3 AFFECTED ENVIRONMENT

This chapter describes the environment that may be potentially affected by the implementation of the proposed operational measures. The following areas are addressed: biological resources (including the right whale and other marine species); physical environment; and the economic environment, with a focus on the shipping industry. The geographical area considered spans the East Coast of the United States (US) from Maine to northern Florida, and includes state waters (out to 3 nm [5.6 km]); US territorial waters (out to 12 nm [22.2 km]); and the US Exclusive Economic Zone (out to 200 nm [370.4 km]). Many of the proposed operational measures would be in application within 30 nm (55.6 km) of the coast, where right whales are usually found. As previously noted, for the purposes of the proposed operational measures and this EIS, the area under consideration is divided among the southeastern United States (SEUS), mid-Atlantic United States (MAUS), and the northeastern United States (NEUS) regions. The extent of each region is described in Section 1.3.

3.1 North Atlantic Right Whale Biology

Right whales are mysticetes (baleen whales), mainly inhabiting coastal and continental shelf waters. In the western North Atlantic Ocean, right whales have the following six main habitat areas, shown in Figure 3-1:

1. Coastal waters off the SEUS (mostly off Florida and Georgia)
2. Cape Cod Bay
3. Massachusetts Bay
4. Great South Channel (east of Cape Cod)
5. Bay of Fundy (Canada)
6. Scotian Shelf

The general right whale seasonal migration patterns are relatively well documented, though some right whales, especially males and nonpregnant adult females, may not follow specific patterns. Typically, pregnant females, females with young calves, and juveniles, as well as a few atypical individuals migrate seasonally along the eastern seaboard of the US and Canada between calving grounds in the south and feeding areas in the north, generally via near shore waters in the mid-Atlantic (Figure 3-1). The peak migration periods are November/December and March/April. In waters along the US mid-Atlantic, most sightings occur within 30 nm (56 km) of the coastline and in waters less than 20 fathoms (36.6 m) deep (Knowlton *et al.*, 2002). Whales generally migrate alone or in mother-calf pairs. Males and nonpregnant females are sometimes observed in the calving grounds; however, it is unknown where the bulk of the noncalving population spends the winter. More research and data are needed to fully understand right whale biology and behavior.

3.1.1 Reproduction

3.1.1.1 Habitat

The SEUS region is the only known calving and nursery area for the western stock of the North Atlantic right whale. Right whales give birth in the shallow coastal waters off the coasts of Georgia and Florida during the winter months. Mothers and calves arrive in this region from November to December and remain in the calving grounds until March or April, when they migrate north.

On June 3, 1994, NMFS designated waters along the Georgia and northeastern Florida coasts as right whale critical habitat (Figure 1-1). The SEUS region Northern Right Whale Critical Habitat includes the coastal waters between the latitudes of 31°15’ N and 30°15’ N from the coast out 15 nm (28 km) and the coastal waters between the latitudes of 30°15’ N and 28°00’ N from the coast out 5 nm (9.3 km) (50 CFR 226). As many as 90 animals have been seen in a given year in the SEUS region.

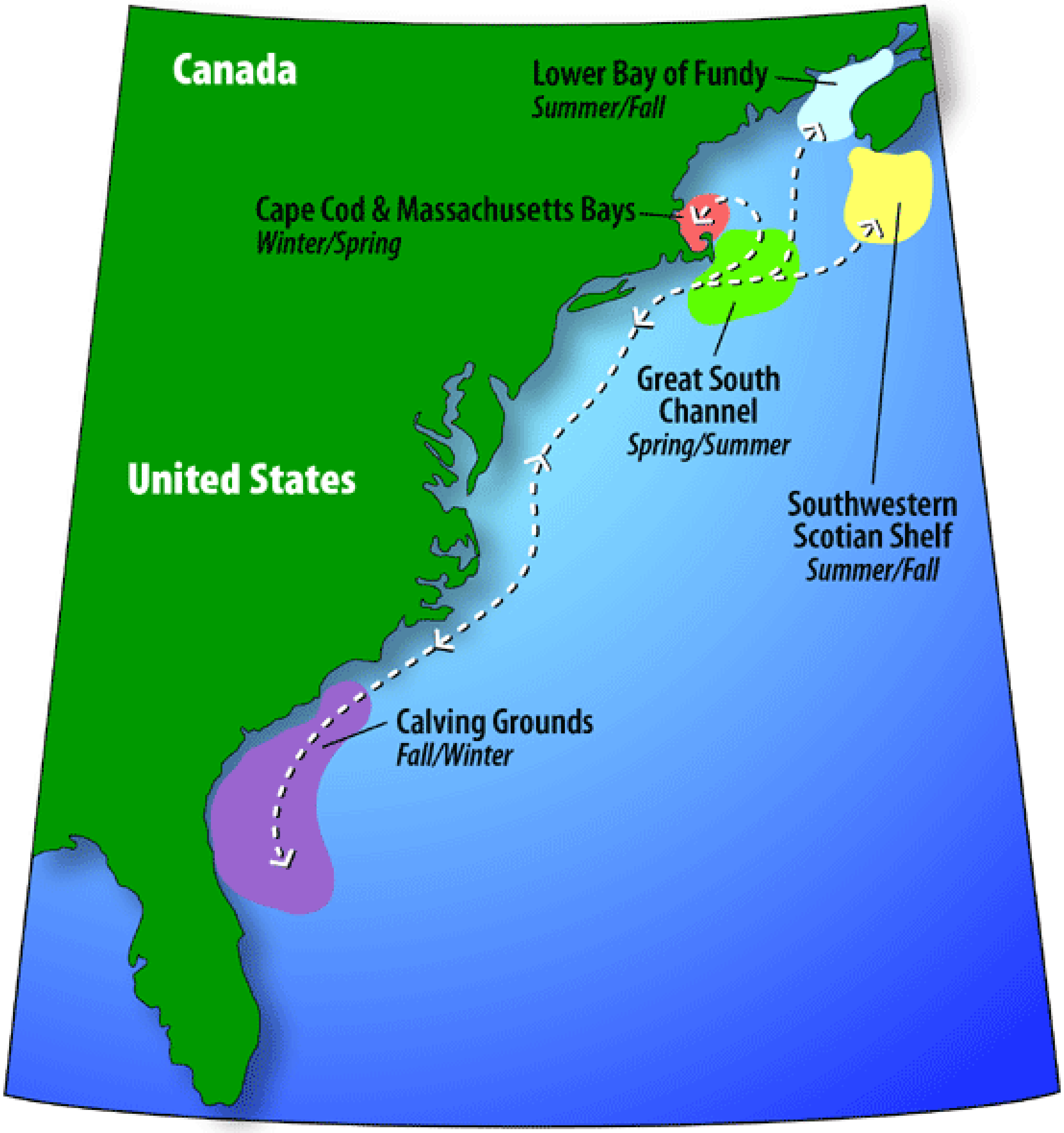
3.1.1.2 Behavior

Right whales engage in competitive mating behavior. They form mating aggregations, and several males compete for a single adult female. The female produces vocalizations to attract males, and males compete for a position adjacent to the female to gain the best chance of mating (Kraus and Hatch, 2001). It is possible that more than one male actually mates with a given female. Mating aggregations have been observed year-round and may serve other social purposes as well. Males have no role in raising the calf. Although mating behaviors have been observed from time to time, exact breeding habitat areas are unknown.

Females usually reach sexual maturity at the age of 7 to 10 years and about 60 percent of the current female population is estimated to be reproductively mature (Hamilton *et al.*, 1998a *in* NMFS 2005b). A new method to assess reproductive status measuring estrogens, progestins, androgens, and other metabolites in right whale fecal samples has recently been developed (Rolland *et al.*, 2005). This technique may allow for a more accurate determination of the age of sexual maturation than the current method that uses the mean age of first calving (Rolland *et al.*, 2005). Gestation lasts from 12 to 16 months. The mother and calf remain close until weaning, which generally occurs when the calf is 10 to 12 months old. Mother-calf pairs tend to remain separate from other pairs. The female then requires one or two years of reproductive rest to recoup the high energy investment necessary to give birth to and raise a calf (Kraus and Hatch, 2001).

Until recently, the average calving interval for North Atlantic right whale females has been increasing, from 3.67 years in 1980–1992 (Knowlton *et al.*, 1994) to 5.8 years in 1990–1998 (Kraus *et al.*, 2001). In addition to the increased calving interval, calf production and recruitment (the number of calves born each year that survive and become part of the population) were low in the 80s and 90s. Poor reproductive performance in the past could present a significant natural obstacle to population recovery, although recent trends indicate the population may be recovering from the reproductive problems in the 1990s. In April 2000 a workshop, *Cause of Reproductive Failure in North Atlantic Right Whales: New Avenues of Research*, identified factors contributing to this poor performance (Reeves *et al.*, 2000). They are as follows:

North Atlantic Right Whale Habitat and Migration Route



Source: E. Paul Oberlander, Woods Hole Oceanographic Institute Graphic Services

Figure 3-1

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- Environmental contaminants and endocrine disruptors
- Body condition/nutritional stress
- Genetics
- Infectious diseases
- Marine biotoxins

Right whales may be exposed to a variety of anthropogenic chemical contaminants throughout their range, which can lead to reproductive dysfunction. Theoretically, a loss of genetic diversity can lead to "inbreeding depression," where inbreeding adversely affects a population's reproduction and recruitment rates. Genetic factors might be affected by external factors, including toxic chemicals and poor nutrition (Reeves *et al.*, 2000). Nutrition is directly related to the availability of food, which is dependent on many oceanographic factors, and to a lesser extent, climate. Nutrition has an effect on the reproductive process in both sexes at many levels, and poor nutrition reduces reproductive success (Reeves *et al.*, 2000). Right whale calving rates and reproductive success are likely related to the regional abundance of the copepod (planktonic crustacean) species, *Calanus finmarchicus* that is hereinafter referred to as *C. finmarchicus* (Greene and Pershing, 2004). Competition for food with other species and climate variability decrease food availability and also reduce reproductive success (Kraus *et al.*, 2001).

"The North Atlantic Oscillation (NAO) is a complex climatic phenomenon in the North Atlantic Ocean (especially associated with fluctuations of climate between Iceland and the Azores). It is characterised predominantly by cyclical fluctuations of air pressure and changes in storm tracks across the North Atlantic."[1] The NAO index measures the difference in sea-level pressure between the subtropical high (Azores) and the subpolar (Iceland) low. During a positive phase[2] in the NAO index during the 1980s, slope water temperatures were warmer than average in the Gulf of Maine and *C. finmarchicus* abundance was relatively high. Modeling studies indicate that the stable calving rates of right whales in the 1980's were related to the high abundance in *C. finmarchicus* during this time (Greene *et al*., 2003). Then a decrease in the NAO index in the mid-1990s resulted in low *C. finmarchicus* abundance in the late 1990s, and coincided with declining calving rates from 1993 to 2001 (Greene *et al*., 2003).

This declining reproductive success in the past has been noticed only in the North Atlantic right whale when compared to other baleen whales (NMFS, 2005a). It is, however, variable, like the factors influencing it. Annual calf production was relatively low from 1993 to 2000, averaging around 12 calves (Greene *et al*., 2003). After 2001, calf production increased, although was still variable: 31 in 2001, 21 in 2002, 19 in 2003, 16 in 2004, and 28 in 2005 (Kraus *et al.*, 2005). The 2005 calving season resulted in the birth of 28 calves, the second highest number on record since the 2000–2001 season, when 31 calves were born. This recent increase in births has to be balanced against the observed increase in mortality rate over the period from 1980 to 1998 to a level of 4 (± 1 percent). The total estimated human-caused mortality and serious injury to right whales from 1999 through 2003 is 3.2 per year, a 1.2 increase from the previous estimate (1997 through 2001). This increase in mortality rate could actually reduce the population growth rate

[1] http://en.wikipedia.org
[2] A positive phase occurs when subtropical pressures are higher than normal and subpolar pressures are lower than normal, resulting in above average temperatures in the eastern US (http://www.cpc.ncep.noaa.gov/data/teledoc/nao.shtml).

10 to 12 percent per year (Kraus *et al.*, 2005). Therefore, the negative effect of the mortality rate on the population growth rate may overweigh the positive contribution of calves born during certain years.

3.1.2 Feeding

Like most mysticetes, right whales fast during the winter calving season and feed during the summer. They may also feed opportunistically while migrating (NMFS, 2003c).

3.1.2.1 Prey

Right whales primarily feed on a *C. finmarchicus*, a type of copepod, which is one of the small-to-microscopic organisms that compose zooplankton, the animal equivalent of phytoplankton. Right whales feed by filtering water through their baleen. Right whales target an older copepodite stage of *C. finmarchicus*, fifth copepodite (C5) (Baumgartner *et al*., 2003). At certain times of the year, this stage is generally in a resting state in deep waters, referred to as diapause (Sameoto and Herman, 1990; Miller *et al*., 1991). Although *C. finmarchicus* aggregate at certain depths, they can be found throughout the water column. Optimal right whale foraging is dependent on the location of dense prey patches.

3.1.2.2 Habitat

From late winter to early fall, North Atlantic right whale distribution tends to correlate with the location of *C. finmarchicus*, which is mostly in temperate to subarctic waters. Main feeding grounds are in the north in the spring and early summer, where particularly dense patches of prey occur. The main feeding areas are:

- Cape Cod Bay (late winter)
- Great South Channel (spring)
- Bay of Fundy (summer and early fall)

As these feeding grounds are vital to right whale survival, the areas in US waters were designated as right whale critical habitat by NMFS on June 3, 1994. Two critical habitat areas included the Great South Channel, and portions of Cape Cod Bay and Stellwagen Bank (Figure 1-3). The Great South Channel critical habitat is bounded by the following longitudes and latitudes:

41° 40’ N	69° 45’ W
41° 00’ N	69° 05’ W
41° 38’ N	68° 13’W
42° 10’ N	68° 31’W

The Cape Cod Bay critical habitat is bounded on the south and east by the interior shoreline of Cape Cod (50 CFR 226) and on the north and west by the following longitudes and latitudes:

42° 04.8’ N	70° 10’ W
42° 12’ N	70° 15’ W
42° 12’ N	70° 30’ W
41° 46.8’ N	70° 30’ W

While whales have been sighted year round in Cape Cod Bay, the peak period of feeding in that area is January to May. Whales primarily concentrate in the eastern part of the bay, but as the season progresses, aggregations are seen in the central and southern portions with some sightings in the western part. Right whales spend about one-third of their time surface feeding in the Cape Cod/Massachusetts Bay and Gulf of Maine areas, which may increase ship strike and entanglement risk from buoy line and surface system lines.

From Cape Cod Bay right whales move to the feeding grounds in the Great South Channel, the northern Gulf of Maine, and other areas via the Off Race Point area (Figure 1-3). While in the Great South Channel (April to June with occasional appearances year-round), right whales spend approximately 10 percent of the time feeding at the surface and 90 percent of the time feeding at lower depths (Goodyear, 1996). Concentrations of whales feeding in the Great South Channel may extend into the northern edge area of Georges Bank as well. Feeding areas of sporadic high use or semiregular use in the Gulf of Maine include areas near the entrance to Portland, Maine, such as Platts Bank, Jeffreys Ledge, and Cashes Ledge. In late summer and fall, adult males typically feed along the Scotian Shelf (Browns and Baccaro Banks) of Canada, while mother-calf pairs and juveniles are more likely found feeding in the Bay of Fundy (Figure 3-1) (Perry *et al.*, 1999). One-third of females do not utilize the Bay of Fundy feeding grounds, which suggests that there are still unidentified feeding grounds (Schaef *et al.*, 1993). The depth that right whales feed depends on the location of the prey in the water column; right whales spend a significant amount of time feeding below the surface in the Bay of Fundy, where most *C. finmarchicus* aggregate just above the bottom mixed layer (Baumgartner and Mate, 2003).

While the majority of right whales feeding in the northeast can be found in areas with high abundance of *C. finmarchicus*, there is an exception in the deep basins of the Gulf of Maine. A study conducted on satellite-tagged right whales in the lower Bay of Fundy during 1989 to 1991 and in 2000 found that the tagged animals did not frequent the deep basins of the Gulf of Maine and Scotian Shelf, where copepods are thought to be abundant (Baumgartner and Mate, 2005). This is probably because deeper dives allow less feeding time and less energetic benefit per dive (Baumgartner and Mate, 2003).

3.1.2.3 Feeding Behavior

Right whales use their baleen to filter food from the mouthfuls of water they collect and then expel. Whales obtain most of their food energy (91.1 percent) by feeding during deep dives, and the remainder (9.9 percent) through surface feeding (Goodyear, 1996). Deep dives occur at depths over 100 ft (30.5 m). When right whales feed at the surface, they skim feed by swimming slowly along the surface with their mouths open collecting dense batches of prey.

Foraging dives occur at depths of 10 meters or more (Reynolds and Rommel, 1999), and if the animal finds a dense patch of prey, it commonly meanders through the area turning frequently to consume as much food as possible. Although the practice of foraging while submerged consumes more energy than skim feeding at the surface, deeper-water copepods are more abundant, have higher caloric content, and are less active than surface ones (Baumgartner *et al.*, 2003). Longer intervals at the surface between foraging dives have been observed for reproductively active females and their calves, which makes this population segment more susceptible to ship strikes (Baumgartner and Mate, 2003).

Right whales usually feed alone, although several individuals may feed simultaneously in the same general area of dense prey patches. Given that other animals have similar diets, some competition for prey may exist with species such as the sei whale and some planktivorous fish species (NMFS, 2003b).

3.1.3 Socializing

Right whale socializing behavior typically involves surface activities in which whales may be in physical contact with each other. This type of behavior is known as a surface active group (SAG) and usually involves a single adult female or focal female surrounded by up to 34 males maneuvering to approach the female. Vocalizations are common and may include calls by the focal female to attract males and increase competition for mating (Kraus and Hatch, 2001). The socializing can include turning, rolling, and lifting flippers into the air.

Social activities may increase the risk of entanglement with fishing gear or ship strike. Being heavily engaged in, and intent on, a particular activity such as feeding, socializing, or mating, probably reduces whales' awareness of external threats, thereby increasing their vulnerability to oncoming ships. On the other hand, the size of the aggregation may also increase the probability that a mariner will spot the whales and take appropriate action to avoid a ship strike.

3.1.4 Diving Behavior

Because of their high blubber content, right whales are positively buoyant animals (Nowacek *et al.*, 2001). Combined with slow swimming, their buoyancy hinders rapid descents, which could be one of the reasons right whales often fail to avoid oncoming vessels. On the other hand, the same buoyancy allows for ascents with little or no energy expenditure, because the animal naturally floats toward the surface. Such buoyancy may contribute to ship strikes because a whale may have difficulty either aborting or modifying a free ascent or descending quickly enough to avoid a ship (Nowacek *et al*., 2001).

A study conducted in Grand Manan Basin in the Lower Bay of Fundy, a late summer feeding ground, examined levels of paralytic shellfish poisoning (PSP) toxins in *C. finmarchicus*, right whales' primary food source. Ingesting large amounts of prey that contains PSP can cause neuropathology, respiratory difficulties, and impaired diving capabilities. Surface aggregations of *C. finmarchicus* have higher PSP toxin levels than deeper copepods (Durbin *et al.*, 2002). Limits on their diving can affect food consumption, which, in turn, can affect their reproductive potential.

3.1.5 Vocalization

Although information has only recently become available on vocalizations by North Atlantic right whales, their sounds are thought to be similar to those of southern right whales. Their vocalizations differ in frequency depending on the type of call and the behavior associated with the call. Right whale vocalizations are typically underwater moans and pulsed calls, with most signal energy under 400 hertz (Hz) (Watkins and Schevill, 1972 *in* Wartzok and Ketten, 1999). One of the more common sounds made by right whales is the "up call," a frequency-modulated upsweep in the 50–200 Hz range (Mellinger, 2004).

In a study on vocalization rates of North Atlantic right whales in Cape Cod, Great South Channel, and the Bay of Fundy, several different types of right whale sounds were recorded using a towed hydrophone array and digital acoustic recording tags (DTAGs) (Matthew *et al.*, 2001). “Moans” ranged from 50 to 500 Hz and lasted 0.4–1.5 seconds, and varied in amplitude and frequency. “Gunshots” were broadband and impulsive, and similar to “slaps” (Clark, 1982; 1983 *in* Matthews et al., 2001). Low-frequency calls had a constant frequency, around 60–80 Hz, and durations from 0.5 to 10 seconds. Moan rates (per aggregation per hour) were related to the size of aggregations: groups of 10 or more whales had the highest rates (~70–700/hr), followed by small groups of less than 10 whales with moan rates of (< 60/hr); individuals rarely produced moans (<10/hr).

Passive acoustic methods of detecting whale calls may be a viable management tool to determine the presence of right whales. Scientists at Cornell University are currently working with passive acoustic technology to detect right whale sounds. Ten autonomous recording devices or ‘pop ups’ were deployed throughout Stellwagen Bank National Marine Sanctuary in 2006 to record the presence/absence of right whales. This study is in support of the effort to reposition the Boston Traffic Separation Scheme. While this method may be shaping certain ship strike policies, additional research is required before it can be utilized to predict right whale distribution and gather real-time monitoring information that may aid in reducing ship strikes.

During sexual and social activities, right whales are quite vocal. When SAGs form, as described in Section 3.1.3, the female calls frequently and males have been observed to produce gunshot-like sounds (Parks, 2003). These sounds have been recorded being made by whales that are alone without appearing to attract other whales (Parks, 2003). The focal female in a social group produces calls at frequencies of 400 HZ and higher that last 0.5–2.8 seconds at an average rate of about 12 per minute (Kraus and Hatch, 2001). These vocalizations are thought to be a mating call from the females to males within an audible distance. Mothers and calves vocalize while the mother is feeding away from the calf; these calls are known as “contact calls” (Reeves, 2000).

3.1.6 Hearing

3.1.6.1 Hearing Characteristics

Although it has not been tested, it is generally accepted that right whale hearing is in the low frequency range, which conforms to the ranges of other mysticetes (baleen whales), whereas odontocetes (toothed whales) vocalize and hear high frequency sounds (Ketten, 1998). The assumption that right whales hear in the low frequency range is based on ear structure and inferences from vocalization characteristics, although there are no audiograms to confirm this.

If there were no anthropogenic sources of noise in the ocean, then whales might be able to hear sounds from other whales and vocalize more effectively. However, there are many sources of low frequency noises from human activities that overlap with the low frequency calls of mysticetes.

Research has been conducted on the effects of vessel noise on certain species of large whales (NMFS, 2003b), although there are still unknowns about right whale hearing capacities. Research suggests that right whale hearing is concentrated in the low frequency range, thus some high frequency noise such as propellers might not be detected (Terhune and Verboom, 1999).

Large vessels cause the most lethal and serious injury to whales and also produce low frequency sounds which may interfere with right whale hearing (Koschinski, 2002).

The ability of a right whale to detect a vessel is related to a variety of factors including bottom reflections, frequency of sounds, location of the whale with respect the vessel, and its depth in the water column. Multipath propagation of vessel noise may confuse the whale as to the direction the ship is going and generally is problematic with low frequency noise. Ships generate higher noise levels towards the stern of the boat than in front of the bow, and even louder noises directly under the ship, so there might be instances in which a whale would not actually hear a vessel until after it has passed. Ship noises are not as loud near the surface as they are 5–10 meters beneath, due to the reflective nature of the surface (Terhune and Verboom, 1999). This is known as the Lloyd-mirror effect, which is amplified in the low frequency range, in calm sea states, and when the source and/or receiver are near the surface (Richardson *et al*., 1995). Therefore, in certain conditions, a whale might be less likely to hear a vessel when the whale is at or near the surface, where it is at a high risk of being struck by a vessel.

3.1.6.2 Masking

Background ambient noise, or underwater noise, including that produced by human activities (dredging, shipping, seismic exploration, and drilling for oil), may interfere with or mask the ability of a marine mammal to detect sound signals, such as calls from other animals (Richardson *et al.*, 1995). Some mysticetes may alter the frequencies of their communication sounds to reduce masking (Richardson *et al.*, 1995).

Masking may also prevent right whales from being able to detect and avoid approaching vessels because they might not be able to distinguish the sound of an approaching ship from the ambient noise in the ocean, although this hypothesis has not been tested. Areas where there is continuous loud distant shipping may mask the sound of individual ships until they are too close (Terhune and Verboom, 1999), which may make right whales more susceptible to ship strikes. Vessel noise may have started as a masking issue where whales could not locate the sound of an individual ship and evolved into becoming habituated or are used to this noise to the point where they no longer react to the noise.

3.1.6.3 Habituation and Behavioral Reactions

Habituation is where whales may not respond to vessel noise because they have become accustomed to continuous noise in areas of heavy vessel traffic and as a result, are less reactive.

Aside from masking and habituation, there are additional factors that interfere with a whales' ability to hear approaching vessels. Even though research indicates that right whales should be able to hear vessels, they do not appear to avoid vessels. Several researchers have confirmed that right whales should be able to hear approaching vessels, which emit sounds in a range they can perceive. Parks (2003) established that whales have the ability to locate a sound and even remember where it originated from for around 20 minutes after the sound stops.

Aside from hearing and detection issues, a whale must perceive a ship as a threat to avoid it, and unless a given individual has had a previous close encounter with a ship, survived, and learned the threat, the urge to avoid a ship may not be great.

One study utilized an archival DTAG to record whale behavioral reaction to an alert signal, vessel noise, other whale social sounds, and a silent control (Nowacek *et al.*, 2003). The whales did not have a significant response to any of the signals other than an alert signal broadcast ranging from 500 to 4,500 HZ. In response to the alert signal whales abandoned current foraging dives, began a high power ascent, remained at or near the surface for the duration of the exposure, and spent more time at subsurface depths (1–10 m) (Nowacek *et al.,* 2003). This increased time just below the surface could substantially increase their risk of ship strike because whales are susceptible to being struck but are not visible at the surface. The consequences of the whales' altered behavior, aside from increased risk of ship strike, are reduced foraging time and an excess use of energy, a problem for an endangered species. The whale's lack of response to a vessel noise stimulus from a container ship and from passing vessels indicated that whales are unlikely to respond to the sounds of approaching vessels even when they can hear them (Nowacek *et al.,* 2003). A second study that utilized a DTAG had similar results. The scientists played a recording of a tanker using an underwater sound source and observed no response to a tagged whale 600 meters away (Johnson and Tyack, 2003). This nonavoidance behavior could be an indication that right whales have become habituated to the vessel noise in the ocean and therefore do not feel the need to respond to the noise or may not perceive it as a threat. These various hypotheses aside, it has not been established why the species is so susceptible to strikes.

3.1.6.4 Effects of Ocean Noise on Cetaceans

The potential effects of noise on cetacean ears range from tissue damage to a reduction in hearing sensitivity. Neither would be expected to occur as a result of vessel noise; however, this section provides a brief description of hearing sensitivity so the reader is aware of the full range of the effects of noise on cetaceans.

Exposure to certain high intensity underwater noises can cause a reduction in hearing sensitivity in cetaceans. This change in the threshold of hearing can either be temporary, in which case it is referred to as temporary threshold shift (TTS), where the animal recovers, or permanent, which is referred to as permanent threshold shift (PTS) (ICES, 2005; Kastack *et al*., 2005). TTS levels for odontocetes are high, although noise induced TTS has not been observed in mysticetes (Kastack *et al*., 2005). PTS in cetaceans has not been observed, and is usually extrapolated. TTS generally results from high intensity, acute sources of noise and is unlikely to occur from the low frequency, ambient noise from vessels.

3.2 Biology of other Marine Species

North Atlantic right whales exist in an interrelated biological environment. This section describes other species whose ranges coincide with that of the right whale. Section 3.3 describes the physical environment.

3.2.1 Other Marine Mammals

While all marine mammals are protected by the MMPA, some stocks are healthy, and thus are not described in detail in this EIS. Along the East Coast of the US, such species include:

- Atlantic spotted dolphin (*Stenella frontalis*)
- Pantropical spotted dolphin (*Stenella attenuata*)
- Spinner dolphin (*Stenella longirostris*)
- Harbor porpoise (*Phocoena phocoena*)
- Bryde's whale (*Balaenoptera edeni*)
- Short-beaked common dolphin (*Delphinus delphis*)
- Cuvier's beaked whale (*Ziphius cavirostris*)
- Minke whale (*Balaenoptera acutorostrata*)
- Killer whale (*Orcinus orca*)
- Short-finned pilot whale (*Globicephala macrorhyncus*)
- Long-finned pilot whale (*Globicephala melas*)
- Pygmy sperm whale (*Kogia breviceps*)
- Dwarf sperm whale (*Kogia sima*)
- Risso's dolphin (*Grampus griseus*)
- Harbor seal (*Phoca vitulina*)

However, other species of marine mammals in that area are listed as endangered under the ESA or depleted[3] under the MMPA. These species are listed in Table 3-1.

Like the right whale, a number of these marine mammal species are affected by ship strikes. The species known to be most commonly struck are the fin whale and the humpback whale, but there are also records of ship strikes to the gray, minke, sperm, southern right, blue, Bryde's, sei, and killer whales. Most reported ship strikes involving large whales worldwide occur in the western North Atlantic and mid-Atlantic. Most large whale ship strikes result in death (Jensen and Silber, 2003).

Table 3-1
Domestic Depleted and ESA-listed or Candidate Marine Mammal Stocks Occurring in or Near the Western Range of the North Atlantic Right Whale

Common Name	Scientific Name	Status*
Blue whale	*Balaenoptera musculus*	E
Fin whale	*Balaenoptera physalus*	E
Humpback whale	*Megaptera novaeangliae*	E
Sei whale	*Balaenoptera borealis*	E
Sperm whale	*Physeter macrocephalus*	E
West Indian manatee	*Trichechus manatus*	E
Bottlenose dolphin (US mid-Atlantic coastal migratory stock)	*Tursiops truncatus*	D

* E = endangered; D = depleted. **Sources:** NMFS, 2004c; USFWS, 2004.

[3] A depleted species is defined in the MMPA as a species or population stock that is below Optimum Sustainable Population (OSP) or if the species is listed as endangered under the ESA (16 U.S.C. 1362).

Blue Whale

The blue whale (*Balaenoptera musculus*) is the largest baleen whale. Blue whales are listed as endangered under the ESA and protected under the MMPA. They are found worldwide and are separated into populations in the North Atlantic, North Pacific, and Southern Hemisphere. The blue whale has been subdivided into three subspecies: *B. musculus intermedia* found in Antarctic waters, *B. musculus musculus* in the Northern Hemisphere, and *B. musculus brevicauda* (the "pygmy" blue whale) in the southern Indian Ocean and southwest Pacific Ocean.[4]

The pre-exploitation population size of the North Atlantic blue whale ranged from 1,100 to 1,500 individuals; current estimates range from 100 to 555 whales. The current minimum population estimate for the western North Atlantic stock is 308 whales. The distribution of blue whales in the western North Atlantic ranges from the Arctic to at least mid-latitude waters (NMFS, 2005c). This species primarily feeds north of the Gulf of St. Lawrence during spring and summer. Blue whales are pelagic, so they are primarily found in deep, offshore waters and are rare in shallow shelf waters. Blue whales have been killed or seriously injured by ship strikes; one occurrence in the North Atlantic in 1998 and several in California in the early 1990s.

Fin Whale

The MMPA stock assessment reports for the fin whale recognize one stock in the US North Atlantic (western North Atlantic) and three stocks in the North Pacific (California, Oregon, and Washington). The species is listed as endangered under the ESA. Fin whales range from the Arctic to the Greater Antilles. The best population estimate for this species in the western North Atlantic is 2,814 individuals, based on a 1999 shipboard and aerial survey of waters from Georges Bank to the mouth of the Gulf of St. Lawrence (Waring *et al.*, 2001). They occur widely in the mid-Atlantic throughout the year, with concentrations from Cape Cod north in summer and from Cape Cod south in winter, and are typically associated with the continental shelf and continental shelf edge. The New England coast is a major feeding ground for fin whales from spring to fall. It is assumed that fin whales breed in the middle North Atlantic, with mating and calving occurring from November to March; however, the location of their wintering grounds is poorly known. Fin whales are one of the species most frequently involved in ship strikes; the average observed annual mortality due to ship strikes is 0.4 fin whales per year for the period 1997–2001.

Humpback Whale

The humpback whale (*Megaptera novaeangliae*) is a mid-sized baleen whale. Humpback whales were listed as endangered throughout their range on June 2, 1970, under the ESA, and are considered depleted under the MMPA. It is estimated that there are fewer than 7,000 humpbacks in US waters. The best population estimate for the Gulf of Maine stock is a minimum of 647 whales (NMFS, 2005c). The four recognized stocks (based on geographically distinct winter ranges) of humpback whales in the US are: the Gulf of Maine stock (previously known as the western North Atlantic stock), the eastern North Pacific stock (previously known as the California-Oregon-Washington stock), the central North Pacific stock, and the western North Pacific stock (NMFS, 2003b). The humpback whale is distributed worldwide in all ocean basins, though it is less common in Arctic waters. Humpback whales migrate seasonally. In the winter, the breeding season, most humpback whales are found in temperate and tropical waters of both

[4] http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/blue_whale.doc

hemispheres. In summer, the feeding season, most are in waters of high biological productivity, usually in higher latitudes. There are 44 records of vessel collisions with humpback whales since 1975 (Jensen and Silber, 2003).

Sei Whale

For management purposes, there are two stocks of sei whales; the Labrador stock and the Nova Scotia stock; and only the latter is considered here. The range of the Nova Scotia stock includes the continental shelf waters of the NEUS and extends northeastward to south of Newfoundland (NMFS, 2003b). The population size of sei whales in US North Atlantic waters is unknown. During the feeding season, sei whales are found at the northern bound of their range, in Nova Scotia. In the spring and summer, they occur in the southern end of their range, which includes the Gulf of Maine and Georges Bank (NMFS, 2003b). The sei whale typically occurs in deeper waters characteristic of the continental shelf edge region (Hain *et al*., 1985 in NMFS, 2003b). They primarily feed on euphausiids and copepods, and have been known to travel to inshore feeding habitats in years of abundant copepods. These areas are late summer feeding grounds for right whales as well. Sei whales in the western North Atlantic occasionally suffer from ship strikes, although records are fewer than for other large whale species such as humpback and fin whales, perhaps due to an offshore distribution. NMFS' stranding and entanglement records from 1997 through 2001 yield an average of 0.2 human-caused mortalities of sei whales per year as a result of recorded ship strikes in New York in 2001 and Boston in 1994.

Sperm Whale

Sperm whales (*Physeter macrocephalus*) are the largest of the odontocetes (toothed whales). Sperm whales are found throughout the world's oceans in deep waters between about 60°N and 60°S latitudes. They are highly social animals. The basic social unit consists of a mixed group of adult females, calves, and some juveniles, usually 20–40 individuals in all. They prey on large mesopelagic (living at depths from 200 to 1,000 meters [656 to 3,280 ft]) squid, other cephalopods (e.g., octopus), demersal (living near the bottom), and occasionally benthic (bottom dwelling) fish. Sperm whales are capable of diving to depths of more than 1,000 meters (3,281 ft) for durations of more than 60 minutes.

There are five stocks of sperm whales, the North Atlantic stock being the only one that overlaps geographically with the right whale. In winter, sperm whales tend to concentrate east and northeast of Cape Hatteras. In spring, the center of distribution shifts northward to areas east of Delaware and Virginia, and the whales are found throughout the central portion of the mid-Atlantic and in the southern portion of Georges Bank. In summer, sperm whales occur east and north of Georges Bank, into the Northeast Channel region and the continental shelf (inshore of the 100 meter isobath) south of New England, where they are most plentiful in the fall (NMFS, 2003b).

The minimum population estimate for the western North Atlantic sperm whale stock is 3,505 individuals. The sperm whale was listed as endangered throughout its range on June 2, 1970, under the ESA and is also protected under the MMPA. There is a potential for sperm whales to be killed or seriously injured by ship strikes. In May 1994, a sperm whale was involved in a ship strike south of Nova Scotia, and in May 2000, a merchant ship reported a ship strike in Block Canyon, New Jersey (NMFS, 2005c).

West Indian Manatee

The West Indian species is divided into two subspecies: the Antillean manatee (*Trichechus manatus manatus*) and the Florida manatee (*Trichechus manatus latirostris*). Only the latter is considered here. The Florida manatee lives mainly in the waters off the coasts of Florida but has been known to occur in southeastern Georgia and even Virginia to the north and Louisiana to the west. In the winter, manatees are generally found in south Florida, though some have also been known to winter further north in naturally and artificially warm waters. The population of Florida manatees is unknown, although it is considered to include at least 1,800 animals.[5] The Florida manatee is listed as endangered under the ESA. Manatees are often struck by recreational vessels.

Bottlenose Dolphin

The bottlenose dolphin is found worldwide in temperate and tropical inshore waters. Sighting data indicate that bottlenose dolphins are distributed along the coast, across the continental shelf, over the continental shelf edge, and in waters over the continental slope with a bottom depth greater than 1,000 meters (3,300 ft). There are two genetically distinct stocks of bottlenose dolphin off the Atlantic coast: the western North Atlantic coastal and western North Atlantic offshore stocks. The coastal stock is smaller and generally not found in waters deeper than 25 meters (82 ft). It is continuously distributed along the Atlantic Coast south of Long Island, around Florida and along the Gulf of Mexico coast (NMFS, 2003b). This stock is migratory and winters south of Cape Hatteras, North Carolina.

The offshore stock can be found in waters deeper than 25 meters (82 ft) and generally occurs along the continental shelf break and into slope waters. Aerial surveys of the offshore stock indicated that it extends along the entire continental shelf break from Georges Bank to Cape Hatteras during spring and summer (CETAP 1982; Kenney 1990 in NMFS, 2003b). In fall, there were more sightings in the south than other portions of the survey area, and there were few to no sightings in the winter in the central portion of the survey area (NMFS, 2003b). “The offshore ecotype was found exclusively seaward of 34 km and in waters deeper than 34 m. Within 7.5 km of shore, all animals were of the coastal ecotype.” (NMFS, 2003b)

3.2.2 Sea Turtles

All six species of sea turtles occurring in US waters are listed under the ESA and all species have recovery plans finalized between 1991 and 1998, and several are currently being revised. These plans contain information on each species and are included here by reference. One species, the olive Ridley turtle (*Lepidochelys olivacea*), is predominantly tropical and is not considered here. The other five species are listed in Table 3-2. Fishery bycatch, habitat loss, egg poaching, marine debris, beach nourishment, and artificial lighting are common threats to sea turtles. Sea turtles in coastal waters and the open ocean are affected by ship strikes as well.

[5] http://www.fws.gov/northflorida/Manatee/manatees.htm

Table 3-2
Sea Turtles Occurring in US East Coast Waters

Common Name	Scientific Name	Status*
Green turtle	*Chelonia mydas*	E, T**
Hawksbill turtle	*Eretmochelys imbricata*	E
Kemp's Ridley turtle	*Lepidochelys kempi*	E
Leatherback turtle	*Dermochelys coriacea*	E
Loggerhead turtle	*Caretta caretta*	T

* E = endangered; T = threatened.
** Status assigned according to population. **Source:** NMFS, 2004a.

Green Turtle

The green turtle is a global species found in tropical and subtropical waters. Hatchlings are pelagic, or occur in the water column of the open ocean. Adults spend most of their time in tropical shallow, nearshore areas; however, they are known to undertake long oceanic migrations between nesting and foraging habitats.

All green turtle populations are threatened except the breeding populations of Florida and the Pacific Coast of Mexico, which are endangered. Since the 1978 listing, the populations have not significantly improved (NMFS, 2004a). There are a number of threats to green turtles, from capture in commercial fisheries, predation, and anthropogenic threats at nesting beaches, to systematic harvest in certain countries. Boating activities may also cause injury or death to green turtles through collisions or propeller wounds.

Hawksbill Turtle

Hawksbill sea turtles are found in the tropical and subtropical waters of the Atlantic, Pacific, and Indian Oceans. They are found along the continental US coastline from Massachusetts southward; however, sightings north of Florida are rare. Like the green turtle, post-hatchling hawksbills are pelagic; adults return to a variety of shallow coastal habitats, including rocky outcrops, coral reefs, lagoons on oceanic islands, and estuaries.

The hawksbill was listed as endangered under the ESA in 1970 (NMFS, 2004a). In addition to other human-caused threats to Hawksbill turtles, they also may incur propeller wounds or other injury from vessel collisions in areas with concentrated vessel traffic.

Kemp's Ridley Turtle

The Kemp's Ridley turtle has a more limited range than other sea turtles. Adult distribution is generally restricted to the coastal areas of the Gulf of Mexico and the northwestern Atlantic Ocean. Nesting occurs primarily in one area near Rancho Nuevo in southern Tamaulipas, which is on the northeastern coast of Mexico. There are also a few scattered nests in Texas, Florida, South Carolina, and North Carolina.

The Kemp's Ridley turtle was listed as endangered in 1970. After long periods of decline, today the population appears to be in the early stages of recovery due to protective measures (NMFS, 2004a). The Kemp's Ridley turtle recovery plan contains additional information and is incorporated by reference (NMFS and USFWS, 1992b). Kemp's Ridley turtles have the potential to be injured by propellers or collisions with vessels.

Leatherback Turtle

The leatherback is the largest extant turtle species (NMFS, 2004a). Leatherback turtles are found worldwide in tropical and temperate waters of the Atlantic, Pacific, and Indian Oceans. Adult leatherbacks are highly mobile and are believed to be the most pelagic of all sea turtles. Females are often observed near the edge of the continental shelf, but do not nest as frequently as other turtle species found in US waters.

Leatherbacks were listed as endangered in 1970. Boating activities may result in direct injury or death through collision impact or propeller wounds.

Loggerhead Turtle

Loggerhead sea turtles are found in tropical, subtropical, and temperate waters throughout the world. The loggerhead is the most abundant sea turtle in US coastal waters. They frequent continental shelves, bays, estuaries, and lagoons.

Loggerheads were listed as threatened in 1978 and their status has not changed. It appears that the nesting populations in South Carolina and Georgia may be declining, while the Florida nesting population seems to be stable.

3.2.3 Seabirds

Seabirds are birds whose normal habitat and food source is the sea; coastal, offshore, or pelagic waters (Harrison, 1983). Seabirds include loons (*Gaviiformes*), grebes (*Podicipediformes*), albatrosses, fulmars, prions, petrels, shearwaters, storm-petrels, diving petrels (*Procellariiformes*), pelicans, boobies, gannets, cormorants, shags, frigatebirds, tropicbirds, anhingas (*Pelecaniformes*), shorebirds, skuas, jaegers, gulls, terns, auks, and puffins (*Charadriiformes*).

Table 3-3 lists the seabird species protected under the ESA. The *Environmental Assessment of Proposed Regulations to Govern Interactions between Marine Mammals and Commercial Fishing Operations, under Section 118 of the Marine Mammal Protection Act* (NMFS, 1995) contains more detailed data on seabirds and is incorporated here by reference.

Table 3-3
ESA-listed Seabirds Occurring along the US East Coast

Common Name	Scientific Name	Status*
Piping plover	*Charadrius melodus*	T
Brown pelican	*Pelecanus occidentalis*	E, R**
Least tern	*Sterna antillarum*	E
Roseate tern	*Sterna dougallii dougallii*	E, T**

* E = endangered; T = threatened; R = recovered (delisted).
** Status assigned according to population. **Sources:** USFWS, 2004.

3.2.4 Protected Anadromous and Marine Fishes

Table 3-4 shows anadromous (living in salt water but reproducing in fresh water) and marine fish species found along the US East Coast that are endangered or threatened under the ESA, or are species of concern for ESA listing. No catadromous (living in fresh water but reproducing in salt water) fishes are listed or are candidates for listing under the ESA.

Table 3-4
Endangered, Threatened, and Candidate Anadromous and Marine Fishes Occurring along the US East Coast

Common Name	Scientific Name	Status*
Atlantic salmon	*Salmo salar*	E
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	SC
Barndoor skate	*Raja laevis*	SC
Dusky shark	*Carcharhinus obscurus*	SC
Goliath grouper	*Epinephelus itajara*	SC
Mangrove rivulus	*Rivulus marmoratus*	SC
Nassau grouper	*Epinephelus striatus*	SC
Night shark	*Carcharhinus signatus*	SC
Opossum pipefish	*Microphis brachyurus*	SC
Sandtiger shark	*Odontaspis Taurus*	SC
Shortnose sturgeon	*Acipenser brevirostrum*	E
Smalltooth sawfish	*Pristis pectinata*	E
Speckled hind	*Epinephelus drummondhayi*	SC
Warsaw grouper	*Epinephelus nigritus*	SC
White Marlin	*Tetrapturus albidus*	SC

* E = endangered; SC = species of concern (are those species for which uncertainties exist regarding status and threats, information is lacking, and listing is not currently being considered).
Sources: NMFS, 2004b and www.nmfs.noaa.gov/pr/species/concern.

A recovery plan exists for the shortnose sturgeon and is incorporated here by reference (NMFS, 1998).

3.2.5 Marine Resources Not Addressed in the EIS

Essential fish habitat (EFH) is not addressed in this EIS because the operational measures would not have an effect on EFH. *Sargassum* mats (i.e., large mats of pelagic brown algae) are frequently found floating on the surface along the East Coast of the US. *Sargassum* mats are EFH for several marine species, such as fish, juvenile sea turtles, and a few marine mammals. Other designated EFHs are subsurface and, therefore, would not be of concern for the implementation of the operational measures. Plankton, benthic organisms, and some fish are not discussed in this section as they would not be affected by the proposed action and alternatives.

3.3 Physical Environment

North Atlantic right whales range from maritime Canada south through the US East Coast to northern Florida. This section describes the specific physical and geographical features within this range. In the Southeast, right whales generally occur in nearshore continental shelf waters (Garrison, 2005), and although they have been sighted offshore, the frequency with which right whales occur in offshore waters in the southeastern US remains unclear (NMFS, 2005f). In the mid-Atlantic, right whales are most commonly found within 30 nm (55.6 km) of the coast (94 percent of recorded sighting) and in depths of up to 60 ft (18.3 m) (71.5 percent of recorded sightings). Only rarely do they occur at depths above 150 ft (45.7 m; 93 percent of recorded sightings occur at depths of up to 150 ft) (Knowlton *et al*., 2002). In contrast to the other two regions, right whales are frequently known to occur in far offshore waters in the Northeast. The information on the physical environment, including water depth, sea floor topography, sediment types, water composition and quality are provided because there are correlations between these attributes and right whale habitat use.

3.3.1 Bathymetry and Substrate

A brief description of bathymetry (i.e., ocean depth and physical features) and bottom sediment types is included in this EIS because certain seafloor features and sediment types are particularly conducive to right whale foraging. Patches of right whales primary food source, *C. finmarchicus*, are found at specific depths in the water column. Right whales aggregate in areas where there is an abundance of prey.

3.3.1.1 General Features

Several geophysical features are common to all three regions considered, including the continental shelf, the continental slope, the continental rise, and the abyssal plain. The continental shelf is a broad, sea floor platform that, although submerged, is a part of the continental mass. Along the Atlantic Coast, the continental shelf extends from the shoreline to a depth of about 660 ft (200 m). It ends at shelf break or shelf edge, usually marked by a noticeable increase in slope, as the continental shelf joins the steeper continental slope, leading to the continental rise. The continental rise is a zone approximately 54–540 nm (100–1,000 km) wide at the base of the continental slope, marked by a gentle seaward gradient ending in the abyssal plain. Figure 3-2 depicts these features by using a color scale to show water depth. Submarine canyons, are steep, v-shaped valleys that cut through the continental slope, continental rise, and, less commonly, the continental shelf.

3.3.1.2 Gulf of Maine/Georges Bank (NEUS Region)

The Gulf of Maine/Georges Bank area includes several important right whale habitat areas. In addition to Cape Cod Bay and Great South Channel critical habitat, right whales are known to occur in Jeffrey's Ledge, the Bay of Fundy, Platts Bank, and other physiographic areas in the Gulf of Maine. Figure 3-3 depicts the bathymetry in the Gulf of Maine/NEUS region, which includes the waters between Nova Scotia and the Bay of Fundy, and also Cape Cod. Georges Bank extends to the southeast of the gulf. The continental shelf in this area is a relatively narrow band surrounding deeper basins. Two of the larger inner basins, Jordan Basin and Wilkinson Basin, are separated by a broad ridge that extends southeastward from the coast of Maine toward Georges Bank. Georges Bank is the third largest basin in this region and is connected to the continental slope through the Northeast Channel, which also separates Georges Bank from the Scotian Shelf (Milliman and Imamura, 1992). Jeffrey's Ledge and Stellwagen Bank are two of several large bathymetric features in the southern Gulf of Maine. Both are within Stellwagen

Bank National Marine Sanctuary (Figure 2-15), which spans approximately 22 miles in a southeast to northwest direction from Cape Cod to Cape Anne in the mouth of Massachusetts Bay (NOS, 1993b).

Figure 3-4 depicts sediment types in the Gulf of Maine/Georges Bank area. Jeffrey's Ledge, located on the northern edge of the Stellwagen Bank National Marine Sanctuary in depths less than 196.8 ft (164 m) is composed primarily of gravel and a gravel-sand mixture, with a sandy boundary to the southeast (NOS, 1993b). Stellwagen Bank, with depths less than 164 ft (50 m), is mainly sand or pebbly-sand, bounded on the east by gravel or a gravel-sand mixture (NOS, 1993b). The Gulf of Maine basin mostly consists of silty-clay or clayey-silt sediments. The seafloors of Stellwagen Basin and Cape Cod Bay are covered by clayey-silt. The outer rim of the Gulf of Maine (Nantucket Shoals, Georges Bank, and the Nova Scotian Shelf) consists of primarily sand and gravel. Sand is the principle sediment for the inner shelf off Cape Cod (NOS, 1993b).

Bottom layer characteristics and other physical oceanographic conditions determine where high density patches of copepods aggregate and, consequently, where right whales are likely to be found foraging. Baumgartner and Mate (2005) reported that right whales in the Gulf of Maine preferred certain bathymetric features over others. Observing that the whales frequently occurred at areas with depths of approximately 150 meters (shallow basins), the authors noted that "the structure, hydrography, and physical processes of these [shallow] basins may improve the availability, quality, and aggregation of *C. finmarchicus*, respectively, for foraging right whales." These areas were preferred over deep basins in the Gulf of Maine and Scotian Shelf (see also Section 3.1.2.1). For instance, Baumgartner and Mate found that whales occurred in areas with low bottom water temperatures, high surface salinity, and high surface stratification. Areas with low bottom water temperatures may support a higher abundance of *C. finmarchicus*, which would explain why the tagged whales preferred these areas (Baumgartner and Mate, 2005). Such correlations allow scientists to better predict the location of foraging whales.

Recent technology takes this relationship between oceanographic conditions and *C. finmarchicus* abundance one step further to predict right whale births. Data from Gulf of Maine Ocean Observing System (GoMOOS) Buoy N (in the Northeast Channel) can provide forecasts of right whale births based on water temperature at the Buoy. As mentioned in Section 3.1.1.2, the NAO affects water temperatures in the Atlantic Ocean and specifically, the Gulf of Maine. Water temperatures in turn, influence right whale's food supply, which affects reproduction and the number of calves born. "After a positive NAO index, whale food becomes plentiful, and right whales produce many calves. After a negative NAO index, food becomes scarce, resulting in few calves being born" (GoMOOS, 2006). Based on this data, 13 births are predicted in 2006 and 16 in 2007.

3.3.1.3 Middle Atlantic Bight (MAUS Region)

Figure 3-5 depicts the bathymetry of the Middle Atlantic Bight/MAUS region, which extends from Cape Cod and Nantucket Shoals to Cape Hatteras, North Carolina (Milliman and Imamura, 1992). Right whales occur throughout the Middle Atlantic Bight during fall and spring. Compared to bathymetry of the Gulf of Maine/Georges Bank area, the Middle Atlantic Bight bathymetry is relatively simple. Water depth usually increases regularly from the coast out to the shelf break. The depth of the break decreases from 150 meters south of Georges Bank to 50 meters off Cape Hatteras. The inner shelf is connected to Narragansett Bay, Long Island Sound,

Bathymetry in the Gulf of Maine

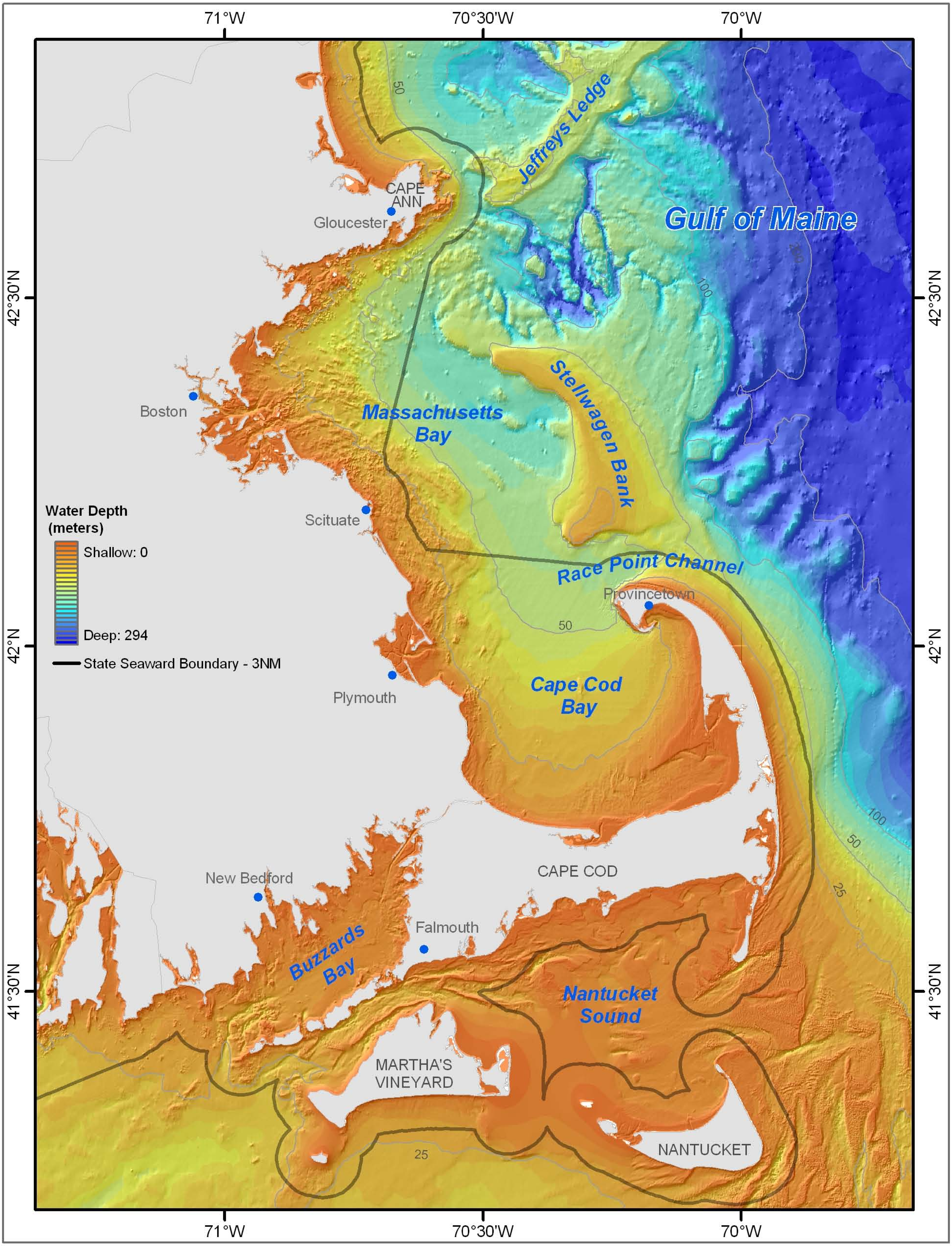

Figure 3-2

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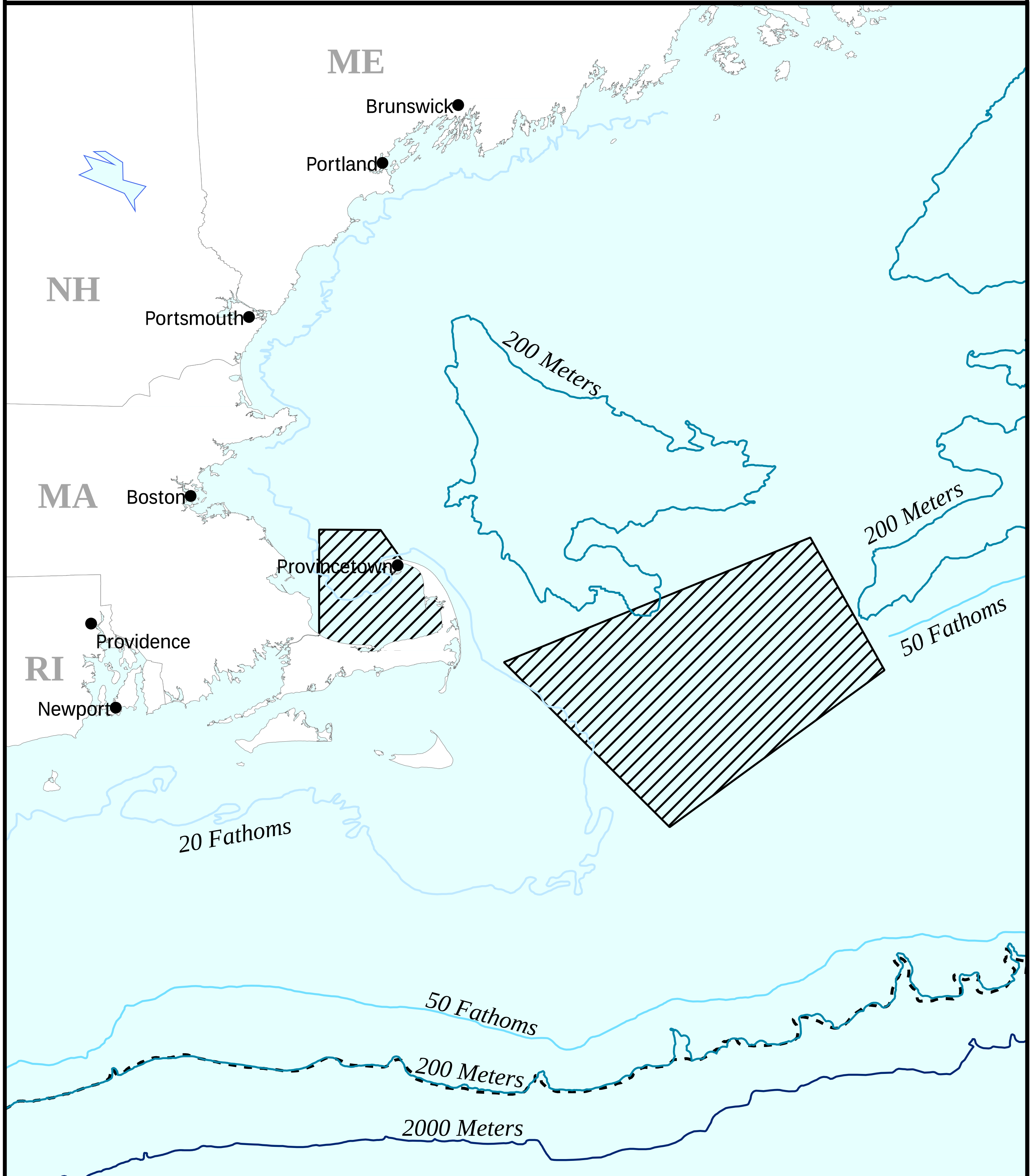
Bathymetry in the Northeastern United States



North Atlantic Right Whale Critical Habitat

Continental Shelf Break

40 20 0 40 Miles

60 30 0 60 Kilometers

N

Note: Map data not projected.

Figure 3-3

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Sediment Classification in Georges Bank / Gulf of Maine

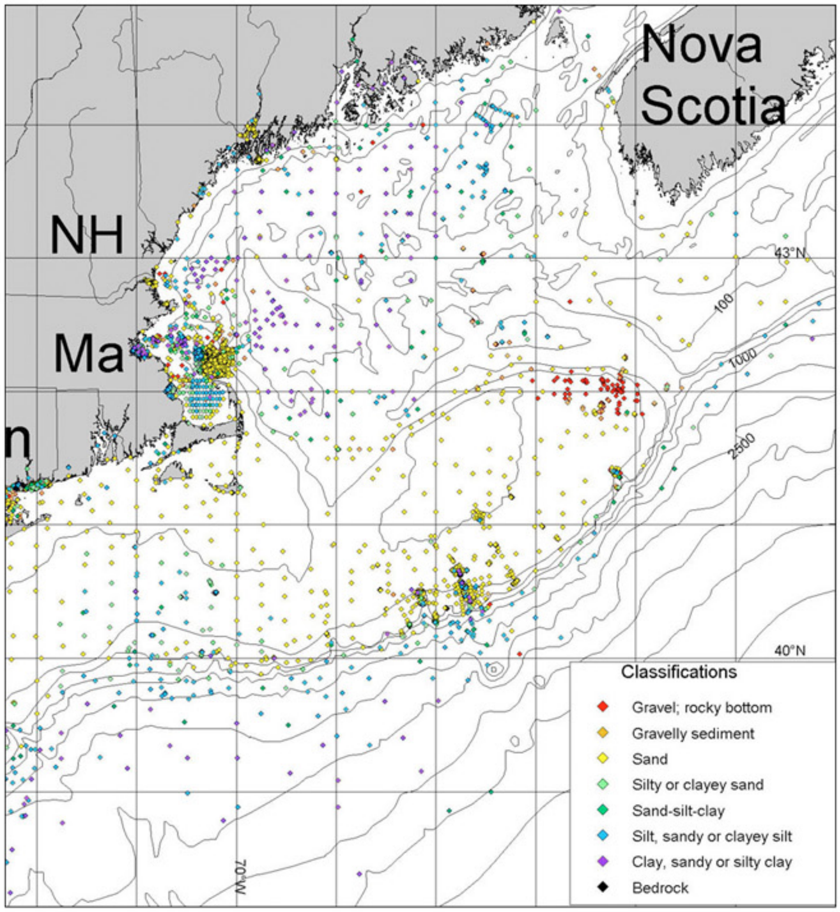

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Figure 3-4

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Bathymetry in the Mid-Atlantic United States

Note: Map data not projected.

Figure 3-5

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the Hudson River, Delaware Bay, and Chesapeake Bay, the largest estuaries on the US eastern seaboard (Milliman and Imamura, 1992). At the shelf edge, the shelf gives way abruptly to the continental slope. The continental slope extends to water depths from 6,562 to 13,125 ft (2,000 to 4,000 m) (DoN, 2001).The (upper slope) area contains several submarine canyons, including Hudson Canyon, Hudson Shelf Valley, and Norfolk Canyon.

The continental shelf and continental slope of the Middle Atlantic Bight are covered with sand, silt, clay, and some gravel (DoN, 2001).

> Coastal areas of North Carolina have varying sedimentation rates, which results in diverse bottom composition. High sedimentation rates typify the area from Raleigh Bay northward, while the low sedimentation rates and scouring by currents in southern North Carolina, especially Onslow Bay, has led to the exposure of rock outcrops. Although sand dominates the sediments of the continental shelf, the concentration of sand typically declines with increasing water depth down the continental slope and rise, where clay and silt predominate. The sandy southern North Carolina continental slope is somewhat atypical, but north of Cape Hatteras silt and clay regain their dominance in continental slope sediments (DoN, 2002a).

Figure 3-6 depicts the sediment classifications in the mid-Atlantic from south Cape Cod to Albermarle Sound, and Figure 3-7 depicts the sediment classifications in the Carolina Trough.

3.3.1.4 South Atlantic Bight (SEUS Region)

Figure 3-8 depicts the bathymetry of the South Atlantic Bight/SEUS region. Right whales migrate through the northern portion of the South Atlantic Bight on their way to and from the calving grounds off the Georgia and Florida coast.

The South Atlantic Bight contains three large Cape areas: Raleigh Bay, Onslow Bay, and Long Bay (Milliman and Imamura, 1992). The dominant bathymetric features there are the continental shelf, the continental slope, and the Blake Plateau. The continental shelf slopes gently from the coast to approximately the 50 meters (164 ft) isobath (line connecting all points having the same depth), where it drops off to the 200 meters (656 ft) isobath. The continental slope is steeply angled and extends approximately from the 200 meters (656 ft) to the 700 meters (2,297 ft) isobath. The slope is widest off Jacksonville, FL (30°N).

> The Blake Plateau (Figure 3-9) is a large physiographic feature 71,250 nm^2 (228,000 km^2) in area, between 2,297 and 3,281 ft (700 and 1,000 m) in depth. The Gulf Stream flows along the Florida-Hatteras Slope over the Blake Plateau's western flank (DoN, 2002b).

Figure 3-9 depicts the sediment classifications in the SEUS region, including the Blake Plateau Basin. The substrate composition ranges from mixed fine sand and gravel near the coast to an increasingly higher percentage of calcium carbonate material at greater depths. There are also traces of gravelly sand, sand and clay, and fine-grained sand and silt found in deeper waters. Continental slope sediments in the south Atlantic area are primarily composed of silt and clay. The inner part of the Blake Plateau contains a minimal amount of sediments due to the sweeping action of the Gulf Stream. The Plateau is also covered by a thick layer of phosphoritic sediments and a thin layer of carbonate sands (DoN, 2002b).

Unlike the NEUS, where whale distribution is relative to prey abundance, in the SEUS, right whales have rarely been observed feeding (Kenney *et al*., 1986), thus other oceanographic variables had to be analyzed in order to predict distribution in this region. A recent study by Keller *et al*. (2006) compares right whale distribution in the southeastern calving grounds in relation to sea-surface temperatures (SST). The results of this study support a nonrandom distribution of whales in relation to SST; whales were sighted in waters with an overall mean SST of 14.3° C ± 2.1°. Sighting data in the EWS survey area, which mainly covers the southeastern critical habitat, was compared to SST data to determine whale location during resident months (January and February). The results suggest a southward shift in whale distribution toward warmer SSTs in the EWS area, while further south, right whales were concentrated in the northern portion that had cooler waters (Keller *et al*., 2006). Further, it appears that warm Gulf Stream waters (generally to the south and east of critical habitat) serve as a thermal limit for right whales, and have a role in their distribution within the calving grounds.

3.3.2 Water Quality

This section on water quality is divided into three subsections: Section 3.3.2.1 describes pollutants and the possible implications to right whales; Section 3.3.2.2 provides a brief overview of water quality in the coastal waters of the states along the US eastern seaboard; and Section 3.3.2.3 provides an overview of the regulatory framework for marine pollution.

3.3.2.1 Implications of Water Pollution on Right Whale Health

Poor water quality may affect right whale health by reducing the quantity and diversity of the zooplankton on which they feed. Chemical pollutants may also affect whales through ingestion and long-term storage in the blubber (fat layer). Pollutants have a tendency to bioaccumulate, or increase in concentration the further up the food chain an animal is situated. For this reason, chemical pollutant levels in mysticetes, such as the right whale, are generally several orders of magnitude lower than the levels found in seals or odontocetes (toothed cetaceans) because seals and odontocetes feed on fish higher up in the food chain, whereas mysticetes feed on zooplankton, at the bottom of the chain (NMFS, 2005a).

Contaminants found in the coastal environment include suspended solids, organic debris, metals, synthetic organic compounds, nutrients, and pathogens. Chemical pollutants from oil spills, leaks, discharges, and organotins (leaching from hulls) may also enter the water as a side effect of shipping operations (Busbee *et al.*, 1999). The following contaminants are of particular concern with regard to right whale health (O' Shea *et al*., 1999; Reijnders *et al*. 2000).

- **Persistent organic pollutants:** PCBs, PCDDs, PCDFs, PAHs, DDT, chlordanes HCH, and other pesticides.
- **Flame retardants:** PBDEs (polybrominated diphenyl ethers) and other brominated flame retardants.
- **Plasticizers:** Phthalate esters.
- **Surfactants:** Alkyphenol ethoxylates (e.g., NPEO–nonylphenoletoxylates).
- **New-era pesticides and herbicides.**

Sediment Classification in the Mid-Atlantic
from Cape Cod to Albemarle Sound

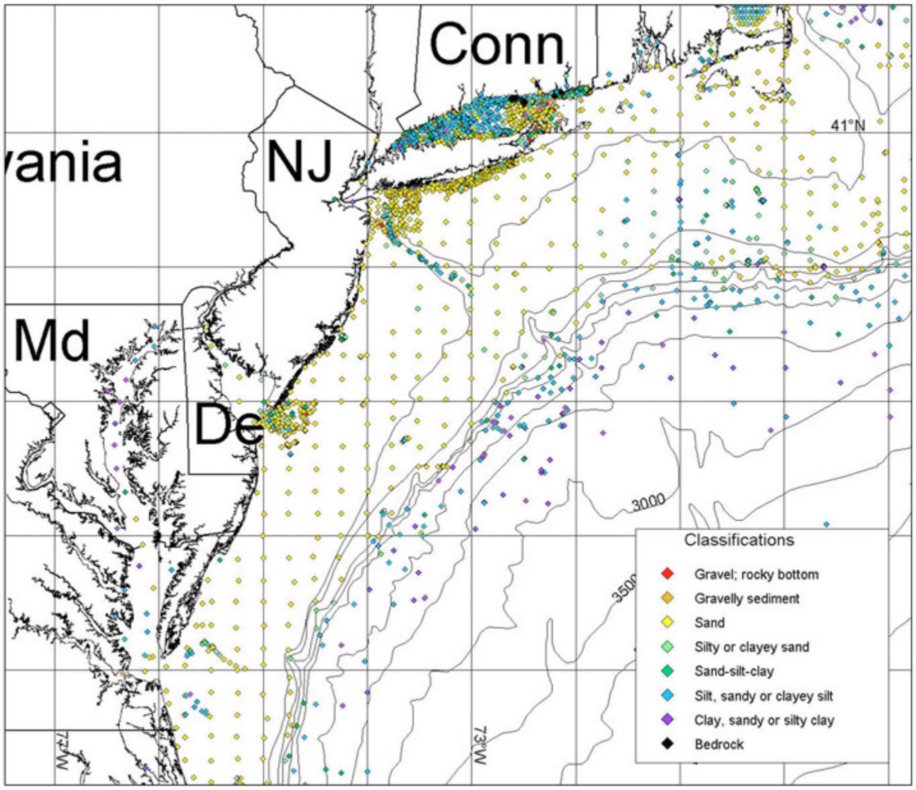

Figure 3-6

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Sediment Classification in Carolina Trough

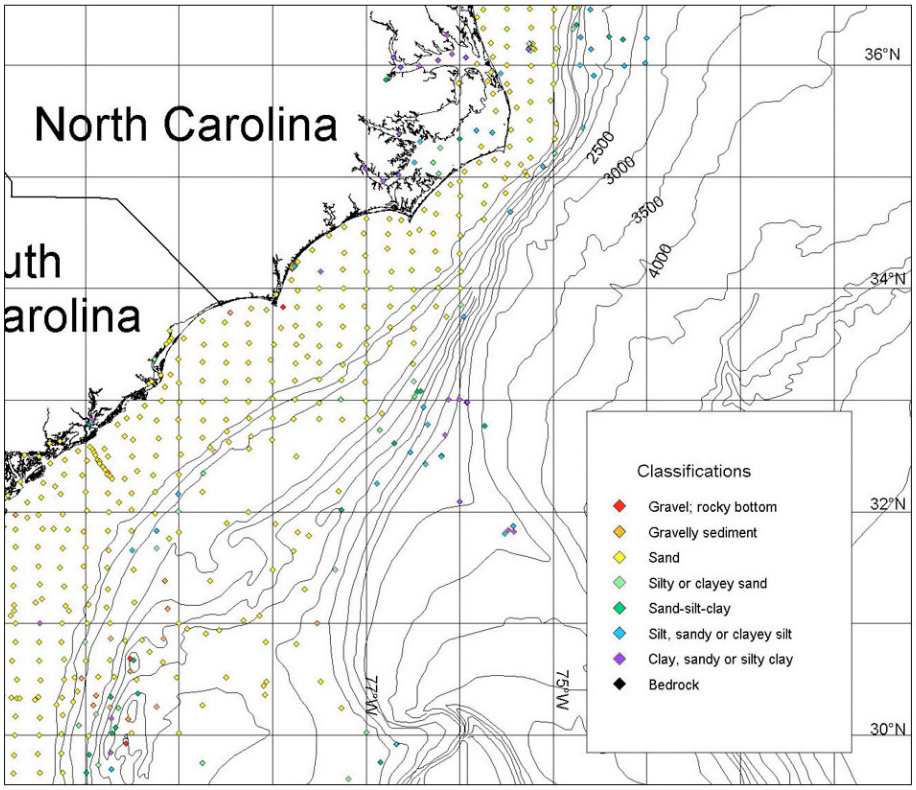

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Figure 3-7

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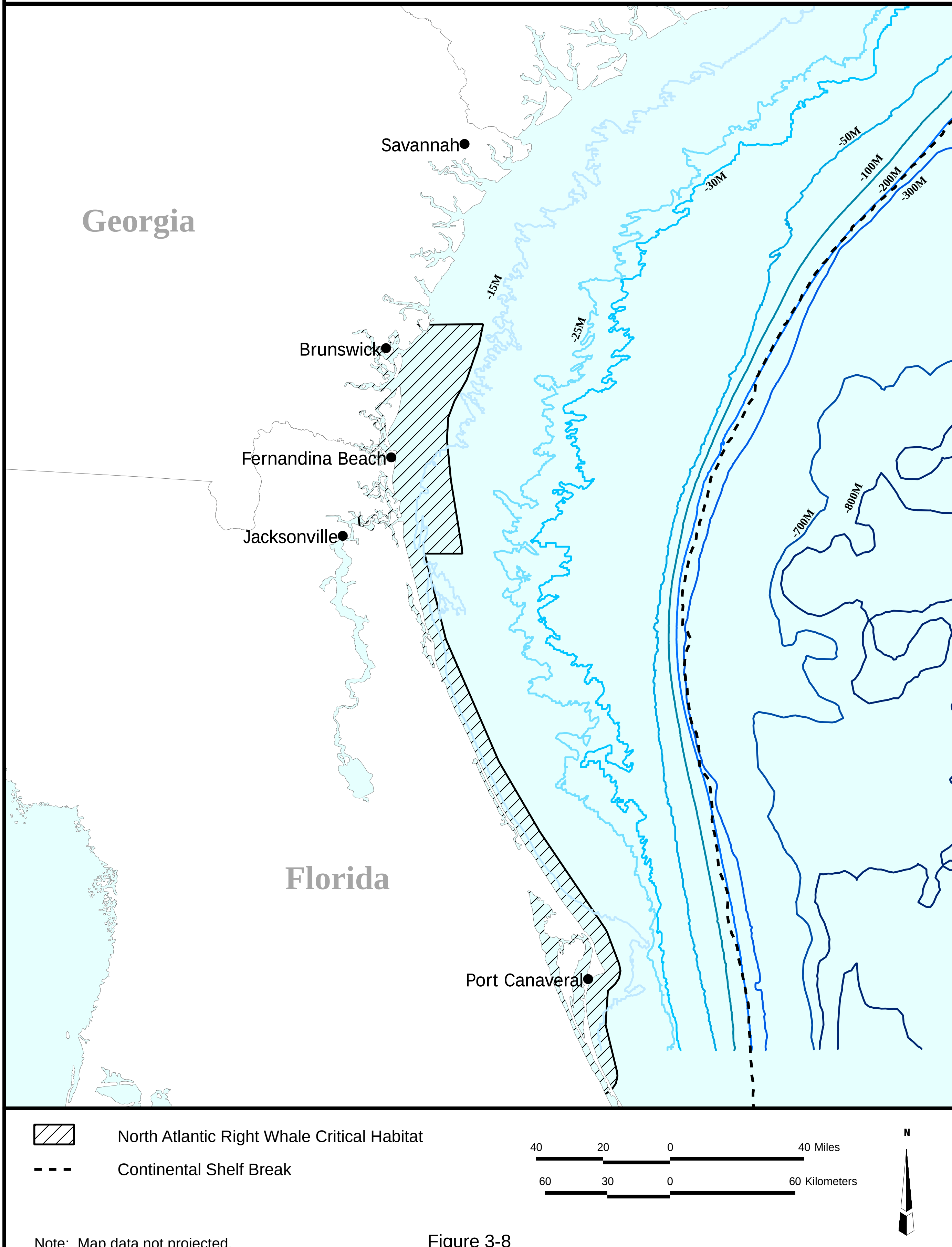
Bathymetry in the Southeastern United States



Note: Map data not projected.

Figure 3-8

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Sediment Classification in the Blake Plateau Basin

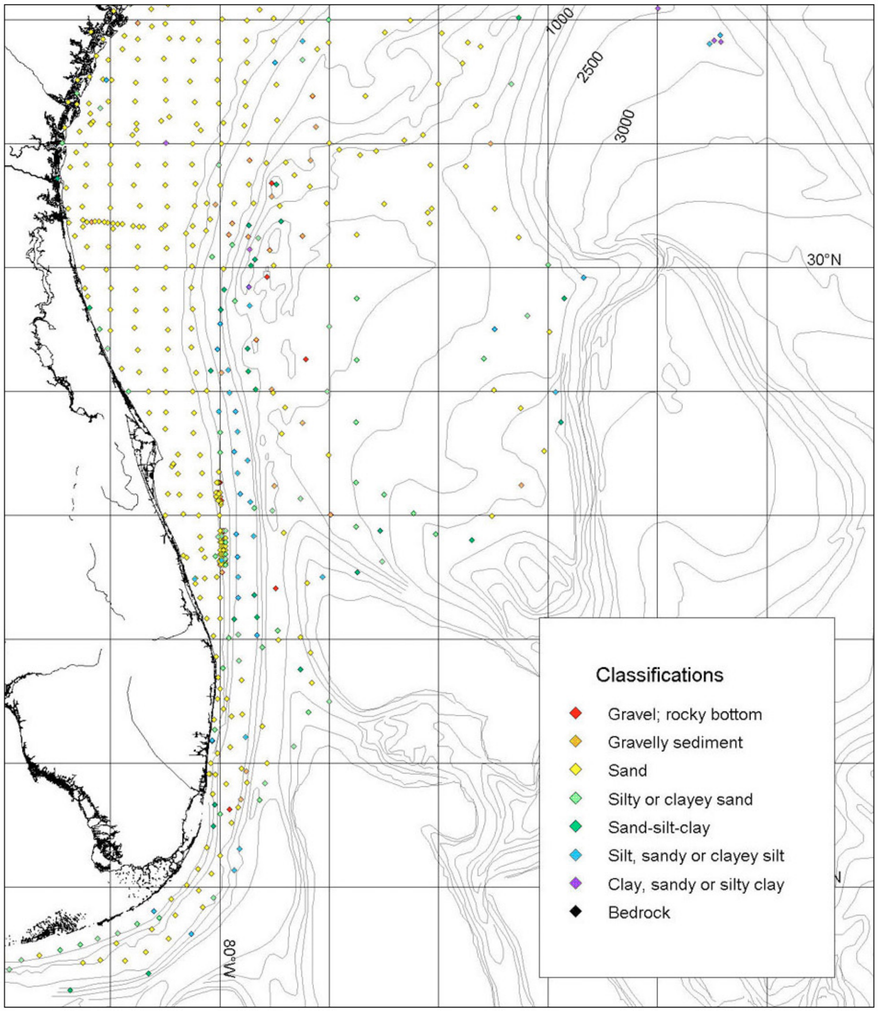

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Figure 3-9

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- **Municipal and industrial effluents:** Endocrine disrupting compounds (e.g., synthetic estrogens, natural hormones, pulp byproducts).
- **Anti-fouling agents:** Organotins and replacement compounds.
- **Dielectric fluids:** PCB replacements (e.g., PCNs–polychlorinated napthalenes, PBBs–polybrominated biphenyls).
- **Aquaculture related chemicals:** Antibiotics, pesticides.
- **Metals:** Methyl mercury (MeHg).

Concentrations of organochlorines; including DDT, PCBs, HCHs, aldrin, and dieldrin; have been observed in many species of marine mammals, including right whales. PCBs have been found in samples of North Atlantic right whale blubber (Weisbrod *et al*., 2000) and, at low levels, in zooplankton sampled from Cape Cod Bay (Reeves *et al*., 2001). PCBs, DDT, and other organochlorines have been detected in northern right whale samples from the Bay of Fundy, Browns, and Baccarro Banks (Woodley *et al.*, 1991 *in* NMFS, 2005a). Whereas contaminants have been detected, it is not known if levels detected are sufficiently high to be detrimental.

Another source of pollutants that may have an effect on right whale health is biotoxins. Biotoxins are highly toxic compounds produced by harmful algal blooms (HABs).[6] Five major classes of biotoxins are associated with HABs: saxitoxins (responsible for paralytic shellfish poisoning), brevatoxins (responsible for neurotoxic shellfish poisoning in the SEUS), domoic acid (amnesic shellfish poisoning), okasdaic acid and dinophysistoxins (diarrhetic shellfish poisoning), and ciguatoxins. The first of three of these classes have been implicated in marine mammal mortality events (Reeves *et al*., 2001). While there is no evidence to date that right whales have been adversely affected by these biotoxins, they are present in right whale habitat and have been known to cause a loss of equilibrium and respiratory distress and to have feeding implications (Reeves *et al*., 2001).

Pollutants also are generated by vessels at sea, but discharges are regulated in state and Federal waters out to the Contiguous Zone. “Graywater” and “blackwater” are two types of waste discharges from vessels at sea. Graywater contains nonsewage waste from showers, baths, sinks, and laundries. It may contain food waste, oil and grease, cleaning products, and detergents. Blackwater is sewage, which is discharged according to the regulations described in Section 3.3.2.3 (Table 3-5). Discharges of untreated sewage in unregulated waters may cause eutrophication, or an influx of high levels of nurtrients, which can lead to excessive plant growth that can consume the oxygen in the water. This limits the oxygen available to other species and, in extreme causes, can harm or kill other organisms in the water. Marine engines can discharge oils, lubricants, and fuel. Discharges of bilge and ballast water may include residual oil, lubricants, and fuel (as well as biological organisms).

[6] Algae are photosynthetic plant-like organisms that live in water. Most species of algae or phytoplankton are not harmful and serve as the energy producers at the base of the food chain. Occasionally, the algae grow very fast or “bloom” and accumulate into dense, visible patches near the surface of the water. “Red Tide” is a common name this situation where certain phytoplankton species contain redish pigments and bloom such that the waters appears red (NMFS, 2005a).

Table 3-5
Regulatory Requirements for Marine Vessel Pollution

Waste	Law or Regulation	Requirements and Thresholds
Blackwater (Sewage)	US Clean Water Act	Discharges of untreated sewage or sewage with a fecal coliform bacterial count greater than 200 colonies per 100 milliliters, or total suspended solids exceeding 150 milligrams per 100 milliliters are not allowed within 3 nautical miles of the shoreline. Requires a certified operable Marine Sanitation Device (MSD) on every vessel (US and foreign) with an installed toilet.
	MARPOL Annex IV	The discharge of sewage into the sea is prohibited, except when: the ship is discharging ground-up and disinfected sewage using a system approved by the administration at a distance of more than 4 nautical miles from the nearest land, or sewage that is not comminuted or disinfected at a distance of more than 12 nautical miles from the nearest land; or the ship has in operation an approved sewage treatment plant which has been certified by the administration. The effluent shall not produce visible floating solids in, nor cause the discoloration of, the surrounding water.
Graywater	US Clean Water Act	No restrictions on discharging graywater.
Solid Wastes, Marine Debris	MARPOL Annex V	Dumping floatable dunnage, lining, and packing material is prohibited within 25 miles of shore. The disposal of plastics is prohibited. Dumping other un-ground garbage is prohibited within 12 miles. Incinerator ash is typically considered nonhazardous, and may be disposed of at sea in accordance with International Convention for the Prevention of Pollution from Ships annex V. Ash identified as being hazardous must be disposed of ashore in accordance with Resource Conservation and Recovery Act.
Toxic Wastes	Resource Conservation and Recovery Act	Dry cleaning solvent (perchlorethylene [PERC]); batteries including lead acid, lithium, and nickel cadmium; some print shop waste; and photo processing waste containing silver in excess of 5 parts per million are classified as hazardous waste under the Resource Conservation and Recovery Act and must be handled accordingly.
Oil	US Oil Pollution Act	No visible sheen or oil content greater than 15 parts per million within 12 miles. Oily waste must be retained onboard and discharged at an appropriate reception facility.
	MARPOL Annex I	All vessels of any type more than 400 gross tons traveling over international waters are required to have an approved Shipboard Oil Pollution Emergency Plan (SOPEP). Vessel must be equipped as far as practicable and reasonable with installations to ensure the storage of oil residues onboard and their discharge to reception facilities, or into the sea providing the ship is more than 12 nautical miles from the nearest land, the oil content of the effluent is less than 100 parts per million, and the ship has in operation an oil discharge monitoring and control system, oil-water separating equipment, and oil filtering system or other installation.

Source: NPS, 2003.

3.3.2.2 State Water Quality

Each state has water quality standards that are approved by the US Environmental Protection Agency (EPA). The EPA compiles state water quality reports (Clean Water Act section 305[b]) into the National Assessment Database. All of the information in this section is from the 2002 National Assessment Database (EPA, 2002). In several cases, data were unavailable for coastal and ocean waters, in which case the category “bays and estuaries” was used, which encompasses some coastal waters. Water quality is fairly localized and, therefore, may vary within a particular region even though only one rating has been assigned. Also, near-coastal water quality may not be a good indicator of offshore water quality. The water quality categories that the EPA utilizes are based on the designated uses assigned to the waters, activities such as swimming, propagation of aquatic life, etc. These nationally developed water quality standards are:

- **Good:** Waters fully support all of their designated uses.
- **Threatened:** Waters currently support all of their designated uses, but one of more of those uses may become impaired in the future if pollution control actions are not taken.
- **Impaired:** Waters cannot support one or more of their designated uses.

If a state has threatened or impaired waters, the state description will also include causes of impairment and sources that generate these pollutants, or impairments.

NEUS Region

Maine

Maine's assessed[7] waters overall water quality attainment for ocean and near coastal waters was rated 100 percent good for the state-designated use of fish, shellfish, and wildlife protection and propagation.

Massachusetts

Massachusetts' assessed waters overall water quality attainment for bays and estuaries was rated 65.83 percent good and 34.17 percent impaired for fish, shellfish, and wildlife protection and propagation. Recreational waters were 82.07 percent good and 17.93 percent impaired. Waters designated for aquatic life harvesting (aquaculture) were 9.32 percent good and 90.68 percent impaired. Waters designated for aesthetic value were rated 89.75 percent good and 10.25 percent impaired. The top causes of impairment were pathogens, total toxics, priority organics, nutrients, and organic enrichment. Major sources of contaminants were unknown sources, municipal (urbanized high density area), and combined sewer overflows.

Cape Cod Bay Monitoring Project

The Provincetown Center for Coast Studies (PCCS) organizes various research projects in Cape Cod Bay, including extensive habitat studies. These projects monitor water quality and the composition and distribution of planktonic species as indicators of the health of the bay and availability of food for right whales.

PCCS began a new project with the Massachusetts Water Resources Authority in response to the relocation of a municipal wastewater discharge outfall tunnel 9 miles into Massachusetts Bay and about 36 miles from Cape Cod Bay. There were concerns that this nitrogen-rich sewage effluent would affect zooplankton diversity. The study concluded that nitrogen from the sewage is being assimilated by autotrophic organisms without affecting the diversity of the plankton community. Therefore, there have been no measurable changes to the dynamic food web in the short term. However, the short-term analysis of data at a limited number of sample sites raises the question of possible long-term effects that have not yet developed. Thus, in the future the project may shift focus to assess the potential cumulative or chronic effects to buffer the effluent over the long-term (Moore *et al.*, 2005). Continued monitoring of Cape Cod Bay is vital to the

[7] Assessed refers to the total square miles of water that were monitored and sampled in the state.

recovery for right whales, as it is their major feeding ground, and this effluent is one of many possible factors that could change ecosystem parameters.

New Hampshire

New Hampshire's assessed measurements of near coastal and ocean waters resulted in ratings of 98.9 percent good and 1.1 percent impaired for recreation. Waters designated for aquatic life harvesting or areas that support coastal aquaculture were 100 percent impaired. The top three causes of impairments for these waters were dioxin, mercury, and polychlorinated biphenyls. The major source of these contaminants was atmospheric deposition of toxics.

Rhode Island

Rhode Island's assessed waters for coastal shorelines were rated 100 percent good for the state designated uses of recreation and aquatic life harvesting.

MAUS Region

Connecticut

Connecticut's assessed waters for overall water quality attainment are categorized as bays and estuaries, although this category includes offshore waters in Long Island Sound as well as coastal waters and beaches. For the designated use of recreation, the sampled waters were rated 87.34 percent good, 7.81 percent threatened, and 4.85 percent impaired. For fish, shellfish, and wildlife protection and propagation, waters were rated 61.25 percent good, 0.05 percent threatened, and 38.7 percent impaired. Waters designated for aquatic life harvesting were rated 68.86 percent good and 31.14 percent impaired. The top five causes for impairment were nutrients, organic enrichment, pathogens, indicator bacteria, and nitrogen/ammonia. Major sources for contaminants were that the area is an urbanized high density area, municipal point source discharges, waterfowl, and combined sewer overflows.

New York

Water quality for New York's coastal shoreline-assessed waters was 100 percent good for the state designated use of fish, shellfish, and wildlife protection and propagation.

New Jersey

Water quality for New Jersey's near coastal and ocean-assessed waters was 21.2 percent good and 78.8 percent impaired for the use of fish, shellfish, and wildlife protection and propagation. No causes or sources for impairment were reported.

Delaware

Water quality for Delaware's coastal shoreline-assessed waters was 100 percent good for all three state designated uses. These uses are fish, shellfish, and wildlife protection, recreation, and industrial.

Maryland

Water quality for Maryland's assessed waters in bays and estuaries was 9.8 percent good and 90.20 percent impaired. No causes or sources for impairment were reported.

Virginia

Water quality for Virginia's assessed waters for bays and estuaries was 5.83 percent good and 29.76 percent threatened, and 64.41 percent impaired for fish, shellfish, and wildlife protection and propagation. Waters designated for recreation were rated as 95.7 percent good, 0.03 percent threatened, and 4.27 percent impaired. Waters designated for aquatic life harvesting were 79 percent good, 13.48 percent threatened, and 7.53 percent impaired. Some of the causes of impairment were nutrients, turbidity, organic enrichment and low dissolved oxygen. The major sources of contaminants were municipal point source discharges, industrial point discharges, and nonpoint sources.

North Carolina

North Carolina's state water quality data were not reported on the EPA website. The "Water quality assessment and impaired waters list (2004 Integrated 305(b) and 303 (d) reports)" can be found at North Carolina's division of water quality website:
http://h2o.enr.state.nc.us/tmdl/General_303d.htm

South Carolina

South Carolina's assessed waters for bays and estuaries were rated as 81.36 percent good and 18.64 percent impaired for fish, shellfish, and wildlife protection and propagation. Waters designated for recreation were 93.35 percent good and 6.65 percent impaired. The top causes for impairment were organic enrichment, pathogens, turbidity, metals, and pH. The major sources for contaminants were natural sources, unknown sources, and industrial point source discharge.

SEUS Region

Georgia

Georgia's assessed waters for overall water quality attainment in bays and estuaries were rated as 100 percent impaired for fish, shellfish, wildlife propagation, and aquatic life harvesting. The top causes for impairment were dissolved oxygen, fish consumption guidance, shellfishing ban, mercury, and polychlorinated biphenyls. The major sources of contaminants were industrial point source discharge, municipal point source discharges, and urban runoff/urban effects.

Florida

Florida's assessed waters for overall water quality attainment in bays and estuaries were rated 100 percent good for the state designated use of recreation.

3.3.2.3 Marine Pollution Regulatory Framework

Relevant international and Federal laws and regulations pertaining to water quality along the eastern cost of the US are listed below and summarized in Table 3-5. State laws and regulations are not identified because there would be no water quality impacts on state waters (out 3 nm [5.6 km]) from implementing the proposed measures.

The International Convention for the Prevention of Pollution from Ships, 1973, modified by the Protocol of 1978, also known as MARPOL 73/78 minimizes vessel pollution by regulating the disposal of wastes from vessel operations, including oil, chemicals, sewage, garbage, and other harmful substances into the ocean. Annex I of MARPOL requires the storage of oil residues and their discharge to reception facilities unless the oil content of effluent is less than 100 parts per million (ppm) and discharge is more than 12 nm (22 km) from the nearest land. Annex IV prohibits the discharge of sewage into the sea, with several exceptions. Annex V of MARPOL regulates the dumping of marine debris within 12 nm (22 km) of land. Vessels flagged under a country that is party to MARPOL 73/78 must comply with the requirements of the convention.

MARPOL 73/78 is implemented in the US by the Act to Prevent Pollution from Ships (33 U.S.C. § 1901), under the lead of the USCG. Under the act, dumping is regulated within the territorial sea (12 nm) and in some cases in the contiguous zone (24 nm). This legislation restricts the discharge of untreated sewage within 12 nm (22 km). It allows the discharge of treated effluent in coastal waters except in designated No Discharge Areas. Some vessels treat water prior to discharging it beyond 12 nm (22 km) or hold waste water and other solid waste until they reach a shoreside treatment facility.

Solid waste includes food waste, bottles, plastic containers, cardboard, and paper. Marine debris may include fishing gear, building materials, packing material, and other items (NPS, 2003). Solid waste and marine debris must be disposed of in accordance with Annex V of MARPOL (see preceding text). Solid waste, except for plastics[8], may be disposed of outside of 12 nm (22 km), and should not have an adverse effect on water quality. There is, however, the potential that marine animals (including sea turtle and sea birds) may accidentally ingest these items, which would have a negative effect on their health and could even cause death. Marine species may also become entangled in marine debris, which may cause injury, starvation, or death. Annex V is implemented and enforced in part by Regulation 9, which requires all ships of 400 GRT and above and every ship certified to carry 15 persons or more to maintain a Garbage Record Book, to record all disposal and incineration operations (IMO, 2004a).

The Federal Water Pollution Control Act or Clean Water Act (CWA) is the principal US law controlling pollution activities in the nation's streams, lakes, and estuaries. The USCG and EPA share responsibilities to implement the act. A number of the provisions included in the CWA contribute directly and indirectly to maintaining the water quality of the marine environment. Specifically, one of the goals of the Act is to provide for the protection and propagation of fish, shellfish, and wildlife (33 U.S.C. § 1251 (a)(2)) (NMFS, 2005a). Under Section 402, any discharge of a pollutant from a point source to the navigable waters of the US or beyond must obtain a National Pollutant Discharge Elimination System (NPDES) permit (33 U.S.C. § 1342). Any discharge to the territorial sea or beyond must comply with the Ocean Discharge criteria established under Section 403 (33 U.S.C. § 1343), or a permit will not be issued. The CWA prohibits the discharge of untreated sewage within all navigable waters[9] of the US. Section 312 of the Act requires vessels with installed toilet facilities to contain marine sanitation devices, and if these devices treat the sewage, then the treated effluent may be discharged into coastal waters. Section 312 also allows the establishment of a No Discharge Area, where discharge of sewage from vessels is completely prohibited. The CWA has no restrictions on discharging gray water, which is water from showers, baths, sinks and laundries. States may have more stringent regulations on discharging gray water within state waters. The CWA generally prohibits discharges of oil and hazardous substances into coastal or ocean waters except when permitted under MARPOL 73/78.

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[8] Annex V of MARPOL totally prohibits of the disposal of plastics anywhere into the sea, and severely restricts discharges of other garbage from ships into coastal waters and "Special Areas" (IMO, 2004a).

[9] The term "navigable waters" means the waters of the United States, including the territorial seas (33 U.S.C. § 1362).

The Oil Pollution Act of 1990 (33 U.S.C. § 2701 *et seq.*) establishes an extensive liability scheme designed to ensure that in the event of a spill of release of oil or other hazardous substances, the responsible parties are liable for the removal costs and damages resulting from the incident. Under the act, waste discharged in waters within 12 nm (22 km) of shore may not have a visible sheen or oil content greater than 15 ppm. Oily water must be retained onboard and discharged at an appropriate reception facility.

The Resource Conservation and Recovery Act of 1976, as amended (42 U.S.C. § 6901 *et seq.*) forbids the dumping at sea of the types of hazardous waste it regulates. If there is compliance with this law, then no hazardous wastes would be discharged in the ocean and there would be no impact on water quality.

The Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA, P.L. 92-532) has two basic aims: (1) to regulate international disposal of materials, and (2) to authorize related research. Title I of the Act, often referred to as the Ocean Dumping Act, prohibits dumping of all municipal sewage, sewage sludge, and industrial waste, and regulates the disposal of dredged material under a US Army Corps of Engineers permit. The EPA also designates sites and imposes strict tests for dredge material disposal. Research provisions concerning general and ocean disposal research are contained in Title II; Title III authorizes the establishment of marine sanctuaries; Title IV established a regional marine research program; and Title V addresses coastal water quality monitoring.

3.3.3 Air Quality

This section presents information on air quality standards, an overview of baseline domestic/international ship emissions, transport and dispersion of air pollutants within the context of regional vessel traffic, and the regulatory framework for marine pollution prevention. The EIS does not attempt to describe local air quality stemming from marine emissions, (as such information is not readily available); however, information on regional air quality at sea is provided where data is available (Section 3.3.3.4).

3.3.3.1 National Ambient Air Quality Standards

Criteria pollutants are those for which the EPA has established National Ambient Air Quality Standards (NAAQS) to protect public health and welfare (40 CFR 50). There are seven criteria pollutants with primary standards: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), lead (Pb), particulate matter with aerodynamic diameter less than or equal to 10 micrometers (PM_{10}), and particulate matter with aerodynamic diameter less than or equal to 2.5 micrometers ($PM_{2.5}$).

3.3.3.2 Air Pollutants from Marine Vessels

Marine engines emit air pollutants, especially hydrocarbons (HC), nitrogen oxides (NO_x), and sulfur oxides (SO_x). Greenhouse gases such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_20) are also emitted during waterborne travel (EPA, 1999). The criteria pollutants from marine engines are shown below in Table 3-6.

Table 3-6
Criteria Pollutant Emissions from Marine Vessels, 1997

Pollutant	Quantity Emitted (thousand short tons)	Percent of Total Emissions of Pollutant
Carbon Monoxide (CO)	85	0.1
Nitrogen Oxides (NO_x)	235	1.0
Volatile Organic Compound (VOCs)	50	0.3
Sulfur Dioxide (SO_2)	245	1.2
Particulate Matter (PM_{10})	31	0.1
Particulate Matter ($PM_{2.5}$)	22	0.3
Lead (Pb)	NA	NA

Note: Percentage of emissions from traditionally inventoried sources (does not include agriculture and forestry, fugitive dust, or natural sources like windblown dust). Does not include recreational marine vessels.
Source: US Environmental Protection Agency, National Air Pollutant Emission Trends, 1900-1997.

Many factors determine emission levels and air impacts, including:

- Number of vessel trips.
- Emissions per volume of fuel consumed, per trip, or per distance traveled, by chemical.
- Distance traveled.
- Engine type, age, and emissions control technology.
- Fuel consumed (by type) – affects emissions per mile.
- Travel characteristics: speed, acceleration, etc. – affects emissions per mile.
- Climatic conditions (temperature, wind, rain, etc.) – affects dispersion/dilution of pollutants and formation of secondary pollutants.
- Population density – affects number of people exposed to pollution.
- Sensitivity of local ecosystems (EPA, 1999).

Engine make and type, size, speed and load are the most influential factors (Corbett and Koehler, 2003). Corbett and Koehler estimated the world fleet fuel consumption, calculated for all main and auxiliary engines in the internationally registered oceangoing fleet (including military vessels), is approximately 289 million metric tons annually (2003). However, the separate pollutants NO_x, SO_x, and CO_2 estimated in this model were higher than the actual fuel usage reported. The IMO estimates sulfur emissions from ships are about 4 percent of total global sulfur emissions at 4.5 to 6.5 million tons per year. These emissions are generally well dispersed except for certain high travel shipping routes (IMO, 2005). NO_x emissions are estimated to account for 7 percent of global emissions at 5 million tons per year and have regional impacts on acid rain and local port areas (IMO, 2005). Table 3-7 lists emission levels and fuel consumption for various cargo and passenger vessels.

Table 3-7
Modeled Cargo and Passenger Fleet Fuel Consumption and Emissions in 1996 and 2000 from the Main and Auxiliary Engines[a] at Normal Cruising Speed

Ship Type	N2O, kt		NOx, Mt		CO, kt		NMVOC, kt		PM, kt		SO2, Mt		CO2, Mt		Fuel Consump-tion, Mt	
	96	00	96	00	96	00	96	00	96	00	96	00	96	00	96	00
Liquefied gas tanker	0.3	0.4	0.3	0.3	27	31	9	10	24	29	0.2	0.2	13	16	4	5
Chemical tanker	0.4	0.5	0.3	0.4	30	39	10	13	25	34	0.2	0.3	14	19	5	6
Oil tanker	2.4	2.4	2.0	2.1	178	185	57	60	172	180	1.4	1.5	93	97	29	31
Bulk ships[b]	2.4	2.4	2.6	2.6	224	226	73	73	222	223	1.6	1.6	96	97	30	30
General cargo[c]	2.1	1.9	1.8	1.7	190	174	62	57	95	113	0.7	0.8	82	75	26	24
Container	1.6	2.3	1.6	2.3	150	214	49	69	124	166	0.9	1.2	64	91	20	29
Ro-ro ships[d]	0.8	0.8	0.7	0.8	72	76	23	25	33	48	0.2	0.3	31	33	10	10
Passenger vessels	0.3	0.4	0.3	0.4	31	38	10	12	15	21	0.1	0.2	13	16	4	5
Refrigerated cargo	0.3	0.3	0.3	0.3	29	28	9	9	15	15	0.1	0.1	12	12	4	4
Total ME	10.6	11.5	9.8	10.8	931	1010	302	327	726	829	5.5	6.2	419	455	132	144
Total (ME + AUX)	11.7	12.7	10.8	11.9	1024	1111	332	360	799	912	6.1	6.8	461	501	145	158

[a] Values are in Mt (106 t) or kt (103 t). ME, main engine(s); AUX, auxiliary engines.
[b] Bulk dry and bulk dry/oil vessels.
[c] Including passenger/general cargo vessels.
[d] Including passenger/RO-ro vessels.

Source: (Endresen *et al*., 2003)

3.3.3.3 Transport and Dispersion of Marine Air Pollutants

The transport and dispersion of air pollutants in the marine environment are influenced by many factors, including global and regional weather patterns. At the local level, wind speed and direction, vertical air temperature gradients, air-water temperature difference, and the amount of solar heating are primary factors affecting transport and dispersion of air pollutants (EPA, 2005a). As there are many factors that determine where air pollutants are transported and how well they are diluted, it is difficult to estimate the amount of pollutants from shipping vessels at sea transported to land and those that are taken up by the ocean without a complex model.

Oceangoing vessels are moving point sources that disperse emissions when transiting the ocean. These moving point sources result in transient, short-lived air quality impacts on receptors both on land and at sea. Elevated concentrations at receptor points resulting from nearby ships will last only a few minutes before the ship either moves away or as the plume centerline moves away from the receptors. The magnitude of transient emissions is also directly dependent on the closest passing distance between the ship and a receptor. In order for average concentrations from ship emissions to increase, the shipping density has to increase significantly in a sustained manner to the point where there would need to be numerous ships in the immediate area or else the emissions from each individual ship would have to increase. Generally a handful of ships are in a shipping channel at any given time. When there are significant decreases in ship to ship distances, certain navigational rules come into play due to safety considerations that will act to increase or maintain ship to ship distances. These measures will generally act to reduce the probability that any two ships' plumes will intersect and lead to elevated pollutant concentrations at receptors near or between ships. Barring any increases in per ship emissions, the only time when systematic increases in concentrations might be expected is when ships sail in a fixed formation like a naval formation or if a shipping lane decreases in area, which could result in a decrease in ship-to-ship distance in the formation.

If the proposed shipping lanes bring the average ship passage closer to a receptor, it is possible that average concentrations might increase at the receptor because for peak transient concentrations a reduction in ship—receptor distance results in larger pollutant concentrations. In the present study the proposed changes to the shipping lanes neither leads to increased near shore congestion, nor a shift in the average position of the channels.

3.3.3.4 Regional Vessel Traffic and Air Quality

The mid-Atlantic region has the heaviest vessel traffic of the three regions on the East Coast, with 21,657 vessel arrivals in 2004. The MAUS region encompasses the majority of the ports on the East Coast, and also includes the busiest port on the coast—New York/New Jersey (described in detail in Section 3.4.1.2). The SEUS has the second highest volume of vessel traffic on the East Coast, with 4,440 vessel arrivals in 2004. The northeastern region ranks third in overall vessel traffic with 2,570 arrivals in 2004.

Air quality at sea in the mid-Atlantic, a high vessel traffic region, has been measured in the vicinity of Wallops Island, Virginia through the Tropospheric Aerosol Radiative Forcing Observational Experiment (TARFOX). This study found that aerosol conditions in the region varied from relatively clean to moderately polluted. The sources of pollution included land-based sources on the East Coast of the US as well as mineral dust that has been transported from North Africa (Russell *et al*., 1999). Additional information on the TARFOX can be found at *www.geo.arc.nasa.gov/sgg/tarfox*.

Data are currently unavailable for air quality at sea in the SEUS.

Air quality over water in the Northeast, which has less vessel traffic than the other two regions, has been measured intensively during the New England Air Quality Study (NEAQS). This study confirmed via O_3 profiling light detection and rating (lidar) that ozone concentrations over water bodies such as the Gulf of Maine can be rather high in the first 1,000 meters during the middle of the day. In some cases ozone concentrations are considerably larger than the old 125 parts per billion (ppb) 1 hour NAAQS.[10] Observations made from the R/V Ron Brown (Senff *et al*., 2003) suggest that these concentrations persist over relatively large areas and cannot be considered transient, short-lived air quality impacts like those associated with ship plumes. Furthermore, given the elevated nature of these ozone enriched layers, back trajectories suggest that much of the ozone and ozone precursors had their origin in the New York City and Boston urban plumes. An observation relevant to shipping traffic is that over the ocean the near surface air chemistry is NO_x limited and NO_x injections by shipping plumes could further increase the already elevated ozone concentrations.

In addition to ozone, the NEAQS offshore observations found layers of high particulate matter (PM) concentrations that also seemed to originate from southwest of New England (Senff *et al*., 2003). Furthermore, some of layers that are more local in origin can be extremely thin due to the suppressed vertical mixing in the marine layer. The PM off the coast of New England is rather rich in secondary organic species when compared to other continental plumes like those off

[10] The allowable concentration of criteria pollutants is measured in one-hour intervals, which should not exceed the standard, 125 ppb for ozone. If the standards are exceeded, the area is in non-attainment for that pollutant.

China. However, sulfate is still a major fraction of the aerosol mass and shipping emissions will act to increase the offshore concentrations of aerosols.

3.3.3.5 Regulatory Framework for Marine Vessel Pollution Prevention

For the first time the Clean Air Act Amendments of 1990 provided the US EPA with a regulatory mandate to control nonroad emissions from marine engines. Since that period a number of regulatory milestones have been reached regarding emissions from marine vessels. Of all of the marine boat/ship categories defined by the US EPA and the USCG, large commercial (Category 1) ships contribute almost 85 percent of all open water HC + NO_x emissions according to an EPA document on control of emissions from marine diesel engines.[11] At the present time there are two sources of marine regulation that are producing or will produce significant emissions reductions from commercial shipping.

There is an international effort to prevent marine emissions. Regulations for reducing air pollution from ships were adopted in the 1997 Protocol to the International Convention on Marine Pollution (MARPOL) 73/78, and the new Annex VI entered into force on May 19, 2005. Marpol Annex VI sets limits on sulfur oxide and nitrogen oxide emissions from marine vessels and prohibits deliberate emissions of ozone depleting substances. It places a global cap of 4.5 percent mass per unit mass (m/m) on the sulfur content of fuel and includes a provision for IMO to monitor the worldwide average sulfur content of fuel. Annex VI also has a provision to establish special SO_x Emission Control Areas, where the sulfur content of fuel must not exceed 1.5 percent m/m or ships may add an exhaust gas cleaning system to the vessel (IMO, 2005). Other provisions include limits on NO_x emissions from diesel engines, prohibit onboard incineration of polychlorinated biphenyls (PCBs), and prohibit deliberate emissions of ozone depleting substances such as halons and chlorofluorocarbons (CFCs) (IMO, 2005).

The EPA is proposing a program to introduce more stringent emission standards for large marine diesel engines. The agency published an advanced notice of proposed rulemaking in the Federal Register on June 29, 2004, to announce the scope of the program to reduce NO_x and PM emissions from new marine diesel engines. Impacts of emissions on ozone may be reduced by lowering NO_x emissions in oceanic background regions (Endresen *et al.*, 2003). The US EPA has implemented an additional set of controls on the sulfur in marine engine fuels. By 2004 sulfur content in fuels are to be reduced by 99 percent, which will result in a reduction of PM sulfate from the fuel sulfur. Together the reduction of emissions in an EPA regulatory analysis was found to be 26 percent for HC, 29 percent for NO_x, and 38 percent for PM. A discussion of the regulatory particulars can be found in the EPA fact sheet, “Overview of EPA’s Emission Standards for Marine Engines” (EPA420-F-04-031).

3.3.4 Noise

Though noise in the marine environment has become a growing concern to the scientific community, there are few data available on the effects of noise on marine mammals. There are several sources of sound in the ocean. Natural sources of sound in the marine environment, such as the waves generated by wind, account for sound energy ranging from 1 Hz to 100 kHz (NRC, 2003). Anthropogenic sources of noise in the marine environment include oil and gas

[11] EPA420-R-99-026

exploration, military activities (sonar and explosives), and acoustic scientific research. However, noise emanating from large vessels is a constant, widespread source, while other sources occur in temporarily in specific locations.

Low frequency noise from vessels is in similar frequency ranges to those used by certain large whales (mysticetes) to communicate (~10–500 Hz) and may disrupt communication among the animals whereby biologically important sounds could be masked by (vessel and other) anthropogenic noise.

The amount of noise produced by large commercial vessels depends on vessel type, size, and operational mode. A major noise source is propeller cavitation (when air spaces created by the motion of propellers collapse) (NMFS, 2005d). Under certain conditions, slower speeds may reduce cavitation noises in some vessels. Vessel quieting technology also can reduce vessel noise. Generally, it is more efficient and economical to incorporate this technology into the design of a vessel, rather than retrofitting vessels already at sea.

Foreign waterborne trade has been steadily increasing over the years, and the number of large vessels is predicted to double over the next two to three decades (NMFS, 2005d). Due to this prediction, research on trends in shipping, marine ambient noise, and the effects of noise on marine mammals should be conducted. The status of current research as well as future research needs was identified in a symposium on shipping noise in marine mammals held by NOAA in May 2004. Although there are plans for developing a global acoustic monitoring network, at this time, there are no complete data sets on ocean noise levels in the geographic area of the strategy. Additionally, the ability to predict current levels of ambient noise and future trends that may result from changes in the sizes and number of vessels in the world's shipping fleet is inherently difficult to predict (Heitmeyer *et al.*, 2004).

3.4 Socioeconomic Characteristics

3.4.1 Port Areas, Existing Regulations, Traffic Corridors, and Vessel Types

3.4.1.1 Port Areas

Twenty-six port areas along the East Coast of the US are identified as having the highest potential to be affected by the proposed action. These port areas are listed in Table 3-8 and shown on Figure 3-10. For some purposes, the port areas have been grouped in port regions, as shown in the table.

3.4.1.2 Summary Descriptions of Port Areas and Operations

The following are brief descriptions of the facilities and operations at each of the port areas considered in this EIS. For some of the areas, more detailed descriptions are available in Appendix D.

Socioeconomic Study Areas

Figure 3-10

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Table 3-8
Socioeconomic Study Area

Port Region	Port Area
Northeastern US – Gulf of Maine	Eastport, Maine Searsport, Maine Portland, Maine Portsmouth, New Hampshire
Northeastern US – Off Race Point	Salem, Massachusetts Boston, Massachusetts
Northeastern US – Cape Cod Bay	Cape Cod, Massachusetts
Mid-Atlantic – Block Island Sound	New Bedford, Massachusetts Providence, Rhode Island New London, Connecticut New Haven, Connecticut Bridgeport, Connecticut Long Island, New York
Mid-Atlantic Ports of New York/New Jersey	New York City, New York
Mid-Atlantic – Delaware Bay	Philadelphia, Pennsylvania*
Mid-Atlantic – Chesapeake Bay	Baltimore, Maryland Hampton Roads, Virginia
Mid-Atlantic Morehead City and Beaufort, North Carolina	Morehead City, North Carolina
Mid-Atlantic Wilmington, North Carolina	Wilmington, North Carolina
Mid-Atlantic Georgetown, South Carolina	Georgetown, South Carolina
Mid-Atlantic Charleston, South Carolina	Charleston, South Carolina
Mid-Atlantic Savannah, Georgia	Savannah, Georgia
Mid-Atlantic Brunswick, Georgia	Brunswick, Georgia
Southeastern United States	Fernandina, Florida Jacksonville, Florida Port Canaveral, Florida

***Note:** Wilmington, Delaware is also in Delaware Bay, but for the purposes of this analysis, is included with Philadelphia.

Eastport, Maine

Eastport is the easternmost port in the US. It is situated in a safe harbor behind Canada's Campobello Island. The waters of Passamaquoddy Bay and Cobscook Bay converge in Eastport, which, as a result, experiences some of the highest tidal ranges in the US. This massive flow keeps the local waters clean and productive. Eastport is home to one of the largest salmon aquaculture operations in the US. Eastport is also centrally located to many of Maine's forest products industries.[12]

Searsport, Maine

Searsport is located at the head of Penobscot Bay. The port has recently undergone a major reconstruction effort to better serve the needs of shippers moving products in and out of Maine, and through the onsite rail yard of the Montreal, Maine, and Atlantic Railway, to provide service to the heartlands of both the US and Canada.[12]

Portland, Maine

Portland Harbor, at the western end of Casco Bay, is the most important port on the coast of Maine. The ice-free harbor offers secure anchorage to deep draft vessels in all weather. There is

[12] Maine Port Authority: http://www.maineports.com/

considerable domestic and foreign commerce in petroleum products, paper, wood pulp, scrap metal, coal, salt, and containerized goods. Portland is also the Atlantic terminus pipeline for shipments of crude oil to Montreal and Ontario. In 1998, Portland became the largest port in the Northeast based on throughput tonnages. A rail system connects the port to a national network that also reaches into Canada, one of the reasons shippers bypass the crowded and more costly port cities of southern New England and the mid-Atlantic.

The port has 11 terminals and piers including several oil terminals, a passenger vessel terminal, and a fish pier. Portland hosts a variety of international cruise lines and frequent ferry services to maritime Canada operate from the port of Bar Harbor.[12]

Portsmouth, New Hampshire

With a deep natural harbor and river, Portsmouth is one of the oldest working ports in the US. The Piscataqua River Basin's recorded seafaring history began in 1603 with a visit by English explorer Martin Pring. In 1957 the New Hampshire State Legislature created the New Hampshire State Port Authority as an autonomous state agency overseen by a board of directors appointed by the Governor and Executive Council. Activity at the port includes pleasure boating and sport and commercial fishing in addition to bulk and general cargo transport to and from points worldwide. Portsmouth's strategic location makes it ideal for import/export traffic with European trading partners and with businesses in the Middle East, Africa, and the Pacific Rim.[13]

Boston, Massachusetts

Boston is the oldest continually active major port in the Western Hemisphere, and still growing. Since 1980, container traffic has tripled and Boston has become one of the most modern and efficient container ports in the country. Conley Terminal for containerized cargo shipments and Moran Terminal, currently leased to Boston Autoport for the import and distribution of automobiles, handle more than 1.3 million tons of general cargo, 1.5 million tons of nonfuel bulk cargos, and 12.8 million tons of bulk fuel cargos yearly.

The passenger ship industry is also expanding in Boston. Numerous four- and five-star cruise lines such as Cunard, Norwegian Majesty, Hapag-Lloyd, and Silversea regularly call at the port. With 101 passenger ships scheduled to call in the 2005 season, Cruiseport Boston is considered one of the fastest growing high-end cruise markets in the country. The Black Falcon Cruise Terminal, located in the Boston Marine Industrial Park will serve over 210,000 cruise passengers this year. Another full cruise season is planned for 2006 between the months of April and October (MASSPORT, 2005).

Boston also hosts a very large complex of privately owned petroleum and liquefied natural gas terminals, which supply more than 90 percent of Massachusetts' petroleum consumption needs. The port is home to two shipyards, numerous public and private ferry operations, world-renowned marine research institutions, marinas, and a major Coast Guard facility. It is also one of America's highest-value fishing ports.

The Boston Harbor Navigation Improvement Project currently underway will deepen portions of Boston's Inner Harbor and surrounding areas in order to allow a larger class of vessels to call in the Port. Upon completion of the dredging, the enhanced accessibility of Boston's channels will

[13] Port of Portsmouth profile: http://www.seacoastnh.com/business/port.html

improve the Port of Boston's competitive position and provide a substantial economic benefit to New England (MASSPORT, 2005).

Salem, Massachusetts

Salem, founded in 1626, has the second largest and deepest natural harbor of the commonwealth and is located on the northeastern coast of Massachusetts.[14] Salem's port facilities receive more than a million tons of coal and 3 million barrels of oil petroleum products each year. An ongoing major port expansion project will enlarge port capacity and allow for cruise vessel and ferry service. These improvements are expected to reestablish the regional prominence of this historic seaport.

Cape Cod, Massachusetts

Cape Cod Bay is enclosed by the Cape Cod peninsula on the south and east and the mainland of Massachusetts on the west. The Cape Cod Canal creates a shortcut for vessel traffic from Buzzard's Bay to Cape Cod Bay. Mariners traveling north or south can transit the canal instead of routing around Cape Cod. This canal is 480 feet wide and 32 feet deep at mean low water.[15] There is a small port in Provincetown on the tip of Cape Cod, which is utilized by commercial fishing vessels, whale watching vessels, small cruise boats, ferry boats, and other commercial and recreational vessels.

New Bedford, Massachusetts

New Bedford is located on the southeastern coast of Massachusetts. It provides access to New England and Canadian markets and has established itself as one of the busiest ports in the state. Since the early 1960s, New Bedford has been one of the area's largest handlers of perishable goods, servicing vessels from around the world. Shipments include fruit, vegetables, and bulk commodities of frozen fish and meat products. Currently, New Bedford has various vessel berths and is able to accommodate the largest refrigerated vessels afloat.[16] Commercial fishing is another dominant industry. Using Federal grants and local funds, the city and the Harbor Development Council (HDC) are planning a $1 million, 8,500-square-foot passenger terminal at State Pier to support passenger ferry service.

Providence, Rhode Island

Providence is New England's third largest city and the Northeast's premiere deep water multimodal port facility for international and domestic trade. The Port of Providence, or ProvPort, was officially founded in 1994 as a fully licensed, bonded Deep Water Port specializing in bulk and break-bulk commodities. Through historical links with China, the port has added trading connections with Central and South America, Europe, the Far East, Russia, Africa, Australia and New Zealand. More than 15 tons of cargo has passed through ProvPort since it opened, including such commodities as cement, chemicals, coal, heavy machinery, liquid petroleum products, lumber, and steel products.[17]

[14] Seaport Advisory Counctil webpage: http:www.mass.gov/seaports/salem.htm
[15] www.nae.usace.army.mil/recreati/ccc/navigation/navigation.htm
[16] Seaport Advisory Council: http://www.mass.gov/seaports/newbed.htm
[17] Providence Port Authority website: http://www.provport.com

New London, Connecticut

New London, Connecticut is located on Long Island Sound. The Port of New London is a historic whaling port, currently utilized by both commercial shipping vessels as well as passenger vessels. The Block Island Sound and Cross Sound Ferries operate out of this port. The USCG Academy and a naval submarine base are located in New London.

New Haven, Connecticut

The Port of New Haven is located on Long Island Sound. As the largest deepwater port in Connecticut, the Port of New Haven is an important contributor to the regional economy. In 2002, 55 percent of the waterborne commerce (by short tons) in Connecticut moved through New Haven. Since 2002, New Haven's port traffic has increased by 16.7 percent, and its share of Connecticut's total traffic has increased 13 percent. The Port primarily handles petroleum and manufactured goods.[18]

Bridgeport, Connecticut

The Bridgeport Port Authority was created in 1993. Currently, Bridgeport is underutilized but growing. The primary tenant is the Bridgeport-Port Jefferson Steamboat Company, a year-round passenger and vehicular service between Bridgeport and Port Jefferson in Long Island, NY. Expected future developments include barge feeder service and high-speed ferry service between Bridgeport, Stamford, and New York.

Long Island, New York

The ports located on Long Island, New York are not as busy as the Port of NY/NJ, although they are frequented by tank barges, tankers, and passenger vessels. There is a regular ferry service from Port Jefferson, NY to Bridgeport, CT, which crosses Long Island Sound. Cold Spring Harbor on Long Island is a historical maritime port.

New York – New Jersey

The port of New York and New Jersey, a natural deep-water harbor that covers 1,500 square miles (sq mi) (3,885 sq km) approximately 9 mi (14.5 km) from the Atlantic Ocean, is the gateway to the densest and wealthiest consumer market in the world. Each year, more than 25 million tons of general cargo move through the port, which has more than 1,100 waterfront facilities, most of which are privately owned and operated. The remaining facilities are owned or operated by the railroads serving the port itself, the Port Authority of New York and New Jersey, and city, state, and the Federal government (USCP 2, 2005). Four major terminals handle cargo and containerships. A passenger ship terminal, the New York Cruise Terminal, is operated by P&O Ports North America for the City of New York. This terminal provides five berths that can accommodate some of the largest cruise ships. The cruise lines calling there include Carnival, Celebrity, Costa, Crystal Cruises, Cunard, Holland America, Norwegian, P&O Cruises, Princess, Radisson Seven Seas, Royal Caribbean, Seabourne, and Silversea (Port Authority of NY/NJ, 2005).

A billion dollars worth of port improvement initiatives is preparing the New York port area to accommodate the growing demand for ocean shipping. Dredging efforts have been coordinated with the USACE, state, and city offices.

[18] New Haven Port Authority: http://www.cityofnewhaven.com/govt/Port_Authority

Philadelphia, Pennsylvania

The Port of Philadelphia is at the intersection of the Delaware and Schuylkill Rivers. For more than 300 years Philadelphia has been an important port city and a major center for international commerce. Philadelphia and its international seaport maintain a preeminent position in several areas of trade, such as the importing of perishable cargoes from South America and high quality paper products from Scandinavia (Philadelphia Port Authority, 2005). The port has two major terminals with more than 45 deep-water piers and wharves and is also a Strategic Military Port (Philadelphia Regional Port Authority, 2005). The port authority has plans to initiate a Delaware River Channeling Deepening Project. Vessel arrivals for the Port of Wilmington, Delaware are included with Philadelphia for the socioeconomic analysis.

Baltimore, Maryland

The port of Baltimore, which supports both commercial shipping and passenger vessels, is located at the head of navigable waters of the Patapsco River, approximately 12 mi (19.3 km) northwest of the Chesapeake Bay. Baltimore's location provides immediate access to the 6.8 million people in the Washington/Baltimore region, the nation's fourth-largest and one of the wealthiest consumer markets in the US.[19] Additionally, the port's inland location makes it the closest Atlantic port to major Midwestern population and manufacturing centers, putting it within a day's reach of one-third of all US households. Baltimore is one of the US top container terminals with high-tech, computerized facilities that greatly increase the port's efficiency and cost-effectiveness. The port has six public terminals and seven private ones, with more than 200 piers and wharves owned by both the Maryland Port Administration and private companies (USCP 3, 2005).

Hampton Roads, Virginia

The port area of Hampton Roads is located in southeastern Virginia, at the southwest corner of Chesapeake Bay, 18 mi (29 km) from the open sea. It encompasses 25 sq mi (64.75 sq km) of accessible waterways. In terms of general cargo, Hampton Roads is the second largest port on the East Coast, after the Port of New York- New Jersey (HRMA, 2005). It includes the ports of Norfolk and Newport News, and has more than 200 piers and wharves (USCP 3, 2005). A new terminal is scheduled to open in 2007 on the Elizabeth River in Portsmouth that would allow the port to handle an additional 500,000 containers per year (HRMA, 2005). The City of Norfolk has plans to build a new terminal to support the growing cruise industry.

In addition to being a major commercial port, Hampton Roads is home to the US Atlantic Fleet and the largest naval base in the world, in Norfolk. Approximately 58 Navy vessels are homeported in Norfolk. The Hampton Roads area is also home to one of the highest concentrations of Coast Guard personnel in the country. The South Atlantic Region of the US Department of Transportation's Maritime Administration (MARAD) in Norfolk is responsible for all MARAD operations on the East Coast (HRMA, 2005).

Morehead City, North Carolina

The port of Morehead City is located 4 mi (6.4 km) from the ocean on the Newport River and Bogue Sound. It is one of the deepest ports on the East Coast. The port has 5,500 feet of continuous wharf two berths and handles break-bulk and bulk cargo. Morehead City is a major

[19] Maryland Department of Transportation. URL: http://www.mdot.state.md.us

port for phosphate products. Container traffic was facilitated by the opening of two inland terminals in the 1980s. More expansions are being planned.[20]

Wilmington, North Carolina

The Port of Wilmington is located on the east bank of the Cape Fear River. It has facilities to handle containerized, bulk, and break-bulk cargo (NC Ports, 2005). It is close to the center of the Southeast US market, the fastest growing region in the country.

Georgetown, South Carolina

The Port of Georgetown is South Carolina State Ports Authority's dedicated break-bulk and bulk cargo facility. Top commodities are steel, salt, cement, aggregates, and forest products.

Charleston, South Carolina

Charleston is the largest city and port in South Carolina. The port of Charleston consists of five terminals dedicated to commercial cargo and containers (South Carolina State Ports Authority, 2005). It also has a cruise terminal with about 49 arrivals in 2005. Norwegian Cruise Line, Carnival, Clipper, Royal Caribbean, and several other smaller cruise companies call at this port. MARAD also utilizes several piers at the former Navy Yard.

Savannah, Georgia

The port of Savannah is Georgia's chief port. It has two deep-water terminals with numerous wharves owned by the Georgia Ports Authority and private entities (Georgia Port Authority, 2005). The Georgia Port Authority has been planning for the expansion of Savannah Harbor since 1999. This project would deepen the channel to a maximum depth of 48 ft (14.6 m). An EIS assessing the impacts of the proposed dredging project is currently being prepared (GA Port Authority, 2005). The Elba Island LNG terminal, owned and operated by Southern LNG, is located on the Savannah River.

Brunswick, Georgia

The Port of Brunswick is located on the Brunswick and East rivers. There are three terminal facilities owned by the Georgia Ports Authority. These terminals handle break-bulk, bulk and ro-ro vessels. There is a harbor deepening project planned for the Port of Brunswick that plans to increase the channel depth from 30 ft (9.8 m) to 36 ft (11 m).

Fernandina Beach, Florida

Fernandina Beach is the center of activity of Amelia Island. The port specializes in break-bulk forest products and container liner services to the Caribbean and South America.

Jacksonville, Florida

The Jacksonville Port Authority (JAXPORT) is a full service international trade seaport operating three public terminals and one passenger cruise terminal. Of 27 principal piers and wharves, six are owned by JAXPORT; the others are privately owned and operated (USCP 2, 2005). Celebrity and Carnival cruise lines operate out of this port (Jacksonville Port Authority, 2005).

[20] http://www.ncports.com

Port Canaveral, Florida

Port Canaveral is strategically located on Florida's central Atlantic Coast and has the necessary intermodal connections to reach all of Florida and the SEUS. In addition, it is an ideal hub between the SEUS, the Caribbean, and Central America. More than 3 million tons of bulk cargo moves through the port every year. Products include fresh produce, frozen food, juice concentrates, milled lumber, bagged cement, steel, and newsprints.

3.4.1.3 Existing Regulations and Traffic Corridors

The Ports and Waterways Safety Act of 1972 authorized the USCG to implement measures to control and supervise vessel traffic to ensure navigational safety and environmental protection in US ports and waterways. It is under this jurisdiction that the USCG will conduct a PARS. The act also authorizes the USCG to require vessels to carry devices that are compatible for use with the Vessel Traffic Services (VTS) system. The VTS is designed to improve the safety and efficiency of vessel traffic and to protect the environment through a national transportation system that collects, processes, and disseminates information on the marine operating environment and maritime vessel traffic in major US ports and waterways. The VTS system was established under Chapter V (Safety of Navigation) of the International Convention on the Safety of Life at Sea (SOLAS). The convention states that governments may establish a VTS when the volume of traffic or the degree of risk justifies such services (IMO, 2004b). Currently, the only VTS within the geographical scope of the strategy is in New York Harbor.

The USCG also issues periodic notices to mariners regarding information about aids to navigation, hazards to navigation, and other information regarding navigational safety (USCG, 2004). In April 2005, the USCG updated the Broadcast Notice to Mariners regarding the presence of right whales within 30 nm (56 km) of the coast along the US mid-Atlantic. The notice to mariners is broadcast via VHF and single side-band radios and published for distribution. The current message states that right whales are prone to vessel collisions, approaching within 500 yards is prohibited, and provides several sources to obtain information on sightings and advisories. The new message suggests that vessel operators use caution and proceed at safe speeds in areas used by right whales.

USCG designates Regulated Navigation Areas (RNA) to control vessel traffic by specifying times of vessel entry, movement, or departure to, from, within, or through ports, harbors, or other waters. There are several designated RNAs within the geographic scope of the proposed rulemaking. The RNA in the Chesapeake Bay Entrance, around Hampton Roads, Virginia, and adjacent waters, requires that all vessels of 300 GRT or greater reduce speeds to 8 knots in the vicinity of the Naval Station Norfolk, to improve security measures and reduce the potential threat to Naval Station Norfolk security that may be posed by these vessels (67 FR 41337). This temporary final rule was republished in the *Federal Register* on December 2002 (68 FR 2201). This rule placed a 5 knot speed limit in Little Creek, a 6 knot speed limit in the southern branch of the Elizabeth River, and a 10 knot speed limit in Norfolk Harbor Reach. The RNA in the Long Island Sound Marine Inspection and Captain of the Port Zone excludes all vessels from operating within 700 yards of the Millstone Nuclear Power Plant or 100 yards from an anchored USCG vessel, in order to ensure public safety and prevent sabotage or terrorists acts. The rule also includes speed restrictions in the vicinity of Naval Submarine Base New London and Lower Thames River. Vessels 300 GRT or more are restricted to 8 knots and lower speeds. This rule was effective from December 2001 to June 2002.

The Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGS) established “safe speeds” for mariners and traffic separation schemes. Rule 10 sets out the navigational rules for vessels operating in or near TSSs. Regulation 8 of SOLAS states that the IMO is the only organization competent to deal with international measures concerning the routing of ships (IMO, 2004a).

In July 2004, the IMO coordinated with Transport Canada and the World Wildlife Federation and moved shipping lanes in the Bay of Fundy away from important right whale feeding grounds. The Canadian proposal to move the shipping lanes was adopted at the IMO annual meeting of the Marine Safety Committee in December of 2002 in London, England (WWF, 2003). This amendment to the TSS added 5 miles to the traveling time for vessels calling at Saint John and 11 miles for vessels calling Bayside and Eastport.

Regulation 19, Chapter V of SOLAS, requires that all vessels of 300 gross tonnage and greater engaged in international voyages, cargo ships of 500 gross tonnage and greater not engaged in international voyages, and passenger ships (irrespective of size) built on or after July 1, 2002, to carry an Automated Identification System (AIS) capable of providing information about the ship to other ships and to coastal authorities automatically (IMO, 2004b). The Regulation also applies to ships built before July 2002, engaged in international voyages, according to the following timetable:

- Passenger ships by 1 July 2003
- Tankers by 1 July 2003
- Ships, other than passenger ships and tankers, of 50,000 gross tonnage and greater by 1 July 2004

Ships other than passenger ships and tankers from 300 up to 50,000 gross tons were required to fit AIS by 31 December 2004. It is conceivable that AIS could be used to alert mariners when whales are sighted.

Port State Control (PSC) is an international protocol developed by the IMO that gives authority to a nation state to inspect foreign ships and verify that the ship and its crew are in compliance with international regulations (IMO, 2005). The US is a signatory to IMO protocols and the USCG is the lead PSC agency in the US. The USCG is also the lead agency in developing guidelines for the International Ship and Port Security (ISPS) compliance inspections.

As a sovereign state, the US has extensive authority to regulate ships entering its ports and to establish port of entry conditions. Therefore, the US has the proper authority to require foreign flag vessels calling at US ports to adhere to the measures of the strategy.

Traffic Corridors

Several types of routing measures are used by the USCG and International Maritime Organization to provide safe access routes to and from ports, including recommended routes, anchorage/no anchorage areas, and TSSs. The purpose of a TSS is to separate opposing streams of traffic by appropriate means and establishing traffic lanes (33 CFR 167). TSSs have been adopted by the IMO in certain areas of the world to aid in navigation safety; all vessels must adhere to operating rules within these routes, although vessels may enter the TSS anywhere along its course. There are several TSSs in the waters along the East Coast.

Northeast

There are two internationally adopted TSSs in the Northeast. A TSS has been established in the approaches to the harbor of Portland, Maine. This TSS consists of directed inbound and outbound traffic lanes with a separation zone and a precautionary area. The second TSS has been established in the approach to Boston, Massachusetts. It originates in the Great South Channel, heads in a northerly direction to a point just off the easterly side of Provincetown, from which it continues in a northwesterly direction, crossing Stellwagen Bank and ending in a Precautionary Area off the entrance to Boston Harbor (NOS, 1993a). The Boston TSS intersects the Great South Channel right whale critical habitat and several of the proposed management areas.

In addition to TSSs, there are other nonofficial, but highly utilized areas or lanes in that area. The majority of the vessels transiting Cape Cod Bay are tugs and barges, which generally operate on the western side of the bay. Some vessels cross the designated critical habitat areas to head north to ports in Boston, New Hampshire, Maine, and Canada, and a small portion calls at Provincetown, Massachusetts (Russell *et al*., 2005). Vessels also transit through Stellwagen Bank via the Cape Cod Canal (NOS, 1993a). Research conducted on the Mandatory Ship Reporting System (MSRS) found that traffic headed for Massachusetts from the east generally uses four “high-use routes” that pass through the Great South Channel critical habitat and Stellwagen Bank and converge near the Boston Approach (Ward-Geiger *et al.*, 2005).

Overall, in spite of the presence of two TSSs, the area experiences a lot of vessel traffic, including within the two critical habitat areas and a national marine sanctuary located there. In particular, there are no officially designated routes for vessels traveling into or out of the Cape Cod Canal.

Mid-Atlantic

Ports in the mid-Atlantic attract a lot of ship traffic. Coastwise (moving up and down the coast) ship traffic travels through the right whale’s migratory corridor and vessels approaching a port cross over the migratory corridor. Some mid-Atlantic ports have domestic or internationally adopted TSSs. There is a TSS for the approaches into Narragansett Bay, Rhode Island, and for the approach to Buzzards Bay, Massachusetts through Rhode Island Sound (USCP 2, 2005). There are also TSSs into the approaches of Delaware Bay and Chesapeake Bay. The Off New York TSS has two eastern approaches—off Nantucket and off Ambrose Light; one southeastern approach, and one southern approach, in addition to precautionary areas (USCP 2, 2005).

Southeast

The major ports in this area are Jacksonville, Fernandina, Brunswick, and Canaveral. There are no internationally adopted traffic schemes in the Southeast region. There is currently an MSRS that operates within the southeastern right whale critical habitat. This system does not specify routing measures, although it provides mariners with information on the location of right whales in the area. Then the mariner can decide whether to change heading to avoid whales. This system also yields data on the location of vessels and their routes.

Analysis of data received from the MSRS identified two “high-use” routes associated with the approach to Jacksonville, one of the most frequented ports, followed by Brunswick, and Fernandina Beach (Ward-Geiger *et al.,* 2005). Both of these routes have southern approaches, one more origination more from the east than the other.

Most of the large ship traffic does not navigate coastwise through the SEUS. Northbound traffic generally stays in the Gulf Stream to take advantage of the current and remains east of the proposed Southeast management area. The southbound traffic is sparse and tends to stay offshore from the coasts of Georgia and Florida. Tug and barge, and recreational traffic tend to use coastwise routes.

3.4.1.4 General Vessel Characteristics

Vessel Types

A wide range of vessel types call at East Coast ports and could be affected by the proposed operational measures. For the purpose of the economic analysis, the following 12 vessel types were considered:

- Bulk Carriers
- Combination Carriers
- Containerships
- Freight Barges
- General Cargo Vessels
- Passenger Vessels
- Refrigerated Cargo Vessels
- Ro-Ro Cargo Vessels
- Tank Barges
- Tank Ship
- Towing Vessels
- Other (includes fishing vessels, industrial vessels, research vessels and school ships)

East Coast Arrivals by Type

Table 3-9 shows how many ships in each category arrived at the 26 port areas in 2003 and 2004, based on the USCG vessel arrival database.[21] In 2003, there were 25,532 vessel arrivals at the ports considered here. In 2004, arrivals increased by 7.3 percent to 27,385 vessel arrivals.

Containerships were the most numerous, with 8,623 arrivals in 2003 (about one-third of all arrivals) and 8,886 arrivals in 2004 (a little under a third of all arrivals). Tank ship was the next most frequent vessel type, with 5,439 arrivals in 2003 and 5,513 in 2004. Other significant vessel types in 2004 include bulk carriers (3,149 arrivals), ro-ro cargo vessels (3,054 arrivals), and general cargo vessels (1,843 arrivals). These top five vessel types accounted for 82 percent of total vessel arrivals in 2004.

[21] Reconciliation of the USCG data is described in detail in the supporting Economic Impact Report, prepared by Nathan Associates, Inc.

Table 3-9
East Coast Vessel Arrivals by Vessel Type, 2003 and 2004

Vessel Type	2003	2004
Bulk carrier	2,743	3,149
Combination carrier	150	106
Containership	8,623	8,886
Freight barge	243	274
General cargo vessel	1,752	1,843
Passenger vessel	1,229	1,666
Refrigerated cargo vessel	621	548
Ro-ro cargo vessel	3,107	3,054
Tank barge	1,127	1,492
Tanker	5,439	5,513
Towing vessel	416	745
Other[1]	82	109
Total	**25,532**	**27,385**

[1] Includes fishing vessels, industrial vessels, research vessels, school ships.
Source: Nathan Associates Inc., 2005

Vessel Weight

In most of these categories, ships come in a range of weights. However, on average, combination carriers are the largest ones, with an average weight of 74,426 dead weight tons (DWT) in 2003 and 58,823 DWT in 2004. Tank ships are next, with an average of 54,476 DWT in 2003 and 56,928 DWT in 2004. The average containership was 40,982 DWT in 2003 and 40,887 DWT in 2004. Dry bulk carriers were the only other vessel type with an average DWT in excess of 30,000 DWT, registering 36,042 DWT in 2003 and 36,730 DWT in 2004.

In addition to length, vessel arrivals are also analyzed by DWT and/or gross registered tons (GRT), which are the customary units in the shipping industry for classifying vessels by size category to estimate vessel operating costs.

East Coast Arrivals by Weight

The size of vessels calling at East Coast ports can vary considerably depending on a number of factors including cargo and vessel type, length of ocean voyage, port and channel draft limitations at the loading or unloading port, customers preferred consignment size, and vessel routing considerations. The majority of the vessels calling on the East Coast are on the lower side of the weight range; 38 percent of the entire East Coast arrivals are comprised of vessels less than 20,000 DWT. Approximately 24 percent of arrivals are of vessels between 20,000 and 40,000 DWT, 25 percent between 40,000 and 60,000 DWT, and 13 percent over 60,000 DWT in 2003 and 2004.

In 2003, the port area of Portland had the highest average vessel DWT (53,810) on the East Coast. The port area of Philadelphia was second with an average of 46,371 DWT. Large tankers bringing principally fuel oil for local power plants account for more than 50 percent of the arrivals to both these port areas. High average vessels DWT were also reported in 2003 for the port areas of Salem, MA (44,738) and Hampton Roads (42,650). The average vessel DWT by port area was similar in 2004 to what it was in 2003. The Economic Impact Report provides a further analysis of average vessel size by DWT quartile for each of the port areas and vessel size by vessel type.

Arrivals by Port Area

The potential for each port area to be affected by the proposed action varies with the amount of shipping activity occurring every year. One measure of this activity is the number and weight of vessels calling at each port. Data Chart 3-1 summarizes arrival data by port region, port area, and DWT for 2003 and 2004.

As noted above, in 2003, there were 25,532 vessel arrivals at the ports considered in this EIS, and 27,385 in 2004. Looking at arrivals into each port region, the most active region in both years was the ports of New York/New Jersey, with 5,426 and 5,550 vessel arrivals in 2003 and 2004, respectively. The Chesapeake Bay port region was next, with 4,486 and 4,875 arrivals in 2003 and 2004, respectively. Other port regions with more than 2,000 vessel arrivals in 2004 include the Southeastern US (4,315 vessel arrivals), the Delaware Bay region (2,661 vessel arrivals), the Block Island Sound region (2,563 vessel arrivals), as well as the single-port areas of Savannah (2,474 vessel arrivals) and Charleston (2,473 vessel arrivals).

In terms of single port areas, New York City had the most vessel arrivals (5,550 arrivals) in 2004, followed by Hampton Roads (2,834 arrivals), Philadelphia (2,661 arrivals), Jacksonville (2,517 arrivals), Savannah (2,474 arrivals), Charleston (2,473 arrivals), Baltimore (2,041 arrivals), and Port Canaveral (1,062 arrivals).

Operating Speed

Table 3-10 shows average speeds by vessel type and DWT category based on data from MSRS reports, USACE estimates of vessel service speeds, and comments from the maritime industry. Further information on these data sources is provided in the Economic Impact Report.

Operating Costs at Sea

In addition to operating speeds, the USACE also prepares estimates of vessel operating costs to be used by planners in studies to determine the potential benefits of harbor improvement projects. Vessel operating costs include annual capital costs as determined by the replacement cost of the vessels and application of capital recovery factors; estimates of fixed annual operating costs such as for crew, lubes and stores, maintenance and repair, insurance and administration; the number of operational days per year; and fuel costs at sea and in port.

Data Chart 3-2 shows hourly vessel operating costs at sea for foreign flag and US flag vessels by type and DWT in 2005, based on data published by the USACE. Operating costs were calculated for both US and foreign flag vessels because of the disparity between similar vessel types in these two categories. For example, operating costs for US flag bulk carriers, combination carriers, and tankers are generally double those of similar foreign flag vessels. Operating costs for US flag containerships, ro-ro vessels, and passenger vessels are about 1.5 times higher than comparable foreign flag vessels.

Data Chart 3-1
Vessel Arrivals by Region, Port Area and DWT, 2003-2004

	2003					2004				
	DWT					DWT				
Port Region and Port Area	0 - 19,999	20,000 - 39,999	40,000 - 59,999	60,000 and Greater	Total	0 - 19,999	20,000 - 39,999	40,000 - 59,999	60,000 and Greater	Total
Northeastern US - Gulf of Maine										
Eastport, ME	23	4	13	-	40	17	-	26	-	43
Searsport, ME	132	43	18	3	196	117	46	31	2	196
Portland, ME	209	111	83	217	620	201	103	104	233	641
Portsmouth, NH	32	91	74	2	199	33	48	91	1	173
Subtotal	396	249	188	222	1,055	368	197	252	236	1,053
Northeastern US - Off Race Point										
Salem, MA	1	1	5	2	9	6	6	-	3	15
Boston, MA	237	109	127	10	483	237	109	127	10	483
Subtotal	238	110	132	12	492	243	115	127	13	498
Northeastern US - Cape Cod Bay										
Cape Cod, MA	9	-	3	10	22	15	1	8	12	36
Subtotal	9	0	3	10	22	15	1	8	12	36
Mid-Atlantic Block Island Sound										
New Bedford, MA	46	33	12	19	110	41	28	8	22	99
Providence, RI	172	74	92	12	350	157	89	72	4	322
New London, CT	96	19	20		135	118	25	36	1	180
New Haven, CT	309	116	117	5	547	520	81	94	6	701
Bridgeport, CT	278	4	15	22	319	349	2	14	27	392
Long Island, NY	624	59	9	88	780	691	77	17	84	869
Subtotal	1,525	305	265	146	2,241	1,876	302	241	144	2,563
Mid-Atlantic Ports of New York/New Jersey										
New York City, NY	1,353	1,311	1,830	932	5,426	1,324	1,548	1,774	904	5,550
Subtotal	1,353	1,311	1,830	932	5,426	1,324	1,548	1,774	904	5,550
Mid-Atlantic Delaware Bay										
Philadelphia, PA	1,117	472	296	594	2,479	1,153	556	327	625	2,661
Subtotal	1,117	472	296	594	2,479	1,153	556	327	625	2,661
Mid-Atlantic Chesapeake Bay										
Baltimore, MD	754	483	415	168	1,820	759	588	443	251	2,041
Hampton Roads, VA	429	763	950	524	2,666	472	855	871	636	2,834
Subtotal	1,183	1,246	1,365	692	4,486	1,231	1,443	1,314	887	4,875
Mid-Atlantic Morehead City and Beaufort, NC										
Morehead City, NC	30	74	15	4	123	37	77	33	4	151
Subtotal	30	74	15	4	123	37	77	33	4	151
Mid-Atlantic Wilmington, NC										
Wilmington, NC	196	168	238	26	628	221	176	240	30	667
Subtotal	196	168	238	26	628	221	176	240	30	667
Mid-Atlantic Georgetown, SC										
Georgetown, SC	19	18	26	-	63	27	28	14	-	69
Subtotal	19	18	26	0	63	27	28	14	0	69
Mid-Atlantic Charleston, SC										
Charleston, SC	371	692	986	228	2,277	406	817	1,045	205	2,473
Subtotal	371	692	986	228	2,277	406	817	1,045	205	2,473
Mid-Atlantic Savannah, GA										
Savannah, GA	507	667	908	316	2,398	496	739	823	416	2,474
Subtotal	507	667	908	316	2,398	496	739	823	416	2,474
Southeastern US										
Brunswick, GA	282	126	46	4	458	271	149	28	4	452
Fernandina, FL	225	4	26	-	255	247	2	35	-	284
Jacksonville, FL	1,376	457	358	49	2,240	1,562	514	389	52	2,517
Port Canaveral, FL	763	70	46	10	889	878	84	85	15	1,062
Subtotal	2,646	657	476	63	3,842	2,958	749	537	71	4,315
All Port Areas	9,590	5,969	6,728	3,245	25,532	10,355	6,748	6,735	3,547	27,385

Source: Prepared by Nathan Associates based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports, 2003-2004.

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Table 3-10
Average Vessel Operating Speeds (Knots) by Vessel Type and Weight (000 DWT)

Vessel Type	0 to 5	5 to 10	10 to 15	15 to 20	20 to 25	25 to 30	30 to 35	35 to 40	40 to 45	45 to 50	50 to 60	60 to 70	70 to 80	80 to 90	90 to 100	100 to 120	120 to 150	150 and Over
Bulk carrier	11.6	11.6	12.2	12.5	12.5	12.5	13	13	13.4	13.4	14	14	14.1	14.1	14.1	14.1	14.1	14.1
Combination carrier	11.6	11.6	12.2	12.2	12.5	12.5	13	13	13.4	13.4	14	14	14.1	14.1	14.1	14.1		
Containership	13	15.8	17.4	18.5	19.3	20	20.7	21.2	21.7	22.1	22.7	23.4	24.1	24.6				
Freight barge	12	14.2	15.3	16.1	16.8	17.3	17.7	18.1	18.4	18.8	19.2							
General cargo vessel	12	14.2	15.3	16.1	16.8	17.3	17.7	18.1	18.4	18.8								
Passenger vessel	16	18	20	22	24													
Refrigerated cargo vessel	13	15.8	17.4	18.5	19.3	20	20.7	21.2	21.7	22.1	22.7							
Ro-ro cargo vessel	13	15.8	17.4	18.5	19.3	20	20.7	21.2	21.7	22.1	22.7	23.4	24.1					
Tank barge	13.2	13.7	13.9	14	14.2	14.2	14.3	14.4	14.4	14.5	14.5							
Tanker	13.2	13.7	13.9	14	14.2	14.2	14.3	14.4	14.4	14.5	14.5	14.6	14.7	14.7	14.8	14.8	14.9	15
Towing vessel	13.2	13.7	13.9	14	14.2	14.2	14.3	14.4	14.4	14.5								
Other[1]	12	12	12	12	12.	12	12											

1. Includes fishing vessels, industrial vessels, research vessels, school ships
Source: Nathan Associates Inc., 2005

Data Chart 3-2
Hourly Vessel Operating Costs at Sea for Foreign Flag and US Flag, Vessel Type and DWT Size Range, 2005 ($)

	DWT (000s)																	
Vessel type and flag	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-60	60-70	70-80	80-90	90-100	100-120	120-150	150+
Foreign Flag 2005 Hourly Operating Costs at Sea																		
Bulk Carrier	735	752	770	789	808	827	847	867	888	909	942	988	1,035	1,086	1,138	1,222	1,375	1,585
Combination Carrier (e.g. OBO)	771	790	809	828	848	868	889	910	932	955	989	1,037	1,087	1,140	1,195	1,283	1,444	1,665
Container Ship	739	830	933	1,048	1,176	1,321	1,484	1,667	1,872	2,102	2,502	3,156	3,981	5,021	6,333	8,971	-	-
Freight Barge	456	558	683	837	1,024	1,254	1,535	1,879	2,301	2,817	-	-	-	-	-	-	-	-
General Dry Cargo Ship	456	558	683	837	1,024	1,254	1,535	1,879	2,301	2,817	-	-	-	-	-	-	-	-
Passenger Ship a/	3,322	4,706	6,666	10,008	12,623	-	-	-	-	-	-	-	-	-	-		-	-
Refrigerated Cargo Ship	1,664	1,869	2,099	2,357	2,647	2,973	3,339	3,750	4,211	4,730	5,629	-	-	-	-	-	-	-
Ro-Ro Cargo Ship	813	914	1,026	1,152	1,294	1,453	1,632	1,833	2,059	2,312	2,752	3,471	4,379	-	-	-	-	-
Tank Barge	909	926	944	961	979	997	1,016	1,034	1,054	1,073	1,103	-	-	-	-	-	-	-
Tank Ship	909	926	944	961	979	997	1,016	1,034	1,054	1,073	1,103	1,145	1,188	1,232	1,278	1,351	1,481	1,654
Towing Vessel	909	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other b/	456	558	683	837	1,024	1,254	1,535	-	-	-	-	-	-	-	-		-	-
US Flag 2005 Hourly Operating Costs at Sea																		
Bulk Carrier	1,272	1,307	1,344	1,381	1,420	1,460	1,500	1,542	1,585	1,630	1,698	1,795	1,896	2,004	2,117	2,300	2,639	3,114
Combination Carrier (e.g. OBO)	1,335	1,373	1,411	1,450	1,491	1,532	1,575	1,619	1,665	1,711	1,783	1,884	1,991	2,104	2,223	2,415	2,771	3,269
Container Ship	1,412	1,528	1,653	1,788	1,934	2,092	2,264	2,449	2,649	2,866	3,225	3,774	4,417	5,170	6,050	7,660	-	-
Freight Barge	903	1,077	1,286	1,535	1,832	2,187	2,610	3,115	3,718	4,438	5,786	-	-	-	-	-	-	-
General Dry Cargo Ship	903	1,077	1,286	1,535	1,832	2,187	2,610	3,115	3,718	4,438	5,786	-	-	-	-	-	-	-
Passenger Ship a/	6,110	7,736	9,795	12,899	15,096	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigerated Cargo Ship	3,177	3,437	3,718	4,022	4,352	4,708	5,093	5,510	5,960	6,448	7,256	-	-	-	-	-	-	-
Ro-Ro Cargo Ship	1,553	1,680	1,818	1,967	2,127	2,302	2,490	2,694	2,914	3,152	3,547	4,152	4,859					
Tank Barge	1,736	1,769	1,802	1,836	1,870	1,906	1,942	1,978	2,016	2,054	2,112	-	-	-	-	-	-	-
Tank Ship	1,736	1,769	1,802	1,836	1,870	1,906	1,942	1,978	2,016	2,054	2,112	2,192	2,276	2,363	2,453	2,594	2,848	3,186
Towing Vessel	1,736	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other b/	903	1,077	1,286	1,535	1,832	2,187	2,610	-	-	-	-	-	-	-	-	-	-	-

Source: Prepared by Nathan Associates Inc. as decribed in text from data provided in U.S. Army Corps of Engineers, Economic Guidance Memorandum 05-01, Deep Draft Vessel Operating Costs and adjusted for bunker fuel prices as of October 19, 2005.

It should be noted that comments from the shipping industry raised concerns that the USACE vessel operating costs for 2004 understated current conditions, especially due to the increased cost of bunker fuels. The USACE operating cost estimates provide the assumed fuel consumption per day at sea for the primary propulsion and auxiliary propulsion for each vessel type and DWT size. The primary propulsion is assumed to use heavy viscosity oil while the auxiliary propulsion is assumed to use marine diesel oil. For the purposes of this study, USACE vessel operating costs were updated to reflect current bunker fuel prices per ton as reported by Lloyd's List Bunker 60 for Houston as of October 19, 2005.[22] The price for heavy viscosity oil was $301 per metric ton and marine diesel oil was $696 per metric ton, representing increases of approximately 125 percent over average bunker fuel prices for 2004. While consumption of fuel varies by vessel type and DWT size, the overall increase in vessel operating costs in 2005 due to bunker fuels is about 35 to 40 percent for foreign flag general cargo vessels and tankers, 45 percent for foreign dry bulk vessels, and 50 to 60 percent for foreign containerships. As the USCG vessel arrival database did not provide adequate information to distinguish single-hull and double-hull tankers, operating costs for double hull tankers were used in the analysis (generally the additional vessel operating cost per hour for double-hull tankers varies from 1 percent greater for the smaller tankers to 7 percent greater for the largest tankers).

3.4.2 Commercial Shipping Industry

The volume and value of goods carried by vessels calling at East Coast ports are major indicators of the economic significance of maritime activity that may be affected by the proposed alternatives. To evaluate this activity, foreign trade statistics published by the US Census Bureau at a Custom District and port level have been analyzed for 2003 and 2004.

Census Bureau data on US imports of merchandise is compiled primarily from automated data submitted through the US Customs' Automated Commercial System.[23] Data are compiled also from import entry summary forms, warehouse withdrawal forms, and Foreign Trade Zone documents that must by law be filed with the US Customs Service. Information on US exports of merchandise is compiled from copies of Shipper's Export Declarations (SEDs) and data from qualified exporters, forwarders, or carriers. Copies of SEDs must be filed with Customs officials at the port of export.

For this study, the following data were used:

- **Customs Import Value.** The value of imports appraised by the US Customs Services in accordance with the legal requirements of the Tariff Act of 1930, as amended. This value is generally defined as the price actually paid or payable for merchandise when sold for exportation to the US excluding US import duties, freight, insurance and other charges incurred in bringing the merchandise to the US.
- **Import Charges.** The aggregate cost of all freight, insurance, and other charges (excluding US import duties) incurred in bringing the merchandise from alongside the

[22] Houston is a major distribution area for fuel and is generally regarded as an important price point for the US.
[23] The description and definition of information from the US Census Bureau Foreign Trade Statistics is based on the Guide to Foreign Trade Statistics: Description of the Foreign Trade Statistical Program available on the US Census Bureau website.

carrier at the port of exportation to placing it alongside the carrier at the first port of entry in the US.

- **F.A.S. Export Value.** The free alongside-ship value of exports at the US seaport based on the transaction price, including inland freight, insurance, and other charges incurred in placing the merchandise alongside the carrier at the US port of exportation. The value, as defined, excludes the cost of loading the merchandise aboard the exporting carrier as well as freight, insurance, and any other charges or transportation costs beyond the port of exportation.
- **Shipping Weight.** The gross weight in metric tons including weight of moisture content, wrappings, crates, boxes, and containers.
- **District of Exportation.** The customs district in which the merchandise is loaded on the vessel that takes the merchandise out of the country.
- **Import District of Unloading.** The district where merchandise is unloaded from the importing vessel.

Data Chart 3-3 presents East Coast maritime trade data (value and weight of imports and exports) by port region and area for 2004.[24]

In 2003, the custom import value of merchandise arriving to the ports of the East Coast was $207.9 billion; nearly triple the $70 billion value of exports.[25] The port area of New York City was the largest in terms of the value of imports ($78.6 billion) and exports ($21.8 billion). It accounted for 38 percent of the value of US East Coast imports and 31 percent of the exports.

The port areas of Charleston, Philadelphia, Hampton Roads, and Baltimore constituted the next tier of port areas, with import values ranging from $20.4 billion to $26.1 billion. For exports, the port area of Charleston recorded exports of $13.5 billion in 2003; next came Hampton Roads and Savannah with exports of $12.2 billion and $7.6 billion, respectively.

In 2004, the value of East Coast imports increased by 17.6 percent to $244.4 billion and the value of exports increased by 15.2 percent to $80.7 billion. The value of total trade increased by 17 percent to $325.1 billion.

The total weight of East Coast imports was 247 million tons in 2003; the corresponding number for exports was 51.7 million tons. The port area of Philadelphia was the largest in terms of import shipping weight, with 71.2 million tons in 2003, followed by New York City, with 68.9 million tons. These two areas account for 57 percent of the total East Coast import shipments by weight. For exports, Hampton Roads was first, with 17.2 million tons, followed by New York City, with 9.6 million tons, and Savannah with 8.1 million tons. The relative rankings by port area for 2004 are similar in terms of export tonnages. Shipping weight is also presented in Data Chart 3-3.

[24] Maritime trade refers to the method of transportation by which the merchandise arrived in or departed from the US.
[25] Please note that for purposes of this study, ports south of Port Canaveral, FL are excluded from the data presented.

Data Chart 3-3
US East Coast Maritime Trade by Port Region and Port Area, 2004

	Imports		Exports		Total Trade	
Port Region and Port Area	Custom import value ($ millions)	Shipping Weight (m.t. 000s)	F.A.S. export value ($ millions)	Shipping Weight (m.t. 000s)	Merchandise Value ($ millions)	Shipping Weight (m.t. 000s)
Gulf of Maine						
Eastport, ME	0.0	0.0	115.7	260.9	115.7	260.9
Searsport, ME	394.4	1,554.0	1.6	0.8	396.0	1,554.8
Portland, ME	1,126.0	3,331.7	339.2	177.6	1,465.2	3,509.3
Portsmouth, NH	625.7	3,640.4	105.6	239.7	731.2	3,880.1
Subtotal	2,146.0	8,526.0	562.0	679.1	2,708.0	9,205.2
Racepoint, MA						
Salem, MA	23.5	543.6	10.2	3.1	33.7	546.7
Boston, MA	6,102.0	16,508.9	850.4	986.2	6,952.4	17,495.2
Subtotal	6,125.5	17,052.6	860.6	989.3	6,986.1	18,041.9
Cape Cod, MA						
Cape Cod, MA	0.4	0.0	0.0	0.0	0.4	0.0
Subtotal	0.4	0.0	0.0	0.0	0.4	0.0
Block Island Sound						
New Bedford, MA	128.7	2,114.7	9.4	12.2	138.0	2,126.9
Providence , RI	2,835.4	4,549.4	63.7	256.8	2,899.1	4,806.3
New London, CT	276.6	241.7	1.9	5.9	278.6	247.6
New Haven, CT	976.7	2,426.0	47.1	239.8	1,023.8	2,665.8
Bridgeport, CT	83.5	1,555.2	1.1	0.4	84.5	1,555.6
Subtotal	4,300.8	10,887.1	123.2	515.1	4,424.0	11,402.2
New York						
New York City, NY	90,968.3	70,340.7	23,567.1	10,303.3	114,535.4	80,644.0
Subtotal	90,968.3	70,340.7	23,567.1	10,303.3	114,535.4	80,644.0
Delaware Bay						
Philadelphia, PA	27,164.9	74,650.0	3,334.5	1,887.0	30,499.4	76,537.0
Subtotal	27,164.9	74,650.0	3,334.5	1,887.0	30,499.4	76,537.0
Chesapeake Bay						
Hampton Roads, VA	24,713.9	12,047.4	13,260.7	18,550.2	37,974.6	30,597.7
Baltimore, MD	24,410.9	22,589.5	6,905.5	6,273.8	31,316.5	28,863.3
Subtotal	49,124.8	34,636.9	20,166.3	24,824.0	69,291.1	59,461.0
Morehead City, NC						
Morehead City, NC	307.8	404.8	282.7	67.4	590.5	472.2
Subtotal	307.8	404.8	282.7	67.4	590.5	472.2
Wilmington, NC						
Wilmington, NC	1,516.1	4,206.4	1,109.9	856.4	2,626.1	5,062.8
Subtotal	1,516.1	4,206.4	1,109.9	856.4	2,626.1	5,062.8
Georgetown, SC						
Georgetown, SC	82.2	661.8	17.6	20.7	99.8	682.5
Subtotal	82.2	661.8	17.6	20.7	99.8	682.5
Charleston, SC						
Charleston, SC	31,103.0	12,823.8	15,341.5	5,778.6	46,444.5	18,602.3
Subtotal	31,103.0	12,823.8	15,341.5	5,778.6	46,444.5	18,602.3
Savannah, GA						
Savannah, GA	16,540.5	15,701.7	9,661.9	8,609.1	26,202.4	24,310.8
Subtotal	16,540.5	15,701.7	9,661.9	8,609.1	26,202.4	24,310.8
Southeastern U.S.						
Brunswick, GA	5,349.2	1,249.9	761.3	678.4	6,110.5	1,928.3
Fernandina, FL	92.9	116.7	199.9	239.7	292.7	356.4
Jacksonville, FL	9,165.5	9,490.9	4,541.1	1,168.2	13,706.6	10,659.1
Port Canaveral, FL	406.1	2,835.1	127.1	138.7	533.2	2,973.7
Subtotal	15,013.6	13,692.5	5,629.4	2,225.0	20,643.0	15,917.6
All Port Areas	244,393.8	263,584.2	80,656.8	56,755.1	325,050.6	320,339.3

Source: Prepared by Nathan Associates from U.S Census Bureau Foreign Trade Statistics for 2004 as described in text.

The Census Bureau reports vessel import charges associated with import of merchandise by customs district.[26] Vessel import charges represent the aggregate cost of all freight, insurance, and other charges (excluding US import duties) incurred in bringing the merchandise from alongside the carrier at the port of exportation and placing it alongside the carrier at the first port of entry.

In 2003, vessel import charges at East Coast customs districts totaled $11.1 billion or 5.3 percent of the vessel import value (Data Chart 3-4).[27] In 2004, vessel import charges increased by 18.5 percent to $13.2 billion, representing 5.3 percent of the vessel import value. In 2004, vessel import charges ranged from a high of 11.9 percent of vessel import value for the customs district of Charlotte to a low of 2.8 percent for the customs district of Providence. Factors such as composition and volume of cargo, value of the merchandise per ton, distance of ocean voyage, size and type of vessel used, and port charges affect the relative importance of vessel import charges at a customs district level.

Data Chart 3-4
US East Coast: Vessel Import Charges as a Percent of Vessel Import Value by Customs District of Unloading, 2003 and 2004

	2003			2004		
Custom District of Unlading	Vessel Import Value (Millions of Dollars)	Vessel Import Charges (Millions of Dollars)	Percent of Vessel Import Value	Vessel Import Value (Millions of Dollars)	Vessel Import Charges (Millions of Dollars)	Percent of Vessel Import Value
1 Portland, ME	$1,765	$86	4.9%	$2,146	$103	4.8%
4 Boston, MA	$6,549	$341	5.2%	$7,591	$407	5.4%
5 Providence, RI	$2,665	$68	2.6%	$2,835	$78	2.8%
10 New York City, NY	$78,601	$4,046	5.1%	$90,968	$4,711	5.2%
11 Philadelphia, PA	$21,818	$1,507	6.9%	$27,165	$1,797	6.6%
13 Baltimore, MD	$20,412	$735	3.6%	$24,411	$944	3.9%
14 Norfolk, VA	$20,886	$1,143	5.5%	$24,714	$1,386	5.6%
15 Charlotte, NC	$1,477	$165	11.1%	$1,824	$217	11.9%
16 Charleston, SC	$26,101	$1,231	4.7%	$31,185	$1,483	4.8%
17 Savannah, GA	$18,310	$1,222	6.7%	$21,890	$1,433	6.5%
18 Tampa, FL	$11,357	$566	5.0%	$12,197	$612	5.0%
Total	$209,941	$11,112	5.3%	$246,927	$13,170	5.3%

Source: Prepared by Nathan Associates Inc. from U.S. Census Bureau, Foreign Trade Statistics for 2003 and 2004.

3.4.3 Commercial Fishing Industry

Commercial fishing along the US East Coast is a multimillion dollar industry. In 2004, commercial fish landings at East Coast ports for which fishing constitute a significant share of their activity totaled $706 million (Data Chart 3-5). The potential for impacts varies with the volume of landings and/or dollar value of landings. In 2003 and 2004, New Bedford, Massachusetts, ranked highest in the nation for landings by port ranked by dollars, with $176.2 million (NMFS, 2002) and $206.5 million (NFMS, 2003c), respectively. Other ports that ranked

[26] As vessel import charges are not reported by the US Census Bureau at the port level, these charges were only analyzed at the customs district level. The data presented does not precisely correspond to the vessel import values shown in Data Chart 3-3 by port area as ports included in customs district that are outside the scope of this study have been excluded from this table.

[27] Vessel import value is equivalent to custom import value for merchandise transported by vessels.

high in 2003 include Hampton Roads, Virginia, ($79.6M), Gloucester, Massachusetts ($37.8), and Portland, Maine ($28.7).

The operational measures would apply to vessels with a length of 65 ft (19.8 m) or greater. Analysis of commercial fishing permits issued by NMFS shows that the vast majority of commercial fishing vessels 65 ft (19.8 m) and above have a GRT of less than 150 tons and therefore, are not captured in the USCG vessel arrival database, which necessitated evaluating commercial fishing permits, rather than relying on just the USCG database. Approximately 84 percent of fishing vessels greater than 65 ft (19.8 m) in the Southeast region are less than 150 tons (Data Chart 3-6). In the Northeast region, almost 67 percent of fishing vessels greater than 65 ft (19.8 m) are less than 150 tons. The average speed for commercial fishing vessels is 10 knots or below; therefore the majority of fishing vessels would not be affected by a speed restriction of 10, 12, or 14 knots. Information was not obtained on state-permitted vessels as there is basically no potential for impact on the commercial fishing industry due to low operating speeds.

Data Chart 3-5
US East Coast Commercial Fishery Landings by Port, 2002 – 2004 (millions of dollars)

Port	2002	2003	2004
New Bedford, MA	168.6	176.2	206.5
Hampton Roads, VA	69.5	79.6	100.6
Cape May-Wildwood, NJ	35.3	42.8	68.1
Gloucetser, MA	41.2	37.8	42.7
Point Judith, RI	31.3	32.4	31.5
Portland,ME	40.4	28.7	24.2
Reedville, VA	24.2	24.2	26.1
Point Pleasnat, NJ	19.7	22.8	19.2
Wanchese-Stumpy Point, NC	23.2	21.0	20.6
Atlantic City, NJ	22.4	20.8	17.7
Stonington, ME	21.7	20.5	7.5
Beaufort- Morehead City, NC	19.1	15.0	16.9
Provincetown-Chatham, MA	15.2	13.5	14.1
Charleston -Mt. Pleasant, SC	9.3	13.0	8.5
Montauk, NY	11.1	11.0	13
Boston,MA	8.6	8.9	8.8
Engelhard-Swanquarter, NC	11.1	8.0	7.8
Beaufort, SC	n.a.	7.0	16.9
Cape Canveral, FL	6.2	6.8	9.3
Ocean City, MD	8.1	6.6	n.a.
Hampton Bay-Shinnicock, NY	8.3	6.5	6.6
Georgetown, SC	5.2	6.0	n.a.
Belhaven- Washington, NC	6.2	5.0	3.7
Oriental-Vandemere, NC	8.5	5.0	7.2
Sneads Ferry-Swansboro, NC	6.4	5.0	n.a.
Rockland, ME	4.3	4.1	2.7
Darien-Belville, GA	6.9	6.0	5
Long Beach-Barnegat, NJ	14.6	16.4	20.6
Total	646.6	650.6	705.8

Source: NOAA Fisheries.

Data Chart 3-6
Fishing Permits Issued to Vessels 65 Feet and Greater by Region, 2003

	Southeast Region				Northeast Region	
Vessel gross registered tons	Fishing perrmits	%	Unique vessels	%	Fishing perrmits	%
All vessels	557	100.0%	347	100.0%	856	100.0%
Vessels less than 150 GRT	482	86.5%	290	83.6%	572	66.8%
Vessels 150 GRT and above	75	13.5%	57	16.4%	284	33.2%

Note: For the Northeast Region fishing permit data provided was for unique vessels only.
Source: Prepared by Nathan Associates Inc. from data provided by National Marine Fisheries Service, Sustainable Fisheries Division, Southeast Fisheries Science Center and NOAA Fisheries, Northeast Fisheries Science Center.

3.4.4 Passenger Vessel Industry

In 2003, there were 1,229 passenger vessel arrivals at US East Coast ports and in 2004 there were 1,666 arrivals[28] (Data Chart 3-7). The USCG category of passenger vessels consists principally of cruise ships and ferries that are 150 GRT and greater. Approximately 53 percent of the vessel arrivals are of vessels more than 60,000 GRT.

In 2003, the SEUS region accounted for 46 percent of East Coast passenger vessel arrivals with 562 arrivals; Port Canaveral alone accounting for 547 of these arrivals. New York City had the second most passenger vessel arrivals, with 226 arrivals in 2003. Boston ranked third, with 94 arrivals. Searsport ranked fourth in passenger arrivals with 66, followed by Baltimore and Charleston, which both had 40 arrivals in 2003.

In 2004, the SEUS region had 695 passenger vessel arrivals, 42 percent of the East Coast total. Port Canaveral again accounted for most of those arrivals (579). New York City again had the second highest number of arrivals in 2004 (307). Boston ranked third with 94 arrivals, followed by Jacksonville (89), Searsport (81), and Baltimore (75).

By far the most important port area for passenger vessel arrivals is Port Canaveral, FL, in the SEUS region. In 2004, over 95 percent of the passenger vessel arrivals in Port Canaveral were of vessels greater than 60,000 GRT, an indication of the importance of the cruise industry there. Disney Cruise Line uses Port Canaveral as the home port for its 83,000 GRT Disney Magic and Disney Wonder vessels. Various other cruise companies including Carnival, RCI, Holland America, Norwegian, SunCruz, and Sterling Casino Lines also dock at this port.

The port area of New York/New Jersey is the second most active area for passenger vessels. Over half of the arrivals are greater than 60,000 GRT. Ferry services account for a percentage of these arrivals.

The Off Race Point region comes in third as the Port of Boston is a growing passenger vessel terminal.

[28] Ports south of Port Canaveral, Florida, are excluded from the data presented here as they are outside the geographical scope of the proposed action.

Data Chart 3-7
Passenger Ship Arrivals by Port Region, Port Area and GRT, 2003 – 2004

	2003					2004				
	Gross Registered Tonnage					Gross Registered Tonnage				
Port Region and Port Area	0 - 19,999	20,000 - 39,999	40,000 - 59,999	60,000 and Greater	Total	0 - 19,999	20,000 - 39,999	40,000 - 59,999	60,000 and Greater	Total
Northeastern US - Gulf of Maine										
Eastport, ME	-	-	-	-	0	-	-	-	-	0
Searsport, ME	3	14	28	21	66	21	16	27	17	81
Portland, ME	-	2	6	11	19	5	3	10	8	26
Portsmouth, NH	1	-	-	-	1	1	-	-	-	1
Subtotal	4	16	34	32	86	27	19	37	25	108
Northeastern US - Off Race Point										
Salem, MA	-	1	-	-	1	3	-	3	-	6
Boston, MA	8	16	46	24	94	8	16	46	24	94
Subtotal	8	17	46	24	95	11	16	49	24	100
Northeastern US - Cape Cod Bay										
Cape Cod, MA	1	2	5	1	9	3	2	8	-	13
Subtotal	1	2	5	1	9	3	2	8	0	13
Mid-Atlantic Block Island Sound										
New Bedford, MA	-	-	-	-	0	2	-	-	-	2
Providence, RI	6	4	11	14	35	15	4	9	15	43
New London, CT	32	-	-	-	32	54	-	3	-	57
New Haven, CT	5	-	-	-	5	-	-	-	-	0
Bridgeport, CT	4	-	-	-	4	4	-	-	-	4
Long Island, NY	32	-	-	-	32	38	-	-	-	38
Subtotal	79	4	11	14	108	113	4	12	15	144
Mid-Atlantic Ports of New York/New Jersey										
New York City, NY	8	22	82	114	226	28	45	65	169	307
Subtotal	8	22	82	114	226	28	45	65	169	307
Mid-Atlantic Delaware Bay										
Philadelphia, PA	3	5	11	7	26	3	15	15	-	33
Subtotal	3	5	11	7	26	3	15	15	0	33
Mid-Atlantic Chesapeake Bay										
Baltimore, MD	3	7	1	29	40	9	16	3	47	75
Hampton Roads, VA	5	12	2	12	31	13	17	28	6	64
Subtotal	8	19	3	41	71	22	33	31	53	139
Mid-Atlantic Morehead City and Beaufort, NC										
Morehead City, NC	-	-	-	-	0	7	-	-	-	7
Subtotal	0	0	0	0	0	7	0	0	0	7
Mid-Atlantic Wilmington, NC										
Wilmington, NC	-	-	-	-	0	4	2	-	-	6
Subtotal	0	0	0	0	0	4	2	0	0	6
Mid-Atlantic Georgetown, SC										
Georgetown, SC	-	-	-	-	0	1	-	-	-	1
Subtotal	0	0	0	0	0	1	0	0	0	1
Mid-Atlantic Charleston, SC										
Charleston, SC	6	5	10	19	40	17	11	25	11	64
Subtotal	6	5	10	19	40	17	11	25	11	64
Mid-Atlantic Savannah, GA										
Savannah, GA	4	1	-	1	6	45	4	-	-	49
Subtotal	4	1	0	1	6	45	4	0	0	49
Southeastern US										
Brunswick, GA	1	-	-	-	1	8	-	-	-	8
Fernandina, FL	1	1	-	-	2	17	2	-	-	19
Jacksonville, FL	7	-	5	-	12	19	1	56	13	89
Port Canaveral, FL	104	4	2	437	547	18	9	1	551	579
Subtotal	113	5	7	437	562	62	12	57	564	695
All Port Regions	234	96	209	690	1,229	343	163	299	861	1,666

Source: Prepared by Nathan Associates based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports, 2003-2004.

3.4.4.1 Cruise Vessels

In 2004, the North American cruise industry[29] contributed more than $30 billion to the US economy, an 18 percent increase from 2003. Cruise passengers residing in the US increased by 11.1 percent from 2003, and the industry increased its total direct spending in the US by 13.8 percent to $14.7 billion. The number of cruise ships increased by 4.3 percent (eight ships) to a total of 192.

The expansion of the cruise industry benefits US ports through the increase in cruise passengers and homeporting. US ports handled 8.1 million cruise embarkations in 2004 (a 14 percent increase from 2003); US residents accounted for 77 percent of the global cruise passengers. In 2000–2004, the Port of Miami was the leader in terms of embarkations with nearly 1.7 million passengers in 2004. Strong growth at Port Everglades moved it from third rank with 0.8 million passengers in 2000 to second rank with 1.3 million passengers in 2004. Port Canaveral also grew from 0.9 million passengers in 2000 to 1.2 million passengers in 2004. Data Chart 3-8 presents information on the number of cruise passenger embarkations at selected East Coast ports in 2000–2003.

Benefits to the general economy from the cruise industry include expenditure on air transportation, food and beverages, ship maintenance and refurbishment, engineering and travel agent commissions. On the East Coast, Florida, New York, and Georgia are the states that benefit most (direct purchases, employment, and income) from the cruise industry (BREA, 2005).

Data Chart 3-8
Embarkations of the North American Cruise Industry for Selected US East Coast Ports, 2000-2004 (passengers in 000s)

Port	2000	2001	2002	2003	2004
Miami	1,682	1,700	1,804	1,965	1,682
Port Everglades	798	1,046	1,202	1,213	1,324
Port Canaveral	941	870	1,028	1,089	1,220
New York	309	238	326	438	547
Norfolk	8.	27	39	48	107
Baltimore	n.a.	n.a.	57	57	105
Boston	n.a.	n.a.	69	69	100
Philadelphia	48	60	1.5	24	29

Source: Business Research & Economic Advisors, The Contribution of the North American Cruise Industry to the US economy in 2004, prepared for the International Council of Cruise Lines, August 2005. Norfolk data from City of Norfolk.

3.4.4.2 Ferry Boats

As mentioned earlier, the USCG vessel arrival data does not include information on vessels less than 150 GRT. As the majority of passenger and car ferries fall below this threshold, USCG data cannot reliably be used to analyze ferry traffic. Instead, information on ferry vessels and ferry routes was obtained from the National Ferry Database published online by the US Department of Transportation (USDOT), Bureau of Transportation Statistics. The National Ferry Database is a

[29] The North American cruise industry is defined as those cruise lines that primarily market their cruises in North America.

comprehensive inventory of existing ferry operations in the US and its possessions. The data were collected as part of a survey conducted by the Federal Highway Administration from March 1, 2000, to September 30, 2000.

The 224 ferry operators surveyed provided services on 487 nonstop ferry route segments comprising 352 ferry routes and serving 578 ferry terminal locations with 677 ferry vessels. Based on the National Ferry Database, 261 ferry vessels operating on the East Coast in 2000 were identified Data Chart 3-9. (A complete inventory of ferry vessels operating in each state including the type of service [passenger, RoRo, or Rail], typical speed, vessel length and gross tonnage is presented in Appendix E). New York State had 65 ferry vessels in operation; Massachusetts had 36, North Carolina 35, and Maine 23. More than 64 percent of the ferry vessels (168) had an overall length of 65 feet or greater. With regard to speed, most ferry vessels can be considered either *conventional,* with typical speeds of 8-16 knots, or *high speed,* with typical speeds in excess of 25 knots.

Data Chart 3-9
Ferry Vessels Operating on the US East Coast by State, 2000

State	Number of Ferry Vessels	Ferry Vessels with LOA of 65 feet or greater	
		Number	Average speed (knots)
Maine	23	11	11.5
New Hampshire	2	2	n.a.
Massachussetts	36	37	16.5
Rhode Island	7	1	n.a.
Connecticut	17	14	19.3
New York	65	45	10.6
New Jersey	20	16	n.a.
Pennsylvania	3	1	n.a.
Delaware	10	7	16.4
Maryland	10	2	n.a.
Virginia	13	6	9.2
North Carolina	35	23	10.1
South Carolina	10	0	0.0
Georgia	4	1	10.0
Florida	6	2	6.0
Total	261	168	n.a.

Source: Prepared by Nathan Assoicates Inc from U.S. Department of Transportation, Bureau of Transportation Statistics, National Ferry Database as presented in Appendix C.

The National Ferry Database yielded information on 172 East Coast ferry routes in 2000 (Data Chart 3-10). New York State had the most routes (46). Massachusetts was next with 36 routes, followed by Maine (23 routes), and North Carolina (16 routes). Most of the ferry routes were within rivers, harbors, sounds, or bays; only 10 of the 172 routes extended into the Atlantic Ocean. Only the latter have any potential to be affected by the proposed action. Further information on each of the ferry routes including the metro area served, water body crossed, type of service, number of passengers and vehicles served, and beginning and end of season service is presented in Appendix E (The table refers to Appendix C of the Economic Report, not the DEIS).

Data Chart 3-10
Ferry Routes Operating on the US East Coast by State, 2000

State	Number of Routes	Routes via Atlantic Ocean
Maine	23	5
New Hampshire	1	1
Massachussetts	36	4
Rhode Island	7	0
Connecticut	5	0
New York	46	0
Pennsylvania	1	0
Delaware	4	0
Maryland	7	0
Virginia	12	0
North Carolina	16	0
South Carolina	6	0
Georgia	4	0
Florida	4	0
Total	172	

Source: Prepared by Nathan Assoicates Inc from U.S. Department of Transportation, Bureau of Transportation Statistics, National Ferry Database as presented in Appendix C.

3.4.5 Whale Watching Industry

In 2000, there were 36 whale watching operations permitted and registered in New England alone (Data Chart 3-11).[30] It is estimated that more than 1.2 million passengers participated in whale watching tours in 2000, generating more than $30 million in revenues. Massachusetts accounted for nearly 80 percent of the New England totals for both passengers and revenues. The peak months for whale watching in New England are July and August, although the season spans from late spring to early fall.

Data Chart 3-11
Characteristics of the New England Whale Watching Industry, 2000

State	Number of Operations	Number of Vessels	Annual Ridership	Annual Revenue ($ millions)
Massachusetts	17	30-35	1,000,000	$24.0
New Hampshire	4	6-10	80,000	$1.9
Maine	14	18-24	137,500	$4.4
Rhode Island	1	1	12,500	$0.3
Total	36	55-70	1,230,000	$30.6

Source: Hoyt, Erich Whale Watching 2000: Worldwide Tourism Numbers, Expenditures and Expanding Socioeconomic Benefits, 2000.

[30] Although whale watching operations exist in the mid- and south-Atlantic states, the degree of activity is smaller and cannot be reliably distinguished from tours to view other species such as dolphins.

Whale watching ships operate out of Bar Harbor, Boothbay, Portland, and Kennebunkport in Maine; and Newburyport, Hyannis, Salem, Provincetown, Boston, Plymouth, and Gloucester in Massachusetts. A 4–6 hour trip averages $30–$40. Vessels range in size from zodiacs to larger vessels, up to 80 ft (24.4 m). Some companies have more than one vessel and also operate charter fishing trips or other types of sightseeing tours.

Along the East Coast outside of New England, whale watching is a less important activity: in 2005, out of 49 East Coast companies, one was in New York State, six in New Jersey, and two in Virginia against 21 in Massachusetts, 15 in Maine, three in New Hampshire, and one in Rhode Island.

By definition, whale watching vessels operate within whale habitats. Currently, they must adhere to a 500-yard (457 m) “no approach” regulation for right whales (50 CFR 222.32). NOAA has also developed whale watching guidelines for the northeastern region of the US. The operational guidelines vary depending on the distance of the vessel from the whales. The distances range from 1 to 2 miles away all the way into 100 ft (30.5 m), in which intentional approach is prohibited. The details of these approach guidelines can be found at the following web address: *http://www.nero.noaa.gov/shipstrike/info/guidetxt.htm*.

3.4.6 Charter Vessel Operations

The charter fishing industry along the US East Coast is particularly active in the Carolinas, Virginia, Florida, New Jersey, and Massachusetts. The industry consists of half-day charters of about 6 hours that typically go up to 20 nm (37 km) off shore, full-day charters between 11 and 12 hours that can go out to 40 nm (74 km) offshore, and extended full day charters that can be from 18 to 24 hours and go up to 50 nm (92.6 km) off shore. The vast majority of the charter fishing industry consists of modern and well-equipped fishing boats of less than 65 ft (19.8 m) length overall (LOA); these vessels would not be subject to the strategy.

Some of the target species off the East Coast inshore and offshore waters include cod, Pollock, bluefish, mackerel, fluke, tautog, striped bass, drumfish, croaker, weakfish, sharks, marlin, swordfish, mahi mahi, wahoo, and tuna. Some of these fisheries are seasonal and charter trips are also contingent on the season in temperate states.

A small segment of the industry referred to as headboats often uses vessels of 80 ft (24.4 m) LOA and above that can accommodate 60 to 100 passengers. These vessels go up to 50 nm (92.6 km) offshore and stop and anchor over wreck and rock formations for fishing species such as red snapper, grouper, triggerfish, and amberjack. The charter fee for a headboat is typically $50 to $80 per person. Table 3-11 shows the number of charter and party boat trips in 2003 and 2004 by state.

Table 3-11
Number of Charter Boat Trips, 2003 & 2004

State	Number of Trips	
	2003	2004
Maine	14,246	52,098
New Hampshire	35,376	39,648
Massachusetts	145,303	154,785
Rhode Island	60,371	45,140
Connecticut	63,570	40,468
New York	405,533	399,045
New Jersey	465,975	468,865
Delaware	37,685	56,297
Maryland	186,916	250,795
Virginia	86,243	94,122
North Carolina	173,573	177,380
South Carolina	39,290	39,284
Georgia	12,190	18,526
East Florida	186,678	179,481

Source: NMFS – Marine Recreational Fisheries Statistics Survey
Note: The number of trips for the states in the north- and mid-Atlantic include party and charter boats.

3.4.7 Demographic Profiles

This section briefly describes the demographic environment of the 26 port areas most likely to be affected by the proposed action based on Census 2000 data. The census area chosen for each port area varied with its size and is as follows:

- Eastport: Washington County, ME
- Searsport: Knox, Hancock, and Waldo Counties, ME
- Portland: York, Cumberland, and Sagadahoc, ME
- Portsmouth: Strafford and Rockingham Counties, NH
- Boston: Middlesex, Suffolk, Norfolk, and Plymouth Counties, MA
- Salem: Essex County, MA
- Cape Cod: Barnstable County, MA
- New Bedford: Bristol County, MA
- Providence: Providence, Bristol, Kent, Newport, and Washington Counties, RI
- New London: New London County, CT
- New Haven: New Haven County, CT
- Bridgeport: Fairfield County, CT
- Long Island: Nassau and Suffolk Counties, NY
- New York City: Bronx, Kings, New York, Putnam, Queens, Richmond, Rockland, and Westchester Counties, NY; Bergen, Essex, Hudson, Middlesex, Monmouth,

Morris, Ocean, Passaic, Somerset, Sussex, and Union Counties, NJ; and Pike County, PA

- Philadelphia: Philadelphia, Montgomery, Delaware, Chester, and Buck Counties, PA; New Castle, Burlington, Camden, Gloucester, and Salem Counties, NJ; and Cecil County, MD
- Baltimore: Anne Arundel, Baltimore, Carroll, Harford, Howard, Queen Anne's Counties, and Baltimore City, MD
- Hampton Roads: Matthews, Gloucester, James City, Surry, Isle of Wight, and Suffolk Counties, VA; Williamsburg, Newport News, Poquoson, Hampton, Norfolk, Portsmouth, Virginia Beach, and Chesapeake cities, VA; and Currituck County, NC
- Morehead City: Carteret and Beaufort Counties, NC
- Wilmington: Pender, New Hanover, and Brunswick Counties, NC
- Georgetown: Georgetown County, SC
- Charleston: Berkeley, Dorchester, and Charleston Counties, SC
- Savannah: Effingham, Bryan, and Chatham Counties, GA
- Brunswick: McIntosh, Glynn, and Brantley Counties, GA
- Fernandina: Nassau County, FL
- Jacksonville: Duval, St. Johns, Clay, and Baker Counties, FL
- Port Canaveral: Brevard County, FL

General demographic characteristics are presented in Data Chart 3-12. Data on income, employment, and poverty status are presented in Data Chart 3-13.

In 2000, the 26 port areas under consideration taken together were home to almost 40 million people, or 14.2 percent of the total US population. Racial distribution differed somewhat from that of the national population, with higher percentages of African-Americans and, to a smaller degree, people of Asian descent (17 and 5 percent respectively, as opposed to 12.3 and 3.6 for the US as a whole).

There were, however, wide variations from port to port both in total population and racial makeup, from Eastport, Maine, with about 34,000 residents, 93 percent of whom were white to the New York City area with 15.6 million residents, only 58 percent of them white. Nine out of the 26 ports considered are proportionately smaller white populations than the US as a whole, all of them south of and including New York City.

The 26 ports had proportionately a slightly smaller Hispanic population than the US as a whole (11.5 against 12.5 percent), but here also, there were wide differences, from less than one percent (0.9) Hispanics in Eastport, Maine, to more than 21 percent in New York City.

Data Chart 3-12
US East Coast Port Areas: Demographic Characteristics, 2000

Port	Area	Population 2000	Racial Distribution (Percentage) White Alone	Black or African American Alone	Asian Alone	Other[(a)]	Percentage of Population that is Hispanic or Latino[(b)]
Eastport	ME	33,941	93.4	0.3	0.5	5.8	0.9
Searsport	ME	127,689	97.8	0.2	0.3	1.7	0.6
Portland	ME	487,568	96.6	0.7	0.9	1.7	0.9
Portsmouth	NH	389,592	96.7	0.6	1.1	1.6	1.2
Boston	MA	3,278,333	81.8	7.3	5.5	6.2	6.0
Salem	MA	723,419	86.4	2.5	2.4	8.8	11.0
Cape Cod	MA	222,230	94.3	1.5	0.6	3.5	1.3
New Bedford	MA	534,678	91.0	2.0	1.4	5.6	3.6
Providence	RI	1,048,319	85.0	4.3	2.3	8.4	8.6
New London	CT	259,088	86.9	5.1	1.9	6.2	5.2
New Haven	CT	824,008	79.3	11.2	2.4	7.1	5.0
Bridgeport	CT	882,567	79.2	10.0	3.2	7.6	11.8
Long Island	NY	2,753,913	82.0	8.4	3.5	6.1	10.3
New York	NY	15,569,089	58.0	19.7	8.1	14.2	21.1
Philadelphia	PA	5,687,147	72.6	19.7	3.3	4.5	5.0
Baltimore	MD	2,552,994	67.4	27.2	2.7	2.7	2.0
Hampton Roads	VA	1,576,370	62.4	30.9	2.7	4.0	3.1
Morehead City – Beaufort	NC	104,341	80.7	16.7	0.4	2.3	2.1
Wilmington	NC	274,532	79.5	17.0	0.6	2.8	2.5
Georgetown	SC	55,797	59.6	38.7	0.3	1.4	1.5
Charleston	SC	549,033	65.2	30.5	1.4	2.9	2.4
Savannah	GA	293,000	61.1	34.9	1.6	2.4	2.0
Brunswick	GA	93,044	73.4	23.7	0.7	2.2	2.4
Fernandina	FL	57,663	90.1	7.4	0.7	1.8	1.8
Jacksonville	FL	1,065,087	71.9	22.2	2.3	3.6	3.9
Port Canaveral	FL	476,230	86.7	8.1	1.5	3.7	4.6
Total All Areas		**39,919,672**	**69.5**	**17**	**5**	**8.5**	**11.5**
United States		**281,421,906**	**75.1**	**12.3**	**3.6**	**9**	**12.5**

(a) Includes American Indian and Alaska Native alone, Native Hawaiian and Other Pacific Islander alone, some other race alone and two or more races. Source: US Census Data, Census 2000, data set SF-3. (b) A self-designated classification for people whose origins are from Spain, the Spanish-speaking countries of Central or South America, the Caribbean, or those identifying themselves generally as Spanish, Spanish-American, etc. Origin can be viewed as ancestry, nationality, or country of birth of the person or person's parents or ancestors prior to their arrival.

Data Chart 3-13
US East Coast Ports: Socioeconomic Characteristics, 2000

Port Area	Labor Force Participation Rate[(a)]	Unemployment Rate[(b)]	Median Household Income (% of US MHI) [(c)]	Per Capita Income (% of US PCI) [(d)]	Number of People Occupied in Rail, Water and Other Transportation Occupations[(e)]	Percentage of People Below Poverty Line
Eastport, ME	57.0	8.5	25,869 (61.6)	14,119 (65.4)	23	19.0
Searsport, ME	63.9	4.8	35,606 (84.8)	19,189 (88.9)	308	11.3
Portland, ME	68.7	3.5	43,736 (104.1)	22,648 (104.9)	1,031	8.0
Portsmouth, NH	72.5	3.1	54,291 (129.3)	24,877 (115.2)	653	5.8
Boston, MA	67.3	4.2	55,882 (133.1)	28,755 (133.2)	4,289	8.8
Salem, MA	65.5	4.6	51,576 (122.8)	26,358 (122.1)	991	8.9
Cape Cod, MA	58.9	5.1	45,933 (109.4)	25,318 (117.3)	508	6.9
New Bedford, MA	65.8	5.8	43,496 (103.6)	20,978 (97.2)	806	10.0
Providence, RI	64.6	5.6	42,370 (100.9)	21,688 (100.5)	1,346	11.9
New London, CT	67.8	3.9	50,646 (120.6)	24,678 (114.3)	516	6.4
New Haven, CT	65.5	5.9	48,834 (116.3)	24,439 (113.2)	1,015	9.5
Bridgeport, CT	66.0	4.8	65,249 (155.4)	38,350 (177.7)	611	6.9
Long Island, NY	64.3	3.8	68,579 (163.3)	29,278 (135.6)	4,433	5.6
New York, NY	60.8	7.4	48,417 (115.3)	25,693 (119.0)	24,848	15.1
Philadelphia, PA	64.2	6.1	49,077 (116.9)	23,972 (111.0)	7,755	10.8
Baltimore, MD	66.4	4.9	50,572 (120.4)	24,398 (113.0)	3,261	9.8
Hampton Roads, VA	67.9	5.0	43,086 (102.6)	20,313 (94.1)	3,342	10.6
Morehead City - Beaufort, NC	58.7	5.5	35,284 (84.0)	19,305 (89.4)	444	14.5
Wilmington, NC	63.0	5.4	38,438 (91.5)	21,469 (99.5)	546	13.0
Georgetown, SC	58.2	6.2	35,312 (84.1)	19,805 (91.7)	70	17.1
Charleston, SC	64.5	5.3	39,232 (93.4)	19,772 (91.6)	942	14.0
Savannah, GA	63.6	5.4	39,558 (94.2)	20,752 (96.1)	758	14.5
Brunswick, GA	63.0	5.5	36,539 (87.0)	19,581 (90.7)	137	15.6
Fernandina, FL	63.9	4.7	46,022 (109.6)	22,836 (105.8)	75	9.1
Jacksonville, FL	66.8	4.6	42,825 (102.0)	21,567 (99.9)	2,016	10.8
Port Canaveral, FL	57.4	4.9	40,099 (95.5)	21,484 (99.5)	746	9.5
United States	63.9	3.7	41,994	21,587		12.4

(a) The labor force includes all people classified in the civilian labor force, plus members of the US Armed Forces (people on active duty with the United States Army, Air Force, Navy, Marine Corps, or Coast Guard). The Civilian Labor Force consists of people classified as employed or unemployed.

(b) All civilians16 years old and over are classified as unemployed if they (1) were neither "at work" nor "with a job but not at work" during the reference week, and (2) were actively looking for work during the last 4 weeks, and (3) were available to accept a job. Also included as unemployed are civilians who did not work at all during the reference week, were waiting to be called back to a job from which they had been laid off, and were available for work except for temporary illness.

(c) In 1999.

(d) In 1999.

(e) From employed civilian population 16 years and over.

Source: US Census Data, Census 2000.

As demonstrated in Data Chart 3-13 and Figure 3-11, economic conditions varied substantially from port to port. At one end of the spectrum, one port area, Eastport, Maine, showed clear signs of economic weakness for all indicators compared to the US as a whole as well as to the other port areas under consideration. Conversely, indicators in areas like Bridgeport, Connecticut, and Long Island, New York, were much better than in the nation at large. Only three areas had an unemployment rate under the national rate (Portland, Maine; Portsmouth, New Hampshire; Long Island, New York). All other port areas had higher unemployment rates, up to 8.5 percent in Eastport, but generally in the 4 to 6 percent range.

The median household income in 1999 for the port areas of Long Island ($68,579) and Bridgeport, CT ($65,249), was well above that for the nation as a whole and more than 2.5 times the level of median household income reported for Eastport, Maine ($25,869) (Figure 3-12). Of the 26 areas considered, 17 had a median household income higher that that of the US as a whole, and 14 had a higher per capita income (Figure 3-13). In general, incomes were higher in the north than in the south: with the exception of Eastport, ME, and Searsport, ME, the median household income in all port areas from Hampton Roads to the north exceeded $40,000. With the exception of Fernandina, FL, and Jacksonville, FL, all port areas south of Hampton Roads had a median household income under $40,000.

Eight of the 16 port areas had rates of poverty exceeding the national rate, with the highest percentages in Eastport, ME (19.0 percent), Georgetown, SC (17.1 percent), Brunswick, GA, (15.6 percent) and New York City (15.1 percent) (Figure 3-14). The port areas with the lowest percentage of people below the poverty were Long Island (5.6 percent), Portsmouth, NH (5.8 percent), New London, CT (6.4 percent), and Bridgeport, CT (6.9 percent).

3.4.8 EO 12898 – Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires Federal agencies to take appropriate and necessary steps, to the greatest extent practicable and permitted by law, to identify and address disproportionately high and adverse effects of Federal projects on the health or environment of minority and low-income populations.

In order to determine whether a potentially affected Environmental Justice community is present within the study area, Council on Environmental Quality guidance on Environmental Justice (CEQ, 1997) offers the following guidelines:

- The minority population of the affected area exceeds 50 percent.
- The minority population percentage of the affected area is meaningfully greater than the minority population of the general population or other appropriate unit of geographic analysis.
- Low-income populations in an affected area should be identified with the annual statistical poverty thresholds from the Bureau of the Census's current Populations Report, Series P-60.

U.S. East Coast Unemployment Rate, 2000

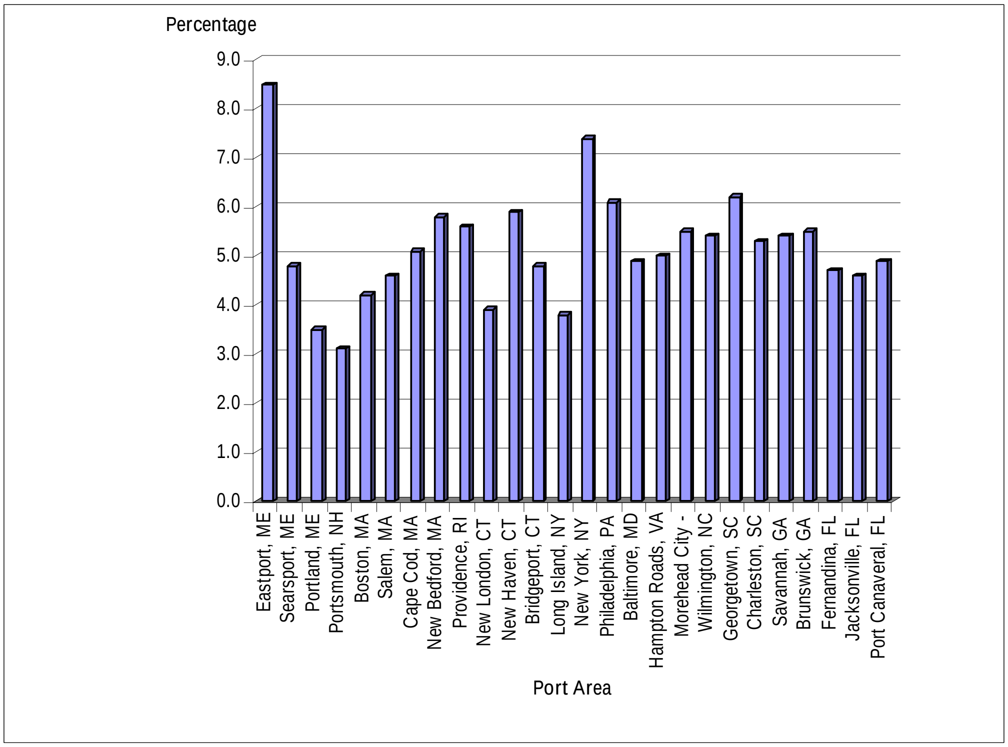

Figure 3-11

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U.S. East Coast Port Areas: Median Household Income, 1999

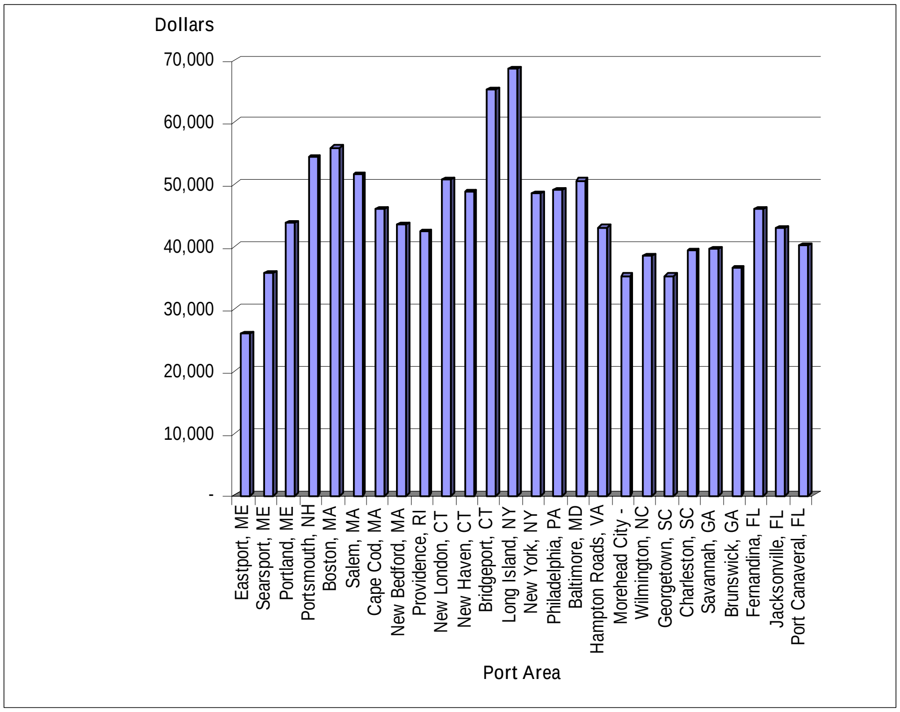

Figure 3-12

U.S. East Coast Port Areas: Per-Capita Income, 1999

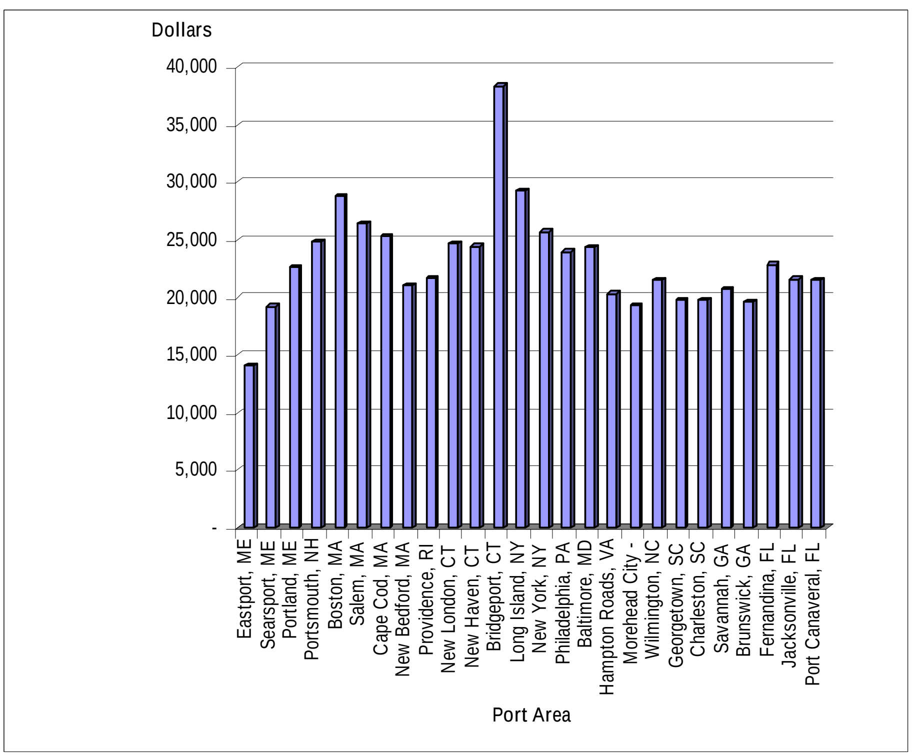

Figure 3-13

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U.S. East Coast Port Areas: Percentage of People below the Poverty Line, 2000

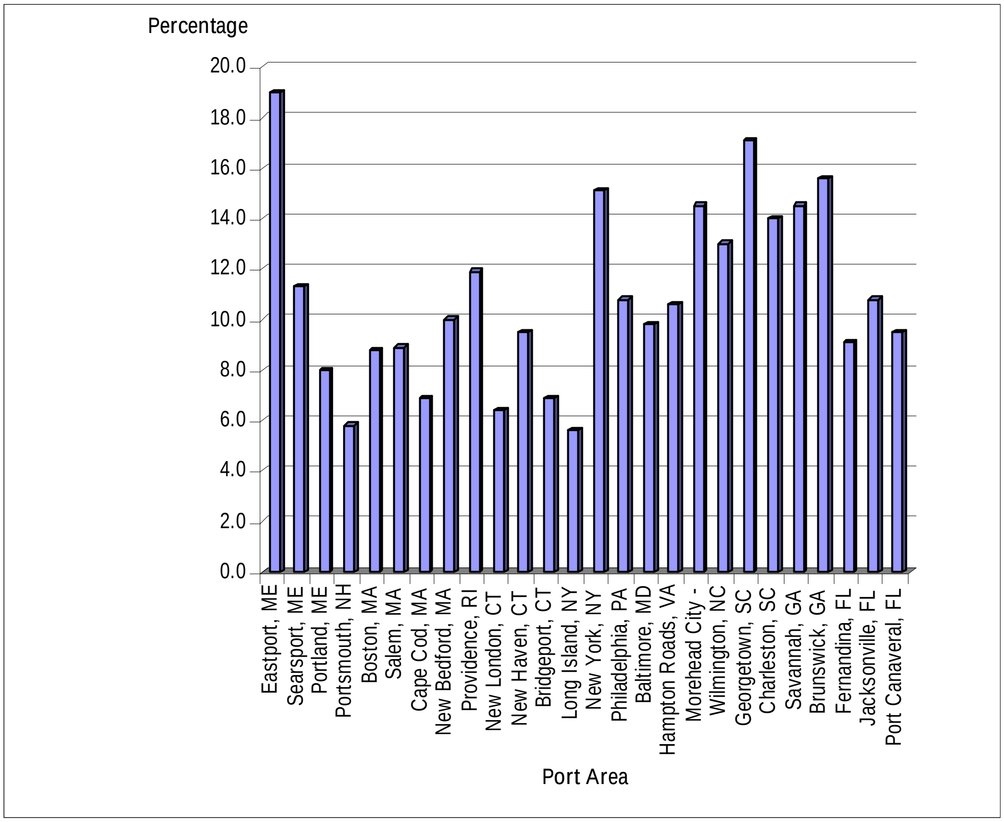

Figure 3-14

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Table 3-12 lists the minority percentages in each area potentially affected by one or more of the proposed regulations in the strategy. There was one area were the minority population exceeded 50 percent: New York. Minority (nonwhite or white Hispanic) population represented 30.9 percent of the US population in 2000. Six of the port areas had proportionately larger minority population than the US as a whole: New York (50.7 percent), Hampton Roads (38.9 percent), Georgetown (41 percent), Charleston (35.9 percent), Savannah (39.8 percent), and Baltimore (33.7 percent).

Table 3-12
Minority Populations within the Scope of the Strategy

Area	% Nonwhite	% Hispanic	% Minority (nonwhite or white Hispanic)
Eastport, ME	6.52	0.81	7
Searsport, ME	2.10	0.61	2.5
Portland, ME	3.51	0.87	4
Portsmouth, NH	3.35	1.15	4.2
Boston, MA	19.01	6.02	21.6
Salem, MA	13.56	11.04	16.9
Cape Cod, MA	5.77	1.35	6.6
New Bedford, MA	9.02	3.60	10.6
Providence, RI	14.99	8.66	18.2
New London, CT	13.00	5.11	15.4
New Haven, CT	20.60	10.09	25.3
Bridgeport, CT	20.69	11.88	27
Long Island, NY	17.97	10.27	23.6
New York, NY	42.02	21.09	50.7
Philadelphia, PA	27.45	5.03	29.4
Baltimore, MD	32.65	2.01	33.7
Hampton Roads, VA	37.60	3.11	38.9
Morehead City, NC	19.13	2.39	20.4
Wilmington, NC	20.53	2.45	21.6
Georgetown, SC	40.31	1.65	41
Charleston, SC	34.90	2.38	35.9
Savannah, GA	38.76	2.18	39.8
Brunswick, GA	26.70	2.44	28.1
Fernandina, FL	9.98	1.51	11.1
Jacksonville, FL	28.06	3.91	30.3
Port Canaveral, FL	13.19	4.61	16.4
TOTAL ALL AREAS	**30.51**	**11.65**	**35.9**
TOTAL US	**24.86**	**12.55**	**30.9**

Source: US Census Data, Census 2000, Data set SF-1, Table DP1.

Table 3-13 lists the percentages of people living under the poverty level based on Census 2000 data. The average percentage of people living in poverty in the US as a whole was 12.4. While the number for the 26 port areas together was lower, eight areas had higher percentages: Eastport (19 percent), New York City (15.1 percent), Morehead City (14.5 percent), Wilmington (13 percent), Georgetown (14 percent), Charleston (14 percent), Savannah (14.5 percent), and Brunswick (15.6 percent). These areas, therefore, will be considered as Environmental Justice communities for the purposes of this EIS.

Table 3-13
Poverty Levels within the Scope of the Strategy

Area	# Poverty Determined	# in Poverty	% in Poverty
Eastport, ME	32,985	6,272	19.0
Searsport, ME	124,390	13,997	11.3
Portland, ME	476,960	38,369	8.0
Portsmouth, NH	381,112	22,080	5.8
Boston, MA	3,167,516	277,649	8.8
Salem, MA	706,651	63,137	8.9
Cape Cod, MA	218,058	15,021	6.9
New Bedford, MA	521,285	52,236	10.0
Providence, RI	1,010,000	120,548	11.9
New London, CT	247,198	15,780	6.4
New Haven, CT	797,702	75,733	9.5
Bridgeport, CT	865,257	59,689	6.9
Long Island, NY	2,707,916	151,802	5.6
New York, NY	15,276,079	2,299,973	15.1
Philadelphia, PA	5,528,515	598,949	10.8
Baltimore, MD	2,486,691	243,792	9.8
Hampton Roads, VA	1,507,652	160,249	10.6
Morehead City, NC	102,902	14,910	14.5
Wilmington, NC	268,858	34,969	13.0
Georgetown, SC	55,263	9,439	17.1
Charleston, SC	531,170	74,504	14.0
Savannah, GA	284,788	41,216	14.5
Brunswick, GA	91,946	14,376	15.6
Fernandina, FL	56,772	5,192	9.1
Jacksonville, FL	1,042,976	112,924	10.8
Port Canaveral, FL	466,775	44,218	9.5
TOTAL ALL AREAS	**38,957,417**	**4,567,024**	**11.7**
TOTAL US	**273,882,232**	**33,899,812**	**12.4**

Therefore, based on the data above, a total of ten of the 26 port areas considered constitute Environmental Justice communities on account either of race or poverty: Eastport, New York City, Baltimore, Hampton Roads, Morehead City, Wilmington, Georgetown, Charleston, Savannah, and Brunswick.

Cultural Resources

Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires Federal agencies to take into account the effects of their undertakings on historic properties (any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places). This includes Native American and Native Hawaiian tribal properties and values.

The proposed action would only affect the operations of certain vessels 65 feet (19.8 m) and longer and has no component that could have an impact on known or unknown, on land or under water cultural resources. Under 36 CFR 800.3(a)(1), if the undertaking considered is a type of activity that does not have the potential to cause effects on historic properties, assuming such properties were present, the agency official has no further obligations under Section 106.

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