacts. Sturgeon have relatively poor hearing, with sensitivities in the low-frequency range from about 50 Hz to 800 Hz, and peak sensitivity between 200 and 300 Hz (Lovell et al. 2005b). The sturgeon's swim bladder is not directly connected to the inner ear, which limits its hearing ability relative to fish species that do have this direct connection. Sturgeon are therefore less sensitive to sound pressure, which is the basis for the biological thresholds used to evaluate potential acoustic impacts to fish, and better adapted to the detection of particle motion (Meyer et al. 2011). However, elevated sound pressure levels may still affect sturgeon due to the presence of the air-filled swim bladder. Overall, it is more likely that fish will experience sub-lethal impacts that increase the possibility for delayed mortality (Hawkins et al. 2014). Because the majority of Project construction sources produce low frequency (LF) noise that is within the sensitive hearing range of most fish, and most of the sources are non-impulsive, the potential for fish to experience TTS, masking, and behavioral impacts is higher than permanent injury or mortality.

2.2.5 Reduction of Prey Availability

There are limited data on hearing mechanisms and potential effects of noise on prey species of marine mammals and sea turtles (i.e., crustaceans and cephalopods). These species have been increasingly researched as concern has grown related to noise impacts on the food web. Invertebrates appear to be able to detect sounds and particle motion (André et al. 2016; Budelmann 1992; Solé et al. 2016, 2017) and are most sensitive to LF sounds (Budelmann and Williamson 1994; Lovell et al. 2005a, b; Mooney et al. 2010; Packard et al. 1990). Reduction of prey availability could affect marine mammals and sea turtles if rising sound levels alter prey abundance, behavior, and distribution (McCauley et al. 2000; Popper and Hastings 2009; Slabbekoorn et al. 2010).

A variety of research has been conducted on how cephalopods and decapods receive, and are impacted by, underwater noise. The following studies summarize existing data:

2.2.5.1 Cephalopods

- Packard et al. (1990) showed that three species of cephalopod (common cuttlefish [*Sepia officinalis*], common octopus [*Octopus vulgaris*], and European squid [*Loligo vulgaris*]) were sensitive to particle motion rather than sound pressure, with the lowest particle acceleration thresholds reported at 1 to 2 Hz.
- In longfin squid (*Loligo pealeii*), Mooney et al. (2010) measured particle acceleration thresholds at lower frequencies between 100 and 300 Hz and reported an SPL threshold of 110 dB re 1 µPa at 200 Hz.
- Solé et al. (2017) showed that SPL ranging from 139 to 142 dB re 1 µPa at one-third octave bands centered at 315 Hz and 400 Hz may be suitable threshold values for trauma onset in cephalopods.

- Hearing thresholds at higher frequencies have been reported, such as 134 and 139 dB re 1 μPa at 1,000 Hz for the oval squid (*Sepioteuthis lessoniana*) and the common octopus, respectively (Hu et al. 2009).
- Cephalopods have exhibited behavioral responses to low frequency sounds (less than 1,000 Hz) including inking, locomotor responses, body pattern changes, and changes in respiratory rates (Hu et al. 2009; Kaifu et al. 2008).
- McCauley et al. (2000) reported that caged squid exposed to seismic airguns showed behavioral responses such as inking. Wilson et al. (2007) exposed two groups of longfin squid in a tank to killer whale echolocation clicks at SPL from 199 to 226 dB re 1 μPa, which resulted in no apparent behavioral effects or any acoustic debilitation. However, both the McCauley et al. (2000) and Wilson et al. (2007) experiments used caged squid, so it is unclear how unconfined animals would react.
- André et al. (2011) exposed four cephalopod species (European squid, common cuttlefish, common octopus, and Southern shortfin squid [*Ilex coindetii*]) to 2 hours of continuous noise from 50 to 400 Hz at received SPL of 157 dB re 1 μPa, and reported lesions occurring on the sensory hair cells of the statocyst that increased in severity with time, suggesting that cephalopods are particularly sensitive to LF sound. Similarly, Solé et al. (2013) conducted an LF (50 to 400 Hz) controlled exposure experiment on two deep-diving squid species (Southern shortfin squid and European squid), which resulted in lesions on the statocyst epithelia. Solé et al. (2013) described their findings as “morphological and ultrastructural evidence of a massive acoustic trauma induced by…low-frequency sound exposure.”
- In experiments conducted by Samson et al. (2014), common cuttlefish exhibited escape responses (i.e., inking, jetting) when exposed to sound frequencies between 80 and 300 Hz with SPL above 140 dB re 1 μPa, and they habituated to repeated 200 Hz sounds. The intensity of the cuttlefish response with the amplitude and frequency of the sound stimulus suggest that cuttlefish possess loudness perception with a maximum sensitivity of approximately 150 Hz.

2.2.5.2 Decapods

- Popper et al. (2001) reviewed behavioral, physiological, anatomical, and ecological aspects of sound and vibration detection by decapod crustaceans and noted that many decapods also have an array of hair-like receptors within and upon the body surface that potentially respond to water- or substrate-borne displacements as well as proprioceptive organs that could serve secondarily to perceive vibrations. They concluded that many are able to detect substratum vibrations at sensitivities sufficient to tell the proximity of mates, competitors, or predators.
- Lovell et al. (2005a, b, 2006) reported potential auditory-evoked responses from prawns (*Palaemon serratus*) that showed auditory sensitivity of sounds from 100 to 3,000 Hz.
- Filiciotto et al. (2016) reported behavioral responses to vessel noise within this frequency range.
- Lovell et al. (2005a) found that the greatest sensitivity for prawns was an SPL of 106 dB re 1 μPa at 100 Hz, noting that this was the lowest frequency at which they tested and that prawns might be more sensitive at frequencies below this.

Fish are another source of prey for marine mammals and sea turtles. As previously described, fish may experience hearing threshold shifts, barotrauma, auditory masking, and/or stress and behavioral responses due to underwater noise effects. Impacts to fish can transitively impact foraging efficiency/ availability of sea turtles and marine mammals as previously described for cephalopods and decapods.

3.0 DESCRIPTION OF AFFECTED RESOURCES

The description of the affected environment was developed by reviewing current public data sources related to marine mammals, sea turtles, and ESA-listed fish including:

- The NOAA Northeast Fisheries Science Center's (NEFSC's) Atlantic Marine Assessment Program for Protected Species (AMAPPS) (NOAA Fisheries 2017; Palka et al. 2017)
- Acoustic detection data from the NOAA Northeast Passive Acoustic Research Group (Baumgartner et al. 2019, 2020)
- The Northeast Large Pelagic Survey Collaborative Aerial and Acoustic Surveys for Large Whales and Sea Turtles (Kraus et al. 2016)
- Remote Marine and Onshore Technology surveys for the New York State Energy Research and Development Authority (NYSERDA) (Normandeau and APEM 2019a, b, c, d, 2020)
- A technical report for the Rhode Island Ocean Special Management Plan (OSAMP) (Kenney and Vigness-Raposa 2010)
- A technical report for the New York State Offshore Wind Master Plan (NYSERDA 2017)
- Sighting, stranding, entanglement information from the Atlantic Marine Conservation Society (AMCS), the Center for Coastal Studies (CFCS), and Coastal Research and Education Society of Long Island (CRESLI)
- Online data portals and mapping databases (e.g., marine mammal habitat density data) on the Northeast Ocean Portal and Ocean Biodiversity Information System Spatial Ecological Analysis of Megavertebrate Populations (OBIS-SEAMAP) (Curtice et al. 2019; Roberts et al. 2016, 2017, 2018)[2]
- NOAA Fisheries ESA Section 7 mapper tool (NOAA Fisheries 2020a) and Threatened and Endangered Species Directory (NOAA Fisheries n.d.[a])
- Cetacean and Turtle Assessment Program (CETAP 1982) surveys
- Published scientific literature relating to relevant marine mammals, sea turtles, and ESA-listed fish
- Correspondence and consultation with federal and state agencies
- Information provided in environmental assessments conducted by BOEM offshore Rhode Island and Massachusetts (BOEM 2013, 2014, 2019, 2020)
- NOAA stock assessment reports (SARs) (NOAA Fisheries 2020b)
- The NYSDEC Whale Monitoring Program Final Comprehensive Report for aerial surveys conducted 2017-2020 (Tetra Tech and LGL 2020)

[2] Roberts et al. 2020 was recently released and information will be considered in future revisions of this report, as appropriate, at that time.

- The Summary Report of the New York Bight Sea Turtle Workshop held in 2018 (Bonacci-Sullivan 2018)
- Available Protected Species Observer (PSO) sightings data derived from different contractor datasets for geophysical and geotechnical surveys undertaken across the Sunrise Wind Project Area (Smultea Sciences 2020) and Bay State Wind Project Area (Smultea Sciences 2019).

Vulnerability of each species to potential impacts is determined based on the status of the stock (i.e., ESA or MMPA listing) and relevant publications indicating responses from previous exposures to similar activities. Available information provided below is applicable to the SRWF, SRWEC (including both the SRWEC–OCS and SRWEC–NYS), and Onshore Facilities (i.e., in the intracoastal waterway [ICW]) as they relate to existing resources that may be affected by the Project. For the purposes of this Technical Report, discussion of Great South Bay was also included. Fish and wildlife sightings and potential suitable habitat within Great South Bay were used as representative data for the ICW, where applicable, as the waterbody is hydrologically connected and immediately adjacent to the ICW.

3.1 MARINE MAMMALS

Marine mammals inhabit all the world's oceans and can be found in coastal, estuarine, shelf, and pelagic habitats. There are 36 marine mammal species in the Western North Atlantic OCS Region whose ranges include the US Northeast (BOEM 2013, 2014, 2019, 2020) where the Project will be located. The marine mammal assemblage includes cetaceans (whales, dolphins, and porpoises), pinnipeds (seals), and sirenians (manatee). There are 36 cetacean species, including 25 members of the suborder Odontoceti (toothed whales, dolphins, and porpoises), six of the suborder Mysticeti (baleen whales), four pinniped species (earless or true seals), and one sirenian (manatee).

Cetaceans are composed of two separate groups: Mysticetes (baleen whales) and odontocetes (toothed whales, dolphins, and porpoise). The Odontocetes all possess teeth and generally feed on fish and invertebrates. The Mysticetes possess large baleen filtration systems instead of teeth, which they use to sieve smaller prey out of the water. Their prey usually consists of zooplankton and small schooling fish. Both groups transit over large distances with Mysticetes migrating seasonally between distinct feeding and breeding areas and odontocetes following prey species and less distinct migratory behavior. The toothed whales, dolphins, and porpoises are generally found in large, stable pods throughout their lives. Baleen whales are known to maintain small, unstable groups or remain as solitary individuals when not breeding (Wilson and Ruff 1999). Whales are capable of very deep or prolonged dives while the smaller dolphin and porpoise species generally dive to shallower depths for shorter periods.

Pinnipeds are composed of three families: Odobenidae (the walrus), Otariidae (eared seals, including sea lions and fur seals), and Phocidae (earless seals). Phocidae are the most diverse and widespread pinnipeds and are the only family of seals with the potential to occur within the SRWF and SRWEC. Along with cetaceans, seals are also protected under the MMPA. There are five species of phocids (true seals) with ranges that include the Project Area: harbor seals (*Phoca vitulina*), gray seals (*Halichoerus grypus*), harp seals (*Pagophilus groenlandicus*), ringed seal (*Pusa hispida*) and hooded seals (*Cystophora cristata*) (CRESLI 2020; Hayes et al. 2017). Finally, one species of sirenian, the Florida manatee (*Trichechus manatus*) may have a rare occurrence in the region during summer months (USFWS 2019).

Table 3.1-1 outlines each of the species included in these groups along with associated conservation status, relative occurrence within the Project Area, estimated population sizes, and identification as 'strategic stock.' As defined by the MMPA, a strategic stock is a marine mammal stock: (a) for which the level of direct human-caused mortality exceeds the potential biological removal level; (2) which, based on the best available scientific information, is declining and is likely to be listed as a threatened species under the ESA within the foreseeable future; or (c) which is listed as a threatened or endangered species under the ESA or is designated as depleted under the MMPA (16 USC § 1362[19]).

The relative occurrence noted in Table 3.1-1 is based on five qualitative categories, which are defined as follows:

- **Common**—Species occurs consistently in moderate to large numbers
- **Regular**—Species occurs in low to moderate numbers on a regular basis or seasonally
- **Uncommon**—Species occurs in low numbers or on an irregular basis
- **Rare**—Species records are available for some years but are limited
- **Not expected**—Species' range includes the Project Area but, due to habitat preferences and distribution information, species is not expected to occur in the Project Area although records may exist for adjacent waters.

Of the 36 marine mammal species/stocks with geographic ranges that include the western North Atlantic OCS, 22 are not expected to be present or are considered to occur only rarely within the Project Area, while the remaining 14 species commonly or regularly occur in the Project Area. These latter species can be reasonably expected to reside, traverse, or routinely visit the Project Area based on information from surveys conducted in the region, NOAA SARs, and other published literature. Life history characteristics and sightings data of these common or regularly occurring species are detailed within this analysis. Additionally, Figure 3.1-1, Figure 3.1-2, and Figure 3.1-3 illustrate these commonly or regularly occurring species identified in Table 3.2-1 based on the most up-to-date OBIS-SEAMAP sightings data available. Seasonal density values from Duke University were derived using the maximum density value for each species within a given season (winter, spring, summer, autumn) (Curtice et al. 2019; Roberts et al. 2016b, 2017, 2018). Species for which density values do not currently exist are noted as "No Data." Calculation of seasonal density values is consistent with the approach used for NOAA Fisheries-approved incidental harassment authorizations (IHAs) and letters of authorization (LOAs).

Designations provided in Table 3.1-1 also take into consideration the results of the three-year aerial survey effort conducted through the NYSDEC Whale Monitoring Program. The Whale Monitoring Program was developed to collect data on large whales to allow for robust estimates of spatio-temporal densities and seasonal abundance (NYSDEC 2021). The Whale Monitoring Program also identifies seasonal and inter-annual variabilities, records data on whale behavior, and identifies areas of particular importance to these species and how/when they are used (NYSDEC 2021). As a part of the Whale Monitoring Program, NYSDEC partnered with Tetra Tech Inc., Smultea Environmental Sciences, LGL Ecological Research Associates, and Aspen Helicopters, Inc. to conduct aerial line-transect surveys from March 2017 to February 2020. A total of 36 monthly aerial surveys (263 survey flights) were conducted within the New York Offshore Planning Area (OPA) (Tetra Tech and LGL 2020). The New York OPA covers a 12,668 nm^2 (16,776 mi^2, 43,449 km^2) area from the south shore of Long Island to the continental shelf break. Aerial surveys were focused around six species of large whales, including: blue whale, fin whale, humpback whale, North Atlantic right whale, sei whale, and sperm whale. And, in addition to whale sightings, aerial surveys within the New York OPA resulted in 10 other marine mammal sightings (identified to species level): *Delphinus/Tursiops/Stenella, Tursiops/Grampus, and Tursiops/Lagenorhynchus* (Tetra Tech and LGL 2020).

Also included below, in Table 3.1-2, are the results of the NYSERDA Remote Marine and Onshore Technology reports from surveys completed Summer 2016 through Winter 2019 (Normandeau 2019a, b, c, d, 2020) for the 14 marine mammal species determined to have a regular or common occurrence within the Project Area. NYSERDA is conducting this multi-year, ultra-high resolution aerial digital survey of marine resources within their OPA which encompasses the waters of the New York Bight from Long Island, southeast to the continental shelf break. These surveys are conducted quarterly to coincide with periods of abundance of avian and marine species that could be vulnerable to impacts from offshore wind activities.

Five of the marine mammal species known to have a presence in the Project Area year-round or seasonally in offshore New York and Rhode Island waters are ESA-listed: the humpback whale, fin whale, sei whale, sperm whale, and North Atlantic right whale. The humpback whale, which may occur year-round, was recently delisted as a federally listed endangered species. There are currently no proposed marine mammal species listed under the ESA. The marine mammals known to occur in the Project Area are all from single stocks except for the common bottlenose dolphin.

To support the protection of marine mammals and other marine species, designated marine protected areas and North Atlantic right whale seasonal management areas (SMA) have been identified by NOAA Fisheries throughout the US. One marine protected area overlaps with the Onshore Facilities and SRWEC–NYS: the Fire Island National Seashore (NOAA Fisheries 2020c). This marine protected area is further discussed in the COP Section 4.4.4. Additionally, one Mid-Atlantic North Atlantic right whale SMA will be crossed by the SRWF and SRWEC–OCS: the Block Island Sound SMA (NOAA Fisheries 2020d). This SMA is further discussed below as it pertains to the North Atlantic right whale. No designated critical habitats for marine mammals will be crossed by the Project.

In recent years, rare incidental sightings of typically northern species such as the St. Lawrence beluga whale (*Delphinapterus leucas*) and the bowhead whale (*Balaena mysticetus*), have been reported off Massachusetts and the Gulf of Maine (Nalpathanchil and Brandon 2014; NOAA Fisheries 2019b). Similarly, in recent years, arctic species including ringed seals (*Pusa hispida*), that were once extremely rare for the Project Area, have been documented in rare incidental sightings (AMCS 2020; CRESLI 2020). However, these species' typical geographic ranges and NOAA stock definitions do not overlap with the Project Area, and the species are highly unlikely to be encountered. Per Orsted's most recently submitted IHA (CSA Ocean Sciences Inc. 2020), NOAA Fisheries concurred that these species do not warrant further consideration. Similarly, although the Risso's dolphin (*Grampus griseus*) was observed in OCS waters offshore of Rhode Island within the OSAMP study area, the species has a low documented presence within the Project Area and is generally associated with deeper waters than are available at the

SRWF; therefore, the species was determined to be “uncommon” and is not discussed further within this analysis.

In 2018, a UME for harbor and gray seals was declared across Maine, New Hampshire, and Massachusetts due to an increase in mortalities from infectious disease (NOAA Fisheries 2020e). The UME investigation now encompasses all seal strandings from Maine to Virginia, as seals began showing clinical signs of stranding as far south as Virginia. Investigations of harp and hooded seal strandings have also begun to show clinical signs of infectious disease, therefore the two species were added to the UME investigation which is ongoing. From July 1, 2018, to March 13, 2020, a total of 172 seals have been stranded within New York state waters (NOAA Fisheries 2020e). Scientists are currently reviewing data collected to provide guidance for the UME investigation; however, it is not expected that the Project will contribute to pinniped infectious disease concerns and further discussion is not included within this analysis.

The following subsections summarize data on the status and trends, distribution and habitat preferences, behavior and life history, and auditory capabilities of ESA-listed and non-listed marine mammals expected to occur in the Project Area as available in published literature and reports including NOAA Fisheries marine mammal SARs. Expected occurrence for each species within the SRWF, SRWEC, and Onshore Facilities were assessed.

Marine wildlife is mobile, with varying occurrences year-to-year and season-to-season. Typically, the waters associated with the Project Area are used by marine mammals for foraging, transiting, or migrating. The presence and/or absence of marine mammals within these waters can be affected by a variety of parameters including, but not limited to, water temperature, movements or availability of prey, and human presence or disturbance. The following species discussions are therefore based on historic behavioral trends; therefore, when densities are discussed, the general seasonal occurrence is noted in the waters in and surrounding the Project Area. Documented sightings within the SRWF and the SRWEC Corridor and Landfall Work Areas are discussed when applicable.

Table 3.1-1 Marine Mammals Potentially Occurring Within the Regional Waters of the Western North Atlantic OCS and Project Area

Species	Stock	Current Listing Status	Best Population Estimate[a]	Relative Occurrence in the SRWF	Relative Occurrence in the SRWEC–OCS	Relative Occurrence in the SRWEC–NYS	Relative Occurrence in the Onshore Facilities
Suborder Mysticeti (Baleen Whales)							
Blue whale (*Balaenoptera musculus*)	Western North Atlantic	ESA Endangered MMPA Depleted NY State Endangered MA State Endangered	402	Uncommon	Uncommon	Not Expected	Not Expected
Fin whale (*Balaenoptera physalus*)	Western North Atlantic	ESA Endangered MMPA Depleted NY State Endangered RI State SGCN MA State Endangered	7,418	Common	Common	Common	Not Expected
Humpback whale (*Megaptera novaeagliae*)	Gulf of Maine	MMPA Depleted NY State Endangered MA State Endangered	1,396	Common	Common	Common	Not Expected

Table 3.1-1 Marine Mammals Potentially Occurring Within the Regional Waters of the Western North Atlantic OCS and Project Area

Species	Stock	Current Listing Status	Best Population Estimate[a]	Relative Occurrence in the SRWF	Relative Occurrence in the SRWEC–OCS	Relative Occurrence in the SRWEC–NYS	Relative Occurrence in the Onshore Facilities
North Atlantic right whale (*Eubalaena glacialis*)	Western North Atlantic	ESA Endangered MMPA Depleted NY State Endangered RI State SGCN MA State Endangered	428[b]	Common	Common	Common	Not Expected
Sei whale (*Balaenoptera borealis*)	Nova Scotia[c]	ESA Endangered MMPA Depleted NY State Endangered MA State Endangered	6,292	Regular	Regular	Uncommon	Not Expected
Minke whale (*Balaenoptera acutorostrata*)	Canadian Eastern Coast	NA	24,202		Common	Common	Not Expected

Common

Table 3.1-1 Marine Mammals Potentially Occurring Within the Regional Waters of the Western North Atlantic OCS and Project Area

Species	Stock	Current Listing Status	Best Population Estimate[a]	Relative Occurrence in the SRWF	Relative Occurrence in the SRWEC–OCS	Relative Occurrence in the SRWEC–NYS	Relative Occurrence in the Onshore Facilities
Suborder Odontoceti (Toothed Whales, Dolphins and Porpoises)							
Sperm whale (*Physeter catodon*)	North Atlantic	ESA Endangered MMPA Depleted NY State Endangered MA State Endangered	4,349	Regular	Regular	Uncommon	Not Expected
Pygmy sperm whale (*Kogia breviceps*)	Western North Atlantic	NA	7,750[d]	Rare	Rare	Rare	Not Expected
Dwarf sperm whale (*Kogia sima*)	Western North Atlantic	NA		Rare	Rare	Rare	Not Expected
Northern bottlenose whale (*Hyperoodon ampullatus*)	Western North Atlantic	NA	Unknown	Not Expected	Not Expected	Not Expected	Not Expected
Cuvier's beaked whale (*Ziphius cavirostris*)	Western North Atlantic	NA	21,818[e]	Rare	Rare	Rare	Not Expected
Mesoplodont beaked whales (*Mesoplodon spp*)	Western North Atlantic	NA	21,818[e]	Rare	Rare	Rare	Not Expected
Killer whale (*Orcinus orca*)	Western North Atlantic	MMPA Depleted	Unknown	Rare	Rare	Rare	Not Expected

Table 3.1-1 Marine Mammals Potentially Occurring Within the Regional Waters of the Western North Atlantic OCS and Project Area

Species	Stock	Current Listing Status	Best Population Estimate[a]	Relative Occurrence in the SRWF	Relative Occurrence in the SRWEC–OCS	Relative Occurrence in the SRWEC–NYS	Relative Occurrence in the Onshore Facilities
False killer whale (*Pseudorca crassidens*)	Western North Atlantic	MMPA Depleted	1,791	Rare	Rare	Rare	Not Expected
Pygmy killer whale (*Feresa attenuata*)	Western North Atlantic	NA	Unknown	Not Expected	Not Expected	Not Expected	Not Expected
Short-finned pilot whale (*Globicephala macrorhynchus*)	Western North Atlantic	NA	28,924	Rare	Rare	Rare	Not Expected
Long-finned pilot whale *(Globicephala melas)*	Western North Atlantic	NA	39,215	Common	Uncommon	Uncommon	Not Expected
Melon-headed whale (*Peponocephala electra*)	Western North Atlantic	NA	Unknown	Not Expected	Not Expected	Not Expected	Not Expected
Risso's dolphin (*Grampus griseus*)	Western North Atlantic	NA	35,493	Uncommon	Uncommon	Uncommon	Not Expected
Short-beaked common dolphin (*Delphinus delphis*)	Western North Atlantic	NA	178,825	Common	Common	Common	Not Expected
Fraser's dolphin (*Lagenodelphis hosei*)	Western North Atlantic	NA	Unknown	Rare	Rare	Rare	Not Expected
Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	Western North Atlantic	NA	93,233		Common	Common	Not Expected

Common

Table 3.1-1 Marine Mammals Potentially Occurring Within the Regional Waters of the Western North Atlantic OCS and Project Area

Species	Stock	Current Listing Status	Best Population Estimate[a]	Relative Occurrence in the SRWF	Relative Occurrence in the SRWEC–OCS	Relative Occurrence in the SRWEC–NYS	Relative Occurrence in the Onshore Facilities
White-beaked dolphin (Lagenorhynchus albirostris)	Western North Atlantic	NA	536,016	Rare	Rare	Not Expected	Not Expected
Pantropical spotted dolphin (*Stenella attenuata*)	Western North Atlantic	NA	6,593	Rare	Rare	Rare	Not Expected
Clymene dolphin (*Stenella clymene*)	Western North Atlantic	NA	4,237	Not Expected	Not Expected	Not Expected	Not Expected
Striped dolphin (*Stenella coeruleoalba*)	Western North Atlantic	NA	67,036	Rare	Rare	Rare	Not Expected
Atlantic spotted dolphin (*Stenella frontalis*)	Western North Atlantic	NA	39,921	Regular	Uncommon	Uncommon	Not Expected
Spinner dolphin (*Stenella longirostris*)	Western North Atlantic	MMPA Depleted	4,102	Rare	Rare	Rare	Not Expected
Rough toothed dolphin (*Steno bredanensis*)	Western North Atlantic	NA	136	Rare	Rare	Rare	Not Expected

Table 3.1-1 Marine Mammals Potentially Occurring Within the Regional Waters of the Western North Atlantic OCS and Project Area

Species	Stock	Current Listing Status	Best Population Estimate[a]	Relative Occurrence in the SRWF	Relative Occurrence in the SRWEC–OCS	Relative Occurrence in the SRWEC–NYS	Relative Occurrence in the Onshore Facilities
Common bottlenose dolphin (*Tursiops truncatus*)	Western North Atlantic, offshore	MMPA Depleted	62,851		Common	Common	Not Expected
	Western North Atlantic, Northern migratory coastal	MMPA Depleted	6,639	Common Rare	Rare	Uncommon	Not Expected
Harbor porpoise (*Phocoena phocoena*)	Gulf of Maine/Bay of Fundy	RI State SGCN	95,543		Common	Common	Not Expected
Suborder Pinnipedia				Common			
Harbor seal (*Phoca vitulina*)	Western North Atlantic	NY State SC RI State SGCN	75,834	Regular	Regular	Regular	Rare
Gray seal (*Halichoerus grypus*)	Western North Atlantic	NA	27,131	Regular	Regular	Regular	Rare
Harp seal (*Pagophilus groenlandicus*)	Western North Atlantic	NA	Unknown	Rare	Rare	Uncommon	Rare
Hooded seal (*Cystophora cristata*)	Western North Atlantic	NA	Unknown	Rare	Rare	Uncommon	Rare

Table 3.1-1 Marine Mammals Potentially Occurring Within the Regional Waters of the Western North Atlantic OCS and Project Area

Species	Stock	Current Listing Status	Best Population Estimate[a]	Relative Occurrence in the SRWF	Relative Occurrence in the SRWEC–OCS	Relative Occurrence in the SRWEC–NYS	Relative Occurrence in the Onshore Facilities
Order Sirenia							
Florida manatee (*Trichechus manatus*)	Sirenian	ESA Threatened MMPA Depleted	Unknown	Rare	Rare	Rare	Not Expected

NOTES:

a/ The latest NOAA Fisheries Stock Assessments for each species were used for estimated populations (NOAA Fisheries 2020b)

b/ An updated NOAA Fisheries Stock Assessment is anticipated in late 2021 or early 2022.

c/ Although there is a Western North Atlantic stock of sei whales, no population estimates have been conducted within the last ten years, therefore population cannot be properly estimated; however, whales from the Nova Scotia stock may be present within offshore waters and recent population estimates of this stock have been made, therefore Nova Scotia population estimates have been provided. For additional information, see Section 3.1.1.2 below.

d/ Population estimate includes both species of *Kogia* combined because they are difficult to differentiate at sea, per NOAA Fisheries 2020b

e/ It is not possible per the data available to determine the minimum population estimate of only the *Mesoplodon* beaked whales, therefore the minimum pop estimate is for the undifferentiated complex of beaked whales (both *Ziphius* and *Mesoplodon* spp.), per NOAA Fisheries 2020b

KEY:

ESA = *Endangered Species Act*

MA = Massachusetts State

MMPA = *Marine Mammal Protection Act*

NA = species is not federally listed, is not designated as depleted under the MMPA, is not state listed in New York, Rhode Island, or Massachusetts, and is not considered a Rhode Island SGCN.

NY = New York State

RI = Rhode Island State

SC = Species of Concern

SGCN = Species of Greatest Conservation Need

SOURCES: NOAA Fisheries n.d.[a], 2019c, 2020b; Normandeau and APEM 2019; Tetra Tech and LGL 2020; Sadove and Cardinale 1993

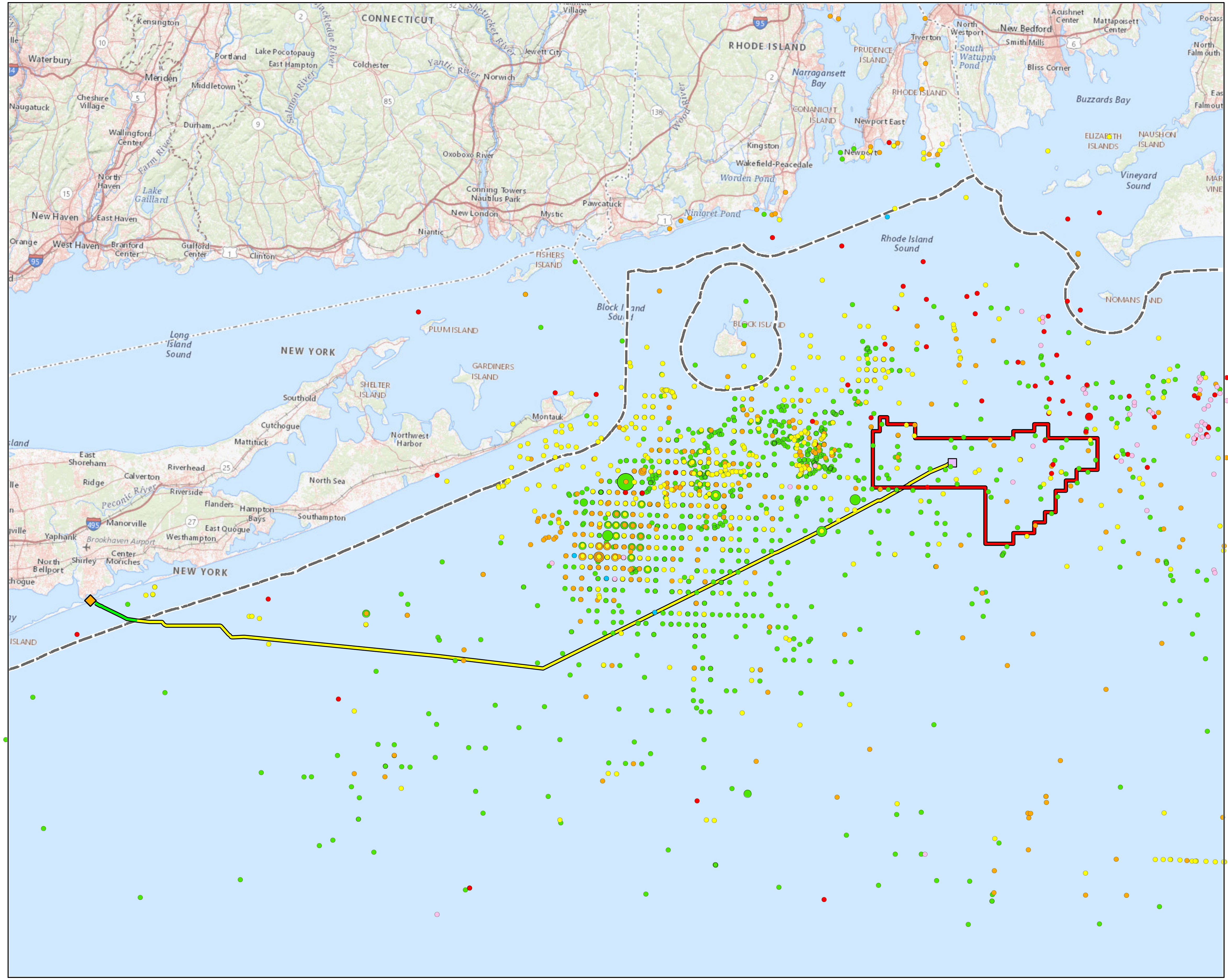


Figure 3.1-1
OBIS-SEAMAP Mysticeti Sightings Data 1960 – 2019

Sunrise Wind | Powered by Ørsted & Eversource

Legend

- Sunrise Wind Farm (SRWF)
- Offshore Converter Station (OCS–DC)
- SRWEC Landfall Location
- Sunrise Wind Export Cable (SRWEC–OCS)
- Sunrise Wind Export Cable (SRWEC–NYS)
- 3-nm State Waters Boundary

Baleen Whale Sighting

- Blue whale
- Fin whale
- Humpback whale
- Minke whale
- North Atlantic right whale
- Sei whale

Baleen Whale Sighting Count

- 1 - 20
- 21 - 40
- 41 - 60
- 61 - 80
- 81 - 100

Sources
1. Mysticeti data extracted on 7/22/2020 from the Ocean Biodiversity Information System Spatial Ecological Analysis of Megavertebrate (OBIS-SEAMAP).
2. Base map: USGS The National Map

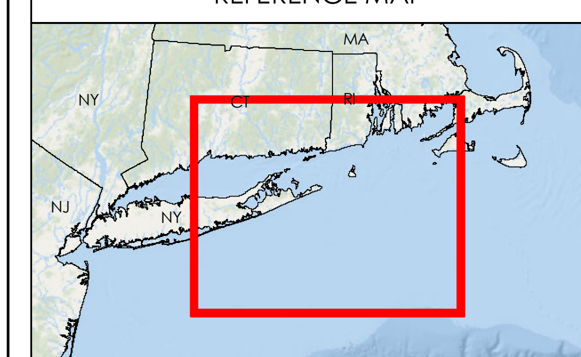
Date	12/18/2020 Revised: 6/1/2021
Project Number	2028113199
Prepared By	EE
Reviewed By	GC

0 10 miles
0 8 nm
0 16 km

N

Scale at 11x17: 1:676,500
NAD 1983 2011 UTM Zone 19N

REFERENCE MAP



Revised: 2021-05-07 By: gcarpenter

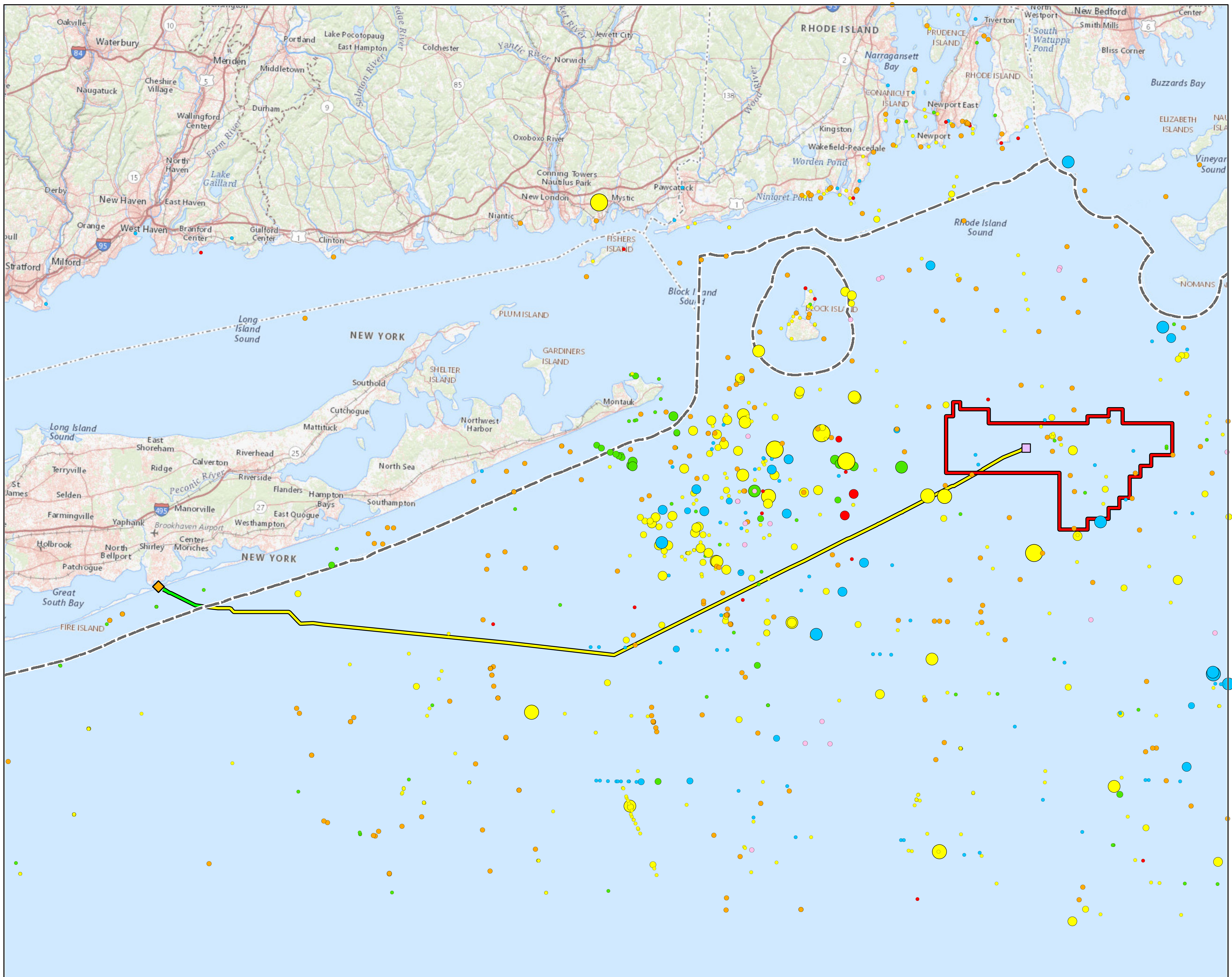


Figure 3.1-2
OBIS-SEAMAP Odontoceti Sightings Data 1974 – 2019

Sunrise Wind | Powered by Ørsted & Eversource

Legend

- Sunrise Wind Farm (SRWF)
- Offshore Converter Station (OCS–DC)
- SRWEC Landfall Location
- Sunrise Wind Export Cable (SRWEC–OCS)
- Sunrise Wind Export Cable (SRWEC–NYS)
- 3-nm State Waters Boundary

Toothed Whale Sighting

- Atlantic white-sided dolphin
- Common bottlenose dolphin
- Common dolphin
- Harbor porpoise
- Long-finned pilot whale
- Sperm whale

Toothed Whale Sighting Count

- 1 - 25
- 26 - 50
- 51 - 100
- 101 - 200
- 201 - 500
- 501 - 1000

Sources
1. Odontoceti data extracted on 7/22/2020 from the Ocean Biodiversity Information System Spatial Ecological Analysis of Megavertebrate (OBIS-SEAMAP).
2. Base map: USGS The National Map

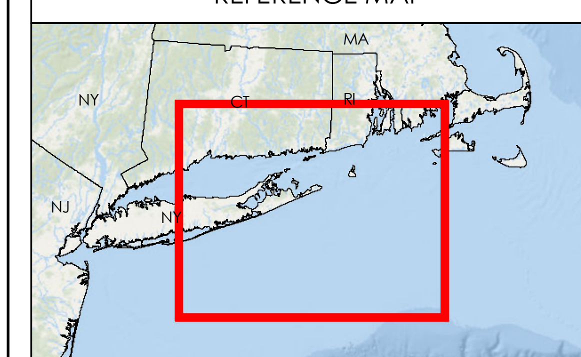
Date	12/18/2020 Revised: 6/1/2021
Project Number	2028113199
Prepared By	EE
Reviewed By	GC

0 10 miles
0 8 nm
0 16 km

N

Scale at 11x17: 1:676,500
NAD 1983 2011 UTM Zone 19N

REFERENCE MAP



V:\1956\active_Task Owner and other Non-BC1956 Jobs\2028113199\03_data\gis_cad\gis\MXDs\COP\Appendix Figures\Appendix_O_MarineMammalsTurtles\2028113199_3.1-2_OdontocetiSighting.mxd Revised: 2021-05-07 By: gcarpentier

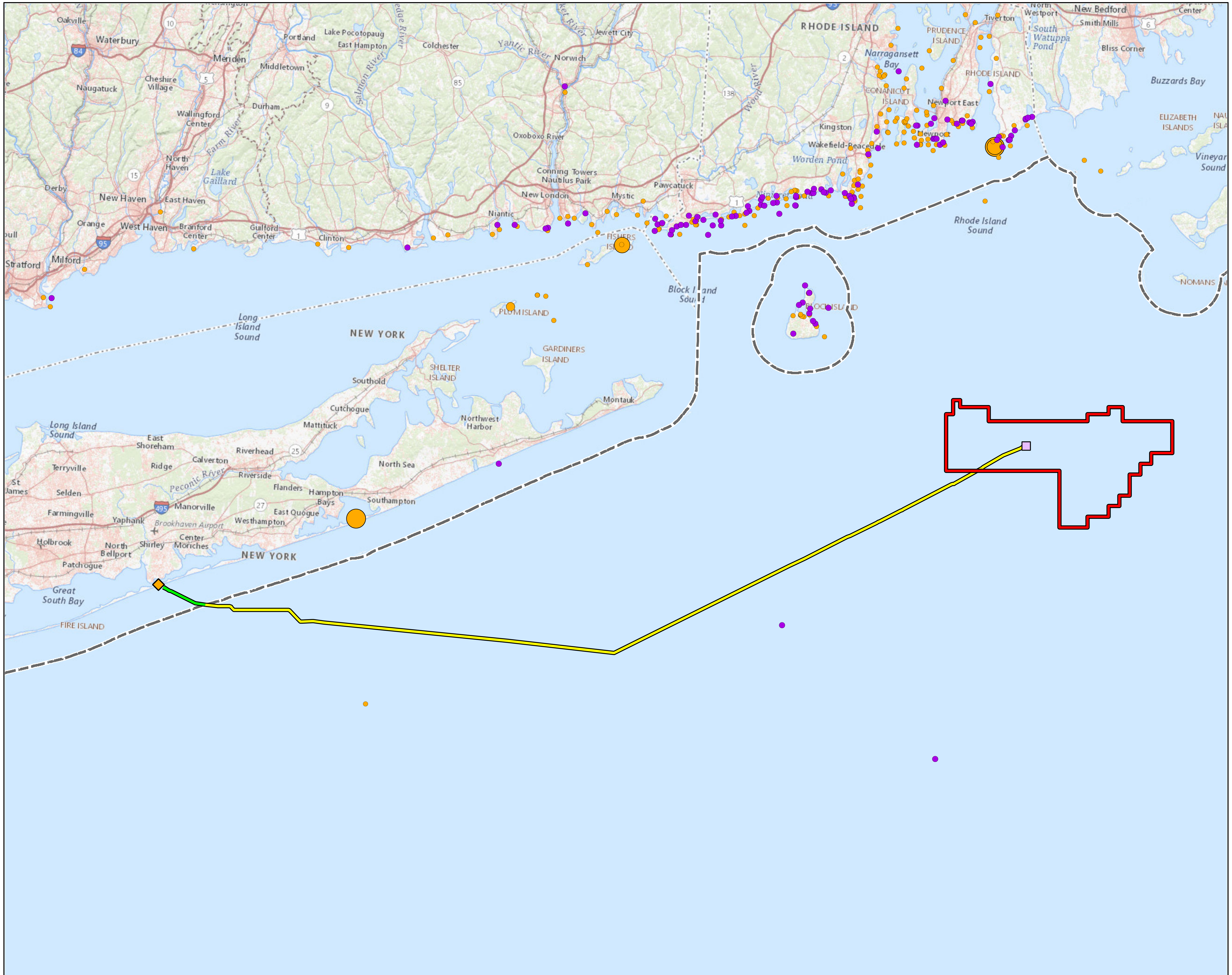


Figure 3.1-3
OBIS-SEAMAP Pinniped Sightings Data
1979 – 2019

Sunrise Wind | Powered by Ørsted & Eversource

Legend
- Sunrise Wind Farm (SRWF)
- Offshore Converter Station (OCS–DC)
- SRWEC Landfall Location
- Sunrise Wind Export Cable (SRWEC–OCS)
- Sunrise Wind Export Cable (SRWEC–NYS)
- 3-nm State Waters Boundary

Seal Sighting Counts

Gray seal
- 1

Harbor seal
- 1
- 2 - 5
- 6 - 10
- 11 - 20
- 21 - 40

Sources
1. Pinniped data extracted on 7/22/2020 from the Ocean Biodiversity Information System Spatial Ecological Analysis of Megavertebrate (OBIS-SEAMAP).
2. Base map: USGS The National Map

Date	12/18/2020 Revised: 6/1/2021
Project Number	2028113199
Prepared By	EE
Reviewed By	GC

0 10 miles
0 8 nm
0 16 km

N

Scale at 11x17: 1:676,500
NAD 1983 2011 UTM Zone 19N

REFERENCE MAP

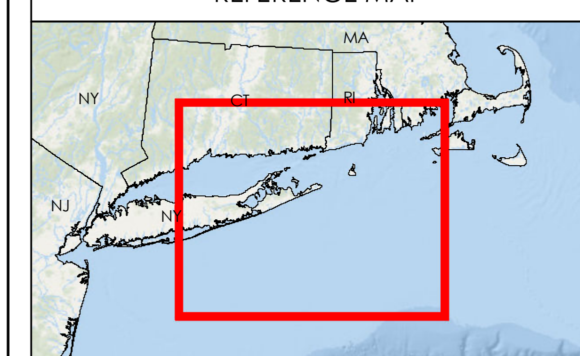


Table 3.1-2 Common or Regularly Occurring Marine Mammal Species Identified within the NYSERDA Remote Marine and Onshore Technology Reports from Summer 2016 through Winter 2019, as reported by Normandeau and APEM (2019a, b, c, d, 2020)[a]

Species	Summer			Autumn			Winter			Spring		
	2016	**2017**	**2018***	**2016**	**2017**	**2018***	**2016–2017**	**2017–2018**	**2019***	**2017**	**2018**	**2019***
Fin whale	137	56	6	56	**451**	1	55	28	1	13	42	1
Sei whale	0	14	0	0	**103**	1	0	0	1	0	84	3
North Atlantic right whale	0	0	0	0	**72**	0	44	0	0	27	0	1
Sperm whale	0	42	5	22	**72**	1	0	0	2	0	0	0
Minke whale	14	0	5	0	**304**	0	77	14	0	66	112	2
Humpback whale	0	0	2	11	**214**	0	22	0	0	66	70	2
Long-finned pilot whale[b]	1,393	726	54	101	**2,965**	8	0	0	0	385	0	22
Atlantic spotted dolphin	0	0	0	607	**649**	0	0	0	0	40	0	2
Atlantic white-sided dolphin	0	0	5	180	**297**	5	77	28	2	0	0	0
Short-beaked common dolphin	765	11,908	1,342	2,507	**53,532**	827	6,264	7,006	472	11,317	3,204	148
Common bottlenose dolphin	1,311	2,443	116	663	**10,517**	1	1,461	403	74	2,298	686	122

Table 3.1-2 Common or Regularly Occurring Marine Mammal Species Identified within the NYSERDA Remote Marine and Onshore Technology Reports from Summer 2016 through Winter 2019, as reported by Normandeau and APEM (2019a, b, c, d, 2020)[a]

Species	Summer			Autumn			Winter			Spring		
	2016	**2017**	**2018***	**2016**	**2017**	**2018***	**2016–2017**	**2017–2018**	**2019***	**2017**	**2018**	**2019***
Harbor porpoise	0	0	0	45	**4,059**	3	2,125	375	43	226	1,189	53
Harbor seal	0	0	0	0	**40**	0	11	28	0	0	0	1
Gray seal	0	0	0	11	**72**	0	33	0	0	0	28	0

NOTES:

a/ Corrected abundance was calculated by the original report authors by dividing the observed abundance by the percent of the area surveyed for each season to account for differing amounts of area surveyed and makes abundances comparable across seasons. Corrected abundance values are frequently non-integers that have been rounded to whole numbers for display purposes. Survey periods marked with an asterisk (*) are raw, reported individuals counted during semi-annual summary reports and are not considered corrected abundances; corrected abundances are not provided in these semi-annual reports.

b/ During surveys, the pilot whales were described as “unidentified” so the corrected abundance provided for this species may be greater than actual abundance of the long-finned pilot whale

SOURCES:

Summer 2016 through Spring 2018 Surveys (Normandeau and APM 2019a)

Summer 2018 Surveys (Normandeau and APM 2019b)

Autumn 2018 Surveys (Normandeau and APM 2019c)

Spring 2019 Surveys (Normandeau and APM 2019d)

Winter 2019 (Normandeau and APEM 2020)

3.1.1 ESA-Listed Species

Six marine mammal species known to occur in the Western North Atlantic are listed under the ESA; these include the fin whale (Endangered), sei whale (Endangered), blue whale (Endangered), North Atlantic right whale (Endangered), sperm whale (Endangered), and Florida manatee (Threatened). Of these six species, all but the Florida manatee may regularly occur in the Project Area and are therefore considered potentially affected species. These species are highly migratory and do not spend extended periods of time in a localized area. The blue whale is more pelagic, and its presence within the SRWF is considered to be uncommon; therefore, the species is not detailed in the following sections. However, due to their endangered status and because they have been detected in the SRWF area during acoustic surveys (Kraus et al. 2016), blue whales were included in the acoustic exposure assessment. The following sections provide further information regarding species behavior and expected occurrence in the SRWF, SRWEC, and Onshore Facilities.

3.1.1.1 Fin Whale

Fin whales have a wide distribution and can be found in the Atlantic and Pacific Oceans in both the Northern and Southern Hemisphere (Gambell 1985; Jonsgård 1966; NOAA Fisheries 2019a). The population is divided by ocean basins; however, these boundaries are arbitrary as they are based on historical whaling patterns rather than biological evidence (NOAA Fisheries 2019a). In the US Northeast, fin whales are the most commonly sighted species and account for 47 percent of the large whale sightings in the region (CETAP 1982; Hain et al. 1992; Sergeant 1977; Sutcliffe and Brodie 1977; Waring et al. 2008). They have been observed in all four seasons, and their distribution ranges from the Mid-Atlantic coast to Nova Scotia in Western North Atlantic OCS waters (Kenney and Vigness-Raposa 2010). Acoustic survey data collected from 2004 to 2014 on 281 collected bottom-mounted recorders (for a total of 35,033 days), concluded that fin whales (as well as sei, blue, and humpback whales) were present from the US Southeast to Greenland in the winter seasons, suggesting baleen whales are widely distributed during these months (Davis et al. 2020).

Fin whales, much like humpback whales, seem to exhibit habitat fidelity (Kenney and Vigness-Raposa 2009; Waring et al. 2007). However, fin whale habitat use has shifted in the southern Gulf of Maine, most likely due to changes in the abundance of sand lance and herring, both of which are major prey species along with squid, krill, and copepods (Kenney and Vigness-Raposa 2009). While fin whales typically feed in the Gulf of Maine and the waters surrounding New England, mating and calving (and general wintering) areas are largely unknown (Waring et al. 2007). The overall pattern of fin whale movement is complex, consisting of a less obvious north-south pattern of migration than that of right and humpback whales. Based on acoustic recordings from hydrophone arrays, Clark (1995) reported a general southward flow pattern of fin whales in autumn from the Labrador and Newfoundland region, past Bermuda, and into the West Indies. The overall distribution may be based on prey availability as this species preys opportunistically on both invertebrates and fish (Watkins et al. 1984).

Fin whales are often confused with other balaenopterid whales (e.g., blue whale, sei whale) during field surveys, but can be distinguished by the white, v-shaped patterns on their back behind the head (Jefferson et al. 1993). Fin whales are the second largest living whale species on the planet (Kenney and Vigness-Raposa 2009). The gestation period for fin whales is approximately 11 months and calf births occur between late autumn and winter. Females can give birth every two to three years.

Fin whales also produce characteristic vocalizations that can be distinguished during passive acoustic monitoring (PAM) surveys (BOEM 2013; Erbe et al. 2017). The most commonly observed calls are the “20-Hz signals,” a short downsweep falling from 30 to 15 Hz over a 1-s period. Fin whales can also produce higher frequency sounds up to 310 Hz, and SLrms as high as 195 dB re 1 µPa @ 1 m have been reported, making it one of the most powerful biological sounds in the ocean (Erbe et al. 2017). Anatomical modeling based on fin whale ear morphology suggests their greatest hearing sensitivity is between 20 Hz and 20 kHz (Cranford and Krysl 2015; Southall et al. 2019).

Fin whales are federally listed as Endangered under the ESA (NOAA Fisheries n.d.[a]) and state listed as Endangered in New York and Massachusetts (MESA 2020; NYSDEC 2015). The species is also listed as Depleted under the MMPA (MMC 2020) and Vulnerable under the IUCN Red List (Cooke 2018).
Fin whale abundance off the coast of the northeastern US is highest between spring and autumn, with some individuals remaining during winter (Hain et al. 1992). The best abundance estimate for the Western North Atlantic stock per the most recent stock assessment is 7,418 (NOAA Fisheries 2019c).
A population trend analysis does not currently exist for this species because of insufficient data; however, based on photographic identification, the gross annual reproduction rate is 8 percent with a mean calving interval of 2.7 years (Agler et al. 1993; NOAA Fisheries 2019a). Potential Biological Removal (PBR) for this stock is 12, and annual human-caused mortality and serious injury for the period between 2013 and 2017 was estimated to be 2.35 per year.

Present threats to fin whales are similar to other whale species, namely fishery entanglements and vessel strikes. Fin whales seem less likely to become entangled than other whale species. Glass et al. (2008) reported that between 2002 and 2006, fin whales belonging to the Gulf of Maine population were involved in only eight confirmed entanglements with fishery equipment. Furthermore, Nelson et al. (2007) reported that fin whales exhibited a low proportion of entanglements (eight reported events) during their 2001 to 2005 study along the western Atlantic. However, vessel strikes may be a more serious threat to fin whales. Eight of 10 confirmed vessel strikes with fin whales were reported by Glass et al. (2008) and Nelson et al. (2007), respectively. This level of incidence was similar to that exhibited by the other whales studied. Conversely, a study compiling whale-vessel strike reports from historical accounts, recent whale strandings, and anecdotal records by Laist et al. (2001) reported that of the 11 great whale species studied, fin whales were involved in collisions most frequently (31 in the US and 16 in France). Other threats to fin whales include contaminants in their habitat and potential climate-related shifts in distribution of prey species. Increase in ambient noise has also impacted fin whales in the Mediterranean that have demonstrated at least two different avoidance strategies after being disturbed by tracking vessels (Jahoda et al. 2003). There is no designated critical habitat for this species in or near the Project Area.

Sunrise Wind Farm/Sunrise Wind Export Cable

As shown in Table 3.1-2, fin whales have a documented presence within the New York OPA, per the NYSERDA Digital Aerial Baseline Surveys conducted from Summer 2016 through Winter 2019 (Normandeau 2019a, b, c, d, 2020). Fin whales sighted within the New York OPA occurred relatively uniformly during all four seasons with the highest number documented in Summer 2016 (137 individuals). Similarly, during the NYSDEC Whale Monitoring Program aerial surveys conducted from 2017-2020, 207 estimated individual fin whales were sighted within the New York Bight (Tetra Tech and LGL 2020). These sightings occurred year-round with a higher prevalence in spring and summer months, within a wide geographical area ranging from nearshore to the continental shelf edge and beyond.

Two well-known feeding grounds for fin whales are present near the SRWF. These include the Great South Channel and Jeffrey's Ledge and waters directly east of Montauk, NY (Kenney and Vigness-Raposa 2010; NOAA Fisheries 2019a). The highest occurrences of fin whales in this region are identified south of Montauk Point, NY to south of Nantucket, MA (Kenney and Vigness-Raposa 2010). Surveys conducted in the RI-MA and MA WEAs indicate that fin whale sightings are highest during spring and summer. During Project-specific geotechnical surveys from November 2019 to March 2020 (Smultea 2020), three estimated individuals were detected inside the SRWF, and one estimated individual was detected outside the SRWF as illustrated in Figure 3.1-4 below.

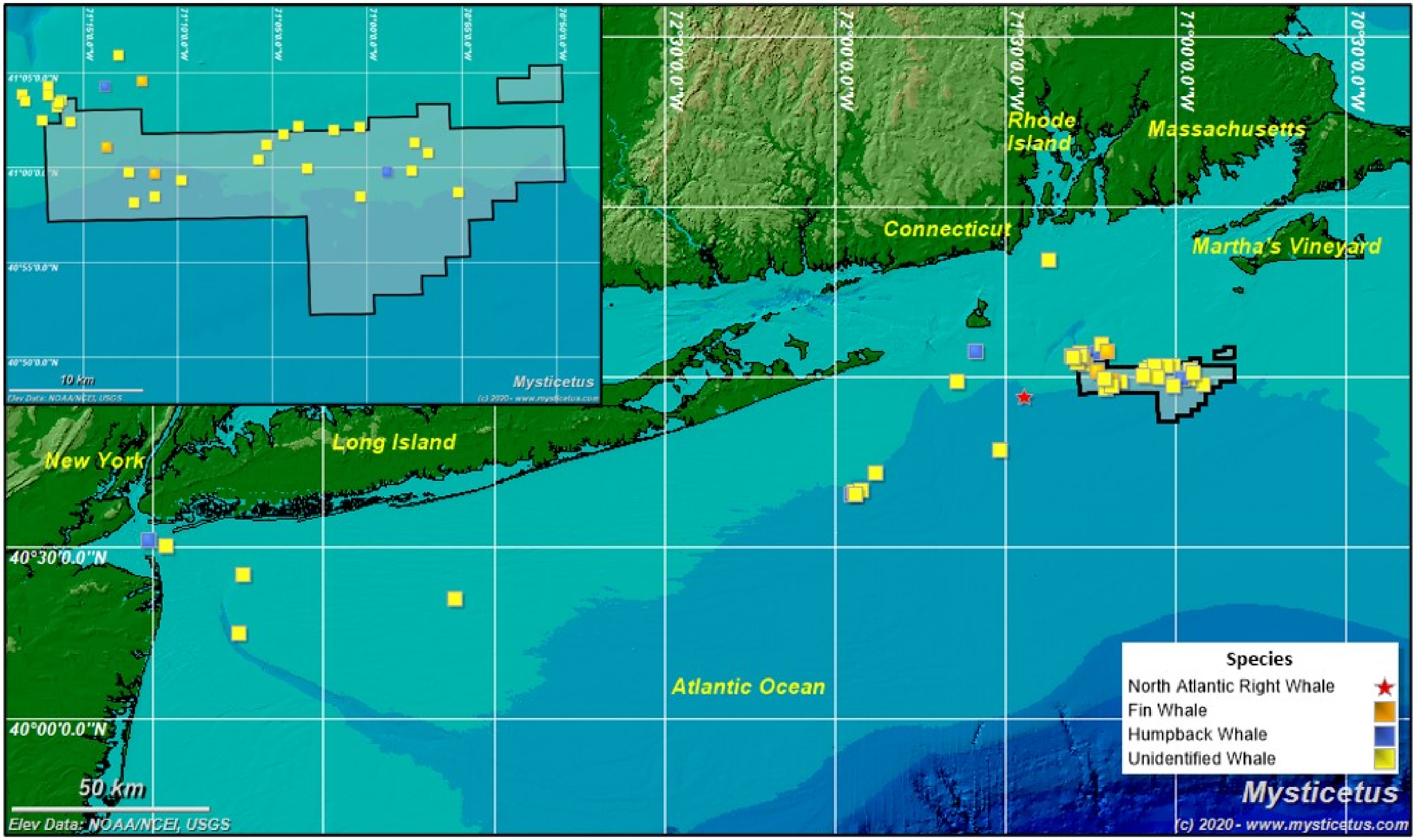
Although fin whale sightings are greatest in spring and summer, they are known to occur in all four seasons in inner shelf waters (Kenney and Vigness-Raposa 2010; Kenney and Winn 1986). Fin whales are typically centered along the 100-m (328-ft) isobath off the US East Coast, but sightings have occurred in both shallower and deeper waters. Fin whales are common in New York state waters and adjacent OCS waters in this area, and aggregations of fin whales are often reported between Block Island, RI and Montauk Point, NY (Kenney and Vigness-Raposa 2010; Sadove and Cardinale 1993). Because of their regular occurrence in this area, a large number of whale-watching boats also frequent this area (Kenney and Vigness-Raposa 2010).

Because of these high occurrences and habitat preferences, the fin whales are expected to be common within the SRWF and SRWEC.

Onshore Facilities

The fin whale is not expected to be encountered within the waterbodies associated with the Onshore Facilities.

Figure 3.1-4 Locations of all Whales Detected during the Sunrise Wind Geotechnical Survey (2019–2020)



NOTE: Inset is an enlargement showing all whale detections close to the SRWF.

3.1.1.2 Sei Whale

Sei whales occur in all the world's oceans and migrate between feeding grounds in temperate and sub-polar regions to winter grounds in lower latitudes (Kenney and Vigness-Raposa 2010; NOAA Fisheries 2019c). In the Northwest Atlantic, it is speculated that the whales migrate from south of Cape Cod along the eastern Canadian coast in June and July and return on a southward migration again in September and October (Waring et al. 2014, 2016). The highest concentration is observed during spring along the eastern margin of Georges Bank and in the Northeast Channel area along the southwestern edge of Georges Bank, primarily in deeper water. The winter habitat for this population remains unknown, but recent PAM data detected sei whale vocalizations from late autumn through winter in Southern George's Bank region, with sporadic detections in the US Southeast around Cape Hatteras and Blake Plateau (NOAA Fisheries 2019c). Acoustic survey data collected from 2004 to 2014 on 281 collected bottom-mounted recorders (for a total of 35,033 days), concluded that sei whales (as well as fin, blue, and humpback whales) were present from the US Southeast to Greenland in the winter seasons, suggesting baleen whales are widely distributed during these months (Davis et al. 2020). In general, sei whales are observed offshore with periodic incursions into shallower waters for foraging (Hain et al. 1985; NOAA Fisheries 2019c).

Although sei whales may prey upon small schooling fish and squid, available information suggests that calanoid copepods and euphausiids are the primary prey of this species (Flinn et al. 2002). Sei whales are occasionally seen feeding in association with right whales in the southern Gulf of Maine and in the Bay of Fundy and with fin whales along Long Island in July and August (Sadove and Cardinale 1993). However, there is no evidence to demonstrate interspecies competition for food resources. Sei whales reach sexual maturity at 5 to 15 years of age. The calving interval is believed to be two to three years (Perry et al. 1999).

Sei whales can often be confused with fin whales during field surveys; however, they do not have the characteristic v-shaped patterns on their backs that are present on fin whales, and their skin is often mottled with scars thought to be caused by lamprey bites (Jefferson et al. 1993). Although uncertainties still exist with distinguishing sei whale vocalizations during PAM surveys, they are known to produce short duration (0.7 to 2.2 sec) upsweeps and downsweeps between 20 and 600 Hz. SL_{rms} for these calls can range from 147 to 183 dB re 1 µPa @ 1 m (Erbe et al. 2017). No auditory sensitivity data are available for this species (Southall et al. 2019).

Sei whales are federally listed as Endangered under the ESA (NOAA Fisheries n.d.[a]) and state listed as Endangered in New York and Massachusetts (MESA 2020; NYSDEC 2015). This stock is also listed as Depleted under the MMPA (MMC 2020) and Endangered under the IUCN Red List (Cooke 2018). Prior to 1999, sei whales in the Western North Atlantic were considered a single stock but, following the suggestion of the Scientific Committee of the International Whaling Commission (IWC), two separate stocks were identified for this species: a Nova Scotia stock and a Labrador Sea stock. No population estimates have been provided for the Western North Atlantic stock within the last ten years; therefore, the current population size of that stock cannot be properly estimated. The Nova Scotia stock however can be found in US waters, and the most recent stock assessment states that the best stock estimate is 6,292 (NOAA Fisheries 2019c).

The PBR for this stock is 6.2, and annual human-caused mortality and serious injury from 2013 to 2017 was estimated to be 1.0 per year (NOAA Fisheries 2019c). Like fin whales, major threats to sei whales include fishery interactions, vessel collisions, contaminants, and climate-related shifts in prey species (NOAA Fisheries 2019c). There is no designated critical habitat for this species in or near the Project Area.

Sunrise Wind Farm/Sunrise Wind Export Cable–OCS

As shown in Table 3.1-2, sei whales have a documented presence within the New York OPA, per the NYSERDA Digital Aerial Baseline Surveys conducted from Summer 2016 through Winter 2019 (Normandeau 2019a, b, c, d, 2020). Sei whales sighted within the New York OPA occurred most often during spring and summer months with the highest number documented in Spring 2018 (84 individuals). Similarly, during the NYSDEC Whale Monitoring Program aerial surveys conducted from 2017-2020, seven estimated individual sei whales were sighted within the New York Bight (Tetra Tech and LGL 2020). These sightings occurred exclusively during the spring within deeper waters along the continental shelf edge.

CETAP surveys observed sei whales along the OCS edge only during spring (237 sightings) and summer (101 sightings) (CETAP 1982). Similarly, the Kraus et al. (2016) study reported sei whales only within the RI-MA and MA WEAs during spring (8 individuals) and summer (13 individuals). No sightings were reported during autumn and winter (Kraus et al. 2016).

A small cluster of five individual sei whales were reported south of Montauk Point, NY and Block Island, RI in July 1981, August 1982, and May 2003 (Kenney and Vigness-Raposa 2010). Additionally, sei whales are associated with the deeper waters along the continental shelf edge and are observed in shallower waters when foraging (NOAA Fisheries 2019c). In spring and summer, sei whales are seen in feeding habitats in Nova Scotia and Cape Cod north of the SRWEC corridor (NOAA Fisheries 2019c). Therefore, sei whales may be regular within the SRWF and SRWEC–OCS particularly in the spring and summer months.

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Sei whales are associated with the deeper waters along the continental shelf edge and are observed in shallower waters when foraging (NOAA Fisheries 2019c). However, sei whales have occasionally been reported feeding in association with fin whales along Long Island in July and August (Sadove and Cardinale 1993). Sei whales are therefore expected to be uncommon within the SRWEC–NYS.

Onshore Facilities

The sei whale is not expected to be encountered within the waterbodies associated with the Onshore Facilities.

3.1.1.3 North Atlantic Right Whale

The North Atlantic right whale occurs in all the world's oceans from temperate to subpolar latitudes. The right whale is a strongly migratory species that moves annually between low-latitude calving grounds in the US Southeast to high-latitude feeding grounds in the US Northeast (NOAA Fisheries 2019c). There are seven areas in the Western North Atlantic in which right whales aggregate seasonally; coastal waters of the US Southeast, the Great South Channel, Jordan Basin, Georges Basin along the northeastern edge of Georges Bank, Cape Cod and Massachusetts Bays, the Bay of Fundy, and the Roseway Basin on the Scotian Shelf (Kenney 2002; Waring et al. 2011). Acoustic surveys have also demonstrated their presence year-round in the Gulf of Maine and off New Jersey (Davis et al. 2017; NOAA Fisheries 2019c). Important feeding habitats include coastal waters off Massachusetts, Georges Bank, the Great South Channel, Gulf of Maine, Bay of Fundy, and the Scotian Shelf. All waters within the Gulf of Maine are designated as a Foraging Area Critical Habitat where right whales feed mostly on copepods belonging to the *Calanus* and *Pseudocalanus* genus (NOAA Fisheries 2019c).

One of the most distinguishing features of the right whale is the whitish callosities, or areas of roughened skin, covering their head, which can be up to one-third of their body length and their prominently curved jawline (Jefferson et al. 1993). Right whales are considered grazers as they swim slowly with their mouths open. They are the slowest swimming whales and can only reach speeds up to 10 mi (8.7 nm, 16 km) per hour. They can dive at least 1,000 feet (ft) (300 m) and stay submerged for typically 10 to 15 minutes (ACSonline 2004). North Atlantic right whales feed by swimming slowly throughout the water column, filter feeding for patches of copepods and other zooplankton, often at or near the surface of the water.

Right whale vocalizations most frequently observed during PAM studies include upsweeps rising from 30 to 450 Hz, often referred to as "upcalls," and broadband (30 to 8,400 Hz) pulses, or "gunshots," with SLrms between 172 and 187 dB re 1 µPa @ 1 m (Erbe et al. 2017). Modeling conducted using right whale ear morphology suggest that the best hearing sensitivity for this species is between 16 Hz and 25 kHz (Southall et al. 2019; Ketten et al. 2014). The most commonly detected call type for passive acoustic monitoring of the North Atlantic right whale in a study conducted by Parks et al. (2019a), showed relatively high upcall rates (3.21 to 7.6 calls per hour) for juvenile and pregnant females. In contrast, mother-calf pairs showed relatively low upcall rates at approximately 0.51 calls per hour (Parks et al. 2019a). Although baleen whales primarily communicate through low-frequency acoustic signals traveling over relatively long distances, mother-calf North Atlantic right whale pairs have been studied for their use of acoustic crypsis to avoid predation (Parks et al. 2019b). In a study by Parks et al. (2019b), acoustic biologging tags were used to determine if right whale mother-calf pairs avoid predatory attention by using a form of acoustic cryptic behavior. The study provided evidence of acoustic crypsis by mother-calf pairs where mother-calf pairs produced significantly fewer high-amplitude signals compared to juvenile and pregnant whales in the same habitat (Parks et al. 2019b). However, in winter calving grounds, lactating females produced higher amplitude tonal calls at lower rates when compared to other similarly aged female whales, suggesting that passive acoustic monitoring may be less effective in wintering habitats (Parks et al. 2019a).

The North Atlantic right whale is federally listed as Endangered under the ESA and state listed as Endangered in New York and Massachusetts (NYSDEC 2015; MESA 2020). The species is also listed by the state of Rhode Island as a Species of Greatest Conservation Need (SGCN; RI SGCN 215), listed as Depleted under the MMPA (MMC 2020), and listed as Critically Endangered under the IUCN Red List (Cooke 2020). Right whales are considered to be one of the most critically Endangered large whales in the world with a pre-exploitation population of more than 1,000 individuals. (Hayes et al. 2019; NOAA Fisheries 2019c). The best abundance estimate for the Western North Atlantic stock per the most recent stock assessment is 428 (NOAA Fisheries 2019c). However, the Western North Atlantic population size was also estimated to be 428 individuals in the most recent Draft 2019 SAR, which used data from the photo-identification database maintained by the New England Aquarium that were available in October 2018 (NOAA Fisheries 2019c). Highly variable data exists regarding the productivity of this stock with periodic swings of per capita birth rates (NOAA Fisheries 2019c). Net productivity rates do not exist as the Western North Atlantic stock lacks any definitive population trend (NOAA Fisheries 2019c).

The predominant threats to North Atlantic right whales are entanglement and vessel collisions although habitat loss, pollution, anthropogenic noise, and intense commercial fishing may also negatively impact their populations (Kenney 2002). Entanglements can represent a significant energy expenditure for large whales, leading to injury or death if disentanglement efforts are not successful within a critical time period (van der Hoop et al. 2016, 2017). Despite recent efforts to reduce entanglement through fishing gear modification, available data from 2000 to 2017 suggest an increase in the percent of injuries and mortalities (per capita) caused by entanglement, and the annual rate of mortality and serious injury from 2013 to 2017 due to vessel strikes was 1.3 whales per year (Glass et al. 2008; NOAA Fisheries 2019c; Pace et al. 2014). Environmental fluctuations and anthropogenic disturbance may be contributing to a decline in overall health of individual North Atlantic right whales that has been occurring for the last three decades (Rolland et al. 2016). The average annual human-related mortality/injury rate exceeds that of the calculated PBR of 0.1, classifying this population as strategic and depleted under the MMPA (NOAA Fisheries 2019c). Estimated human-caused mortality and serious injury between 2013 and 2017 was 6.85 whales per year (NOAA Fisheries 2019c).

Elevated mortalities of the North Atlantic right whale were documented from the most recent 2017 to 2020 UME (NOAA Fisheries 2020f). A total of 17 confirmed dead stranded whales were not accounted for in the 2000-2017 reports, and from 2017 to 2020 (as of December 4, 2020) a total of 32 dead stranded whales (21 in Canada and 11 in the US) have been confirmed, with the leading cause of death being human interaction from entanglements and/or vessel strikes (NOAA Fisheries 2020f). Thirteen other non-stranded whales have been documented as seriously injured from 2017-2020, bringing the likely estimated total up to 45 individual whales.

Ship strikes of individuals can impact northern right whales on a population level due to the intrinsically small remnant population that persists in the North Atlantic (Laist et al. 2001). Most ship strikes are fatal to the North Atlantic right whales (Jensen and Silber 2004). Right whales have difficulty maneuvering around boats and spend most of their time at the surface, feeding, resting, mating, and nursing, increasing their vulnerability to collisions. Mariners should assume that North Atlantic right whales will not move out of their way nor will they be easy to detect from the bow of a ship for they are dark in color and maintain a low profile while swimming (World Wildlife Fund 2005). To address potential for ship strike, NOAA Fisheries designated the Mid-Atlantic US SMA for right whales. The SRWF and SRWEC–OCS will cross the Block Island SMA (NOAA Fisheries 2020d). NOAA Fisheries requires that all vessels 65 ft (19.8 m) or longer must travel at 10 knots or less within the right whale SMA from November 1 through April 30 when right whales are most likely to pass through these waters. The most recent SAR noted that studies by van der Hoop et al. (2015) have concluded large whale vessel strike mortalities decreased inside active SMAs but have increased outside inactive SMAs.

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North Atlantic right whales are known to occur within both New York and Rhode Island state and adjacent OCS waters year-round. During the NYSDEC Whale Monitoring Program aerial surveys conducted from 2017-2020, 24 estimated individual North Atlantic right whales were sighted within the New York Bight (Tetra Tech and LGL 2020). These sightings occurred in the fall, winter, and spring seasons just outside New York state waters in federal, offshore waters extending out to the continental shelf edge. As shown in Table 3.1-2, the North Atlantic right whale has a documented presence within the New York OPA as well, per the NYSERDA Digital Aerial Baseline Surveys conducted from Summer 2016 through Winter 2019 (Normandeau 2019a, b, c, d, 2020). North Atlantic right whales sighted within the New York OPA occurred most often in the spring and winter months, with the highest number documented in Winter 2016 and 2017 (44 individuals). Kraus et al. (2016) observed North Atlantic right whales in the RI-MA and MA WEAs during winter and spring. However, the North Atlantic right whale has the potential to occur within the waters off Rhode Island and Massachusetts any time of the year. Typically, right whale sightings begin in December and continue through April. A total of 77 individuals was sighted in the WEAs from October 2011 to June 2015. The greatest numbers are seen in March. The Muskeget Channel and south of Nantucket, both located within the RI-MA and MA WEAs, were also identified as right whale hotspots during spring (Kraus et al. 2016).

The Gulf of Maine has been designated as a critical habitat area; therefore, they may migrate through the SRWEC corridor and SRWF as they travel to this feeding habitat. Kraus et al. (2016) reported a seasonal cluster of right whales south of Martha's Vineyard, MA and east of Nantucket, MA during winter. Right whales have been observed along Long Island, primarily by whale-watching vessels originating from Montauk.

During Project-specific PSO surveys from 2019 to 2020 (Smultea 2020), no individuals were detected inside the SRWF, but two estimated individuals were detected outside the SRWF as previously shown in Figure 3.1-4. The SRWF will also overlap with the designated Block Island SMA as previously mentioned. Right whales are therefore likely to be a common species within the SRWF and SRWEC.

Onshore Facilities

The North Atlantic right whale is not expected to be encountered within the waterbodies associated with the Onshore Facilities.

3.1.1.4 Sperm Whale

Sperm whales can be found throughout the world's oceans near the edge of the ice pack in both hemispheres and along the equator. The North Atlantic stock is distributed along the continental shelf-edge, over the continental slope, and in mid-ocean regions, where the species prefers water depths of 1,969 ft (600 m) or more and are less common in waters less than 984 ft (300 m) deep (NOAA Fisheries 2019c; Waring et al. 2015). In winter, sperm whales have been observed east and northeast of Cape Hatteras, and in spring, they are more widely distributed throughout the Mid-Atlantic Bight and southern portions of George's Bank (NOAA Fisheries 2019c). In summer, sperm whale distribution is similar to spring, but they are more widespread in Georges Bank and the Northeast Channel region and have also been observed inshore of the 328-ft (100-m) isobath south of New England (NOAA Fisheries 2019c). Sperm whale occurrence on the continental shelf in areas south of New England is at its highest in autumn (NOAA Fisheries 2019c).

Sperm whales can easily be distinguished in visual surveys by their large, blunt head, narrow underslung jaw, and characteristic blow shape resulting from the S-shaped blowhole set at the front-left of the head (Jefferson et al. 1993). Unlike mysticete whales that produce various types of calls used solely for communication, sperm whales produce clicks that are used for echolocation and foraging as well as communication (Erbe et al. 2017). Sperm whale clicks have been grouped into five classes based on the click rate, or number of clicks per second; these include "squeals," "creaks," "usual clicks," "slow clicks," and "codas." In general, these clicks are broadband sounds ranging from 100 Hz to 30 kHz with peak energy centered around 15 kHz. Depending on the class, SL_{rms} for sperm whale calls range between approximately 166 and 236 dB re 1 µPa @ 1 m (Erbe et al. 2017). Hearing sensitivity data for this species are currently unavailable (Southall et al. 2019).

The Western North Atlantic stock is federally listed as Endangered under the ESA (NOAA Fisheries n.d.[a]) and state listed as Endangered in New York and Massachusetts (MESA 2020; NYSDEC 2015). The species is also considered Depleted under the MMPA (MMC 2020) and listed as Vulnerable under the IUCN Red List (Taylor et al. 2019). Although 2011 surveys show sperm whale best estimates at 2,288 with a minimum estimate of 1,815, all estimates were not corrected for dive-time and are therefore likely to be downwardly biased and an underestimate of actual abundance, per the most recent (2014) stock assessment (NOAA Fisheries 2020b).

The best and most recent abundance estimate is 4,349 (NOAA Fisheries 2019c). No population trend analysis is available for this stock. Thousands of sperm whales were killed in the early eighteenth century. A moratorium on sperm whale hunting was adopted in 1986, and currently no hunting is allowed for any purposes in the North Atlantic. Occasionally, sperm whales will become entangled in fishing gear or be struck by ships off the US East Coast. However, this rate of mortality is not believed to have biologically significant impacts.

The current PBR for this stock is 6.9, and because the total estimated human-caused mortality and serious injury is less than 10 percent of this calculated PBR, it is considered insignificant (NOAA Fisheries 2019c). Between 2013 and 2017, 12 sperm whale strandings were documented along the US East Coast, but none of the strandings showed evidence of human interactions (NOAA Fisheries 2019c). Other threats to sperm whales include contaminants, climate-related changes in prey distribution, and anthropogenic sound although the severity of these threats on sperm whales is currently unknown (NOAA Fisheries 2019c). There is no designated critical habitat for this population in the Project Area.

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As shown in Table 3.1-2, sperm whales have a documented presence within the New York OPA, per the NYSERDA Digital Aerial Baseline Surveys conducted from Summer 2016 through Winter 2019 (Normandeau 2019a, b, c, d, 2020). Sperm whales sighted within the New York OPA occurred the most often in summer and autumn months with the highest number documented in Summer 2017 (42 individuals). Similarly, during the NYSDEC Whale Monitoring Program aerial surveys conducted from 2017 to 2020, a total of 32 sperm whale sightings (an estimated 72 individuals) were recorded (Tetra Tech and LGL 2020). These sightings occurred year-round within deeper waters along the continental shelf edge; however, sightings were more prevalent in the summer seasons. All sperm whale sightings occurred near the OCS in water greater than 656 ft (200 m) (Tetra Tech and LGL 2020).

Sperm whales were the fifth most commonly sighted large whale in the CETAP study area and were observed in all four seasons (CETAP 1982). The study sighted 341 individuals, which accounted for only 8 percent of the total large whale sightings during their survey period (CETAP 1982). Kraus et al. (2016) similarly reported sightings of sperm whales in the RI-MA and MA WEAs during the summer and autumn months: five individuals in August 2012, one in September 2012, and three in June 2015. There have also been occasional strandings in Massachusetts and Long Island (Kenney and Vigness-Raposa 2010). As accounts of sperm whales in the area are low, their occurrence within the SRWF, SRWEC–OCS, and surrounding waters is expected to be regular.

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CETAP reported that the distribution of sperm whales primarily centers at about the 1,000-m (3,280-ft) depth contour. However, their distribution can also extend shoreward, inshore of the 328-ft (100-m) contour, particularly in summer and autumn (CETAP 1982; NOAA Fisheries 2019c). Although relatively infrequent, sightings have been reported in waters as shallow as 197 ft (60 m). Southern New England is one of the few locations in the world in which sperm whales frequent inshore areas (Kenney and Vigness-Raposa 2010). Many reported sightings take place from May through November in a narrow band just south of Block Island, RI Martha's Vineyard, MA and Nantucket, Massachusetts. This high occurrence of sperm whales is believed to be related to the presence of spawning squid (CETAP 1982). Sadove and Cardinale (1993) also reported sperm whale presence south of Montauk Point in less than 18 m depths from late May through early June and again in October (Sadove and Cardinale 1993).

Given the species' preference for deeper waters, and the low and recent sightings data nearshore, sperm whales are expected to have an uncommon occurrence within the SRWEC–NYS.

Onshore Facilities

The sperm whale is not expected to be encountered within the waterbodies associated with the Onshore Facilities.

3.1.2 Non-ESA Listed Species

Of the 36 non-listed species whose ranges include the US Northeast, 14 are expected to have a regular or common occurrence within the Project Area and are therefore considered potentially affected species. The following sections provide further information regarding species behavior and expected occurrence in the SRWF, SRWEC, and Onshore Facilities.

3.1.2.1 Minke Whale

Minke whales prefer the colder waters in northern and southern latitudes, but they can be found in every ocean in the world (Risch et al. 2014). Available data suggest that minke whales are distributed in shallower waters along the continental shelf between spring and autumn and are located in deeper oceanic waters between winter and spring (NOAA Fisheries 2019c). They are most abundant in New England waters in spring, summer, and early autumn (NOAA Fisheries 2019c).

Common minke whales range between 20 and 30 ft (6 and 9 m, with maximum lengths of 30 to 33 ft [9 to 10 m]) and are the smallest of the North Atlantic baleen whales (Jefferson et al. 1993; Kenney and Vigness-Raposa 2009; Wynne and Schwartz 1999). A prominent morphological feature of the minke whale is the large, pointed median ridge on top of the rostrum. The body is dark gray to black with a pale belly and frequently shows pale areas on the sides that may extend up onto the back. The flippers are smooth and taper to a point, and the middle third of each flipper has a conspicuous bright white band that can be distinguished during visual surveys (Kenney and Vigness-Raposa 2010). As is typical of the baleen whales, minke whales are usually seen either alone or in small groups although large aggregations sometimes occur in feeding areas (Reeves et al. 2002). Minke populations are often segregated by sex, age, or reproductive condition. Known for their curiosity, minke whales often approach boats. The primary prey species for minke whales are most likely sand lance, clupeids, gadoids, and mackerel (Kenney and Vigness-Raposa 2009). These whales basically feed below the surface of the water, and calves are usually not seen in adult feeding areas.

In the North Atlantic, minke whales commonly produce pulse trains lasting 10 to 70 sec with a frequency range between 10 and 800 Hz. SL_{rms} for this call type have been reported between 159 and 176 dB re 1 μPa @ 1 m (Erbe et al. 2017). Some minke whales also produce a unique “boing” sound which is a train of rapid pulses often described as an initial pulse followed by an undulating tonal (Erbe et al. 2017; Rankin and Barlow 2005). The “boing” ranges from 1 to 5 kHz with an SLrms of approximately 150 dB re 1 μPa @ 1 m (Erbe et al. 2017). Auditory sensitivity for this species based on anatomical modeling of minke whale ear morphology is best between 10 Hz and 34 kHz (Southall et al. 2019; Ketten et al. 2014).

Minke whales are not federally listed under the ESA, are not state listed in New York, Massachusetts, or Rhode Island, are not considered Depleted under the MMPA, and are listed as Least Concern under the IUCN Red List (Cooke 2018; MESA 2020; MMC 2020; NOAA Fisheries n.d.[a], NYSDEC 2015; RI DEM 2012). The best abundance estimate for the Canadian East Coast stock per the most recent stock assessment 24,202 (NOAA Fisheries 2019c). The current global abundance estimate for the minke whale, compiled by the IUCN Red List, is around 200,000. The most recent population estimate for the Canadian East Coast stock, which occurs in the Project Area, is 24,202 minke whales (NOAA Fisheries 2019c). There are no current population trends or net productivity rates for this species due to insufficient data. The PBR for this stock is estimated to be 189 (NOAA Fisheries 2019c).

Minke whales may also be vulnerable to climate-related changes in prey distribution although the extent of this effect on minke whales remains uncertain (NOAA Fisheries 2019c). No designated critical habitat for this stock currently exists in the Project Area. The estimated annual human-caused mortality and serious injury from 2013 to 2017 was 8.0 per year attributed to fishery interactions, vessel strikes, and non-fishery entanglement in both the US and Canada (NOAA Fisheries 2019c).

Since January 2017, a high number of minke whale mortalities along the Atlantic coast prompted NOAA Fisheries to declare a UME (NOAA Fisheries 2020g). NOAA Fisheries, in collaboration with the Working Group on Marine Mammal UMEs, is working to review collected data on these events, as findings were not consistent across on whales examined. From January 2017 through December 3, 2020, a total of 16 minke whales were stranded off the coast of NYS, with an overall total of 102 strandings from South Carolina to Maine (NOAA Fisheries 2020g).

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As shown in Table 3.1-2, minke whales have a documented presence within the New York OPA, per the NYSERDA Digital Aerial Baseline Surveys conducted from Summer 2016 through Winter 2019 (Normandeau 2019a, b, c, d, 2020). Minke whales sighted within the New York OPA occurred most often in the spring and winter months, but they were sighted relatively uniformly during all four seasons with the highest number documented Spring 2018 (112 individuals). During previous studies conducted in the RI-MA and MA WEAs, 103 minke whales were sighted within the area (Kraus et al. 2016). Minke whales are almost absent from OCS waters off the western Atlantic in winter; however, they were common in autumn and abundant in spring and summer (CETAP 1982; Kenney and Vigness-Raposa 2010). Spring observations included the most individuals (76 sightings) followed by summer (26 sightings) and autumn (1 sighting) (Kraus et al. 2016).

Minke whales have been sighted offshore New York in both state and OCS waters in all four seasons (Kenney and Vigness-Raposa 2010). Based on sighting data, the minke is the second most abundant mysticete in the New York Bight. It is found regularly near the coast and occasionally in the Peconic Estuary, the Long Island Sound, and the Great South Bay (Sadove and Cardinale 1993). A large proportion of these sightings were reported from whale-watching boats. A dense concentration was seen between Block Island, RI and Montauk Point, NY in spring and summer (Kenney and Vigness-Raposa 2010; Kopelman 2013, 2015).

Minke whales are therefore expected to be common in spring and summer within the SRWF and SRWEC.

Onshore Facilities

Although the minke whale has a historic presence within Great South Bay as noted above, no recent sightings data (within the last 27 years) are available. The minke whale is therefore not expected to be encountered within the waterbodies associated with the Onshore Facilities.

3.1.2.2 Humpback Whale

The humpback whale can be found worldwide in all major oceans from the equator to sub-polar latitudes. Humpback whales exhibit consistent fidelity to feeding areas within the northern hemisphere (Stevick et al. 2006) where there are six subpopulations of humpback whales that feed in six different areas during spring, summer, and autumn. These feeding populations can be found in the Gulf of Maine, the Gulf of St. Lawrence, Newfoundland/Labrador, western Greenland, Iceland, and Norway (Waring et al. 2015). During the winter months, humpbacks migrate to calving grounds in subtropical or tropical waters such as the Dominican Republic in the Atlantic and the Hawaiian Islands in the Pacific (NOAA Fisheries 2019c). Humpback whales from the North Atlantic feeding areas mate and calve in the West Indies (NOAA Fisheries 2019c). Since 1989, observations of juvenile humpbacks in the Mid-Atlantic have been increasing during the winter months, peaking January through March (Swingle et al. 1993). Biologists theorize that non-reproductive animals may be establishing a winter feeding range in the Mid-Atlantic since they are not participating in reproductive behavior in the Caribbean. Acoustic survey data collected from 2004 to 2014 on 281 collected bottom-mounted recorders (for a total of 35,033 days) concluded that humpback whales (as well as fin, sei, and blue whales) were present from the US Southeast to Greenland in the winter seasons, suggesting baleen whales are widely distributed during these months (Davis et al. 2020).

In summer, humpback whales in the Western North Atlantic are typically observed in the Gulf of Maine and along the Scotian Shelf, and there have also been numerous winter sightings in the US Southeast (NOAA Fisheries 2019c). Feeding behavior has also been observed in New England off Long Island, NY, and survey data from NOAA suggest a potential increase in humpback whale abundance off New Jersey and New York (NOAA Fisheries 2019c).

Humpback whales are easily identified in field surveys by their long flippers, which can be up to one-third of their total body length, as well as the bumps covering their head and flippers (Jefferson et al. 1993). Humpback whales feed on small prey that is often found in large concentrations including krill and fish such as herring and sand lance (Kenney and Vigness-Raposa 2010; Waring et al. 2007). Humpback whales are thought to feed mainly while migrating and in summer feeding areas; little feeding is known to occur in their wintering grounds. Humpbacks feed over the continental shelf in the North Atlantic between New Jersey and Greenland, consuming roughly 95 percent small schooling fish and 5 percent zooplankton (i.e., krill), and they will migrate throughout their summer habitat to locate prey (Kenney and Winn 1986). They swim below the thermocline to pursue their prey, so even though the surface temperatures might be warm, they are frequently swimming in cold water. Humpback whales from all of the North Atlantic migrate to the Caribbean in winter, where calves are born between January and March (Blaylock et al. 1995).

During migration and breeding seasons, male humpback whales are often recorded producing vocalizations arranged into repetitive sequences termed “songs” that can last for hours or even days.

These songs have been well studied in the literature to document changes over time and geographic differences; generally, the bandwidth of these songs range from 20 Hz to over 24 kHz. Most of the energy is focused between 50 and 1,000 Hz and reported SL_{rms} range from 151 to 189 dB re 1 μPa @ 1 m (Erbe et al. 2017). Other calls produced by humpbacks, both male and female, include pulses, moans, and grunts used for foraging and communication. These calls are lower frequency (under 2 kHz) with SL_{rms} ranging from 162 to 190 dB re 1 μPa @ 1 m (Erbe et al. 2017; Thompson et al. 1986). Anatomical modeling based on humpback whale ear morphology indicate that their best hearing sensitivity is between 18 Hz and 15 kHz (Ketten et al. 2014; Southall et al. 2019).

The humpback whale was federally listed as Endangered under the ESA in 1970 due to population decrease resulting from overharvesting (Breiwick et al. 1983); however, this species was delisted as of September 8, 2016 (81 FR 62259). Similarly, the State of New York is proposing to remove humpback whales from the current Listing of Endangered, Threatened, and Special Concern Species (6 NYCRR Part 182.5) (NYSDEC 2019). The species is not considered Depleted by the MMPA (MMC 2020), is not state listed in Rhode Island or Massachusetts (MESA 2020; RI DEM 2012) and is listed as a species of Least Concern under the IUCN Red List (Cooke 2018). Globally, there are 14 distinct population segments (DPSs) recognized for humpback whales, four of which are listed as Endangered. The Gulf of Maine stock (formerly known as the Western North Atlantic stock), which occurs in the Project Area, is not considered strategic under the MMPA and does not coincide with any ESA-list DPS (NOAA Fisheries 2019c).

The best abundance estimate for the Gulf of Maine stock per the most recent stock assessment is 1,396 (NOAA Fisheries 2019c). Available data indicate that this stock is characterized by a positive population trend, with an estimated increase in abundance of 2.8 percent per year (NOAA Fisheries 2019c).

Major threats to humpback whales include vessel strikes, fishery entanglements, and climate-related shifts in prey distribution (Cassoff et al. 2011; NOAA Fisheries 2019c). It is estimated that 3 percent of the Northwest Atlantic population die annually as the result of entanglements (Robbins 2009, 2010, 2011, 2012 in NOAA Fisheries 2019c). From 2013 through 2017, there are 23 reports of serious injuries and mortalities resulting from of collision with a vessel and 456 records of injuries (prorated or serious) and mortalities attributed to entanglement (NOAA Fisheries 2019c). In 2016, a high number of humpback whale mortalities on the Atlantic coast prompted NOAA Fisheries' Office of Protected Resources to declare an Unusual Mortality Event (UME) (NOAA Fisheries 2020h). As of the last reported online update of December 3, 2020, 140 humpback whales were found dead along the Atlantic coast from Maine to Florida, including 31 off New York (Henry et al. 2020; NOAA Fisheries 2020h). Of the carcasses that have been examined, approximately 50 percent have shown signs of human interaction, either vessel strike or entanglement. The level of vessel strikes between 2016 and 2017 was more than six times the 16-year average for this region (NOAA Fisheries 2019c). Most recently, on July 17, 2020, a humpback whale was recorded stranded approximately 6 mi (9.7 km) offshore near Montauk, and on July 18, 2020, another humpback whale was reported to the New York State Stranding Hotline by a vessel conducting G&G surveys for the Project (AMCS 2020). The whale washed ashore that evening at Smith Point County Park. The whale recorded offshore was not autopsied; however, the beached whale's head tissues were examined and were found to be consistent with vessel strike trauma (AMCS 2020).

Entanglements can represent a significant energy expenditure for large whales, leading to injury or death if disentanglement efforts are not successful within a critical period (van der Hoop et al., 2016, 2017). Such energy expenditures can have significant sub-lethal impacts, particularly to reproductive females where time for reproduction could be delayed for months or years (van der Hoop et al. 2016), contributing to fluctuations in population growth (van der Hoop et al. 2016). Evidence suggests that recent efforts to reduce large whale entanglement through fishing gear modification have not resulted in decline of frequencies of entanglement or serious injury due to entanglement (Pace et al. 2014). The PBR for this stock is 22, and the estimated annual human-caused mortality and serious injury between 2013 and 2017 was 12.15 whales per year (NOAA Fisheries 2019c). While the current annual mortality and serious injury is below the calculated PBR, this estimate only includes detected mortalities and serious injuries. Detected mortality is estimated to only be 20 percent of all mortality, which could indicate the total mortality in humpbacks has or will exceed PBR, a prediction further supported by the Unusual Mortality Event (UME) declared for this species in 2016 (NOAA Fisheries 2019c). There is no designated critical habitat for this stock in the Project Area.

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As shown in Table 3.1-2, the humpback whale has a documented presence within the New York OPA, per the NYSERDA Digital Aerial Baseline Surveys conducted from Summer 2016 through Winter 2019 (Normandeau 2019a, b, c, d, 2020). Humpback whales sighted within the New York OPA occurred most often during the spring and autumn months; however, they were recorded in all four seasons with the highest number documented in Spring 2018 (70 individuals). Similarly, during the NYSDEC Whale Monitoring Program aerial surveys conducted from 2017-2020, 279 estimated individual humpback whales were sighted within the New York Bight (Tetra Tech and LGL 2020). These sightings occurred during all seasons with a higher prevalence in the summer, within a wide geographical area ranging from nearshore to the continental shelf edge and beyond.

Kraus et al. (2016) reported humpback whale sightings in the RI-MA and MA WEAs during all seasons, with peak abundance during spring and summer, but their presence within the region varies between years. Increased stocks of sand lance (*Ammodytes* spp.) appear to correlate with the years in which most whales were observed, suggesting that humpback whale distribution and occurrences could largely be influenced by prey availability (Kenney and Vigness-Raposa 2010). The greatest number of sightings of humpbacks in the RI-MA and MA WEAs occurred during April (33 sightings); their presence increased starting in March and continued through July. Seasonal abundance estimates of humpback whales in the RI-MA and MA WEAs range from 0 to 41, with higher estimates observed during spring and summer (Kraus et al. 2016). Acoustic detections within the RI-MA and MA WEAs were primarily during the summer months (Kraus et al. 2016).

In the 1980s, numerous sightings of humpbacks were reported between Long Island, NY and Martha’s Vineyard, MA. Humpback whales were regularly found in shallow water for extended periods of time (greater than one week) within Long Island Sound, Block Island Sound, and Gardiner’s Bay. They were also observed moving in and out of some of the inlets along the south shore of Long Island (i.e., Shinnecock, Fire Island, New York Harbor) (Sadove and Cardinale 1993).

Montauk boats reported two sightings in 1986 and 63 sightings in 1987 (Kenney and Vigness-Raposa 2010; Sadove and Cardinale 1993). Recently, multiple humpbacks were reported feeding off Long Island, NY during July 2016 and near New York City during November and December 2016 (NOAA Fisheries 2019c; Waring et al. 2016). Humpback strandings were also reported along the southern shore of eastern Long Island, NY in February 1992, November 1992, October 1993, August 1997, and April 2004.

Humpbacks are known to occur within New York state and adjacent OCS waters; however, their presence is relatively unpredictable and may be strongly influenced by prey availability (Kenney and Vigness-Raposa 2010; Sadove and Cardinale 1993).

Furthermore, during Project-specific PSO surveys from 2019 to 2020 (Smultea 2020), one estimated individual was detected inside the SRWF, and six estimated individuals were detected outside the SRWF as illustrated in Figure 3.1-4.

Based on these data, humpback whales are likely to be common within the SRWF and SRWEC, predominantly during spring and summer.

Onshore Facilities

Although the humpback whale has a historic presence within Great South Bay as noted above, no recent sightings data (within the last 27 years) are available. The humpback whale is therefore not expected to be encountered within the waterbodies associated with the Onshore Facilities.

3.1.2.3 Long-finned Pilot Whale

There are two species of pilot whale in the Western North Atlantic, long-finned and short-finned. Because it is difficult to differentiate between these two species in the field, sightings are usually reported to genus level only (CETAP 1982; NOAA Fisheries 2019c). However, short-finned pilot whales are a southern or tropical species, and pilot whale sightings above approximately 42°N are most likely long-finned pilot whales, and short-finned pilot whale occurrence in the Project Area is considered rare (CETAP 1982; NOAA Fisheries 2019c). Long-finned pilot whales are distributed along the continental shelf waters off the US Northeast in winter and early spring. By late spring, pilot whales migrate into more northern waters, including Georges Bank and the Gulf of Maine, and remain there until autumn. The best abundance estimate for the Western North Atlantic stock per the most recent stock assessment is 39,215 (NOAA Fisheries 2019c).

Both short-finned and long-finned pilot whales are similar in coloration and body shape; however, long-finned pilot whales can be distinguished by their long flippers, which are 18 to 27 percent of the body length with a pointed tip and angled leading edge (Jefferson et al. 1993). Like dolphin species, long-finned pilot whales can produce whistles and burst-pulses used for foraging and communication. Whistles typically range in frequency from 1 to 11 kHz, while burst-pulses cover a broader frequency range from 100 Hz to 22 kHz (Erbe et al. 2017). Auditory evoked potential (AEP) measurements conducted by Pacini et al. (2010) indicate that the hearing sensitivity for this species ranges from <4 kHz to 89 kHz.

Long-finned pilot whales are not federally listed under the ESA are not state listed in New York, Massachusetts, or Rhode Island, are not considered Depleted under the MMPA, and are considered a species of Least Concern under the IUCN Red List (MESA 2020; Minton et al. 2018; MMC 2020; NOAA Fisheries n.d.[a], NYSDEC 2015; RI DEM 2012). However, threats to this population include entanglement in fishing gear, contaminants, climate-related shifts in prey distribution, and anthropogenic sound (NOAA Fisheries 2019c). There is no designated critical habitat for this stock in the Project Area. The PBR for this stock is 306, and the annual human-caused mortality and serious injury was estimated to be 21 whales between 2013 and 2017 (NOAA Fisheries 2019c). Long-finned pilot whales have a propensity to mass strand in US waters although the role of human activity in these strandings remains unknown (NOAA Fisheries 2019c).

Sunrise Wind Farm

As shown in Table 3.1-2, pilot whales have a documented presence within the New York OPA, per the NYSERDA Digital Aerial Baseline Surveys conducted from Summer 2016 through Winter 2019 (Normandeau 2019a, b, c, d, 2020). Pilot whales sighted within the New York OPA occurred most often during the summer months but also had high occurrences in autumn and spring with the highest recorded occurrence in Summer 2016 (1,393 individuals). CETAP surveys reported long-finned pilot whales as the third most commonly sighted small whale in their study area with 12,438 individuals (CETAP 1982). Long-finned pilot whales have been observed in OCS waters off Rhode Island in all four seasons, with peak occurrences in spring (CETAP 1982; Sadove and Cardinale 1993). There are 43 records of long-finned pilot whales and 226 records of non-specific pilot whales in this area. Nine sightings during summer and three sightings in spring were reported from whale-watching data for pilot whales (Kenney and Vigness-Raposa 2010).

Within the RI-MA and MA WEAs, no sightings of pilot whales were observed during summer, autumn, or winter (Kraus et al. 2016). Long-finned pilot whales are expected to be common within the SRWF during spring.

Sunrise Wind Export Cable

Long-finned pilot whales have been observed inshore along the 30- to 40-fathom contours between the area south of Shinnecock Inlet east to south of Block Island primarily during spring (Sadove and Cardinale 1993). However, they prefer deep pelagic temperate to subpolar oceanic waters and are expected to be uncommon within the SRWEC.

Onshore Facilities

The long-finned pilot whale is not expected to be encountered within the waterbodies associated with the Onshore Facilities.

3.1.2.4 Atlantic Spotted Dolphin

Atlantic spotted dolphins are found in tropical and warm temperate waters. In the Western North Atlantic, their distribution ranges from the US Northeast to the Gulf of Mexico and the Caribbean to Venezuela (NOAA Fisheries 2019c). They are regularly seen in continental shelf and slope waters. There are two Atlantic spotted dolphin ecotypes which may be distinct sub-species (Rice 1998). The larger heavily spotted ecotype inhabits OCS waters inside or near the 200-m (656-ft) isobath south of Cape Hatteras, and the smaller form is less spotted and is found further offshore and only occurs in the Atlantic (Mullin and Fulling 2003). Recent genetic data also suggest that they may be genetically distinct populations (NOAA Fisheries 2019c). Both ecotypes can occur in the US Northeast; however, they are difficult to differentiate at sea and are therefore not distinguished in this assessment. The best abundance estimate for the Western North Atlantic stock per the most recent stock assessment is 39,921 (NOAA Fisheries 2019c).

Young Atlantic spotted dolphins start out with no spotting and resemble slender common bottlenose dolphins. Large spotting develops as the animals age, making it easier to distinguish them in visual surveys (Jefferson et al. 1993). Atlantic spotted dolphins have an estimated auditory bandwidth of 150 Hz to 160 kHz and vocalizations typically range from 100 Hz to 130 kHz (Department of the Navy 2007; Southall et al. 2007). No auditory sensitivity data are available for this species (Southall et al. 2019).

Atlantic spotted dolphins are not federally listed under the ESA, are not state listed in New York, Massachusetts, or Rhode Island, are not considered Depleted under the MMPA, and are considered a species of Least Concern under the IUCN Red List (Braulik and Jefferson 2018; MESA 2020; MMC 2020; NOAA Fisheries n.d.[a], NYSDEC 2015; RI DEM 2012). However, threats to this population include anthropogenic sound; offshore development, particularly south of Cape Hatteras where this species inhabits inshore shelf waters; contaminants; and climate-related shifts in prey distribution (NOAA Fisheries 2019c). Twenty-one Atlantic spotted dolphins were reported stranded between North Carolina and Florida during this period; however, no definitive evidence of human interaction was found (NOAA Fisheries 2019c). The PBR for this stock is 320, and the estimated annual human-caused mortality and serious injury from 2013 to 2017 was presumed to be zero (NOAA Fisheries 2019c). There is no designated critical habitat for this stock in the Project Area.

Sunrise Wind Farm

As shown in Table 3.1-2, the Atlantic spotted dolphin has a documented presence within the New York OPA, per the NYSERDA Digital Aerial Baseline Surveys conducted from Summer 2016 through Winter 2019 (Normandeau 2019a, b, c, d, 2020). Atlantic spotted dolphins sighted within the New York OPA occurred most often during the spring and autumn months with the highest occurrence in Autumn 2016 (607 individuals). There are reported occurrences of general spotted dolphins (*Stenella* spp.) in the Project Area. CETAP described spotted dolphins as the seventh most commonly sighted cetaceans in the study area, with 126 sightings over the course of a three-year study. The 1982 CETAP data observed 40 individuals south of Block Island, RI (CETAP 1982). NOAA Fisheries shipboard surveys conducted during June to August between central Virginia and the Lower Bay of Fundy reported 542 to 860 individual sightings from two separate visual teams (Palka et al. 2017). Surveys conducted by the New York State

Marine Mammal and Sea Turtle Stranding Program indicated that sightings were in offshore waters more than 164 ft (50 m) in depth along the continental shelf south of Montauk Point and at the shelf valley of Hudson Canyon (Sadove and Cardinale 1993).

During Project-specific PSO surveys from 2019 to 2020 (Smultea 2020), four estimated individuals were detected inside the SRWF, with no individuals detected outside the SRWF as illustrated in Figure 3.1-5. Atlantic spotted dolphins are therefore expected to have a regular occurrence within the SRWF.

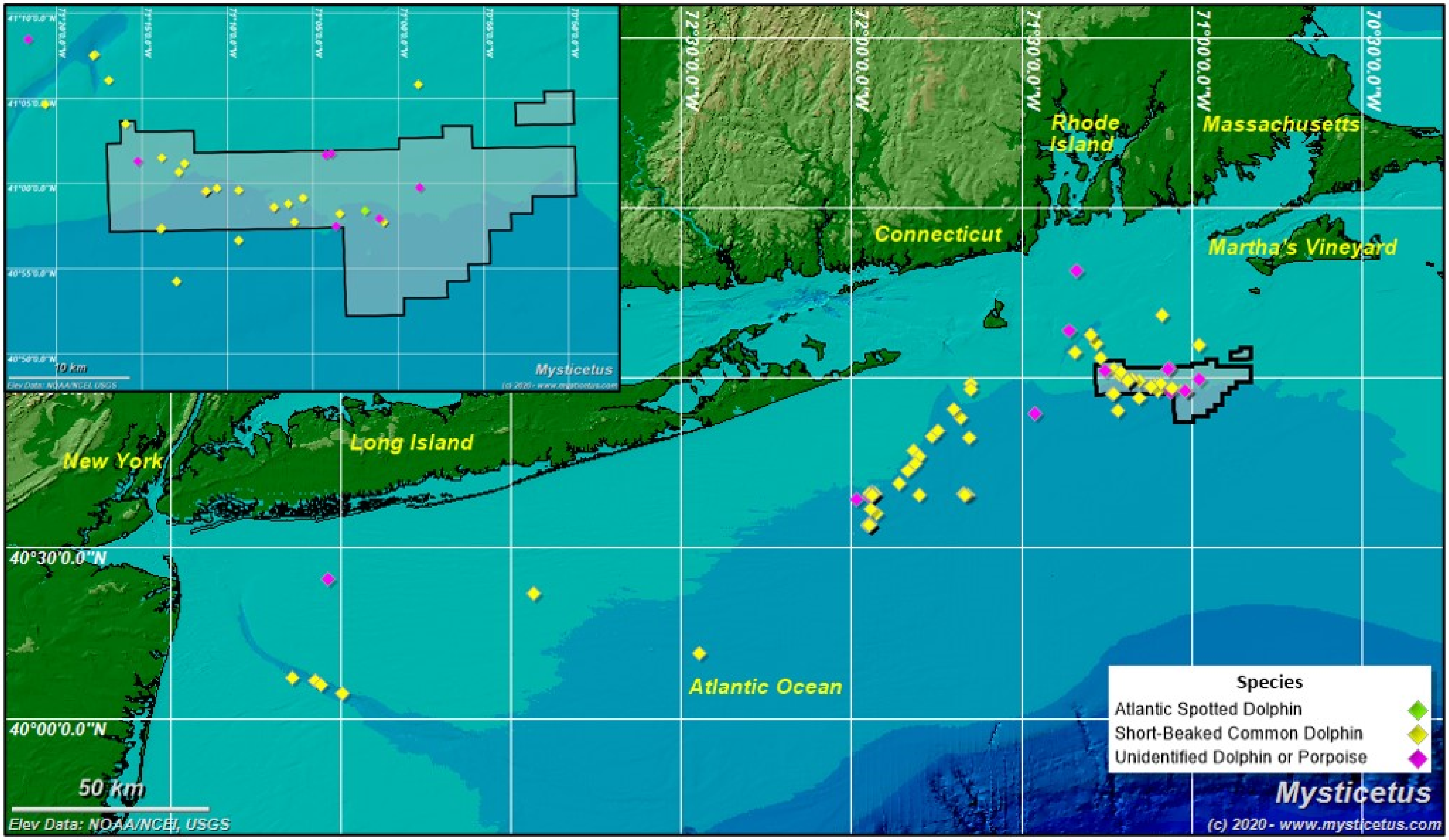
Sunrise Wind Export Cable

Atlantic spotted dolphins north of Cape Hatteras tend to be observed offshore over and beyond the continental slope; however, per sightings outlined above, their presence in the SRWEC is expected to be uncommon.

Onshore Facilities

The Atlantic spotted dolphin is not expected to be encountered within the waterbodies associated with the Onshore Facilities.

Figure 3.1-5 Locations of all Dolphins and Porpoises Detected during the Sunrise Wind Geotechnical Survey (2019–2020)



NOTE: The SRWF is indicated by the gray polygon. Inset is an enlargement showing all dolphin and porpoise detections in or close to the SRWF.

3.1.2.5 Atlantic White-sided Dolphin

Atlantic white-sided dolphins migrate between the temperate and polar waters of the North Atlantic Ocean but usually maintain migration routes over the deeper-sloped continental shelves (Doksaeter et al. 2008; Waring et al. 2008). This is the most abundant dolphin in the Gulf of Maine and the Gulf of St. Lawrence; they are rarely seen off the coast of Nova Scotia (Kenney and Vigness-Raposa 2010; Sadove and Cardinale 1993).

This species is highly social but not as demonstrative as some other common dolphins. They typically form pods of around 30 to 150 individuals but have also been seen in very large pods of 500 to 2,000 individuals (NOAA Fisheries 2019c). It is common to find these pods associated with the presence of other white-beaked dolphins, pilot whales, fin whales, and humpback whales. The Atlantic white-sided dolphin gets its name from the distinctive white stripe on its side, which starts just below the dorsal fin and runs into a yellow/ochre blaze continuing onto the tailstock, which is easily seen when the animal is bow-riding or porpoising. It has a whitish lower jaw, throat, and belly to genital region, with a dark eye patch and face-flipper stripe (Cipriano 2002; Jefferson et al. 1993).

Like most dolphin species, Atlantic white-sided dolphins produce clicks, buzzes, calls, and whistles. Their clicks are broadband sounds ranging from 30 to 40 kHz that can contain frequencies over 100 kHz and are often produced during foraging and for orientation within the water column. Buzzes and calls are not as well studied, and they may be used for socialization as well as foraging. Whistles are primarily for social communication and group cohesion and are characterized by a downsweep followed by an upsweep with an approximate starting frequency of 20 kHz and ending frequency of 17 kHz (Hamran 2014). No hearing sensitivity data are currently available for this species (Southall et al. 2019).

The best abundance estimate for the Western North Atlantic stock per the most recent stock assessment is 93,233 (NOAA Fisheries 2019c). An abundance estimate of 31,912 (CV=0.61) US Gulf of Maine white-sided dolphins was generated from a shipboard and aerial survey conducted from June 27 to September 28, 2016 in an area of 425,192 km^2 from central Virginia to Maine (Palka (in review) *cited in* NOAA Fisheries 2019c).

Atlantic white-sided dolphins are not federally listed under the ESA, are not state listed in New York, Massachusetts, or Rhode Island, are not considered Depleted under the MMPA, and are a species of Least Concern under the ICUN Red List (Braulik 2019; MESA 2020; MMC 2020; NOAA Fisheries n.d.[a], NYSDEC 2015; RI DEM 2012; MMC 2020). A trend analysis is not currently available for this stock due to insufficient data (NOAA Fisheries 2019c). The PBR for this stock is 544, and the annual rate of human-caused mortality and serious injury from 2013 to 2017 was estimated to be 26 dolphins. This estimate is based on observed fishery interactions, but Atlantic white-sided dolphins are also threatened by contaminants in their habitat and climate-related shifts in prey distribution (NOAA Fisheries 2019c). There is no designated critical habitat for this stock in the Project Area.

Sunrise Wind Farm/Sunrise Wind Export Cable

As shown in Table 3.1-2, the Atlantic white-sided dolphin has a documented presence within the New York OPA, per the NYSERDA Digital Aerial Baseline Surveys conducted from Summer 2016 through Winter 2019 (Normandeau 2019a, b, c, d, 2020). Atlantic white-sided dolphin sighted within the New York OPA occurred most often during the autumn and winter months with the highest documented occurrence in Autumn 2016 (180 individuals). Over the course of BOEM's study in the RI-MA and MA WEAs, 185 individual Atlantic white-sided dolphins were sighted within the SRWF; most were observed during summer (112 sightings) followed by autumn (70 sightings) (Kraus et al. 2016).

Atlantic white-sided dolphins are one of the three odontocetes primarily inhabiting OCS waters shoreward of the 100-m (328-ft) depth contour (CETAP 1982; NOAA Fisheries 2019c; Sadove and Cardinale 1993). Most of the sightings (90 percent) were seen within an estimated depth range of 125 to 889 ft (38 to 2,710 m). Sightings are concentrated in coastal waters near Cape May, NJ, and in shallow waters within the Gulf of Maine (CETAP 1982; Sadove and Cardinale 1993). The Gulf of Maine population is commonly seen from the Hudson Canyon to Georges Bank. Sightings south of Georges Bank and Hudson Canyon occur year-round although at lower densities (NOAA Fisheries 2019c).

Atlantic white-sided dolphins are common in OCS waters, with a slight tendency to occur in shallower New York state waters in spring (Kenney and Vigness-Raposa 2010). Records indicate that there is an aggregation of sightings southeast of Montauk Point, NY, during spring and summer. Strandings of white-sided dolphins within the SRWEC are relatively rare; from 2001 to 2011, there was an average of 1.2 strandings per year (Kenney and Vigness-Raposa 2010; Smith 2014). Atlantic white-sided dolphins occur in seasonably high numbers in nearshore areas during spring and summer.

Atlantic white-sided dolphins are, therefore, one of the most likely delphinids that would be a common species year-round within the SRWF and SRWEC waters.

Onshore Facilities

The Atlantic white-sided dolphin is not expected to be encountered within the waterbodies associated with the Onshore Facilities.

3.1.2.6 Short-beaked Common Dolphin

The short-beaked common dolphin has a wide distribution and can be found in both tropical and temperate areas of the Pacific and Atlantic Oceans in both nearshore and offshore waters (Perrin 2002). Two common dolphin species were previously recognized: the long-beaked common dolphin (*Delphinus capensis*) and the short-beaked common dolphin (*Delphinus delphis)*; however, Cunha et al. (2015) summarized the relevant data and analyses along with additional molecular data and analysis and recommended that the long-beaked common dolphin not be further used for the Atlantic Ocean.
This highly social and energetic species usually travels in large pods consisting of 50 to more than 1,000 individuals (Hammond et al. 2008) and is frequently seen performing acrobatics and interacting with large vessels and other marine mammals. Short-beaked common dolphins have been found feeding on herring, mackerel, and squid depending on their abundance (Sadove and Cardinale 1993).

Short-beaked common dolphins have a very distinct color pattern that takes the form of an hourglass on its side, and most individuals also have a prominent white patch on the dorsal fin (Jefferson et al., 2008). Short-beaked common dolphin clicks are broadband sounds between 17 and 45 kHz with peak energy between 23 and 67 kHz. Burst-pulse sounds are typically between 2 and 14 kHz, while the key frequencies of short-beaked common dolphin whistles are between 3 and 24 kHz (Erbe et al. 2017). No hearing sensitivity data are available for this species (Southall et al. 2019).

The best abundance estimate for the Western North Atlantic stock per the most recent stock assessment is 178,825 (NOAA Fisheries 2019c). Short-beaked common dolphins are not federally listed under the ESA, are not state listed in New York, Massachusetts, or Rhode Island, are not considered Depleted under the MMPA, and are a species of Least Concern under the IUCN Red List (Hammond et al. 2008; MESA 2020; MMC 2020; NOAA Fisheries n.d.[a], NYSDEC 2015; RI DEM 2012). However, the species faces anthropogenic threats because of its utilization of nearshore habitat and highly social nature, but it is not considered a strategic stock under the MMPA because the average annual human-caused mortality and serious injury does not exceed the calculated PBR of 1,452 for this stock (NOAA Fisheries 2019c). Historically, this species was hunted in large numbers for food and oil. Currently, they continue to suffer incidental mortality from vessel collisions and Eastern North American fishing activities within the Atlantic, most prominently yellowfin tuna (*Thunnus albacares*) nets, driftnets, and bottom-set gillnets (Kraus et al. 2016; NOAA Fisheries 2019b). The annual estimated human-caused mortality and serious injury for 2013 to 2017 was 419.2, which included fishery-interactions and research takes (NOAA Fisheries 2019c). Other threats to this species include contaminants in their habitat and climate-related changes in prey distribution (NOAA Fisheries 2019c). There is no designated critical habitat for this stock in the Project Area.

Sunrise Wind Farm/Sunrise Wind Export Cable

As shown in Table 3.1-2, the short-beaked common dolphin has a documented presence within the New York OPA, per the NYSERDA Digital Aerial Baseline Surveys conducted from Summer 2016 through Winter 2019 (Normandeau 2019a, b, c, d, 2020). Short-beaked common dolphins sighted within the New York OPA occurred relatively uniformly across all four seasons with the highest number documented in Summer 2017 (11,908 individuals).

Kraus et al. (2016) observed 3,896 short-beaked common dolphins within the RI-MA and MA WEAs. Most were observed during summer surveys (1,964 sightings), followed by autumn (725), winter (132), then spring (75). This was the highest number of individual sightings of all the small cetaceans. Similarly, during Project-specific PSO surveys from 2019 to 2020 (Smultea 2020), the short-beaked common dolphin was the most commonly recorded species and also the marine mammal with the largest average group size. A total of 86 estimated individuals was detected inside the SRWF, and 566 estimated individuals were detected outside the SRWF.

The majority of sightings of this species are found in water depths greater than 33 ft (10 m) along the south shore of Long Island (Sadove and Cardinale 1993). They are also found frequently around significant submarine features such as Hudson and Block Canyons with aggregations up to 10,000 individuals (Sadove and Cardinale 1993). Strandings have been recorded in Long Island Sound, the eastern end of Long Island near Montauk, and inland waters of Rhode Island (Smith 2014).

Since the short-beaked common dolphin has a wide distribution, can be found in both nearshore and offshore waters of the Pacific and Atlantic Oceans, and has a documented presence within the SRWF per PSO data (Smultea 2020), they are expected to be a common occurrence within the SRWEC. Reported PSO data of the short-beaked common dolphin are illustrated in Figure 3.1-5.

Therefore, the short-beaked common dolphin is anticipated to be one of the most commonly occurring delphinids to occur year-round within the SRWF and SRWEC.

Onshore Facilities

The short-beaked common dolphin is not expected to be encountered within the waterbodies associated with the Onshore Facilities.

3.1.2.7 Common Bottlenose Dolphin

In the Western North Atlantic, there are two morphologically and genetically distinct common bottlenose morphotypes: the Western North Atlantic Northern Migratory Coastal stock and the Western North Atlantic Offshore stock (Rosel et al. 2009). The offshore stock is a year-round resident primarily distributed along the OCS and slope from Georges Bank to Florida and in the Gulf of Maine is largely concentrated around significant submarine features such as Hudson and Block Canyons (NOAA Fisheries 2019c; Sadove and Cardinale 1993). The northern migratory coastal stock is distributed along the coast between southern Long Island, NY and Florida (NOAA Fisheries 2019c; Sadove and Cardinale 1993) and has been observed in the Project Area in recent years (AMCS 2020). Common bottlenose dolphins are large, relatively robust animals. The snout is stocky and set off from the head by a crease. They are typically light to dark grey in color with a white underside (Jefferson et al. 1993).

Whistles produced by bottlenose dolphins can vary over geographic regions, and newborns are thought to develop “signature whistles” within the first few months of their lives that are used for intraspecific communication. Whistles generally range in frequency from 300 Hz to 39 kHz with SL_{rms} between 114 and 163 dB re 1 µPa @ 1 m (Erbe et al. 2017). Common bottlenose dolphins also make burst-pulse sounds and echolocation clicks, which can range from a few kHz to over 150 kHz. As these sounds are used for locating and capturing prey, they are directional calls; the recorded frequency and sound level can vary depending on whether the sound was received head-on or at an angle relative to the vocalizing dolphin. SL_{rms} for burst-pulses and clicks range between 193 and 228 dB re 1 µPa @ 1 m (Erbe et al. 2017). There are sufficient available data for common bottlenose dolphin hearing sensitivity using both behavioral and AEP methods as well as anatomical modeling studies to show hearing for the species is greatest between approximately 400 Hz and 169 kHz (Southall et al. 2019).

Common bottlenose dolphins are not federally listed under the ESA, are not state listed in New York, Massachusetts, or Rhode Island, and are a species of Least Concern under the IUCN Red List (MESA 2020; NOAA Fisheries n.d.[a], NYSDEC 2015; RI DEM 2012; Wells et al. 2019). The species is however considered Depleted under the MMPA (MMC 2020). The best abundance estimate for the Western North Atlantic offshore stock per the most recent stock assessment is 62,851 (NOAA Fisheries 2019c). Palka (as cited in NOAA Fisheries 2019c) estimated 17,957 individuals based on aerial and vessel-based surveys conducted in 2016 between New Jersey to the lower Bay of Fundy.

The PBR for this stock is 519, and the average annual human-cause mortality and serious injury from 2013 to 2017 was estimated to be 28, attributed to fishery interactions (NOAA Fisheries 2019c). Because annual mortality does not exceed PBR, this stock is not classified as strategic under the MMPA.

In addition to fisheries, threats to common bottlenose dolphins include non-fishery-related human interaction; anthropogenic sound; offshore development; contaminants in their habitat; and climate-related changes in prey distribution (NOAA Fisheries 2019c). There is no designated critical habitat for either stock in the Project Area.

Sunrise Wind Farm/Sunrise Wind Export Cable

As shown in Table 3.1-2, the common bottlenose dolphin has a documented presence within the New York OPA, per the NYSERDA Digital Aerial Baseline Surveys conducted from Summer 2016 through Winter 2019 (Normandeau 2019a, b, c, d, 2020). Common bottlenose dolphins sighted within the New York OPA occurred most often during the spring and summer months; however, they were recorded in all four seasons with the highest number documented in Summer 2017 (2,443 individuals).

Common bottlenose dolphins were reported in the RI-MA and MA WEAs in all seasons; highest seasonal abundance estimates were during autumn, summer, and spring. Kraus et al. (2016) report the offshore stock as only being sighted in the RI-MA and MA WEAs during the summer months. The greatest concentrations of common bottlenose dolphins were observed in the southernmost portion of the RI-MA WEA study area in autumn (Kraus et al. 2016).

Common bottlenose dolphins that occur within the nearshore areas of the Project Area can come from either the migratory or the offshore stock. However, seasonal stranding records have historically matched the temporal patterns of the offshore stock rather than the coastal stock (Kenney and Vigness-Raposa 2010), but recent observations of the migratory stock in New York waters suggests the distribution may be shifting northward (AMCS 2020).

Therefore, common bottlenose dolphins are expected to be a common species within the SRWF and SRWEC.

Onshore Facilities

The common bottlenose dolphin is not expected to be encountered within the waterbodies associated with the Onshore Facilities.

3.1.2.8 Harbor Porpoise

The harbor porpoise is mainly a temperate, inshore species that prefers to inhabit shallow, coastal waters of the North Atlantic, North Pacific, and Black Sea. Harbor porpoises mostly occur in shallow OCS and coastal waters. In summer, they tend to congregate in the Northern Gulf of Maine, Southern Bay of Fundy, and around the southern tip of Nova Scotia (NOAA Fisheries 2019c; 2000). In autumn and spring, harbor porpoises are widely distributed from New Jersey to Maine (NOAA Fisheries 2019c). In winter, intermediate densities can be found from New Jersey to North Carolina, with lower densities from New York to New Brunswick, Canada (Kenney and Vigness-Raposa 2010). In cooler months, harbor porpoises have been observed from the coastline to deeper waters (>1,800 m [5,905 ft]), although the majority of sightings are over the continental shelf (NOAA Fisheries 2019c). The best abundance estimate for the Gulf of Maine/Bay of Fundy stock per the most recent stock assessment is 95,543 (NOAA Fisheries 2019c).

This species is among the smallest of the toothed whales and is the only porpoise species found in US Northeast waters. A distinguishing physical characteristic is the dark stripe that extends from the flipper to the eye. The rest of its body has common porpoise features: a dark gray back, light gray sides, and small, rounded flippers (Jefferson et al. 1993).

Harbor porpoises produce high frequency (HF) clicks with a peak frequency between 129 and 145 kHz and an estimated SL_{rms} that ranges from 166 to 194 dB re 1 µPa @ 1 m (Villadsgaard et al. 2007). Available data estimating auditory sensitivity for this species suggest that they are most receptive to sound between 300 Hz and 160 kHz (Southall et al. 2019).

Harbor porpoises are not federally listed under the ESA (NOAA Fisheries n.d.[a]), are not state listed in Massachusetts or New York, are not considered Depleted under the MMPA, and are a species of Least Concern under the IUCN Red List (Braulik et al. 2020; MESA 2020; MMC 2020; NYSDEC 2015). The species is, however, a Rhode Island SGCN (RI SGCN 2015). The PBR for this stock is 851, and the estimated human-caused annual mortality and serious injury from 2013 to 2017 was 217 (NOAA Fisheries 2019c). This species faces major anthropogenic effects because of its nearshore habitat. Historically, Greenland populations were hunted in large numbers for food and oil. Currently, they continue to suffer incidental mortality from Western North Atlantic fishing activities such as gillnets and bottom trawls (NOAA Fisheries 2019c). Harbor porpoises also face threats from contaminants in their habitat, vessel traffic, habitat alteration due to offshore development, and climate-related shifts in prey distribution (NOAA Fisheries 2019c). There is no designated critical habitat for this species near the Project Area.

Sunrise Wind Farm/Sunrise Wind Export Cable

As shown in Table 3.1-2, the harbor porpoise has a documented presence within the New York OPA, per the NYSERDA Digital Aerial Baseline Surveys conducted from Summer 2016 through Winter 2019 (Normandeau 2019a, b, c, d, 2020). Harbor porpoises sighted within the New York OPA occurred most often during spring and winter with the highest number documented in Winter 2016-2017 (2,125 individuals).

Over the course of another study, Kraus et al. (2016) observed 121 individual harbor porpoises within the RI-MA and MA WEAs. Autumn observations included the most individuals (49 sightings), followed by winter (35), spring (36), and summer (1). Vertical camera detections of all small cetaceans showed that the most commonly detected species over time was the harbor porpoise (Kraus et al. 2016). The preferred habitat of the harbor porpoise further increases the likelihood of encountering them seasonally in autumn, winter, and spring (BOEM 2013; NOAA Fisheries 2019c).

Strandings are reported all along the southern shore of Long Island, NY and along both sides of Long Island Sound (Smith 2014). There are occasional sightings in the bays, estuaries, and rivers of New York state. In spring, they tend to congregate in the southwestern Gulf of Maine around Nantucket Shoals, western Georges Bank, and the southern New England shelf (Sadove and Cardinale 1993). In autumn and spring, harbor porpoises are widely distributed from New Jersey to Maine, from the coastline to deep waters (more than 1,800 m [5,905 ft]). In winter, intermediate densities can be found from New Jersey to North Carolina, with lower densities from New York to New Brunswick, Canada (Kenney and Vigness-Raposa 2010).

The species is therefore expected to be common within the SRWF and SRWEC.

Onshore Facilities

The harbor porpoise is not expected to be encountered within the waterbodies associated with the Onshore Facilities.

3.1.2.9 Harbor Seal

Harbor seals, also known as common seals, are one of the most widely distributed seal species in the Northern Hemisphere and can be found inhabiting coastal and inshore waters from temperate to polar latitudes. Genetic variability from different geographic populations has led to five subspecies being recognized. Harbor seals are found in the Western Atlantic from the US Mid-Atlantic to the Canadian Arctic and east to Greenland and Iceland (Rice 1998). Harbor seals are year-round inhabitants of the coastal waters of eastern Canada and Maine (Katona et al. 1993) and occur seasonally along the coasts from southern New England to Virginia from September through late May (Rees et al. 2016; Schroeder 2000; Toth et al. 2018). Harbor seals are known to move generally southward in the fall from the Bay of Fundy to north-eastern US coastal waters, particularly in southern New England waters, although they are considered to be generally non-migratory (Barlas 1999; Waring et al. 2010). The best abundance estimate for the Western North Atlantic stock per the most recent stock assessment is 75,834 (NOAA Fisheries 2019c). Global population estimates reach 610,000 to 640,000 (Bjørge et al. 2010; Lowry 2016; NOAA Fisheries 2019c).

The harbor seal is one of the smaller pinnipeds, and adults are often light to dark grey or brown with a paler belly and dark spots covering the head and body (Jefferson et al. 1993; Kenney and Vigness-Raposa 2010). Peak breeding and pupping times range from February to early September, and breeding occurs in open water (Temte 1994).

Harbor seals communicate through a variety of vocalizations, particularly during breeding seasons. Male harbor seals have been documented producing an underwater roar call which is used for competition with other males and attracting mates. These are relatively short calls with a duration of about 2 seconds and a peak frequency between 1 and 2 kHz (Van Parijs et al. 2003). Matthews et al. (2017) found that vocalizations peaked in June and July, corresponding with the estimated breeding season of harbor seals. The range of harbor seal source level breeding vocalizations were found to be from 129 to 149 dB re 1 μPa with an average of 144 dB re 1 μPa at 3.3-ft (Matthews et al. 2017). Furthermore, roar vocalization was shown to play a role in male-female communication by Matthews et al. (2018) where female harbor seals were shown to approach playback speakers playing dominant vocalizations more often than subordinate vocalizations. Behavioral audiometric studies for this species estimate peak hearing sensitivity between 100 Hz and 79 kHz (Southall et al. 2019).

Harbor seals are not federally listed under the ESA are not state listed in Massachusetts and are considered a species of Least Concern under the IUCN Red List (Lowry 2016; MESA 2020; NOAA Fisheries n.d.[a]). However, the species considered a New York Species of Concern (NYSDEC 2015) and a Rhode Island SGCN (RI SGCN 2015). The species is not considered Depleted under the MMPA (MMC 2020). The PBR for this population is 2,006, and the annual human-caused mortality and serious injury from 2013 to 2017 was estimated to be 350 seals per year attributed to fishery interactions, non-fishery-related human interactions, and research activities (NOAA Fisheries 2019c). Other threats to harbor seals include disease and predation (NOAA Fisheries 2019c). There is no designated critical habitat for this species in the Project Area.

Sunrise Wind Farm/Sunrise Wind Export Cable

As shown in Table 3.1-2, the harbor seal has a documented presence within the New York OPA, per the NYSERDA Digital Aerial Baseline Surveys conducted from Summer 2016 through Winter 2019 (Normandeau 2019a, b, c, d, 2020). Harbor seals sighted within the New York OPA occurred most often during the winter months with the highest number documented in Winter 2017-2018 (28 individuals).

Several seal haulout sites are located on Block Island, RI (BOEM 2013). Survey data collected from NOAA Fisheries and the Provincetown Center for Coastal Research reported 151 harbor seal sightings, a large concentration of which were observed near the coast from eastern Long Island, NY to Buzzards Bay and Vineyard Sound (CRESLI 2020). There were also occurrences of harbor seal offshore; however, the level of abundance was lower than what was observed near haulout sites (Kenney and Vigness-Raposa 2010).

There are about 30 known Long Island haulout sites, which are scattered around the eastern end of Long Island and along both sides of the Atlantic and Long Island Sound shores (CRESLI 2020; Kenney and Vigness-Raposa 2010). From 2019 to 2021, the AMCS has documented approximately four harbor and/or gray seal haulout sites along the Atlantic coastline of Long Island, with more scattered within Long Island Sound and off the coast of Rhode Island (AMSC 2021; R. DiGiovanni Jr., personal communication, March 9, 2021).

Seals are generally present on New York beaches from late fall until early spring (CRESLI 2020) and are most likely to be encountered at low tide. Furthermore, seal watching activities on the northeast US coastline is most prevalent from December through mid-April in New York (DiGiovanni and Sabrosky 2010). Within the last three years, seals have been sited along the Fire Island National Seashore, Cupsogue Beach County Park, Montauk Point State Park, and Smith Point County Park (Long Island Pulse 2017; Newsday 2020). In November 2018, an aerial survey of haulout sites around Long Island, Connecticut, and Rhode Island were conducted by the AMCS to support a UME investigation. During this survey, more than 900 harbor and gray seals were observed (AMSC 2021).

Harbor seals are regularly observed in coastal areas and are the most abundant seals found in New York State. Important haulouts in Long Island include Fishers Island, Great Gull Island, Montauk Point, Gardiners Island, and Sag Harbor (Kenney and Vigness-Raposa 2010). Harbor seals make up approximately 95 percent of the seal population known to utilize these haulout sites (Kopelman n.d.). Harbor seals utilize Eastern Point and Montauk Point of Long Island as terrestrial habitat, and the nearshore portion of the SRWEC as foraging and potential breeding grounds. These seals can likely be found in the nearshore areas around the proposed SRWEC landfall location at Smith Point adjacent to Fire Island. The most localized estimates of populations residing within the Long Island Sound harbors come from CRESLI, which observed nearly 16,000 harbor seals over 302 seal observation trips from 2007 through 2017 around Cupsogue Beach, during which CRESLI found the highest monthly concentrations of seals from December through April, with abrupt declines in May.

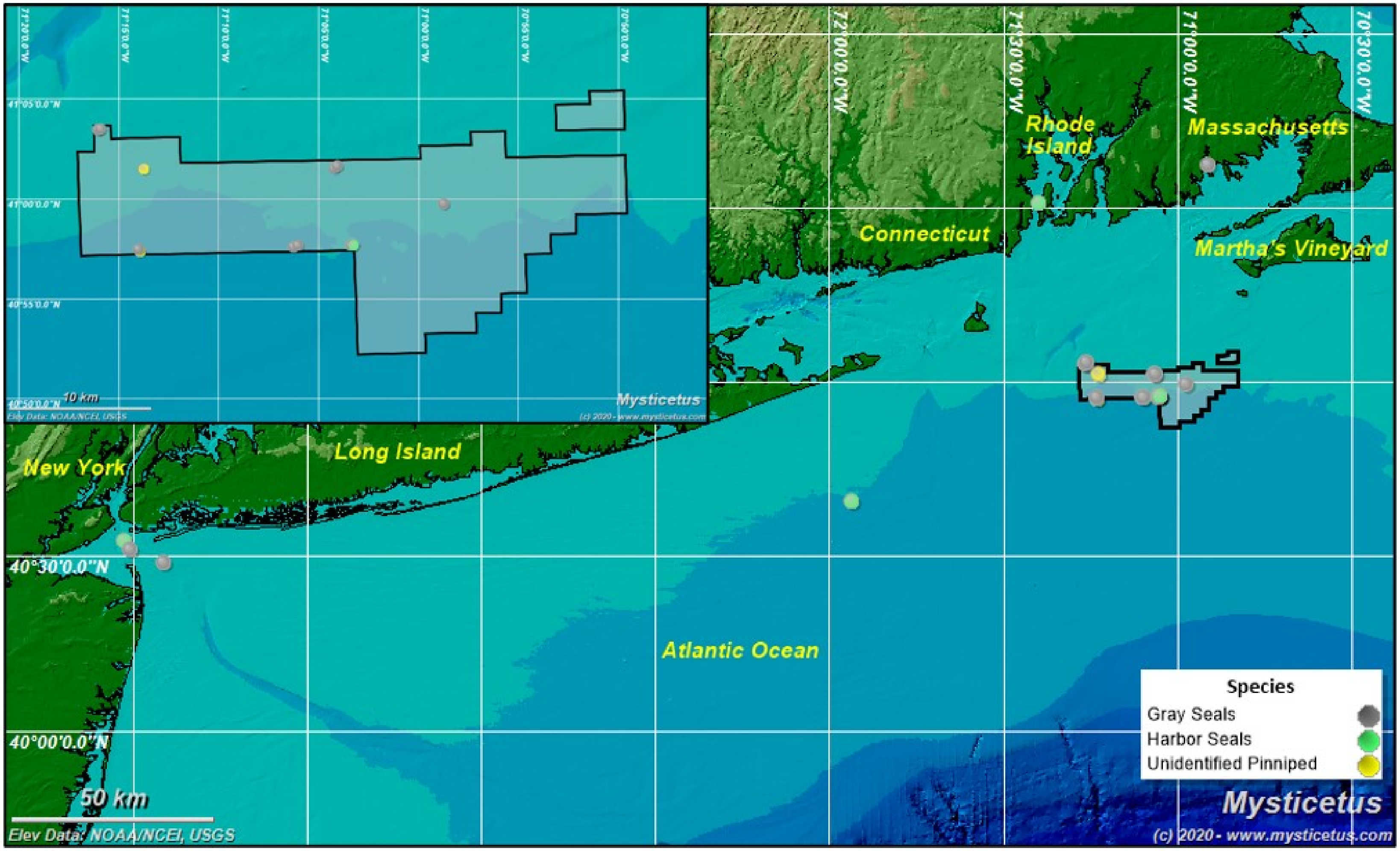
During Project-specific PSO surveys from 2019 to 2020 (Smultea 2020), three estimated individuals were detected inside the SRWF, and four estimated individuals were detected outside the SRWF, as illustrated below in Figure 3.1-6.

Harbor seals are therefore expected to have a regular occurrence within the SRWF and SRWEC.

Onshore Facilities

Limited data is available on the harbor seal’s potential presence within Great South Bay or the ICW; however, its life history characteristics, habitat preferences, and known nearby haulout sites, make it possible that the species could have a rare occurrence within the waterbodies associated with the Onshore Facilities.

Figure 3.1-6 Locations of all Pinnipeds Detected during the Sunrise Wind Geotechnical Survey (2019–2020)



NOTE: SRWF is indicated by the gray polygon. Inset is an enlargement showing all pinniped detections in or close to the SRWF.

3.1.2.10 Gray Seal

Gray seals inhabit temperate to sub-Arctic waters of the North Atlantic, in both nearshore and deeper OCS waters (Hall 2002). Three different geographic populations occur: Western North Atlantic, Eastern North Atlantic, and Baltic populations (Kenney and Vigness-Raposa 2010). Peak breeding and pupping times are January to late March, and breeding occurs in open water (Baker et al. 1995).

Gray seals are among the larger phocids found in the Western North Atlantic (Jefferson et al. 1993). Two types of underwater vocalizations have been recorded for male and female gray seals: clicks and hums. Clicks are produced in a rapid series resulting in a buzzing noise with a frequency range between 500 Hz and 12 kHz. Hums, which is described as similar to that of a dog crying in its sleep, are lower frequency calls, with most of the energy less than 1 kHz (Schusterman et al. 1970). AEP studies indicate that hearing sensitivity for this species is greatest between 140 Hz and 100 kHz (Southall et al. 2019).

Gray seals are not federally listed under the ESA, are not state listed in New York, Massachusetts, or Rhode Island, and are not considered Depleted under the MMPA (MESA 2020; MMC 2020; NOAA Fisheries n.d.[a], NYSDEC 2015; RI DEM 2012). However, general mortality is attributed to fishery interactions, non-fishery related human interactions and hunting, research activities, Canadian commercial harvest, and removals of nuisance animals in Canada (NOAA Fisheries 2019c). Other threats to this population include disease, predation, and natural phenomena like storms (NOAA Fisheries 2019c). There is no designated critical habitat for this species in the Project Area.

Estimates of the entire Western North Atlantic gray seal population are not available; only estimated portions of the stock are available. However, recent genetic evidence suggests that all Western North Atlantic gray seals may comprise a single stock (NOAA Fisheries 2019c). The best abundance estimate for the Western North Atlantic stock per the most recent stock assessment is 27,131 (NOAA Fisheries 2019c). The population of gray seals is likely increasing in the US Atlantic Exclusive Economic Zone; recent data show approximately 28,000 to 40,000 gray seals were observed in Southeastern Massachusetts in 2015 (NOAA Fisheries 2019c). A population trend is not currently available for this stock although the observed increase in the number of pops born in US pupping colonies between 1991 and 2016 is currently being evaluated (NOAA Fisheries 2019c). The PBR for this population is 1,389, and the annual human-caused mortality and serious injury between 2013 and 2017 was estimated to be 5,410 in both the US and Canada (NOAA Fisheries 2019c).

Sunrise Wind Farm/Sunrise Wind Export Cable

As shown in Table 3.1-2, gray seals have a documented presence within the New York OPA, per the NYSERDA Digital Aerial Baseline Surveys conducted from Summer 2016 through Winter 2019 (Normandeau 2019a, b, c, d, 2020). Gray seals sighted within the New York OPA occurred most often during the spring and winter months but were also documented in autumn, with the highest number documented in Winter 2016 to 2017 (33 individuals). As previously described, from 2019 to 2021, the AMCS has documented approximately four harbor and/or gray seal haulout sites along the Atlantic coastline of Long Island, with more scattered within Long Island Sound and off the coast of Rhode Island (AMSC 2021). Furthermore, in November 2018, an aerial survey of haulout sites around Long Island, Connecticut, and Rhode Island were conducted by the AMCS to support a UME investigation. During this survey, more than 900 harbor and gray seals were observed (AMSC 2021).

Young pups have been documented as stranded at Long Island, NY and Rhode Island beaches. The AMAPPS surveys identified 11 individuals during their winter aerial surveys (NOAA Fisheries 2017; Palka et al. 2017;). The overall time spent in US waters remains uncertain (NOAA Fisheries 2019c), but the updated US population estimates make it possible that these seals will be seen around offshore New York waters. Additionally, during Project-specific PSO surveys from 2019 to 2020 (Smultea 2020), 12 estimated individuals were detected inside the SRWF, and three estimated individuals were detected outside the SRWF as illustrated in Figure 3.1-6.

Historically, gray seals were relatively absent from New York, Massachusetts, Rhode Island, and nearby OCS waters. However, with the recent recovery of the Massachusetts and Canadian populations, their occurrence has increased in the US Mid-Atlantic (Kenney and Vigness-Raposa 2010). Records of gray seal strandings are primarily observed in spring and are distributed broadly along ocean-facing beaches in Long Island, NY and Rhode Island. In New York, gray seals are typically seen alongside harbor seal haulouts. Two frequent sighting locations include Great Gull Island and Fisher's Island, NY as well as Sag Harbor and Gardiners Island (Kenney and Vigness-Raposa 2010). Gray seals make up approximately 4 percent of the seals known to inhabit Long Island (Kopelman n.d.).

The gray seal is therefore expected to have a regular presence within the SRWF and SRWEC.

Onshore Facilities

Limited data are available on the gray seal's potential presence within Great South Bay or ICW; however, its life history characteristics, habitat preferences, and known nearby haulout sites, make it possible that the species could have a rare occurrence within the waterbodies associated with the Onshore Facilities.

3.1.3 Regional Effects of Climate Change on Distributions of Marine Mammals

Anticipated direct impacts of climate change on the marine environment include an increase in temperature, a rise in sea levels, and a decrease in sea-ice cover (Learmonth et al. 2006). These changes are likely to have both direct and indirect effects on marine mammals (Albouy et al. 2020; MacLeod 2009; Sousa et al. 2019;). Risks to stocks will vary based on population status and taxonomic groupings. Some studies show a greater effect predicted on porpoises than large whales (MacLeod 2009), and other studies show vulnerable whale populations may be greatly affected (Greene and Pershing 2004). Climate change in the marine environment is not wholly new, and marine mammals have likely been subject to changing conditions historically; however, the current rate of change is a higher magnitude stressor.

The primary impacts on marine mammals from climate change-related stressors are changes in prey availability or abundance, or, for those species in ice-based habitat for all or a portion of their life cycle, changes to this habitat. Other anticipated stressors are potential increases in toxin exposure, higher rates of pathogen transmission and (pathogen) survival rates, more susceptibility to disease by hosts (marine mammals), and mismatching of breeding cycles with prey abundance cycles, which would impact migrating marine mammals since they travel long distances between feeding and breeding grounds. These effects are, in turn, expected to have direct or indirect impacts on marine mammals such as altering known ranges of marine mammal distributions or changing species abundance (MacLeod 2009). Ranges may undergo expansion, contraction, or even elimination. Some stocks, especially if geographically isolated, could possibly suffer a higher risk of extinction. It is also possible in some cases that range changes may be beneficial, if for example a species increases in distribution or abundance.

Indirect effects include changes to availability, locality, and abundance of food sources, which affects health and animal distributions or population numbers. Changes in food sources also indirectly affect reproductive success (Simmonds and Elliot 2009). Sea temperature changes may result in an additional indirect effect on animal health as pathogen transmission becomes more prevalent as body condition deteriorates (Simmonds and Elliot 2009). Recent increases in ocean acidification are expected to continue in response to atmospheric carbon dioxide loads (Saba et al. 2016). Effects of these changes are still being examined, and resultant changes to the interrelationships in food web cycles and the complicated oceanic factors that affect biological resources are largely unknown. Current data show that water temperatures across the range of depths in the Project Area vary widely throughout the year but have generally been reported to be increasing over time (Kavanaugh et al. 2017).

Groundfish species shifts have already occurred, with groundfish moving northward and into deeper waters (Nye et al. 2009), and other species shifting southward, including the Atlantic cod, a known prey species for some large whales (Selden et al. 2018). Similarly, during acoustic surveys conducted from 2004 to 2014 by Davis et al. (2020), fin, blue, and sei whales were more frequently detected in northern latitudes after 2010, indicating a northward shift matching documented prey availability (Davis et al. 2020). Temperature increases in southern New England are expected to continue and may exceed the global ocean average by at least a factor of 2. North Atlantic right whales may be especially vulnerable to changes in prey availability due to their specialized filter feeding preferences as previously described. Reproductive rates of this species in the Gulf of Maine have been specifically linked to the abundance of copepods (Meyer-Gutbrod et al. 2015). Copepod size and abundance has been shown to significantly decrease due to warming sea temperatures, causing concern for higher trophic levels (Garzke et al. 2014).

Ocean circulation patterns are also projected to change (Saba et al. 2016). The Gulf of Maine, a feeding ground for many large baleen whales and other odontocetes found in the Project Area, is undergoing climate change and sea temperature change more rapidly than any other body of water in the world for unknown reasons. It is warming at a rate that is faster than 99.9 percent of the rest of the ocean (Pershing et al. 2015). Climate models predict the rate to continue at a speed at least twice the global average (Saba et al. 2016). Certain marine mammal species or populations are likely to be more vulnerable than others, and these vulnerable populations will face a greater risk of extinction. Greene and Pershing (2004) investigated the effects of climate change on the North Atlantic right whale and found it played a role in the demographic balance for this species.

Many stressors on marine mammals act synergistically; thus, it can be more difficult to discriminate impacts from environmental threats. MacLeod (2009) predicts 88 percent of cetaceans will be affected by sea temperature changes, and 47 percent of species will have unfavorable conservation implications. As these are global forecasts, some of these predictions may be less applicable to the stocks known to occur in the Project Area; however, prey changes will affect marine mammals in all portions of their ranges, and these effects are widely expected to be deleterious.

Evidence exists for changes in cetacean distributions as a results of climate change. A decline in strandings and sightings of white-beaked dolphins and an increase in strandings and sightings of short-beaked common dolphins was documented in areas where sea temperatures are changing. The white-beaked dolphin has been considered a more cold-water species and the short-beaked common dolphin a warmer-water species. The change in strandings and sightings may be a direct impact from habitat change (sea temperature) or indirect due to changes in success of competition (MacLeod et al. 2005; Simmonds and Elliot 2009). Climate-induced prey reduction in the North Sea may have played a role in increases of harbor porpoise strandings or starving conditions.

North Atlantic right whales may be especially vulnerable since populations are small and declining, and they have a more specialized feeding preference (copepods) (Albouy et al. 2020). Previous projections and modeling studies may not have adequately addressed the effects of climate change on right whales (Greene and Pershing 2004). The small and decreasing population of North Atlantic right whales may be additionally impacted by climate change reducing reproductive rates. Right whale calving is a function of food availability as well as the number of breeding females in the population. Fewer calves are born during a period of poor feeding conditions, and longer periods of less prey availability could put the population at greater risk (Greene and Pershing 2004). Previous studies have suggested that the North Atlantic right whale population reproductive rate is highly coupled to the abundance of the copepod *Calanus finmarchicus* in the Gulf of Maine, which is affected by changing sea temperatures (Meyer-Gutbrod et al. 2015). *Calanus finmarchicus* has been documented to respond to ecosystem regime shifts associated with decadal-scale climate changes.

Additionally, generalized oceanic circulation models predict that climate change will affect oxygen concentrations in the upper layers of the ocean, where oxygen levels are likely to decrease based on increased stratification. This could lead to changes in upwelling patterns, a key factor in marine mammal feeding. Changes in ocean currents as a result of climate change will have other indirect "downstream" effects such as changes in eutrophication levels or changing rates of anoxic or hypoxic events. The uneven heating distribution of ocean waters will drive ocean currents more rapidly and outside their normal cycles. Upwelling (when deeper colder water rises to the surface) resulting from water temperature differentials plays a critical role in complicated oceanic dynamics and is part of baleen whale feeding (Hoegh-Guldberg and Bruno 2010) since upwelling brings a variety of nutrients to the surface.

As discussed, in Section 1.3, although no single renewable energy project can reverse the direction of climate change, the Project will contribute to the cumulative reduction in the use of fossil fuels that are associated with increased ocean temperatures and other large-scale changes in climate and can have a long-term positive impact.

3.2 SEA TURTLES

There are four species of sea turtle found throughout the western North Atlantic Ocean that may occur in the SRWF, SRWEC, and ICW and are, therefore, considered potentially affected species. These include the green sea turtle (*Chelonia mydas*), Kemp's ridley sea turtle (*Lepidochelys kempii*), loggerhead sea turtle (*Caretta*), and leatherback sea turtle (*Dermochelys coriacea*). These species are listed as threatened or endangered under the ESA and by the states of New York, Massachusetts, and Rhode Island (MA NHESP 2020; NYSDEC 2015; RI DEM 2020) (Table 3.2-1). Additionally, under the IUCN Red List, the loggerhead and leatherback sea turtles are listed as Vulnerable, the Kemp's ridley sea turtle is listed as Critically Endangered, and the green sea turtle is listed as Endangered (Casale and Tucket 2017; Seminoff 2004; Wallace et al. 2013; Wibbels and Bevan 2019).

A fifth species, the hawksbill sea turtle (*Eretmochelys imbricata*), may occur infrequently within the region, but is found predominantly in tropical waters associated with coral reef habitats and is considered extremely rare (NOAA GARFO 2020a). Kraus et al. (2016) documented no sightings over a four-year survey period, and AMAPPS (NOAA Fisheries 2017) documented one hawksbill turtle sighting out of 992 unique sea turtle sightings in 2017 with no other sightings in any of seven other annual surveys in the SRWF completed since 2010. The survey by CETAP (1982) has no mention of hawksbill species sightings. One hawksbill turtle stranding was recorded in Massachusetts in 1968 (Kenney and Vigness-Raposa 2010), and one hawksbill turtle sighting was noted from the Bay State Wind site assessment survey data in SRWF waters from two years of survey data. The potential for hawksbill occurrence is very low; therefore, no impacts are expected, and this species is not considered further in the following analysis.

The northeast coast, including marine components of the SRWF, contains a variety of habitats suitable for sea turtles such as deeper waters of the Atlantic Ocean (Burke et al. 1993); Rhode Island Sound; Block Island Sound; and, shallow, enclosed waters of Great South Bay (including Bellport Bay and Narrow Bay). In the offshore and coastal waters of New York, all four species of sea turtles discussed within this analysis have been recently documented (predominantly in summer and autumn) during the NYSERDA Digital Aerial Baseline Surveys (Normandeau 2019a, b, c, 2020). Summary results of the NYSERDA Digital Aerial Baseline Surveys for sea turtle sightings within the OPA are included below in Table 3.2-2. OBIS-SEAMAP sighting data from 1989 to 2016 were additionally developed from multiple surveys and published studies which were compiled in literature reviews (Curtice et al. 2019; Halpin et al. 2009; Roberts et al. 2018, 2016a, 2016b). These data show leatherback sea turtles and loggerhead sea turtles residing in mostly offshore waters with occasional occurrences nearshore. Kemp's ridley sea turtles were shown to occur most commonly in nearshore waters with the occasional appearances offshore. Green turtles were not documented as heavily within this dataset; however, the few occurrences of the species occurred just outside the Block Island Channel. Figure 3.2-1 illustrates the OBIS-SEAMAP sightings.

Sea turtle sightings were also recorded within the New York OPA during the three-year aerial surveys completed for the previously described NYSDEC Whale Monitoring Program. A total of 474 sea turtle sightings (with an estimated 557 individuals) were recorded from 2017 to 2020 (Tetra Tech and LGL 2020). A total of 50 sea turtle groups (54 individuals) were identified to species, including 16 loggerhead sea turtles, 37 leatherback sea turtles, and one Kemp's ridley sea turtle (Tetra Tech and LGL 2020). The remaining sightings (424 sightings, 503 individuals) were unidentified sea turtles (Tetra Tech and LGL 2020).

Table 3.2-1 Sea Turtle Species with Potential Occurrence in the Project Area

Species	Current Listing Status[b]	Estimated Population	Seasonal Density (no./100 km^2)[a]				Relative Occurrence in the SRWF	Relative Occurrence in the SRWEC–OCS	Relative Occurrence in the SRWEC–NYS	Relative Occurrence in the Onshore Facilities
			Winter	Spring	Summer	Autumn				
Leatherback Sea Turtle (*Dermochelys coriacea*)	ESA Endangered NY State Endangered RI State Endangered MA State Endangered	• Northwest Atlantic DPS estimate of 31,380 adult males and females (TEWG 2007; Epperly 2017; USFWS 2013) • Between 34,000 and 36,000 estimated nesting females in the US (Sea Turtle Conservancy 2020a) • Global total average estimate of 426,000 (SWOT 2020)	0.0003	0.000	0.0003	0.0003	Common	Common	Common	Not Expected
Loggerhead Sea Turtle (*Caretta caretta*)	ESA Threatened NY State Threatened RI State Endangered MA State Threatened	• Western North Atlantic adult female population estimate of 38,334 (Richards et al. 2011) • Between 40,000 and 50,000 estimated nesting females in the US (Sea Turtle Conservancy 2020b) • Global total average estimate of 314,000 (SWOT 2020)	0.001	0.002	0.001	0.001	Common	Common	Common	Regular

Table 3.2-1 Sea Turtle Species with Potential Occurrence in the Project Area

Species	Current Listing Status[b]	Estimated Population	Seasonal Density (no./100 km^2)[a] Winter	Spring	Summer	Autumn	Relative Occurrence in the SRWF	Relative Occurrence in the SRWEC–OCS	Relative Occurrence in the SRWEC–NYS	Relative Occurrence in the Onshore Facilities
Kemp's Ridley Sea Turtle (Lepidochelys kempii)	ESA Endangered NY State Endangered RI State Endangered MA State Endangered	• Between 7,000 and 9,000 estimated nesting females in the US (Sea Turtle Conservancy 2020c) • Global total average estimate of 21,000 (SWOT 2020)	0.0007	0.0007	0.00007	0.0007	Uncommon	Uncommon	Common	Regular
Green Sea Turtle (*Cheloria mydas*)	ESA Threatened NY State Threatened RI State Endangered MA State Threatened	• Northwest Atlantic DPS nester abundance distribution estimates 167,424 total abundance (Seminoff et al. 2015) • Between 85,000 and 90,000 estimated nesting females in the US (Sea Turtle Conservancy 2020d) • Global total average estimate of 1,002,000 (SWOT 2020)	No Data				Uncommon	Not Expected/ Rare	Rare	Regular

KEY:
DPS = distinct population segment

a/ Sea turtle density provided by OBIS-Seamap (Curtice et al. 2019; Roberts et al. 2018, 2016a, 2016b; Halpin et al. 2009).

b/ Listing status as stated in NOAA Fisheries n.d.[a], MA NHESP 2019; RI DEM 2011; NYSDEC 2020a

Table 3.2-2 Sea Turtle Species Identified within the NYSERDA Remote Marine and Onshore Technology Reports from Summer 2016 through Winter 2019, as reported by Normandeau and APEM (2019a, b, c, d, 2020)[a]

Species	Summer			Autumn			Winter			Spring			TOTAL
	2016	2017	2018*	2016	2017	2018*	2016-2017	2017-2018	2019*	2017	2018	2019*	
Leatherback sea turtle	123	70	3	315	28	0	0	0	0	0	0	0	**539**
Loggerhead sea turtle	5,297	9,060	340	67	69	0	11	0	0	66	0	3	**14913**
Kemp's ridley sea turtle	205	335	18	11	69	0	0	0	0	13	0	0	**651**
Green sea turtle	14	0	0	0	0	0	0	0	0	0	0	0	**14**

NOTES:

a/ Corrected abundance was calculated by dividing the observed abundance by the percent of the area surveyed for each season to account for differing amounts of area surveyed and makes abundances comparable across seasons. Corrected abundance values are frequently non-integers that have been rounded to whole numbers for display purposes. Survey periods marked with an asterisk (*) are raw, reported individuals counted during semi-annual summary reports and are not considered corrected abundances.

b/ During surveys, the pilot whales were described as "unidentified" so the corrected abundance provided for this species may be greater than actual abundance of the long-finned pilot whale

SOURCES:

Summer 2016 through Spring 2018 Surveys (Normandeau and APM 2019a)

Summer 2018 Surveys (Normandeau and APM 2019b)

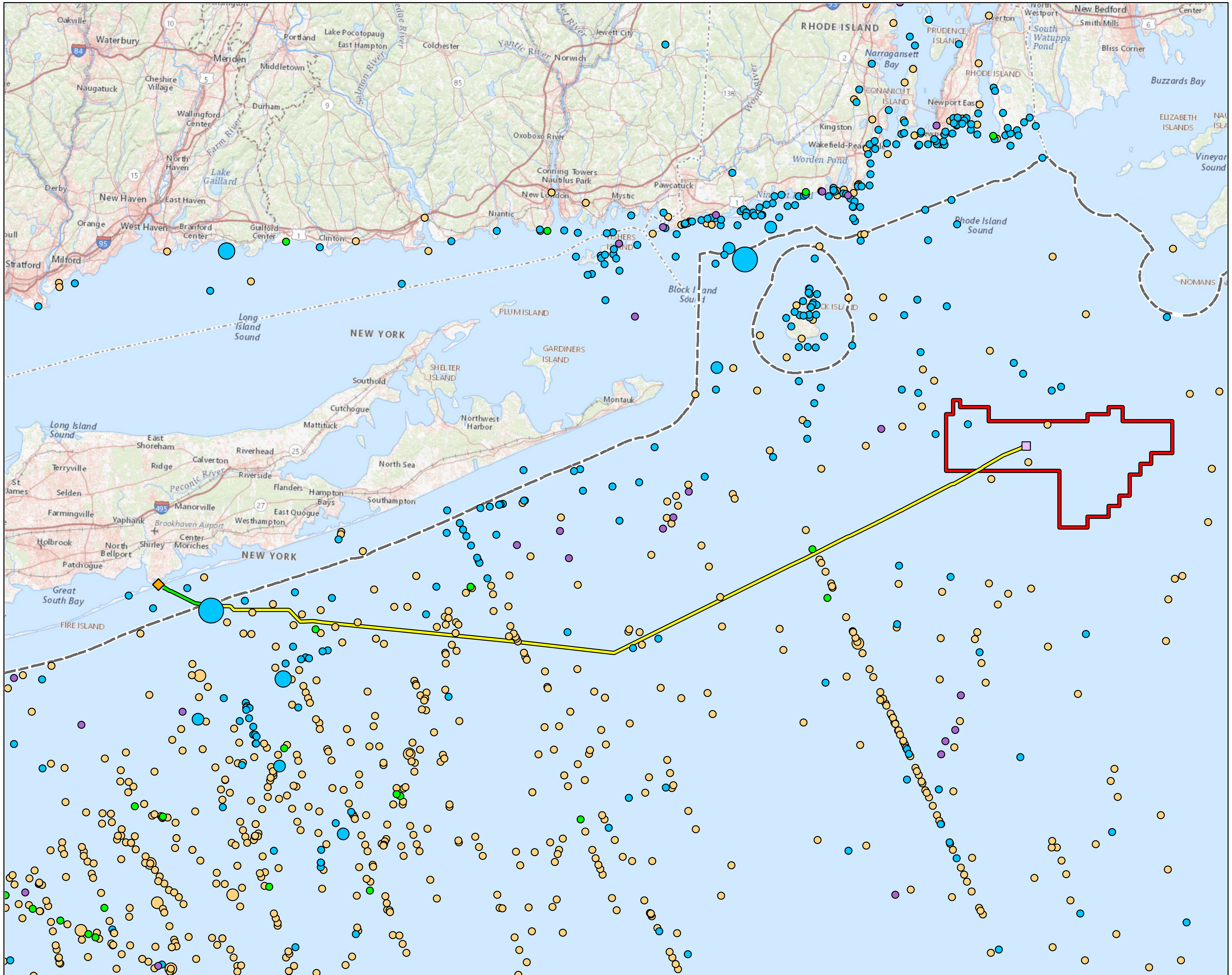
Autumn 2018 Surveys (Normandeau and APM 2019c)

Spring 2019 Surveys (Normandeau and APM 2019d)

Winter 2019 (Normandeau and APEM 2020)

Figure 3.2-1
OBIS-SEAMAP Sea Turtle Sightings Data 1963 – 2019

Sunrise Wind | Powered by Ørsted & Eversource



Legend

- Sunrise Wind Farm (SRWF)
- Offshore Converter Station (OCS–DC)
- SRWEC Landfall Location
- Sunrise Wind Export Cable (SRWEC–NYS)
- Sunrise Wind Export Cable (SRWEC–OCS)
- 3-nm State Waters Boundary

Sea Turtle Sighting Counts

- Green sea turtle: 1
- Kemp's ridley sea turtle: 1
- Loggerhead sea turtle: 1, 2
- Leatherback sea turtle: 1, 2, 3, 5

Sources

1.Sea turtle data extracted on 7/14/2020 from the Ocean Biodiversity Information System Spatial Ecological Analysis of Megavertebrate (OBIS-SEAMAP).
2. Base map: USGS The National Map

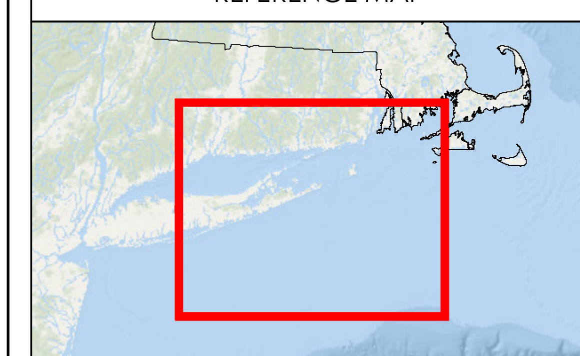
Date	12/18/2020 Revised: 6/1/2021
Project Number	2028113199
Prepared By	GC
Reviewed By	LJ

0 10 miles
0 8 nm
0 16 km

N

Scale at 11x17: 1:676,500
NAD 1983 2011 UTM Zone 19N

REFERENCE MAP



V:\1956\active_Task Owner and other Non-BC1956 Jobs\2028113199\03_data\gis_cad\gis\MXDs\COP\Appendix Figures\Appendix_O_MarineMammalsTurtles\2028113199_3.2-1_SeaTurtles.mxd Revised: 2021-05-07 By: gcarpenter

PSO data from the Bay State Wind Geotechnical Survey (Smultea 2019) showed two sea turtle sightings outside the SRWF: one green sea turtle in nearshore waters off of western Long Island and one unidentified turtle within OCS waters offshore of eastern Long Island (Smultea 2019). Project-specific PSO data from Sunrise Geotechnical Surveys during the winter season (Smultea 2020) detected no sea turtles within the SRWF.

Sea turtle strandings have been documented on Long Island during the winter months although surveys have not recorded sea turtle observations in winter (Kraus et al. 2016). In Rhode Island, from 1990 to 2011, a total of 71 sea turtles (green [2], Kemp's ridley [7], leatherback [11], loggerhead [48], and unknown [3]) was documented as stranded in Rhode Island waters (RI DEM 2011). Additionally, NOAA maintains online weekly reports dating back to 1998 on stranded sea turtles within the US. NOAA's Southeast Fisheries Science Center (SEFSC)'s Sea Turtle Stranding and Salvage Network Reports are managed by the SEFSC and contain all reported New York State sea turtle strandings reports which are defined as "a sea turtle that is either found dead or is alive but is unable to go about its normal behavior due to any injury, illness, or other problem" and is "found washed ashore or floating in the water" (NOAA SEFSC 2020). Refer to Table 3.2-2 for results of strandings data reported by the NOAA SEFSC from the five-year period between 2015 and 2019 in inshore and offshore New York waters.

There are no nesting habitats or designated critical habitats in the Project Area for sea turtles on the Atlantic coastline or within the ICW. Typically, sea turtle nesting occurs in the southeastern US only stretching as far north as North Carolina; however, there was a recent incidence of nesting by a Kemp's ridley sea turtle in New York (AM New York 2018). During the New York Bight Sea Turtle Workshop held in 2018, it was suggested that a nesting response plan is needed in the unlikely event that a sea turtle nest is discovered in New York, and work on that plan is expected to include discussion between USFWS, NYSDEC, the New York Marine Rescue Center, and the AMCS (Bonacci-Sullivan 2018). However, as there are no sea turtle nesting records north of New York, the one instance of nesting in New York is considered an extremely rare occurrence, likely the result of climate change effects.

As the climate continues to change, sea turtle habitat, nest site selection, and reproductive success may be affected. Nearshore habitats and sea grasses could be adversely affected by increased water temperatures, changes in salinities, and other climate-related factors which could make habitats potentially unsuitable for sea turtles or their prey (Fuentes and Abbs 210; Witt et al. 2010). Similarly, rising temperatures could affect the amount of suitable nesting habitat available and cause clutch mortality. Marine turtle eggs are sensitive to temperatures during the incubation period with offspring sex determined by temperature (Hawkes et al. 2009; Janzen 1994). Climate change could therefore impact sex ratios, causing strain on sea turtle reproductive success. Sea turtles could also experience changes in prey foraging success from climate-change effects. Oceanographic current patterns are an important factor on sea turtle prey availability (jellyfish, salps, and epipelagic prey); therefore, sea turtles may alter daily movements and migrations based on available forage.

Table 3.2-3 Sea Turtle Strandings in New York as Reported by the SEFSC Sea Turtle Stranding and Salvage Network Reports, 2015–2019[1, 2]

Year	Inshore Strandings Reported				Offshore Strandings Reported			
	Leatherback	Loggerhead	Kemp's Ridley	Green	Leatherback	Loggerhead	Kemp's Ridley	Green
2015	--	9	6	23	4	25	1	2
2016	4	18	24	16	4	14	--	--
2017	3	14	23	11	5	19	3	1
2018	1	24	27	6	2	16	2	1
2019	6	15	56	34	1	10	3	1
TOTAL	**14**	**80**	**136**	**90**	**16**	**84**	**9**	**5**

SOURCE: NOAA SEFSC 2020

NOTES:

The NOAA SEFSC defines sea turtle stranding reports as “a sea turtle that is either found dead or is alive but is unable to go about its normal behavior due to any injury, illness, or other problem” and is “found washed ashore or floating in the water”

In both 2015 and 2016, one unknown species of sea turtle was reported stranded in New York nearshore waters, and in 2015, one unknown species was also reported in offshore waters.

KEY:

-- No Strandings Reported

3.2.1 Leatherback Sea Turtle

The leatherback sea turtle is the widest ranging of all the sea turtle species as well as the most migratory and most pelagic (NOAA Fisheries n.d.[a]; USFWS 2015). The species' range includes the Atlantic, Pacific, and Indian Oceans (NOAA Fisheries n.d.[a]). Leatherback turtles undertake extensive migrations in pelagic waters (Hughes et al. 1998; NOAA Fisheries n.d.[a]) and are generally associated with oceanic front systems such as shelf breaks and edges of oceanic gyre systems (Eckert 1993). The species has a higher temperature tolerance than other sea turtles (Kenney and Vigness-Raposa 2010) and also dives deeper than all other sea turtles (James et al. 2005a, b, 2006; Jonsen et al. 2007; NOAA Fisheries n.d.[a]).

Historically, the most important nesting ground for the leatherback was the Pacific coast of Mexico. However, because of exponential declines in leatherback nesting, French Guiana in the Western Atlantic now has the largest nesting population. Other important nesting sites for the leatherback include Papua New Guinea, Papua-Indonesia, and the Solomon Islands in the Western Pacific. In the US, nesting sites include the Florida east coast; Sandy Point, US Virgin Islands; and Puerto Rico. US nesting occurs from March through July. On average, individual females nest every two to three years, laying an average of five to seven nests per season with an average clutch size of 70 to 80 eggs. Critical habitat has been designated for the leatherback sea turtle in the US Virgin Islands at Sandy Point Beach, St. Croix, and the water adjacent to Sandy Point Beach (44 FR 17710).

Leatherback sea turtles feed on soft-bodied prey such as jellyfish and salps (Aki et al. 1994; NOAA Fisheries n.d.[a]; USFWS 2020a) but have been known to feed on sea urchins, squid, crustaceans, tunicates, fish, blue-green algae and floating seaweed (USFWS 2020a). Adult leatherback sea turtles can range from 4 to 8 ft (1.2 to 2.4 m) in length and weigh 500 to 2,000 pounds (lbs) (227 to 907 kilograms [kg]) (USFWS 2020a). The leatherback turtle is unique in that lacks a hard shell and instead has a composition of small bones covered by firm, rubbery skin with seven longitudinal ridges (NOAA Fisheries n.d.[a]; USFWS 2020a).

Dow Piniak et al. (2012b) found that hatchling leatherback sea turtles responded to stimuli between 50 and 1,200 Hz in water and 50 and 1600 Hz in air. The maximum sensitivity was between 100 and 400 Hz in water and 50 and 400 Hz in air.

Aerial surveys conducted in offshore US and Nova Scotian waters by CETAP (1982), AMAPPS surveys (NOAA Fisheries 2017), and Kraus et al. (2016) have shown leatherback sea turtles both near the coastline and beyond the 6,560-ft (2,000-m) isobath. Similarly, the AMAPPS surveys documented 50 leatherback turtle sightings in one survey year (NOAA Fisheries 2017) and Kenney and Vigness-Raposa (2010) found that leatherback turtles were the most commonly observed sea turtle species in the Ocean SAMP area. Surveys performed by the AMAPPS surveys (NOAA Fisheries 2017) and the Kraus et al. (2016) surveys furthermore documented leatherback sea turtle sightings in the RI-MA and MA WEAs during summer. The species has been noted as relatively absent in the winter months (Kenney and Vigness-Raposa 2010).

As previously stated, leatherback sea turtles have a presence in both the inshore and offshore waters of Rhode Island and New York. In Rhode Island, 11 leatherback sea turtles were documented from 1990 to 2011 in offshore waters (RI DEM 2011). The Sea Turtle Stranding and Salvage Network Reports managed by the SEFSC reported a total of 14 leatherback sea turtles stranded inshore and 16 stranded offshore of New York from 2015 to 2019 (NOAA SEFSC 2020). Kraus et al. (2016) further reports that leatherback turtles were documented in the coastal waters of Long Island Sound in summer.

Several anthropogenic activities impact all sea turtles; however, two threats impact leatherback sea turtles more than other species: climate change (previously described) and fisheries bycatch. Commercial fisheries using longline or coastal gillnet fishing techniques often cause the incidental capture of the leatherback sea turtle (Lewison et al. 2004). This is likely due to the species' diving to depths targeted by longline fishing and because the turtles have less maneuverability than other species because of their size.

Other threats that all sea turtles, including the leatherback, experience include habitat loss/alteration, egg harvesting, vessel strikes, and ocean pollution/debris (NOAA Fisheries n.d.[a]; USFWS 2020a). Beach nesting habitat is often reduced either due to physical barriers or lighting effects, and nesting activities that are successful are often predated-on or harvested (NOAA Fisheries n.d.[a]). Foraging habitat is also often impacted due to marine pollution and debris. Turtles sometimes ingest debris, mistaking it for food, which can cause internal damage and impact their ability to continue normal foraging. Debris in the water may also cause entanglement of sea turtles, which could impede foraging ability and/or could weigh them down and ultimately drown them. The leatherback sea turtle is federally listed as endangered throughout its range and is state listed as endangered in New York, Massachusetts, and Rhode Island.

3.2.1.1 Sunrise Wind Farm/Sunrise Wind Export Cable–OCS

As detailed above, leatherback sea turtles are one of the most likely of the four species included in Table 3.2-1 to be found within offshore waters at the SRWF and SRWEC–OCS (along with the loggerhead sea turtle). Leatherback sea turtles were the most frequently sighted turtle species in the RI-MA and MA WEAs and were predominantly observed from summer through autumn (Kraus et al. 2016). As shown in Table 3.2-2, leatherback turtles have a documented presence within the New York OPA, per the NYSERDA Digital Aerial Baseline Surveys conducted from Summer 2016 through Winter 2019 (Normandeau 2019a, b, c, d, 2020). Leatherback turtles sighted within the New York OPA occurred only in summer and autumn, with the highest number documented in Autumn 2016 (315 individuals). During the NYSDEC Whale Monitoring Program aerial surveys conducted from 2017-2020, 37 individual leatherback sea turtles were sighted within the New York Bight during spring, summer, and fall seasons (Tetra Tech and LGL 2020). These sightings occurred within offshore, federal waters in the vicinity of the SRWF and SRWEC–OCS.

Leatherbacks were rarely detected around the SRWF and SRWEC–OCS in particular during spring and not detected at all during winter of some surveys (Kraus et al. 2016; Normandeau 2016a, b; 2017a,b,c, 2018). The greatest number of leatherback sea turtle detections in the RI-MA and MA WEAs occurred in August, with a high concentration of sightings south of Nantucket (Kraus et al. 2016) in autumn. Furthermore, as shown in Figure 3.2-1, leatherback sea turtles have a heavily documented presence within offshore New York and Rhode Island waters from 1963 to 2019 OBIS-SEAMAP data. The species is therefore expected to be common in the offshore waters of the SRWF and SRWEC–OCS in summer and autumn (Kraus et al. 2016).

3.2.1.2 Sunrise Wind Export Cable–NYS

In New York waters, leatherback turtles are often seen on the south shore of Long Island, in the New York Bight region, and within the Long Island Sound (CETAP 1982; NYSDEC n.d.[a]). Boaters fishing within 10 mi (8.7 nm; 16 km) of the south shore of Long Island frequently report leatherback sightings (NOAA Fisheries and USFWS 1992).

Leatherback strandings on US shores have been mostly of adult or near-adult size turtle (NOAA Fisheries and USFWS 1992). In relation to species occurrences, leatherback sightings generally are fewer in number when compared to loggerheads and Kemp's ridleys. Leatherback distribution is similar to loggerheads with occurrences from Cape Hatteras to Long Island, but leatherbacks are more frequently observed in the Gulf of Maine, southwest of Nova Scotia, Canada. Leatherback sea turtles have a documented presence within New York State waters, per the OBIS-SEAMAP data presented in Figure 3.2-1.

Leatherback occurrence within the SRWEC–NYS is therefore considered to be common.

3.2.1.3 Onshore Facilities

As previously described, the Onshore Facilities portion of the Project will cross the ICW, and sea turtles that may be present in nearshore New York waters have the ability to utilize the available habitat within the nearby Great South Bay through openings in the barrier island. However, historically, leatherback sea turtles have been observed along the south shore of Long Island and Long Island Sound but rarely in the bays (Sadove and Cardinale 1993). No leatherback turtle sightings were reported within the OBIS-SEAMAP sightings data illustrated in Figure 3.2-1. As the species is more associated with offshore habitats and there are no current records of leatherback sea turtles within Great South Bay or the ICW, the species is not expected to be encountered within the waterbodies associated with the Onshore Facilities.

3.2.2 Loggerhead Sea Turtle

Loggerhead sea turtles range from tropical and temperate regions within the Atlantic, Pacific, and Indian Oceans (NOAA Fisheries n.d.[b]; USFWS 2020b). This species is the most abundant sea turtle species found in US coastal waters within the Atlantic Ocean (NOAA Fisheries n.d.[b]), with distribution likely influenced by water temperature and water depth. Five populations of loggerhead sea turtles exist worldwide in the Atlantic Ocean, Pacific Ocean, Indian Ocean, Caribbean Sea, and Mediterranean Sea.

In the Western Atlantic Ocean, the five major nesting aggregations are: (1) a northern nesting aggregation from North Carolina to northeast Florida, approximately 20° N latitude; (2) a south Florida nesting aggregation from 29° N latitude on the east coast to Sarasota on the west coast; (3) a Florida Panhandle nesting aggregation at Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán nesting aggregation on the eastern Yucatán Peninsula, Mexico; and (5) a Dry Tortugas nesting aggregation on the islands of the Dry Tortugas, near Key West, Florida (TEWG 2000).

Loggerhead sea turtles mate from late April through early September. Individual females might nest several times within one season and usually nest at intervals of every two to three years. For their first 7 to 12 years, loggerhead sea turtles inhabit pelagic waters near the North Atlantic Gyre and are called pelagic immatures. When loggerhead sea turtles reach 40 to 60 cm (15.7 to 23.6 in) straight-line carapace length, they begin transitioning to coastal inshore and nearshore waters of the continental shelf through the US Atlantic and Gulf of Mexico and are referred to as benthic immatures. Benthic immature loggerheads have been found in waters from Cape Cod, MA to southern Texas. Loggerhead sea turtles forage off the US Northeast and migrate south in autumn as temperatures drop. Most recent estimates indicate that the benthic immature stage ranges from ages 14 to 32 years, and they mature at around ages 20 to 38 years.

Loggerhead sea turtles feed primarily on mollusks and crustaceans; however, they may also forage on fish and other marine animals (NOAA Fisheries and USFWS 2008; NOAA Fisheries n.d.[b]; USFWS 2020b). The species has blunt jaws and a large head, with adults growing to an average length of 3 ft (0.9 m) and 200 lbs (91 kg) (USFWS 2020b).

Based on Bartol et al. (1999), juvenile loggerhead sea turtles respond to click stimuli from tone bursts of 250 to 750 Hz. Martin et al. (2012) recorded the AEPs of one adult loggerhead sea turtle, which responded to frequencies between 100 and 1,131 Hz, with greatest sensitivity between 200 and 400 Hz.

Results from a CETAP aerial surveys found that 84 percent of loggerhead sea turtle sightings occurred in waters less than 262.5 ft (80 m) in depth, suggesting that they prefer shallow waters (CETAP 1982). Loggerhead sea turtles, like green and Kemp's ridley sea turtles, transition from offshore habitats occupied by hatchlings to nearshore habitats occupied by adults. However, both adult and juvenile loggerhead sea turtles are also known to spend time in the open ocean.

A minimum of 8,000 to 11,000 loggerhead turtles are estimated to be present within the Northeast US Continental Shelf Large Marine Ecosystem waters each summer, as reported by Shoop and Kenney (1992). However, the smaller size of these turtles makes them difficult to detect in surveys; therefore, sightings may be lower than actual presence (Kenney and Vigness-Raposa 2010). During the AMAPPS (NOAA Fisheries 2017), Kraus et al. (2016), and CETAP (1982) surveys, loggerhead sea turtles were sighted in RI-MA and MA WEAs. Additionally, all surveys found the species to be more abundant in Rhode Island than leatherback sea turtles. The AMAPPS surveys reported 337 loggerhead sightings in one year, and Kraus et al. (2016) sighted loggerheads in all seasons except winter.

As previously stated, loggerhead sea turtles have a presence in both the inshore and offshore waters of New York and Rhode Island. In Rhode Island, 48 loggerhead sea turtles were documented from 990 to 2011 in offshore waters (RI DEM 2011). The Sea Turtle Stranding and Salvage Network Reports managed by the SEFSC reported a total of 80 stranded loggerhead sea turtles inshore and 84 stranded offshore of New York from 2015 to 2019 (NOAA SEFSC 2020).

The most common threats to the loggerhead turtle include bycatch from fishing gear, intentional killing, and ocean pollution/marine debris (NOAA Fisheries n.d.[b]). Loggerheads are often caught accidentally in trawls, longlines, and gillnets but have also been caught in pound nets, traps and pots, and dredge fisheries (NOAA Fisheries n.d.[b]). The highest number of loggerhead sea turtle fishery mortalities are attributed to shrimp trawl fisheries; however, each year several hundred loggerhead sea turtles are also captured in herring, mackerel, squid, butterfish, and monkfish fisheries (NOAA Fisheries 2011). Loggerhead turtles may also experience bycatch due to pound net, summer flounder, scup fisheries, Atlantic pelagic longline fisheries, and gillnet fisheries (NOAA Fisheries 2011). In addition to the threat of bycatch, the loggerhead sea turtle has been traditionally killed for its skin and meat, and the species experiences the same threats described above for leatherback turtles with regards to ocean pollution and marine debris.

Other threats to the loggerhead sea turtle include vessel collision and habitat degradation (NOAA Fisheries and USFWS 2008; USFWS 2020b). Collision and propeller injuries from vessels were found on 14.9 percent of stranded loggerhead turtles from 1997 to 2005 in the US Atlantic and Gulf of Mexico (NOAA Fisheries and USFWS 2008). A trend from the late 1980s to the early 2000s was shown within these data; however, some injuries may have been post-mortem (NOAA Fisheries and USFWS 2008). The threat of habitat degradation is similar to that described for the leatherback turtle, where either physical reduction in available habitat or lighting effects to onshore nesting habitat are a threat.

There are nine listed DPSs for loggerhead sea turtles; the Northwest Atlantic Ocean DPS, which occurs in the Project Area, was listed as Threatened in 2011 (NOAA Fisheries n.d.[b]). They are also listed as Endangered by the state of Rhode Island and Threatened by the states of New York and Massachusetts. In 2014, NOAA Fisheries designated critical habitat for the Northwest Atlantic Ocean DPS in multiple locations along the US East Coast and in the Gulf of Mexico. These areas include Sargassum habitat, nearshore reproductive habitat, overwintering areas, breeding habitat, and migratory corridors located between North Carolina and Florida in the Atlantic Ocean (79 FR 39855). No designated critical habitat exists in the Project Area.

3.2.2.1 Sunrise Wind Farm/Sunrise Wind Export Cable–OCS

As detailed above, loggerhead sea turtles are one of the most likely of the four species included in Table 3.2-1 to be found within offshore waters at the SRWF and SRWEC–OCS (along with the leatherback sea turtle). As shown in Table 3.2-2, loggerhead sea turtles have a heavily documented presence within the New York OPA, per the NYSERDA Digital Aerial Baseline Surveys conducted from Summer 2016 through Winter 2019 (Normandeau 2019a, b, c, d, 2020). Loggerhead turtles sighted within the New York OPA occurred all four seasons with the highest number documented in Summer 2017 (9,060 individuals). Similarly, during the NYSDEC Whale Monitoring Program aerial surveys conducted from 2017–2020, 16 individual loggerhead sea turtles were sighted within the New York Bight during summer and fall seasons (Tetra Tech and LGL 2020). These sightings occurred within a wide geographical area ranging from nearshore to the continental shelf edge and beyond.

Loggerhead sea turtles forage off the US Northeast and migrate south in autumn as temperatures drop. As previously discussed, loggerhead sea turtles frequently occur in waters off the coast of New York, Massachusetts, and Rhode Island. AMAPPS surveys reported loggerhead sea turtles as the most commonly sighted sea turtles in shelf waters from New Jersey to Nova Scotia, Canada (Palka et al. 2017). During December 2014 through March 2015 aerial abundance surveys, 280 individuals were recorded (Palka et al. 2017). Additionally, Kraus et al. (2016) reported that loggerhead sea turtle occurrence in the RI-MA and MA WEAs was highest during summer and autumn; and, during the NYSERDA Digital Aerial Baseline Surveys (NYSERDA 2017), sightings were dispersed across the continental shelf offshore of Long Island, with the greatest number of detections during summer surveys. During the 2017 NYSERDA aerial surveys, 649 loggerhead detections were documented.

Furthermore, as shown in Table 3.2-1, loggerhead sea turtles have a heavily documented presence within offshore New York and Rhode Island waters from 1963 to 2019 OBIS-SEAMAP data. Reported sightings show a wide distribution seasonally and indicate that loggerhead sea turtles are likely to be a common species encountered within the SRWF and SRWEC–OCS during summer and autumn (Kraus et al. 2016; Palka et al. 2017).

3.2.2.2 Sunrise Wind Export Cable–NYS

As previously described, as water temperatures begin to rise in late spring and early summer, the coastal waters of New York become more suitable for sea turtles (NYSDEC n.d.[a]). Sea turtles remain local to New York from approximately May through November and prefer the warmer waters in coastal bays and the Long Island Sound. By the end of November, they begin their migration south to warmer nesting waters (NYSDEC n.d.[a]).

Loggerhead sea turtles are the most frequently seen sea turtle in New York waters (Normandeau and APEM 2019; NYSDEC n.d.[a]) although they inhabit different regions during different parts of their lives. Juveniles are frequently found in nearshore bays and Long Island Sound, while adults are found up to 40 mi (34.8 nm, 64 km) off the southern Long Island coast (CETAP 1982; NYSDEC n.d.[a]). As juveniles transition to adults, habitat preferences shift to shallower water with open ocean access such as Florida Bay (NYSDEC n.d.[a]). Loggerheads are most commonly seen in June and then decrease by October (Shoop and Kenney 1992). Loggerhead turtles that migrate late in the season may succumb to cold-stunning, which usually occurs during autumn when water temperatures begin to fall. In 1985, 56 cold-stunned turtles were stranded in eastern Long Island (Kenney and Vigness-Raposa 2010).

Furthermore, loggerhead turtle occurrence within New York state waters is illustrated within Table 3.2-1. The species is therefore expected to be common within SRWEC–NYS waters.

3.2.2.3 Onshore Facilities

As previously described, all four species of sea turtles have been sighted in nearshore New York waters in summer and autumn (CETAP 1982; Kenney and Vigness-Raposa 2010; Kraus et al. 2016; NOAA Fisheries 2017). These nearshore turtles also have the ability utilize the available habitat within Great South Bay through openings in the barrier island. As detailed in the COP Appendix M2 (INSPIRE Environmental [INSPIRE] 2020a), in Summer 2020, a towed video sled was deployed along

22 transects within 328 ft (100 m) of the planned ICW HDD route to document the presence or absence of SAV. Six SAV observations were obtained from the video footage. These observations included small, solitary SAV shoots within a dense macroalgal mat observed on the north side of the ICW. No SAV beds were documented. Therefore, minimal to no foraging habitat will be crossed by the Project. However, Great South Bay contains a significant presence of eelgrass along the borders of Suffolk and Nassau Counties (NYSDEC 2020), providing forage for sea turtles. Loggerhead turtles have also been documented as foraging within Great South Bay's eelgrass beds (Audubon n.d.).

Loggerhead sea turtles are therefore expected to be regularly encountered within the waterbodies associated with the Onshore Facilities.

3.2.3 Kemp's Ridley Sea Turtle

Kemp's ridley sea turtles are found in the Gulf of Mexico and along the US Atlantic coastline from Florida to New England (NOAA Fisheries n.d.[c]). Adults are typically found in nearshore habitats with muddy or sandy bottoms; however, when hatchlings first enter the water, they swim offshore until they develop into late stage juveniles or adults (NOAA Fisheries n.d.[c]; USFWS 2020c). Juveniles inhabit the US Atlantic Coast from Florida to the Canadian Maritime Provinces and often associate with floating Sargassum algae (NOAA Fisheries n.d.[c]). Kemp's ridley sea turtles have been observed in migratory pathways in the Gulf of Mexico at depths of less than 164 ft (50 m) (NOAA Fisheries and USFWS 2015). In late autumn, Atlantic juveniles/sub adults travel northward to forage in the coastal waters off Georgia through New England, then return southward for winter (NYSDEC 2020; Stacy et al. 2013).

Preferred habitats include sheltered areas along the coastline such as estuaries, lagoons, and bays (NOAA Fisheries n.d.[c]). Sixty percent of Kemp's ridley nesting occurs on beaches near Rancho Nuevo, Tamaulipas, Mexico. The nesting season spans from April through July (NOAA Fisheries and USFWS 2007). On average, individual females nest every one to two years, with an average of one to three clutches every season and an average clutch size of 110 eggs per nest (NOAA Fisheries and USFWS 2007).

Kemp's ridley sea turtles typically feed on small animals and plants within floating algae complexes in the early stages of life in offshore habitats (NOAA Fisheries n.d.[c]). Once this species moves to nearshore waters, it predominantly feed on crabs but also forages for discarded bycatch and dead fish (NOAA Fisheries n.d.[c]). Kemp's ridley sea turtles have triangular-shaped heads with slightly hooked beaks and five pairs of costal scutes overlaying a bony carapace (NOAA Fisheries n.d.[c]; USFWS n.d.[c]). The species can grow to 2 ft (0.6-m) in length and weigh up to 100 lbs (45 kg) (USFWS 2020c).

Data are limited on Kemp's ridley hearing capability; however, available studies show that all sea turtle species can likely detect lower frequency sounds below approximately 1 to 2 kHz. Generally, sea turtle hearing is thought to more closely resemble that of fish rather than marine mammals given their inner ear morphology and the lower frequency ranges over which sea turtle hearing has been reported (Bartol and Ketten 2006; Dow Piniak et al. 2012a; Martin et al. 2012; Popper et al. 2014).

Kemp's ridley sea turtles were sited during the AMAPPS surveys (NOAA Fisheries 2017), Kraus et al. (2016) surveys, and the Kenney and Vigness-Raposa (2010) surveys. During AMAPPS surveys, 22 were sited out of 992 sea turtle sightings within one survey year (NOAA Fisheries 2017). Kraus et al. (2016) sighted six Kemp's ridley sea turtles within one year (in August and September). Additionally, Kenney and Vigness-Raposa (2010) sighted fourteen Kemp's ridley sea turtles within Rhode Island waters. During CETAP surveys, no Kemp's ridley turtles were observed; however, they were reported within strandings data in Massachusetts (CETAP 1982).

As previously stated, Kemp's ridley sea turtles have a presence in both the inshore and offshore waters of Rhode Island and New York. In Rhode Island, seven Kemp's ridley sea turtles were documented from 1990 to 2011 in offshore waters (RI DEM 2011). The Sea Turtle Stranding and Salvage Network Reports managed by the SEFSC reported a total of 136 stranded Kemp's ridley sea turtles inshore and 9 stranded offshore of New York from 2015- to 2019 (NOAA SEFSC 2020).

Primary threats to the Kemp's ridley sea turtles include fishing gear bycatch, egg harvesting, and ocean pollution/marine debris (NOAA Fisheries n.d.[d]) as previously described for other sea turtle species. Additional threats to this species include vessel collision (NOAA Fisheries and USFWS 2008), degradation of nesting or foraging habitat (reduction of habitat and/or lighting effects), climate change, disease, and predation (USFWS 2018).

The Kemp's ridley sea turtle was listed as Endangered throughout its range in 1970 (NOAA Fisheries 2020a) and is currently listed as Critically Endangered under the IUCN Red List. They are also listed as Endangered by the states of New York, Massachusetts, and Rhode Island. There is no designated critical habitat for this species in the Project Area (NOAA Fisheries 2020a).

3.2.3.1 Sunrise Wind Farm/Sunrise Wind Export Cable–OCS

Adult Kemp's ridley sea turtles spend limited time in offshore pelagic waters, although those that occur in southern New England can be seen in Long Island Sound, along the Rhode Island coastline, and in Cape Cod Bay, Massachusetts (CETAP 1982*;* Waring et al. 2012). They are more common in the New York Bight region and along the Long Island coastline; however, there are few visual sighting data for Kemp's ridley turtles in the SRWF and SRWEC–OCS waters, which is in part attributable to their small size that makes detections during aerial surveys difficult (Normandeau and APEM 2019). During the NYSDEC Whale Monitoring Program aerial surveys conducted from 2017-2020, one individual Kemp's ridley sea turtle was sighted within the New York Bight during one summer season (Tetra Tech and LGL 2020). This sighting occurred within federal, offshore waters off the coast of New Jersey.

As shown in Table 3.2-2, Kemp's ridley sea turtles have a documented presence within the New York OPA, per the NYSERDA Digital Aerial Baseline Surveys conducted from Summer 2016 through Winter 2019 (Normandeau 2019a, b, c, d, 2020). Kemp's ridley sea turtles sighted within the New York OPA occurred in summer, autumn, and spring seasons with the highest number documented in Summer 2017 (335 individuals). Kenney and Vigness-Raposa (2010) reported 14 observations of Kemp's ridley sea turtles offshore Rhode Island around Block Island in summer and autumn between 1979 and 2002. AMAPPS surveys documented five during aerial surveys conducted from August through September in 2010 in waters from Cape May, New Jersey to the Gulf of St. Lawrence, Canada (NOAA Fisheries 2017).

No confirmed sightings of the Kemp's ridley sea turtle were reported from 2011 through 2014 during Palka et al. (2017) studies.

Furthermore, as shown in Figure 3.2-1, Kemp's ridley sea turtles have a limited documented presence within offshore New York and Rhode Island waters from 1963 to 2019 OBIS-SEAMAP data. The Kemp's ridley sea turtle is, therefore, likely to be an uncommon species found within SRWF and SRWEC–OCS waters.

3.2.3.2 Sunrise Wind Export Cable–NYS

As previously described, when water temperatures begin to rise in late spring and early summer, the coastal waters of New York become more suitable for sea turtles (NYSDEC n.d.[a]). Sea turtles remain local to New York from approximately May through November and prefer the warmer waters in coastal bays and the Long Island Sound. By the end of November, they begin their migration south to warmer nesting waters (NYSDEC n.d.[a]).

Beginning in July, Kemp's ridley sea turtles inhabit the Long Island Sound area, and in October, the turtles begin to migrate out of the estuaries and back into pelagic environments. Individuals that do not migrate by late November are likely to become cold-stunned. There are many records of cold stunned Kemp's ridley sea turtles washing ashore on Long Island (Burke et al. 1993). Out of 130 cold stunned turtles collected over a three-year period along the shores of Long Island, 77 percent were Kemp's ridley turtles (Morreale et al. 1992).

The Kemp's ridley turtle has a documented presence off the coast of Long Island, NY and is likely to be encountered in the SRWEC–NYS (CETAP 1982; Waring et al. 2012). Additionally, OBIS-SEAMAP data from 1963 to 2019 illustrated in Figure 3.2-1 shows Kemp's ridley sightings within Rhode Island State waters. The Long Island Sound has not been formally identified as critical habitat; however, research has suggested that this area could potentially provide critical coastal developmental habitat for immature Kemp's ridley turtles during their early turtle life stages (two to five years) (Morreale et al. 1992; NYSDEC n.d.[a]). The species is, therefore, expected to have a common presence within the SRWEC–NYS.

3.2.3.3 Onshore Facilities

As previously described, the Onshore Facilities portion of the Project crosses the ICW (between Narrow Bay and Bellport Bay) and all four species of sea turtles have been sighted in nearshore New York waters in summer and autumn (CETAP 1982; Kenney and Vigness-Raposa 2010; Kraus et al. 2016; NOAA Fisheries 2017). These nearshore turtles also have the ability utilize the available habitat within the Great South Bay through openings in the barrier island. As previously described, six SAV observations were obtained from the ICW video footage from summer 2020 site-specific surveys. These observations included small, solitary SAV shoots within a dense macroalgal mat observed on the north side of the ICW, with no SAV beds documented. However, Great South Bay contains a significant presence of eelgrass along the borders of Suffolk and Nassau Counties (NYSDEC 2020), providing forage for sea turtles. The Kemp's ridley sea turtle has also been documented as foraging within Great South Bay's eelgrass beds (Audubon n.d.).

One sea turtle nesting event of a Kemp's ridley sea turtle was documented in New York (AM New York 2018) although this was likely an extremely rare occurrence. The Kemp's ridley sea turtle could, therefore, be regularly encountered within the waterbodies associated with the Onshore Facilities.

3.2.4 Green Sea Turtle

Green sea turtles have a worldwide distribution and can be found in both tropical and subtropical waters (NOAA Fisheries and USFWS 1991; NOAA Fisheries n.d.[d]; NatureServe 2019). In the Western North Atlantic Ocean, they can be found from Massachusetts to Texas as well as in waters off Puerto Rico and the US Virgin Islands (NOAA Fisheries and USFWS 1991). The species makes long-distance migrations between nesting grounds and pelagic feeding habitats (Bjorndal 1997; USFWS 2020d). Adult and juvenile green sea turtles are generally found in the shallow waters of coastal bays, reefs, and inlets where seagrass beds are present (NOAA Fisheries n.d.[d]; NOAA Fisheries and USFWS 1991; USFWS 2020d). Hatchlings are found in open ocean habitats immediately after emerging from the beach, and they live in offshore waters for many years until they develop and migrate to nearshore foraging grounds (NOAA Fisheries n.d.[d]).

Major green sea turtle nesting colonies occur on Ascension Island, Aves Island, Costa Rica, and Suriname. In the US, green sea turtles nest in North Carolina, South Carolina, Georgia, Florida, the US Virgin Islands, and Puerto Rico (USFWS 2018a). Nesting seasons vary by region. On average, individual females nest every two to four years, laying an average of 3.3 nests per season at approximately 13-day intervals. The average clutch size is approximately 136 eggs, and incubation ranges from 45 to 75 days (USFWS 2018a).

Green turtles are primarily herbivores, eating algae and seagrass; however, they may also eat sponges and invertebrates if algae and seagrass are unavailable (NOAA Fisheries n.d.[d]). Hatchling and early juvenile green sea turtles located in offshore waters often feed on pelagic drift communities such as *Sargassum* (NOAA Fisheries n.d.[d]). Green sea turtles are the largest hard-shelled turtle with a small head, growing up to 4 ft (1.2 m) in length and weighing up to 350 lbs (159 kg) (NOAA Fisheries n.d.[d]).

Unique to green sea turtles are two large scales located between the eyes and hard shells with five scutes running down the middle and four scutes running down each side (NOAA Fisheries n.d.[d]). This species is particularly vulnerable to cold shock when temperatures rapidly drop (Kenney and Vigness-Raposa 2010).

Bartol and Ketten (2006) measured the AEPs of two Atlantic green sea turtles and six sub-adult Pacific green sea turtles. Sub-adults were found to respond to stimuli between 100 and 500 Hz, with a maximum sensitivity of 200 and 400 Hz. Juveniles responded to stimuli between 100 and 800 Hz, with a maximum sensitivity between 600 and 700 Hz. Piniak et al. (2016) confirmed similar levels as juvenile green sea turtles responded to underwater stimuli between 50 and 1,600 Hz with maximum sensitivity between 200 and 400 Hz. Dow Piniak et al. (2012a) found that the AEPs of juvenile green sea turtles were between 50 and 1600 Hz in water and 50 and 800 Hz in air, with ranges of maximum sensitivity between 50 and 400 Hz in water, and 300 and 400 Hz in air.

Green turtles were sited during AMAPPS (NOAA Fisheries 2017) and CETAP (1982) surveys. AMAPPS surveys documented 15 green sea turtles (out of 992 unique turtle sightings) in one survey year (NOAA Fisheries 2017). During CETAP surveys, only one stranding of a green sea turtle was reported, and it was located on the Outer Banks of North Carolina (CETAP 1982). Similarly, Kraus et al. (2016) did not report any green turtle sightings. As previously stated, green sea turtles have a documented presence in both the inshore and offshore waters of Rhode Island and New York. In Rhode Island, two green sea turtles were documented from 1990 to 2011 in offshore waters (RI DEM 2011). The Sea Turtle Stranding and Salvage Network Reports managed by the SEFSC reported a total of 90 stranded green sea turtles inshore and five stranded offshore of New York from 2015 to 2019 (NOAA SEFSC 2020).

Primary threats to green sea turtles include fishing gear bycatch, intentional killing or harvesting of turtles and eggs, loss and degradation of nesting habitat, and ocean pollution/marine debris (NOAA Fisheries n.d.[d]e), as previously discussed for other sea turtle species. Additional threats similar to other species include vessel collision, climate change (USFWS 2018a). A threat unique to the green sea turtle is the fibropapillomatosis disease. This disease results in tumors that cause reduced vision, blindness, disorientation, reduced swimming and feeding abilities, and increased susceptibility to parasites and entanglement (NOAA Fisheries n.d.[d]).

There are 11 listed DPSs for green sea turtles, all of which are ESA-listed. The North Atlantic DPS, which is likely to occur in the Project Area, was listed as Threatened in 1978 (NOAA Fisheries n.d.[d]). The global population is listed as Endangered under the IUCN Red List. They are also listed as Endangered by the state of Rhode Island (RI DEM 2020) and Threatened by the states of New York and Massachusetts. Worldwide, green sea turtle populations have declined due to past harvesting for eggs and meat (USFWS 2018a). Currently, major risks to green sea turtles include loss of nesting and foraging habitat, nest predation, marine pollution, vessel strikes, and anthropogenic activity such as offshore dredging or fishing (USFWS 2018a). Critical habitat was designated by NOAA Fisheries for the green sea turtles in 1998 in the coastal waters of Culebra Island, Puerto Rico, and its outlying keys (USFWS 2018a). There is no designated critical habitat for green sea turtles in the Project Area.

3.2.4.1 Sunrise Wind Farm/Sunrise Wind Export Cable–OCS

There are a limited number of reported, confirmed sightings of green sea turtles in the general vicinity of the SWRF and SRWEC–OCS, which is likely a result of both effort, difficulty of locating small species in large areas of open water, and their actual distribution and life history characteristics. As shown in Table 3.2-2, green sea turtles were only documented in Summer 2016 per the NYSERDA Digital Aerial Baseline Surveys conducted from Summer 2016 through Winter 2019 (Normandeau 2019a, b, c, d, 2020). One confirmed green sea turtle sighting was reported in March 2005, south of Long Island between the 131- and 164-ft (40- and 50-m) isobaths (Kenney and Vigness-Raposa 2010). When NOAA's Northeast Fisheries Science Center conducted a combination of AMAPPS along the Northeast US Coast from 2010 to 2015, green sea turtles were spotted only in 2010 and 2011 out of the five surveys that were done from Cape May, New Jersey to the mouth of the Gulf St. Lawrence, Canada (Palka et al. 2017). During those surveys, six individuals were sighted south of Long Island, NY and within the Nantucket Shoals during summer aerial surveys (17 August through 26 September 2010), and five were also sighted off the southern coast of Long Island, NY during the summer aerial surveys (7 August through 26 August 2011)

(Palka et al. 2017). Furthermore, as shown in Figure 3.2-1, green sea turtles have a limited presence within offshore New York and Rhode Island waters from 1963 to 2019 per OBIS-SEAMAP data.

Few observations of green sea turtles have been reported in the offshore area, and their preferred habitat includes high-energy oceanic beaches, pelagic convergence zones, and shallow protected waters (NOAA Fisheries and USFWS 1991). However, a few green sea turtles may have a rare occurrence in the shallower water portions of the SRWEC–OCS during summer (Kenney and Vigness-Raposa 2010). As such, green sea turtles are expected to have an uncommon presence within the SRWF.

3.2.4.2 Sunrise Wind Export Cable–NYS

As water temperatures begin to rise in late spring and early summer, the coastal waters of New York become more suitable for sea turtles (NYSDEC n.d.[a]). Sea turtles remain local to New York from approximately May through November and prefer the warmer waters in coastal bays and the Long Island Sound. By the end of November, they begin their migration south to warmer nesting waters (NYSDEC n.d.[a]). All four species included in Table 3.2-1 may be present within nearshore New York state waters where the SRWEC–NYS portion of the Project will make landfall.

During the warmer months of the year, juvenile and occasionally adult green sea turtles have been sighted in sea grass beds off the eastern side of Long Island (NOAA Fisheries and USFWS 1991).

Although green sea turtles have been documented in New York waters, based on the infrequency of records, the wide distribution of these reports, and the higher likelihood of green sea turtles in New York waters concentrating around seagrass beds, it is not likely that green sea turtles would be encountered along the SRWEC–NYS route.

3.2.4.3 Onshore Facilities

The Onshore Facilities portion of the Project will cross the ICW between Narrow Bay and Bellport Bay. Nearshore turtles also have the ability to utilize the available habitat within Great South Bay through openings in the barrier island. As previously described, six SAV observations were obtained from the ICW video footage collected during summer 2020 site-specific surveys. These observations included small, solitary SAV shoots within a dense macroalgal mat observed on the north side of the ICW. No SAV beds were documented. However, Great South Bay contains a significant presence of eelgrass along the borders of Suffolk and Nassau Counties (NYSDEC 2020), providing forage for sea turtles. Green sea turtles have also been documented as foraging within Great South Bay's eelgrass beds (Audubon n.d.).

Sea turtles are not expected to nest on the beaches within the ICW as they typically nest in tropical, subtropical, and warm-temperate beaches, shoreward of the mean high tide line (Davenport 1997). While nesting does occur along the western shore of the Atlantic Ocean, densities vary from state to state.

Green sea turtles are expected to be regularly encountered within the waterbodies associated with the Onshore Facilities.

3.3 ESA-LISTED FISH

NOAA Fisheries has listed five fish species as federally protected within the New England/Mid-Atlantic region (NOAA Fisheries n.d.[a]): the Atlantic salmon (*Salmo salar*) (Gulf of Maine DPS), Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), giant manta ray (*Manta birostris*), oceanic whitetip shark (*Carcharhinus longimanus*), and shortnose sturgeon (*Acipenser brevirostrum*). While the cusk (*Brosme brosme*) has been listed by NOAA Fisheries as a candidate species for listing throughout its range under the ESA (71 FR 61022), there are currently no additional fish species proposed for listing under the ESA.

All listed species are outlined in Table 3.3-1 and discussed within the following sections with one exception— The only remaining populations of the Gulf of Maine DPS of the Atlantic salmon are in Maine. Smolts migrate from their natal river to foraging grounds in the North Atlantic, and after one or more winters at sea, adults return to their natal river to spawn. Atlantic salmon are not known to occur within or near the Project Area; the only potential for overlap with their distribution is during their migration route in the Gulf of Maine, which may be transited by vessels. There is no evidence of interactions between vessels and Atlantic salmon. Vessel strikes are not identified as a threat in the listing determination (74 Federal Register 29344) or the recent recovery plan (USFWS and NOAA Fisheries 2018), and there is no information to suggest that vessels in the ocean have any effects on migrating Atlantic salmon. Therefore, effects to Atlantic salmon are not expected even if migrating individuals co-occur with Project vessels moving between the Project site and distant ports.

Additional information on finfish and EFH can be found in the COP Appendix N – *Essential Fish Habitat Assessment* (INSPIRE 2020b), and underwater noise is assessed in the COP Appendix I1 (Denes 2020).

Table 3.3-1 ESA-Listed Fish Species with Potential Occurrence in the Project Area

Species	Where Listed	Current Listing Status	Relative Occurrence in the SRWF	Relative Occurrence in the SRWEC–OCS	Relative Occurrence in the SRWEC–NYS	Relative Occurrence in the Onshore Facilities
Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*)	New York Bight DPS	Federal—Endangered NYS—High Priority Species of Greatest Need[a] RI—State Historical MA—Endangered	Regular	Regular	Regular	Uncommon
Giant Manta Ray (*Manta birostris*)	Throughout its range	Federal—Threatened NYS—Not listed RI—Not listed MA—Not listed	Rare	Rare	Rare	Not Expected
Oceanic Whitetip Shark (*Carcharhinus longimanus*)	Throughout its range	Federal—Threatened NYS—Not listed RI—Not listed MA—Not listed	Rare	Rare	Not Expected	Not Expected
Shortnose Sturgeon (*Acipenser brevirostrum*)	Throughout its range	Federal—Endangered NYS—Endangered RI—State Historical MA—Endangered	Not Expected	Not Expected	Not Expected	Not Expected

SOURCES: NOAA Fisheries n.d.[a], 2019; NYSDEC 2015, 2019; RINHS 2012; MESA 2020

NOTES:

a/ In New York State, the Atlantic sturgeon is proposed for a change in status from High Priority Species of Greatest Need to Endangered (NYSDEC 2019)

3.3.1 Atlantic Sturgeon

The Atlantic sturgeon is an anadromous, subtropical species that can be found along the Atlantic coast from Labrador, Canada to Florida (ASMFC 2019; Murdy et al. 1997). It is classified into five distinct DPSs: the New York Bight, Gulf of Maine, Chesapeake Bay, Carolina, and South Atlantic, which are grouped by ranges according to designations published by NOAA Fisheries (77 FR 5880; 77 FR 5914). The New York Bight DPS is federally listed as endangered and includes all anadromous Atlantic sturgeon that are spawned in the watersheds that drain into coastal waters from Chatham, MA to the Delaware-Maryland border on Fenwick Island, Delaware. Within this range, Atlantic sturgeon have been documented in the Hudson and Delaware Rivers as well as at the mouth of the Connecticut and Taunton Rivers and throughout Long Island Sound (77 FR 5880; O'Leary et al. 2014). The New York Bight DPS is designated as critical habitat; however, the critical habitat does not include Long Island or offshore waters (82 FR 39160; NOAA Fisheries n.d.[e]).

The Atlantic sturgeon is characterized by its five rows of bony plates (scutes) and a snout with four slender barbels. The species feeds on invertebrates and bottom-dwelling fish including crustaceans, worms, mollusks, and sand lance (NOAA Fisheries n.d.[e]). Atlantic sturgeon can grow to 14 ft (4.3 m) in length and live as long as 60 years (NOAA Fisheries n.d.[e]) The primary hearing range of the species is generally described as a lower frequency (under approximately 1kHz), and swim bladders are not utilized for hearing as with some other fish species (Popper et al. 2014).

Atlantic sturgeon migrate upriver to freshwater rivers to spawn in spring and early summer and migrate downriver in autumn to reside in estuarine and marine waters (Atlantic Sturgeon Status Review Team 2007; NYSERDA 2017; O'Leary et al. 2014). During the spawning season, most spawning-age adults will be found in natal rivers. Atlantic sturgeon eggs are typically laid on hard surfaces such as cobble and gravel, are adhesive, and are often found in cold, clear waters important for larval development (ASMFC 2012; NYSERDA 2017). When not spawning, it is common for adult Atlantic sturgeon to inhabit offshore marine waters of the continental shelf, ranging from 35 to 165 ft (10 to 50 m) (Dunton et al. 2015). Offshore water habitat preferences generally include waters with sandy and/or gravel substrate (NOAA Fisheries n.d.[e]; NYSERDA 2017). Juvenile Atlantic sturgeon are often found in estuarine and coastal waters (NOAA Fisheries n.d.[e]; Secor et al. 2000) and are often observed over mud-sand bottoms (Dadswell 2006).

Atlantic sturgeon have been collected during trawl surveys in the New York Bight at water depths of 33 to 49 ft (10 to 15 m) (Dunton et al. 2010; Dunton et al. 2012; Dunton et al 2015). Adult Atlantic sturgeon in the coastal ocean off Long Island typically occur deeper than 33 ft (10 m) below the surface during the winter and spring months from November through April (Erickson et al. 2011). Atlantic sturgeon are most abundant in the coastal ocean during the spring and fall months (Dunton et al. 2010; Dunton et al 2015; Breece et al. 2016). During the late spring and summer months, sturgeon are less abundant off the coast of Long Island when they move inshore to feed or spawn in coastal estuaries and rivers during that time (Dunton et al. 2010, Dunton et al. 2015, Ingram et al. 2019). During the late fall and winter months, many subadult and adult Atlantic sturgeon move to deeper water (greater than 98 ft [30 m]) off the coast of New York (Ingram et al. 2019) or migrate south along the US coast (Dunton et al 2010; Dunton et al. 2015; Breece et al. 2016).

Relevant occurrences of the Atlantic sturgeon in US Northeast waters are documented as follows:

- Many juvenile and adult Atlantic sturgeon have been captured in otter trawls and sink gill nets in the vicinity of the SRWF (Stein et al. 2004). Through an evaluation of commercial bycatch data, Stein et al. (2004) found that the highest cumulative catches were associated with vessels from New Jersey and Massachusetts ports.
- In the latest status review for the species in 2007 (Atlantic Sturgeon Status Review 2007), the majority of tagged sturgeon recaptures (61 percent) happened within 3 mi (2.6 nm, 4.8 km) of shore.
- Atlantic sturgeon have a documented presence along the New Jersey and New York coastline per surveys conducted by Dunton (2014).
- Atlantic sturgeon were documented as being present in autumn and winter as bycatch within the NYSERDA Area of Analysis, per their Fish and Fisheries Study (NYSERDA 2017; Dunton et al. 2015).
- A trawl study conducted by Dunton et al. (2015) along the south coast of Long Island, NY found that Atlantic sturgeon use the coastal areas along the entire region, with most individuals caught at depths less than 49 ft (15 m) and in areas of previously known aggregations. Data analyzed within this study also indicated that adult and juvenile Atlantic sturgeon are also found further offshore as seen in commercial otter trawl and sink gill net bycatch databases. Spring was identified as the time of year with the greatest bycatch rates along the eastern end of Long Island.
- In a study by O'Leary et al. (2014), earlier findings were confirmed from a genetic analysis that three river spawning populations of Atlantic sturgeon (from the Hudson, James, and Delaware Rivers), are the primary sources of marine aggregations within the Mid-Atlantic Bight.
- Breece et al. 2016 confirmed findings by Dunton et al. 2010 that Atlantic sturgeon have been known to concentrate at the mouths of estuaries and inlets, coastal habitats, and use relatively narrow corridors along the coast to migrate between these habitats.
- Project-specific PSO data from Sunrise Geotechnical Surveys (Smultea 2020) detected no Atlantic sturgeon within the survey area, which included the SRWF.

The most significant threats to Atlantic sturgeon are accidental bycatch, habitat degradation, habitat impediment, and vessel strikes (NOAA Fisheries n.d.[e]). Bycatch of sturgeon happens most often with gillnet and trawl fisheries, with bycatch rates depending on the fishing season. Adults are often captured when moving into rivers to spawn, and juveniles are often captured when moving from nursery habitats in rivers and estuaries. Habitat degradation and impediment can also be disrupted due to anthropomorphic activities such as dredging, dams, and/or saltwater intrusion from groundwater pumping or droughts. In particular, dams impede access to sturgeon upstream spawning habitats, limiting reproduction activities (NOAA Fisheries n.d.[e]).

NOAA Fisheries listed the New York Bight DPS as Endangered in 2012 (77 FR 5879), and the critical habitat designation was finalized in 2017 (82 FR 3916). The IUCN lists the Atlantic sturgeon as Critically Endangered (Gesner et al. 2010). The Atlantic Sturgeon benchmark (SAR) (ASMFC 2017) indicates that all DPS stocks are depleted but recovering. In the state of New York, the Atlantic sturgeon is not endangered or threatened, rather it is categorized as a "high priority species of greatest conservation need" (NYSDEC 2015).

Similarly, the state of Rhode Island has the species listed as “state historical” (RI DEM 2012). The state of Massachusetts however has listed the Atlantic sturgeon as endangered within the New York Bight (MESA 2020).

3.3.1.1 Sunrise Wind Farm/Sunrise Wind Export Cable–OCS

As outlined above, adult and juvenile Atlantic sturgeon within the New York Bight DPS have a recorded presence within offshore marine waters when not spawning (from spring to early summer). Due to life history characteristics and the data previously described on presence of the species offshore of New York and Rhode Island, adult and juvenile sturgeon may be regularly present within the SRWF and SRWEC–OCS areas from autumn through spring.

3.3.1.2 Sunrise Wind Export Cable–NYS

As previously described, sturgeon have a documented presence offshore of Long Island. As Atlantic sturgeon migrate from offshore and coastal marine waters into inland rivers to spawn in springtime, then back into offshore waters in the fall, they are likely to have a regular presence within New York state waters.

3.3.1.3 Onshore Facilities

Atlantic sturgeon may be seasonally present within the Great South Bay as they migrate from offshore and coastal marine waters to inland rivers to spawn in spring, and juveniles are often found in estuaries and bays before growing into adults and migrating further offshore during non-spawning seasons. However, the New York Bight DPS is only known to spawn within the Hudson and Delaware Rivers (Atlantic Sturgeon Status Review Team 2007). Furthermore, there are no records of the Atlantic sturgeon’s presence within the ICW; therefore, the species is expected to be uncommon within the waterbodies associated with the Onshore Facilities.

3.3.2 Shortnose Sturgeon

Shortnose sturgeon have the same general range as the Atlantic sturgeon and can be found in rivers and coastal waters from Florida to Canada. However, unlike the Atlantic sturgeon, shortnose sturgeon spend less time in open ocean habitats (NOAA Fisheries n.d.[f]; Shortnose Sturgeon Status Review Team 2010). In marine waters, the species typically remains closer to shore when compared with the Atlantic sturgeon. During spring spawning season, shortnose sturgeon move far upstream; after spawning, the species moves rapidly downstream to estuaries and coastal environments where the fish reside before the next spawning season (NOAA Fisheries n.d.[f]). The species is considered amphidromous (a species that spawns and remains in freshwater for most of its life cycle but spends some time in saline waters) as opposed to anadromous. When moving between rivers, Kynard et al. (2016) recorded individuals moving 87 mi (76 nm, 140 km) in six days.

The mid-Atlantic metapopulation of shortnose sturgeon have a documented presence, or were seen foraging, within the following rivers: Saint John (Canada), Penobscot, Kennebec, Androscoggin, Piscataqua, Merrimack, Connecticut, Hudson, Delaware, Potomac, St. George, Medomak, Damariscotta, Sheepscot, Saco, Deerfield, East, and Susquehanna (NOAA Fisheries n.d.[f]). On rare occasions, the species has also been documented within the Narraguagus, Presumpscot, Westfield, Housatonic, Schuylkill, Rappahannock, and James Rivers (NOAA Fisheries n.d.[f]). In New York State, the shortnose sturgeon has a limited documented presence in the lower portion of the Hudson River from the southern tip of Manhattan to the Federal dam at Troy (NYSDEC n.d.[b], [c]). When not spawning, the species has been documented within Haverstraw Bay and Yonkers (NYNHP 2020).

The shortnose sturgeon is morphologically similar to the Atlantic sturgeon with the same hearing capabilities; however, the species is relatively smaller in overall size, growing to approximately 4.5 ft (1.4 m) (NOAA Fisheries n.d.[f]). The species feeds off muddy and sandy bottoms, utilizing its barbels to gather crustaceans, insects, worms, and mollusks (NOAA Fisheries n.d.[f]).

The greatest threat to the shortnose sturgeon is habitat impediment by locks and dams (NOAA Fisheries n.d.[f]). These structures impede access of sturgeon to upriver spawning habitats. Other anthropogenic threats include dredging, water withdrawals, saltwater intrusion, chemical contamination, and commercial fisheries bycatch (NOAA Fisheries n.d.[f]). Bycatch occurs most often in gillnet fisheries but has also occurred due to pound nets, fyke/hoop nets, catfish pots, shrimp trawls, and the recreational hook and line fishery (NOAA Fisheries n.d.[f]).

The shortnose sturgeon is federally listed as Threatened under the ESA throughout the species' range (32 FR 4001). The species is listed as Vulnerable under the IUCN Red List (Friedland and Kynard 2004) and does not currently have any critical habitat designated within the New England/Mid-Atlantic region.

3.3.2.1 Sunrise Wind Farm/Sunrise Wind Export Cable–OCS

Due to the shortnose sturgeon's preference for shallower, coastal waters and its limited documented presence in the Hudson River, Haverstraw Bay, and Yonkers, the species is not expected to be encountered in offshore waters within the SRWF and SRWEC–OCS.

3.3.2.2 Sunrise Wind Export Cable–NYS

Due to the shortnose sturgeon's limited documented presence in only the Hudson River, Haverstraw Bay, and Yonkers, the species is not expected to be encountered within coastal New York State waters.

3.3.2.3 Onshore Facilities

Due to the shortnose sturgeon's limited documented presence in only the Hudson River, Haverstraw Bay, and Yonkers, the species is not likely to be encountered within the waterbodies associated with the Onshore Facilities.

3.3.3 Giant Manta Ray

The giant manta ray occurs in tropical, sub-tropical, and temperate waters with a distribution including the Atlantic Ocean from the Carolinas to Brazil and is rarely found in colder waters of the Western North Atlantic. Giant manta rays undergo seasonal migrations, which are thought to coincide with the movement of zooplankton, current circulation and tidal patterns, seasonal upwelling, seawater temperature, and possibly mating behavior. The giant manta ray is a seasonal visitor to productive coastlines, oceanic island groups, and offshore pinnacles and seamounts. They are generally found at depths below 33 ft (10 m), and tagging studies indicate diving depths ranging from 656 to 1,476 ft (200 450 m) (NOAA Fisheries n.d.[g]). The species has also been observed in seagrass beds and along sandy bottoms (NOAA Fisheries n.d.[g]). Along the US east coast, the species has been noted as commonly found in waters from 19 to 22°C (66.2 to 71.6°C) (NOAA Fisheries n.d.[g]).

Giant manta rays are filter feeders, eating zooplankton within the water column (NOAA Fisheries n.d.[g]). They are slow growing, highly migratory animals with sparsely distributed and fragmented populations throughout the world. Giant manta rays are ovoviviparous, meaning females grow eggs inside the body then hatch them internally and birth live rays (Manta Ray World n.d.). Giant manta rays may reach disc widths of more than 23 ft (7 m) (NOAA Fisheries n.d.[g]). Regional population sizes are small (between 100 to 1,500 individuals) (IUCN 2018; NOAA Fisheries n.d.[g]).

NYSERDA studies determined that, based on its habitat and life characteristics, the giant manta ray could be found within their Area of Analysis in the offshore waters of New York (NYSERDA 2017). During the 2017-2020 NYSDEC Whale Monitoring Program aerial surveys within the New York OPA, manta rays were opportunistically sighted (29 groups with an estimated 51 individuals); however, all but one of the individuals were recorded in depths greater than 656 ft (200 m) along the OCS (Tetra Tech and LGL 2020).

The biggest threat to the species is commercial and artisanal fishing. The giant manta ray is overutilized for commercial purposes and is also often caught as bycatch (NOAA Fisheries n.d.[g]). Harvesting of giant manta rays due to Asian market demand is also an increasing threat as ray gills are heavily traded (NOAA Fisheries n.d.[g]).

As of 2018, the giant manta ray is listed as Threatened under the ESA and is listed as Vulnerable under the IUCN Red List (Marshall et al. 2018). The species is not state listed in New York, Massachusetts, or Rhode Island, and there are no designated critical habitats for the giant manta ray (MESA 2020; NYSDEC 2015; RINHS 2012).

3.3.3.1 Sunrise Wind Farm/Sunrise Wind Export Cable

The giant manta ray's range and habitat preferences indicate the species could be present within the SRWF and SRWEC. Giant manta rays were documented during NYSERDA Digital Aerial Baseline Surveys Summer 2016 (55 individuals), Summer 2017 (28 individuals), and Summer 2018 (3 individuals) within the New York OPA (Normandeau 2019a, b, c, d, 2020). Giant manta rays were also documented during the NYSDEC Whale Monitoring Program 2017-2020 aerial surveys (29 groups with an estimated 51 individuals); however, all but one individual were documented in 656 ft (200 m) depths or greater

(Tetra Tech and LGL 2020). Due to these limited sightings, the species is expected to have a rare occurrence within the SRWF and SRWEC.

3.3.3.2 Onshore Facilities

Due to habitat and life characteristics as well as lack of documented sightings, the giant manta ray is not expected to be to be encountered within the waterbodies associated with the Onshore Facilities.

3.3.4 Oceanic Whitetip Shark

Oceanic whitetip sharks are found worldwide in tropical and subtropical waters. The species spends its lifetime in offshore waters around the OCS or around oceanic islands in 600 ft (183 m) or deeper waters (NOAA Fisheries n.d.[h]). The oceanic whitetip shark is considered a surface-dwelling species with a strong preference for warm water surface mixing layers (NOAA Fisheries n.d.[h]).

The oceanic whitetip shark typically feed on cephalopods and bony fishes; however, they are opportunistic feeders and have also been known to feed on sea birds, other sharks and rays, marine mammals, and marine debris (NOAA Fisheries n.d.[h]). The species is large and stocky with distinctive white mottled patterns on the tips of their dorsal fins. Oceanic whitetip sharks mature between ages six and nine and reproduce biennially (NOAA Fisheries n.d.[h]).

NYSERDA studies determined that, based on its habitat and life characteristics, the oceanic whitetip shark could be found within their Area of Analysis in the offshore waters of New York (NYSERDA 2017). Per the NYSDEC Shark Spotter Viewer (NYSDEC n.d.[d]), within the last 18 months, no oceanic whitetip sharks were publicly spotted and/or reported. Commercial landings of US Atlantic pelagic sharks from 2014 to 2018 recorded a total of 22 oceanic whitetip shark landings; however, all 22 landings occurred in 2014 (NOAA Fisheries 2020i). Within the same timeframe, records show that oceanic whitetip sharks were released alive in 2014 (three individuals), 2015 (seven individuals), 2016 (one individual), and 2018 (two individuals) (NOAA Fisheries 2020i).

Oceanic whitetip sharks are particularly vulnerable to depletions with a low likelihood of recovery due to their low reproductive output and the late age they reach maturity (NOAA Fisheries n.d.[h]). Other primary threats to the species include commercial fisheries bycatch and international fin harvest and trading.

In 2018, the species was federally listed as threatened under the ESA throughout its range. In 2020, it was determined that the species does not require designation of critical habitat within the New England/ Mid-Atlantic range (85 FR 12898; NOAA Fisheries 2020i). Under the IUCN Red List, the oceanic whitetip shark is listed as Critically Endangered (Rigby et al. 2019).

3.3.4.1 Sunrise Wind Farm/Sunrise Wind Export Cable–OCS

Based on habitat requirements and life characteristics and the available species landings data in Atlantic offshore waters, the species may have a rare presence within SRWF and SRWEC–OCS waters; however, an encounter would be unlikely due to the low density of the species expected to be present in the area. Oceanic whitetip sharks were documented Summer 2016 (14 individuals) within the New York

OPA during the NYSERDA Digital Aerial Baseline Surveys; however, none were documented any other seasons from 2016 through 2019 (Normandeau 2019a, b, c, d, 2020).

3.3.4.2 Sunrise Wind Export Cable–NYS

Due to habitat requirements and life characteristics, the oceanic whitetip shark is not expected to be present within New York state waters and therefore is not expected to be encountered within the SRWEC–NYS.

3.3.4.3 Onshore Facilities

Due to habitat requirements and life characteristics, the oceanic whitetip shark is not expected to be encountered within the waterbodies associated with the Onshore Facilities.

4.0 AVOIDANCE, MINIMIZATION, MITIGATION, AND MONITORING MEASURES

Two protected species mitigation and monitoring plans were developed for the Project: COP Appendix O2 – *Marine Mammal Protected Species Mitigation and Monitoring Plan* and COP Appendix O3 – *Sea Turtle and ESA-listed Fish Protected Species Mitigation and Monitoring Plan*. These plans incorporate findings from the underwater acoustic assessment; supplement existing data gaps; allow for an evaluation of changes caused by offshore infrastructure within the context of larger regional shifts in species distributions; and describe the avoidance, minimization, mitigation, and monitoring measures and approaches taken by Sunrise Wind. Long-term regional monitoring efforts are also discussed in COP Appendices O2 and O3. These plans are a result of Sunrise Wind working with BOEM and NOAA Fisheries to refine an adaptive mitigation and monitoring approach that optimizes flexibility, while appropriately mitigating potential impacts to marine mammals, including through the use of the following proposed environmental protection measures:

- Sunrise Wind will comply with the current National Oceanic and Atmospheric Administration (NOAA) Fisheries speed restrictions at the time of Project activities.
- Sunrise Wind will require operational automatic identification system (AIS) on all vessels associated with the construction, O&M, and decommissioning of the Project, pursuant to USCG and AIS carriage requirements. AIS will be used to monitor the number of vessels and traffic patterns for analysis and compliance with vessel speed requirements.
- Sunrise Wind will adhere to vessel strike avoidance measures as required by BOEM and NOAA Fisheries.
- To the extent feasible, the SRWEC and IAC will typically target a burial depth of 3 to 7 ft (1 to 2 m). The target burial depth will be determined based on an assessment of seabed conditions, seabed mobility, the risk of interaction with external hazards such as fishing gear and vessel anchors, and a site-specific Cable Burial Risk Assessment. The SRWEC Landfall will be installed via horizontal directional drilling (HDD) to avoid impacts to the dunes, beach, nearshore zones and finfish resources. The Onshore Transmission Cable will also be installed via HDD under the Intracoastal

Waterway (ICW) to avoid impacts to coastal resources; HDD and trenchless methods will also be used elsewhere onshore, where appropriate, to minimize impacts to resource areas.

- For all munitions and explosives of concern / unexploded ordnance (MEC/UXO) clearance methods, safety measures such as the use of guard vessels, enforcement of safety zones, and others will be identified in consultation with a MEC/UXO specialist and the appropriate agencies and implemented as appropriate. Residual risk management actions will be implemented, including developing an emergency response plan, conducting MEC/UXO-specific safety briefings, and retaining an on-call MEC/UXO consultant.
- Plow cables/umbilicals will be under constant tension, and in this taut condition, are not expected to represent an entanglement risk.
- Sunrise Wind will require all construction and O&M vessels to comply with applicable International Convention for the Prevention of Pollution from Ships (IMO MARPOL), federal (USCG and EPA), and state regulations and standards for the management, treatment, discharge, and disposal of onboard solid and liquid wastes and the prevention and control of spills and discharges.
- Sunrise Wind will provide training for personnel onboard Project vessels, including PSO monitoring and reporting procedures, to emphasize individual responsibility for marine mammal, sea turtle, and ESA-listed fish awareness and protection.
- All crew supporting the Project will undergo marine debris awareness training, and such training will include use of the data and educational resources available through the NOAA Fisheries Marine Debris Program.
- Sunrise Wind will advise all construction and O&M vessels to comply with USCG and EPA regulations that require operators to develop waste management plans, post informational placards, manifest trash sent to shore, and use special precautions such as covering outside trash bins to prevent accidental loss of solid materials.
- Sunrise Wind completed a comprehensive underwater acoustic assessment to include modeling in support of evaluation of potential impacts due to noise generated during construction of the Project. The assessment followed NOAA Fisheries' 2018 revised *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing* (NOAA Construction and Operations Plan Fisheries 2018a) and NOAA Fisheries' Greater Atlantic Regional Fisheries Office (GARFO) tool for assessing the potential effects to marine mammals ESA-listed fish and sea turtles exposed to elevated levels of underwater sound from pile driving. Potential zones of influence described in this assessment will be reflected in the proposed mitigation measures in the mitigation and monitoring plan.
- Sunrise Wind will continue to support external initiatives to further mitigate marine traffic impacts and currently is a supporter of the Whale Alert system.
- Sunrise Wind will participate in a developer co-funded initiative to support continuation of New England Aquarium Right Whale Aerial Surveys in 2020/21.

- Additionally, the Project will implement the following mitigation measures, pursuant to ongoing dialogue with BOEM and NOAA Fisheries. Each of these methods and tools has been successfully applied by Orsted, Sunrise Wind, and/or its affiliates in support of geophysical surveys and/or the construction and operation of offshore wind projects across the globe. COP Appendix O2 describes these measures and will be included within the Letter of Authorization (LOA); these measures for marine mammals will also aid in minimizing impacts to sea turtles:
  - Exclusion and monitoring zones
  - Ramp-up/soft-start procedures
  - Shutdown procedures (if technically feasible)
  - Qualified and NOAA Fisheries-approved protected species observers (PSOs)
  - Noise attenuation technologies
  - Passive Acoustic Monitoring systems (fixed and mobile)
  - Reduced visibility monitoring tools/technologies (e.g., night vision, infrared and/or thermal cameras)
  - Adaptive vessel speed reductions
  - Utilization of software to share visual and acoustic detection data between platforms in real time.
- Time-of-year in-water restrictions will be employed to the extent feasible to avoid or minimize direct impacts to species of concern, such as Atlantic sturgeon or winter flounder, during construction. If work is anticipated to occur outside of these time-of- year restriction periods, Sunrise Wind will work with state and federal agencies to develop appropriate construction monitoring and impact minimization plans.

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