Final Environmental Impact Statement
to Implement Vessel Operational Measures to Reduce Ship Strikes to North Atlantic Right Whales

August 2008

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Prepared for:
National Oceanic and Atmospheric Administration (NOAA)
National Marine Fisheries Service (NMFS)
Office of Protected Resources

In accordance with:
NOAA Administrative Order Series 216-6:
Environmental Review Procedures for Implementing
The National Environmental Policy Act (NEPA)

Pursuant to:
The National Environmental Policy Act of 1969

Final Environmental Impact Statement To Implement Vessel Operational Measures to Reduce Ship Strikes to North Atlantic Right Whales

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Abstract

The National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) proposes to implement vessel operational measures to reduce the occurrence and severity of vessel collisions with endangered western North Atlantic right whales (*Eubalaena glacialis*). The proposed action addresses the lack of recovery of the North Atlantic right whale population by reducing the probability and threat of ship strike related deaths and serious injuries to the species. This final environmental impact statement (FEIS) analyzes the potential environmental impacts of implementing five alternative sets of vessel operational measures and the No Action Alternative.

Comments must be submitted no later than September 29, 2008
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EXECUTIVE SUMMARY

The National Oceanic and Atmospheric Administration (NOAA)'s National Marine Fisheries Service (NMFS) has prepared this final environmental impact statement (FEIS) pursuant to the National Environmental Policy Act (NEPA) of 1969, the Council on Environmental Quality (CEQ) Regulations for Implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508), and the NOAA environmental review procedures (NOAA Administrative Order 216-6).

ES.1 Proposed Action

The proposed action is to implement vessel operational measures in waters off the East Coast of the United States to reduce vessel collisions with the endangered North Atlantic right whale. Due to regional differences in right whale distribution and behavior, oceanographic conditions, and ship traffic patterns, the proposed vessel operational measures would apply only in certain areas and at certain times of the year, or under certain conditions. To account for regional variations, the US East Coast is divided into three regions: northeastern United States (NEUS), mid-Atlantic United States (MAUS), and southeastern United States (SEUS). All vessels 65 ft (19.8 m) and greater in overall length and subject to US jurisdiction would be required to abide by the operational measures, except for vessels owned or operated by, or under contract to the Federal government, and law enforcement vessels of a state, or political subdivision thereof, when engaged in enforcement or human safety missions. An additional exemption would apply for vessels to maintain safe maneuvering speed under certain conditions. The measures considered include the following:

- **Seasonal Management Areas (SMAs).** SMAs are predetermined and established areas within which seasonal speed restrictions apply.
- **Dynamic Management Areas (DMAs).** DMAs are temporary areas consisting of a circle around a confirmed right whale sighting. The radius of this circle expands incrementally with the number of whales sighted and a buffer is included beyond the core area to allow for whale movement. Speed restrictions apply within DMAs, which may be mandatory or voluntary and apply only when and where no SMA is in effect.
- **Routing Measures.** These consist of a set of routes designed to minimize the co-occurrence of right whales and ship traffic. Use of these routes is voluntary; therefore, they constitute a non-regulatory measure. However, mandatory speed restrictions would apply in the portions of the routes located within an active SMA. NMFS would monitor these routes and consider making them mandatory if use is low.

Within the proposed SMAs (when in effect) and DMAs (when in effect), NMFS' proposed restriction is 10 knots; however, for comparison purposes, the FEIS also considers speed limits of 12 and 14 knots.

Not all measures are considered for all regions: the specific measures considered for each of the three regions of implementation are shown in Table ES-1. Each of the action alternatives evaluated in the FEIS, including Alternative 6, the proposed action, include one or more of the measures. Table ES-1 also shows which alternatives include each measure.

Table ES-1
Summary of Proposed Operational Measures by Region

Region	Proposed Measures	Period of Application	Included in Alternative
Southeast (SEUS)	Southeast SMA off the coast of Georgia and Florida, bounded to the north by latitude 31º27'N, to the south by latitude 29º45'N, to the east by longitude 80º51.6'W, and to the west by the shoreline.	November 15 to April 15	6
	or		
	SMA including all waters within the Mandatory Ship Reporting System (MSRS) WHALESSOUTH reporting area and the presently-designated right whale critical habitat	November 15 to April 15	3 and 5
	and/or		
	Recommended routes into and out of the ports of Jacksonville and Fernandina Beach, Florida, and Brunswick, Georgia.	Year-round	4,5, and 6
Mid-Atlantic (MAUS)	Six Separate SMAs, including under one option a 30-nm (56-km)-wide rectangular SMA south and east of the mouth of Block Island Sound; SMAs with a 20-nm (37-km) radius around the entrances to the ports of New York/New Jersey, the Delaware Bay and Chesapeake Bay, and Morehead City and Beaufort, North Carolina; finally, a continuous SMA from the shore out to 20 nm (37 km) from Wilmington, NC, south to Brunswick, GA. Under another option, the 20-nm SMAs would be 30-nm (56-km) in size.	November 1 to April 30	6 (20-nm SMAs Option)
	or		
	One continuous 25-nm SMA between Block Island Sound and Savannah, GA	October 1 to April 30	3 and 5

Region		Proposed Measures	Period of Application	Included in Alternative
Northeast (NEUS)	Cape Cod Bay	CCB SMA, covering the entire bay, including the Cape Cod Bay critical habitat and the area directly west of the critical habitat to the shoreline	January 1 to May 15	6
		or		
		Critical Habitat SMA, coinciding with the designated critical habitat	Year-round	3 and 5
		and/or		
		Recommended Routes from Cape Cod Canal through the Critical Habitat, on the western side of the bay, towards Massachusetts Bay and other points north	Year-round	4,5, and 6
	Off Race Point	Off Race Point SMA, an area approximately 50 by 50 nm (93 by 93 km) in size to the north and east of Cape Cod	March 1 to April 30	6
		or		
		SAM West SMA, coinciding with the expanded Seasonal Area Management (SAM) West identified in the Atlantic Large Whale Take Reduction Plan (ALWTRP)	Year-round	3, and 5
	Great South Channel	GSC SMA, within a defined area of the Great South Channel	April 1 to July 31	6
		or		
		SAM East SMA, coinciding with the expanded Seasonal Area Management (SAM) East identified in the ALWTRP	Year-round	3 and 5
All Three Regions		Mandatory DMAs throughout the EEZ	Year-round	2 and 5
		or		
		Voluntary DMAs throughout the EEZ	Year-round	6

ES.2 Purpose and Need

NMFS' purpose and need for the vessel operational measures considered in the FEIS is to reduce the occurrence and severity of vessel collisions with North Atlantic right whales, thereby contributing to the recovery and sustainability of the species while minimizing adverse effects on the shipping industry and maritime commerce.

NMFS has authority and responsibility under both the ESA and the MMPA to protect the endangered North Atlantic right whale. Although various measures to reduce ship strikes have been in place for several years, these measures have not significantly reduced the number of vessel collisions with right whales. A continued lack of recovery, and possibly extinction, will occur if deaths from ship strikes are not reduced. Therefore, additional action is needed for NMFS to fulfill its responsibility. Collision with vessels is the primary anthropogenic cause of serious injuries and deaths to right whales. Therefore, NMFS is proposing to reduce this threat by taking the regulatory approach expected to be most effective at facilitating population recovery while minimizing adverse economic impacts. The proposed action consists of vessel operational measures that would impose regulatory speed restrictions and provide for nonregulatory routing measures on specific vessel classes to reduce the ship-strike threat to right whales without imposing an undue economic burden on the shipping industry. The combination of speed restrictions and reducing the co-occurrence of right whales and vessel traffic is expected to be an effective means to reduce the occurrence and severity of ship strikes and promote population growth and recovery.

ES.3 Alternatives

As a result of public comment and additional research, the alternatives have evolved from those originally proposed in the notice of intent (NOI) to prepare a draft environmental impact statement (DEIS), to those in the DEIS, and the final alternatives in the FEIS. With the exception of Alternative 1, each of the alternatives would enact one or more of the vessel operational measures summarized in Table ES-1. Table ES-2 summarizes the alternatives. In addition to the alternatives described below, the FEIS incorporates by reference DEIS alternative 6 (preferred alternative of the DEIS) and associated analyses.

Table ES-2
Summary of Alternatives Considered in the FEIS

Operational Measure	Alternative					
	1	2	3	4	5	6[1] (Proposed Action)
Recommended Routes	No	No	No	Yes	Yes	Yes
DMAs	No	Yes, mandatory	No	No	Yes, mandatory	Yes, voluntary
SMAs	No	No	Yes, SAM East, SAM West, and Critical Habitat SMAs; Continuous 25-nm SMA; MSRS WHALES-SOUTH/Critical Habitat SMA	No	Yes, SAM East, SAM West, and Critical Habitat SMAs; Continuous 25-nm SMA; MSRS WHALES-SOUTH/Critical Habitat SMA	Yes, CCB SMA, Off Race Point SMA, GSC SMA, Separate SMAs (20-nm SMAs option), Southeast SMA

ES.3.1 Alternative 1 – No Action

No new operational measures would be implemented under the No Action Alternative. NMFS would continue to implement existing measures and programs to reduce the likelihood of ship strikes. Research would continue and existing technologies would be used to determine whale locations and disseminate this information to mariners. Non-regulatory actions may be taken and existing conservation measures would remain active.

ES.3.2 Alternative 2 – Mandatory Dynamic Management Areas

Alternative 2 would incorporate the elements of Alternative 1 (i.e., continuing existing conservation measures) plus the mandatory DMA component of the proposed operational measures. Compliance with DMAs would be mandatory because DMAs are a stand-alone measure under this alternative. DMAs would be defined, as warranted by right whale sightings in all US territorial waters and within the Exclusive Economic Zone (EEZ) along the East Coast.

[1] The operational measures proposed under Alternative 6 will expire 5 years from their date of effectiveness.

ES.3.3 Alternative 3 – Speed Restrictions in Designated Areas

Alternative 3 includes the elements of Alternative 1 plus the following measures:

- In the SEUS region, the MSRS WHALESSOUTH/Critical Habitat SMA.
- In the MAUS region, the Continuous 25-nm SMA Option.
- In the NEUS region, the SAM West, SAM East, and Critical Habitat SMAs.

SMAs would be larger or last longer under Alternative 3 than under the other alternatives that include SMAs.

ES.3.4 Alternative 4 – Recommended Shipping Routes

This alternative includes all the elements of Alternative 1 plus the recommended routes for the SEUS and the NEUS regions. This alternative does not include speed restrictions. No measures would apply to the MAUS region.

ES.3.5 Alternative 5 – Combination of Alternatives 1-4

All of the measures previously mentioned under Alternatives 1, 2, 3, and 4 would apply under Alternative 5.

ES.3.6 Alternative 6 – Proposed Action (Preferred Alternative)

Under Alternative 6, the proposed action, NMFS would implement the following operational measures:

- In the SEUS region, Southeast SMA and recommended routes.
- In the MAUS region, Separate SMAs (20-nm SMAs option)
- In the NEUS region, CCB SMA, Off Race Point SMA, and GSC SMA as well as recommended routes.
- In all three regions, Voluntary DMAs. (NMFS would evaluate the compliance rate and effectiveness of the DMA measures and use this information to inform future agency action, including consideration of mandatory DMAs.)

Additionally, the operational measures proposed under Alternative 6 would expire five years after their date of effectiveness.

ES.4 Impacts

In general, for alternatives in which speed restrictions apply, both the biological and economic impacts increase in magnitude with the speed restriction (e.g., 10 knots vs. 14 knots). In the first three sections below, the impacts of speed restrictions are discussed in general and not for 10, 12, and 14 knots specifically. All costs refer to estimated annual economic impacts based on vessel arrivals in 2004 (i.e., the costs reflect the impacts as if the operational measures had been in place in 2004). With regard to Alternative 6, because under this alternative the proposed operational measures would expire five years after they become effective, the economic impacts described in this section would only last five years. The major positive impacts on right whales also would occur only during the five years the measures would be effect.

ES.4.1 Impacts on the North Atlantic Right Whale

Alternative 1 would have significant, direct long-term, negative effects on the right whale population and recovery. Alternative 2 would have minor, direct, long-term, positive effects on the right whale population. Alternative 3 would have direct, long-term, positive effects on the right whale population. Alternative 4 would have direct, long-term, positive effects on right whales in the NEUS and SEUS, although it would offer no protection in the MAUS and does not include speed restrictions, therefore the overall effects would be minor. Alternative 5 would have significant, direct, long-term, positive effects on the right whale population; this alternative would provide the highest level of protection to the population. Alternative 6 would have major direct positive effects on the right whale population.

ES.4.2 Impacts on Other Marine Species

Alternative 1 would have indirect, long-term, adverse effects on marine mammals. Any positive impacts on sea turtles that would result from the proposed measures (see below) would not occur under the No Action alternative. Alternative 2 would have no significant effects on marine mammals and sea turtles. Alternative 3 would have minor, indirect, long-term, positive effects on marine mammals and sea turtles that occur in the designated areas with speed restrictions. Alternative 4 would result in minimal effects on marine mammals and sea turtles, depending on their distribution with respect to the recommended routes. Alternative 5 would have major, indirect, long-term, positive impacts on other marine mammals, although benefits to sea turtles would be less likely. Alternative 6 would also have indirect positive effects on marine mammals and sea turtles.

ES.4.3 Impacts on the Physical Environment

Alternative 1 would not affect bathymetry and substrate, water quality, air quality, or ocean noise levels. Alternatives 2 through 6 would not affect bathymetry and substrate. Alternative 2 would have negligible effects on water quality, and minor, direct positive impacts on air quality and ocean noise. Alternative 3 would have a negligible effect on water quality, direct, short-term positive impacts on air quality, and potentially direct, short- and long-term positive impacts on ocean noise levels. Alternative 4 would have negligible or minor adverse effects on water quality, no significant effects on air quality, and minimal, direct, short-term, adverse effects on ocean noise levels. Alternative 5 would have negligible or minor adverse effects on water quality, minor, direct, long-term, positive effects on air quality, and potentially minimal, direct, long-term, positive effects on ocean noise. Alternative 6 would have negligible impacts on water quality in the NEUS and minor adverse impacts in the SEUS, and minor, direct positive effects on both air quality and ocean noise.

ES.4.4 Impacts on Port Areas and Vessel Operations

Alternative 1 would not affect port areas or vessel operations. The other alternatives would have adverse impacts due to the additional operating costs resulting from compliance with speed restrictions and/or routing measures. The impacts detailed below are per year and were estimated based on 2004 port arrival data: that is, they reflect the costs associated with the proposed measure as if these measures had been in place in 2004 (the analysis in the main text also provides estimates based on 2003 conditions.). However, operating costs were updated to reflect 2008 fuel prices.

Alternative 2 would result in an estimated direct economic impact of $27.6 million annually with a 10-knot speed restriction, $17.7 million annually with a 12-knot restriction, and $10.8 million annually with a 14-knot restriction. Alternative 3 would result in an estimated total (including both direct and indirect impacts) annual economic impact of $301.4 million at 10 knots, $186.3 million at 12 knots, and $106 million at 14 knots. Alternative 4 would result in a direct economic impact of $2.8 million annually (no measures involving speed restrictions are proposed under this alternative). Alternative 5 would result in an estimated total annual economic impact of $326.3 million at 10 knots, $199.6 million at 12 knots, and $118 million at 14 knots. Alternative 6 would result in an estimated total economic impact of $120.1 million annually at 10 knots, $65.6 million annually at 12 knots, and $36.9 million annually at 14 knots.

To determine whether these increased shipping costs would significantly affect the price and volume of traded goods via East Coast ports, the estimated economic impacts were compared to the value of East Coast trade. At 10 knots, the Alternative 2 impact would represent 0.008 percent of total trade value; impacts from Alternatives 3 and 5 would represent 0.050 and 0.051 percent, respectively; Alternative 4 would have almost no impact relative to trade value (0.001 percent); and Alternative 6 impacts would represent 0.022 percent of trade value. These results indicate that implementation of the proposed operational measures would not have a measurable impact on the volume of merchandise traded through East Coast ports.

Ocean freight costs are considered a conservative proxy for shipping industry revenues, and thus can help assess the significance of the abovementioned costs for the shipping industry. For example, at 10 knots, the Alternative 2 impacts would represent 0.160 percent of ocean freight costs; Alternative 3 impacts would represent 0.940 percent; Alternative 4 impacts, 0.016 percent; Alternative 5 impacts, 0.968 percent, and Alternative 6 impacts 0.409 percent. These results indicate that implementation of the proposed operational measures would have a minimal impact on the financial revenues and hence the financial performance of the vessel operators calling at East Coast ports.

ES.4.5 Impacts on Commercial Fishing Vessels

There would be no impacts on commercial fishing vessels under Alternative 1. There would be negligible adverse impacts on commercial fishing vessels under Alternative 2 at any of the speed restrictions. Alternative 3 would not affect commercial fishing vessels at a 12- or 14- knot speed restriction, but there would be a measurable economic impact at a 10-knot speed restriction, estimated at $1.7 million annually. Alternative 4 would result in negligible impacts on commercial fishing vessels. Alternative 5 would result in the same impacts as Alternative 3. Alternative 6 would not affect vessels at a 12- or 14- knot speed restriction, but the economic impact at a 10-knot speed restriction would be $1.3 million annually, representing less than 0.2 percent of the East Coast commercial fishery landings for all vessels in 2004. Also, only fishing vessels 65 ft (19.8 m) long or more would be affected, and among those, only those vessels traveling at speeds more than 10 knots, which represent only 40 percent of the total. When compared to the total annual revenue generated in 2004 by these affected vessels only, the estimated annual impact would amount to 0.5 percent of this revenue.

ES.4.6 Impacts on Ferry Vessels and Ferry Passengers

The vast majority of passenger ferry vessels operate within inland waters that would not be affected by the proposed operational measures. Among the vessels that would be affected – specifically, those that operate in southern New England – impacts would vary depending on whether the companies utilize fast ferry services (with typical speeds ranging from 24 to 39 knots) or regular ferry services (with typical speeds ranging from 12 to 16 knots). The No Action Alternative would not affect ferry vessel operations. There would be direct, long-term, adverse impacts on ferry vessels under Alternative 2, in the amount of $8.1 million annually at 10 knots, $6.1 million annually at 12 knots, and $4.1 million annually at 14 knots. Alternative 3 would result in annual direct, long-term, adverse economic impacts in the amount of $13.0 million at 10 knots, $11.1 million at 12 knots, and $8.3 at 14 knots. Alternative 4 would not affect ferry vessels. Alternative 5 would result in the same impacts as Alternative 3. There would be direct adverse economic impacts on ferry vessels under Alternative 6, in the amount of $8.6 million annually at 10 knots, $6.6 million annually at 12 knots, and $4.6 million annually at 14 knots.

Under Alternative 6 with a 10-knot speed restriction, the annual impact on affected high-speed ferry operators would amount to 4.9 percent of the annual revenue generated by the affected vessels; the impact on affected regular-speed ferry operators would amount to 7.9 percent of the annual revenue of the affected vessels. These numbers assume 100 percent compliance with voluntary DMAs. Should ferry operators choose not to comply with DMA speed restrictions, however, then annual economic impacts would be $400,000 for high-speed ferries, or less than one percent of annual revenues; and $132,000 for regular-speed ferries, or about 0.2 percent of annual revenues. It should also be noted that the large majority of passenger ferries operate within the COLREG lines, and therefore, would not be affected at all by the proposed measures.

Alternatives 1 and 4 would have no effect on ferry passengers. Alternative 3 and 5 would have an adverse effect amounting to $12 million annually with a 10-knot speed restriction, $8.9 million with a 12-knot restriction, and $5.5 million with a 14-knot restriction. Alternative 6 would have an annual adverse effect estimated at $5.2 million at 10 knots, $3.9 million at 12 knots, and $2.5 million at 14 knots. The effects of Alternative 2 would be $4.5 million annually at 10 knots; $3.4 million at 12 knots; and $2.3 million at 14 knots.

ES.4.7 Impacts on Whale-Watching Vessels

The majority of whale-watching vessels are 65 ft (19.8 m) and longer and would be affected by the operational measures, although impacts would vary according to whether the operations deploy high-speed vessels (typical speeds of from 25 to 38 knots) or regular-speed vessels (with typical speeds of from 16 to 20 knots). Alternative 1 would not affect whale-watching vessels. Alternative 2 would result in annual direct, long-term, adverse economic impacts of $1.3 million at 10 knots, $0.9 million at 12 knots, and $0.7 million at 14 knots. Alternative 3 would have a larger direct, long-term, adverse economic impact, with an estimated $5.6 million annually at 10 knots, $3.1 million at 12 knots, and $1.9 million at 14 knots. There would be no impacts under Alternative 4. Alternative 5 would have the same impacts as Alternative 3. Alternative 6 would have direct adverse economic impacts estimated at $1.3 million annually at 10 knots, $0.9 million at 12 knots, and $0.7 million at 14 knots.

With the exception of the New England Aquarium, all the potentially affected whale-watching operators are small entities (the Aquarium accounts for one affected vessel out of 18). Considering these small operators only, the annual impacts under Alternative 6 (10-knot speed restriction) would amount to an estimated 4.2 percent of the total annual revenue generated by the affected high-speed vessels and 3.8 percent of the revenue generated by affected regular-speed vessels. However, only a small minority of the total number of whale watching operations (approximately 13 percent) and of vessels (approximately 7 percent) would be affected. Also, all above estimates conservatively assume full compliance with DMAs. Should vessels operators choose not to observe the voluntary speed restrictions, as they would be free to do, there would be no impacts.

ES.4.8 Impacts on Charter Vessels

There would be no impacts to charter vessel operations under Alternatives 1, 2, or 4. Alternatives 3 and 5 would result in minor, direct, long-term, adverse impacts on charter vessels, estimated at $1.0 million annually at 10 knots, $598,000 at 12 knots, and $299,000 at 14 knots. Alternative 6 would have a slightly larger annual direct adverse economic impact of $796,000 at 10 knots, $480,000 at 12 knots, and $240,000 at 14 knots. For headboats more than 65 ft (19.8m) in length, these costs would result from an increase in roundtrip steaming time.

Under Alternative 6 with a 10-knot speed restriction, the impacts would represent 3.9 percent of the annual revenue generated by the potentially affected boats. However, the proportional impact would be much less when compared to the total revenue generated by the charter fishing industry since most of the industry’s fleet consists of boats less than 65 ft (19.8 m) long, which would not be affected by the proposed measures.

ES.4.9 Impacts on Environmental Justice

Although ten of the 26 port areas considered in this FEIS could be considered environmental justice communities, the economic impacts from the proposed measures under any of the action alternatives on these areas would not disproportionately affect minority or low-income populations. Rather, the impacts would be distributed throughout the entire region or local economy.

ES.4.10 Impacts on Cultural Resources

No cultural resources have been identified on the ocean surface in waters that would be affected by the operational measures. Therefore, there are no impacts on cultural resources under any of the alternatives.

ES.5 Areas of Controversy

NMFS has provided many opportunities for public involvement and comments on the advanced notice of proposed rulemaking; proposed rulemaking; NOI to prepare a DEIS; DEIS; and various public meetings. As the purpose of the proposed operational measures is to reduce serious injury and deaths of right whales from ship strikes *while* minimizing the adverse economic effects on the maritime industry, NMFS has incorporated elements of the public comments and recommendations into the FEIS to balance both industry and environmental perspectives. The major areas of controversy raised by the stakeholders are:

- **Speed Restrictions.** Some members of the public commented on the basis of the speed restrictions and in general were concerned that the speed restrictions may not effectively reduce the occurrence and severity of ship strikes. Environmental stakeholders generally believed that restricting speeds to 10 knots would be the most effective, but that 12 knots would also reduce ship strikes. Industry stakeholders generally preferred less stringent speed restrictions, if any, and would rather have routing measures implemented. To show the entire range of impacts, this FEIS analyzes speed restrictions of 10, 12, and 14 knots.

  NMFS is proposing a 10-knot speed restriction, although the agency requested comments on restrictions set at 12 and 14 knots as well, and the FEIS analyzes impacts for all three speeds. The proposed restriction of 10 knots is based on historical and recent studies that indicate that 10 knots or less is the optimal speed limit in the range considered for right whale recovery. Lower speeds have greater protective value but the proposed 10-knot restriction balances protection and cost.

- **Federal Vessels.** The majority of Federal agencies supported the exemption of Federal vessels, whereas other stakeholders, from both industry and environmental groups, commented that the operational measures should apply to all vessels unless the Federal vessels were operating under mitigation measures from a Section 7 consultation.

  The proposed regulations would not apply to vessels owned or operated by, or under contract to, Federal agencies. This exemption would also extend to foreign sovereign vessels engaging in joint exercises with the US Department of the Navy or engaged in innocent passage in US waters. NMFS believes that the national security, navigational, and human safety missions of some agencies may be compromised by mandatory vessel-speed restrictions. However, this exemption would not relieve Federal agencies of their obligations under the ESA, including Section 7. NMFS will be reviewing the federal actions involving vessel operations to determine where ESA Section 7 consultations would be appropriate. NMFS also requests all Federal agencies to voluntarily observe the conditions of the proposed regulations when and where their missions are not compromised.

- **Navigational Safety.** Representatives from the shippping industry expressed concerns about complying with the speed restrictions during hazardous weather conditions and when transiting breakwaters or other confined areas.

  The proposed measures include an exemption that allows for a vessel, under severe conditions, to operate at a speed above the required 10 knots in order to maneuver safely. A vessel would be able to operate at a speed necessary to maintain safe maneuvering instead of the required 10 knots only if justified because the vessel is in an area where oceanographic, hydrographic and/or meteorological conditions severely restrict the maneuverability of the vessel and the need to operate at such speed is confirmed by the pilot on board or, when a vessel is not carrying a pilot, the master of the vessel. If a deviation from the 10-knot speed limit is necessary, the reasons for the deviation, the speed at which the vessel is operated, the latitude and longitude of the area, and the time and duration of such deviation would be entered into the logbook of the vessel. The master of the vessel would attest to the accuracy of the logbook entry by signing and dating it.

- **Dynamic Management Areas.** Stakeholders across the board were concerned with the lag time between an aggregation of right whales that would trigger a DMA and the time when it would actually be implemented through publication of a notice in the *Federal Register*. Industry representatives, specifically those from the whale-watching and ferry-vessel companies, were concerned about a DMA being implemented in their operating area(s) during peak season. Several of these companies indicated that such a situation would potentially put them out of business. Others, however, favored this measure over SMAs.

  In response to these comments, and given the current limitations in agency resources that would prevent the immediate establishment of a DMA, NMFS is proposing a voluntary DMA program under the preferred alternative. NMFS would announce DMAs to mariners through its customary maritime communication media and any other appropriate media channels. Vessel operators would be expected, but not required, to proceed through the area at 10 knots or less, or to route around the DMA. Voluntary DMAs would alleviate some of the economic burden of DMAs, especially if a DMA was established in the route of a whale-watching or ferry vessel during peak summer months.

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ACRONYMS AND ABBREVIATIONS

Acronym	Definition
ac	Acres
AIS	Automated Identification System
ALWTRP	Atlantic Large Whale Take Reduction Plan
ALWTRT	Atlantic Large Whale Take Reduction Team
ANPR	Advanced Notice of Proposed Rulemaking
ATBA	Area to be Avoided
BO	Biological Opinion
BREA	Business Research and Economic Advisors
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CCB	Cape Cod Bay
CEA	Cumulative Effects Analysis
CEQ	Council on Environmental Quality
CETAP	Cetacean and Turtle Assessment Program
CFCs	Chlorofluorocarbons
CFR	Code of Federal Regulations
CH_4	Methane
CHASN	Charleston
CHPT	Cherry Point
CI	Confidence Interval
COLREGS	Convention on the International Regulations for Preventing Collisions at Sea
COMDTINST	Commandant Instruction
CV	Coefficient of Variation
CWA	Clean Water Act
CY	Calendar Year
CZMA	Coastal Zone Management Act
DAM	Dynamic Area Management
dB	Decibels
DDT	Dichloro-Diphenyl-Trichloroethane
DEIS	Draft Environmental Impact Statement
DMA	Dynamic Management Area
DoD	Department of Defense
DoN	Department of the Navy
DTAG	Digital Acoustic Recording Tag
DWT	Dead Weight Tons
EA	Environmental assessment
EBRV	Energy Bridge Regasification Vessel
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental impact statement
ENC	Electronic Navigational Charts
EO	Executive Order
EPA	Environmental Protection Agency

Acronym	Definition
ESA	Endangered Species Act
EWS	Early Warning System
FACSFAC	Fleet Area Control and Surveillance Facility
VACAPES	Virginia Capes
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FONSI	Finding of No Significant Impact
FR	*Federal Register*
FRFA	Final Regulatory Flexibility Analysis
Ft	Foot (feet)
FWS	Fish and Wildlife Service
FY	Fiscal Year
GIS	Geographic Information Systems
GPA	Georgia Port Authority
GoMOOS	Gulf of Maine Ocean Observing System
GRNMS	Gray's Reef National Marine Sanctuary
GRT	Gross registered tons
GSC	Great South Channel
ha	Hectare
HAB	Harmful Algal Bloom
HC	Hydrocarbons
HCH	Hexachlorocyclohexane
HITS	Historical Temporal Shipping database
HRMA	Hampton Roads Maritime Association
Hz	Hertz
IMO	International Maritime Organization
IRFA	Initial Regulatory Flexibility Analysis
ISPS	International Ship and Port Security
IUCN	World Conservation Union
IWC	International Whaling Commission
JAXPORT	Jacksonville Port Authority
kHz	Kilohertz
km	Kilometer(s)
LFA	Low Frequency Active [Sonar]
LIDAR	Light Detecting and Rating
LNG	Liquefied Natural Gas
LOA	Length overall
M	Meter(s)
m/m	mass per unit mass
Mi	Miles
MARPOL	International Convention on Marine Pollution
MARAD	Maritime Administration
MASSPORT	Massachusetts Port Authority
MAUS	Mid-Atlantic region of the United States
MMPA	Marine Mammal Protection Act

Acronym	Definition
MMS	Mineral Management Service
MPRSA	Marine Protection Research and Sanctuaries Act
MSA	Metropolitan Statistical Area
MSC	Military Sealift Command
MSD	Marine Sanitation Device
MSRS	Mandatory Ship Reporting System
NAAQS	National Ambient Air Quality Standards
NAO	North Atlantic Oscillation
NAICS	North American Industry Classification System Codes
NDRF	National Defense Reserve Fleet
NEAQS	New England Air Quality Study
NEIT	Northeast Implementation Team
NEPA	National Environmental Policy Act
NERO	Northeast Regional Office
NEUS	Northeastern United States
NHPA	National Historic Preservation Act
Nm	Nautical mile(s)
NMAO	NOAA Marine and Aviation Operations
NMFS	National Marine Fisheries Service
NMSA	National Marine Sanctuary Act
NMSP	National Marine Sanctuary Program
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
N_2O	Nitrous Oxide
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOS	National Ocean Service
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRHP	National Register for Historic Places
NSF	National Science Foundation
NSWC	Naval Surface Warfare Center
NWS	National Weather Service
O_3	Ozone
OEIS	Overseas Environmental Impact Statement
OPAREA	Operating Area
OSP	Optimum Sustainable Population
PARS	Port Access Routes Study
Pb	Lead
PBR	Potential Biological Removal level
PCB	Polychlorinated Biphenyl
PCDD	Polychlorinated Dibenzo –p– Dioxins
PCDF	Polychlorinated Dibenzofurans

Acronym	Definition
PCCS	Provincetown Center for Coastal Studies
PM_{10}	Particulate Matter (diameter less than or equal to 10 micrometers)
PM_{25}	Particulate Matter (diameter less than or equal to 25 micrometers)
ppb	Parts per billion
ppm	Parts per million
PSP	Paralytic Shellfish Poisoning
PTS	Permanent Threshold Shift
PWSA	Ports and Waterways Safety Act
RIR/RIA	Regulatory Impact Review/Regulatory Impact Assessment
RFA	Regulatory Flexibility Act
RNA	Regulated Navigation Area
Ro-Ro	Roll-on Roll-off
ROD	Record of Decision
SAG	Surface Active Group
SAM	Seasonal Area Management
SANS	Ship Arrival Notification System
SAR	Stock Assessment Report
SAS	Sighting Advisory System
SBA	Small Business Administration
SBNMS	Stellwagen Bank National Marine Sanctuary
SCSPA	South Carolina State Port Authority
SE	Standard Error
SED	Shipper's Export Declarations
SEIT	Southeast Implementation Team
SERO	Southeast Regional Office
SEUS	Southeastern United States
SHPO	State Historic Preservation Office
SINKEX	Sinking Exercises
SMA	Seasonal Management Area
SO_2	Sulfur Dioxide
SO_x	Sulfur Oxides
SOLAS	International Convention on the Safety of Life at Sea
SONAR	Sound Navigation and Ranging
SOPEP	Shipboard Oil Pollution Emergency Plan
SPUE	Sightings Per Unit Effort
sq	Squared
SRV	Shuttle Regasification Vessel
SST	Sea Surface Temperature
SURTASS	Surveillance Towed Array Sensor System
TARFOX	Tropospheric Aerosol Radiative Forcing Observational Experiment
TBT	Tributylin
TRP	Take Reduction Plan
TRT	Take Reduction Team
TSS	Traffic Separation Scheme
TTS	Temporary Threshold Shift

Acronym	Definition
UNOLS	University-National Oceanographic Laboratory System
URI	University of Rhode Island
USACE	United States Army Corps of Engineers
U.S.	United States
USC	United States Code
USCG	United States Coast Guard
USCP	United States Coast Pilot
USDOT	United States Department of Transportation
USFWS	United States Fish and Wildlife Service
USGS	USGS
VACAPES	Virginia Capes
VAST/IMPASS	Virtual At-Sea Training/Integrated Maritime Portable Acoustic Scoring & Simulator
VHF	Very High Frequency
VPA	Virginia Port Authority
VSRP	Voluntary Speed Reduction Program
VTS	Vessel Traffic Service
VTSS	Vessel Traffic Separation Scheme
WTG	Wind Turbine Generator

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1 PURPOSE AND NEED

Introduction

The National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) proposes to implement a set of vessel operational measures to reduce ship strikes of North Atlantic right whales, an endangered species under the Endangered Species Act (ESA). North Atlantic right whales are also designated as depleted under the Marine Mammal Protection Act (MMPA). The vessel operational measures are part of a larger set of measures NMFS is proposing to reduce ship strikes to right whales. This final environmental impact statement (FEIS) analyzes the potential environmental impacts of implementing the vessel operational measures only. Other proposed ship-strike reduction measures are not addressed. This FEIS has been prepared pursuant to the National Environmental Policy Act (NEPA) of 1969, the Council on Environmental Quality's Regulations for Implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508), and the NOAA environmental review procedures (NOAA Administrative Order 216-6) (NOAA, 1999).

1.1 Background: The Western North Atlantic Right Whale

The western North Atlantic right whale (*Eubalaena glacialis*), whose habitat generally extends from waters off the coasts of southern Canada to the mid-coast of Florida, is a critically endangered large whale species. This species was overharvested by aboriginal and commercial whaling operations from the 16th to 19th centuries. Right whales were easy targets because they are slow swimmers and their high body fat content causes them to float after death. Hence their common name: they were the "right" whales to hunt.

Right Whales

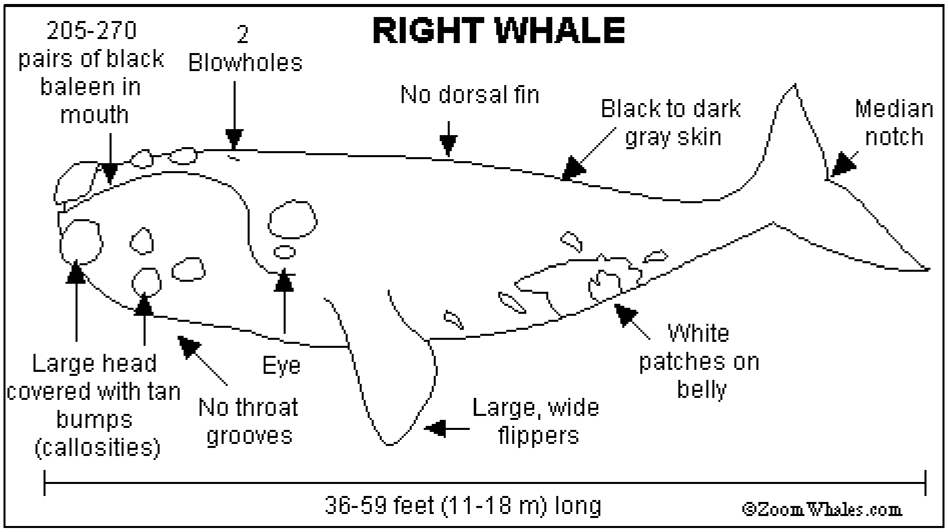
Right whales are found in three general regions: the North Pacific, the Southern Hemisphere, and the North Atlantic.

The **North Pacific right whale** (*Eubalaena japonica*) was considered until recently to be the same species as the North Atlantic right whale. Based on genetic studies that provided evidence that they are in fact different species, NMFS published a final rule to list them as separate species under the ESA on March 6, 2008 (73 FR 12024). The current population size of the north Pacific right whale is unknown (Brownell *et al.*, 2001). It is classified as endangered in the World Conservation Union (IUCN) Red List.

The **Southern right whale** (*Eubalaena australis*) is a distinct species of right whale that occurs only in the Southern Hemisphere off the coasts of South America, Australia, New Zealand, and South Africa. Although it is classified as lower risk/conservation dependent in the IUCN Red List, and is listed under Australia's endangered species legislation, the Southern right whale population is recovering (estimated at over 10,000 animals with a 7.2 percent annual growth rate [Best *et al.*, 2001]).

Additionally, there are two distinct populations of **North Atlantic right whales** (*Eubalaena glacialis*): the eastern population, once found from northern Europe to the northwest coast of Africa, which now appears to be nearly extinct; and the western population. Unless otherwise specified, **all references to "right whales" in this FEIS are to the western North Atlantic right whale**. The North Atlantic right whale is classified as endangered on the IUCN Red List.

Right whales belong to the family of baleen whales, also referred to as mysticetes (Sub-order *Mysticeti*). Adults are generally between 45 and 55 feet (ft) (14 and 17 meters [m]) long and can weigh up to 70 tons, with females being somewhat larger than males; calves are 18 to 20 ft (5.5 to 6 m) long at birth. Distinguishing features of right whales include a stocky body, a generally black coloration (although some individuals have white patches on their undersides), a lack of a dorsal fin, a large head (about one quarter of the body length), a strongly bowed margin of the lower lip, and callosities (raised patches of roughened skin) about the head. Two rows of long (up to 8 ft [2.4 m]), dark baleen plates hang from the upper jaw, with an average of 225 plates on each side. The tail is broad, deeply notched, and all black with a smooth trailing edge.[1]



1.1.1 Right Whale Population Status

International protection for the right whale began in 1935 when the Convention for the Regulation of Whaling banned commercial whaling for certain species.[2] Prior to the ban, and primarily in the 16th, 17th, and 18th centuries, right whales were severely overharvested. The Northern right whale has been listed as endangered under the ESA since the passage of the act in 1973. The North Atlantic and North Pacific right whales were originally listed as one species, the northern right whale, on the Federal list of threatened and endangered animals and plants maintained by the US Fish and Wildlife Service (USFWS). However, after a status review, NMFS concluded that these are two separate species and, on March 6, 2008, published a final rule to list these species separately (71 FR 77704). Despite protective measures, right whale populations in the Northern Hemisphere continue to be depleted.

The best estimate of the size of the North Atlantic right whale population is a range of 300 to 350 animals. Although other population size estimates are available, the most recent Stock Assessment Report (SAR) (Waring *et al*., 2007) providing a peer-reviewed estimate indicates that the best estimate of minimum population size for the species is 313 individually-recognized whales known to be alive in 2002. Models indicate that this population is likely declining rather than remaining static or increasing (Caswell *et al.*, 1999). The number of catalogued whales in

[1] www.nmfs.noaa.gov/pr/species/mammals/cetaceans/right_whales.doc
[2] The International Whaling Commission did not impose a worldwide ban on all commercial whaling until 1985.

the right whale sighting database represents the minimum number of right whales that NOAA knows are alive. That number fluctuated between years and slightly increased from 284 in 1995 to 313 in 2002 (Waring *et al.*, *in review*). Between 1993 and 2007, NOAA observed 234 calves born. Of these 13 calves are known to have died (Waring *et al.*, *in review*). Furthermore, 26 adult right whales are known to have died in 1993-2006. Thus, even though multiple factors affect the minimum population number, NOAA believes that the number of whales in the minimum population is lower than might be expected because observed mortality is lower than total mortality as not all carcasses are found (Waring *et al.*, *in review*). While the life span of the right whale is relatively long and complete extinction is unlikely in the immediate future, studies have shown that if current conditions (i.e., high death rates due to human activities) continue, extinction is probable in less than 200 years (Caswell *et al.*, 1999; Fujiwara and Caswell, 2001).

Today, the right whale population is sufficiently fragile for the early death of a single mature female to make recovery of the species likely unattainable (for biological reasons, the number of reproductive-age females is more essential to a species' ability to maintain itself or grow than the number of males.) The primary causes of premature mortality among right whales are anthropogenic (i.e., from human activities), mainly ship strikes and fishing-gear entanglement. Recently, there has been an increase in known anthropogenic mortality and serious injury: for the five-year period 1999 to 2003, the average rate was 2.6 right whales per year; for the five-year period 2000 to 2004, the rate was 2.8; from 2001 to 2005, the rate was 3.2 (NMFS, 2005f; NMFS, 2006; Waring *et al*., 2007). The most recent estimate of anthropogenic mortality and serious injury available shows a rate of 3.8 right whales per year from 2002 to 2006. Of these, 2.4 were attributed to ship strikes and 1.4 were attributed to entanglements (Glass *et al*., 2008). In addition to maintaining optimal habitat conditions, any recovery of the right whale population is contingent upon reducing the effects of human activities on the species.

More than 73 right whale deaths have been confirmed since 1970; this number represents a minimum, as it is likely that not all deaths are detected. Nearly half of these deaths (49 percent) have been attributed to ship collisions (29 deaths) or entanglements (7 deaths). Fifty of these deaths (71 percent) have occurred since 1990, suggesting an increase in frequency, though the increase may also reflect an increased awareness about reporting and increased surveying efforts, suggesting that the death rate may in fact have been high for some time. In the 16 months between January 2004 and May 2005, there were eight confirmed right whale deaths (Kraus *et al.*, 2005). Three (possibly four) of these eight deaths were caused by ship strikes and one by fishing gear; the causes of the other deaths are unknown at this time. Six of the eight whales were adult females, three of which were carrying near-term fetuses (Kraus *et al.*, 2005). Four of the six females were entering their years of sexual maturity, during which they would have borne calves. Since on average, a female right whale will produce 5.25 calves over her lifetime, the death of four females represent a lost reproductive potential of as many as 21 animals (Kraus *et al.*, 2005).

Right whale mortality levels over the last two decades have well exceeded the NMFS potential biological removal (PBR) level for the species. The PBR level is the maximum number of individuals that can be removed from a marine mammal population by nonnatural mortality while still allowing that population to reach or maintain its optimum sustainable population

(OSP).[3] NMFS develops PBR levels to assess the effects of nonnatural mortalities on a population. NMFS estimates that the North Atlantic right whale population is well below the OSP. Therefore, the PBR level for the species has been set to zero, meaning that any mortality or serious injury is significant.

1.1.2 Anthropogenic Causes of Right Whale Injury and Mortality

1.1.2.1 Ship Strikes

Ship strikes are responsible for the majority of human-caused right whale mortalities (Jensen and Silber, 2003; Knowlton and Kraus, 2001; NMFS, 2005b). As such, ship strikes are a primary cause of the lack of recovery of the species. In waters off the US and Canadian east coasts, several major shipping corridors overlap with, or are adjacent to, right whale habitat areas and migratory corridors, posing a grave threat to these animals. Presumably, right whales are either unable to detect approaching vessels or they ignore them when involved in important activities such as feeding, nursing, or mating. Additionally, right whales are very buoyant and slow swimmers, which may make it difficult for them to avoid an oncoming vessel even if they are aware of its approach. Finally, given the density of ship traffic and the distribution of right whales, overlap is nearly inevitable, thereby increasing the probability of a collision even if either the whale or the vessel actively tries to avoid it.

In 2003, NMFS published a database of all known ship strikes to large whales worldwide (Jensen and Silber, 2003). Although this database is comprehensive, not all ship strikes are documented; therefore, it almost certainly underestimates the actual number of strikes. Indeed, based on a recent estimate of the mortality rate and records of ship strikes to large whales, scientists estimate that less than a quarter (17 percent) of ship strikes are actually detected (Kraus *et al.*, 2005). The available records indicate that collisions occur off almost every US coastal state, though strikes are most common along the East Coast. More than half (56 percent) of the recorded ship strikes from 1975 to 2002 occurred off the coasts of the northeastern United States and Canada, while the mid-Atlantic and southeastern areas each accounted for 22 percent (Jensen and Silber, 2003). Records from Knowlton and Kraus (2001), an account of right whale deaths, show similar results: of 15 confirmed ship strikes in the western North Atlantic (including Canada) from 1970 to 1999, nine (60 percent) occurred in the Northeast and three (20 percent) occurred in the mid-Atlantic and Southeast. Although all large whale species are represented in the ship strike records, Vanderlaan and Taggart (2007) have concluded that right whales are more vulnerable, on a *per capita* basis, than other species.

The International Whaling Commission (IWC) global database of collision incidents between vessels and cetaceans identifies 763 records, 68 percent of which were confirmed definite vessel-cetacean collisions (Van Waerbeek and Leaper, 2008). Records of deaths from 1970 to 1999 indicate that ship strikes are responsible for over one-third (16 out of 45, or 35.5 percent) of all confirmed right whale mortalities (a confirmed mortality is one observed under specific

[3] The term "optimum sustainable population" means, with respect to any population stock, the number of animals which will result in the maximum productivity of the population or the species, keeping in mind the carrying capacity of the habitat and the health of the ecosystem of which they form a constituent element [16 U.S.C. § 1362 (9)].

conditions defined by NMFS).[4] Of the remaining confirmed mortalities, three (6.7 percent) were due to entanglement in fishing gear; 13 (28.9 percent) were neonate deaths; and another 13 (28.9 percent) were deaths of non-calf animals from unknown causes (Knowlton and Kraus, 2001). Based on criteria developed by Knowlton and Kraus (2001), 56 unconfirmed serious injuries and mortalities from entanglement or ship strikes were found to have occurred between 1970 and 1999: 25 (44.6 percent) from ship strikes and 31 (55.4 percent) from entanglement. Of these, 19 were fatal interactions (16 ship strikes, three entanglements); 10 possibly fatal (two ship strikes, eight entanglements); and 27 nonfatal (seven ship strikes, 20 entanglements) (Knowlton and Kraus, 2001).

Another study conducted over a similar period – 1970 to 2002 – examined 30 (18 adults and juveniles, and 12 calves) out of 54 reported right whale mortalities from Florida to Canada (Moore *et al.*, 2005). Human interaction (ship strike or gear entanglement) was evident in 14 of the 18 adults examined, and trauma, presumably from vessel collision, was apparent in 10 out of the 14 cases. Trauma was also present in four of the 12 calves examined, although the cause of death was more difficult to determine in these cases. In 14 cases, the assumed cause of death was vessel collision; an additional four deaths were attributed to entanglement. In the remaining 12 cases, the cause of death was undetermined (Moore *et al.*, 2005).

Glass *et al*. (2008) reported that there were 54 determinations of right whale mortality and serious injury between 2002 and 2006. Out of 21 verified right whale mortalities, 10 were from ship strikes and 3 were from entanglement. Entanglement was identified as the cause of four recorded serious injuries. There were also two documented serious injuries from ship strikes (Glass *et al*., 2008).

Many types and sizes of vessels have been involved in ship strikes with large whales, including container/cargo ships/freighters, tankers, steamships, US Coast Guard (USCG) vessels, Navy vessels, cruise ships, ferries, recreational vessels, fishing vessels, whale-watching vessels, and other vessels (Jensen and Silber, 2003). Vessel speed (if recorded) at the time of a large whale collision has ranged from 2 to 51 knots (Jensen and Silber, 2003). Vessels can be damaged during ship strikes (occasionally, collisions with large whales have even harmed or killed humans on board the vessels); of 13 recorded vessels that reported damages from a strike, all were traveling at a speed of at least 10 knots (Jensen and Silber, 2003). A summary paper on ship collisions and whales by Laist *et al.* (2001) reported that out of 28 recorded collisions resulting in lethal or severe injuries to whales in which vessel speed was known, 89 percent involved vessels traveling at 14 knots or faster and the remaining 11 percent involved vessels traveling at 10 to 14 knots. None occurred at speeds below 10 knots. The IWC database of vessel collisions identified 83 events where speed was recorded; the majority of serious injuries and mortalities occurred within a similar range of 15 to 20 knots (Van Waerbeek and Leaper, 2008). With regard to the severity of injuries at increasing speeds, Pace and Silber (2005) found a predicted 45 percent chance of death or serious injury at 10 knots. Vanderlaan and Taggart (2007) came to a similar conclusion, determining that the probability of death from a collision was approximately 35-40 percent at 10 knots.

[4] There are four main criteria used to determine whether serious injury or mortality resulted from ship strikes: (1) Propeller cut(s) or gashes that are more than approximately 8 cm in depth; (2) Evidence of bone breakage determined to have occurred premortem; (3) Evidence of haematoma or haemorrahaging; and (4) The appearance of poor health in the ship-struck animal (Knowlton and Kraus, 2001).

1.1.2.2 Fishing Gear Entanglement

Entanglement in fishing gear is another common anthropogenic cause of right whale mortality and serious injury. Because right whale distribution can overlap with fishing areas, gear entanglement is frequent and can cause death by drowning or serious injuries such as lacerations, which in turn can lead to severe infections. In areas where right whales are feeding, entanglements in the mouth are common. Entanglements of juveniles are particularly dangerous because the line will tighten and infections can worsen as the whale grows. Most right whale entanglements appear to be with gillnets, lobster pots, crab pots, seines, fish weirs, and aquaculture equipment (NMFS, 2005a). NMFS maintains a *List of Fisheries* that categorizes commercial fisheries based on the level of serious injury and mortality to marine mammals caused by each fishery. A fishery qualifies as a Category I if the annual mortality and serious injury of a marine mammal stock in that fishery is greater than, or equal to, 50 percent of the PBR level; as a Category II if annual mortality and serious injury is greater than one percent and less than 50 percent of the PBR level; and as a Category III if annual mortality and serious injury is less than, or equal to, one percent of the PBR level (16 United States Code [U.S.C.] § 1387).

Section 118 of the MMPA requires NMFS to develop and implement take reduction plans to assist in the recovery or prevent the depletion of strategic marine mammal stocks that interact with Category I and II fisheries. As there are four Category I and II fisheries on the East Coast that interact with large whales, NMFS established the Atlantic Large Whale Take Reduction Plan (ALWTRP) to regulate these fisheries and assist in population recovery (Section 1.2.2).

Since the inception of the ALWTRP in 1997, reported right whale entanglements have slightly decreased. According to the 2007 SAR, 44 percent of the records of mortality and serious injury from 2001 to 2005 involved gear entanglement or fishery interactions (Waring *et al*., 2007). This represents an improvement over the 57 percent reported for 2000-2004 (NMFS, 2006), and the approximately 69 percent reported for 1999-2003 (NMFS, 2005f).

Although entanglement does not always result in death or serious injury, it poses a serious threat to North Atlantic right whales. Analysis of 447 individual animals in the North Atlantic Right Whale Catalog[5] indicates that 338 (75.6 percent) right whales documented from 1980 to 2002 showed physical evidence of entanglement, such as scars, and between 14 and 51 percent experienced entanglements each year (Knowlton *et al.*, 2005).

1.2 Background: NOAA's Current Right Whale Conservation Measures

Prior to developing the current set of right whale ship strike reduction measures, NMFS implemented various conservation measures to reduce anthropogenic threats to the right whale population.

1.2.1 Existing Ship Strike Reduction Measures

Due to increasing concern in the 1990s over the disturbance to right whales caused by vessels passing nearby, NMFS issued an interim final rule in 1997 to reduce such disturbance and the

[5] The Right Whale Catalog is a database of whale sightings and photos maintained by the New England Aquarium.

associated potential for collision. The rule states that it is illegal to knowingly approach a North Atlantic right whale within 500 yards (460 m) by vessel, aircraft, or any other means unless permitted by NMFS (50 CFR 222.32).

In addition to vessel-approach restrictions, NMFS has developed and implemented various programs to further reduce the potential for vessel collision. NMFS also has several mechanisms in place to alert mariners of right whales' locations and thus help reduce ship strikes. The following sections describe these programs, research projects, and other conservation measures to reduce ship strikes.

1.2.1.1 Surveys

Systematic surveys from aircraft or vessels are conducted to locate right whales in their migratory corridor and critical habitats to:

- Provide sighting locations to mariners.
- Photograph individuals for identification and life-history data collection.
- Document fishery or vessel interactions.
- Record ship traffic patterns and, in some cases, contact mariners directly when whales are in their paths.
- Further quantify or refine distribution patterns, abundance estimates, etc.

Comprehensive surveying began in 1993 in the Southeast Atlantic area (where it is known as the Right Whale Early Warning System) and in 1997 in the Northeast Atlantic area (where it is known as the Right Whale Sighting Advisory System). The collected information is distributed through various means, including the Mandatory Ship Reporting Systems (MSRS).

Surveys are integral to implementing the dynamic management areas described in Section 1.4. Several commenters on the draft environmental impact statement (DEIS) expressed concerns over the viability of surveys, particularly given fluctuations in federal funds available to conduct the surveys. In response to these comments, Table 1-1 shows expenditures for right whale aerial surveys during fiscal years 2003-2005.

Total labor costs steadily increased over the three-year period, while direct costs increased from fiscal year 2003 (FY03) to FY04, and then decreased in FY05. FY06 expenditures for aerial surveys were approximately $1.1 million for non-state cooperative funding; an additional $1.5 million was appropriated for state cooperative funding, which includes funds for aerial surveys, recovery implementation, and enforcement (Right Whale News, 2006). NOAA's appropriations for aerial surveys in FY07 were approximately $1.3 million for non-state cooperative funding and an additional $1.6 million was appropriated for state cooperative funding (Right Whale News, 2007).

Table 1-1

Expenditures for Right Whale Aerial Surveys from FY03 – FY05

Agency	Type	FY03 Costs ($)		FY04 Costs ($)		FY05 Costs ($)	
		Labor	Direct	Labor	Direct	Labor	Direct
NOAA	Surveys/Aerial Surveys (Internal)	366,130	440,000	433,727	500,000	466,100	580,000
	Surveys (External)	0	146,448	0	420,461	0	249,361
	Early Warning/Sighting system surveys	33,000	620,000	24,999	670,000	24,000	670,000
Navy	Early Warning/Sighting system surveys	0	155,000	0	155,000	21,450	155,000
USACE	Early Warning/Sighting system surveys	0	141,000	0	174,000	0	185,000
USCG	Aerial Surveys (External)	0	8,071	0	24,272	0	0
	Aerial Surveys (Time-Area Closures)	0	27,280	0	108,484	0	20,270
	Early Warning/Sighting system surveys	0	191,000	0	221,000	0	223,000
Total		399,130	1,537,799	458,726	2,052,217	511,550	1,859,631
Source: Marine Mammal Commission right whale program review, March 2006.							

1.2.1.2 Mandatory Ship Reporting Systems

NOAA designed the Mandatory Ship Reporting System (MSRS) and prepared a proposal for the International Maritime Organization (IMO) in an effort to further raise mariner awareness of right whales and to disseminate information on the location of the whales and how to avoid them. The United States submitted the proposal to the IMO, which approved it in December 1998. Jointly funded by NOAA and the USCG, the MSRS began operation in July 1999. The two agencies continue to operate the program. The overall goals of the MSRS are to:

- Alert mariners to right whale locations in two East Coast aggregation areas.
- Raise awareness about the whales' vulnerability to ship strikes.
- Obtain data on ship traffic volumes and patterns from the incoming ship reports to aid in developing measures to reduce ship strikes.

When ships greater than 300 gross tons enter two key right whale habitats – one in waters off the northeastern United States and one off the southeastern United States – they are required to report to a shore-based station. Mariners report their ship's location, speed, course, waypoints, and destination. In return, ships receive an automated message about right whales, their vulnerability to ship strikes, precautionary measures the ship can take to avoid hitting a whale, and locations of recent whale sightings. Mariners are advised to reduce their speed to 10 knots or less when whales are reported in the area, when transiting through whale critical habitat, or in conditions of poor visibility. The MSRS are in effect year-round in a predetermined area that includes Cape Cod Bay and the Great South Channel (WHALESNORTH) in the northeast and from November 15 to April 16 in southeastern waters (WHALESSOUTH).

Compliance with the MSRS varies by region and port. The average monthly compliance rate for major ports (ports that expect to receive more than 12 calls during the period when the MSRS is in effect, e.g. Boston) within WHALESNORTH is 78 percent for calendar year 2006 (CY06). This percentage reflects a range of 34 percent compliance in Quincy, Massachusetts to 100 percent in Castle Island. The average monthly compliance for minor ports (ports that expect to receive 12 or fewer calls during the period when the MSRS is in effect, e.g. Gloucester) within WHALESNORTH is 54 percent. This percentage reflects a range of zero percent compliance in Provincetown, Massachusetts to 100 percent in South Boston. The average monthly compliance rate for major ports within WHALESSOUTH was 74 percent for CY06. This percentage reflects a range of 59 percent compliance in Blount Island to 86 percent in Brunswick. Due to the low number of port calls at minor ports, even one failure to report can greatly affect the observed compliance rate. In general, MSRS compliance rates have steadily increased over the years.

There are several caveats associated with these data. MSRS compliance rates are measured by cross-checking the Ship Arrival Notification System (SANS) database (96-hour notices provided by inbound ships) against mariners' MSRS reports. Due to changes in vessel movement after the vessels submit their MSRS and SANS reports, compliance may be underreported. The data represent a snapshot in time, added into the database on a monthly basis to gauge the general compliance rate. The USCG continues to work with NMFS to ensure that the automated system is a robust management tool that will monitor effectiveness of the MSRS program and indicate which ports require additional outreach efforts to increase compliance rates.

1.2.1.3 Charts and Publications

The National Ocean Service (NOS) routinely updates and publishes nautical charts with new or emerging navigational hazards, regulations, or requirements. Additionally, NOS publishes *Coast Pilot*, a series of regional references on navigation hazards, rules, and environmental conditions that ship captains of a certain vessel size class are expected to carry in US waters. NMFS routinely works with NOS to ensure that the information on endangered species in this publication is current. At the request of NMFS, NOS has added advisories and precautions for mariners regarding right whales. As a result, NOS' nautical charts and *Coast Pilots* contain information on right whale critical habitat, seasonal occurrence, MSRS, and regulations regarding approaching protected marine species. In 2005, updates to these navigational aids provided by NMFS included speed advisories that suggested mariners travel at 12 knots or less when whales are present. NMFS updated this speed advisory in 2007 to suggest a 10-knot speed restriction.

Additionally, at NOAA's request, the National Geo-Spatial Intelligence Agency routinely includes information on right whales and other endangered species in its international guides to mariners – *Notice to Mariners* and *Sailing Directions*. Information on avoiding collisions with right whales and other endangered species was first added in 1998 and is updated annually.

1.2.1.4 Regional Recovery Plan Implementation Teams

Two recovery-plan implementation teams (as provided for under the ESA) exist for the right whale, one in the US Southeast Atlantic region and one in the US Northeast Atlantic region. In the past, these implementation teams focused on critical habitat areas, vessel strikes, and entanglement reduction[6], as provided for under the MMPA. However, the Right Whale Recovery Plan Northeast Implementation Team (NEIT) was reorganized by NMFS in 2004, and the focus shifted to ship strike reduction efforts. Occasionally the teams are limited by funding; this has been the case for the NEIT since FY06.

The principal focus of the Right Whale Recovery Plan Southeast Implementation Team (SEIT) is currently education and outreach, including the collection and real-time dissemination of right whale sighting information to mariners through collaboration with the Navy, USCG, and US Army Corps of Engineers (USACE). The team has several ongoing efforts to protect right whales, including a geographic information system (GIS) subcommittee to analyze sightings, vessel-traffic data, and environmental data to learn how to aid in reducing threats and enhancing recovery. One of its principal foci, however, is to develop priorities and implement a list of tasks to maximize industry-wide mariner education programs. This work is quite comprehensive, involving the execution of a number of projects, and is ongoing. The SEIT has also provided recommendations to NMFS regarding; right whale research in the Southeast, additional measures to reduce the possibility of ship strikes, and restrictions of hazardous fishing gear in right whale calving areas (NMFS, 2005b).

1.2.1.5 Right Whale Grant Program for Research

Congressional funding for right whale research and management by NMFS began in 1986. NMFS oversees and distributes a portion of this funding through a competitive grant program for right whale research. NMFS contributes funds to the recovery activities previously mentioned as well as the following ones:

- Photo identification and sighting databases to help assess such things as right whale demographics, right whale distribution, and threats to right whales.
- VHF radio tracking and passive acoustic detection of vocalizing right whales to assess distribution and movements.
- Detection of whales at sea.
- Predictive modeling.
- Habitat and zooplankton abundance monitoring.
- GIS analysis of whale distribution and vessel traffic patterns.

1.2.1.6 Ship Speed Advisories

NOAA issues ship-speed advisories to mariners to help reduce ship strikes using NOAA-based communications. Advisories are distributed by e-mail, fax distribution lists, postings on websites (e.g., National Data Buoy Center website)[7], NAVTEX[8], local Notices to Mariners, and, as noted above, insertion in navigational publications and the MSRS. The National Weather Service (NWS) issues right whale advisories and speed advisories on NOAA weather radio when aggregations are sighted. Compliance with the advisories is voluntary and is expected only in areas where right whale sightings have been confirmed. The advisories indicate that neither

[6] Entanglement reduction through the take-reduction process is described in Section 1.2.2.
[7] http://www.ndbc.noaa.gov/
[8] NAVTEX is an international automated medium frequency (518 kHz) direct-printing service for delivery of navigational and meteorological warnings and forecasts as well as urgent marine safety information to ships.

navigational nor human safety is to be jeopardized as a result of reduced speeds. As noted above, speed advisories have also been integrated into NOAA publications.

In addition, Federal agencies that conduct vessel operations along the East Coast have been advised to modify their vessel operating procedures by posting extra lookouts in areas where whales may occur, limiting transits through such areas, and training ship crews to detect, identify, and avoid large whales. The USCG and Navy have issued speed advisories to their respective Atlantic fleets, and, in 2005, NMFS contacted all relevant Federal agencies, requesting that their vessels proceed at 12 knots or less while in right whale habitat in the absence of any overriding need to travel faster (e.g., national security or rescue mission).

In 2007, the USCG updated the Local Broadcast Notice to Mariners to include a message that NOAA recommends a speed of 10 knots or less in areas used by right whales. The Local Broadcast Notice to Mariners is transmitted via VHF and single-band radios, and is published for distribution. More information on this medium is provided in Section 3.4.1.3.

As noted in Section 1.2.1.3, the National Ocean Service's Office of Coast Survey publishes language on right whales in the *Coast Pilot* series. These publications have been updated to include the ship-speed advisories. In addition, there is the possibility that real-time environmental data layers (including right whale advisories) could be incorporated into NOAA's Electronic Navigational Charts.

A study of mariner compliance with NMFS-issued speed advisories in the Great South Channel found that 95 percent (38 out of 40) of the ships tracked did not slow down or route around areas for which right whales sighting locations and speed advisories had been provided (Moller *et al*., 2005). Whether this is due to mariners disregarding the alerts or their being unaware of them is not known. In a related study, Wiley *et al*. (2008) found that commercial whale watching vessel operators exhibited high non-compliance rates even when they were aware of vessel speed zones around whales. Therefore, even when whale locations are detected and provided, it is not clear how, or if at all, mariners will respond.

1.2.1.7 Review of Current and Emerging Technologies

While there currently is no proven technology to effectively manage the risk to right whales, NMFS plans to review technologies periodically in order to assess technology-based systems that might be used to reduce the risk of ship strikes to right whales. As part of these reviews, NMFS may engage the maritime industry and the scientific community to work on developing efficient and effective technologies to address the threat of ship strikes. NMFS will document any findings and may in some cases prepare a draft report for public comment. Should a technology be deemed viable, NMFS may consider taking appropriate steps to allow its use. In general, NMFS will consider implementing new technologies provided they are at least as protective as speed restrictions and more cost effective.

In support of this effort, NMFS held a workshop in Providence, Rhode Island in July 2008. The goals of this workshop were to (1) identify existing or emerging technologies that might be useful in reducing ship strikes, (2) assess the feasibility of each in reducing ship strikes, and (3) identify research and development needs and schedule requirements to make a given technology useful in reducing the threat. To meet these goals, NMFS will (a) update a 2002 summary paper on technologies, (b) identify emerging technologies by hearing from inventors or companies with candidate technologies, and (c) evaluate and rank technologies considering (i) research and development needs, (ii) costs, and therefore (iii) overall feasibility.

1.2.1.8 Other Conservation Measures

NMFS also develops and implements education and outreach programs to raise mariner awareness about the right whale ship-strike problem. Working collaboratively, NMFS and other organizations have produced a variety of materials to distribute to mariners, fishermen, shipping companies, cruise ships, and ports concerning right whales and ship strikes.

For example, Holland America Line, in collaboration with NMFS and the National Park Service (NPS), developed an interactive, computer-based training program called "Avoiding Whale Strikes" that is mandatory for all Holland America captains and crew. The program provides guidelines for identifying whales at sea, and precautionary measures to take when transiting known whale habitats, including speed restrictions in Glacier Bay National Park in Alaska and areas where right whales are known to aggregate seasonally along the US east coast. Holland America has made the CD available to other cruise lines through the International Council of Cruise Lines, and has given NOAA and NPS permission to distribute the CD to other industries for non-commercial purposes.

NOAA has implemented various routing measures to reduce the probability of vessel collisions with right whales and other baleen whales.

Finally, as provided in Section 7 of the ESA, NMFS has conducted several interagency consultations with other Federal agencies regarding the effects of military operations, dredging, Liquefied Natural Gas (LNG) terminals, and vessel operations on right whales. A synopsis of these consultations is provided in Section 1.7.3; more detailed information is provided in Appendix A.

1.2.2 Fisheries Gear Entanglement Prevention Measures

The 1994 amendments to the MMPA required NMFS to establish teams comprised of stakeholder groups to determine ways to reduce serious injury and mortality of strategic stocks of marine mammals, including threatened or endangered species, that interact with category I or II fisheries (see Section 1.1.2.2). The Take Reduction Team assists NMFS in developing a Take Reduction Plan. The immediate goal of the Take Reduction Plan is to reduce incidental mortality or serious injury to the marine mammal stock’s PBR level within six months of the plan’s implementation. The longer-term goal is to reduce serious injuries and mortality to an insignificant level approaching a zero mortality and serious injury rate (NMFS, 2005b).

In August 1996, NMFS established the Atlantic Large Whale Take Reduction Team (ALWTRT) to design an ALWTRP for North Atlantic right whales, humpback whales, fin whales, and minke whales affected by the southeastern US shark gillnet fishery, the Northeast/mid-Atlantic lobster trap/pot fishery, the mid-Atlantic coastal gillnet fishery, and the Northeast sink gillnet fishery. The ALWTRP was first put into effect in 1997 and has been modified several times since, most recently in August 2003. The ALWTRP includes gear restrictions, research recommendations, time and area closures, outreach and education recommendations, and a disentanglement program. In February 2005, NMFS released a draft EIS to analyze alternatives for gear modifications and improved time and area management in the ALWTRP (NMFS, 2004d). The proposed rule for these modifications to the ALWTRP was published in the *Federal Register* in June 2005. The final EIS was released on August 17, 2007, and the final rule published on October 5, 2007. However, NMFS published a proposed rule on June 6, 2008 to delay the effective date of one of the broad-based gear modifications from October 2, 2008 to April 5, 2009.

One measure contained in the ALWTRP is seasonal area management (SAM). SAM restrictions are in place to protect from entanglement in fishing gear the predictable aggregations of right whales in waters off Cape Cod out to the Exclusive Economic Zone (EEZ). The western zone is in effect from March 1 to April 30 and the eastern zone is in effect from May 1 to July 31. The SAM program restricts the use of lobster trap/pot and gillnet gear. Such gear may only be used if it meets the requirements allowing it to be considered low-risk gear as described in the ALWTRP.

In addition, dynamic area management (DAM) measures were in place in Cape Cod Bay and the Gulf of Maine to limit fishery interactions with right whales when whales are sighted at unanticipated times or in unanticipated locations. Three or more right whales in an area covering 75 square nautical miles [nm^2] (0.04 right whales per nm^2) was the density required to trigger DAM closures in an area (NMFS, 2004g). On April 5, 2008, under the recent ALWTRP regulations and expansion of the SAM areas, the DAM program was eliminated.

1.2.3 Other Conservation Measures

NMFS encourages research geared towards assessing the effects of habitat destruction and pollution on right whales. Other threats to the right whale population, including disease, loss of genetic diversity, and food availability, are accounted for through research and workshops. NOAA has also launched a collaborative effort to gather information and assess the impact of shipping noise on all marine mammals. NMFS designated critical habitat for right whales in 1994 to further protect important feeding grounds in the Northeast and calving grounds in the Southeast. The location of the critical habitat areas is discussed in Chapter 2.

1.3 Purpose and Need

NMFS' purpose and need for the vessel operational measures considered in this FEIS is to reduce the occurrence and severity of vessel collisions with North Atlantic right whales, thereby contributing to the recovery and sustainability of the species while minimizing adverse effects on the shipping industry and maritime commerce.

NMFS has authority and responsibility under both the ESA and the MMPA to protect the endangered North Atlantic right whale. Although various measures to reduce ship strikes (described in Section 1.2.1) have been in place for several years, these measures have not significantly reduced the number of vessel collisions with right whales. A continued lack of recovery, and possibly extinction, will occur if deaths from ship strikes are not reduced. Therefore, additional action is needed for NMFS to fulfill its responsibility. Collision with vessels is the primary anthropogenic cause of serious injuries and deaths to right whales. Therefore, NMFS is proposing to reduce this threat by taking the regulatory approach expected to be most effective at facilitating population recovery while minimizing adverse economic impacts. The proposed action consists of vessel operational measures that would impose regulatory speed restrictions and provide for nonregulatory routing measures on specific vessel classes to reduce the ship-strike threat to right whales without imposing an undue economic burden on the shipping industry. The combination of speed restrictions and reducing the co-occurrence of right whales and vessel traffic is expected to be an effective means to reduce the occurrence and severity of ship strikes and promote population growth and recovery.

1.4 Vessel Operational Measures

The conservation measures described in Section 1.2 have increased awareness of the endangered status of right whales and of the threats of ship strikes, gear entanglement, and naturally-occurring obstacles to recovery. However, they have failed to sufficiently reduce the occurrence of human-caused mortality among right whales. Therefore, while existing conservation programs will continue, NMFS proposes to take additional steps to reduce ship strikes. To this end, NMFS developed, published, and requested comments on a set of North Atlantic right whale ship-strike reduction measures in an advanced notice of proposed rulemaking (ANPR) dated June 1, 2004 (69 FR 30857).[9] On June 26, 2006, NMFS published and requested comments on proposed rulemaking to restrict vessel speeds in areas where right whales occur (71 FR 36299). The proposed rule contains vessel operational measures to reduce the likelihood and threat of collisions between vessels and endangered North Atlantic right whales. It also aims to minimize, through nonregulatory actions, the geographical overlap of shipping lanes and whale occurrence to reduce the likelihood of ship strikes in a manner that minimizes adverse effects on the shipping industry and maritime commerce.

The operational measures are customized by region to account for differences in (1) oceanography, (2) commercial ship traffic patterns, (3) navigational concerns, and (4) right whale migration patterns and behavior. Three regions of implementation have been defined and are (from south to north):

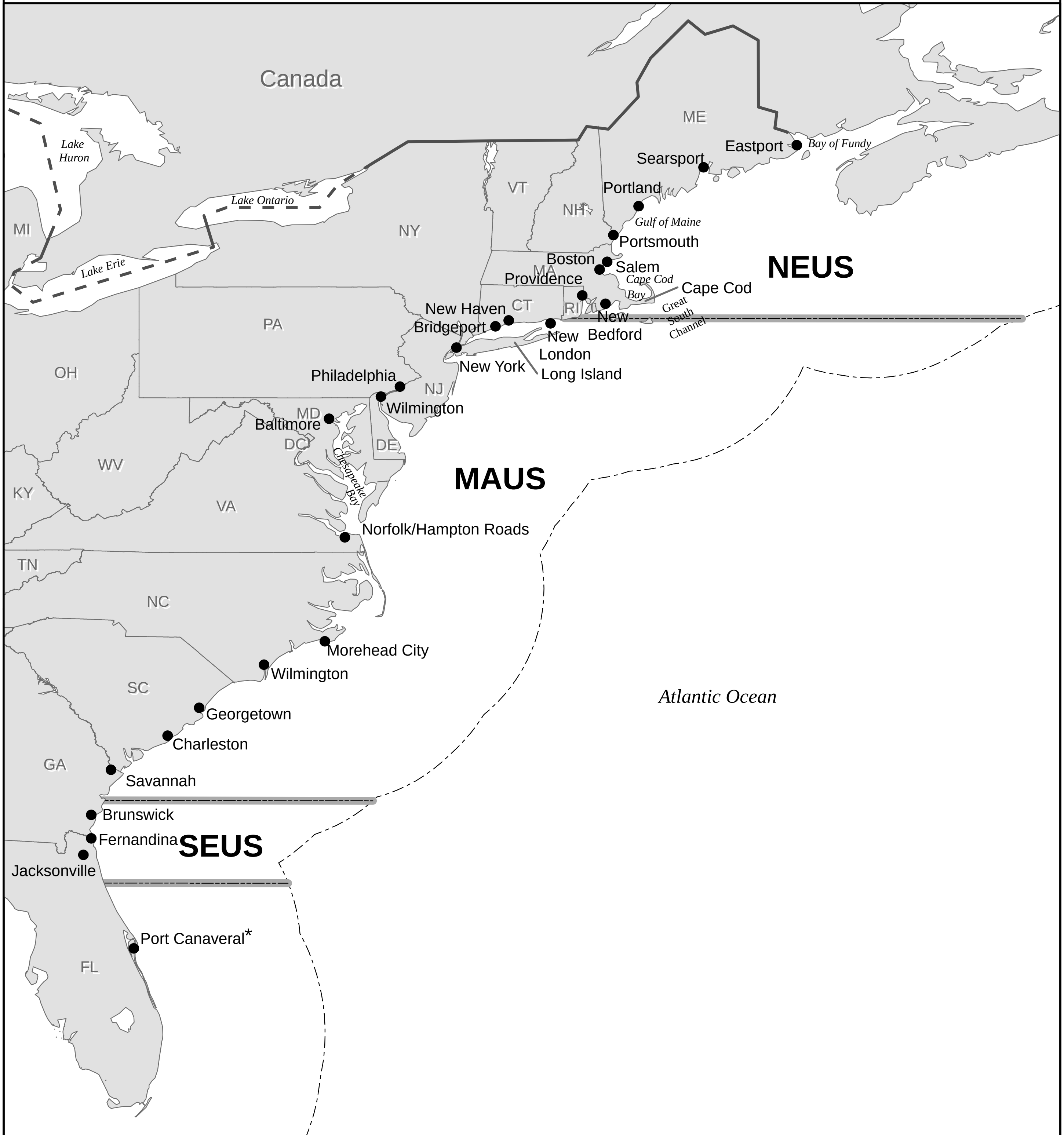
1. The southeastern US (SEUS) Atlantic Coast region, bounded to the north by latitude 31º27’N and to the south by latitude 29º45’N.
2. The mid-Atlantic US (MAUS) region, extending from the northernmost boundary of the SEUS to the southernmost boundary of the third region, the northeastern US (NEUS) Atlantic Coast.
3. The NEUS Atlantic Coast region, north and east of Block Island northward up to Canada.

Seaward, each area extends out to the US EEZ. The regions of implementation are illustrated in Figure 1-1.

The vessel operational measures would only apply to non-sovereign vessels 65 ft (19.8 m) and greater in overall length subject to the jurisdiction of the United States. They would not apply to sovereign vessels, that is, vessels owned or operated by, or under contract to, the US Federal

[9] In documents and communications prior to February 2007, these measures were collectively referred to as NMFS’s *North Atlantic Right Whale Ship Strike Reduction Strategy*. In addition to the vessel operational measures considered in this FEIS, the ANPR included the following actions: continue ongoing research and conservation activities; continue to develop mariner education and outreach programs; review the need for ESA Section 7 consultations with all Federal agencies that operate or authorize the use of vessels in waters inhabited by right whales, or whose actions directly or indirectly affect vessel traffic; and negotiate a Right Whale Conservation Agreement with the government of Canada.

Regions of Implementation



*Under Alternatives 3 and 5, operational measures in the SEUS would extend to Port Canaveral and points immediately south of it.

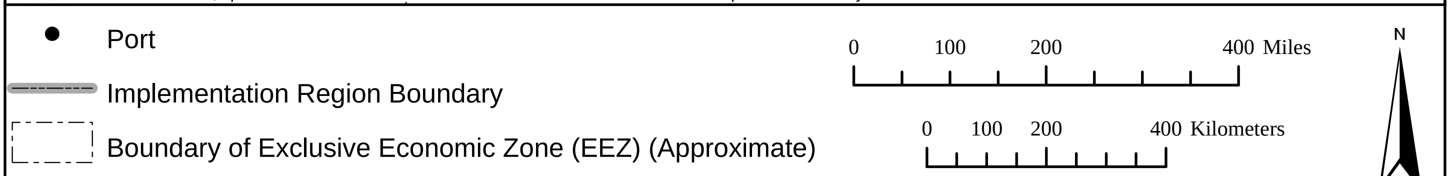


Figure 1-1

government, or to law enforcement vessels of a state or political subdivision thereof, when engaged in enforcement or human safety missions. Additionally, where speed restrictions would normally apply, a vessel could operate so as to maintain safe maneuvering speed instead of the required speed if oceanographic, hydrographic, and/or meteorological conditions in the area severely restrict maneuverability and if the need to operate at such speed is confirmed by the pilot on board or, when the vessel is not carrying a pilot, the master of the vessel. If a deviation from the speed limit is necessary, the reasons for the deviation, the speed at which the vessel is operated, the latitude and longitude of the area, and the time and duration of such deviation would be entered into the logbook of the vessel. The master of the vessel would attest to the accuracy of the logbook entry by signing and dating it.

Research on vessel collisions indicates that most severe and lethal injuries to whales resulting from ship strikes involved large ships. A recent synthesis using strike records for which vessel speed at the time of strike is available showed that out of 58 collisions with a whale (all large whale species), 23 resulted in the death of the animal. Of these 23, at least 20 (87 percent) involved vessels longer than 262 ft (80 m). Of the 15 collisions where the whale was seriously injured, three involved vessels less than 65 ft (19.8 m), three involved vessels between 65 and 262 ft (19.8 and 80 m), and the rest involved vessels more than 262 ft (80 m) (Laist *et al*., 2001). Until recently, the smallest vessel known to have been involved in a fatal collision with a right whale was an 82-ft (25-m) USCG ship (NMFS, 2004i). However, on March 10, 2005, a 43-foot vessel struck a right whale, inflicting serious injuries. It is likely that this incident resulted in the death of the animal, although this has not been confirmed (NOAA, 2005). NMFS is aware that vessels less than 65 ft (19.8 m) in length may pose a threat and will continue to consider means, including future rulemaking, to address this issue. In the interim, NMFS has determined that, for the purposes of the measures considered in this FEIS, the appropriate threshold vessel size is 65 ft (19.8 m). Additionally, the 65-ft (19.8-m) threshold corresponds to a well-established criterion used in many USCG regulations, and one understood by mariners.

Chapter 2 of this FEIS describes the alternatives being considered to meet the purpose and need, including the Proposed Action (NMFS' preferred alternative). The proposed vessel operational measures considered by NMFS in the development of the alternatives are summarized below. As described in Chapter 2, each of the alternatives analyzed in this FEIS consists of one or more of these measures. Details on the specific components (e.g., season, location, duration) of the measures are described in Chapter 2. The three types of measure considered are:

- **Seasonal Management Areas (SMAs).** SMAs are predetermined and established areas within which seasonal speed restrictions apply.
- **Dynamic Management Areas (DMAs).** DMAs are temporary areas consisting of a circle around a confirmed right whale sighting. The radius of this circle expands incrementally with the number of whales sighted and a buffer is included beyond the core area to allow for whale movement. Speed restrictions apply within DMAs, which may be mandatory or voluntary and apply only when and where no SMA is in effect.
- **Routing Measures.** These consist of a set of routes designed to minimize the co-occurrence of right whales and ship traffic. Use of these routes is voluntary; therefore, they constitute a non-regulatory measure. However, mandatory speed restrictions would apply in the portions of the routes located within an active SMA. NMFS would monitor these routes and consider making them mandatory if use is low.

The vessel routing measures adopted by the IMO and those submitted for consideration, described in the DEIS, are no longer included among the potential measures evaluated in this FEIS. The US proposal to modify the northern leg of the Boston Traffic Separation Scheme (TSS) was accepted by the IMO in 2006 and was implemented in July 2007. Starting July 1, 2007, the USCG alerted mariners of the changes in the TSS through standard maritime communications and updated charts. The United States submitted two additional proposals to the IMO in 2008. One proposal is to amend the north-south leg of the Boston TSS, and the second proposal is to create a seasonal Area to be Avoided (ATBA) in the Great South Channel. If accepted, these proposals will be implemented in summer 2009. As changes in the TSS and creation of an ATBA are independent of the NMFS rulemaking and the vessel operational measures considered in the FEIS, they are no longer included among the potential measures. However, they are considered in the cumulative impact analysis.

1.5 Relevant Legislation

Federal rulemaking and implementation of Federal regulations must be consistent with a number of relevant laws and regulations. The following sections provide brief descriptions of the principal requirements relevant to the proposed vessel operational measures. Both the MMPA and the ESA require NMFS to implement plans to protect the North Atlantic right whale, as it is both a depleted marine mammal species and an endangered species. The MMPA and the ESA both prohibit the taking of North Atlantic right whales.

1.5.1 Endangered Species Act

The ESA provides broad protection for species and critical habitats of fish, wildlife, and plants that are listed as threatened or endangered. Under the ESA, it is generally unlawful for any person subject to the jurisdiction of the United States to “take” any such species within the United States or on the high seas, unless authorized under specific provisions of the ESA. The ESA defines “take” as to “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct to species listed as threatened or endangered.” [16 U.S.C. § 1532(19)]

The North Atlantic right whale population is currently part of a wider-ranging species listed as endangered under the ESA (although NMFS has proposed to list the North Atlantic right whale separately [Section 1.1.1]). Therefore, in accordance with ESA Section 4(f), NMFS is responsible for developing and implementing a recovery plan for the conservation and survival of the species. The recovery plan requires actions to assess and establish voluntary or mandatory measures to reduce the likelihood of ship/whale interactions. In 1991, NMFS completed a Final Recovery Plan for the Northern Right Whale (which included both the North Atlantic and Pacific right whales). This plan was revised in 2005, and is now entitled *Recovery Plan for the North Atlantic Right Whale*. Reduction of ship strikes is one of the top priorities identified in the plan.

1.5.2 Marine Mammal Protection Act

The MMPA protects all marine mammals. Right whales are designated as “depleted” under the MMPA because the population is below OSP (see Section 1.1.1) and they are listed as endangered under the ESA. The MMPA, subject to limited exceptions, prohibits any person or vessel subject to the jurisdiction of the United States from "taking" marine mammals in the US or on the high seas without authorization. The term "taking" is defined in the MMPA [16 U.S.C. § 1362(13)] as "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal." The term "harassment" in the context of this action means any act of pursuit, torment, or annoyance which [16 U.S.C. § 1362(18)(a)]:

- Has the potential to injure a marine mammal or marine mammal stock in the wild (Level A Harassment); or
- Has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B Harassment).

Because the North Atlantic right whale is considered part of a depleted marine mammal species, the MMPA requires NMFS to develop a conservation plan designed to conserve and restore the species.

1.5.3 Ports and Waterways Safety Act

The Ports and Waterways Safety Act of 1972 (PWSA) gives the USCG authority over vessel and port operations to promote vessel safety and protection of the marine environment. The act recognizes the need for advanced planning to ensure protective measures for the nation's ports and waterways and continued consultations with other Federal agencies (33 U.S.C. § 1221). Section 1224 of the act gives the USCG authority over vessel traffic services (VTS) and related activities. It also gives the USCG authority to require specified navigation equipment and other electronic devices, specify times of entry and departure, and establish routing measures.

1.5.4 Regulatory Flexibility Act

Under the Regulatory Flexibility Act of 1980 (RFA), Federal agencies must consider the economic impacts their rules may have on small entities, including small businesses, organizations, and governmental jurisdictions. The agency must prepare an initial and final regulatory flexibility analysis (IRFA/FRFA), unless it can certify that the rule would not have "a significant economic impact on a substantial number of small entities." In IRFA/FRFA documents, among other kinds of processes regulatory alternatives must undergo is evaluation of the extent to which they achieve the objective of applicable statutes and might minimize negative economic impacts on small entities. However, the RFA does not require that the alternative with the least cost or the least impact on small entities be selected as the preferred alternative.

1.5.5 Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) is designed to encourage and assist states in developing coastal management programs, to coordinate state activities, and to safeguard regional and national interests in the coastal zone. Section 307(c) of the CZMA and the implementing regulations (15 CFR 930) require that any Federal activity affecting the land or water uses or natural resources of a state's coastal zone must be consistent to the maximum extent practicable with the enforceable policies of the state's federally-approved coastal zone management program. Compliance with Section 307(c) can be achieved through a coastal zone consistency determination letter from the action agency to the affected state coastal zone management programs.

1.5.6 National Marine Sanctuaries Act

The National Marine Sanctuaries Act (NMSA) (16 U.S.C. § 1431 *et seq.*) authorizes the Secretary of Commerce to designate and manage areas of the marine environment which have special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archeological, educational, or esthetic qualities as national marine sanctuaries. Following designation, there are several mechanisms under this act that allow for continued protection of national marine sanctuaries. For example, if the Secretary finds a Federal action is likely to destroy, cause the loss of, or injure a sanctuary resource, the National Marine Sanctuary Program (NMSP) is required to recommend reasonable and prudent alternatives that will protect sanctuary resources if implemented by the agency in taking the action. This may be achieved through interagency coordination or commenting on the proposed rule and/or DEIS.

1.6 Applicable Executive Orders

Two executive orders (EOs) are applicable to the proposed vessel operational measures.

1.6.1 Executive Order 12898

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, directs all Federal agencies to incorporate environmental justice considerations in achieving their missions. Each Federal agency is to accomplish this by conducting programs, policies, and activities that substantially affect human health or the environment in a manner that does not exclude communities from participation in, deny communities the benefits of, or subject communities to discrimination under, such actions because of their income, race, color, or national origin.

1.6.2 Executive Order 12866

EO 12866, *Regulatory Planning and Review*, requires Federal agencies to follow “a program to reform and make more efficient the regulatory process.” During regulatory decision-making, Federal agencies are required to maximize net benefits after conducting quantitative and qualitative cost-benefit analyses, including the option of not regulating.

1.7 Plans, Policies, and Interagency Coordination

This section describes other relevant conservation activities, recovery plans, and other policies related to NMFS’ proposed right whale ship-strike reduction measures and subsequent right whale recovery.

1.7.1 Right Whale Recovery Plan

The *Final Recovery Plan for the Northern Right Whale (Eubalaena glacialis)* was originally published by NMFS in December 1991. The revised *Recovery Plan for the North Atlantic Right Whale* was released in May 2005.

The ultimate goal of the recovery plan is to promote the recovery of North Atlantic right whales to a level sufficient to warrant their removal from the Federal list of endangered and threatened wildlife and plants. The intermediate goal is to reclassify the species from endangered to threatened. The most significant need for North Atlantic right whale recovery is to reduce or eliminate deaths and injuries from anthropogenic activities, namely shipping and commercial fishing operations. In addition, the development of demographically-based recovery criteria must be completed quickly. Secondary priorities for the species' recovery are characterization, monitoring, and protection of important habitat; and identification and monitoring of the status, trends, distribution, and health of the species. Third-level priorities include conducting studies on the effects of other potential threats and ensuring they are addressed; and conducting genetic studies to assess population structure and diversity. An overarching need is to work closely with state, other Federal, international, and private entities to ensure that research and recovery efforts are coordinated (NMFS, 2005b).

1.7.2 Atlantic Large Whale Take Reduction Plan

The ALWTRP (see Section 1.2.2) was developed pursuant to Section 118 of the MMPA to reduce serious injury and mortality of right, humpback, fin, and minke whales due to incidental interactions with commercial fisheries. NMFS published final regulations to modify the ALWTRP by instituting broad-based fishing gear modifications on October 5, 2007. This section discusses the differences between the ALWTRP and ship-strike reduction regulations.

The measures considered in this FEIS focus solely on ship strikes to right whales, whereas the ALWTRP is intended to reduce fishing-gear threats to humpback, fin, and minke whales as well. While fin whales and humpback whales are affected by vessel collisions, Vanderlaan and Taggart (2007) have found that right whales are far more vulnerable, per capita, to ship strikes than other large whales. Although both fin whales and humpback whales are endangered, the measures evaluated in this FEIS focus on right whales because they are critically endangered, and the need for rigorous protection is immediate. From 2002 to 2006, right whales had the highest proportion of entanglements and ship strikes relative to the number of reports for a species (i.e., even though right whales had fewer reports than other species, there was still a high occurrence of incidents) (Glass *et al*., 2008). Steps taken to protect right whales will benefit other large whale species because in some areas their habitats overlap.

1.7.3 ESA Section 7 Consultations

Under Section 7 of the ESA and implementing regulations, Federal agencies are required to consult with NMFS and/or the USFWS to ensure that their actions do not jeopardize the continued existence of any listed species or destroy or adversely modify critical habitat. Generally, a Biological Opinion (BO) is issued when the action is likely to adversely affect a listed species. BOs include conservation recommendations, reasonable and prudent measures to mitigate the adverse effects, and terms and conditions with which the agency is required to comply.

The Marine Mammal and Sea Turtle Conservation Division of NMFS' Office of Protected Resources requested initiation of informal Section 7 consultation with the office's Endangered Species Division on the proposed rulemaking in January 2007, and received concurrence that implementation of the proposed regulations may affect, but are wholly beneficial to, large whale species listed under the ESA.

A summary of previous NMFS consultations conducted under Section 7 of the ESA involving right whales is provided in Appendix A.[10] NMFS will be reviewing Federal agency actions involving vessel operations to determine where new or re-initiated Section 7 consultations would be appropriate, although it is the action agencies that formally request consultation. However, this FEIS does not address these future Section 7 consultations with other Federal agencies that operate vessels in waters inhabited by right whales because it only evaluates the vessel-operational-measures component of the overall set of proposed ship-strike reduction measures. NMFS' Office of Protected Resources has previously conducted Section 7 consultations with the Navy, USCG, and the USACE regarding right whale protection measures. BOs were issued following consultations with the USCG in 1995, 1996, and 1998; with the US Navy in 1997 and several in 2008; and with the USACE in 1978, 1980, 1986, 1991, 1995, 1997, 2000, 2002, and 2003.

The 1995 USCG BO addressed the potential impacts of USCG vessel and aircraft operations off the US East Coast on threatened and endangered species. The BO concluded that the proposed activities may adversely affect, but were not likely to jeopardize, the continued existence of endangered and threatened species under NMFS' jurisdiction. In 1996, the USCG re-initiated consultation on the same activities. NMFS concluded that these actions may affect, but were not likely to jeopardize, the continued existence of humpback and fin whales or any species of sea turtles except the Olive ridley, but *were* likely to jeopardize the continued existence of the North Atlantic right whale. NMFS issued a reasonable and prudent alternative based on these findings (Appendix A). In 1997, the USCG again re-initiated the consultation. NMFS found that USCG actions were not likely to jeopardize the continued existence of specific endangered species and not likely to destroy or adversely modify the critical habitat that had been designated for the North Atlantic right whale. Although there were findings of no jeopardy, mitigation measures were developed to minimize potential adverse affects, and are included in Appendix A.

The 1997 BO issued to the US Navy for activities off the coast of the southeastern US concluded that these actions were not likely to jeopardize the continued existence of any endangered or threatened species under NMFS jurisdiction. The mitigation measures included in this BO are described in Appendix A.

The consultation that culminated with this 1997 BO commenced following the deaths of six right whales early in 1996 in waters adjacent to the southeastern US critical habitat. US Navy facilities adjacent to the critical habitat used offshore areas for gunnery exercises. Because several of the carcasses were found near a Navy gunnery range, it was suspected that some deaths were related to the use of underwater explosives. Although a link to military activities was not established, the

[10] Appendix A is not inclusive of all BOs, although it does summarize the major consultations dealing with right whales.

US Navy implemented right whale protection measures and initiated consultation with NMFS under Section 7 of the ESA following the right whale deaths in March 1996.

NMFS is currently engaged in, or has completed Section 7 consultations with, the US Navy on several Navy actions off the East Coast of the United States. In April 2008, NMFS issued a BO on training activities the US Navy planned to conduct in the Virginia Capes, Cherry Point, and Charleston - Jacksonville Range Complexes from spring through winter 2008. In July 2008, NMFS issued a BO on ship shock trials the US Navy planned to conduct on the Mesa Verde. Both of these biological opinions considered potential collisions between surface vessels and endangered whales that might occur in the action area of the consultation; that consideration included measures the US Navy planned to use to avoid collisions (including scheduling and locating exercises to avoid whale distributions, having observers on the bridge of ships to look for whales and protocols for changing course and speed to maintain safe distances from whales) and a review of data on the effectiveness of those measures.

NMFS is currently engaged in section 7 consultations on active sonar training activities the US Navy plans to conduct along the Atlantic Coast and Gulf of Mexico over the next five years; on training activities that do not involve active sonar in the Virginia Capes, Cherry Point, and Charleston – Jacksonville Range Complexes; and on the Navy's proposal to homeport additional vessels at the Mayport Naval Station in Florida. Each of these consultations, which should be complete by early 2009, is considering the potential effects of ship traffic associated with each specific proposal as well as the potential cumulative risks of collision associated with the total ship traffic. For background information, the mitigation measures that the Navy has proposed offshore of the eastern United States related to vessel transit and North Atlantic right whales are described in a Navy's *Draft Atlantic Fleet Active Sonar Training EIS/Overseas EIS*, which is available on line at *http://afasteis.gcsaic.com* and in other Navy Draft EISs addressing proposed activities in the Navy's east coast range complexes (see, for example, *http://www.vacapesrangecomplexeis.com* and *http://www.jacksonvillerangecomplexeis.com*).

The USACE BOs were issued on the potential impacts of harbor dredging and related activities. Consultations in the southeastern United States began in 1978 and were re-initiated in 1980, 1986, 1991, 1995, and 1997. The pursuant BOs found that these actions were not likely to adversely affect right whales, although reasonable and prudent measures were developed as part of the 1991 BO (Appendix A). Similar consultations on dredging in the Northeast in 2002 and 2003, and a beach renourishment project in 2000, also found the potential for whale/vessel interaction was unlikely, although conservation measures were adopted for these actions as well.

In 2005, informal and formal Section 7 consultations were initiated on proposed sites for LNG terminals in the northeastern and mid-Atlantic United States (see Section 4.7.3.1). At the time of this writing, NMFS has completed three BOs on LNG facilities, the first of which was the Crown Landing BO (Delaware River), on May 23, 2006. The applicants agreed to adhere to seasonal speed restrictions identified in the ship-strike reduction proposed rule as an interim measure until final regulations are issued. The BO contained a 'not likely to adversely affect' determination for whales. The Neptune BO was signed on January 12, 2007, and came to a finding of 'may adversely affect, but is not likely to jeopardize right whales'. The NE Gateway BO was signed on February 5, 2007, and came to the same finding as the Neptune BO. The applicants for these offshore LNG facilities voluntarily committed to mitigation measures, which are described in Section 4.7.2.7. These LNG sites have been approved, and after they are constructed or expanded they will cumulatively contribute additional vessel traffic along the coast, which could increase the risk of ship strikes. However, in an effort to reduce this risk, the mitigation measures the facilities are operating under are consistent with the proposed ship-strike reduction regulations.

1.7.4 Stellwagen Bank National Marine Sanctuary

The NOS' Office of National Marine Sanctuaries administers Stellwagen Bank National Marine Sanctuary (SBNMS). SBNMS is located around Massachusetts Bay and provides habitat for many species, including right whales. Eight percent of the Sanctuary is within the proposed Cape Cod Bay SMA and 55 percent is within the proposed Off Race Point SMA (see Section 2.1.3 and Figure 2-12 for these SMAs). SBNMS is required to develop and maintain a management plan under the NMSA (see Section 1.5.6). The original management plan was completed in 1993; it was revised and released as a draft management plan in April 2008. The management plan provides a review of information relevant to large whale conservation, including shipping traffic, fishing-gear entanglements, and whale watching. Refer to the Marine Mammal Vessel Strike Action Plan in Chapter 7 of the draft management plan for specific strategies SBNMS is recommending to reduce vessel strikes.

NMFS is coordinating with SBNMS on various operational and technical measures to reduce right whale ship strikes. One of these measures involves analyzing vessel traffic patterns through SBNMS in an effort to re-route shipping lanes through areas with low whale densities. SBNMS initiated the analysis that led to NOAA's preparation of the US proposal to the IMO to rotate the Boston TSS 12 degrees to the north into an area with lower densities of baleen whales. This shift is expected to result in a decrease in the potential for whale encounters with shipping vessels. It would add approximately 3.75 nm (6.9 km) to the TSS, which would increase a vessel's travel time by approximately 10 to 22 minutes depending on speed (Wiley, 2005, *unpublished data*). After working with other Federal agencies through the interagency review process, the USCG (on behalf of the United States) submitted the proposal for a modification to the TSS to the IMO in April 2006; the Maritime Safety Committee endorsed the proposal in December 2006. The modification to the TSS was implemented in July 2007.

SBNMS, NMFS, and Cornell University have collaborated to use technology to improve understanding of right whale distribution in the Sanctuary, with the intention of better protecting the whales from ship strikes and entanglements. Ten acoustic pop-up buoys, or passive listening devices were installed in an array that covers 85 percent of the sanctuary. Among other things, these devices allow for the detection of present and vocalizing whales and inform LNG carrier transits. LNG vessels are required to slow down to 10 knots when whales are detected.

1.8 Related NOAA NEPA Documents

The following sections provide a brief summary of NEPA documents NOAA is preparing that are related to this EIS because the North Atlantic right whale is one of the species considered in those documents.

1.8.1 Draft Environmental Assessment to Implement the Operational Measures of the North Atlantic Right Whale Ship Strike Reduction Strategy

This draft environmental assessment (EA) was completed in June 2005 (NMFS, 2005e). It provided an analysis of the potential environmental impacts of the proposed vessel operational measures. The analysis indicated that some of the impacts had the potential to be highly controversial and/or significant. Consequently, in compliance with NEPA regulations, NMFS initiated preparation of this EIS.

1.8.2 EIS for Amending the Atlantic Large Whale Take Reduction Plan

On February 25, 2005, NMFS published in the *Federal Register* (70 FR 9306) a notice of availability (NOA) of the DEIS for proposed amendments to the ALWTRP regulations (50 CFR 229.32). The proposed rule was published in the *Federal Register* on June 21, 2005 (70 FR 35894). The NOA for the FEIS was published in the *Federal Register* (72 FR 46217) on August 17, 2007. The final rule was published on October 5, 2007 (72 FR 57104). The ALWTRP was developed pursuant to Section 118 of the MMPA to reduce serious injury and mortality of right, humpback, and fin whales due to incidental interactions with commercial fisheries. NMFS is proposing additional regulations for the fisheries currently covered by the ALWTRP, which include the Northeast sink gillnet, Northeast/mid-Atlantic American lobster trap/pot, mid-Atlantic coastal gillnet, Southeast Atlantic gillnet, and southeastern Atlantic shark gillnet fisheries. NMFS is also proposing to regulate the following fisheries from the MMPA's List of Fisheries (Section 1.1.2.2) for the first time under the ALWTRP: Northeast anchored float gillnet, Northeast drift gillnet, Atlantic blue crab, and Atlantic mixed species trap/pot fisheries targeting crab (red, Jonah, and rock), hagfish, finfish (black sea bass, scup, tautog, cod, haddock, pollock, redfish [ocean perch], and white hake), conch/whelk, and shrimp.

1.8.3 Right Whale Scientific Research Permit EIS

NMFS' Office of Protected Resources is in the preliminary stages of a programmatic analysis of the issuance of scientific research permits for both North Atlantic and North Pacific right whales. Permits are required for scientific research because right whales are protected under both the MMPA and ESA. Permits and authorizations are required under the ESA and the MMPA to conduct activities that may result in the "taking" of a protected species. As indicated in Sections 1.5.1 and 1.5.2, "taking" is defined slightly differently by the ESA and the MMPA. "Taking" is defined by the ESA as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct," whereas MMPA defines "taking" as "to harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect, or kill any marine mammal."

1.9 Public Involvement

Public involvement is an integral part of the NEPA process. This section describes the public involvement activities conducted in connection with the scoping, draft, and final versions of this EIS. To avoid redundancies, NMFS has integrated, as much as possible, public involvement efforts and outcomes for the overall set of proposed ship-strike reduction measures and the ANPR, with the public involvement for this EIS. NMFS' intent is to encourage the public to participate in the rulemaking and NEPA processes, including interested citizens and environmental organizations, the shipping industry, and local, state, and Federal agencies, as well as any other agencies with relevant jurisdiction or expertise.

1.9.1 Public Involvement in Formulating the Proposed Ship Strike Reduction Measures

NMFS fostered public participation in the formulation of the proposed ship-strike reduction measures through several methods, including solicitation of public comments on the ANPR, public meetings, industry stakeholder meetings, and focus group meetings. NMFS worked with state and Federal agencies, concerned citizens and citizens groups, environmental organizations, and the shipping industry to address the ongoing threat of ship strikes to right whales. Meetings, presentations, and workshops were convened by the ship-strike committee as early as 1999 in support of developing recommended measures to reduce ship strikes to right whales. Between 1999 and 2001, NMFS held 26 meetings along the East Coast. A NMFS contractor compiled information from these meetings and synthesized right whale sighting data to develop recommended measures, which were submitted to NOAA in August 2001 (Russell, 2001). NMFS formed an internal working group to review the report and to identify and assess options available to reduce ship strikes. Many of the measures in the 2001 report were eventually included in the ANPR.

NMFS published the ANPR for right whale ship strike reduction in the *Federal Register* on June 1, 2004 (69 FR 30857) and provided a comment period (ultimately extended until November 15, 2004 [September 13, 2004; 69 FR 55135]) to determine issues of concern with respect to the practical considerations involved in implementing the proposed measures and to determine whether NMFS was considering the appropriate range of alternatives. Five-thousand two-hundred fifty comments were received from governmental entities, individuals, and organizations. These comments were in the form of e-mails, letters, website submissions, correspondence from action campaigns (e-mail and US mail), faxes, and a phone call. They are available on NMFS' website.[11] The majority (more than 4,500) of the submissions were e-mails from action campaigns; 700 of the submissions were form letters; fewer than 100 were unique letters.

NMFS also held five public meetings on the ANPR at the following locations:

- Boston, MA: Tip O'Neill Federal Building (July 20, 2004)
- New York/New Jersey area: Newport Courtyard Marriot (July 21, 2004)
- Wilmington, NC: Hilton Riverside Wilmington (July 26, 2004)

[11] www.nmfs.noaa.gov/pr/shipstrike

- Jacksonville, FL: Radisson Riverwalk Hotel (July 27, 2004)
- Silver Spring, MD: NOAA Headquarters Science Center (August 3, 2004)

During these meetings, public comments were requested and recorded, and questions were answered. In addition, nine industry stakeholder meetings were held in the following cities in the fall of 2004:

- Boston, MA (September 30, 2004)
- Portland, ME (October 1, 2004)
- Norfolk, VA (October 4, 2004)
- Morehead City, NC (October 6, 2004)
- Jacksonville, FL (October 13, 2004)
- Savannah, GA (October 14, 2004)
- New London, CT (October 20, 2004)
- Newark, NJ (October 25, 2004)
- Baltimore, MD/Washington, DC (October 27, 2004)

A summary report of these meetings and a list of the attendees are posted on the Internet at *http://www.nero.noaa.gov/shipstrike*.

NMFS also hosted two focus-group discussions with participants from non-governmental organizations, academia, and Federal and state agencies. The first meeting was held in Silver Spring, MD, on September 26, 2004; the second in New Bedford, MA, on November 5, 2004.

Comments on the ANPR addressed several broad topics, including: speed restrictions; vessel size and operations; speed and routing issues specific to regions; routing restrictions (recommended routes and ATBA); safety of navigation; alternative or expanded dates for the vessel operational measures; military and sovereign vessel exemptions; enforcement; and compliance. The written comments received are available on the aforementioned NMFS website.

1.9.2 Public Involvement for the EIS

1.9.2.1 Notice of Intent

NMFS published the NOI to prepare this EIS in the *Federal Register* on June 22, 2005 (70 FR 36121; a copy is included in Appendix B). In addition to describing the proposed action and the agency's purpose and need as well as providing background information, the NOI presented, and solicited comments on, six initial alternatives:

- Alternative 1: No Action (continuation of existing conditions).
- Alternative 2: Use of DMAs only.
- Alternative 3: Speed Restrictions in Designated Areas.
- Alternative 4: Use of Designated or Mandatory Routes.
- Alternative 5: Combination of Alternatives 1 through 4.
- Alternative 6: NOAA Preferred Alternative, similar to Alternative 5 but with less extensive speed restrictions.

Because several public and stakeholder meetings, workshops, and other consultation were held as part of the ANPR public involvement effort and sufficient public input was received on the NOI, NMFS did not consider it necessary to hold scoping meetings for the EIS. However, interviews were conducted at several key port areas (Boston, Hampton Roads, Charleston, Savannah, and Jacksonville) in reference to the economic impact analysis.

1.9.2.2 Summary of Major Comments on the Notice of Intent

During the 30-day comment period that followed publication of the NOI (June 22, 2005 to July 22, 2005), NMFS received 41 letters and approximately 300 form e-mails. A complete table of these comments with NMFS' responses is provided in Appendix B. The following is a brief summary:

- **Comments from Federal Agencies.** Several Federal agencies encouraged enhanced interagency communications to further develop the proposed ship-strike reduction measures and ensure consistency with international law.
- **Comments from Stakeholders.** Passenger-vessel stakeholders voiced concerns that the initial analysis presented in the June 2005 EA (see Section 1.8.1) underestimated the number of passenger-vessel arrivals. Recreational-vessel stakeholders indicated their group was not given proper consideration in the draft EA, although they did not understand why recreational vessels should be required to abide by speed restrictions. Stakeholders representing environmental groups urged NMFS to take immediate action with emergency regulations and/or implementation prior to completion of the EIS. Several groups suggested that NMFS develop viable and effective enforcement measures. Shipping stakeholders indicated that operating costs had risen considerably since the 2002 and 2003 estimates used in the EA. They also voiced concern about potential delays resulting from speed restrictions, and the possibility of a port being affected as a result of shipping entities choosing an alternate destination. Industry representatives also recommended that NMFS evaluate impacts on port operations, impacts on local economies that serve ports and port communities, and any other indirect economic and environmental impacts. Several stakeholders suggested the EIS contain a review of Navy and USCG vessel activity along the East Coast. Several commenters proposed that NMFS seek technological solutions instead of, or in conjunction with, changes in vessel operations. Specific port authorities raised port-specific issues and the possibility of cumulative impacts to the port area. Commenters from various groups recommended that NMFS require Federal vessels to adhere to the proposed vessel operational measures. Several industry groups raised the issue of additional vessel traffic and regulations associated with the proposed and current LNG terminals.
- **Comments on the Alternatives.** There was broad support from the general public for Alternative 6, although several comments recommended changes to the times, dimensions, and boundaries of the SMAs. There was also broad agreement among environmental conservation organizations that Alternatives 2, 3, and 4 would not be sufficient to reduce ship strikes; however, a number of industry commenters preferred these stand-alone measures. A few comments supported Alternative 1 (No Action). Several commenters recommended Alternative 5 as the most effective means to reduce ship strikes, although they also indicated Alternative 6 was reasonable as the minimum for protective measures.

- **Comments on Speed Restrictions.** Some commenters were supportive of the proposed speed restrictions in the range of 10 to 14 knots based on the best available data, whereas other commenters questioned the effectiveness of speed restrictions as a mitigation measure and would not support this measure until further speed and hydrodynamic studies are completed. Commenters provided no new data on the effectiveness or lack thereof of specific vessel speed.
- **Comments on DMAs.** Commenters suggested that certain revisions to triggering and implementing a DMA were necessary before they could be considered a viable measure.

1.9.2.3 Notice of Availability for the DEIS

Following publication of the Notice of Availability (NOA) of the DEIS on July 7, 2006 (71 FR 38641), NMFS held three public hearings (in Jacksonville, FL; Baltimore, MD; and Boston, MA) to solicit and receive comments. NMFS advertised these meetings via notices in the *Federal Register* and major local newspapers. Interested parties could also send written comments to mailing and e-mail addresses printed on the title page of the DEIS and in the NOA.

1.9.2.4 Summary of Major Comments on the DEIS

NMFS originally provided 60 days (from July 7 to September 5, 2006) for interested parties to review and comment on the DEIS. This review period was subsequently extended by 30 days to October 5, 2006. A total of 121 comments were received on the DEIS, 42 of which were form e-mails, 39 oral comments from the public hearings, and 40 letters, e-mails, and faxes. These comments are available online at *www.nmfs.noaa.gov/pr/shipstrike.* A complete table of these comments with NMFS' responses is provided in Appendix B. NMFS carefully considered all comments on the DEIS in the development of this FEIS. A summary of the comments on the DEIS follows:

- **Comments on the Alternatives.** In general, the environmental conservation groups supported Alternative 5 and a 10-knot speed restriction, and stated that Alternative 6 should be the bare minimum for protection. Other commenters requested an explanation for the differences in dates and management areas among Alternatives 3, 5, and 6. Commenters also asked for an explanation of the rationale for selecting the preferred alternative in the FEIS.
- **Comments on DMAs.** Many commenters suggested that the effective date and time of the designation of a DMA in the Federal Register should be shortly after the initial sighting of whales that triggers the DMA. Other commenters said that DMAs need to be actively managed throughout the period during which they are in effect and that the restrictions should be lifted when the whales are no longer present rather than after 15 days. Representatives of the ferry and whale-watching industries were concerned about the impacts a DMA could have on their businesses if it went into effect during their peak season.
- **Comments on the Economic Analysis.** Some commenters suggested that the economic analysis did not consider the secondary effects on the cities serviced by commercial shipping and ferry vessels. Others commented that the impacts were understated or did not account for logistical constraints. Several commenters also requested that the EIS provide an assessment of the economic benefits of right whale protection and the fuel

cost benefits of slowing ships down. However, no commenters provided new or specific economic information that would contradict the DEIS analysis.

- **Comments on Federal Vessels.** The majority of comments pertaining to Federal vessels stated that exemptions should only be granted for certain critical activities, such as human safety, national security, and national disaster missions, or if they are operating under conditions identified in a BO. Other commenters stated that the exemption should not apply to government research vessels or similar vessels not involved in the above-mentioned critical activities. There were also several requests for information on the number of vessels to which the exemption would apply.
- **Comments on Speed Restrictions.** Among the comments pertaining to speed restrictions that mentioned a specific speed, most advocated 10 knots. Others were concerned that vessel maneuverability would be compromised at 10 knots. Several commenters stated that there are insufficient data to support the assumption that speed restrictions would adequately protect whales against ship strikes. Several commenters suggested that speed restrictions would increase the risk of ship strikes because vessels would be in the area for a longer time and would emit less noise than they would at their regular speed. Commenters provided no new data on the effectiveness or lack thereof of specific vessel speeds.
- **Comments on Routing Measures.** In general, commenters supported the recommended routes. Several commenters requested a more detailed explanation of how and when the TSS modification and ATBA would be implemented.
- **Comments on SMAs.** There were numerous comments on the timing and boundaries of the SMAs, including comments suggesting a January start date for the Off Race Point SMA, that the timing and boundary of the Southeast SMA be extended to include the critical habitat and/or additional ports to the north of Brunswick, Georgia, and that the times in which restriction would be in effect be synchronized among the regions so that they are the same for all alternatives.

1.9.2.5 Review of the FEIS

The FEIS will be available for public review for 30 days from the release date; NMFS will not issue a Record of Decision (ROD) until the close of this review period.

1.10 Structure of the FEIS

Chapter 1 presents the purpose and need for the proposed action and background information.

Chapter 2 describes the alternatives evaluated in the FEIS, including the proposed action (preferred alternative).

Chapter 3 describes the affected environment.

Chapter 4 analyzes the potential impacts of the alternatives on the environment.

Chapter 5 addresses requirements under EO 12866 (Regulatory Impact Review).

Chapter 6 lists references.

Chapter 7 lists the persons, organizations, and agencies that were sent a copy of the Draft and Final EIS for review.

Chapter 8 lists the persons that prepared the FEIS.

Several **appendices** contain supporting information too detailed or technical to be incorporated in the body of the FEIS.

1.11 Issues Not Addressed in the FEIS

1.11.1 Enforcement

Enforcement of the proposed vessel operational measures is not addressed in the FEIS. NMFS is addressing enforcement in the final rule and in select responses to comments in Appendix B.

1.11.2 National Security

The proposed action and alternatives are not expected to affect national security. Neither the Navy nor the USCG expressed national security concerns in their comments on the DEIS. Although these agencies are taking a number of right whale conservation steps, their vessels would not be subject to the proposed operational measures, and therefore their operations would not be affected. Requiring vessels to limit their speed may even promote national security, as suggested by the fact that the USCG occasionally slows vessels as a step to decrease the potential for a security threat (Section 3.4.1.3).

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2 ALTERNATIVES

This chapter describes alternatives the National Marine Fisheries Service (NMFS) is considering to implement proposed regulatory and non-regulatory vessel operational measures. Section 2.1 describes the full set of vessel operational measures being considered by geographical area. Section 2.2 outlines the six alternatives analyzed in the FEIS, including taking no action. With the exception of Alternative 1, the alternatives consist of subsets of the operational measures described in Section 2.1. Some alternatives include one type of measure only (Alternatives 2, 3 and 4); others include a combination of measures (Alternatives 5 and 6). Alternative 6, the proposed action, is NMFS' preferred alternative. Differences between the FEIS and DEIS are described in Section 2.3. Measures once considered by NMFS, but dismissed from further consideration early in the planning process, are discussed in Section 2.4. NEPA only requires that reasonable alternatives be considered in an EIS. An exception to this is the No Action Alternative, which, even if it is not a reasonable alternative, is analyzed in accordance with the Council on Environmental Quality (CEQ)'s Regulations to provide a baseline against which to assess the impacts of the other alternatives. Sections 2.5 and 2.6 discuss the environmentally preferable alternatives and the preferred alternative (proposed action), respectively.

2.1 Overview of the Vessel Operational Measures Considered

The regulatory and non-regulatory vessel operational measures considered in this FEIS would affect three regions along the East Coast of the United States: the southeastern United States region (SEUS), the mid-Atlantic United States region (MAUS), and the northeastern United States region (NEUS), where right whales aggregate or through which they migrate (see Figure 1-1). Seaward, the measures would, at a maximum, apply no farther than the US Exclusive Economic Zone[1] (EEZ).

The vessel operational measures considered are of three different types:

- **Seasonal Management Areas (SMAs).** SMAs are predetermined and established areas within which seasonal speed restrictions apply.
- **Dynamic Management Areas (DMAs).** DMAs are temporary areas consisting of a circle around a confirmed right whale sighting. The radius of this circle expands incrementally with the number of whales sighted and a buffer is included beyond the core area to allow for whale movement. Speed restrictions apply within DMAs, which may be mandatory or voluntary, depending on the alternative, and apply only when and where no SMA is in effect.
- **Routing Measures.** These consist of a set of routes designed to minimize the co-occurrence of right whales and ship traffic. Use of these routes is voluntary; therefore, they constitute a non-regulatory measure. However, mandatory speed restrictions would apply in the portions of the routes located within an active SMA. NMFS would monitor these routes and consider making them mandatory if use is low.

[1] The US EEZ extends to a distance 200 nm (370 km) from the baseline from which the breadth of the territorial sea is measured (www.archives.gov/federal_register/codification/proclamations/05030.html).

Specific measures of each type are described in greater detail by region of application in Sections 2.1.1 through 2.1.4. For each measure, which alternative(s) include(s) it is specified. Only a subset of the measures is included in the proposed action (Alternative 6), as summarized in Section 2.2.6.

As the modifications to the Boston Traffic Separation Scheme (TSS) and creation of an Area To Be Avoided (ATBA) in the Great South Channel are independent of the NMFS rulemaking and the vessel operational measures considered in the FEIS, they are no longer included as potential measures (see Section 1.4).

In all regions, unless otherwise noted, the vessel operational measures would apply only to non-sovereign[2] vessels subject to the jurisdiction of the United States that are 65 ft (19.8 m) or greater in length overall. Sixty-five feet is a vessel-size class recognized by the maritime community and commonly used in maritime regulations (e.g., Automatic Identification System [AIS]; International Navigational Rules Act, Rules of the Road sections) to distinguish between a motorboat and a larger vessel. All Federal vessels and those state enforcement vessels engaged in enforcement or human safety missions would be exempt. In response to comments about vessel maneuverability, NMFS also decided to exempt all vessels from the speed restrictions where oceanographic, hydrographic, and/or meteorological conditions severely restrict vessel maneuverability (see Section 1.4).

With regard to speed restrictions, NMFS' proposed limit is 10 knots; however, for comparison purposes, the FEIS also considers speed limits of 12 and 14 knots. Records of ship strikes in which vessel speed was known indicate that the majority of serious injuries to, or deaths of, whales resulting from ship strikes involved ships operating at speeds of 14 knots or more (Laist *et al.*, 2001; Jensen and Silber, 2003); therefore, a vessel traveling at less than 14 knots would reduce the likelihood and the severity of a ship strike. Recent analysis of these same records indicates that the probability of death or serious injury increases with ship speed. There is a 50 percent (0.26–0.71 for 95 percent confidence interval [CI]) chance that death or serious injury will occur if a right whale is hit by a vessel traveling at 10.5 knots. The probability increases to 75 percent at 14 knots, and exceeds 90 percent at 17 knots (Pace and Silber, 2005). Vanderlaan and Taggart (2007) came to a similar conclusion, determining that the probability of death from a collision was approximately 35-40 percent at 10 knots, 45-60 percent at 12 knots, and 60-80 percent at 14 knots; above 15 knots, it asymptotically approaches 100 percent.

Additionally, vessels traveling at lower speeds may also produce weaker hydrodynamic forces. At higher speeds, such forces have the capacity to first push a whale away from a moving ship and then draw the whale back toward the ship or propeller, resulting in a strike (Knowlton *et al*., 1998). These forces increase with the vessel's speed; therefore, a whale's ability to avoid a ship in close quarters may be reduced at higher vessel speeds. In a modeling study using data from observed encounters of right whales with vessels, Kite-Powell *et al*. (2007) determined that more than half of the right whales located in or swimming into the path of an oncoming ship traveling at 15 knots or more are likely to be struck even if the whales attempt evasive action. The strike risk posed by a conventional ship moving 20 to 25 knots could be reduced by 30 percent by its slowing to 12 or 13 knots, and by 40 percent by slowing to 10 knots because of the whales' increased ability to detect and avoid approaching vessels.

[2] Non-sovereign vessels are commercial and recreational vessels, not owned, operated, or under contract to the US Federal Government.

Slutsky (2007) measured the forces involved in whale-vessel collisions using whale and ship models in a tow tank. The author determined that the magnitude of forces exerted on the whale increased linearly with vessel speed (Slutsky, 2007). A separate study examined the effects of these forces by looking at the biomechanical properties of right whale mandibles as related to blunt force trauma inflicted by a vessel (Campbell-Malone, 2007). Citing Kite-Powell *et al*. (2007), Campbell-Malone (2007) found that there are compounded (both behavioral and force of impact) benefits to implementing speed restrictions and predicted, like Kite-Powell *et al*. (2007), a reduction in right whale deaths as a result of vessel speed limits in right whale habitat.

2.1.1 Measures Considered for the Southeastern United States Region

Sighting data indicate that right whales occur in consistent aggregations in specific areas during certain times of the year; such areas and times are the foci of the measures considered for the SEUS region. Right whales occur in waters off the SEUS in winter and early spring; this area is utilized for calving and as a nursery. The only known calving area for North Atlantic right whales is located adjacent to the coasts of northern Florida and Georgia. This area was designated critical habitat for right whales in 1994 (59 FR 28793) (NMFS received a petition on July 11, 2002, requesting the expansion of the critical habitat by approximately 2,700 nm^2 (5,003.6 km^2). On August 28, 2003, NMFS made a determination not to expand the critical habitat[3], as the information presented in the petition did not adequately support the proposed expanded boundaries [68 FR 51758]).

There are three major ports in the SEUS (Brunswick, GA; Jacksonville, FL; and Fernandina, FL) and a number of small harbors primarily serving recreational vessels. The most recent confirmed ship strikes in the SEUS occurred in 2006: three mortalities and one serious injury have been documented for that year (Glass *et al.*, 2008).

2.1.1.1 Vessel Operational Measures

The operational measures considered for application in the SEUS region include SMAs and routing measures. The measures would apply only to non-sovereign vessels 65 ft (19.8 m) or more in length.

Within the SMAs (the extent and duration of which is described in Section 2.1.1.2), vessels would be required to slow down. As previously noted, NMFS is proposing a maximum speed of 10-knots; however, this FEIS also considers speeds of 12 and 14 knots.

Vessels would also be encouraged to use specific shipping routes (described in Section 2.1.1.2); use of the routes would be recommended, not mandatory.

2.1.1.2 Areas and Times

SMAs

Depending on the alternative, two different SMA options are being considered for the SEUS region, as described below.

[3] The determination stated that the requested revision, "…is not warranted at this time. However, NMFS will continue to analyze the physical and biological habitat features essential to the conservation of right whales.

Southeast SMA Option

Under this option, the SMA would cover an area bounded to the north by latitude 31º27'N (coinciding with the northernmost boundary of the mandatory ship reporting system [MSRS]; see Section 1.2.1.2); to the south by latitude 29º45'N; to the east by longitude 80º51.6'W (eastern boundary of the MSRS), and to the west by the shoreline (see Figure 2-1). Speed restrictions would apply in the Southeast SMA from November 15 to April 15. This measure is included in Alternative 6.

Studies indicate that in this period, right whale concentrations are highest in the SEUS' calving and nursery areas. Because this is the only known calving area for North Atlantic right whales, the welfare of reproducing females in this area is vital to the recovery of the species and is a priority for protective measures. Estimates of the relative density of right whales in the SEUS region have been developed based on survey data from 1992 to 2003. In December, the areas of high sighting per unit effort (SPUE) occur in the northern part of the region. In January, the highest SPUE occurs in the central area of the habitat. In February, right whales are concentrated in the southern and central areas, with very high SPUE values near Fernandina Beach and Jacksonville, FL. In March, SPUE values are generally low, with higher occurrences in the northern area (NMFS, 2005, *unpublished*).

MSRS WHALESSOUTH/Critical Habitat SMA Option

Under this option, the SMA would include all waters within the MSRS WHALESSOUTH reporting area (see Section 1.2.1.2) and the presently-designated right whale critical habitat. It would be in effect from November 15 to April 15. This measure is included in Alternatives 3 and 5.

Shipping Routes

Recommended shipping routes, illustrated in Figure 2-2, have been established for the approaches to the ports of Jacksonville and Fernandina Beach, FL, and Brunswick, GA, which partially overlap with the designated right whale critical habitat area and experience high levels of vessel traffic. The goal of the routes is to consolidate traffic so as to avoid areas of relatively high right whale densities (Garrison, 2005). The USCG analyzed the routes for navigational en environmental safety in a Port Access Routes Study (PARS) and released its report on May 24, 2006.[4] The recommended routes were slightly modified after the PARS report was issued to avoid potential navigational hazards associated with fish havens and other potential obstructions that were hydrographically surveyed only recently. The revised routes were assessed taking into account whale occurrence and the expected distribution of vessel traffic (illustrated in Figure 2-3). As stated in Garrison (2006), "the vessel traffic patterns reported to the MSR system from 2001 – 2005 were used as a baseline to assess the reduction in risk. This raster representation of traffic was then multiplied by modeled right whale densities to quantify relative risk." Based on this analysis, which considered both ship-strike risk and potential navigational hazards, the routes are expected to provide a 40 percent average reduction in the risk of ship strikes to right whales (Garrison, 2006). Use of the routes would be recommended year-round. This measure is included in Alternatives 4, 5, and 6.

[4] The PARS report and other documents on the recommended routes are available at http://www.nmfs.noaa.gov/pr/shipstrike/routes.htm.

Southeast SMA

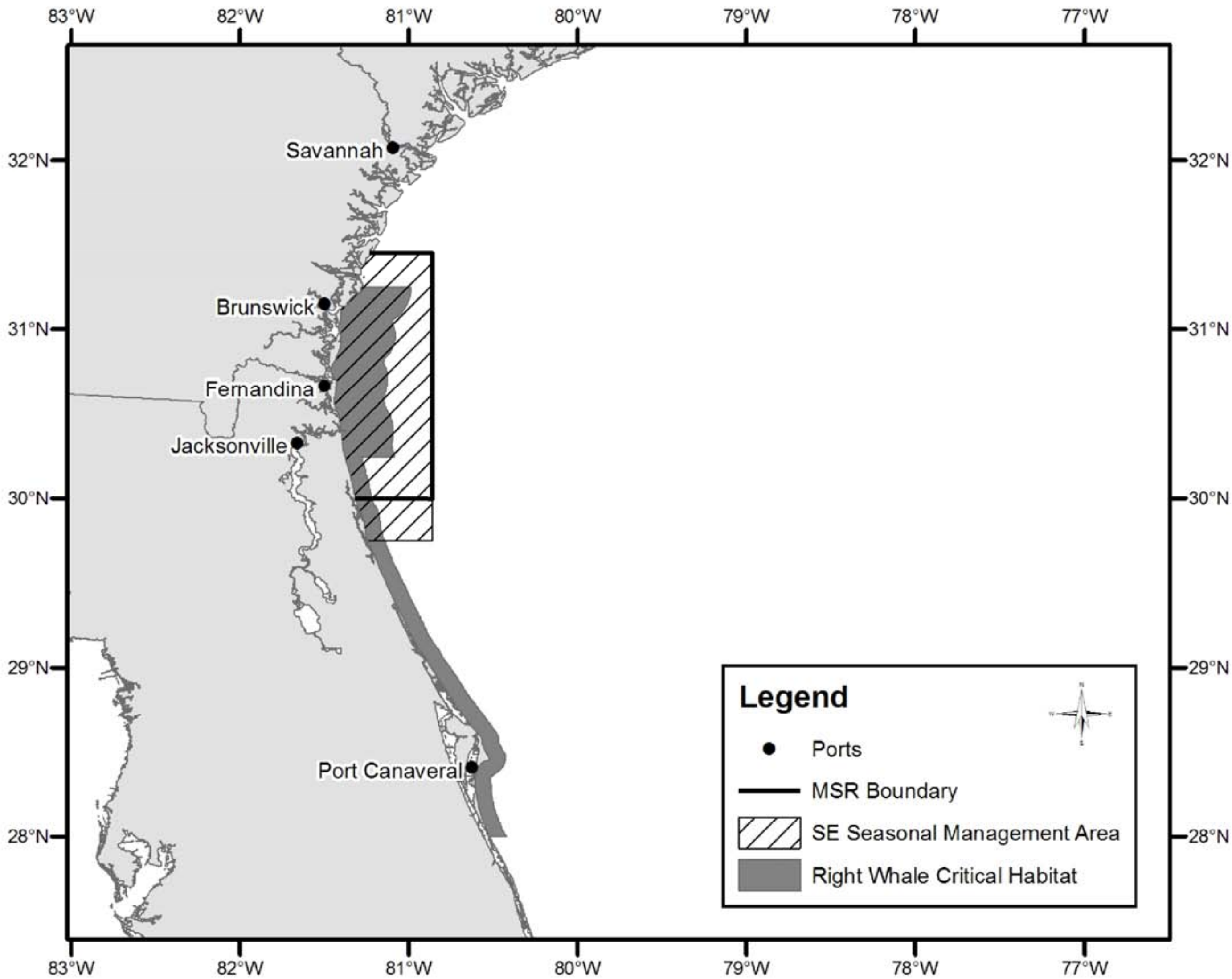

Figure 2-1

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Recommended Routes in the SEUS

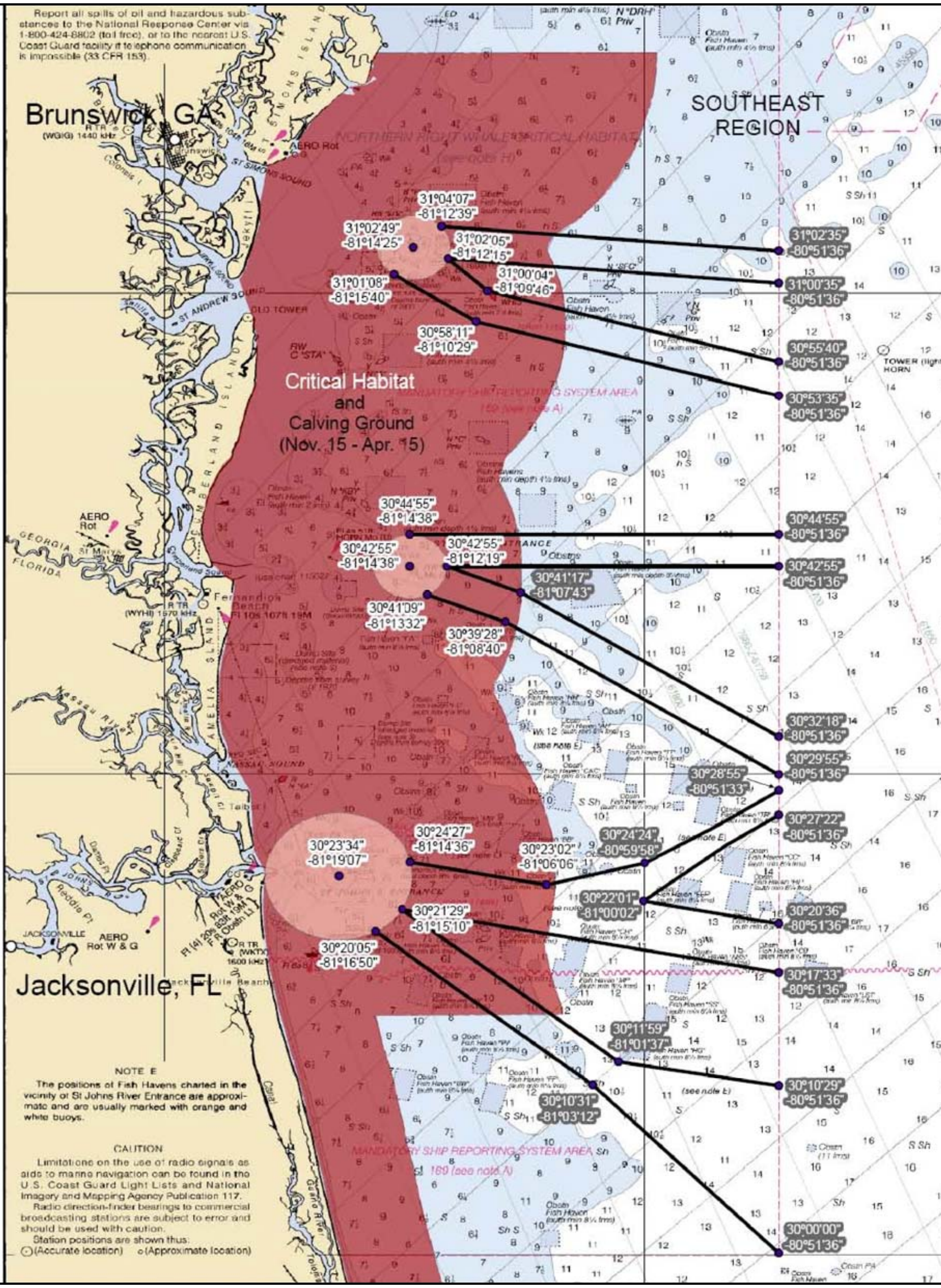
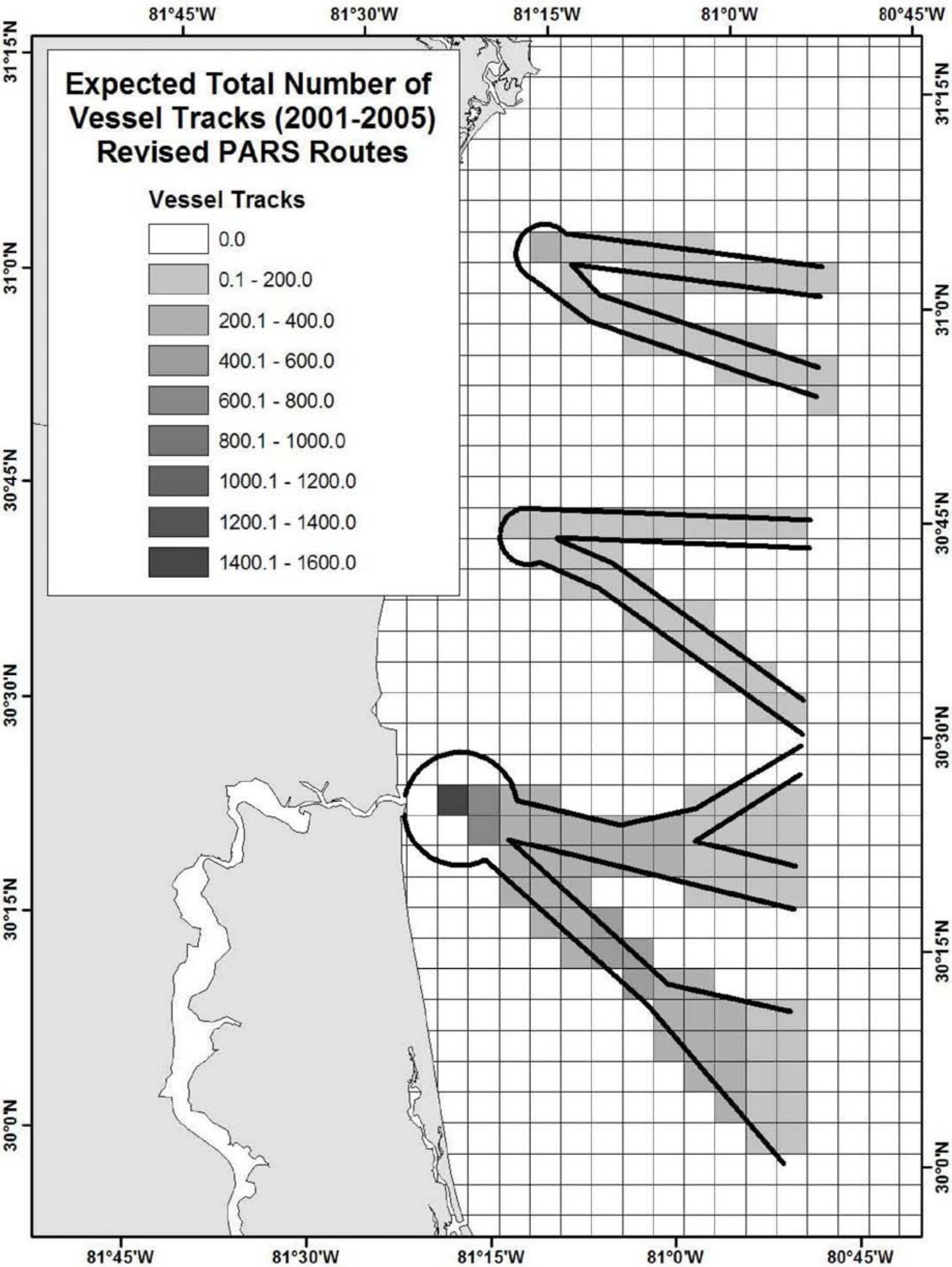


Figure 2-2

Recommended SEUS Shipping Routes and Expected Distribution of Vessel Traffic



Source: Garrison (2006), The blocks are 4x4 km squares (Raster cell representation) used to model right whale sightings per unit effort and summarize vessel traffic.

Figure 2-3

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2.1.2 Measures Considered for the Mid-Atlantic United States Region

The MAUS region includes the coastal migratory corridor right whales use to travel between their calving and nursery grounds in the SEUS region and the feeding grounds in the NEUS region and Canada. The mother-calf pairs that are traveling through the mid-Atlantic generally spend more time at or near the surface, which makes them even more prone to ship strike. Many ships enter ports throughout the MAUS region and traverse the migratory corridor, creating a high-risk situation for migrating right whales. Given the small population size, the death of any right whale is serious, and during the 4-year period from 2001 to 2004, five females and calves died from ship strikes in the MAUS region. Two right whale calves were found dead in the MAUS region in 2001; one had propeller wounds, indicating that the death was caused by a ship strike. In 2002, a one-year old female was found dead off the coast of Ocean City, Maryland. In 2004, a dead pregnant female right whale, first observed floating off the Virginia coast, subsequently stranded in North Carolina, where it was determined to have died from a vessel collision. Also in 2004, another pregnant female was found dead in North Carolina; the left half of its fluke had been severed, indicating a ship strike. These five NMFS-confirmed ship strike mortalities (Cole *et al*., 2006) attest to the risk of ship strikes in the MAUS.

2.1.2.1 Vessel Operational Measures

The operational measures considered for the MAUS region consist of SMAs. The SMAs and associated speed restrictions would apply only to non-sovereign vessels 65 ft (19.8 m) or longer. As previously noted, NMFS is proposing a speed restriction of 10 knots; however, this FEIS also considers restrictions of 12 and 14 knots.

2.1.2.2 Areas and Times

Depending on the alternative, three SMA options are being considered: a) separate SMA out to 20 nm from shore around certain port areas; b) separate SMA out to 30 nm from shore around the MAUS port areas; and c) a continuous SMA out 25 nm from the entire MAUS coast.

The 1972 Convention on International Regulations for Preventing Collisions at Sea (COLREGS) developed lines to demarcate harbor entrances, known as COLREGS demarcation lines. These lines were established to delineate the waters in which mariners must comply with either the COLREGS or the Inland Navigational Rules Act of 1980 (Inland Rules). Waters inside the lines are Inland Rules Waters; waters outside the lines are COLREGS Waters. The COLREGS lines provided the coastal baseline for the definition of the SMAs around the MAUS ports. Vessels transiting waters landward of these lines (Inland Rules Waters) would not have to adhere to speed restrictions or any operational measure. All vessels transiting seaward of the COLREGS lines would be required to adhere to speed restrictions within the SMAs. Applicable COLREGS lines for the MAUS ports are provided in Appendix C.

Separate SMAs Options

20-nm SMAs Option

Under this option, six discrete SMAs would be defined around the nine port areas in the MAUS region, as listed below and illustrated in Figure 2-4. Of the six, five would extend out to 20 nm and one out to 30 nm, as detailed below. Those SMAs would be in effect from November 1 to April 30, consistent with right whale occurrence in the MAUS. This measure is included in Alternative 6.

Separate SMAs – 20-nm Option

1. South and east of Block Island Sound (Montauk Point to western end of Martha's Vineyard). Out to 30 nm. See Figure 2-5.
2. Ports of New York and New Jersey. Out to 20 nm. See Figure 2-6.
3. Delaware Bay (Ports of Philadelphia and Wilmington). Out to 20 nm. See Figure 2-7.
4. Entrance to Chesapeake Bay (Ports of Hampton Roads and Baltimore). Out to 20 nm. See Figure 2-8.
5. Ports of Morehead City and Beaufort, NC. Out to 20 nm. See Figure 2-9.
6. Continuous SMA between and including the Ports of Wilmington, NC, and Savannah, GA. Out to 20 nm. See Figure 2-10.

The Block Island Sound SMA would be a 30-nm (56-km)-wide rectangular area extending south and east of the mouth of the sound. Sightings data show that in this area, approximately 90 percent of right whale sightings from 1972 through 2000 occurred within 30 nm (56 km) of the coast (NMFS, 2008, *unpublished*). The SMAs for New York and New Jersey, Delaware Bay, Chesapeake Bay, and Morehead City and Beaufort, North Carolina would be circular, each with a 20-nm (37-km) radius. The remaining four ports – Wilmington, Georgetown, Charleston, and Savannah – would share a continuous 20-nm (37-km) SMA. An analysis of sightings data from 1972 through 2000 from Connecticut to the South Carolina/Georgia border indicated that approximately 83 percent of all right whale sightings (total sample size n = 290) occurred within 20 nm (37 km) of the coast (NMFS, 2008, *unpublished*). The distribution patterns mentioned in this section are illustrated in Figure 2-11.

30-nm SMAs Option

Under this option, vessel operational measures in the MAUS region would consist of 30-nm (56-km) SMAs around the nine port areas in the MAUS region. These 30-nm (56-km) SMAs would be in effect from November 1 to April 30, consistent with right whale occurrence in the MAUS. The Block Island Sound SMA would be rectangular area extending south and east of the mouth of the sound. The SMAs for New York and New Jersey, Delaware Bay, Chesapeake Bay, and Morehead City and Beaufort, North Carolina would be circular. The remaining four port areas – Wilmington, Georgetown, Charleston, and Savannah – would share a continuous SMA adjacent to the northern boundary of the SEUS SMA (see Section 2.1.1.2).

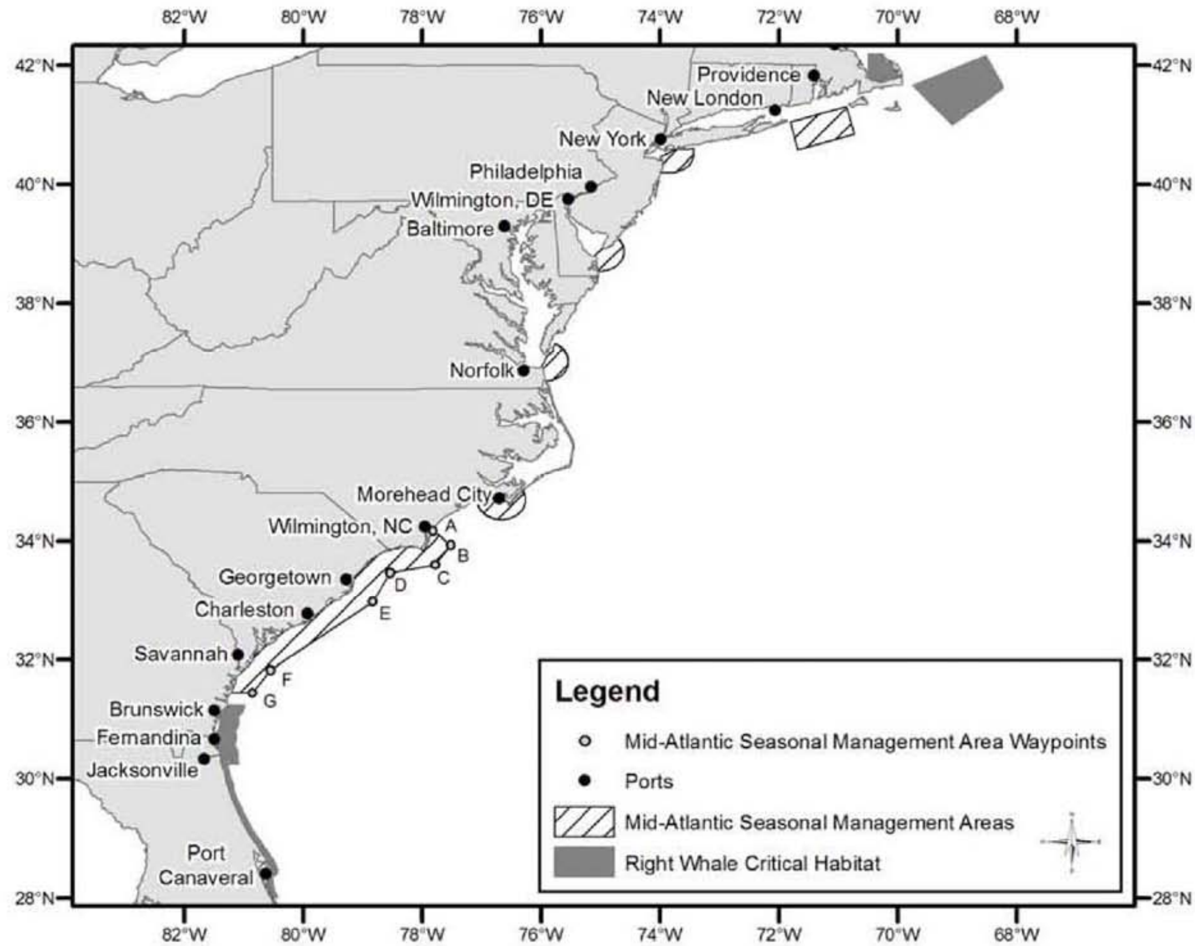
Continuous 25-nm SMA Option

Under this option, a SMA would be defined in the MAUS region that would include all waters 25 nm (46 km) seaward of the coastline between Providence, RI/New London, CT (Block Island Sound) and Savannah, GA. This SMA would be in effect from October 1 to April 30. This measure is included in Alternatives 3 and 5.

2.1.3 Measures Considered for the Northeastern United States Region

Right whales use the NEUS region mostly for foraging. Data indicate that right whales concentrate their feeding efforts in four distinct zones of the NEUS region: Cape Cod Bay, Off Race Point, the Great South Channel, and the Gulf of Maine. Vessel operational measures considered for the NEUS vary with the zone considered and include new designated shipping lanes as well as speed restrictions within SMAs.

Separate SMAs in MAUS Region (20 - nm Option)

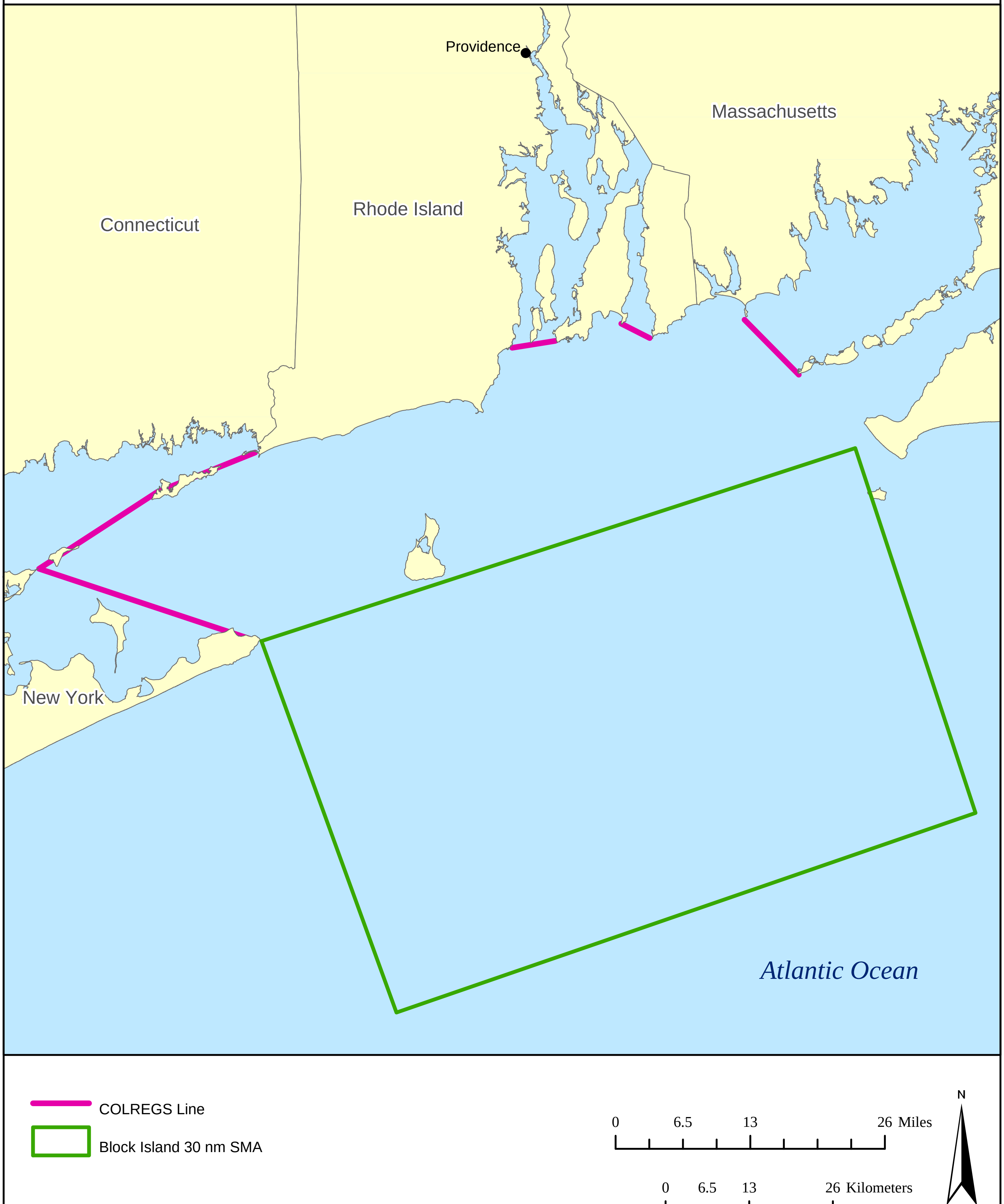


<u>Continuous 20 - nm SMA</u>

Point	Latitude	Longitude
A	34°10'30"	77°49'12"
B	33°56.42"	77°31'30"
C	33°36'30"	77°47'06"
D	33°28'24"	78°32'30"
E	32°59'06"	78°50'18"
F	31°50'00"	80°33'12"
G	31°27'00"	80°51'36"

Figure 2-4

Block Island SMA



Note: COLREGS lines are approximate and this chart should not be used for navigation.

Figure 2-5

Ports of New York and New Jersey SMA

Note: COLREGS lines are approximate and this chart should not be used for navigation.

Figure 2-6

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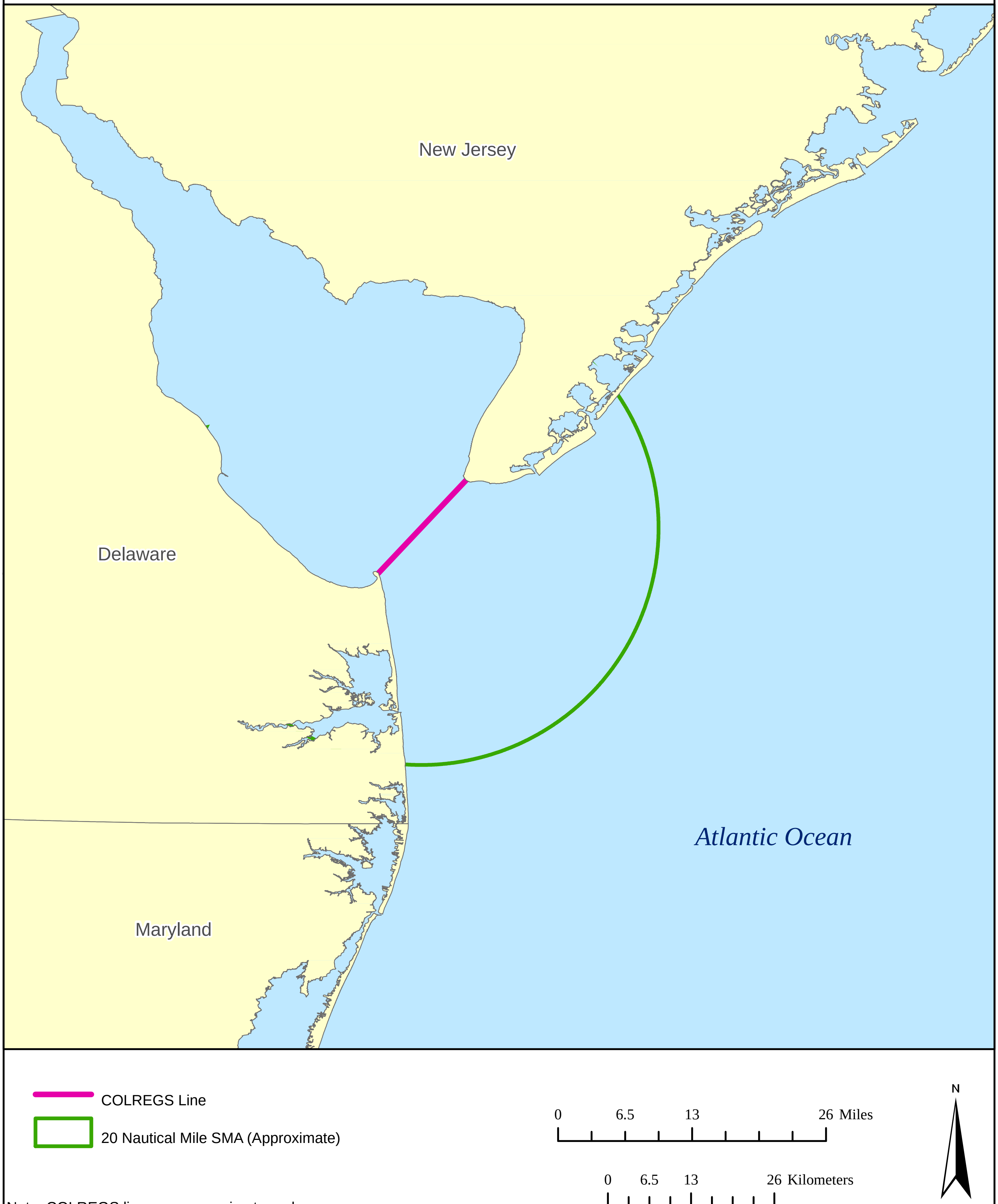
Delaware Bay SMA



Note: COLREGS lines are approximate and this chart should not be used for navigation.

Figure 2-7

Chesapeake Bay SMA

Note: COLREGS lines are approximate and this chart should not be used for navigation.

Figure 2-8

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Morehead City & Beaufort, NC SMA

Note: COLREGS lines are approximate and this chart should not be used for navigation.

Figure 2-9

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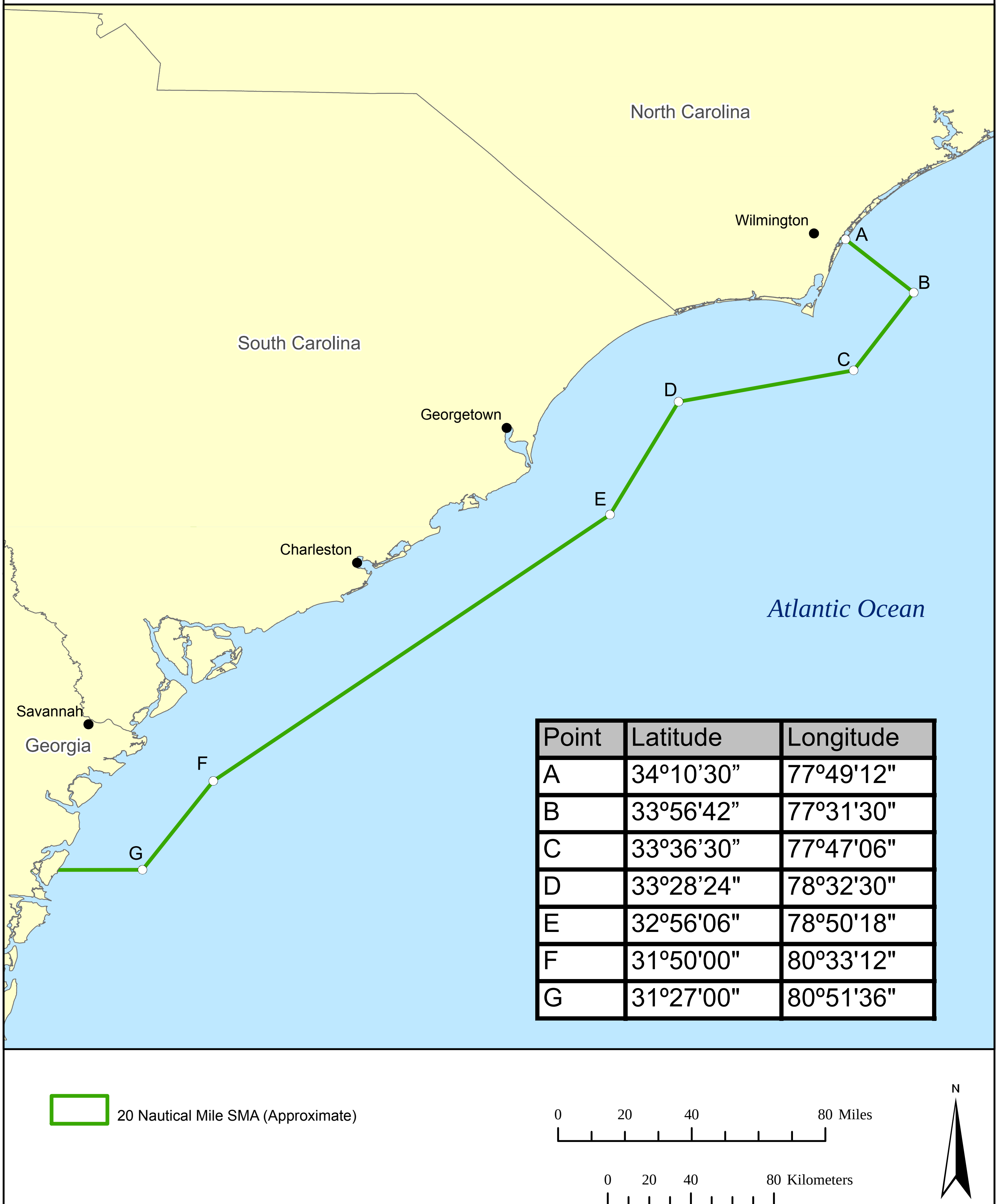
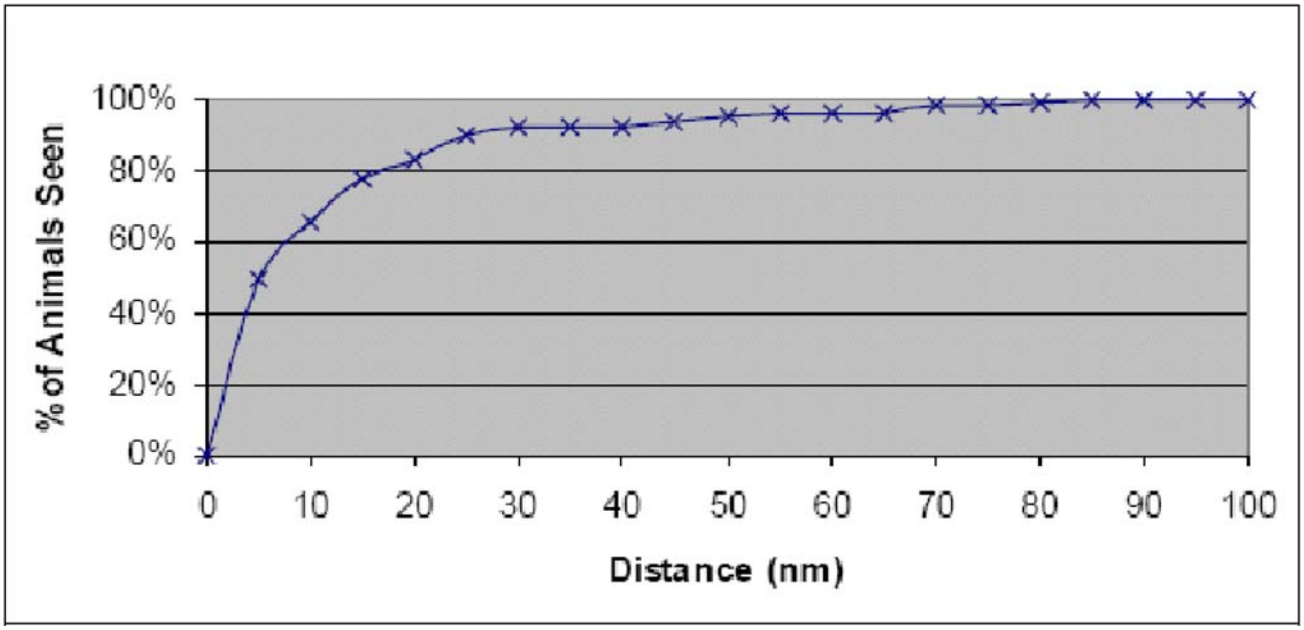
Continuous 20-nm SMA



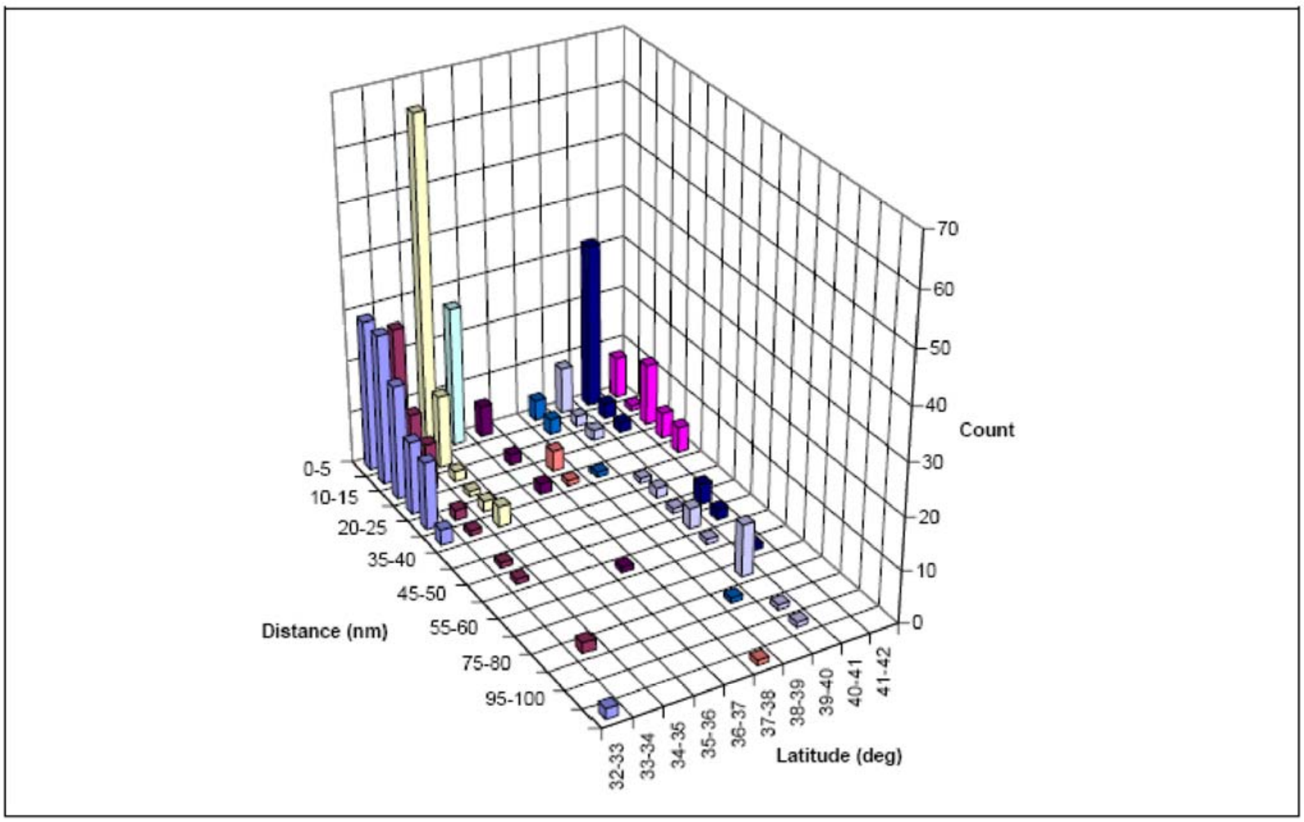
Point	Latitude	Longitude
A	34º10’30”	77º49'12"
B	33º56'42”	77º31'30"
C	33º36’30”	77º47'06"
D	33º28’24"	78º32'30"
E	32º56'06"	78º50'18"
F	31º50'00"	80º33'12"
G	31º27'00"	80º51'36"

Figure 2-10

Cumulative Distribution of Right Whales Offshore of NC - VA, 1960 - 2003



Right Whale Sighting Distances Offshore by Latitude, 1960 - 2003



Source: Merrick 2005

Figure 2-11

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2.1.3.1 Cape Cod Bay

Right whales occur in Cape Cod Bay from winter through spring, when food is typically abundant. Given its importance as a feeding and aggregation area, Cape Cod Bay was designated as right whale critical habitat in 1994 (50 CFR 226.203). (The critical habitat petition referred to in Section 2.1.1 also requested the expansion and combination of the Cape Cod Bay and Great South Channel critical habitat areas. NMFS concluded that this request was unwarranted at the time, but analysis is underway with respect to redefining the areas).

Vessel Operational Measures

Depending on the alternative, measures considered for Cape Cod Bay (CCB) include SMAs and recommended shipping routes. Within the SMAs (when in effect) non-sovereign vessels 65 ft (19.8 m) and longer would have to observe a required speed restriction. NMFS is proposing a 10-knot restriction; however this FEIS also considers 12-and 14-knot restrictions. Use of the shipping routes would be recommended but not required.

Areas and Times

CCB SMA

The SMA would cover the entire bay, including the Cape Cod Bay critical habitat and the area directly west of the critical habitat all the way to the shoreline, with its northern boundary at latitude 42°12’N (see Figure 2-12). The SMA would be in effect from January 1 to May 15, consistent with right whale occurrence illustrated in Figure 2-13. This measure is included in Alternative 6.

Critical Habitat SMA

The area would coincide with the critical habitat and thus be smaller than the CCB SMA. However, unlike that SMA, it would be effective year-round. It is included in Alternatives 3 and 5.

Shipping Routes

The recommended routes are illustrated in Figure 2-14. The routes have been established from Cape Cod Canal through the Critical Habitat, on the western side of the bay, towards Massachusetts Bay and other points north. The recommended routes minimize the travel distance through the Cape Cod Bay Critical Habitat for ships entering and leaving the port of Provincetown via Cape Cod Canal or from the north, by routing them along the edges of the Critical Habitat (NMFS, 2004e), thus minimizing collision risks. Use of the routes would be recommended year-round. Where and when the routes overlap with an active SMA, vessels would be required to observe the associated speed restriction. This measure is included in Alternatives 4, 5, and 6.

2.1.3.2 Off Race Point Area

Race Point is located at the tip of Cape Cod and the Off Race Point SMA would consist of waters around the northern end of Cape Cod. As food resources in Cape Cod Bay diminish toward the end of April, right whales begin to migrate toward the Great South Channel to feed on offshore prey aggregations. Before reaching the Great South Channel, right whales tend to transit or aggregate in neighboring areas, such as Stellwagen Bank, areas east of Stellwagen Bank, and the northern end of Provincetown Slope, which is the area extending east of Cape Cod to the

Great South Channel. For the purposes of this FEIS, these areas are collectively referred to as the “Off Race Point” area, a box approximately 50 by 50 nm (93 by 93 km) in size to the north and east of Cape Cod (see Figure 2-12) and defined by the following coordinates, developed based on right whale sighting data and vessel traffic patterns:

Table 2-1
Coordinates for the Off Race Point Area

Location	Latitude (N)	Longitude (W)	Comment
NW Corner	42° 30’	070° 30’	
NE Corner	42° 30’	069° 45’	
SE Corner	41° 40’	069° 45’	
Southern Mid-point	41° 40’	069° 57’	Continues North along the eastern shore of Cape Cod to the next point.
Western Center-point	42° 04.8’	070° 10’	(Northern tip of Cape Cod)
Western Center-point	42° 12’	070° 15’	(NE corner of critical habitat)
SW Corner	42° 12’	070° 30’	(NW corner of critical habitat)

Ship traffic within the Off Race Point area is heavy, primarily into and out of Boston and associated harbors, exposing right whales to the possibility of ship strikes. Boston was the most frequently reported destination for ships that traveled through designated critical habitat areas: 69 percent of the 2,146 ships that reported to the Northeast MSRS were bound for Boston (Ward-Geiger et al., 2005).

Vessel Operational Measures

SMAs are the measures considered for the Off Race Point Area. The SMAS would apply only to non-sovereign vessels 65 ft (19.8 m) in length and longer. Such vessels would be required to slow down through the SMA or to route around it. NMFS is proposing a 10-knot restriction; however, this FEIS also analyses 12-and 14-knot restrictions.

Areas and Times

Off Race Point SMA

The Off Race Point SMA would cover the Off Race Point Area as defined in Table 2-1 and illustrated in Figure 2-12. The Off Race Point SMA would be effective from March 1 to April 30, consistent with historic right whale sighting information. This measure is included in Alternative 6. Figure 2-15 shows the right whale sighting data that was analyzed to determine the spatial and temporal boundaries of the Off Race Point SMA.

SAM West SMA

Alternatively, this SMA would coincide with the expanded Seasonal Area Management (SAM) West identified in the ALWTRP (See Section 1.2.2). The extent of SAM West is shown in Figure 2-16. Its eastern and northern boundaries coincide with those of the Off Race Point area as defined above. To the west, it extends beyond it, to 69° 24’ longitude. This measure is included in Alternatives 3 and 5.

Proposed Cape Cod Bay, Off Race Point, and Great South Channel SMAs

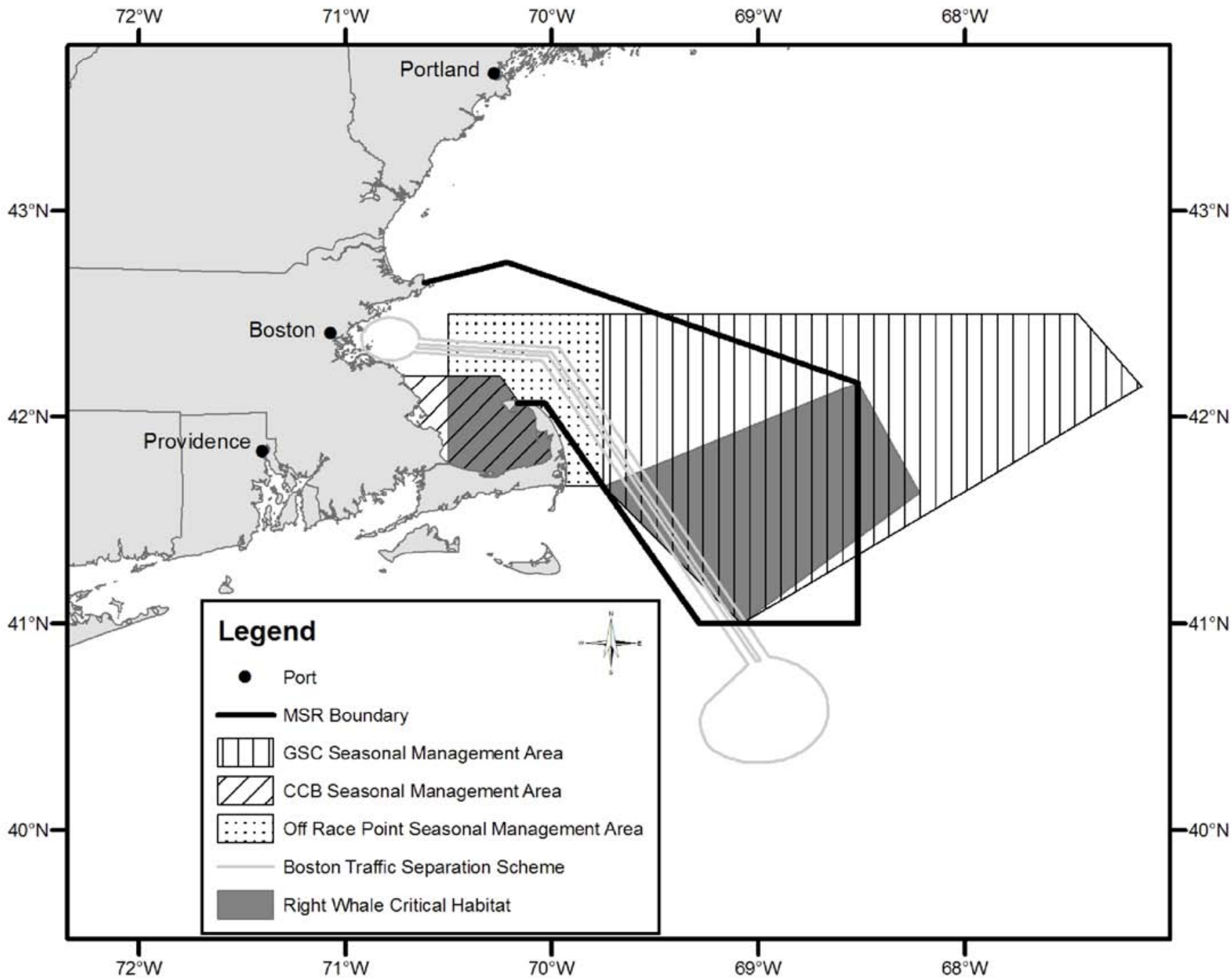

Figure 2-12

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Right Whale Sightings in the Cap Cod Bay SMA
January - May, 1970 - 2003

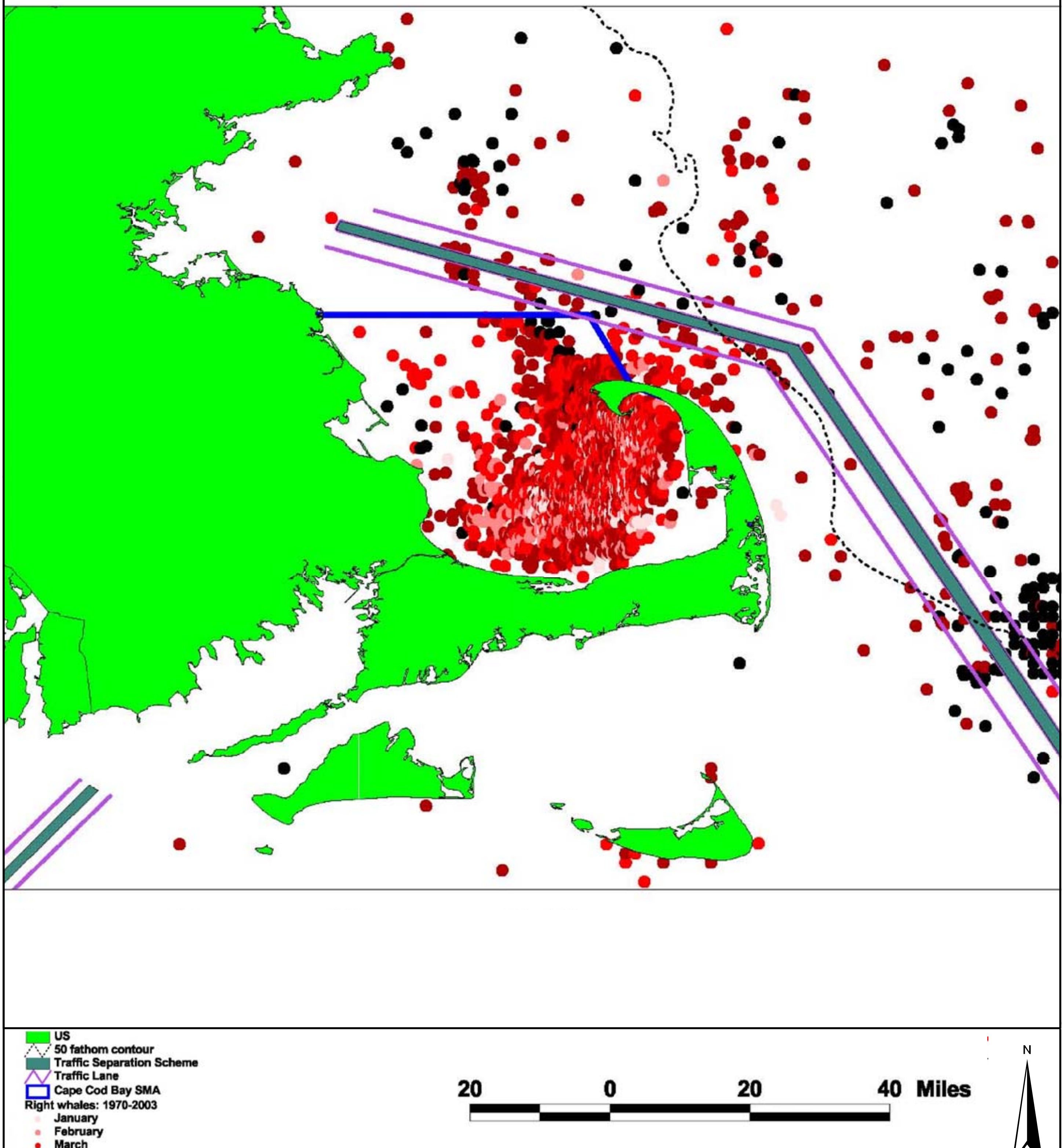

Figure 2-13

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Recommended Shipping Routes in Cape Cod Bay

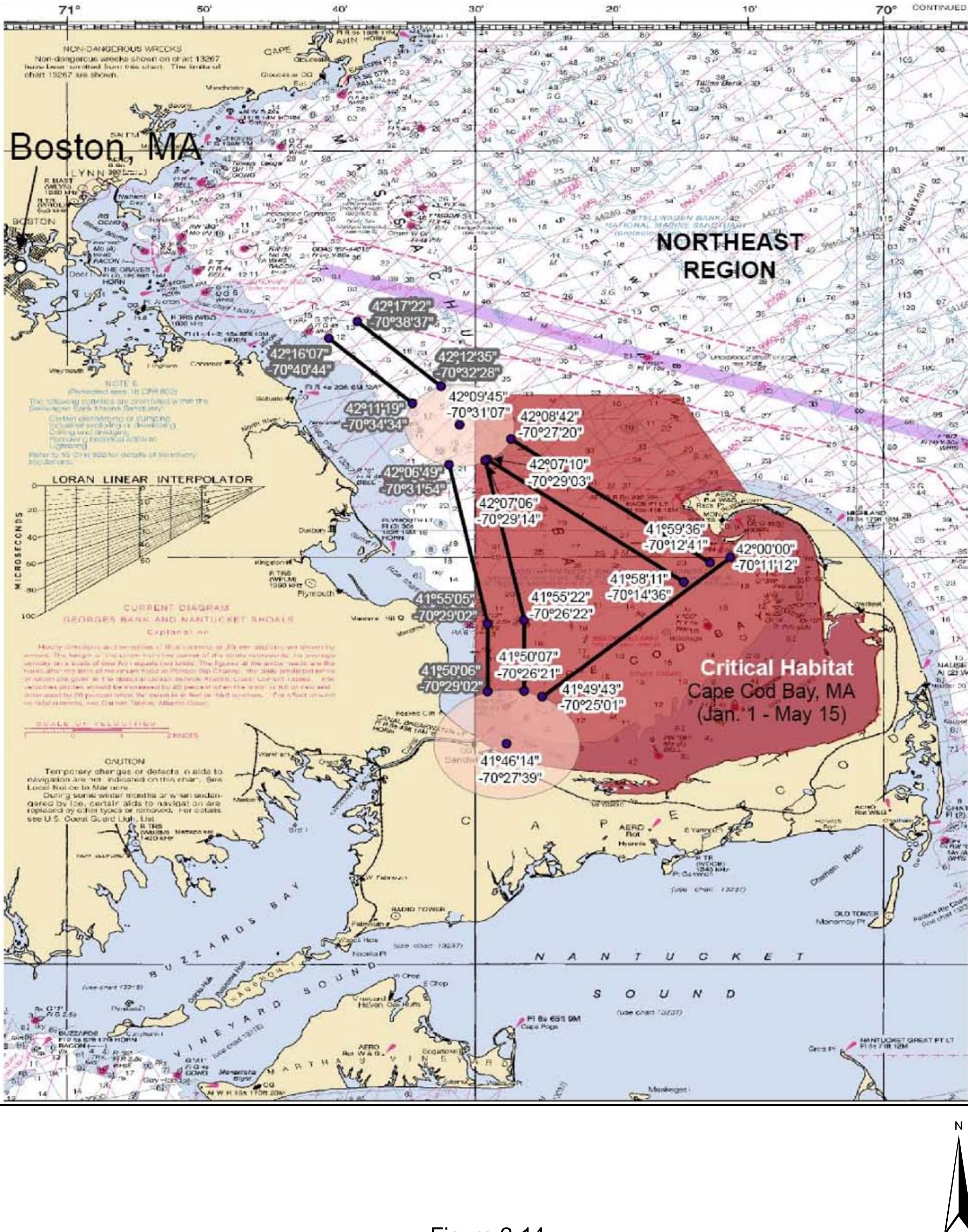

Figure 2-14

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Right Whale Sightings in the Off Race Point SMA
March - April, 1970 - 2003

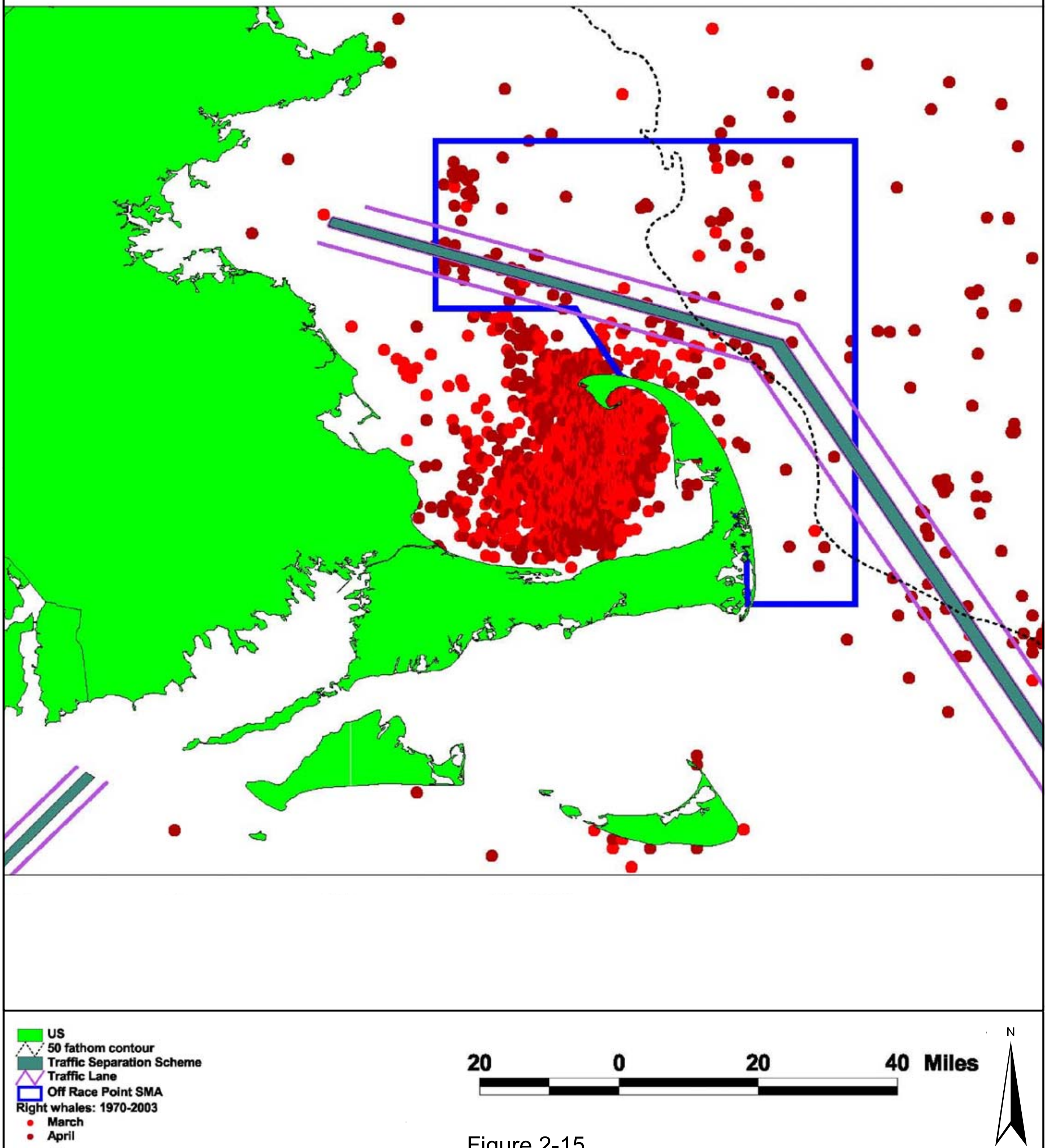

Figure 2-15

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ALWTRP SAMs

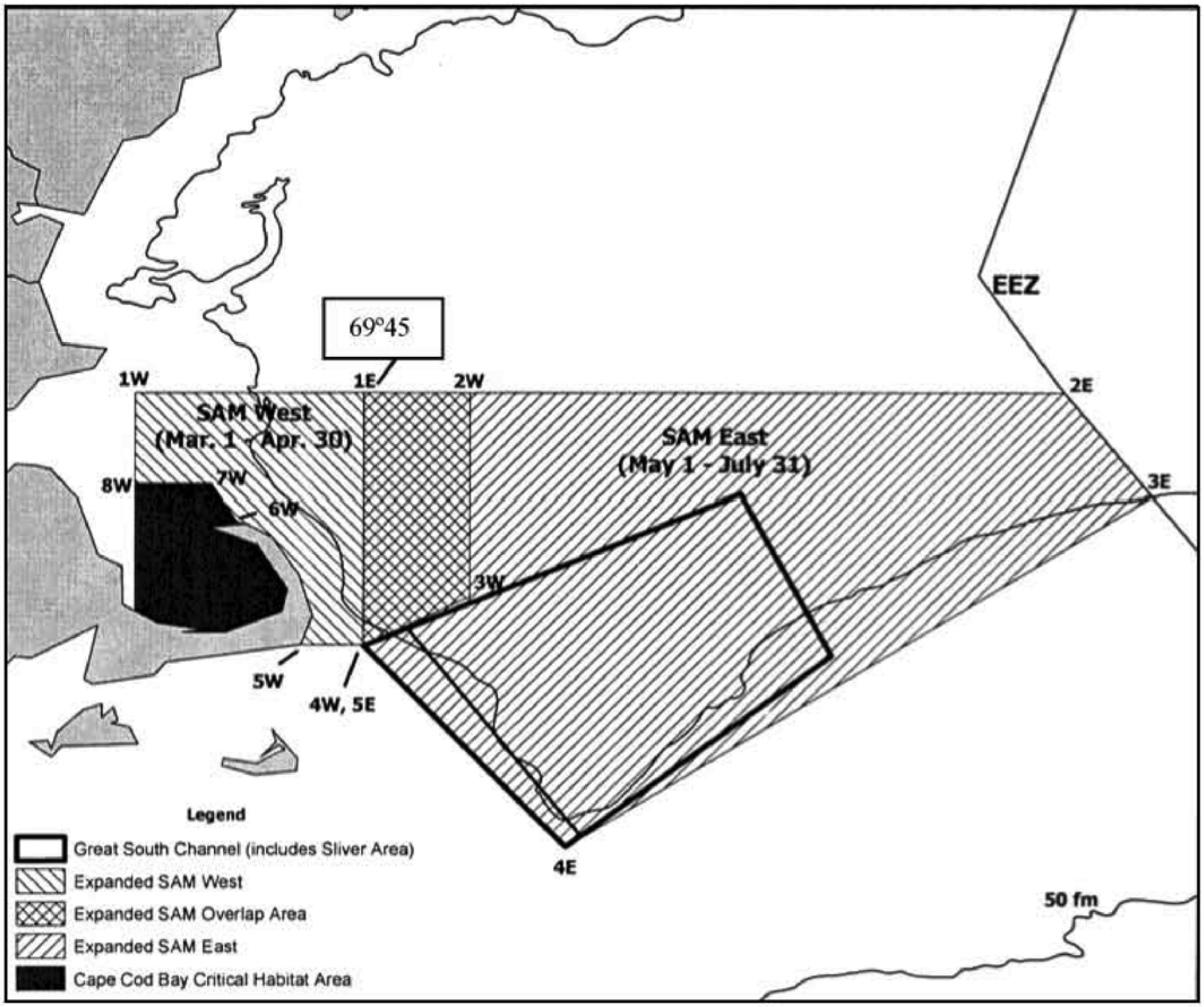

Figure 2-16

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2.1.3.3 Great South Channel

During spring and early summer, large numbers of right whales aggregate in the Great South Channel, a designated critical habitat and important feeding ground. The critical habitat area is located in the southern portion of the Great South Channel management area (see Figure 2-12). At times, more than half the entire North Atlantic right whale population is feeding in or passing through the Great South Channel. Some individuals are rarely, if ever, observed in other feeding grounds (such as the Bay of Fundy) at this time of year. The GSC area experiences heavy commercial ship traffic; analysis of reports to the MSRS identified three high-use traffic corridors through the Great South Channel critical habitat (Ward-Geiger *et al*., 2005). Thus, vessel collisions with right whales are a serious risk when whales are present.

Operational Measures

The operational measure considered for the Great South Channel area are SMAs. The SMAs would apply to all non-sovereign vessels 65 ft (19.8 m) and longer, which would be required to slow down when traversing them. As previously noted, NMFS is proposing a 10-knot restriction; however, this FEIS also analyses 12-and 14-knot restrictions.

Areas and Times

GSC SMA

Under this option, the SMA would cover the area defined in Table 2-2 and illustrated in Figure 2-12. The boundaries were defined based on right whale sighting and recent survey data.

Table 2-2
Coordinates for the Great South Channel SMA

Location	Latitude (N)	Longitude (W)
NW Corner	42° 30’	069° 45’
NE Corner	42° 30’	067° 27’
SE Corner	42° 09’	067° 08.4’
Southern Mid-point	41° 00’	069° 05’
SW Corner	41° 40’	069° 45’

Speed restrictions would be in effect within the GSC SMA from April 1 to July 31, corresponding to the peak period of right whale presence, illustrated in Figure 2-17, which shows the right whale sighting data that was analyzed to determine the spatial and temporal boundaries of the GSC SMA. This measure is included in Alternative 6.

SAM East SMA

Alternatively, this SMA would coincide with the expanded Seasonal Area Management (SAM) East identified in the ALWTRP (See Section 1.2.2). The extent of SAM East is shown in Figure 2-16. The SAM coincides with the GSC SMA as defined above except to the west, where it extends to 69° 24’ longitude only instead of 69° 45.’ This measure is included in Alternatives 3 and 5.

2.1.3.4 Summary of Operational Measures Considered for the NEUS Region

A summary of the measures considered for the NEUS region is presented in Table 2-3.

Table 2-3
Summary of Operational Measures Considered for the NEUS Region

Area	Type of Measure	Period When Applicable	Included in Alternative
Cape Cod Bay	CCB SMA **or** Critical Habitat SMA **and/or** Recommended Routes	January 1 to May 15 Year-round Year-round	6 3 and 5 4, 5 and 6
Off Race Point Area	Off Race Point SMA **or** SAM West SMA	March 1 to April 30 Year-round	6 3 and 5
Great South Channel	GSC SMA **or** SAM East SMA	April 1 to July 31 Year-round	6 3 and 5

2.1.4 Measures Considered for All Three Regions

DMAs are a type of operational measure that is non-region specific and could be applied in all three regions whenever right whales are determined to be present.

DMAs consist of a circular buffer zone drawn around a core area of whale sightings that would reduce the risk of ship strikes to the whales. DMAs would only occur when and where other measures (i.e., SMAs) are not in effect. The size of the buffer, as described below, is determined by the number of whales in the aggregation.

The type of right whale aggregation that would trigger the implementation of a DMA has been defined based on the ALWTRP DAM trigger criteria, which were developed by Clapham and Pace (2001). A DMA would be triggered by a single reliable report from a qualified individual[5] of an aggregation of three or more right whales within 75 nm^2 (257 km^2), such that right whale density is equal to or greater than 0.04 right whales per nm^2 (3.43 km^2), that is, the equivalent of four right whales per 100 nm^2 (343 km^2). Clapham and Pace's study found that such an aggregation is indicative of a feeding group and is likely to persist for up to two weeks.

When the criteria are met, NMFS would use the following procedures to establish a DMA:

1. A circle with a radius of at least 2.8 nm (5.2 km) would be drawn around the location of each individual sighting. This radius would be adjusted for the number of whales, so that a density of four right whales per 100 nm^2 (343 km^2) is maintained.

[5] A qualified individual is an individual ascertained by NMFS to be reasonably able, through training or experience, to identify a right whale. Such individuals include, but are not limited to, NMFS staff, USCG and Navy personnel trained in whale identification, scientific research survey personnel, whale-watch operators, naturalists, and mariners trained in whale species identification through disentanglement training or some other training program deemed adequate by NMFS. A reliable report is a credible right whale sighting on the basis of which a DAM zone would be triggered.

Right Whale Sightings in the Great South Channel SMA
April - July, 1970 - 2003

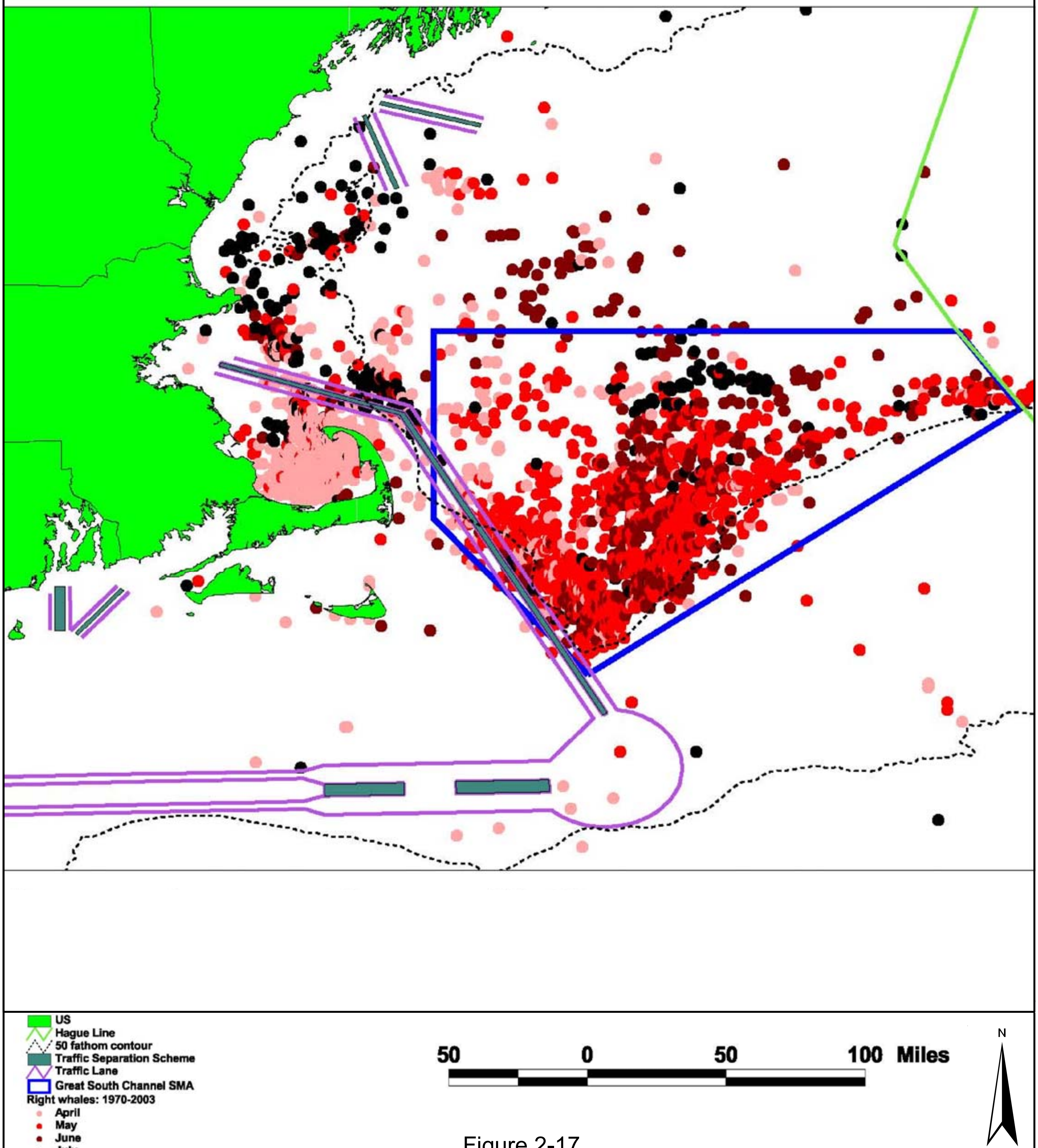

Figure 2-17

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Information on how to calculate the length of the radius can be found in the final rule to amend the regulations that implement the ALWTRP (67 FR 1133).

2. If any circle or group of contiguous circles includes three or more right whales, this core area and its surrounding waters would be a candidate DMA zone.

Following this designation, the agency would expand this initial core area to provide a buffer in which the whales could move and still be protected. NMFS would determine the size of the DMA zones as follows:

1. A large circular zone would be drawn extending 15 nm (27.8 km) from the perimeter of a circle around each core area.
2. The DMA would be a polygon drawn outside, but tangential to, the circular buffer zone(s), defined by the latitudinal and longitudinal coordinates of its corners.

For example, a DMA for three whales would consist of a core area with a radius of 4.8 nm (9 km) plus the 15-nm (28-km) circular zone or buffer for a total radius of 19.8 nm (37 km), and a diameter of 39.6 nm (73 km).

A DMA would remain in effect for a minimum of 15 days from the date of the initial designation and automatically expire after that period. The period may be changed if subsequent surveys within the 15-day period demonstrate that (a) whales are no longer present in the zone, in which case the DMA would expire immediately upon making this determination; or (b) the aggregation has persisted, in which case NMFS would extend the period for an additional 15 days from the date of the most recent sightings in the zone.

NMFS is considering two options for DMAS: the Mandatory DMAs Option (in which case vessels would be required either to traverse the DMA at a restricted speed or to route around it) and Voluntary DMAs Option (in which case, vessels would be encouraged, but not required, to traverse the DMA at restricted speed or route around it). Mandatory DMAS are included in Alternatives 2 and 5; voluntary DMAS are included in Alternative 6. As previously noted, NMFS is proposing a 10-knot speed restriction; however, the FEIS also considers restrictions of 12 and 14 knots. Like all the measures considered, DMAs would only apply to non-sovereign vessels 65 ft (19.8 m) or longer.

2.1.5 Summary of Operational Measures Considered

A summary of the vessel operational measures considered is provided in Table 2-4.

Table 2-4
Summary of All Operational Measures Considered

Region		Measures	Period of Application	Included in Alternative
Southeast (SEUS)		Southeast SMA	November 15 to April 15	6
		or		
		MSRS WHALESSOUTH/Critical Habitat SMA.	November 15 to April 15	3 and 5
		and/or		
		Recommended routes	Year-round	4, 5, and 6
Mid-Atlantic (MAUS)		Separate SMAs (20-nm SMAs or 30-nm SMAs option)	November 1 to April 30	6 (20-nm SMAs option)
		or		
		One continuous 25-nm SMA	October 1 to April 30	3 and 5
Northeast (NEUS)	**Cape Cod Bay**	CCB SMA	January 1 to May 15	6
		or		
		Critical Habitat SMA	Year-round	3 and 5
		and/or		
		Recommended Routes	Year-round	4, 5, and 6
	Off Race Point	Off Race Point SMA	March 1 to April 30	6
		or		
		SAM West SMA	Year-round	3 and 5
	Great South Channel	GSC SMA	April 1 to July 31	6
		or		
		SAM East SMA	Year-round	3 and 5
All Three Regions		Mandatory DMAs	Year-round	2 and 5
		or		
		Voluntary DMAs	Year-round	6

2.2 FEIS Alternatives

The alternatives evaluated in the FEIS and described in this section differ slightly from those assessed in the DEIS. The changes, detailed in Section 2.3, were made in response to comments received on the DEIS and proposed rule.

With the exception of Alternative 1, each of the alternatives would enact one or more of the vessel operational measures described in Section 2.1. For all alternatives that include speed restrictions, NMFS' proposed restriction is 10 knots. However, the FEIS also evaluates impacts based on speed restrictions of 12 and 14 knots.

In addition to the alternatives described below, the FEIS incorporates by reference DEIS alternative 6 (the DEIS preferred alternative) and associated analyses.

2.2.1 Alternative 1 – No Action Alternative

Under the No Action Alternative, no new vessel operational measures would be implemented. NMFS would continue to implement existing measures and programs to reduce the likelihood of right whale mortalities from ship strikes. Research would continue and existing technologies would be used to determine whale locations and pass this information on to mariners. Ongoing activities include the use of aerial surveys to determine right whale locations and notify mariners accordingly via a comprehensive, multi-agency information dissemination program, which includes vessel speed advisories; the operation of MSRS; support of Recovery Plan Implementation Teams; education and outreach programs for mariners; and ongoing research on technological solutions. Additionally, non-regulatory actions may be taken and existing conservation measures (see Section 1.2) would remain active.

Alternative 1 is not a reasonable alternative because existing conservation measures have not sufficiently reduced the threat of ship strike to right whales or improved chances for species recovery. Therefore, this alternative does not meet the requirements of the ESA and the MMPA to protect the endangered North Atlantic right whale as specified in these two statutes. However, the No Action Alternative is analyzed in this FEIS per the CEQ's regulations, because it provides a baseline against which to assess the impacts of the action alternatives.

2.2.2 Alternative 2 – Mandatory Dynamic Management Areas

Alternative 2 would incorporate the elements of Alternative 1 (i.e., continuing existing conservation measures) plus the mandatory DMA component of the operational measures, as described in Section 2.1.4. Compliance with DMAs would be mandatory because DMAs are a stand-alone measure under this alternative. DMAs would be defined, as warranted by right whale sightings in all US territorial waters and within the EEZ along the East Coast.

Successful implementation of this alternative would depend on maintaining survey efforts and ensuring that specific sighting locations are recorded and made available. A commitment to continuing aircraft-surveillance coverage and expanding coverage in the mid-Atlantic, as necessary, would be required. This alternative would require a larger commitment of resources than the other alternatives, as aerial surveys are time-intensive and expensive. Human safety risks are inherent to aerial surveys, especially when they are conducted in inclement weather, and increasing the number of aerial surveys would increase these risks. This alternative relies on a single new measure, which would not have as great a conservation value as it would if used in concert with other measures.

2.2.3 Alternative 3 – Speed Restrictions in Designated Areas

Alternative 3 includes the elements of Alternative 1 plus the following measures:

- In the SEUS region, the MSRS WHALESSOUTH/Critical Habitat SMA Option.
- In the MAUS Region, the Continuous 25-nm SMA Option.
- In the NEUS Region, the SAM West, SAM East, and Critical Habitat SMA Options.

SMAs under Alternative 3 would be larger or last longer than under the other alternatives that include SMAs.

2.2.4 Alternative 4 – Recommended Shipping Routes

This alternative includes all the elements of Alternative 1 plus the recommended routes, as described in Sections 2.1.1 (for the SEUS region) and 2.1.3 (for the NEUS region). This alternative does not include speed restrictions. No measures would apply to the MAUS region.

2.2.5 Alternative 5 – Combination of Alternatives

This alternative includes all elements of Alternatives 1 through 4 as previously described. As Alternative 5 includes the mandatory DMAs of Alternative 2, the larger and/or longer SMAs of Alternative 3, and the recommended routes of Alternative 4, it would provide the highest level of protection for the right whale population.

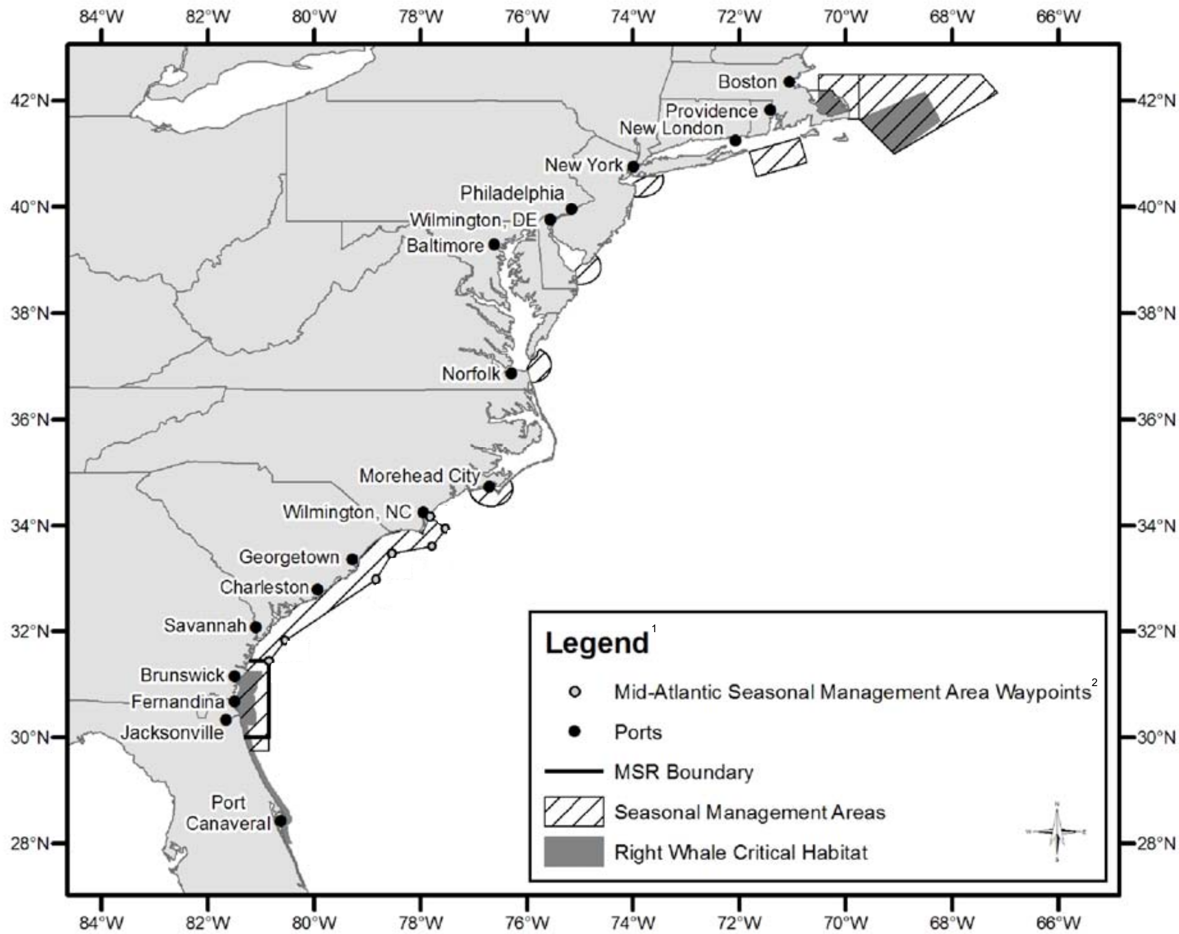
2.2.6 Alternative 6 – Proposed Action (Preferred Alternative)

Under Alternative 6, the preferred alternative, NMFS would implement the following operational measures:

- In the SEUS region, Southeast SMA Option and recommended routes.
- In the MAUS region, Separate SMAs (20-nm SMA option).
- In the NEUS region, CCB SMA, Off Race Point SMA, and GSC SMA options as well as recommended routes.
- In all three regions, Voluntary DMAs Option. (NMFS would evaluate the compliance rate and effectiveness of the DMA measures and use this information to inform future agency action, including consideration of mandatory DMAs.)

Additionally, under Alternative 6, the operational measures would expire five years after their date of effectiveness. Alternative 6 is illustrated in Figure 2-18.

Alternative 6 - Proposed Action



[1] Alternative 6 also includes voluntary DMAs (not shown)

[2] See Figure 2-4 for waypoint coordinates

Figure 2-18

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2.2.7 Summary of Alternatives

Table 2-5 summarizes the alternatives considered in this FEIS, and indicates, for each operational measure, whether it is included or not in the given alternative.

Table 2-5
Summary of Alternatives Considered in this FEIS

Operational Measure	Alternative					
	1	2	3	4	5	6[6] (Proposed Action)
Recommended Routes	No	No	No	Yes	Yes	Yes
DMAs	No	Yes, mandatory	No	No	Yes, mandatory	Yes, voluntary
SMAs	No	No	Yes, SAM East, SAM West, and Critical Habitat SMAs; Continuous 25-nm SMA; MSRS WHALES-SOUTH/Criti-cal Habitat SMA	No	Yes, SAM East, SAM West, and Critical Habitat SMAs; Continuous 25-nm SMA; MSRS WHALES-SOUTH/Criti-cal Habitat SMA	Yes, CCB SMA, Off Race Point SMA, GSC SMA, Separate SMAs (20-nm Option), Southeast SMA

2.3 Changes Made Between the DEIS and FEIS

A number of changes, corrections, and clarifications to the DEIS have been made based on public comments, the availability of new scientific studies, and the incorporation of other current information, such as fuel costs. The comments and responses in Appendix B provide detailed information on how comments were considered in development of this FEIS. This section focuses on the manner in which those comments, changes, and information informed the alternatives, and summarizes the changes in the alternatives between the DEIS and FEIS. The DEIS Alternative 6 and associated analyses and impacts remains an alternative fully considered, and the DEIS Alternative 6 and analyses from the DEIS are incorporated herein by reference. Note that all discussion of Alternative 6 throughout this FEIS is specific to FEIS Alternative 6. In addition to the alternatives described below, the FEIS incorporates by reference DEIS alternative 6 (the DEIS preferred alternative) and associated analyses.

[6] The operational measures proposed under Alternative 6 would expire 5 years after their date of effectiveness.

2.3.1 Alternative 1 – No Action Alternative

There are no changes between the measures included under Alternative 1 in the DEIS and FEIS.

2.3.2 Alternative 2 – Mandatory Dynamic Management Areas

The only change under this alternative relative to the DEIS is the trigger mechanism. In the DEIS, there were two triggers:

1. A concentration of three or more whales (Clapham and Pace, 2001).
2. One or more whale(s) sighted within a TSS, recommended shipping route, or within a mid-Atlantic 30-nm (56-km) port entrance zone and the whales show no evidence of continued coast-wise transiting (i.e., they appear to be non-migratory or feeding).

The criteria for eliciting a DMA action have been modified in the FEIS; the same modifications apply to Alternative 2 and all other alternatives that include a DMA component. Only the first trigger developed by Clapham and Pace (2001) is now used. The second trigger proposed in the DEIS is no longer considered. NMFS made this change because it found that implementing a DMA based on the sighting of one whale in a shipping lane would place an undue burden on the shipping industry because the majority of sightings are individual whales.

2.3.3 Alternative 3 – Speed Restrictions in Designated Areas

Only one change has been made to Alternative 3 in the FEIS relative to the DEIS: in the SEUS, the effective dates have been changed to November 15 to April 15 from December 1 to March 31. Everything else has remained the same.

This revision is in response to commenters that questioned the discrepancy in dates between Alternatives 3 and 6, both of which contain this operational measure. In the DEIS, Alternative 3 had larger restricted areas and/or longer implementation periods than Alternative 6 except for the SEUS; the SEUS implementation period was shorter under Alternative 3. The implementation period for the SEUS SMA under Alternative 3 is now consistent with that under Alternative 6. The change was made because whales are in fact present in the SEUS during that period and would have been unprotected for up to one month under the Alternative 3 as proposed in the DEIS.

2.3.4 Alternative 4 – Recommended Shipping Routes

There are several changes to Alternative 4 in the FEIS relative to the DEIS: 1) specific coordinates for the recommended routes have been determined and the routes are now in effect; 2) periods in which the routes are effective have been revised; and 3) modification of the Boston TSS and creation of an ATBA are no longer included in the alternative. In the DEIS, the positioning of the recommended routes was based on the risk-reduction analysis by Garrison (2006). Since publication of the DEIS, the specific coordinates of the recommended routes have been determined and are used in this FEIS. In the DEIS, the dates considered for the recommended routes were January 1 to April 30 in Cape Cod Bay and December 1 to March 31 in the SEUS. In the FEIS, recommended routes are in effect year-round instead of seasonally.

Several commenters questioned the rationale for the shorter implementation periods under Alternative 4, and year-round routing measures will afford protection to whales occurring at times outside of the typical feeding season. Establishing an ATBA and modifying the TSS are no longer included in this alternative because they will be established by the IMO independently of, and on a different schedule from that of, NMFS' vessel operational measures (see Section 2.1).

2.3.5 Alternative 5 – Combination of Alternatives

Alternative 5 of the FEIS incorporates the changes made to Alternatives 1 through 4 as described in Sections 2.3.1 through 2.3.4.

2.3.6 Alternative 6 – Proposed Action (Preferred Alternative)

The following changes have been made to Alternative 6 in the FEIS relative to the DEIS: criteria for triggering the establishment of a DMA have been modified, as described in Section 2.3.2; compliance with DMAs has been made voluntary; the 30-nm (56 km) radius around the entrances to the ports of New York/New Jersey, the Delaware and Chesapeake Bay, and Morehead City and Beaufort, North Carolina has been changed to 20-nm (37 km); the ports of Wilmington, Georgetown, Charleston, and Savannah (in the MAUS region) are now included in one continuous SMA extending from the shore outward to 20 nm (37 km); the recommended routes, which have been established in two locations along the East Coast, are in effect year-round; and the measures would expire five years from their date of effectiveness.

The decision to make the DMAs voluntary was due, in part, to limitations in agency resources that would make it difficult to verify and subsequently establish DMAs quickly. This lag time between the initial right whale sighting and the effective date of the DMA would reduce the overall effectiveness of the program. Voluntary DMAs would be effective soon after the initial sighting, and mariners would be notified about the location of the DMA through customary maritime communication media. Additionally, voluntary DMAs will alleviate the economic burden on whale watch and ferry vessels if a DMA was established in their route during peak season.

After weighing the MAUS SMAs relative to the economic impacts on the shipping industry, NMFS decided to change all MAUS SMAs (except for the SMA offshore of Block Island Sound) from 30- to 20-nm (56- to 37-km). These SMAs still provide protection for the majority of right whale sightings while further minimizing impacts on shipping vessels[7]. An analysis of sightings data from 1972 through 2000 from the South Carolina/Georgia border to Connecticut (n=290) indicated that approximately 83 percent of all right whale sightings occurred within 20 nm (37 km) of the coast, and approximately 90 percent of all right whale sightings occurred within 30 nm (56 km) of the coast (NMFS, 2008, *unpublished*).

The creation of a continuous MAUS SMA from Wilmington, NC to south of Savannah, Georgia was based on comments and a review of sighting data by NMFS scientists who determined there are recurring right whale sightings between the ports of Wilmington, Georgetown, Charleston,

[7] By reducing the proposed SMAs from 30 to 20 nm, the weighted average coast-wide time burden per vessel arrival was reduced from 73 minutes to 53 minutes; transit time through the SMAs dropped from 28 minutes to 16 minutes (weighted average, depending on the port).

and Savannah. This change will primarily benefit right whale aggregations off the coast of South Carolina.

The recommended routes were placed on nautical charts in late 2006, and after this point, the USCG typically does not remove routing measures from charts on a seasonal basis.

Finally, in the FEIS, the operational measures included in Alternative 6 would expire five years from their date of effectiveness, except for the recommended routes. Some commenters, in light of existing ship strike data, have raised issues regarding whether the measures would significantly reduce serious injury and deaths of large whales caused by ship strikes. In recognition of these concerns, and of the burdens imposed on vessel operators, the measures included in Alternative 6 would expire five years from the date they become effective. During the five-year effectiveness of the measures, to the extent possible with existing resources, NOAA will synthesize existing data, gather additional data, or conduct additional research on ship-whale interactions to address those uncertainties. NOAA will also review the economic consequences of the measures. After this analysis is complete, NOAA will determine what further steps to take regarding the measures.

2.3.7 All Alternatives

General changes that apply to all alternatives involve two exemptions. In response to comments concerning safety of navigation and vessel maneuverability at 10 knots, NMFS is now providing an exemption from speed restrictions for vessels to maintain safe maneuvering speed under certain conditions (see Section 1.4). Another exemption from speed restrictions applicable to all FEIS alternatives is for law-enforcement vessels of a state, or political subdivision thereof, when engaged in law-enforcement or human-safety missions.

2.4 Alternatives Considered and Dismissed from Further Analysis

Based on consultations, meetings, and public comments involving participants from NMFS, other Federal agencies, state agencies, concerned citizens and citizens’ groups, environmental organizations, and the shipping industry, many potential operational measures that might reduce right whale ship strikes were identified and considered. This section discusses potential measures and alternatives that were considered and dismissed from further analysis because they did not adequately meet NMFS’ purpose and need for one or several of the following reasons:

- They were not sufficiently protective of right whales.
- They imposed too many restrictions on the shipping industry or would significantly hinder maritime commerce.
- They did not allow NMFS to fulfill its mandate and/or required too much in terms of agency resources.
- They were based on currently unavailable technology.

General alternatives that were considered and dismissed are addressed in Sections 2.4.1 to 2.4.8. Sections 2.4.9 to 2.4.13 address dismissed alternatives that were region-specific.

2.4.1 Speed Restrictions of 8 Knots or Less or over 14 Knots

NMFS dismissed alternatives involving speed restrictions of or less than 8 knots because these speeds might affect a vessel's maneuverability and would result in undue economic hardship to the shipping industry. Although a speed restriction of 8 knots or less would be expected to reduce the severity and number of ship strikes, it would also have an economic impact several orders of magnitude larger than that of the range of speed restrictions considered in the alternatives retained for analysis. Therefore, speed restrictions of 8 knots or less would not meet the purpose and need.

Speed restrictions greater than 14 knots, on the other hand, would have significantly less economic impacts. However, such restrictions would not meet NMFS' purpose and need: since the majority of recorded ship strikes occurred with vessels traveling at 14 knots or faster (Jensen and Silber, 2003; Laist *et al*., 2001), speed restrictions above this threshold likely would not substantially reduce the risk of ship strikes.

2.4.2 Restrictions for Vessels Less than 65 Feet in Length

Although vessels less than 65 ft (19.8 m) in length have been involved in ship strikes of large whales, NMFS considers that such vessels pose a lesser risk to right whales than larger ones. Small, fast vessels with planing hulls have shallow drafts and are highly maneuverable, which increases the mariner's ability to avoid a whale if one is sighted. Small vessels with single positive-displacement hulls are limited by their hull speed,[8] and therefore these vessels have a reduced likelihood of seriously injuring or killing a whale relative to vessels 65 ft (19.8 m) and longer. Consequently, NMFS dismissed alternatives that would include restrictions to vessels less than 65 ft (19.8 m) in length (see Section 1.4). However, because of a recent ship strike by a 43-foot (13-m) vessel and other such incidents, NMFS will continue to consider means, including future rulemaking, to address strikes by vessel classes below 65 ft (19.8 m). In collaboration with other organizations, NMFS has developed and will implement education and outreach programs about the vulnerability of right whales to ship strikes, geared toward recreational, fishing, and other coastal maritime activities that generally involve vessels less than 65 ft (19.8 m).

2.4.3 Satellite Tagging

NMFS dismissed from further consideration the option of attaching implantable satellite tags to all or nearly all individual right whales for tracking and avoidance purposes because satellite tags are difficult to attach to whales and often have a short useful life. Even if tags could be successfully and safely attached to most or all whales and real-time information on the location of the whales could be transmitted to ships, mariners would need to avoid collisions and this would still require slowing down or entirely avoiding certain areas. In light of the difficulty of implanting tags in a significant number of right whales and the technological and logistical constraints (e.g., ship time, weather, human safety) associated with tagging, NMFS considered this alternative unreasonable and dismissed it from further consideration.

[8] The maximum speed of a ship with a displacement hull is dependent upon the waterline length of the vessel. This speed is called the hull speed. The longer the hull, the higher the hull speed.

2.4.4 Escort Boats Equipped with Acoustic Detection and/or Deterrence Devices

Under this option, escort boats would accompany vessels in the vicinity of regulated port areas and while transiting in critical habitat areas. The escort boats would be equipped with acoustic detection or deterrence devices. A detection device would inform the captain of the presence of whales in the area; a deterrence device would emit some kind of acoustic alert that would encourage the whale to stay away from the ship. However, the kind of technology assumed by this option does not yet exist and the cost of developing and implementing it (including outfitting the escort boats) would be prohibitive. In addition, studies have shown that the behavioral changes demonstrated by right whales when they are exposed to alarm devices may actually increase the risk of ship strikes (Nowacek *et al*., 2004). Finally, there are concerns about the impact of adding new sources of noise to the ocean. Consequently, NMFS is not considering this alternative further.

2.4.5 Limit Port Approaches to Daylight Transits Only

The premise for this potential measure is that vessels cannot spot a right whale at night; therefore, vessels would limit their travel through whale-sensitive areas to daylight hours only. However, there is little expectation that vessel crews could reliably, consistently, and under all sea conditions spot a right whale even in daylight. Furthermore, sighting a whale does not ensure that the mariner will be able to avoid it. Many collisions probably occur when whales surface unexpectedly close to the vessel. This measure would significantly hinder maritime commerce for little potential return. Therefore, NMFS dismissed this option from further consideration.

2.4.6 Voluntary Measures Only

NMFS also dismissed from further consideration voluntary compliance, as opposed to mandatory compliance, with the proposed operational measures. As shipping companies that would choose to participate would suffer a competitive disadvantage compared to the companies that would choose not to participate, it is likely that few companies would choose to participate. As a result, proposing only voluntary measures would not fulfill NMFS' mandate under the ESA. The relatively low initial compliance rate for the MSRS (see Section 1.2.1.2), even though it is mandatory, further suggests that voluntary-only measures would have very limited success. Therefore, proposing only voluntary measures would not be a viable alternative to meet NMFS' purpose and need.

2.4.7 Requiring Trained Marine Mammal Observers on Commercial Shipping Vessels

NMFS considered requiring the posting of trained marine-mammal observers on vessels of 65 ft (19.8 m) and greater length to detect whales. However, there are several limitations associated with this measure that preclude it from being a viable ship-strike reduction measure. The bridge of most commercial shipping vessels is toward the aft (back) of the ship, which would prevent the observer from sighting a whale directly in front of the vessel – an especially severe limitation since in many cases, it may be necessary to spot the whale hundreds of feet from the bow to be able to avoid a strike. Furthermore, the probability of an observer sighting a whale in rough seas or in times of low visibility is limited; at night, the probability is extremely low. In the event that a whale is sighted by the observer, depending on the location of the whale relative to the vessel, there may not be sufficient time for the captain to slow the vessel or change direction to avoid the whale. For these reasons, NMFS is not considering this measure further in this EIS.

2.4.8 Including Federal Vessels

NMFS has considered including vessels owned or operated by, or under contract to, Federal agencies into one or more of the alternatives. A description of the number and operations of these vessels is provided in Section 3.4.7. The number of Federal vessels that operate on the US East Coast is relatively small compared to the number of commercial vessels. Furthermore, the majority of relevant Federal agencies already employ ship-strike reduction measures, which are summarized in Appendix A. Most of these measures are similar to, if not more stringent than, the measures considered in this FEIS. As discussed in Section 1.8.3, NMFS expects to review Federal actions involving vessel operations to determine where ESA Section 7 consultations would be appropriate. NMFS may request agencies to reinitiate consultation, although the decision to reinitiate lies with the action agency. NMFS also requests all Federal agencies to voluntarily observe the conditions set forth in the regulations when and where this would not compromise their missions. For these reasons, and because NMFS believes that the national security, navigational, and human-safety missions of some agencies may be compromised by mandatory vessel-speed restrictions for Federal vessels, any alternative that would include such restrictions for Federal vessels was dismissed from further consideration.

2.4.9 Management Measures South of the SEUS Critical Habitat

NMFS determined that extending the Southeast management area south of the SEUS critical habitat boundary was unnecessary. Waters there are shallow and, as a result, deep-draft and other vessels remain further away from shore. The pilot buoy for Port Canaveral is 3 nm (5.6 km) from the coast. Most vessels calling at Port Canaveral take on a pilot and would have to slow down well before the pilot buoy. The critical habitat, where most whale sightings occur, extends only 5 nm (9.3) km offshore in this area, so that vessels are already slowing down through the area where right whales reside, making additional restrictions unnecessary. Therefore, this measure was dismissed from further analysis.

2.4.10 New Shipping Routes in the MAUS Region

Establishing new shipping routes in the MAUS region is not a reasonable alternative because, due to the large size of the area, right whale migratory patterns there are somewhat unpredictable (whales are generally traveling through the area and rarely reside). There are not many existing shipping routes in the MAUS. Defining new routes would unnecessarily constrain the shipping industry without yielding any substantial benefits to the right whale population. Therefore, NMFS dismissed this alternative from further consideration.

2.4.11 Implement an MSRS in the MAUS Region

Establishing a MSRS in the MAUS region was dismissed from further analysis because the MAUS region mostly is a migratory corridor for right whales and few, if any, sustained aggregations occur there. Migrating whales are difficult to spot via surveys and only a small amount of real-time information would be transmitted back to a ship. Also, sighting locations are likely to be short-lived since, generally, whales only transit through the area. Finally, whales' presence varies seasonally in the MAUS, which would complicate compliance with the MSRS. Overall, the conservation benefits of this measure likely would not justify expending the resources needed to operate and maintain the system. Therefore, implementation of an MSRS in the MAUS area is not a reasonable alternative and NMFS has dismissed it from further consideration.

2.4.12 Expand Existing MSRS into the Gulf of Maine

Many of the vessels weighing more than 300 gross registered tons (GRT) that enter the Gulf of Maine transit through the existing MSRS reporting area in the Northeast. Whale sightings throughout the Gulf of Maine (within the area of responsibility of the First Coast Guard District) are reported to ships via the MSRS, NAVTEX[9], and Broadcast Notice to Mariners. Therefore, extension of the MSRS to the Gulf of Maine is unwarranted, and NMFS dismissed this option from further consideration. To address those operators and areas (tugs and tows, small ports, and pilots) not covered by the existing MSRS, NMFS is planning a comprehensive outreach and education program that would accomplish the same goals as an MSRS without the additional regulatory burden.

2.4.13 Seasonal Management Measures in the Gulf of Maine

While right whales do occur in the Gulf of Maine, their presence is neither constant nor periodic. Where and when a right whale or aggregation of right whales will appear cannot be predicted in advance. In addition, vessel traffic in this area is relatively light and exhibits little common or predictable patterns. Therefore, there is no justification to define SMAs in the Gulf of Maine area. SMAs would unnecessarily burden the shipping industry with little advantage to right whales. Consequently, NMFS dismissed this option from further consideration.

2.5 Environmentally Preferable Alternative

The CEQ's implementing regulations for NEPA require that the environmentally preferable alternative(s) be identified in the Record of Decision. The proposing agency is encouraged to identify the environmentally preferable alternative in the EIS. However, it is not required to select the environmentally preferable alternative as its preferred alternative.

Although the environmentally preferable alternative varies with the resource considered, Alternatives 3 and 5 include a combination of measures that would provide the best protection of

[9] NAVTEX is an IMO-designated communication system used to transmit urgent marine-safety information to ships worldwide. In the US, NAVTEX is broadcast by USCG facilities.

biological resources while causing minimal damage to the environment. Both alternatives would result in a major positive impact to right whales. However, Alternative 3 would offer only minor benefits to other marine mammals, whereas Alternative 5 would offer them more protection through the addition of DMAs and recommended routes. Alternative 5 may result in minor adverse effects on water quality in the SEUS, whereas Alternative 3 would not affect water quality. Impacts on other resources are comparable between Alternatives 3 and 5, as summarized in Table 2-6.

Table 2-6
Environmentally Preferable Alternatives Analysis by Resource Area

Resource Area	Alternative					
	1	2	3	4	5	6
Right Whale	-	+	++	+	++	+
Other Marine Mammals	-		+		++	+
Sea Turtles	-		+		+	+
Bathymetry						
Water Quality				-	-	-
Air Quality		+	+		+	+
Ocean Noise		+	+	-	+	+
Socioeconomics		+	-	+	-	-

Note: (+) indicates that there is a minor positive impact, (++) indicates a major positive impact, (-) indicates a negative impact, and a blank cell indicates that there is either no net impact or that the impact is negligible.

2.6 Preferred Alternative

CEQ's implementing regulations for NEPA require the agency to identify a preferred alternative that best fulfills its purpose and need. The stand-alone measures included Alternatives 2, 3, and 4 would only partially meet the purpose and need. Although Alternative 4 would result in the least economic impacts of all the alternatives, recommended routes would only provide a minimum level of protection to right whales. Alternative 2 also would have a relatively low economic impact, although DMAs as a stand-alone measure are unlikely to provide sufficient protection against ship strikes. Alternative 3 would provide a higher level of protection against ship strikes than Alternatives 2 and 4, although it would have the second highest economic impact. Even though Alternative 5 would provide the highest level of protection to right whales, it also has the greatest economic impact, which does not meet the second goal of the purpose and need – to "…reduce the occurrence and severity of vessel collisions with North Atlantic right whales, thereby contributing to the recovery and sustainability of the species *while minimizing the effects on the shipping industry and maritime commerce*." Alternative 6, which would meet both goals – reducing the number and severity of ship strikes, and minimizing the economic impact – is, therefore, NMFS' preferred alternative.

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3 AFFECTED ENVIRONMENT

This chapter describes the environment that may potentially be affected by the implementation of the proposed vessel operational measures. The following areas are addressed: biological resources (including the right whale and other marine species); the physical environment; and the economic environment, with a focus on the shipping and other maritime industries. The geographical area considered spans the East Coast of the United States from Maine to northern Florida, and includes state waters (seaward from the shore to 3 nm [5.6 km]); US territorial waters (seaward from the shore to 12 nm [22.2 km]); and the US Exclusive Economic Zone (EEZ, out to 200 nm [370.4 km]). The effective distance of the proposed vessel operational measures varies. For the purposes of the proposed operational measures and this FEIS, the area under consideration is divided into the southeastern United States (SEUS), mid-Atlantic United States (MAUS), and the northeastern United States (NEUS) regions. The geographical extent of each region is described in Section 1.4 and illustrated in Figure 1-1.

3.1 The North Atlantic Right Whale

Right whales are baleen whales (also known as mysticetes) that mainly inhabit coastal and continental shelf waters. In the western North Atlantic Ocean, right whales have the following six main habitat areas, illustrated 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

Right whale seasonal migration patterns are relatively well documented, though some right whales, especially males and nonpregnant adult females, may not conform to the generalized model. Typically, pregnant females, females with young calves, and some juveniles (as well as a few atypical individuals) migrate seasonally, generally via near-shore waters along the eastern seaboard of the United States and Canada between calving areas located in waters off the SEUS and feeding areas located in waters off New England and the Canadian Maritime Provinces (see Figure 3-1). Peak migration periods are November/December and March/April. In waters along the US mid-Atlantic coast, right whales are generally found in waters less than 20 fathoms (36.6 m) deep (Knowlton *et al*., 2002); a large majority of sightings occur within 20 nm (37 km) of the coastline and almost all sightings occur within 30 nm (56 km) (see Section 2.3.6). Whales generally migrate alone or in mother-calf pairs. Males and nonpregnant females are sometimes observed in the calving grounds; however, where the bulk of the noncalving population spends the winter is not known. More studies are needed to fully understand right whale migration patterns and behaviors in each region.

3.1.1 Reproduction

3.1.1.1 Habitat

The SEUS region contains 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 winter. Mothers and calves are present in this area from November to April. Nearly all whales are gone from the area by mid-April, having migrated north. As many as 90 right whales have been seen in a given year in the SEUS region.

On June 3, 1994, NMFS designated waters along the Georgia and northeastern Florida coasts as right whale critical habitat (see Figure 2-1). The Northern right whale critical habitat in the Southeast 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).

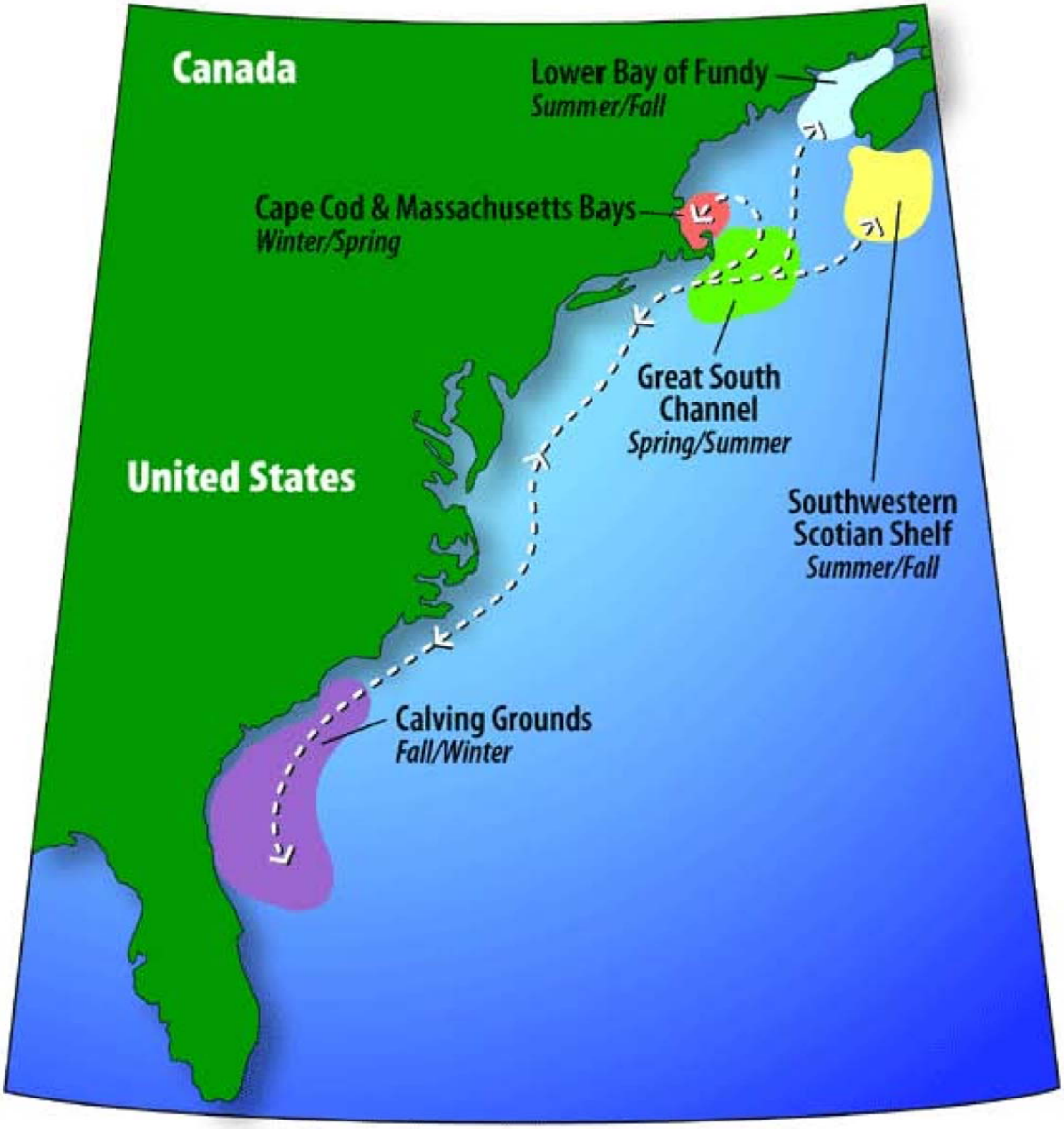
3.1.1.2 Behavior

Right whales engage in competitive mating behavior. They form mating aggregations and several males are thought to compete for a single female. The female produces vocalizations, probably 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 probable that more than one male mates with a given female. Mating aggregations have been observed year-round and may serve other social purposes besides reproduction. Males have no role in raising the calf. Although mating behavior has been observed from time to time, exact breeding habitat areas are unknown.

Females usually reach sexual maturity between seven and ten years of age. About 60 percent of the current female population is estimated to be reproductively mature (Hamilton *et al.*, 1998; NMFS, 2005b). A recently-developed technique, which involves measuring estrogens, progestins, androgens, and other metabolites found in right whale fecal samples, now allows for a more accurate determination of age of sexual maturation than the traditional method, which relies on the mean age of first calving (Rolland *et al.*, 2005). Gestation lasts from 12 to 16 months. 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 at least 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).

The average calving interval for North Atlantic right whale females has been increasing, from 3.67 years in 1980 through 1992 (Knowlton *et al.*, 1994) to 5.8 years in 1990 through 1998 (Kraus *et al.*, 2001). In addition, calf production and recruitment (the number of calves born each year that survive and become part of the population) were low in the 1980s and 1990s. Continuation of such poor reproductive performance could present a significant obstacle to population recovery, although recent trends indicate the population may be recovering from the reproductive problems observed in the 1990s. Although the exact reasons for past poor reproductive performance are not known, an April 2000 workshop, *Cause of Reproductive Failure in North Atlantic Right Whales: New Avenues of Research,* identified factors that may contribute to it (Reeves *et al.*, 2001), including:

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 may lead to reproductive dysfunction. Theoretically, a loss of genetic diversity can lead to “inbreeding depression,” whereby inbreeding adversely affects a population’s reproduction and recruitment rates, although this has not been established. Genetic conditions (e.g. inbreeding, loss of biodiversity, and effective sex ratio) might be affected by external factors, including toxic chemicals and poor nutrition (Reeves *et al.,* 2001). Nutrition has an effect on the reproductive process in both sexes at many levels, including, but not limited to, sexual maturation age, sperm production, milk production, and calving intervals; therefore, poor nutrition reduces overall reproductive success (Reeves *et al.*, 2001).

Nutrition is directly related to the availability of food, which is in turn dependent on many oceanographic factors and, to a lesser extent, climate. Right whale calving rates and reproductive success are likely related to the regional abundance of the copepod (planktonic crustacean) species *Calanus finmarchicus* (hereinafter referred to as *C. finmarchicus*) (Greene and Pershing, 2004). Competition for food with other species and climate variability decrease food availability and reduce calf production (Kraus *et al.*, 2001).

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

This declining calf production in the past has been observed only in the North Atlantic right whale, not other baleen whales (NMFS, 2005a). Even among right whales, it is variable, like the factors thought to influence it. Annual observed calf production was relatively low from 1993 to 2000, averaging around 12 calves (Greene *et al*., 2003). After 2001, calf production increased, although it remained variable: 31 in 2001, 21 in 2002, 19 in 2003, 16 in 2004, 28 in 2005 (Kraus *et al.,* 2005), and 19 in 2006 (Right Whale News, 2007). During this period, calf production averaged more than 22 calves per year, and the average calving interval for adult females declined to close to its lowest recorded level (Kraus *et al*., 2007).

[1] 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 United States (http://www.cpc.ncep.noaa.gov/data/teledoc/nao.shtml).

The recent increase in births has been partially offset by the observed increase in the estimated rate of human-caused mortality and serious injuries: this rate was 3.8 per year for the period from 2002-2006 (Glass *et al*., 2008), a marked increase from previous estimates: for the five-year period 1999 to 2003, the average rate was 2.6 right whales per year; for the five-year period 2000 to 2004, the rate was 2.8; and from 2001 to 2005, the rate was 3.2 (NMFS, 2005f; NMFS, 2006; Waring *et al*., 2007; Nelson *et al.*, 2007). Since pregnant females and reproductively-mature adults account for several of the recent mortalities, this upward trend may have serious, long-term ramifications for the population of right whales.

3.1.2 Feeding

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

3.1.2.1 Prey

Right whales primarily feed on *C. finmarchicus*, a type of copepod, one of the small-to-microscopic organisms that compose zooplankton. Right whales feed by filtering water through their baleen. Right whales target an older copepodite stage of *C. finmarchicus* – fifth copepodite (Baumgartner *et al*., 2003) – which at certain times of the year is generally resting (referred to as being in the diapause state) in deep waters (Sameoto and Herman, 1990; Miller *et al*., 1991). Although *C. finmarchicus* aggregate at particular depths, they can occur 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 correspond to the location of *C. finmarchicus*, which is found mostly in temperate to subarctic waters. Major feeding areas are in waters off New England and the Canadian Maritime Provinces in spring and early summer, where particularly dense patches of prey occur, including:

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

Because these feeding grounds are essential to right whale survival, NMFS designated the areas in US waters as right whale critical habitat on June 3, 1994 (50 CFR 226). Two critical habitat areas were defined, one including the Great South Channel and the other encompassing portions of Cape Cod Bay and Stellwagen Bank (see Figure 2-12). The Great South Channel critical habitat is bounded by the following coordinates:

41° 40’ N	069° 45’ W
41° 00’ N	069° 05’ W
41° 38’ N	068° 13’W
42° 10’ N	068° 31’W

The Cape Cod Bay critical habitat is bounded on the south and east by the interior shoreline of Cape Cod and on the north and west by the following coordinates:

42° 04.8’ N	070° 10’ W
42° 12’ N	070° 15’ W
42° 12’ N	070° 30’ W
41° 46.8’ N	070° 30’ W

While whales have been sighted year round in Cape Cod Bay, the peak period of feeding in that area is from January to May. Roughly one-fourth of the entire right whale population utilizes Cape Cod Bay during this time (Brown *et al*., 2002) and more individuals enter Cape Cod Bay as the season progresses. Mean individual residency in Cape Cod Bay was 32 days from 1998 to 2001, 18 days in 2002, 20 days in 2003, and 26 days in 2004 (Standard Error [SE] ± 18) (Mayo *et al*., 2004). While these numbers are representative of the general residency of right whales in Cape Cod Bay, gaps in sighting records of certain individuals indicate that some whales travel in and out of Cape Cod Bay during winter and spring (Mayo *et al*., 2004).

Whales primarily concentrate in the eastern part of Cape Cod Bay; as the season progresses, aggregations are seen in the central and southern portions and, to a lesser extent, in the western part as well. Distribution and residency within the bay are related to the presence and abundance of *C. finmarchicus*. Costa *et al*. (2006) studied environmental factors in Cape Cod Bay and how these factors affected zooplankton and right whale abundance in the bay from 2000 to 2003. The authors suggested that limited use and short residency time of whales in Cape Cod Bay in 2002 resulted from a change in wind and ocean circulation patterns that resulted in a low density of *C. finmarchicus.* Studies such as this are helpful in both determining past anomalies and predicting future distribution in an important feeding habitat. This type of research is especially pertinent in areas like the Cape Cod/Massachusetts Bay and the Gulf of Maine, where right whales spend about one-third of their feeding time at the surface, which may increase the risk of ship strikes and entanglements from buoy lines and surface-system lines.

From Cape Cod Bay, right whales tend to move to the feeding grounds in the Great South Channel, the northern Gulf of Maine, and other areas via the Off Race Point area. While in the Great South Channel (April to July, with occasional appearances year-round), right whales spend approximately 10 percent of their time feeding at the surface and 90 percent 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 sporadically-high or semi-regular 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 to be found feeding in the Bay of Fundy (Figure 3-1) (Perry *et al.*, 1999). One-third of the females do not utilize the Bay of Fundy feeding grounds, which suggests that there are still unidentified feeding grounds (Schaef *et al.*, 1993). Right whales spend a significant amount of time feeding at depth in the Bay of Fundy, where most *C. finmarchicus* aggregate just above the bottom mixed layer (a temperature/salinity gradient) (Baumgartner and Mate, 2003).

While the majority of right whales feeding in the Northeast occur in areas with high abundance of *C. finmarchicus*, there is an exception in the deep basins of the Gulf of Maine. A study of 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, even though copepods are thought to be abundant at these locations (Baumgartner and Mate, 2005). This is probably because the whales would have to feed at very great depths there (below 200 m [656 ft]), and deeper dives make for shorter feeding times and less energetic benefit per dive than dives in shallower waters (Baumgartner and Mate, 2005).

3.1.2.3 Feeding Behavior

Right whales use their baleen (long plates of keratin and hair attached to the upper jaw) to filter food from the mouthfuls of water and prey they collect and then expel. Whales obtain most of their food energy (91.1 percent) by feeding during long dives and the remainder (8.9 percent) through surface feeding (Goodyear, 1996). Surface-feeding right whales skim-feed by swimming slowly along the surface with their mouths open, collecting dense batches of prey. When right whales dive to feed, they go down to depths ranging from 10 m (32.8 ft) to more than 100 m (328 ft).

When prey is located, the whale typically meanders through the area to gather as much food as possible. Although the practice of foraging while submerged consumes more energy than skim-feeding, 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 in reproductively active females and their calves, which makes them more susceptible to ship strikes (Baumgartner and Mate, 2003). Feeding at the surface may also increase exposure to toxins.

A study conducted in the 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* (Durbin *et al.,* 2002). During this study, the right whales were feeding at depth, and thus had a lower toxin intake than if they had been feeding on surface aggregations of *C. finmarchicus,* which have higher PSP toxin levels than those occurring at depth (Durbin *et al.,* 2002). Ingesting large amounts of prey that contain PSP toxins can cause neuropathology, respiratory difficulties, and impaired diving capabilities. Since copepods are more abundant at depth, diving limitations may affect their ability to ingest enough prey to meet their caloric requirements.

Right whales usually feed alone, although several individuals may feed simultaneously in the same general area of dense prey patches. Given that other species have similar diets, some competition for prey may exist with species such as the sei whale and some planktivorous fish species (NMFS, 2003b). In fact, this scenario may influence the departure of right whales from their feeding habitat in the southern Gulf of Maine for their summer feeding grounds in Canadian waters. Payne *et al*. (1990) hypothesized that the abundance of planktivorous fish, such as sandlance, which also feed on *C. finmarchicus*, is inversely related to the abundance of right whales. That is, when sandlance in Stellwagen Bank are sparse, copepods are more abundant, and more right whales are present to feed on them. Conversely, if sandlance are abundant, and right whales are competing for copepods, the whales may move to other feeding grounds (Payne *et al*., 1990).

3.1.3 Socializing

Right whale socializing behavior typically involves surface activities during which whales may be in physical contact with each other. The collection of individuals taking part in 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 (but typically fewer) males maneuvering to approach her. Vocalizations are common and may include calls by the focal female to attract males and increase competition for mating (Kraus and Hatch, 2001). Socializing behavior can include turning, rolling, and lifting flippers into the air.

Social activities may increase the risk of entanglement with fishing gear or of a ship strike. Being heavily engaged in, and intent on, a particular activity such as socializing or mating likely 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 strike.

3.1.4 Diving Behavior

Because of their high lipid content and relatively large amounts of blubber, right whales are positively buoyant (Nowacek *et al.*, 2001). Combined with slow swimming, this buoyancy hinders rapid descents, which could be a factor in right whale vulnerability to ship strikes. On the other hand, the same buoyancy allows for ascents with little or no energy expenditure, since the animal naturally floats toward the surface. This may also contribute to ship strikes because a whale may have difficulty either aborting or modifying a free ascent (Nowacek *et al*., 2001).

3.1.5 Vocalization

Vocalizations by North Atlantic right whales (thought to be similar to those by southern right whales) differ in frequency depending on the type of call and the behavior associated with the call. Right whales are quite vocal during mating, foraging, and social activities. Vocalizations are typically 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 types of right whale sounds were recorded using a towed hydrophone array and digital acoustic recording tags (DTAGs) (Matthews *et al*., 2001). "Moans" ranged from a frequency of 50 to 500 Hz, lasted 0.4–1.5 seconds, and varied in amplitude. "Gunshots" were broadband and impulsive (Parks *et al*., 2005) and similar to the southern right whale's "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 groups of less than 10 whales, with moan rates of < 60/hr; individuals rarely produced moans (<10/hr) (Matthews *et al*., 2001).

A 2005 study recorded six major call types within a SAG: scream, gunshot, blow, upcall, warble, and downcall (Parks and Tyack, 2005). When SAGs form, as described in Section 3.1.3, females call frequently and males have been observed to produce gunshot-like sounds (Parks, 2003). These sounds have also been recorded emanating from 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).

Other research techniques, such as passive acoustic methods (i.e., listening/recording devices, as opposed to "active" methods, like sonar) are being employed to detect whale calls and establish long-term monitoring of a specific area. Passive acoustic technology may be a viable management tool to determine the presence of right whales through recording vocalizations; scientists at Cornell University are currently working with this type of technology. Ten autonomous recording devices or 'pop ups' were deployed throughout Stellwagen Bank National Marine Sanctuary in 2006 to record the presence or absence of right whales. The purpose of this study is to determine the occurrence and distribution of the whales, in support of the effort to modify the Boston Traffic Separation Scheme (TSS). While this method may eventually shape certain ship-strike policies, additional research is required before it can be effectively utilized to predict right whale distribution and gather real-time monitoring information that may aid in reducing ship strikes.

3.1.6 Hearing

3.1.6.1 Hearing Characteristics

Although it has not been tested by developing an audiogram, it is generally accepted that right whale hearing is in low frequencies, consistent with the ranges of other mysticetes (baleen whales), whereas odontocetes (toothed whales) vocalize and hear in high frequencies (Ketten, 1998). The assumption that right whales hear in low frequencies is based on ear structure and inferences from vocalization characteristics. A preliminary model based on inner ear anatomy indicates that right whale hearing may be in the range of 10 Hz – 22 kilohertz (kHz) (Parks *et al.*, 2007).

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, many human activities (including the operation of large vessels) are sources of noise in the same low-frequency ranges mysticetes use, which may interfere with their hearing and communication (Koschinski, 2002).

Research has been conducted on the effects of vessel and industrial noise on certain species of large whales (NMFS, 2003b), but there are still unknowns about right whale hearing capacities. While right whales likely are able to hear some anthropogenic sounds, they may not hear high-frequency sounds, such as the noise made by propellers (Terhune and Verboom, 1999).

A right whale's ability to detect an approaching vessel is related to a variety of factors, including bottom reflections, the frequency of the noise, the location of the whale with respect to 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 headed because low-frequency sounds can be difficult to localize. Ships generate higher noise levels toward the stern than near the bow, and even louder noises directly under the ship, so the chances of detection are greater behind the ship than in front. Ship noises are not as loud near the surface as they are 5 to 10 meters beneath it because the water surface reflects sound waves (Terhune and Verboom, 1999). This is known as the Lloyd mirror effect. The Lloyd mirror effect is stronger 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, which is precisely the location where it is also at a high risk of being struck.

3.1.6.2 Masking and Habituation

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

Masking may reduce the likelihood of a right whale detecting and avoiding an approaching vessel because the animal may not be able to distinguish the sound of the approaching ship from surrounding ambient noise; however, this hypothesis has not been tested. Areas where there is continuous loud distant noise from shipping may mask the sound of individual ships until they are too close for the whale to avoid a strike (Terhune and Verboom, 1999), increasing right whales' susceptibility to such incidents. It may also be that initially, vessel noise was mostly a masking issue for whales, preventing them from locating the sound of an individual, approaching ship. Subsequently, the animals may have become habituated to the noise, to the point where they no longer react to it, a phenomenon known as habituation.

3.1.6.3 Behavioral Reactions

Aside from masking and habituation, other factors may interfere with a whale's ability to respond to approaching vessels. Although right whales should, in theory, be able to hear vessels, they do not always appear to avoid them. Yet 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. However, a whale must perceive a ship as a threat to avoid it (Watkins, 1986), 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 a DTAG to record whale behavioral reaction to an alert signal, vessel noise, other whale social sounds, and a silent control (Nowacek *et al.*, 2004). 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 foraging dives, began a high power ascent, remained at the surface for the duration of the exposure, or spent more time just below the surface, at depths of 3–33 ft (1–10 m) (Nowacek *et al.,* 2004), also the draft range of most large vessels. This increased time just below the surface could substantially increase the risk of a ship strike because whales at this depth are not visible, and, are therefore more susceptible to being struck. The consequences of the whales' response to the alert signal, aside from the increased risk of a ship strike, are reduced foraging time and an excess use of energy, which is a problem for an endangered species. The whales' 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 noise made by an approaching vessel even when they can hear it (Nowacek *et al.,* 2004). A second study (Johnson and Tyack, 2003) utilizing a DTAG yielded similar results. Playback of recordings of a tanker elicited no response from a tagged whale 1,970 ft (600 m) away. As previously noted, lack of response may indicate an inability to detect; habituation; failure to perceive the noise as a threat; or some unknown factor, since the reasons for the right whales' susceptibility to ship strikes has not been firmly established.

3.1.6.4 Effects of Ocean Noise on Cetacean Hearing

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

Exposure to certain high-intensity underwater noises (e.g., SONAR) can cause a reduction in hearing sensitivity in cetaceans. This change in the hearing threshold can either be temporary, in which case it is referred to as temporary threshold shift (TTS), or permanent, referred to as permanent threshold shift (PTS) (ICES, 2005; Kastack *et al*., 2005). Neither TTS nor PTS has been recorded in mysticetes and is usually extrapolated. TTS generally results from high-intensity, acute noises and is unlikely to be caused by the low-frequency noise generated by vessels.

3.2 Other Marine Species

This section provides information on marine species whose ranges coincide with that of the right whale. Marine species and habitats that have no potential to be noticeably affected by the proposed vessel operational measures are not addressed. This includes several marine mammals that, although protected under the general provisions of the MMPA, are not considered depleted, such as:

- 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*)

Essential fish habitat (EFH) is another marine resource that has no potential to be affected by the proposed action. Most designated EFH is subsurface and beyond the range of any potential impacts from the proposed measures. Similarly, plankton, as well as benthic (bottom-dwelling), demersal (living near the bottom) and other species and habitats found beyond the range of any potential effects from the proposed measures are not addressed.

3.2.1 Protected Marine Mammals

Threatened, endangered, and depleted[2] species of marine mammals are protected under the ESA and 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 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, but it is important to note that these conclusions are drawn from a database that does not constitute a random sample (Jensen and Silber, 2003). Most reported large-whale ship strikes result in death (Jensen and Silber, 2003).

Table 3-1
Domestic Depleted and ESA-listed 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; United States Fish and Wildlife Service (USFWS), 2004.

3.2.1.1 Blue Whale

The blue whale (*Balaenoptera musculus*) is the largest of the baleen whales. Blue whales are listed as endangered under the ESA and are protected under the MMPA. They are found worldwide and are separated into North Atlantic, North Pacific, and Southern Hemisphere populations. 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.[3]

[2] 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 or population stock is listed as an endangered or threatened species under the ESA (16 U.S.C. 1362).
[3] http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/blue_whale.doc

The pre-exploitation population size of the North Atlantic blue whale ranged from 1,100 to 1,500 individuals; estimates of current population 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 was recorded in the North Atlantic in 1998 and several in California in the early 1990s.

3.2.1.2 Fin Whale

The MMPA stock assessment report (SAR) for the fin whale recognizes one stock in the US North Atlantic (western North Atlantic) and three stocks in the North Pacific (California, Oregon, and Washington) (NMFS, 2006). The species is listed as endangered under the ESA. Fin whales range from the Arctic to the Greater Antilles. The minimum population estimate for the western North Atlantic stock is 2,362; the best population estimate for this stock in 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). Fin whales 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 1.0 fin whale per year for the period 2000-2004 (NMFS, 2006).

3.2.1.3 Humpback Whale

The humpback whale (*Megaptera novaeangliae*) is a mid-sized baleen whale. Humpback whales were listed as endangered under the ESA throughout their range on June 2, 1970 and as such, 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 902 individuals; the minimum estimate is 647 whales (NMFS, 2005c). The four recognized stocks of humpback whales in the United States (based on geographically-distinct winter ranges) 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 found 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 hemispheres. In the 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 from 1975 to 2002 (Jensen and Silber, 2003), and many more in 2005 and 2006. From 2000 through 2004, the annual anthropogenic rate of mortality and serious injury was 3.0 (NMFS, 2006).

3.2.1.4 Sei Whale

For management purposes, there are two stocks of sei whales (*Balaenoptera borealis*): the Labrador stock and the Nova Scotia stock. Only the latter is considered here. The range of the Nova Scotia stock includes the continental shelf waters of the northeastern United States 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 limit 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 deep 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 because of their offshore distribution. NMFS' stranding and entanglement records from 1997 through 2001 yield an average of 0.2 mortalities of sei whales per year as a result of recorded ship strikes in New York in 2001 and Boston in 1994. A similar review of records from 1999 to 2003 indicated an increase in the number of mortalities to 0.4 per year as a result of ship strikes. The second ship strike during this period occurred outside of Norfolk Naval Base in Virginia (NMFS, 2005f).

3.2.1.5 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 to 40 individuals in all. They prey on large mesopelagic (living at depths of 660 to 3,280 ft [200 to 1,000 m]) 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 3,280 ft (1,000 m) 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 from this stock 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 328-ft [100-m] 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 3,539 individuals; the best estimate is 4,804. The sperm whale was listed as endangered under the ESA throughout its range on June 2, 1970 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). From 1999 through 2003, the annual anthropogenic rate of serious injury and mortality was 0.4 (NMFS, 2005f).

3.2.1.6 West Indian Manatee

The West Indian manatee 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 is listed as endangered under the ESA and thus is considered depleted under the MMPA. It occurs mainly in 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 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 exact population size of Florida manatees is unknown but the minimum population is estimated at 1,822 animals, based on intensive statewide winter aerial surveys at warm-water refuges coordinated by the Florida Department of Environmental Protection in early February of 1995 (United States Fish and Wildlife Service [USFWS], 2000). Anthropogenic causes of death include collisions with large and small boats; crushing by barges and flood gates/canal locks; entanglement in nets and lines; entrapment in culverts; poaching; and entanglement in, and ingestion of, marine debris. From 1974 through 1994, 2,456 manatee carcasses were recovered in the southeastern United States; one-third of the deaths were attributed to human-related causes (USFWS, 2000).

3.2.1.7 Bottlenose Dolphin

The bottlenose dolphin (*Tursiops truncatus*) 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 3,280 ft (1,000 m). 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 morphotype[4] is smaller and generally not found in waters deeper than 82 ft (25 m). It is continuously distributed along the Atlantic Coast south of Long Island, around Florida and along the Gulf of Mexico coast (NMFS, 2003b). This morphotype is migratory and winters south of Cape Hatteras, North Carolina. This stock is defined as depleted under the MMPA because the stock is below its OSP.

The offshore morphotype can be found in waters deeper than 82 ft (25 m) and generally occurs along the continental shelf break and into slope waters. Aerial surveys of the offshore morphotype indicate that it extends along the entire continental shelf break from Georges Bank to Cape Hatteras during spring and summer (Cetacean and Turtle Assessment Program [CETAP] 1982; Kenney 1990 *in* NMFS, 2003b). In fall, more sightings were reported in the south than in other portions of the survey area; in the winter, there were few to no sightings in the central portion of the survey area (NMFS, 2003b). The offshore morphotype was found exclusively seaward of 18 nm (34 km) and in waters deeper than 112 ft (34 m). Within 4 nm (7.5 km) of shore, all animals were of the coastal morphotype (NMFS, 2003b).

Abundance estimates for each management unit of the coastal and offshore stocks are provided in the 2005 NMFS SAR (NMFS, 2005f). Anthropogenic threats to bottlenose dolphins are primarily from entanglement with fishing gear such as gillnets, seines, long-lines, shrimp trawls, and crab pots (Read, 1994; Wang *et al*., 1994). The total estimated average annual fishery-related

[4] A morphotype is term that describes local populations or subpopulations of a single species of animal that are phenotypically or behaviorally distinct from the larger population as a whole.

mortality in 1996-2000 was 233 (Coefficient of Variation [CV] = 0.16) in the mid-Atlantic coastal gillnet fishery. Other threats to bottlenose dolphins include pollution and habitat degradation.

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, several of which are currently being revised. These plans contain information on each species and are incorporated 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 are highly susceptible to vessel collisions because they regularly surface to breathe and often rest at or near the surface.

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.

3.2.2.1 Green Turtle

The green turtle is a global species found in tropical and subtropical waters. In the United States, green turtles occur in inshore and nearshore waters from Texas to Massachusetts. Hatchlings are pelagic, i.e., they occur in the water column of the open ocean. Adults spend most of their time in tropical shallow, nearshore areas, but green turtles are known to undertake long oceanic migrations between nesting and foraging habitats.

All green turtle populations are threatened except the breeding populations off 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 human activities on nesting beaches to systematic harvesting in certain countries. Boating activities may also cause injury or death to green turtles through collisions or propeller wounds.

A study on vessel speed and collisions with green turtles in Moreton Bay Australia analyzed behavioral responses of turtles to an approaching 20-ft (6-m) vessel at slow (2 knot), moderate (6 knot), and fast (10 knot) speeds (Hazel *et al*., 2007). The authors found that turtles fled frequently in encounters with slow vessels, infrequently with moderate vessels, and rarely in encounters with fast vessels. Further, the turtles that fled in encounters with a slow vessel did so at a greater distance than those that fled in encounters with moderate vessels. Although vessel noise is within a turtle's hearing range, there are several factors that impede their recognition of the noise as a threat (e.g. directionality of the noise in the ocean and habituation to background vessel noise). The results indicate that the only effective speed that would allow sufficient time for a turtle to avoid an approaching vessel would be a very slow speed of 2 knots. On this basis, the authors determined that vessel speed was a significant factor in the likelihood of a strike and concluded that mandatory vessel speed restrictions were necessary to reduce the risk of vessel strikes to sea turtles (Hazel *et al*., 2007).

3.2.2.2 Hawksbill Turtle

Hawksbill sea turtles are found in the tropical and subtropical waters of the Atlantic, Pacific, and Indian oceans. In the United States, they are found along the 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 turtle was listed as endangered under the ESA in 1970 (NMFS, 2004a). In addition to other human-caused threats to hawksbills, they may incur propeller wounds or other injury from vessel collisions in areas with concentrated vessel traffic.

3.2.2.3 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. In the US Atlantic, they occur in the coastal waters off Georgia north to New England. Nesting occurs primarily in one area near Rancho Nuevo in southern Tamaulipas, 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 here by reference (NMFS and USFWS, 1992b). Kemp's Ridley turtles have the potential to be injured by propellers or collisions with vessels.

3.2.2.4 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. In the United States, leatherbacks nest in southeastern Florida but have been sighted as far north as the Gulf of Maine. 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; they 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.

3.2.2.5 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, occurring from Texas to Massachusetts. 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. Loggerheads face threats on both nesting beaches and in the marine environment. The greatest cause of decline and the continuing primary threat to loggerhead turtle populations worldwide is incidental capture in fishing gear, primarily in longlines and gillnets, but also in trawls, traps and pots, and dredges. In addition to entanglement in fishing gear, loggerheads have also been injured and killed by vessel strikes.

3.2.3 Seabirds

Seabirds are birds that normally live and forage in coastal, offshore, or pelagic (open- sea) 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*). The main threats to seabirds include bycatch in commercial long-line fisheries, habitat degradation, development, pollution, and predation on eggs.

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.
Source: 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 considered species of concern. 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 and Species of Concern Anadromous and Marine Fishes Occurring Along the US East Coast

Common Name	Scientific Name	Status*
Alewife	*Alosa pseudoharengus*	SC
Atlantic halibut	*Hippoglossus hippoglossus*	SC
Atlantic salmon (†Gulf of Maine)	*Salmo salar*	E
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	SC
Atlantic wolffish	*Anarhichas lupus*	SC
Barndoor skate	*Raja laevis*	SC
Blueback herring	*Alosa aestivalis*	SC
Cusk	*Brosme brosme*	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
Porbeagle shark	*Lamna nasus*	SC
Rainbow smelt	*Osmerus mordax*	SC
Sand tiger shark	*Carcharias taurus*	SC
Shortnose sturgeon	*Acipenser brevirostrum*	E
Smalltooth sawfish (†Portion of U.S. range)	*Pristis pectinata*	E
Thorny skate	*Amblyraja radiata*	SC
Speckled hind	*Epinephelus drummondhayi*	SC
Warsaw grouper	*Epinephelus nigritus*	SC
White Marlin	*Tetrapturus albidus*	SC

*E = endangered; SC = species of concern (those species for which uncertainties exist regarding status and threats, information is lacking, and listing is not currently being considered).
†DPS = distinct population segments.
Sources: www.nmfs.noaa.gov/pr/species/esa/fish and www.nmfs.noaa.gov/pr/species/concern.

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

3.3 Physical Environment

North Atlantic right whales range from maritime Canada south along the US East Coast to northern Florida. In the SEUS region, right whales generally occur in nearshore continental shelf waters (Garrison, 2005); right whales have been sighted in SEUS offshore waters, but with what frequency they occur there remains unknown (NMFS, 2005f). In the MAUS region, right whales are almost always found within 30 nm (56 km) of the coast: recent studies have shown that 90 percent of all sightings from the South Carolina/Georgia border to Connecticut are within that distance from the shore, with a large majority of the sightings (83 percent) within 20 nm (37 km) (NMFS, 2008, *unpublished*). In that region, right whales generally occur at depths of up to 60 ft (18.3 m) (71.5 percent of recorded sightings) and are rarely found at depths greater than 150 ft

(45.7 m); 93 percent of recorded sightings are at 150 ft or less (Knowlton *et al*., 2002). In contrast to what has been observed in the other two regions, right whales are frequently found in offshore waters in the NEUS region. The following section provides information on the physical environment, including water depth, sea floor topography, sediment types, water composition and quality, of those areas in which right whales are most commonly found.

3.3.1 Bathymetry and Substrate

A brief description of bathymetry (i.e., ocean depth and physical features) and bottom sediment types is provided in this FEIS because certain seafloor features and sediment types are particularly conducive to right whale foraging. Patches of the right whale's 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, including the continental shelf, the continental slope, the continental rise, and the abyssal plain, are common to all three regions considered. The operational measures proposed for the MAUS and SEUS are within the continental shelf; those proposed for the NEUS are within the continental shelf and slope areas.

The continental shelf is a broad, sea-floor platform that, although submerged, is in fact 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 the 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 to 540 nm (100 to 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. Submarine canyons are steep, v-shaped valleys that cut through the continental slope, continental rise, and, less commonly, the continental shelf. There are several submarine canyons in the mid-Atlantic Bight.

3.3.1.2 Gulf of Maine/Georges Bank (NEUS Region)

The Gulf of Maine/Georges Bank area includes important right whale habitat. In addition to the Cape Cod Bay and Great South Channel critical habitat, right whales are known to occur in Jeffreys Ledge, the Bay of Fundy, Platts Bank, and other physiographic areas in the Gulf of Maine. Figure 3-3 depicts the Gulf of Maine, which includes the waters between Nova Scotia and the Bay of Fundy as well as 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). Jeffreys Ledge and Stellwagen Bank are two of several large bathymetric features in the southern Gulf of Maine. The majority of Stellwagen Bank and a small section of the southern end of Jeffreys Ledge are within Stellwagen Bank National Marine Sanctuary, which spans approximately 22 miles (35.4 km) in a southeast to northwest direction from Cape Cod to Cape Anne at the mouth of Massachusetts Bay, is about 6 miles (9.7 km) across at the widest point, and has waters depths from 65 to 600 feet (19.8 to 182.8 m) (National Ocean Service [NOS], 1993b).

Figure 3-4 depicts sediment types in this area. Jeffreys Ledge, located on the northern edge of the Stellwagen Bank National Marine Sanctuary at depths less than 197 ft (60 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).

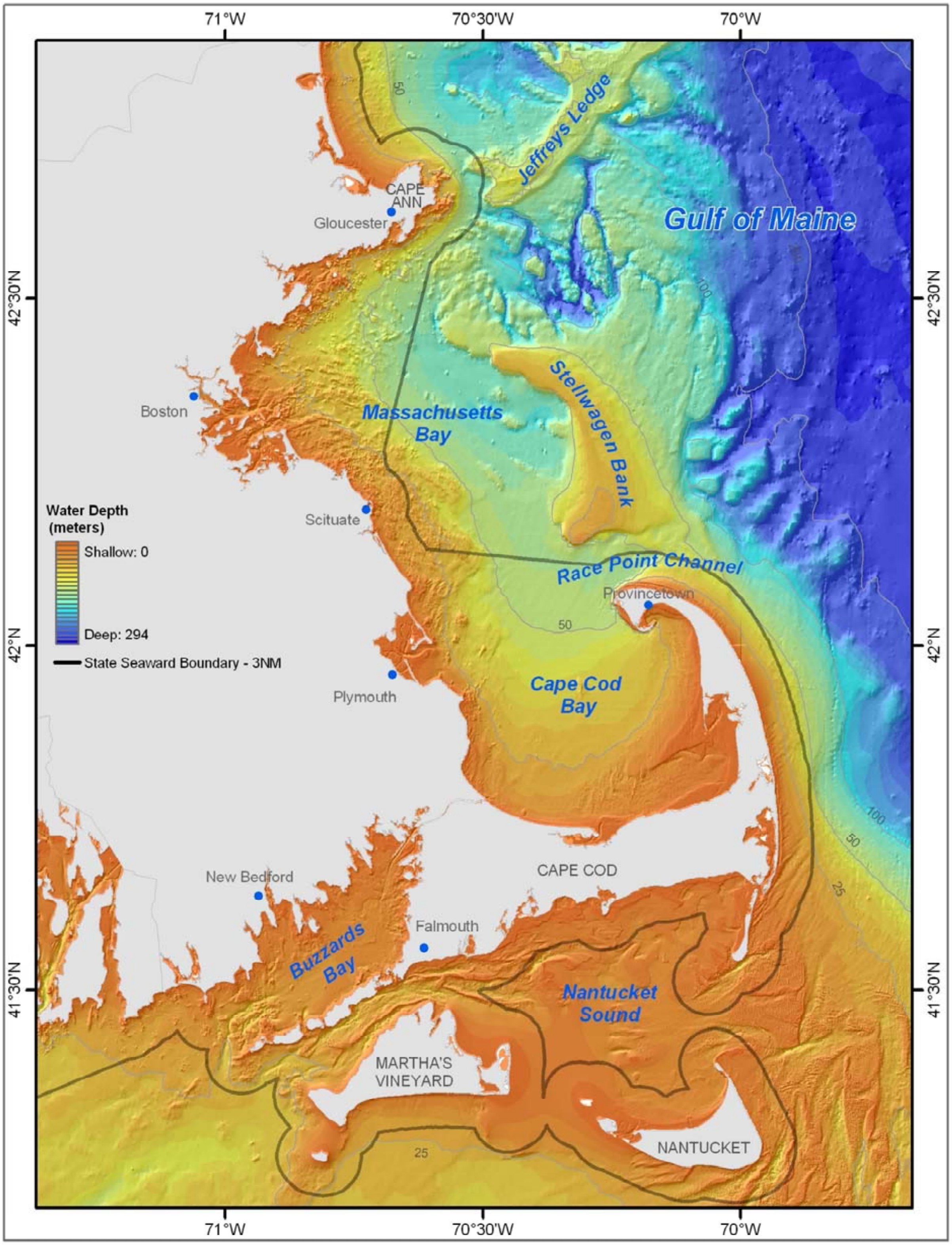
Bottom-layer characteristics and other physical oceanographic conditions determine the location of high-density patches of copepods and, consequently, where right whales are most likely to be found foraging. Baumgartner and Mate (2005) report that right whales in the Gulf of Maine are more commonly found in areas characterized by specific bathymetric features. They observed that whales generally occurred in areas with low bottom water temperatures, high surface salinity, and high surface stratification. Such areas may support a higher abundance of *C. finmarchicus*, which would explain why the whales preferred them (Baumgartner and Mate, 2005). Baumgartner and Mate (2005) adduced a similar reason to explain that the whales preferred shallow basins (areas with depths of approximately 492 ft [150 m]) to the deep basins of the Gulf of Maine and Scotian Shelf, noting that “the structure, hydrography, and physical processes of these [shallow] basins may improve the availability, quality, and aggregation of *C. finmarchicus* for foraging right whales.” Such correlations between bathymetry and prey abundance 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 these data, 13 births were 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, 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 the 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 492 ft (150 m) south of Georges Bank to 164 ft (50 m) off Cape Hatteras. The inner shelf is connected to Narragansett Bay, Long Island Sound, the Hudson River, Delaware Bay, and Chesapeake Bay, the largest estuaries on the US eastern seaboard (Milliman and Imamura, 1992). At the shelf’s edge, it gives way abruptly to the continental

Bathymetry in the Gulf of Maine



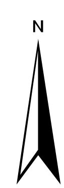


Figure 3-2

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Bathymetry in the Northeastern United States

Note: Map data not projected.

Figure 3-3

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Sediment Classification in Georges Bank / Gulf of Maine

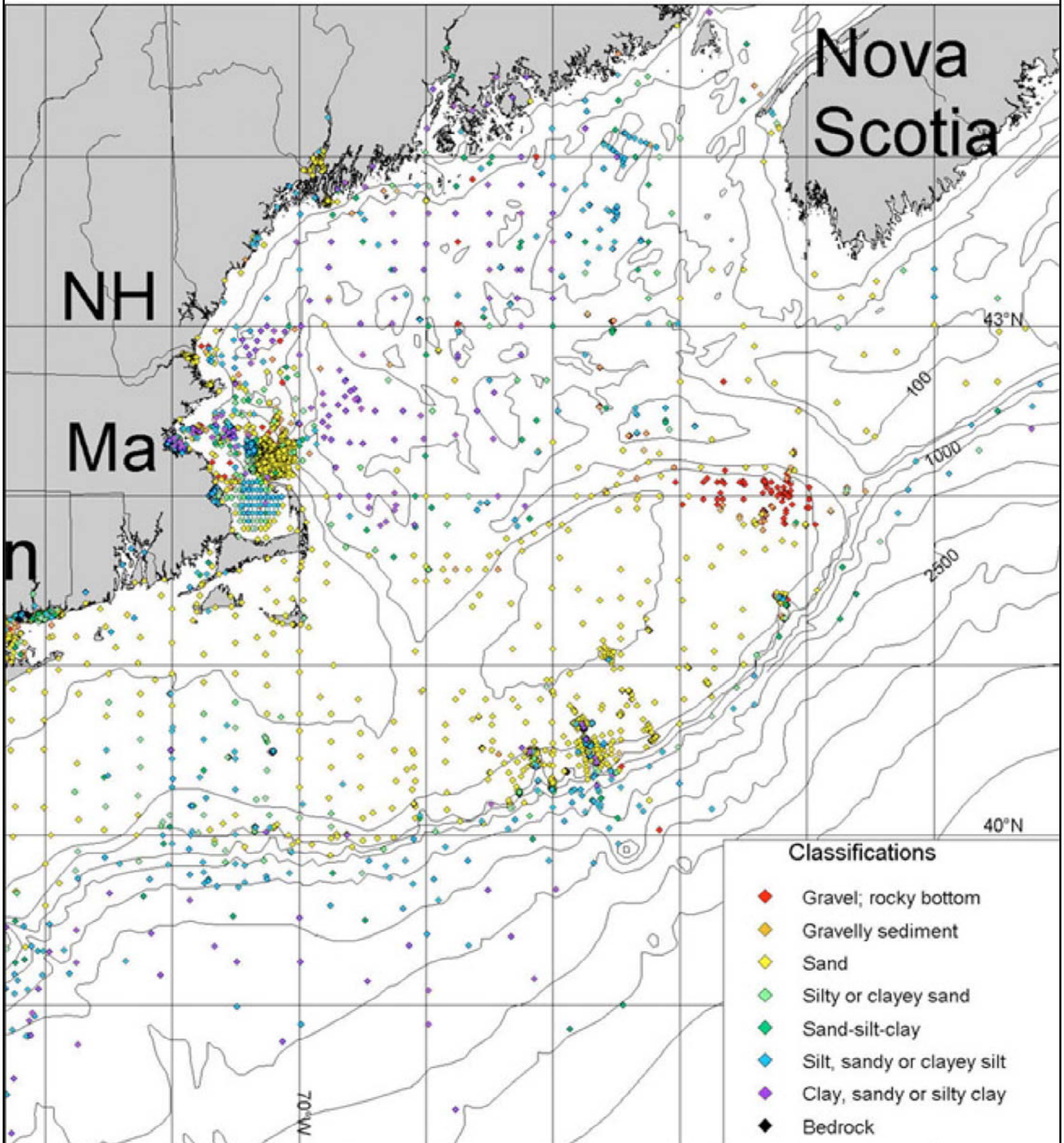

Figure 3-4

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Bathymetry in the Mid-Atlantic United States

Note: Map data not projected.

Figure 3-5

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slope. The continental slope extends to water depths ranging from 6,562 to 13,125 ft (2,000 to 4,000 m) (Department of the Navy [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 and Figure 3-7 depict sediment types in the MAUS region.

3.3.1.4 South Atlantic Bight (SEUS Region)

Figure 3-8 depicts the bathymetry of the South Atlantic Bight. 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 Bays: 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 164-ft (50-m) isobath (line connecting all points having the same depth), where it drops off to the 656-ft (200-m) isobath. The continental slope spans from approximately the 656-ft (200-m) to the 2,297-ft (700-m) isobaths. 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).

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 (Figure 3-9). 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).

In the NEUS, prey abundance determines right whale distribution; however, in the SEUS, right whales have rarely been observed feeding (Kenney *et al*., 1986), so different oceanographic variables must be considered in order to predict distribution in this region. A recent analysis by Keller *et al*. (2006) studies right whale distribution in the southeastern calving grounds in relation to sea-surface temperatures (SST). The results 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 early warning system (EWS) survey area, which mainly covers the

Southeastern critical habitat, were compared to SST data to determine whale location during resident months (January and February). A southward shift in whale distribution was observed to occur 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). It also appears that warm Gulf Stream waters (generally to the south and east of the critical habitat) serve as a thermal limit for right whales and play a role in their distribution within the calving grounds.

3.3.2 Water Quality

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

3.3.2.1 Implications of Water Pollution for Right Whale Health

Pollution and poor water quality may affect right whale health indirectly, by reducing the quantity and diversity of the zooplankton on which they feed, or more directly through ingestion and long-term storage in the blubber (fat layer). Pollutants can bioaccumulate – that is, increase in concentration as energy is transferred up the food chain. 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 at relatively high trophic levels, whereas most mysticetes feed on zooplankton, near 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*., 1994; Reijnders *et al*., 1999).

- **Persistent organic pollutants:** Polychlorinated biphenyls (PCBs), polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDF)s, dichloro-diphenyl-trichloroethane (DDT), chlordanes, hexachlorocyclohexane (HCH), and other pesticides.
- **Flame retardants:** Polybrominated diphenyl ethers (PBDEs) and other brominated flame retardants.
- **Plasticizers:** Phthalate esters.
- **Surfactants:** Alkyphenol ethoxylates (e.g., NPEO–nonylphenoletoxylates).
- **New-era pesticides and herbicides.**
- **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).

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

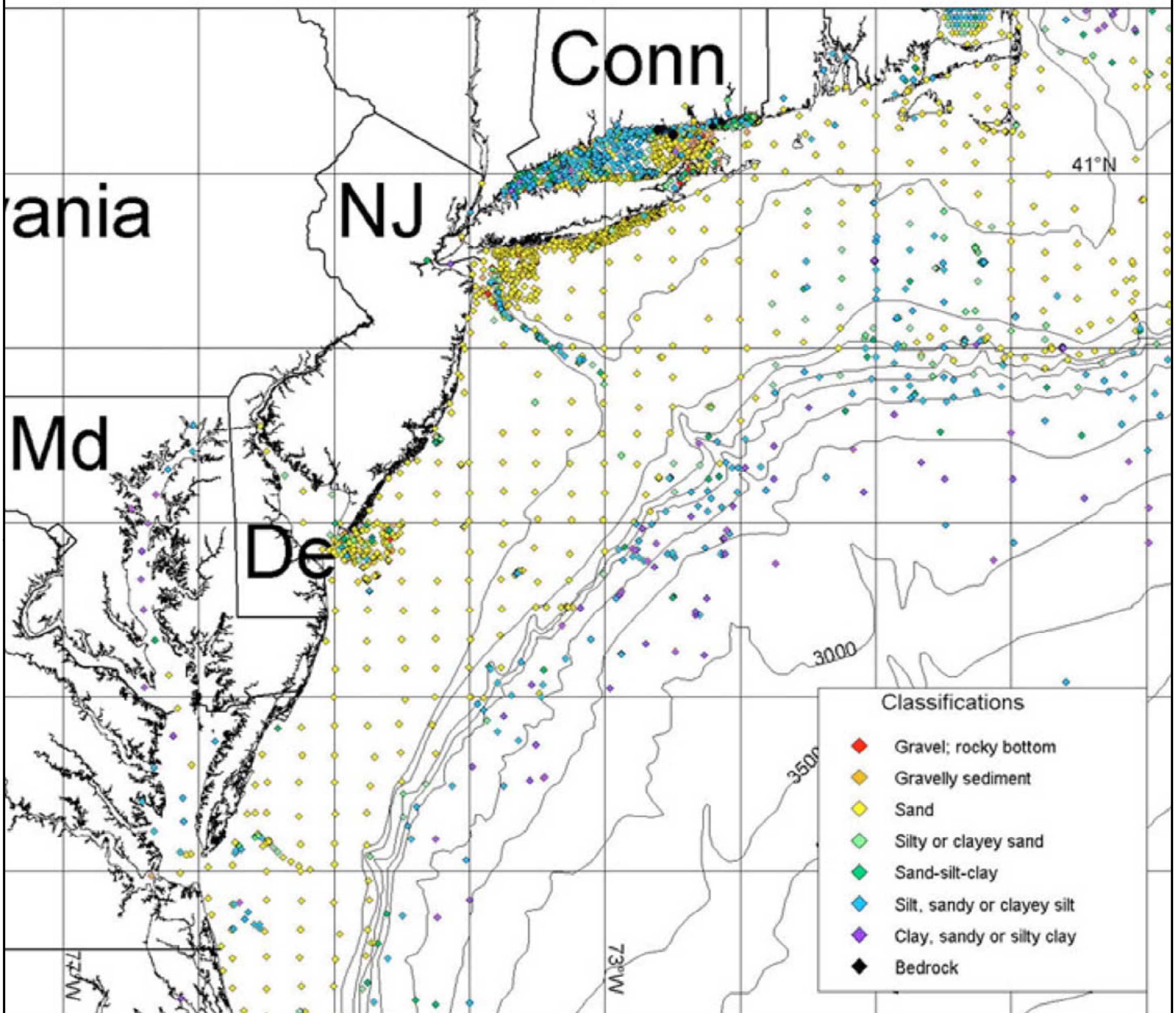

Figure 3-6

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Sediment Classification in the Carolina Trough

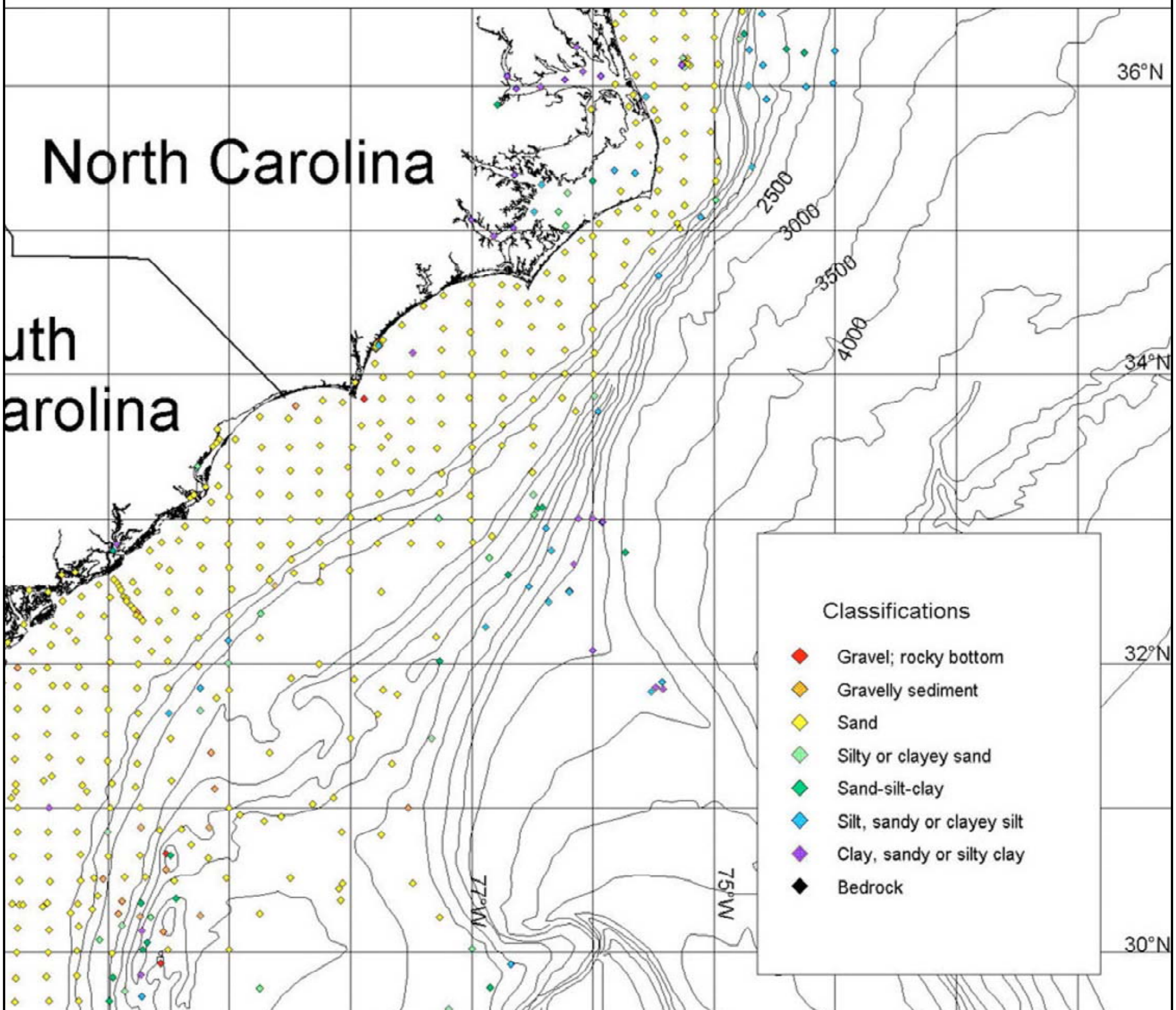

Figure 3-7

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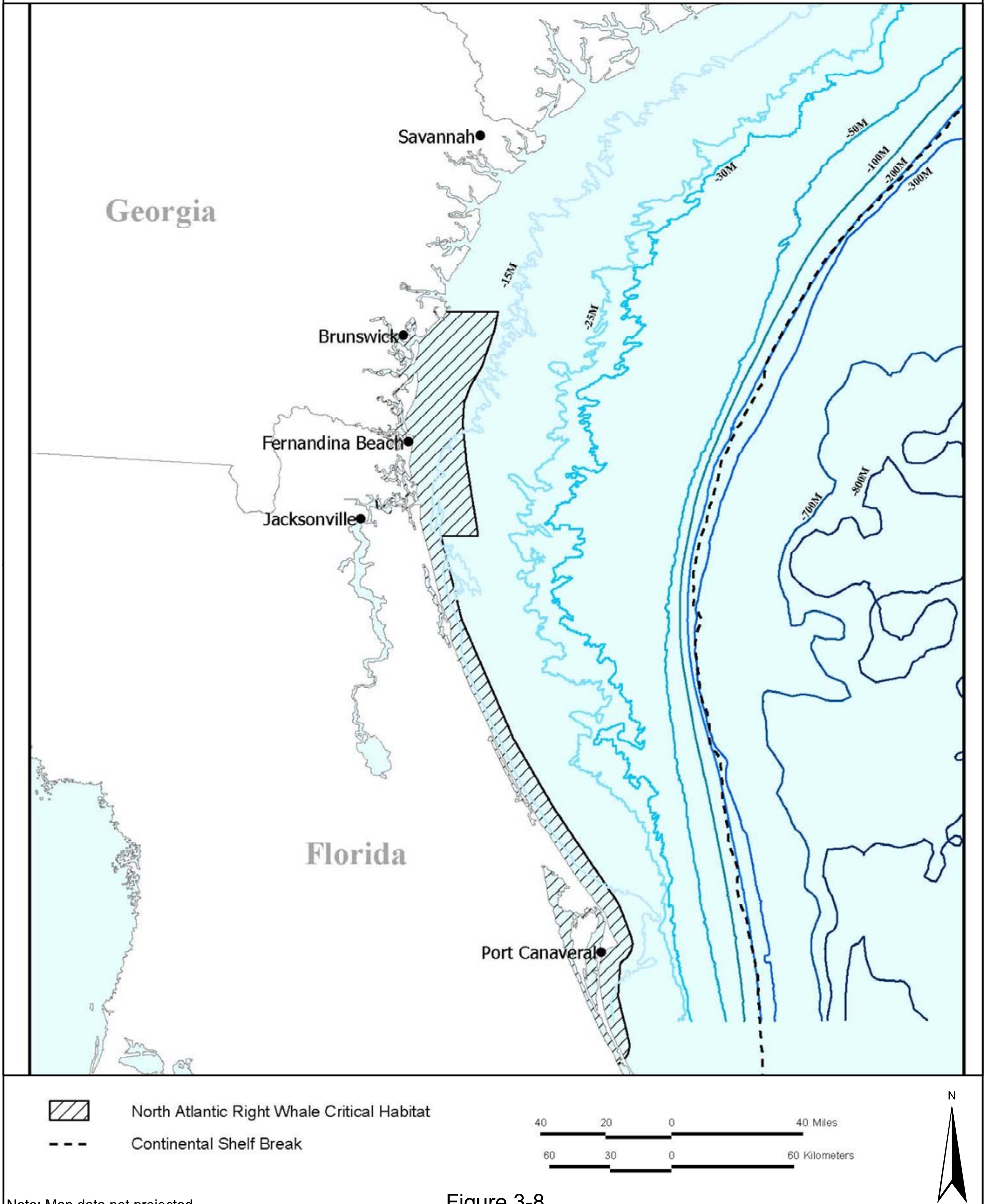
Bathymetry in the Southeastern United States



Note: Map data not projected.

Figure 3-8

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Sediment Classification in the Blake Plateau Basin

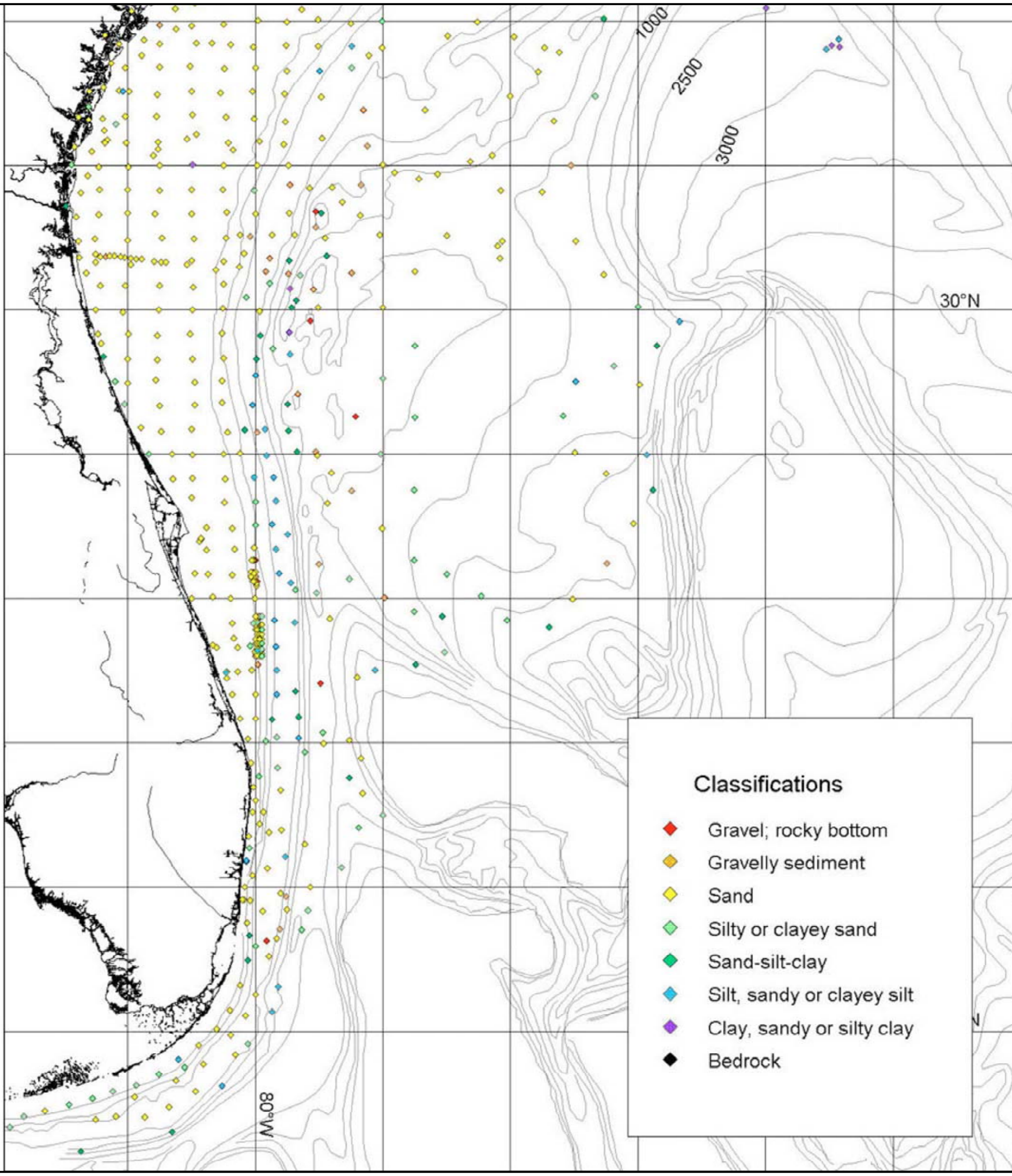

Figure 3-9

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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 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). However, it is not known whether the levels detected are sufficiently high to be detrimental.

Another source of pollutants that may have an effect on right whale health and reproduction are biotoxins. Biotoxins are transferred to right whales through ingestion of copepods, such as *C. finmarchicus*, which consume PSP toxin-producing dinoflagellates such as *Alexandrium* and similar organisms (Doucette *et al*., 2006). Biotoxins are highly toxic compounds produced by harmful algal blooms (HABs).[5] 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 three of these classes have been implicated in marine mammal mortality events (Reeves *et al*., 2001).

While there is minimal evidence to date that right whales have been adversely affected by these biotoxins, they are present in the whales' environment and have been known to cause loss of equilibrium and respiratory distress; they may also affect feeding (Reeves *et al*., 2001). In addition to the findings of Durbin *et al*. (2002; see Section 3.1.2.3), recent research has confirmed the presence of PSP toxins in right whales by sampling their feces and prey species in the Bay of Fundy (Doucette *et al*., 2006). Doucette *et al*. (2006) also compared the amount of *Alexandrium* in the water with right whale calving rates to further investigate the relationship suggested by Durbin *et al*. (2002) but found no correlation. However, the possible impact of PSP toxins on feeding and diving behavior could indirectly affect the ability to conceive or to maintain pregnancy (Doucette *et al*., 2006). Even though more research is required to understand the specific effects of PSP toxins, evidence suggests that they may be contributing to the slow population-recovery rate.

Other pollutants are generated by vessels at sea. Discharges are regulated in state and Federal waters out to the Contiguous Zone, which includes waters contiguous to the territorial sea out to 24 nm (44 km). "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, that is, a high level of nutrients in the water, which can in turn lead to excessive plant growth that can deplete the oxygen in the water. This limits the oxygen available to other species and, in extreme cases, can harm or kill other organisms in the water. However, eutrophication is generally limited to inshore estuaries or slow-moving streams, which are affected by land-based pollution more than water-based sources, and it is unlikely to occur in right whale habitat. Marine engines can

[5] 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 for this situation, whereby certain phytoplankton species contain redish pigments and bloom such that the waters appear red (NMFS, 2005a).

discharge oils, lubricants, and fuel. Discharges of bilge and ballast water may include residual oil, lubricants, and fuel (as well as biological organisms).

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 nm 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 nm from the nearest land, or sewage that is not comminuted or disinfected at a distance of more than 12 nm 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 nm of shore. The disposal of plastics is prohibited. Dumping other un-ground garbage is prohibited within 12 nm. 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 nm. 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). Vessels 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 nm 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: National Park Service (NPS) 2003.

3.3.2.2 State Water Quality

Each state has water-quality standards that are approved by the United States Environmental Protection Agency (EPA). The EPA compiles state water-quality reports (Clean Water Act [CWA] 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 or 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[6] 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.

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 PCBs. The major source of these contaminants was atmospheric deposition of toxic materials.

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 (mi) (15 km) into

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

Massachusetts Bay and about 36 mi (58 km) 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 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.

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 urbanized high-density areas, 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 coast of the United States 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 to 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 United States 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 [22 km]) and in some cases in the contiguous zone (24 nm [44 km]). 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 materials, and other items (National Park Service [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[7], 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 turtles 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 gross registered tons (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 (International Maritime Association [IMO], 2004a).

The Federal Water Pollution Control Act or 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, for any discharge of a pollutant from a point source to the navigable waters of the United States or beyond a National Pollutant Discharge Elimination System (NPDES) permit must be obtained (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[8] of the United States. 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 graywater. States may have more stringent regulations on discharging graywater within state waters than these Federal requirements. The CWA generally prohibits discharges of

[7] 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).
[8] The term “navigable waters” means the waters of the United States, including the territorial seas (33 U.S.C. § 1362).

oil and hazardous substances into coastal or ocean waters except when permitted under MARPOL 73/78.

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 or 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), in addition to other provisions, 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 the disposal of dredged material. 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 FEIS 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 are 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 (Thousands of 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). The table 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), which affects emissions per mile.
- Travel characteristics: speed, acceleration, etc., which affect emissions per mile.
- Climatic conditions (temperature, wind, rain, etc.), which affect dispersion/dilution of pollutants and formation of secondary pollutants.
- Population density, which determines the 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 (2003) estimated that 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. However, the pollutants NO_x, SO_x, and CO_2 estimated in this model were higher than the actual fuel usage reported. The IMO estimates that sulfur emissions from ships are about four 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 seven 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	N_2O, kt		NOx, Mt		CO, kt		NMVOC, kt		PM, kt		SO_2, Mt		CO_2, Mt		Fuel Consumption, 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]Main engines (ME); auxiliary engines (AUX). Values are in metric tons (Mt) (106 t) or kilotons (kt) (103 t).
[b] Bulk dry and bulk dry/oil vessels.
[c] Including passenger/general cargo vessels.
[d] Including passenger/roll-on roll-off (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 differences, and the amount of solar heating are primary factors affecting transport and dispersion of air pollutants (EPA, 2005a). There are many factors that determine where air pollutants are transported and how well they are diluted. Without a complex model, it is difficult to determine the fate of vessel emissions that are transported landward or taken up by the ocean.

Oceangoing vessels are moving point sources that disperse emissions. 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 ships will last only a few minutes before the ship either moves away or the effluent plume 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. An increase in overall ship emission levels would require an increase in the number of ships in a specific area or the amount of effluent from each ship. When ship-traffic densities act to decrease distances between ships, navigational safety provisions dictate that ships maintain certain spacing, thereby reducing emission concentrations in a specific area. 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, as in 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 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. However, the recommended routes neither lead 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 includes 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 United States 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 within 1,000 meters of the atmosphere 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.[9] Observations made from the research vessel (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 the layers of particulate matter are localized in origin and can be extremely thin due to the suppressed vertical mixing in the surface of the ocean. The PM off the coast of New England is rather rich in secondary organic species when compared to other

[9] 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.

continental plumes like those off 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

The Clean Air Act Amendments of 1990 were the first statutes to provide the EPA with a regulatory mandate to control emissions from marine engines. Since then, a number of regulatory milestones have been reached regarding emissions from marine vessels. Of all of the marine boat/ship categories defined by the 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.[10] At present, there are two sources of marine regulation that are producing or will produce significant emissions reductions from commercial shipping.

International efforts exist to prevent marine emissions. Regulations for reducing air pollution from ships were adopted in the 1997 Protocol to 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 fuel sulfur content. 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 must 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 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 the open ocean (Endresen *et al.,* 2003). The EPA has implemented an additional set of controls on the sulfur in marine engine fuels. By 2004 sulfur content in fuels is to be reduced by 99 percent, which will result in a reduction of PM sulfate from fuel containing sulfur. An EPA analysis found that a reduction of 26 percent for HC, 29 percent for NO_x, and 38 percent for PM would result from the regulations. 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

Noise in the ocean originates from a myriad of natural and anthropogenic sources. Natural sources of sound in the marine environment, such as from earthquakes, wind, and biologics, can range in frequency from below 1 Hz to above 100 kHz (NRC, 2003). Anthropogenic sources of noise in the marine environment are quite diverse with many producing sound for a particular purpose (e.g., oil and gas exploration, military activities such as sonar or explosives and acoustic scientific research) or incidental to their normal operations (e.g., construction and shipping).

[10] EPA420-R-99-026

Commercial shipping has been identified as one of the primary sources contributing to the increase in ambient (background noise) sound levels of the marine environment. For example, recent studies off the California coast have demonstrated a 3 decibel (dB) increase in the ambient sound level (i.e., doubling of background sound) from commercial shipping per decade (Andrew *et al*., 2002; McDonald *et al*., 2006). A major source of noise, from these types of vessels, results from propeller cavitation (when air spaces created by the motion of the propeller collapse), as well as noise generated from onboard machinery (NMFS, 2005d). The amount of noise produced by large commercial vessels depends on vessel type, size, speed, and engine type. The low-frequency sounds produced by commercial vessels have the potential to overlap with sounds used by large whales for critical life functions (e.g., communication) and are of concern.

Foreign waterborne trade has been steadily increasing over the years, with the number of large vessels predicted to double over the next two to three decades (NMFS, 2005d). Due to this prediction, research on trends in shipping, marine ambient noise, effects of long-term exposure of noise on marine mammals, as well as potential vessel quieting technologies should be investigated. Some of these issues have recently been addressed by two NOAA symposia on shipping noise and marine mammals (2004) and on vessel-quieting technology (2007) and are predicted to be continually addressed nationally and internationally due to the global nature of this issue.

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 United States are identified as having the highest potential to be affected by the proposed action. The term port area is used because the port may include smaller ports within the general vicinity of a larger port, although they are not formally included within the boundaries of a single port authority. These port areas are listed in Table 3-8 and shown on Figure 3-10. The port areas have been grouped into 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 FEIS. For some of the port 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 United States – Gulf of Maine	Eastport, Maine Searsport, Maine Portland, Maine Portsmouth, New Hampshire
Northeastern United States – Off Race Point	Salem, Massachusetts Boston, Massachusetts
Northeastern United States – 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
Southeastern United States – 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 United States. It is situated in a harbor behind Canada's Campobello Island. The waters of Passamaquoddy Bay and Cobscook Bay converge in Eastport, which, as a result, cause some of the highest tidal ranges in the United States. Due to this tidal action, the local waters are clean and productive. Eastport is home to one of the largest salmon aquaculture operations in the United States. Eastport is also centrally located to many of Maine's forest products industries, making transportation of these products economically efficient. [11]

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 United States and Canada.[11]

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

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 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, and is 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 ports of Portland and Bar Harbor (Port of Portland, 2005).

Portsmouth, New Hampshire

With a deep natural harbor and river, Portsmouth is one of the oldest working ports in the United States. 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. In total, about five million tons of cargo enter or exit Portsmouth Harbor each year. 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. The Port is ice-free year round – the closest such port to Europe. Rail service is available to the Port Authority and many other private facilities, while access to Interstate Highway 95 is only a half-mile away. Pease International Tradeport is 2 mi (3.2 km) away in Newington.[12]

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.[13] Salem's port facilities receive more than a million tons of coal and 3 million barrels of 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.

Boston, Massachusetts

Boston is the oldest continually-active major port in the Western Hemisphere, and is 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 annually.

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

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

[13] Seaport Advisory Council webpage: http:www.mass.gov/seaports/salem.htm

Terminal, located in the Boston Marine Industrial Park, will serve over 210,000 cruise passengers in 2006. A full cruise season was planned for 2006 between April and October (MASSPORT, 2005). In 2007, from April through December 15, the cruise season expects 101 vessel calls.

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

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 use the canal instead of routing around Cape Cod. This canal is 480 feet wide and 32 feet deep (146 m wide and 9.8 m deep) at mean low water.[14] A small port in Provincetown on the tip of Cape Cod 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.[15] Commercial fishing products, such as frozen fish, are transported from this port to various destinations in the United States. Using Federal grants and local funds, the city and the Harbor Development Council 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 premier 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. In the past ten years, 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

[14] www.nae.usace.army.mil/recreati/ccc/navigation/navigation.htm
[15] Seaport Advisory Council: http://www.mass.gov/seaports/newbed.htm

such commodities as cement, chemicals, coal, heavy machinery, liquid petroleum products, lumber, and steel products.[16]

New London, Connecticut

The Port of New London is located in Connecticut on Long Island Sound. The Port of New London is a historic whaling port, currently utilized by 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 deep-water 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 approximately 17 percent, and its share of Connecticut's total traffic has increased 13 percent. The Port primarily handles petroleum and manufactured goods.[17]

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 ferry 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 railroads serving the port itself, the Port Authority of New York and New Jersey, and by the city, state, and the Federal government (United States Coast Pilot [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).

[16] Providence Port Authority website: http://www.provport.com
[17] New Haven Port Authority: http://www.cityofnewhaven.com/govt/Port_Authority

A billion dollars worth of port improvement initiatives is preparing the New York port area to accommodate growing demand, including ongoing dredging projects.

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 Channel-Deepening Project. Vessel arrivals for the Port of Wilmington, Delaware are included with Philadelphia in the socioeconomic analysis contained in this FEIS.

Baltimore, Maryland

The port of Baltimore, which supports both commercial shipping and passenger-vessel industries, 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 United States.[18] 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 country's 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 (Hampton Roads Maritime Association [HMRA], 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 will 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).

[18] Maryland Department of Transportation: www.mdot.state.md.us.

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 ft (1,676 m) of continuous wharf, two berths for loading and unloading, and handles break-bulk and bulk cargo. Morehead City is a major port for phosphate products. Container traffic was facilitated by the opening of two inland terminals in the 1980s. More expansions are being planned.[19]

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 cargo, and break-bulk cargo.[19] It is close to the center of the Southeast market, the fastest-growing region in the country.

Georgetown, South Carolina

The Port of Georgetown is South Carolina State Ports Authority's dedicated bulk cargo and break-bulk cargo facility. Top commodities are steel, salt, cement, aggregates, and forest products (South Carolina State Ports Authority [SCSPA], 2005).

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 (SCSPA, 2005). It also has a cruise terminal, which hosted 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 [GPA], 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 (GPA, 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 roll-on roll-off (ro-ro) vessels. There is a harbor-deepening project planned for the Port of Brunswick that would increase the channel depth from 30 to 36 ft (9.8 m to 11 m) (GPA, 2005).

Fernandina Beach, Florida

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

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

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).

Port Canaveral, Florida

Port Canaveral is strategically located on Florida’s central Atlantic Coast and has intermodal connections to reach all of Florida and other states in the Southeast. In addition, it is an ideal hub between the southeastern United States, 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 Vessel Regulations

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. Under this authority, the USCG conducts Port Access Routes Studies (PARS) for changes in vessel operations, including the one conducted of vessel-routing measures to protect right whales. 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 operational measures 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. 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 (yds) (457 m) 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. In 2007, the notice was updated with a message that NOAA recommends speeds of 10 knots or less in areas used by right whales.

The USCG designates Regulated Navigation Areas (RNAs) 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 yds (640 m) of the Millstone Nuclear Power Plant or 100 yds (91 m) from an anchored USCG vessel, to ensure public safety and prevent sabotage or terrorist acts. The rule also includes speed restrictions in the vicinity of Naval Submarine Base New London and Lower Thames River, whereby 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, Canada, Transport Canada, the World Wildlife Federation, and others submitted a proposal to the IMO to move shipping lanes in the Bay of Fundy away from important right whale feeding grounds. The proposal was adopted by the IMO at its annual meeting of the Marine Safety Committee in December of 2002 in London, England, and was enacted in 2003 (WWF, 2003). This shift in the TSS added 5 mi (8 km) to the distance traveled for vessels calling at Saint John and 11 mi (18 km) for vessels calling at Bayside and Eastport. Currently marine scientists and Transport Canada are developing a proposal for the implementation of an ATBA in Roseway Basin.

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, 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 to 50,000 gross tonnage were required to have AIS by 31 December 2004. It is possible 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 United States is a signatory to IMO protocols and the USCG is the lead PSC agency in the United States. 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 United States has extensive authority to regulate ships entering its ports and to establish port-of-entry conditions. Therefore, the United States has the authority to require foreign flag vessels calling at US ports to adhere to the vessel operational measures to reduce ship strikes.

Vessel Traffic

Several types of routing measures are used by the USCG and IMO 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 establish 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 a 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. One 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 right whale critical habitats northbound to ports in Boston, New Hampshire, Maine, and Canada, and a small portion calls at Provincetown, Massachusetts, (Russell *et al*., 2005) and southbound to the Canal. Vessels also transit Stellwagen Bank via the Cape Cod Canal (NOS, 1993a). Analysis of Mandatory Ship Reporting System (MSRS) data 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, the area experiences heavy vessel traffic, including within the two critical habitat areas and a national marine sanctuary. There were no existing routes for vessels traveling into or out of the Cape Cod Canal, until the recommended routes within Cape Cod Bay were established in November 2006.

Mid-Atlantic

Significant amounts of ship traffic utilize ports in the mid-Atlantic. Coastwise (moving up and down the coast) ship traffic travels through the right whale’s migratory corridor and vessels approaching and leaving ports intersect the migratory corridor. Some mid-Atlantic ports have domestic or internationally-adopted TSSs. TSSs exist for the approaches into Narragansett Bay, Rhode Island, and 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 four approaches: two eastern approaches – off Nantucket and off Ambrose Light, one southeastern approach, and one southern approach (USCP 2, 2005).

Southeast

The major ports in this area are Jacksonville, Fernandina, Brunswick, and Canaveral. There are no internationally-adopted traffic schemes in this region. A MSRS is in effect 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. Upon receipt of the information, the mariner can decide if a heading change is necessary based on the whales' location. 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, although one is oriented more toward the east than the other. Most 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. Southbound traffic is sparse and tends to stay off 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 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 ships
- 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.[20] In 2003, there were 25,532 vessel arrivals at the ports considered here. In 2004, arrivals increased by 7.3 percent, to 27,385 arrivals.

[20] Reconciliation of the USCG data is described in detail in the supporting Economic Impact Report, prepared by Nathan Associates, Inc. Vessel arrival data for 2005 through 2007 did not became available until after the majority of work on the economic analysis had been completed. Vessel-arrivals data for 2003 and 2004 provide a suitable

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 one 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 include bulk carriers (3,149 arrivals in 2004), ro-ro cargo vessels (3,054 arrivals in 2004), and general cargo vessels (1,843 arrivals in 2004). These top five vessel types accounted for 85 percent of total vessel arrivals in 2003 and 82 percent in 2004.

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
Tank ship	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, and school ships.
Source: Nathan Associates Inc., 2005.

Vessel Weight

In addition to type, vessel arrivals are also analyzed here by dead weight tons (DWT) and/or GRT, which are the customary units used by the shipping industry for classifying vessels by size category to estimate vessel operating costs.

In most categories, a range of ship weights is represented. On average, combination carriers are the largest, with an average weight of 74,697 DWT in 2003 and 59,777 DWT in 2004. Tank ships are next, with an average of 54,513 DWT in 2003 and 57,060 DWT in 2004. The average containership was 40,895 DWT in 2003 and 40,760 DWT in 2004. Dry bulk carriers were the only other vessel type with an average DWT in excess of 30,000 DWT, registering 36,193 DWT in 2003 and 36,620 DWT in 2004.

basis for identifying the level of economic impact for later years, as annual variations in the composition and volume of vessel traffic are relatively modest. For example, while new and larger vessels come into service each year, these new vessels would not significantly alter the average vessel operating costs used in this analysis by type and size of vessel. Similarly, the annual growth in overall traffic would affect all alternatives analyzed and pales in significance when compared to the large differences amongst the alternatives analyzed.

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. For the entire East Coast, 38 percent of vessel 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 vessel DWTs were also reported in 2003 for the port areas of Salem, MA (44,738) and Hampton Roads (42,749). The average vessel DWT by port area was similar in 2004 to what it was in 2003. (The supporting 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. Measures of this activity are the number and combined 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 FEIS, and 27,385 in 2004. Considering arrivals into each port region, the most active region in both years was the Port 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 United States (4,315 vessel arrivals), the Delaware Bay region (2,661 vessel arrivals), and the Block Island Sound region (2,563 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, United States Army Corps of Engineers (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.

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.

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, June 2008 ($)

	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 2008 Hourly Operating Costs at Sea																		
Bulk Carrier	1,153	1,181	1,209	1,239	1,269	1,300	1,332	1,364	1,398	1,432	1,484	1,558	1,635	1,715	1,800	1,935	2,183	2,522
Combination Carrier (e.g. OBO)	1,210	1,240	1,270	1,301	1,333	1,365	1,398	1,433	1,467	1,503	1,559	1,636	1,716	1,801	1,890	2,032	2,292	2,648
Container Ship	1,137	1,291	1,466	1,664	1,890	2,145	2,436	2,766	3,140	3,565	4,313	5,560	7,167	9,239	11,911	17,433	-	-
Freight Barge	697	853	1,044	1,279	1,566	1,917	2,348	2,874	3,520	4,310	-	-	-	-	-	-	-	-
General Dry Cargo Ship	697	853	1,044	1,279	1,566	1,917	2,348	2,874	3,520	4,310	-	-	-	-	-	-	-	-
Passenger Ship a/	5,164	7,558	11,062	17,252	22,240	-	-	-	-	-	-	-	-	-	-		-	-
Refrigerated Cargo Ship	2,558	2,905	3,298	3,744	4,251	4,827	5,481	6,223	7,065	8,021	9,704	-	-	-	-	-	-	-
Ro-Ro Cargo Ship	1,251	1,420	1,612	1,831	2,078	2,360	2,679	3,042	3,454	3,922	4,744	6,116	7,884	-	-	-	-	-
Tank Barge	1,323	1,349	1,375	1,401	1,428	1,456	1,484	1,512	1,541	1,571	1,617	-	-	-	-	-	-	-
Tank Ship	1,323	1,349	1,375	1,401	1,428	1,456	1,484	1,512	1,541	1,571	1,617	1,679	1,745	1,812	1,883	1,994	2,193	2,459
Towing Vessel	1,323	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other b/	697	853	1,044	1,279	1,566	1,917	2,348	-	-	-	-	-	-	-	-		-	-
US Flag 2008 Hourly Operating Costs at Sea																		
Bulk Carrier	1,672	1,720	1,768	1,819	1,870	1,923	1,977	2,033	2,091	2,150	2,242	2,371	2,507	2,651	2,803	3,048	3,504	4,143
Combination Carrier (e.g. OBO)	1,756	1,806	1,857	1,909	1,963	2,019	2,076	2,135	2,195	2,258	2,354	2,489	2,632	2,783	2,943	3,200	3,679	4,350
Container Ship	1,741	1,933	2,147	2,385	2,649	2,942	3,267	3,628	4,030	4,476	5,238	6,461	7,970	9,831	12,126	16,611	-	-
Freight Barge	1,143	1,372	1,647	1,977	2,374	2,850	3,421	4,107	4,931	5,920	7,787	-	-	-	-	-	-	-
General Dry Cargo Ship	1,143	1,372	1,647	1,977	2,374	2,850	3,421	4,107	4,931	5,920	7,787	-	-	-	-	-	-	-
Passenger Ship a/	7,734	10,595	14,514	20,953	25,845	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigerated Cargo Ship	3,917	4,350	4,831	5,366	5,959	6,619	7,351	8,164	9,067	10,070	11,786	-	-	-	-	-	-	-
Ro-Ro Cargo Ship	1,915	2,127	2,362	2,623	2,914	3,236	3,594	3,991	4,433	4,923	5,762	7,107	8,767					
Tank Barge	2,187	2,228	2,270	2,312	2,355	2,400	2,445	2,490	2,537	2,585	2,658	-	-	-	-	-	-	-
Tank Ship	2,187	2,228	2,270	2,312	2,355	2,400	2,445	2,490	2,537	2,585	2,658	2,758	2,862	2,971	3,083	3,260	3,577	3,998
Towing Vessel	2,187	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other b/	1,143	1,372	1,647	1,977	2,374	2,850	3,421	4,107	4,931	5,920	7,787	-	-	-	-	-	-	-

a/ Includes recreational vessels.

b/ Includes fishing vessels, industrial vessels, research vessels, and school ships.

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 reported by Bunkerworld for IFO380 and MDO for New York as of June 13, 2008.

Operating Costs at Sea

In addition to estimates of vessel service speeds, the USACE prepares estimates of vessel operating costs to be used by planners 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, lubricants and stores (supplies), 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 2008, 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 3-2 shows costs based on 2008 bunker fuel prices because comments from the shipping industry raised concerns that USACE vessel operating costs for 2004 would not adequately reflect current conditions, especially due to the increased cost of fuel. 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, 2005 USACE vessel operating costs were updated to reflect the average bunker fuel prices per ton as reported by Bunkerworld for New York as of June, 2008.[21] In 2008, the price for heavy viscosity oil was $631 per metric ton and marine diesel oil was $1,245 per metric ton, representing increases of approximately 360 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 2008 due to bunker fuel cost is about 95 to 115 percent for foreign flag general cargo vessels and tankers, 130 percent for foreign dry bulk vessels, and 150 to 170 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.

[21] New York is a major distribution area for fuel and is generally regarded as an important price point for the US.

Census Bureau data on US imports of merchandise is compiled primarily from automated data submitted through the US Customs' Automated Commercial System.[22] Data are also compiled 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 United States.
- **Import Charges.** 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 to placing it alongside the carrier at the first port of entry in the United States.
- **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 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 Charts 3-3a and 3-3b present East Coast maritime trade data (value and weight of imports and exports) by port region and area for 2003 and 2004, respectively.[23]

[22] 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.

[23] Maritime trade refers to the method of transportation by which the merchandise arrived in or departed from the US.

Data Chart 3-3a
US East Coast Maritime Trade by Port Region and Port Area, 2003

	Imports		Exports		Total Trade	
ANPR 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	133.3	309.7	133.3	309.7
Searsport, ME	295.4	1,342.7	5.6	2.0	301.0	1,344.7
Portland, ME	892.6	3,330.4	122.9	187.4	1,015.4	3,517.8
Portsmouth, NH	576.9	4,329.3	74.6	149.5	651.5	4,478.9
Subtotal	1,764.9	9,002.5	336.3	648.6	2,101.2	9,651.1
Racepoint, MA						
Salem, MA	29.4	790.9	9.4	4.2	38.8	795.1
Boston, MA	5,126.5	15,893.1	798.8	821.1	5,925.3	16,714.3
Subtotal	5,155.8	16,684.1	808.2	825.3	5,964.1	17,509.4
Cape Cod, MA						
Cape Cod, MA	0.0	0.0	0.1	0.0	0.1	0.0
Subtotal	0.0	0.0	0.1	0.0	0.1	0.0
Block Island Sound						
New Bedford, MA	135.9	2,087.1	7.9	5.2	143.8	2,092.3
Providence , RI	2,665.2	4,522.9	61.3	296.4	2,726.5	4,819.3
New London, CT	149.5	193.3	11.3	56.2	160.9	249.5
New Haven, CT	961.6	2,764.0	35.3	234.7	996.9	2,998.7
Bridgeport, CT	146.0	1,677.8	2.0	6.5	148.0	1,684.4
Subtotal	4,058.4	11,245.1	117.7	599.0	4,176.1	11,844.0
New York						
New York City, NY	78,601.0	68,879.8	21,760.0	9,585.8	100,361.0	78,465.5
Subtotal	78,601.0	68,879.8	21,760.0	9,585.8	100,361.0	78,465.5
Delaware Bay						
Philadelphia, PA	21,817.7	71,221.2	2,080.8	1,768.0	23,898.5	72,989.2
Subtotal	21,817.7	71,221.2	2,080.8	1,768.0	23,898.5	72,989.2
Chesapeake Bay						
Hampton Roads, VA	20,885.7	11,357.2	12,245.2	17,242.8	33,130.9	28,600.0
Baltimore, MD	20,412.1	17,726.0	5,753.1	4,708.8	26,165.2	22,434.8
Subtotal	41,297.8	29,083.2	17,998.3	21,951.7	59,296.1	51,034.8
Morehead City, NC						
Morehead City, NC	226.7	463.8	359.6	40.2	586.4	504.1
Subtotal	226.7	463.8	359.6	40.2	586.4	504.1
Wilmington, NC						
Wilmington, NC	1,250.7	3,337.1	953.2	730.1	2,203.9	4,067.2
Subtotal	1,250.7	3,337.1	953.2	730.1	2,203.9	4,067.2
Georgetown, SC						
Georgetown, SC	37.1	610.7	24.3	47.3	61.3	658.0
Subtotal	37.1	610.7	24.3	47.3	61.3	658.0
Charleston, SC						
Charleston, SC	26,063.4	11,886.0	13,483.2	5,399.4	39,546.7	17,285.3
Subtotal	26,063.4	11,886.0	13,483.2	5,399.4	39,546.7	17,285.3
Savannah, GA						
Savannah, GA	13,630.7	11,888.7	7,634.1	8,134.9	21,264.8	20,023.6
Subtotal	13,630.7	11,888.7	7,634.1	8,134.9	21,264.8	20,023.6
Southeastern U.S.						
Brunswick, GA	4,679.6	1,138.3	657.5	689.5	5,337.1	1,827.8
Fernandina, FL	79.4	92.8	194.6	239.7	274.0	332.5
Jacksonville, FL	8,884.0	8,826.5	3,475.7	942.9	12,359.7	9,769.5
Port Canaveral, FL	355.4	2,647.4	127.8	131.1	483.2	2,778.5
Subtotal	13,998.3	12,705.1	4,455.6	2,003.2	18,454.0	14,708.3
All Port Areas	207,902.6	247,007.2	70,011.5	51,733.4	277,914.1	298,740.7

Source: Prepared by Nathan Associates from U.S Census Bureau Foreign Trade Statistics for 2003 as described in text.

Data Chart 3-3b
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.

In 2003, the custom import value of merchandise arriving to the ports of the East Coast was $207.9 billion, nearly three times the $70 billion value of exports.[24] 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 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, followed by 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 over 2003 values 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 in 2004 (see Data Chart 3-3b).

2003 and 2004 shipping weight values for each port are presented in Data Charts 3-3a and 3-3b, respectively. The total shipping weight of East Coast imports was 247 million tons in 2003 (263.5 million tons in 2004); the total shipping weight for exports was 51.7 million tons (56.7 om 2004). In 2003, the port area of Philadelphia was the largest in terms of import shipping weight, with 71.2 million tons, followed by New York City, with 68.9 million tons. These two areas accounted for 57 percent of the total East Coast import shipments by weight. With regard to 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. Rankings in 2004 were similar.

The Census Bureau reports vessel import charges associated with import of merchandise by customs district.[25] Vessel import charges represent the aggregate cost of all freight, insurance, and other charges (excluding US import duties) incurred in loading the merchandise from alongside the carrier at the port of exportation and unloading 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).[26] 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 11.9 percent of vessel import value for the customs district of Charlotte to 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.

[24] For purposes of this study, ports south of Port Canaveral, FL are excluded.
[25] 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 do not necessarily correspond to the vessel import values shown in Data Charts 3-3a and 3-3b by port area as ports included in customs district that are outside the scope of this study have been excluded from this table.
[26] Vessel import value is equivalent to custom import value for merchandise transported by vessels.

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 East Coast is a multimillion dollar industry. In 2005, commercial fish landings at East Coast ports for which fishing constitutes a significant share of their activity totaled $801 million (Data Chart 3-5). In 2004 and 2005, New Bedford ranked highest in the United States for landings by port in dollars, with $206.5 million and $282.5 million, respectively.

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 indicated that the vast majority of commercial fishing vessels 65 ft (19.8 m) and longer have a GRT of less than 150 tons and therefore, are not captured in the USCG vessel-arrival database. Compilation of data on such vessels required use of commercial fishing permit data, in addition to the USCG arrival 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. Many commercial fishing vessels steam at 10 knots or below, and would not be affected by a 10-knot speed restriction. The typical steaming speed for other commercial fishing vessels is assumed to be 12 knots (Table 3-10). Information was not obtained on state-permitted vessels, as impacts to the commercial fishing industry are expected to be low.

Data Chart 3-5
US East Coast Commercial Fishery Landings by Port, 2002 – 2005 (millions of dollars)

Port	2002	2003	2004	2005
New Bedford, MA	168.6	176.2	206.5	282.5
Hampton Roads, VA	69.5	79.6	100.6	85.2
Cape May-Wildwood, NJ	35.3	42.8	68.1	68.4
Gloucetser, MA	41.2	37.8	42.7	45.9
Point Judith, RI	31.3	32.4	31.5	38.3
Portland,ME	40.4	28.7	24.2	34.6
Stonington, ME	21.7	20.5	7.5	32.3
Reedville, VA	24.2	24.2	26.1	27.1
Long Beach-Barnegat, NJ	14.6	16.4	20.6	26.7
Point Pleasnat, NJ	19.7	22.8	19.2	21.6
Provincetown-Chatham, MA	15.2	13.5	14.1	19.8
Wanchese-Stumpy Point, NC	23.2	21.0	20.6	19.6
Atlantic City, NJ	22.4	20.8	17.7	18.5
Montauk, NY	11.1	11.0	13.0	16.5
Charleston -Mt. Pleasant, SC	9.3	13.0	8.5	12.2
Boston,MA	8.6	8.9	8.8	10.6
Beaufort- Morehead City, NC	19.1	15.0	16.9	9.7
Hampton Bay-Shinnicock, NY	8.3	6.5	6.6	8.1
Rockland, ME	4.3	4.1	2.7	7.4
Cape Canveral, FL	6.2	6.8	9.3	6.1
Engelhard-Swanquarter, NC	11.1	8.0	7.8	5.3
Oriental-Vandemere, NC	8.5	5.0	7.2	4.7
Beaufort, SC	n.a.	7.0	n.a.	n.a.
Ocean City, MD	8.1	6.6	n.a.	n.a.
Georgetown, SC	5.2	6.0	n.a.	n.a.
Belhaven- Washington, NC	6.2	5.0	3.7	n.a.
Sneads Ferry-Swansboro, NC	6.4	5.0	n.a.	n.a.
Darien-Belville, GA	6.9	6.0	5.0	n.a.
Total	646.6	650.6	688.9	801.1

Source: NOAA Fisheries.

Data Chart 3-6
Fishing Permits Issued to Vessels 65 Feet and Longer 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 East Coast ports, rising in 2004 to 1,666 arrivals[27] (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 of 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 accounted for 547 of these. New York City had the second-highest number of passenger-vessel arrivals, with 226 in 2003. Boston ranked third, with 94 arrivals, followed by Searsport with 66, and Baltimore and Charleston, with 40 arrivals each 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 (307), followed by Boston with 94 arrivals, Jacksonville (89), Searsport (81), and Baltimore (75). The importance of Port Canaveral to the cruise industry in the SEUS region is indicated below. 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, including ferry vessels. There were 226 vessel arrivals in 2003 and 307 in 2004. Over half of the arrivals are of vessels greater than 60,000 GRT.

3.4.4.1 Cruise Vessels

In 2004, the North American cruise industry[28] contributed more than $30 billion to the US economy, an 18 percent increase from 2003. US residents taking cruises increased by 11.1 percent from 2003, and the industry increased its total direct spending in the United States by 13.8 percent, to $14.7 billion. The cruise ship fleet increased by eight ships, to a total of 192.

The expansion of the cruise industry benefits US ports through the increase in cruise passengers and homeporting. All US ports combined handled 8.6 million cruise embarkations in 2005 (a 6.3 percent increase from 2004); US residents accounted for 77 percent of the global cruise passengers (Business Research and Economic Advisors [BREA], 2006). From 2000 to 2005, the Port of Miami had the greatest number of embarkations, and had nearly 1.8 million passengers in 2005. Strong growth at Port Everglades moved it from third rank with 0.8 million passengers in 2000 to second rank with nearly 1.3 million passengers in 2005. Port Canaveral also grew from 0.9 million passengers in 2000 to 1.2 million passengers in 2005 (Data Chart 3-8). 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 (in terms of direct purchases, employment, and income) from the cruise industry (BREA, 2006).

[27] Ports south of Port Canaveral, Florida, are excluded from the data presented here as they are outside the geographical scope of the proposed action.
[28] The North American cruise industry is defined as those companies that primarily market their trips in North America.

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.

Data Chart 3-8
Embarkations of the North American Cruise Industry for Selected US East Coast Ports, 2000-2005 (passengers in 000s)

Port	2000	2001	2002	2003	2004	2005
Miami	1,682	1,700	1,804	1,965	1,682	1,771
Port Everglades	798	1,046	1,202	1,213	1,324	1,283
Port Canaveral	941	870	1,028	1,089	1,220	1,234
New York	309	238	326	438	547	370
Jacksonville	n.a.	n.a.	n.a.	6	113	137
Norfolk	8	27	39	48	47	45
Baltimore	n.a.	n.a.	57	57	105	67
Boston	n.a.	n.a.	69	69	100	80
Charleston	n.a.	n.a.	n.a.	31	39	41
Philadelphia	48	60	1.5	24	29	50

Source: Business Research & Economic Advisors, The Contribution of the North American Cruise Industry to the US economy in 2005, prepared for the International Council of Cruise Lines, August 2006. Jacksonville, Norfolk, and Charleston data from U.S. Maritime Administration.

3.4.4.2 Ferry Boats

As previously noted, the USCG vessel-arrival database does not include information on vessels of less than 150 GRT. Most passenger and car ferries are below this threshold, and therefore USCG arrival data do not reflect all 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 comprehensive inventory of existing ferry operations in the United States and its possessions. Data were collected as part of a survey conducted by the Federal Highway Administration from March 1 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, ro-ro, 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.

The National Ferry Database contained 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 enter the Atlantic Ocean proper. Hence, most ferry operations on the East Coast would not be affected by the proposed regulations as they operate landward of COLREGS lines. Further information on each of the ferry routes, including the city or port served, water body crossed, type of service, number of passengers and vehicles served, and beginning and end of operating season is presented in Appendix E (Data Chart 3-9 and 3-10 refer to Appendix C of the Economic Report).

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 Associates Inc. from U.S. Department of Transportation, Bureau of Transportation Statistics, National Ferry Database as presented in Appendix C.

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	10

Source: Prepared by Nathan Associates 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).[29] It is estimated that more than 1.2 million passengers participated in whale-watching tours in 2000, generating more than $30 million in revenue. 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.

Whale-watching vessels operate out of Bar Harbor, Boothbay, Portland, and Kennebunkport in Maine; and Newburyport, Hyannis, Salem, Provincetown, Boston, Plymouth, and Gloucester in Massachusetts. Fare for a four- to six-hour trip averages $30–$40. Vessels range in size from inflatable boats, such as Zodiacs, to vessels up to 80 ft (24.4 m). Some companies operate multiple vessels and may operate charter fishing trips or other types of sightseeing tours.

Along the East Coast outside 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, in contrast to 21 in Massachusetts, 15 in Maine, three in New Hampshire, and one in Rhode Island.

In addition to providing an ecotourism activity, whale watching has also played a role in outreach and education. Most whale watching operators hire naturalists to educate customers about the whale species they encounter and conservation issues facing the species. Some operators even provide a platform for research when scientists conduct photo-identification projects on board, which provides important data about whale sightings (Hoyt, 2001).

By definition, whale-watching vessels operate within whale habitats. Currently, vessels must adhere to a 500-yd (457-m) "no approach" regulation for right whales (50 CFR 222.32). NOAA has also developed whale-watching guidelines for the northeastern United States. Operational guidelines vary depending on the distance between vessel and whales. Distances at which approach is prohibited range from 100 ft (30.5 m) to 1 to 2 mi (1.6 to 3.2 km). Detailed approach guidelines can be found at: *http://www.nero.noaa.gov/shipstrike/info/guidetxt.htm*.

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

3.4.6 Charter Vessel Operations

The charter fishing industry along the 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) from shore, full-day charters of between 11 and 12 hours that can go out to 40 nm (74 km) from shore, and extended full-day charters that can last from 18 to 24 hours and go up to 50 nm (92.6 km) from shore. The 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 operational measures.

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; 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) from shore and may anchor over wreck or rock formations for 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

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

3.4.7 Federal Vessels

Many comments were received about the exemption of vessels owned or operated by, or under contract to, Federal agencies, and several commenters requested a description of such Federal vessels in the FEIS. Table 3-12 provides an approximate number of Federal vessels 65 ft (19.8 m) and longer that are located and/or operate on the East Coast. An estimated 302 Federal vessels operate on the East Coast, but this number is not indicative of the number of vessels at sea at one time; these vessels may be deployed to other regions, and may be docked for a significant portion of the year. The percentage of time at sea varies with the specific mission and objectives of each agency. For example, a study conducted on Navy vessel traffic estimated that of the Navy's 121 East Coast vessels, there are 12 vessels on the East Coast within 200 nm (370.4 km) of shore at any given time (Filadelfo, 2001). Some agencies only operate at sea intermittently for training missions or research cruises, while others are at sea patrolling on a regular basis. The remainder of this section describes the standard operations of these vessels for each Federal agency.

State law-enforcement vessels would be exempt from the proposed speed restrictions when engaged in enforcement or human safety missions. Because the majority of state law-enforcement vessels are less than 65 ft (19.8 m) in length and would, therefore, be exempt from the proposed restriction on this basis, this exception would have a negligible effect on the number of exempted vessels. For this reason, state law-enforcement vessels are not described in this section.

Table 3-12
Federal Vessel Operations

Summary of US East Coast Federal Vessels ≥ 65 Feet in Length		
Agency	**Total Number**	**Number on East Coast**
Navy	261[a]	121
MARAD (National Defense Reserve Fleet)	230	55[b]
USCG	250	108[c]
NSF	25	5
NOAA	18	6
USACE (Dredges – FY07 Operations)	11	4[d]
EPA	1	1
DOI (MMS, FWS, NPS, USGS)	2	2[e]
Total Federal vessels	**798**	**302**

Notes:

[a] The total for Navy vessels excludes vessels in the Military Sealift Command.

[b] MARAD has a total of 86 vessels in the East Coast/South Atlantic inventory, although 30 of these vessels are outported to other US ports, leaving 55 vessels anchored in the James River, VA, excluding one vessel in the Custody program (explained below). These vessels are not at sea on a regular basis, and are generally only deployed during times of war or national emergency.

[c] East Coast totals overestimate the actual number of affected vessels, as the estimates include Miami, Key West, and other cities that are not within the geographic scope of the rulemaking.

[d] USACE dredges include vessels scheduled to operate on the East Cost for Fiscal Year (FY) 07, although the schedule may change and vessels may relocate to areas outside of the East Coast during the FY. Only two of the four vessels scheduled to operate on the East Coast are actually docked on the East Coast. The USACE vessels only include those owned by the USACE; dredges contracted/operated by USACE are described below because the number of dredges varies every year.

[e] USGS, Woods Hole Science Center occasionally leases two research vessels.

Numbers are accurate as of December 2006.

3.4.7.1 United States Army Corps of Engineers

The missions of the USACE, among other things, include the congressionally-mandated requirement to maintain safe, reliable, and economically efficient navigation channels. USACE maintains navigation channels from Maine to Miami Harbor on the Atlantic Coast using four of its own dredges and approximately 50 others under contract to USACE. Not all navigation channels are dredged every year and some dredging operations may last days while others could last a month or longer. These dredges make multiple transits to 44 Atlantic Coast ocean dredged-material disposal areas when engaged in dredging navigation channels. The very nature of maintaining navigation channels necessitates that the dredges operate in the navigation channels and that dredged-material disposal operations operate outside of the navigation channels (J. Wilson, e-mail communication, January 22, 2007).

The USACE owns 11 dredging vessels that operate in waters throughout the entire United States. Only four of these vessels operate in waters off the East Coast, and this number varies depending on project locations each year. For Fiscal Year 2007 (FY07), four of the USACE-owned dredges are scheduled to operate in waters off the East Coast, although only two of the dredges are physically located on the East Coast. The major project locations for FY07 are within the Philadelphia and Wilmington districts, although there are projects in various cities in other districts (USACE, 2007). USACE also owns a number of survey vessels (some longer than 65 ft [19.8 m]) and several drift collection vessels that are 65 ft (19.6 m) and longer. These vessels are sometimes mobilized by the USCG for emergency operations in waters off the East Coast. These vessels are not included in Table 3-12, as they rarely operate in right whale habitat.

USACE utilizes contractors for the majority of dredging projects. In addition to the USACE-owned dredges above, an additional 53 contracts were issued for projects on the East Coast in FY06. The majority of the projects in FY06 were within the Wilmington and Jacksonville districts. These vessels are not included in Table 3-12 because this number changes every year, depending on the specific projects in each district. These contracted vessels are only in the project area for the duration of the project, and then may move to another project at any US port.

These dredges generally transit from the project sites (river, harbor, etc.) to near-shore sites for beach renourishment, or ocean disposal sites, which range from approximately 0 to 20 nm (0 to 37 km) offshore. In the New England District, there are 11 active disposal sites, including three in waters off the coast of Maine (Cape Arundel, Portland, and Rockland), three in waters off of Massachusetts (Massachusetts Bay, Cape Cod, and Buzzards Bay), one in waters off of Rhode Island (Rhode Island Sound), and four off the coast of Connecticut in Long Island Sound (New London, Cornfield Shoals, and Central and Western Long Island Sound). Four disposal sites exist in the Philadelphia District (Manasquan, Barnegat, Absecon, and Cold Springs Inlets). There are no active disposal sites in the Baltimore District. There are two sites in the Norfolk District (Dam Neck and Norfolk), and four in the Wilmington District (although only two – Morehead City and Wilmington Harbor – are active). There are six sites in the Charleston District, including one for the Charleston, South Carolina harbor-deepening project. In the Savannah District, there are two sites, one for Savannah Harbor and another for Brunswick. The Jacksonville district includes the entire state of Florida, although there are only two sites within the geographic scope of the proposed action – Fernandina Beach and Jacksonville (USACE, 2007).

Since the late 1980's USACE Atlantic Coast dredging operations have operated under one or more Biological Opinions (BOs). Those BOs contain a number of provisions aimed at protecting endangered sea turtles and marine mammals, including requirements to have trained observers onboard each vessel during times of the year when species of concern are anticipated to be present, and vessel speed limits at night and when sea and weather conditions limit visibility. Dredges operate under the requirements of a BO, whether operated by, or under contract to USACE. Requirements imposed under existing BOs provide the same if not a greater level of protection to right whales from USACE dredging operations than would occur from the proposed rule, thus warranting the exemption (J. Wilson, e-mail communication, January 22, 2007).

3.4.7.2 Maritime Administration

MARAD's National Defense Reserve Fleet (NDRF) has several internal programs that categorize vessels by the type of vessel operations and the status of the vessel. Vessels in the Custody program are owned and/or sponsored by other Federal agencies for use within their agency programs, but are being maintained by MARAD in the NDRF on a reimbursable basis. Agencies participating in this program include the Army, Navy, NOAA, and USCG. Vessels in the Non-retention program no longer have a useful application and are pending disposal. The Retention program includes MARAD vessels that are being preserved for Federal-agency programs. These programs include, but are not limited to, the Emergency Sealift, fleet support, military useful, school ships, and training. The Ready Reserve Force includes active vessels that are ready to support Department of Defense (DoD) surge sealift requirements. Altogether, as of October 31, 2006, MARAD's fleet consists of 230 vessels (not including 19 vessels in the Custody program, because they might be counted twice if they were added to MARAD's inventory). Fifty-five of these vessels are anchored on the East Coast; six are in the Retention program, 49 are in the Non-retention program, and there are no vessels in the Ready Reserve Force (Table 3-12) (MARAD, 2006). Therefore, the vast majority of these vessels (49 of 55) no longer operate at sea and soon will be disposed of.

3.4.7.3 United States Coast Guard

The USCG is a military, multi-mission, maritime service within the Department of Homeland Security and one of the nation's five armed services. To serve the public and meet its missions, the USCG has five fundamental roles: maritime safety, maritime security, maritime mobility, national defense, and protection of natural resources. The USCG cutters listed in Table 3-12 operate in US waters to fulfill these roles (USCG, 2006). A "cutter" is any USCG vessel 65 feet (19.8 m) in length or greater; all other USCG vessels are smaller boats that do not meet the length threshold for the rule. As mentioned in Section 1.7.3, the BOs for these vessels are summarized in Appendix A.

3.4.7.4 Environmental Protection Agency, National Science Foundation, and National Oceanic and Atmospheric Administration

The vessels operated by these agencies are for oceanic and atmospheric research, mapping, and monitoring. The National Science Foundation (NSF) utilizes vessels within the University-National Oceanographic Laboratory System (UNOLS). UNLOS is an organization of 62 academic institutions and National Laboratories involved in oceanographic research formed for the purpose of coordinating oceanographic ships' schedules and research facilities. Funding for operation of these vessels is provided by academic institutions and the following Federal agencies: NSF, Minerals Management Service (MMS), Navy, NOAA, USCG, and the US Geological Survey (USGS) (University of Rhode Island [URI], 2007). The economic analysis for this FEIS estimates 12 knots as the average speed of research vessels[30], which is based on several data sources. The EPA only has one vessel greater than 65 ft (19.8 m); it is a coastal monitoring vessel (EPA, 2006). The NSF and NOAA have less than 10 vessels combined that are 65 feet or longer operating on the East Coast (URI, 2007; NOAA Marine and Aviation Operations [NMAO], 2006).

3.4.7.5 Department of the Interior

MMS, USFWS, and NPS do not own or have long-term leases on any vessels 65 ft (19.8 m) or longer on the East Coast. The USGS Woods Hole Science Center in Massachusetts does occasionally lease ships for short-term use. The two most used are the research vessel (R/V) MEGAN MILLER out of Port Jefferson, NY (Miller Marine) and the R/V ATLANTIC SURVEYOR from Dive Masters Corp. out of Manasquan, NJ, both of which are 65 ft (19.8 m) or longer (C. MacArthur, personal communication, December 8, 2006).

3.4.7.6 Navy

The 261 Navy vessels listed in Table 3-12 do not include vessels in the Navy's Military Sealift Command (MSC). The MSC operates non-combatant, civilian-crewed ships worldwide that provide combat logistics support to Navy ships at sea; special mission support to US government agencies; prepositioning of US military supplies and equipment at sea; and ocean transportation of DoD cargo in both peacetime and war (MSC, 2007). As of March 2007, there are 136 ships in the MSC (not including the 46 ships in the MARAD's Ready Reserve Force, because these vessels that are not outported are already included in MARAD's vessel count in Table 3-12). There are 108 vessels with full operating status: 36 in the Naval Fleet Auxiliary Force, 23 special mission ships, 29 prepositioning ships, and 20 sealift ships. Not including MARAD's Ready Reserve Force vessels, there are 28 vessels with reduced operating status (F. Stone, personal communication, March 22, 2007). The majority of the these vessels operate overseas, and only transit in waters off the East Coast when departing or arriving from overseas destinations or for maintenance. There is an average of six to seven MSC vessels operating in waters off the US East Coast at any one time (F. Stone, personal communication, March 22, 2007).

A study of Navy vessel traffic estimated that Navy vessels account for roughly three percent of vessel traffic out to 200 nm (370.4 km) on each coast of the United States (Filadelfo, 2001). These vessels primarily operate in specific waters designated for the Navy, although they must transit other waters to get to and from these areas. The DoD designates areas within US territorial waters and the US EEZ as "operating areas" (OPAREAs) and air space as "warning areas" in support of military operations involving training, readiness, and support of national defense and security interests (NOS, 1993). The six military operating areas on the Atlantic that overlap with the geographical scope of the rulemaking are briefly described below. All OPAREAs listed below (except for the Jacksonville/Charleston [JAX/CHASN] OPAREA) are controlled by the Fleet Area Control and Surveillance Facility Virginia Capes (FACSFAC VACAPES).

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[30] Research vessels are included in the 'other' vessel category of the USCG arrival database, and also include fishing vessels, industrial vessels, and school ships.

- The Boston OPAREA extends from Washington County, Maine, south to offshore Nantucket Island, and includes such exercises as submarine operations, gunnery practice, anti-submarine warfare tactics, sea trials, radar tracking, warship maneuvers, and general operations (NOS, 1993). Stellwagen Bank National Marine Sanctuary lies within the Boston OPAREA.
- The Narragansett Bay OPAREA is located off the coasts of Massachusetts, Rhode Island, and New York. With the departure of the operational Navy from Rhode Island, this OPAREA is seldom utilized.
- The Atlantic City OPAREA is located off the coasts of New York and New Jersey. This area is occasionally utilized for surface and surface-to-air exercises.
- The Virginia Capes (VACAPES) OPAREA is located in the coastal and offshore waters off Delaware, Maryland, Virginia, and North Carolina, and is utilized by the Navy for various preparedness exercises. As previously stated, Norfolk is a major port in this OPAREA. “Naval operations represent 5 percent of the total traffic moving in and out of the Chesapeake Bay” (Russell, 2001).
- The Cherry Point (CHPT) OPAREA is located in the coastal and offshore waters of North Carolina, and is used for various training and mission preparedness exercises. This OPAREA is contiguous to VACAPES.
- The JAX/CHASN OPAREA is located in the coastal and offshore waters off North Carolina, South Carolina, Georgia, and northeastern Florida. This OPAREA is controlled by FACSFAC Jacksonville and is utilized for various preparedness exercises.

As mentioned in Section 1.7.3, a summary of the Navy’s mitigation measures as stipulated by BOs is provided in Appendix A.

The impacts on Federal vessels are not analyzed in Chapter 4 of the FEIS because Federal vessels are exempt from the operational measures. While NMFS does request all Federal agencies to voluntarily observe the conditions of the regulations when and where their missions are not compromised, it is assumed that they would observe the speed restrictions and/or routing measures only under the specified conditions, and that therefore there would be minimal impacts on Federal agencies. Because of the Navy’s mitigation measures, this exemption is not expected to have significant adverse effects on right whales.

3.4.8 Demographics and Environmental Justice

3.4.8.1 Port Area 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 varied with its size; the areas are as follows:

- Eastport: Washington County, ME
- Searsport: Knox, Hancock, and Waldo counties, ME
- Portland: York, Cumberland, and Sagadahoc counties, 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 respectively, for the United States 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 exhibited proportionately smaller white populations than the United States as a whole, all of them south of, and including, New York City.

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

			Racial Distribution (Percentage)				
Port	Area	Population 2000	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.

The 26 ports had proportionately a slightly smaller Hispanic population than the United States as a whole (11.5 and 12.5 percent respectively), but here also, the ports exhibited ranges in demographic make-up – from less than one percent (0.6) Hispanics in Searsport, Maine, to more than 21 percent in New York City.

Economic conditions varied substantially from port to port (Data Chart 3-13; Figure 3-11). At one end of the spectrum, one port area – Eastport, Maine – showed clear signs of economic weakness for all indicators compared to the United States as a whole as well as to the other port areas under consideration. Conversely, indicators of economic health were higher in areas like Bridgeport, Connecticut, and Long Island, New York, than in the nation at large. Only three areas – Portland, Maine, Portsmouth, New Hampshire, and Long Island, New York – had an unemployment rate under the national rate, also a sign of economic health. All other port areas had unemployment rates higher than the national average – 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 than that of the United States 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 line were Long Island (5.6 percent), Portsmouth, NH (5.8 percent), New London, CT (6.4 percent), and Bridgeport, CT (6.9 percent).

3.4.8.2 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. These areas are referred to as Environmental Justice Communities.

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.

Table 3-13 lists the minority percentages in each area potentially affected by one or more of the proposed vessel operational measures. There was one area where 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 United States 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 3-14 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 United States as a whole was 12.4. While the number for the 26 port areas together (11.7) was lower than the US average of 12.4, eight areas had higher percentages than the US average: Eastport (19 percent), New York City (15.1 percent), Morehead City (14.5 percent), Wilmington (13 percent), Georgetown (17.1 percent), Charleston (14 percent), Savannah (14.5 percent), and Brunswick (15.6 percent). These areas, therefore, are considered as Environmental Justice communities for the purposes of this FEIS.

Based on these data, a total of ten of the 26 port areas constitute Environmental Justice communities as determined by either race and/or poverty levels: Eastport, New York City, Baltimore, Hampton Roads, Morehead City, Wilmington, Georgetown, Charleston, Savannah, and Brunswick.

Table 3-13
Minority Populations within the Scope of the Proposed Action

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

U.S. East Coast Unemployment Rate, 2000

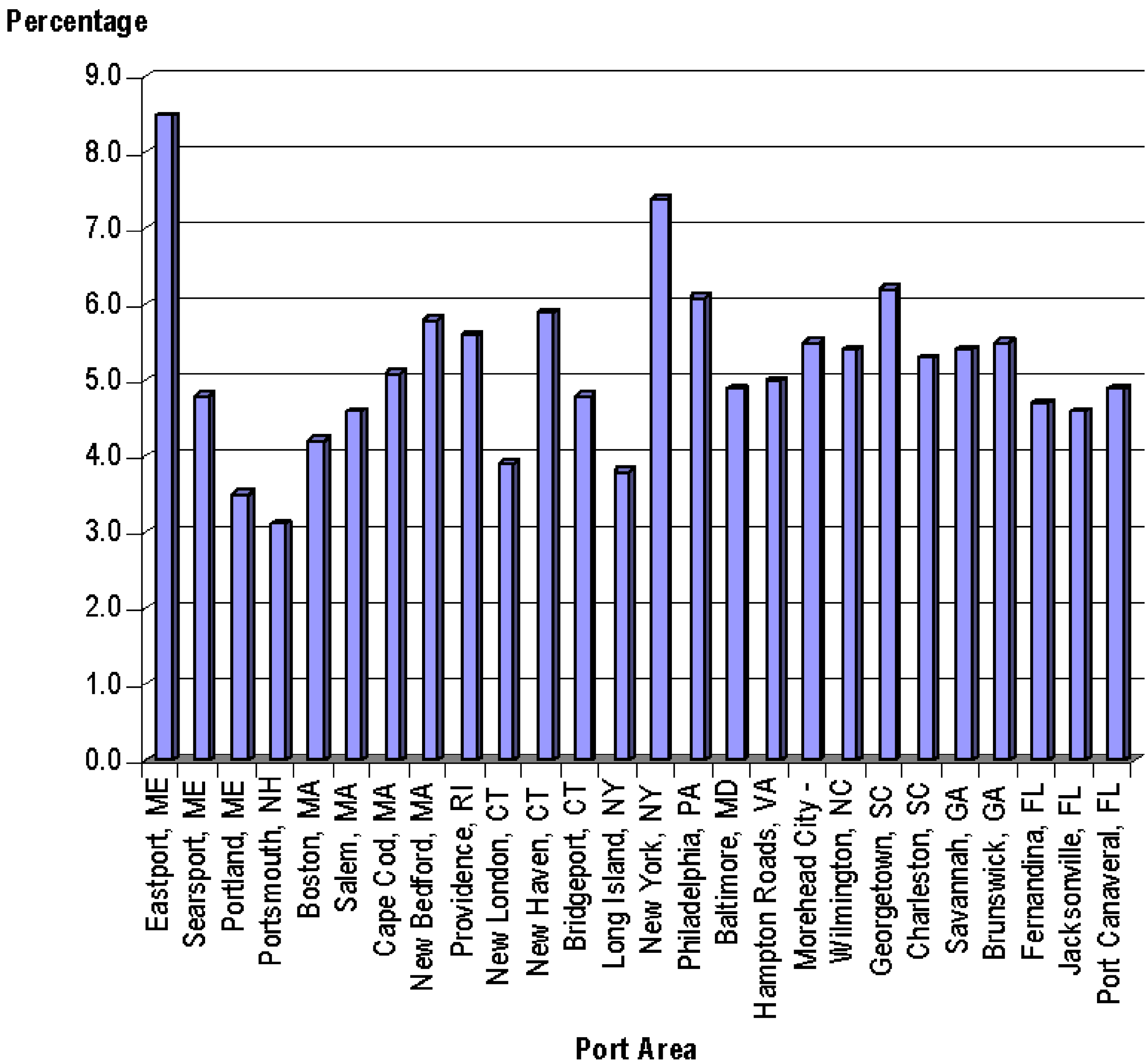

Figure 3-11

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

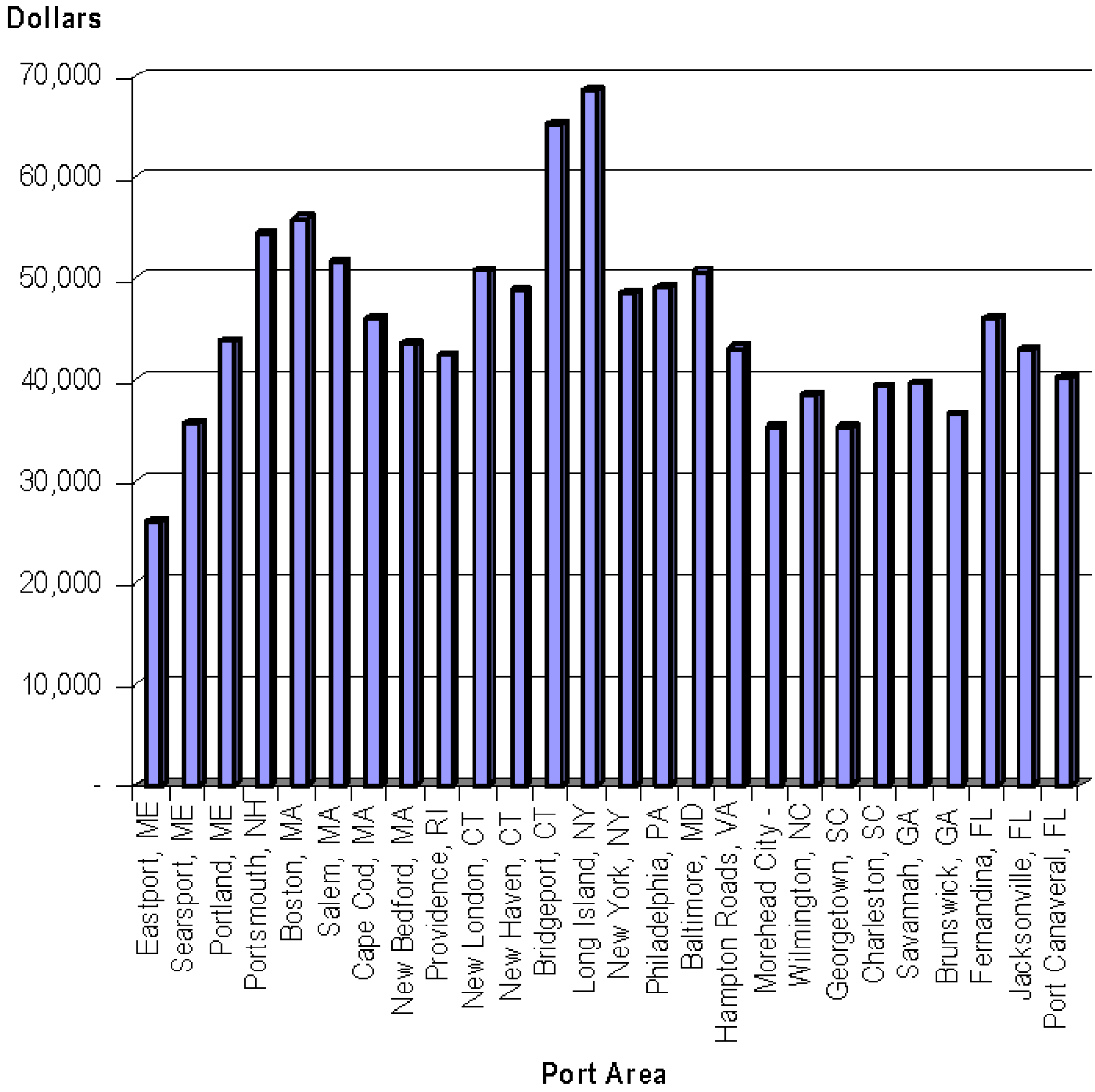

Figure 3-12

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

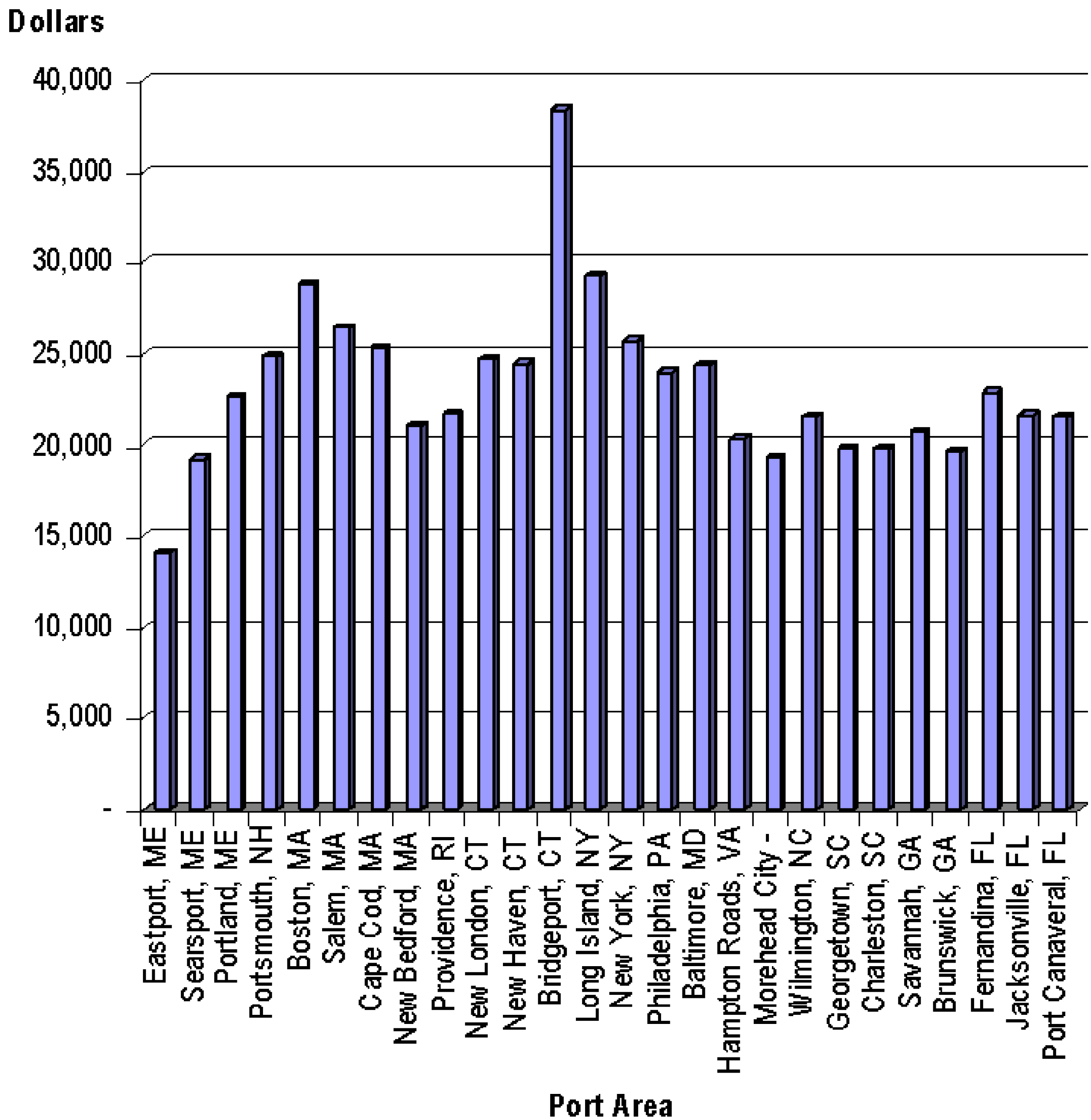

Figure 3-13

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

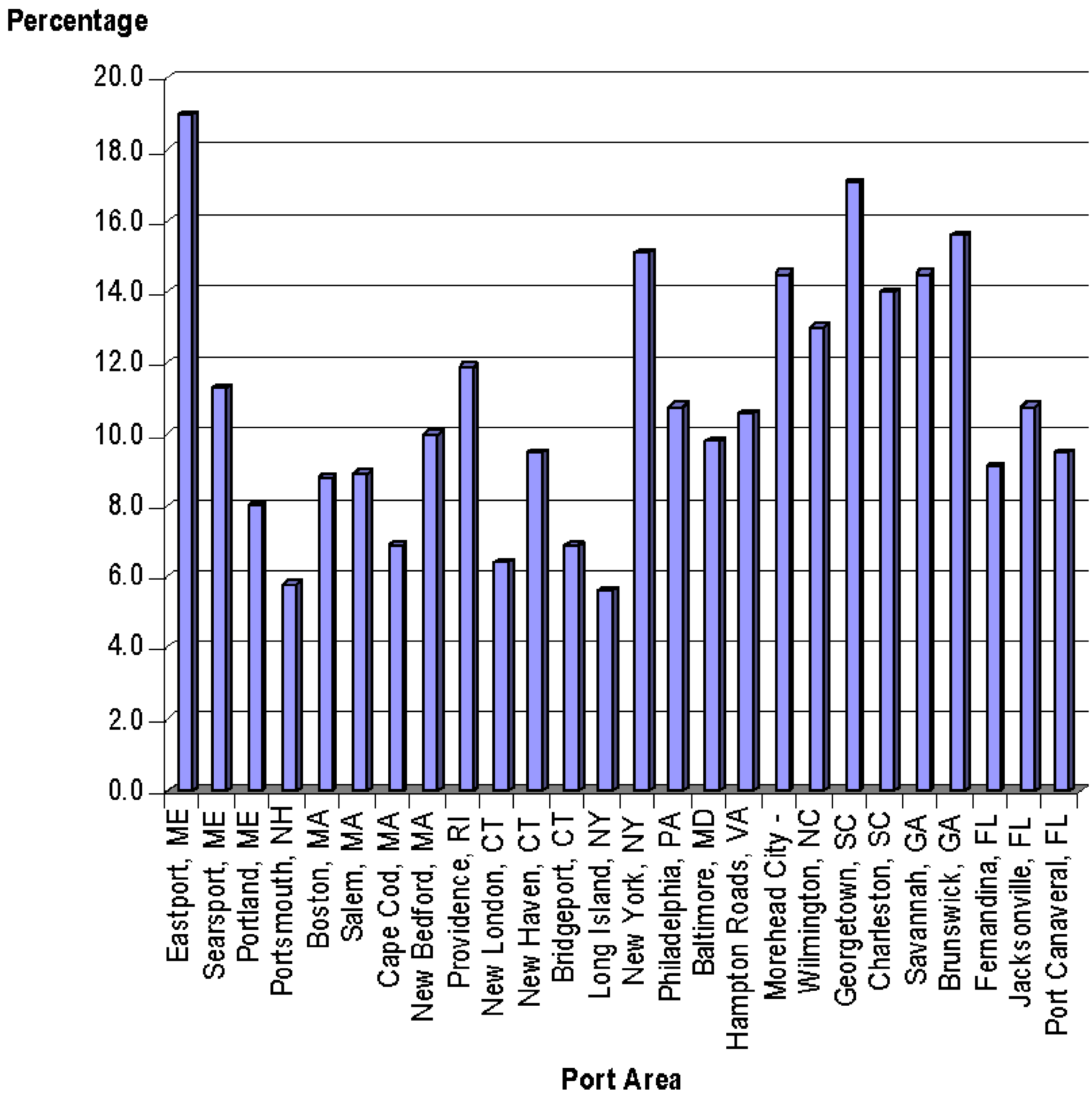

Figure 3-14

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Area	% Nonwhite	% Hispanic	% Minority (Nonwhite or White Hispanic)
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 3-14
Poverty Levels within the Scope of the Proposed Action

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

Area	# Poverty Determined	# in Poverty	% in Poverty
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**
Source: US Census Data, Census 2000.			

3.5 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 underwater 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.

4 ENVIRONMENTAL IMPACTS

This chapter provides an evaluation of the potential direct, indirect, and cumulative impacts to the affected environment described in Chapter 3, resulting from implementing vessel operational measures to reduce ship strikes of North Atlantic right whales under any of the five action alternatives being considered by NMFS. With regard to Alternative 6, the proposed action, because under this alternative the proposed operational measures would expire five years after they become effective, the annual economic impacts described in this chapter (Section 4.4) would only last five years. The major positive impacts on right whales described in Section 4.1.6 also would occur only during the five-year period the measures would be in effect.

4.1 Biological Impacts on the North Atlantic Right Whale

NMFS has designed the proposed vessel operational measures to reduce the threat of ship strikes as a major cause of right whale mortality and serious injury. During the period these measures would be in effect, NMFS expects that implementation of the proposed action will result in fewer right whale deaths, and therefore, could facilitate population growth and recovery.[1]

Because the population of North Atlantic right whales is small and the population growth rate has declined from an estimated 1.05 in 1980 to 0.92 in 1997[2] (at a 1.00 rate, the population would be stable), a more favorable growth rate could be achieved by preventing even a small number of right whale deaths (Caswell *et al.*, 1999). In addition to a decline in the population growth rate, Kraus *et al.* (2005) indicated that the mortality rate had increased between 1980 and 1998 to a level of 4 percent (±1 percent). If survivorship continues to decline at current rates, the Caswell *et al*. (1999) model predicts extinction in less than 200 years. Protective measures will help reverse this declining trend by reducing the number of right whale deaths, and in time, the population growth rate would rise. In addition, if it were to rise and remain above 1.00 – that is, replacement level – the population would no longer be facing extinction in the long term.

Fujiwara and Caswell (2001) predicted that preventing the death of just one whale a year could have a positive impact on the population. If this “saved” whale were a female, then it would have an even more substantial impact on the population. Preventing the death of two female whales per year would result in an increasing population growth rate. This study also indicates that the decline in population growth rate is linked to reduced survival probability rates for mother whales. Vessel operational measures proposed for the SEUS region in particular – the only known calving ground for right whale mothers and calves – would play an essential role in reducing the number of female (and juvenile) deaths, a key component to the recovery of the population.

While the actual number of ship strikes that could be prevented by implementing each alternative cannot be calculated at this time, it is reasonable to assume that each action alternative has some

[1] An increase in population growth rate based on ship strike reduction measures assumes that mortalities from entanglement or natural deaths remain the same or decrease as well.
[2] These population growth rate values were computed by a model that utilized estimates of survival probability and reproductive rate (Caswell *et al*., 1999).

potential to prevent at least one death or serious injury per year, which would have a positive impact on the population. Preventing nonnatural mortalities will bring right whales closer to the potential biological removal (PBR) levels for the population (Section 1.1.1), and ultimately help the population grow toward its optimum sustainable population (OSP).

All of the action alternatives – Alternatives 2, 3, 4, 5 and 6 – would result in a reduction in the number and/or severity of right whale “takes” (Sections 1.5.1 and 1.5.2) under the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA). This reduction would have minor to significant, direct, positive effects on the population, depending upon the alternative. This would also result in an indirect positive impact on NOAA’s mandate under these statutes to reduce the taking of right whales and to aid in the recovery of an endangered species.

The remainder of this section describes the potential biological impacts on the North Atlantic right whale that would result from implementing the No Action Alternative and each of the action alternatives. The impacts are analyzed by region (the boundaries of the regions are described in Section 1.4):

- Southeastern US (SEUS)
- Mid-Atlantic US (MAUS)
- Northeastern US (NEUS)

The following discussions of the biological impacts of the proposed changes to vessel operations are by alternative, and the analysis is largely qualitative. Some limitations and uncertainties in current knowledge do not allow development of an accurate quantitative model to project the number or percentage of ship strikes that would be prevented by the proposed action and alternatives or how much this decrease in ship strikes would increase the population growth rate.[3] Creating such a model would require, among other things, real-time information on the exact location and number of vessels and the exact locations, numbers, and depths of right whales in the water column. In addition, sufficient historical data on the fates of the whales with respect to the speed and type of vessel implicated would also be needed, as well as data on whale behavior, including reactions to approaching vessels based on various activities such as feeding, mating, resting, and the role of vessel speed on a whale’s ability to avoid an oncoming vessel. NMFS funding for studies of these factors may be available in the future.

Some of the criteria and information used to qualitatively evaluate the effects of the measures identified in each of the alternatives on the right whale population include:

- Right whale distribution and occurrence.
- Vessel operating speeds.
- Ability of the whales to avoid vessels.
- Vessel size and hydrodynamic effects at various speeds.

[3] As stated earlier, the positive impacts resulting from the operational measures are expected to reduce the likelihood and severity of ship strikes at current shipping levels. However, the number of large vessels in the world’s oceans are expected to double over the next two to three decades to keep up with increased volumes of traded cargo (NMFS, 2005d).

4.1.1 Alternative 1 – No Action Alternative

The No Action Alternative would have significant, direct, long-term, negative effects on the North Atlantic right whale population because no actions beyond those already in place would be taken to reduce the threat of ship strikes. The number of ship strikes in recent years indicates that current measures are not sufficient to protect right whales. Under the No Action Alternative, ship strikes would likely continue at the same rate, or – perhaps more likely – increase with the predicted increase in commercial shipping. Applying the predictions by Caswell *et al.* (1999), if ship strikes were to continue at current rates or increase, the western population of the North Atlantic right whale would be extinct within 200 years.

4.1.1.1 Northeastern United States (NEUS)

The NEUS contains several key feeding areas, including the designated critical habitat in Cape Cod Bay, where right whales feed, socialize, and mate. Right whale behavior in this region makes the animals particularly susceptible to ship strikes. When right whales are feeding, mating, and socializing, they appear to be less aware of oncoming vessels (Mayo et al., 2004; Nowacek *et al*., 2004). Given that relatively high densities of both right whales and ships occur in this area, the likelihood of ship strikes is high. Of all recorded ship strikes internationally, the majority (over 70 percent) occurred in the North Atlantic (US and Canadian waters). While this could be a function of the amount of traffic, it may also be a reflection of higher reporting rates in these areas (Jensen and Silber, 2003). Without new operational measures to protect whales in this region, vessel strikes would continue, thereby threatening the small population.

As in the other geographic regions, current conservation measures would continue under the No Action Alternative. Current measures have proven to be insufficient to protect right whales from ships strikes, as is indicated by the number of recorded ship strikes that have occurred over the last few years. For instance, eight known right whale deaths from ship strikes occurred between 2001 and 2005 (Nelson *et al*., 2007). Taking no additional actions would lead to significant, direct, long-term, negative impacts in the NEUS by hindering the survival and recovery of the western population of the North Atlantic right whale.

4.1.1.2 Mid-Atlantic United States (MAUS)

The MAUS includes waters along the coast where whales tend to occur close to shore at certain times of the year. The majority of the whales that occur in this area are migrating from feeding grounds in the north and calving grounds in the south, although nonmigratory whales have been sighted in this area on occasion. Ships must pass through this habitat to get to port, which places right whales in danger of ship strikes. The general north-south direction of migrating right whales intersects with the east-west direction of vessels traveling in and out of ports in this region, which intensifies the need for action in the MAUS, where current right whale protection measures are minimal.

With the exception of mariner education and other voluntary measures, there are virtually no active ship strike reduction measures in the MAUS. Therefore, the No Action Alternative, which would continue to rely on these measures alone, would have a potentially significant, direct, long-term, negative impact on the western population of North Atlantic right whales. Without the recommended protective operational measures, ships would continue to use a broad choice of routes at customary sea speeds to enter each port and the chances of striking a right whale would remain high because ship traffic in and out of ports is heavy in the MAUS (Section 3.4.1.4).

Any vessel strike, especially one resulting in serious injury or death, would have a significant, direct, long-term, negative effect on the small, critically endangered right whale population. Because most right whales using coastal MAUS waters are presumably pregnant females, mothers, juveniles, calves, or members of the population representing the population's reproductive potential and therefore most important to recovery, failure to implement the recommended operational measures in the MAUS, as in the SEUS, would result in continued ship strikes, and severely hinder the population's capacity to recover.

4.1.1.3 Southeastern United States (SEUS)

The SEUS is the only known calving ground for North Atlantic right whales, i.e., it is a location vital to the population. It is a very high-risk area for pregnant females, new mothers, and calves.

The No Action Alternative would have a significant, direct, long-term, negative impact on the right whale population because it would allow the threat of ship strikes to remain at current levels or increase with the expected increase in ship traffic (NMFS, 2005d). Without protective measures, ship strikes are expected to continue, which could result in continued, negative impacts to pregnant females, new mothers, calves, and juveniles – all vital reproductive components of the population.

Whale calves and juveniles are much more susceptible than adults to serious injury or death from ship strikes; one reason for this may be that they spend more time at the surface than adults do. Calves are also slower swimmers than adults, do not dive as deep or as long, and spend more time at the surface while nursing. Of 16 right whale mortalities by ship strikes recorded between 1970 and 1999, almost one-third – 31 percent, or five individuals – were calves and juveniles, and three others were no more than two years old (Knowlton and Kraus, 2001). Over the same period, of 56 documented right whales seriously injured (as defined by Knowlton and Kraus, 2001) by ship strikes or entanglement, more than one-third were calves or juveniles; the others were adults (Knowlton and Kraus, 2001). Vessels of all sizes can seriously harm calves and juveniles. In addition, a vessel strike to a new mother leaves a calf alone, which is most likely to lead to the death of the calf. The death of any one member of the population would seriously hinder recovery of the population and, in fact, could contribute directly to the extinction of the western stock of the North Atlantic right whale within the next 200 years (Section 1.1.1).

4.1.2 Alternative 2 – Mandatory Dynamic Management Areas

Implementing speed restrictions in Dynamic Management Areas (DMAs) under Alternative 2 would have minor, direct, long-term, positive effects on the right whale population because it would lower the potential for ship strikes of right whales throughout the range of the species within US waters and the EEZ. However, because the only operational measure proposed under Alternative 2 is the use of DMAs, this alternative is less likely than the other action alternatives to reduce ship strikes sufficiently to promote population recovery. Speed restrictions associated with DMAs are expected to reduce the severity of ship strikes, although unlike Alternatives 4, 5, and 6, which include recommended shipping routes, this alternative does not reduce the co-occurrence of whales and vessels unless mariners choose to route around a DMA. Furthermore, whereas the other alternatives are based on the known occurrence of whales at certain times of the year, DMAs would only occur where and when unexpected aggregations are sighted. The probability of whales being sighted is contingent on the several conditions, including the ability to fly aerial surveys (which are weather-limited), the availability of adequate funding, and the capacity to survey the entire range of the population on any day (Section 1.1.1). Sightings reported from non-NMFS vessels or aircraft would either trigger a Dynamic Area Management (DAM) measure under the Atlantic Large Whale Take Reduction Plan (ALWTRP) or a DMA under the ship strike reduction program. However, there are only two institutions (Provincetown Center for Coastal Studies and Whale Center New England) whose reports NMFS would be able to rely on to implement a DAM or a DMA without verifying the sighting. From 2002, (when the ALWTRP DAM program began) through November 2006, half the implemented DAMs resulted from sightings from sources other than NMFS surveys. Even though there are mechanisms through which DMA may be implemented even with limited resources, funding limitation on the number of aerial surveys flown by NMFS would still limit the effectiveness of DMAs as a protection measure.

When right whales are sighted and a DMA is implemented, ships would be required to adhere to speed restrictions while in the designated area, which may allow the whales and mariners to avoid collision and reduce the severity of a ship strike: research indicates that ship strikes recorded at speeds under 14 knots tend to result in minor to serious injuries; ship strikes that occurred at 14 knots and greater tend to result in serious injury or death (Laist *et al.*, 2001; Jensen and Silber, 2003). Alternatively, mariners may opt to route around the defined area, thus minimizing the chance for a collision. DMAs provide temporary measures to protect right whales when they are sighted in aggregations of three or more individuals. When right whale sightings trigger a DMA, the restrictions are expected to be in place for 15 days and lifted if whales are no longer sighted or extended if whales are re-sighted. Therefore, these temporary restrictions would provide short-term protective measures during times and in areas where no other measures (i.e., SMAs) are in place.

4.1.2.1 NEUS

Implementing Alternative 2 would have minor, direct, long-term, positive effects on right whales in the NEUS. The effectiveness of DMAs in protecting right whales in the NEUS is limited by the difficulty to locate them by aerial surveys in rough seas or poor weather conditions. Routine aerial surveys are flown over this area to locate right whales, but the Northeast is more prone to rough seas than the other regions. Rough seas limit detectability of whales, and submerged whales also go undetected. As a result, DMAs may not occur at all due, in some cases, to the low probability of detection. Finally, aerial surveys are expensive, logistically difficult, and cannot assure 100 percent coverage of all areas at all times.

4.1.2.2 MAUS

Implementing a DMA program in the MAUS would have minor, direct, long-term, positive effects on right whales. Aerial surveys to identify aggregations of right whales are not conducted as frequently throughout the entire MAUS as in the NEUS and SEUS; without the ability to identify right whales aggregations that might trigger DMAs, this operational measure would not prove effective as a management measure. Implementing DMAs as the sole operational measure in the MAUS, without increasing survey efforts, would provide a low level of protection to right whales.

4.1.2.3 SEUS

Implementing actions identified in Alternative 2 would have minor, direct, long-term, positive effects on right whales in the SEUS. Aerial surveys are conducted systematically during the season when right whales utilize the SEUS as a calving ground. Although implementing a DMA program as an independent operational measure would have an overall positive impact on right whales, this alternative may not provide sufficient conservation value to reduce ship strikes and meet the ultimate goal of aiding the recovery of the right whale population, due to limitations of the effectiveness of aerial surveys as described in the preceding sections.

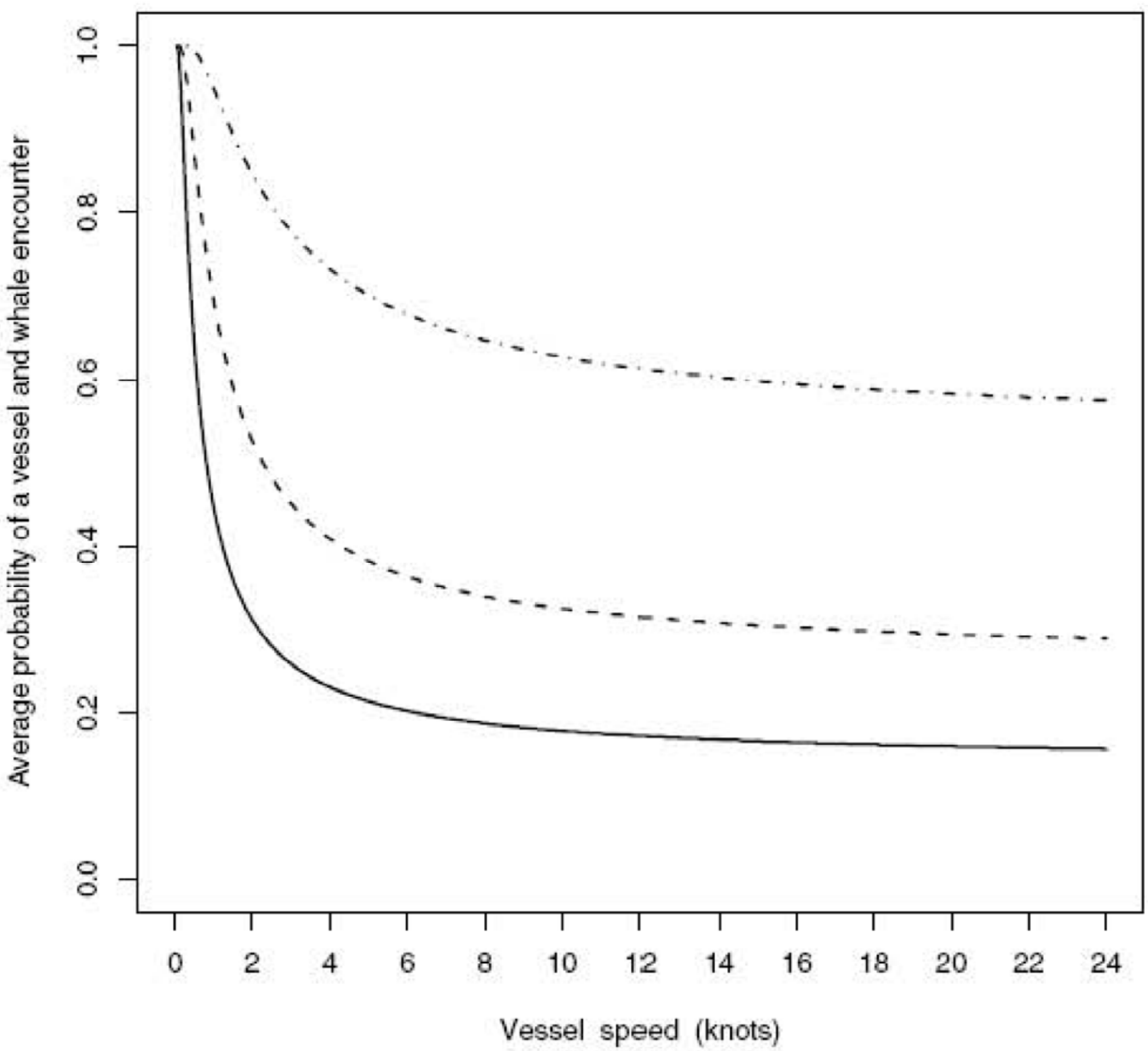
4.1.3 Alternative 3 – Speed Restrictions in Designated Areas

Implementing the ship-speed restrictions considered under Alternative 3 would result in direct, long-term benefits to the right whale population. This FEIS analyzes establishing ship-speed restrictions of 10, 12, and 14 knots. Generally, lower speed restrictions would result in a decreased probability of serious injury or death. A comparison of the impacts on right whales at each of these speed restrictions is provided after the background information on the relationship between vessel speed and the severity and occurrence of ship strikes presented in the following paragraphs.

Records of right whale ship strikes (Knowlton and Kraus, 2001) and large whale ship strike records (Laist *et al*., 2001; Jensen and Silber, 2003) have been compiled, and all indicate vessel speed is a principal factor in ship strikes. In assessing records in which vessel speed was known Laist *et al*. (2001) found “a direct relationship between the occurrence of a whale strike and the speed of the vessel involved in the collision.” The authors concluded that most deaths occurred when a vessel was traveling in excess of 14 knots.

Vanderlaan and Taggart (2007) asserted the probability of a vessel–whale encounter as a function of speed using a random walk model. This model addressed the question of whether slower vessels that spend more time in an area pose more of a risk to right whales than those traveling faster and, therefore, spending less time in the area. The model demonstrates that the encounter probability increases with decreasing speed, but only at speeds of six knots or less. Therefore, a vessel reducing its speed from 24 knots (or any other speed between 24 and 10 knots) to 10 knots would not increase the encounter probability (see Figure 4-1). The encounter probability changes with the number of vessels, and would show different results if this model used multiple whales and various sizes or speeds for the whale and vessel. To ensure that these variables would not increase encounter probability at 10 knots, NMFS independently conducted a sensitivity analysis using a random walk model, and tested the additional variables mentioned above. The outputs of this sensitivity analysis agreed with the findings of the Vanderlaan and Taggart (2007) random walk model. In conclusion, slower vessels do not increase the risk of ship strike simply by transiting through an area for a longer time, unless the vessel is traveling at a speed of six knots or less.

Probability of a Vessel-Whale Encounter as a Function of Speed



Source: Vanderlaan and Taggart (2007), Encounter probability within a 1 km² domain estimated using a random walk model in two dimensions of a 16.5 m whale swimming at 1.5 ms^{-1} in the presence of an example vessel (125 m length and 20 m beam). The lines represent the domain with one whale and one vessel (solid), two vessels (dash), and five vessels (dash dot).

Figure 4-1

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Jensen and Silber (2003) identified 292 records of known or probable ship strikes of all large whale species from 1975 to 2002. In 58 of the records, ship speed at the time of collision was known: it ranged from two to 51 knots, with an average of 18.1 knots. The majority (79 percent) of the strikes occurred at speeds of 13 knots or greater. When the 58 records are grouped by speed, vessels traveling at 13-15 knots made up the largest group, followed by those traveling at 16-18 knots, then those traveling at 22-24 knots (Jensen and Silber, 2003).

Of the 58 cases where speed was known, 19 (32.8 percent) resulted in serious injury to the whale (as determined by blood in the water, propeller gashes or severed tailstock, and fractured skull, jaw, vertebrae, hemorrhaging, massive bruising, or other injuries noted during necropsy) and 20 (34.5 percent) resulted in death. Therefore, in total, 39 (67.3 percent) ship strikes in which ship speed was known resulted in serious injury or death. The mean vessel speed that resulted in serious injury or death to the whale was 18.6 knots (Jensen and Silber, 2003).

Using a total of 64 records of ship strikes in which vessel speed was known, Pace and Silber (2005) tested speed as a predictor of the probability of death or serious injury. The authors concluded that there was strong evidence that the probability of death or serious injury increased rapidly with increasing speed. Specifically, the predicted probability of serious injury or death increased from 45 percent to 75 percent as vessel speed increased from 10 to 14 knots, and exceeded 90 percent at 17 knots (see Figure 4-2). Interpretation of the logistic regression curve used to obtain these probabilities indicates that there is a 100 percent probability of serious injury or death around 25 knots and faster. In a related study, Vanderlaan and Taggart (2007) analyzed all published historical data on vessels striking large whales. The authors found that the probability of a lethal injury resulting from a strike ranged from 20 percent at nine knots to 80 percent at 15 knots and 100 percent at 21 knots or more (Figure 4-2).

Related studies of the occurrence and severity of strikes relative to vessel speed have been conducted for other species and locations. Panigada *et al*. (2006) concluded that vessel speed restrictions and the relocation of vessel routes in high cetacean density areas would reduce the likelihood of ship strikes of fin whales in the Mediterranean Sea. Speed zones were adopted in Florida in the early 2000s to reduce manatee injuries resulting from collisions with boats. Laist and Shaw (2006) assessed the effectiveness of these speed zones at reducing watercraft-related manatee deaths. Watercraft-related manatee deaths did decline in the areas assessed in the paper, and the authors reported that this decline reflected the fact that well-designed speed restrictions could be effective if properly enforced. They further stated that “reduced speed allows time for animals to detect and avoid oncoming boats, and that similar measures may be useful for other marine mammal species vulnerable to collision impacts with vessels (e.g., North Atlantic right whales)” (Laist and Shaw, 2006). Another study involving laboratory impact tests examined the energy levels required to break manatee bones. The study found that ship strikes can cause bone fractures capable of inflicting fatal injuries to manatees at 13-15 miles per hour (15-17.3 knots) (Clifton, 2005). The boats analyzed in this research were the small recreational boats typically found in Florida waters, in contrast to the large commercial vessels generally implicated in right whale ship strikes. However, manatee bones are generally not as strong as other mammalian bones (Clifton, 2005), so it would be difficult to apply these results to right whales.

Although there is uncertainty regarding the behavior of whales in the path of approaching ships, documented cases suggest last-second flight responses when the ship is within 100 yds (91 m) or less of the whale. If a whale attempts to avoid an oncoming vessel at the last minute, a burst of speed coupled with a push from the bow wave could mean that mere seconds might determine whether the whale is struck (Laist *et al*., 2001). A reduction in speed from 18 knots to 10 knots would give whales an additional 8.6 seconds (at a distance of 100 m) to avoid the vessel in this flight response. A decrease from 18 to 12 knots would provide 5.2 seconds; with a decrease from 18 to 14 knots, the whale would only have 3.1 extra seconds to react (Laist, 2005, *unpublished data*).

In a separate study involving whale behavior, Kite-Powell *et al*. (2007), developed a model that analyzed ship strike risk with respect to vessel speed and whale avoidance behavior. In summary, the authors assert that ship strike risk decreases as speed decreases and the distance that the whale detects the vessel increases. Assuming certain whale behavior, the model suggests that the ship strike risk posed by a conventional ship (e.g., container ship) traveling at 20 to 25 knots can be reduced by 30 percent at a speed of 12 or 14 knots and by 40 percent at 10 knots, due to the whales' increased ability to detect and avoid approaching vessels. If a whale detects and reacts to an oncoming vessel at a distance of 820 ft (250 m) or longer, it will likely avoid a ship strike, whereas at detection distances less than 328 ft (100 m), the probability of ship strike is almost one at speeds of 15 knots or faster. Cumulatively, model results suggest that more than half the right whales swimming into the path of an oncoming ship traveling at 15 knots or faster are likely to be struck even if they do take evasive action (Kite-Powell *et al*., 2007).

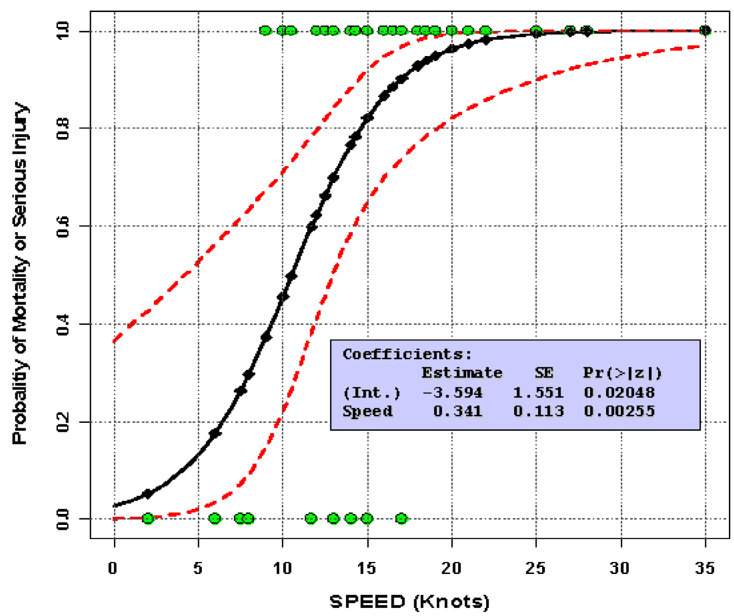
Another factor in the likelihood and severity of a vessel-whale collision is the hydrodynamic forces affecting a whale in the path of an oncoming vessel.[4] Knowlton *et al.* (1998) developed a model that considered the effect of ship speeds of 10, 15, and 20 knots on a moving whale that was 10 ft (3 m) forward of the bow. They found that a collision occurred at 20 knots, while the whale was able to avoid collision at the lesser speeds. Hydrodynamic forces from a passing ship would not draw an inactive whale into a ship because the pressure wave in front of the ship tends to push objects away from the hull before drawing them back toward the ship, amidships and near the stern. However, if a whale appears – that is, surfaces from a dive – after this initial flow of water away from the boat, it can be drawn into the ship along the hull or close to the propeller. Therefore, if a whale is trying to avoid an approaching ship, reduced ship speed would increase its ability to avoid collision (Knowlton *et al*., 1998).

In a more recent study, Slutsky (2007) measured the hydrodynamic forces involved in whale-vessel collisions using whale and ship models in a tow tank. The author determined that the magnitude of forces exerted on the whale increased linearly with vessel speed (Slutsky, 2007). A separate study examined the effects of these forces by examining the biomechanical properties of right whale mandibles as related to blunt force trauma inflicted by a vessel (Campbell-Malone, 2007). Citing Kite-Powell *et al*. (2007), Campbell-Malone (2007) indicated that there are compound (both behavioral and force of impact) benefits to implementing speed restrictions; both studies predicted a reduction of right whale deaths as a result of vessel speed limits in right whale habitat.

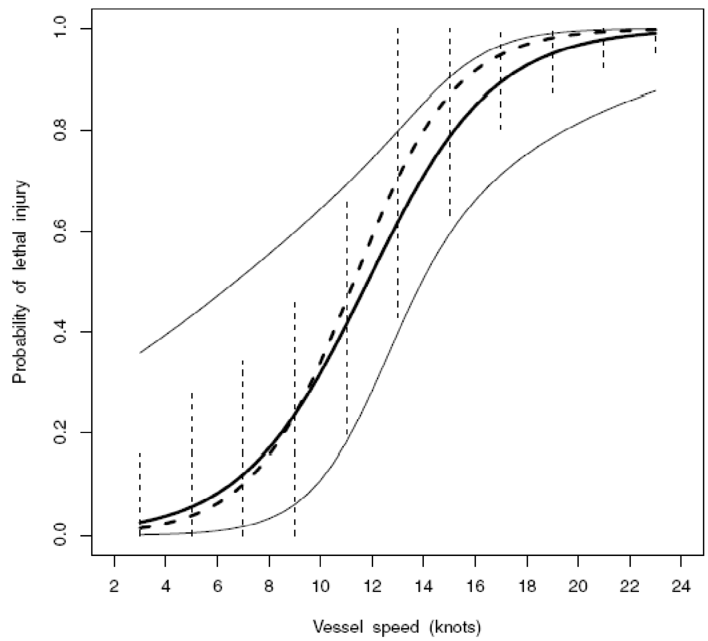
Reduced speeds can also have a positive impact on mariner safety and reduce the amount of damage a vessel incurs following a collision with a whale. Thirteen records in the ship strike database reported vessel damage resulting from a vessel collision with a whale. Three of these cases occurred at speeds between 10 to 15 knots and the remaining reports occurred at speeds over 20 knots. Physical damage to vessels results in repair costs and economic loss due to lost

[4] Hydrodynamic refers to the dynamics of a fluid in motion, and for the purpose of this FEIS, the forces imposed on a whale by a passing ship are referred to as sway, surge, and yaw.

Probability of Mortality or Serious/Lethal Injury as a Function of Vessel Speed



Source: Pace and Silber (2005), Fitted logistic regression showing the relationship between serious injury and vessel speed. (Green dots are observed, black diamonds are predicted and red-dashed lines are the 95% CI about the individual prediced values).



Source: Vanderlaan and Taggart (2007), Simple logistic regression (solid heavy line) and 95% CI (solid thin lines) and the logistic fitted to the bootstrapped predicted probability distributions (heavy dashed line) and 95% CI for each distribution (vertical dashed line).

Figure 4-2

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profits from dry-docking the vessel and not utilizing it for business operations. Several cases also involved human injury from the force of the strike. Therefore, reduced speeds would potentially lessen the extent of damage to the vessel and risks to human health and safety during a collision.

Impact of a 10-Knot Speed Limit

Research on vessel-whale collisions indicates that of the three speeds considered – 10, 12, and 14 knots – adopting a speed limit of 10 knots would be the most beneficial to the recovery of the right whale population. Historically, only a small percentage of ship strikes occurred at 10 knots, and those that did usually resulted in injury rather than death (Laist *et al*., 2001). However, while a 10-knot speed restriction would be most effective at reducing the risk of ship strikes, it would not eliminate the risk; there is still a 45 percent predicted probability of serious injury or mortality at 10 knots (Pace and Silber, 2005).

Impact of a 12-knot Speed Limit

A speed limit of 12 knots would also benefit right whales. Only a small percentage (11 percent) of ship strikes that result in serious injury or mortality occurred at speeds between 10 and 14 knots (Laist *et al*., 2001). Through interpretation of the logistic regression graph of the relationship between serious injury and vessel speed, there is approximately a 60 percent predicted probability of serious injury or mortality at 12 knots (Pace and Silber, 2005).

Impact of a 14-knot Speed Limit

Adopting a speed limit of 14 knots would be less beneficial to right whales than adopting speed limits of 10 or 12 knots because ship strikes that occurred at 14 knots or higher generally resulted in death or serious injury. The majority (89 percent) of known collisions occurred at speeds of 14 knots or faster (Laist *et al*., 2001). Further, there is a 75 percent predicted probability of serious injury or mortality at 14 knots (Pace and Silber, 2005).

In summary, speed restrictions are proposed as a stand-alone measure under Alternative 3 because they are expected to reduce both the severity and occurrence of ship strikes in certain locations where whales are known to occur. Based on the discussions above, this alternative affords a moderate level of protection to right whales.

4.1.3.1 NEUS

Alternative 3 proposes year-round speed restrictions in specific areas in the NEUS, which would have a direct, long-term, positive impact on the right whale population for the reasons previously described. The geographical area where these speed restrictions would apply includes all waters in the expanded SAM zones and critical habitat as designated in the proposed rule and DEIS for amending the ALWTRP (see Section 2.2.3).

Speed restrictions are especially important in the NEUS because this region includes right whale feeding habitat, and whales that are actively feeding may be less responsive to approaching ships (Laist *et al*., 2001). They also may be skim feeding at the surface, which may reduce their awareness of approaching ships and, because the whales are at the surface, increase their vulnerability to vessel collisions.

Speed restrictions in the NEUS under Alternative 3 differ from those under Alternative 6 because they are year-round instead of seasonal. However, Alternative 3 does not include establishing DMAs, and therefore lacks a mechanism to protect whales occurring outside of the SAM zones.

Alternative 3 also does not include recommended routes[5], as do alternatives 4, 5, and 6, so this Alternative does not spatially separate vessel traffic from whales and their habitat. Therefore, as a stand-alone measure, the speed restrictions proposed in Alternative 3 would reduce the severity and occurrence of ships strikes but this alternative does not include two key measures (DMAs and routing measures) that would provide additional protection.

4.1.3.2 MAUS

Alternative 3, which proposes a SMA off the US mid-Atlantic coast effective from October 1 through April 30, would have direct, long-term, positive impacts on the recovery of the right whale population by reducing the number and severity of ship strikes in this migratory corridor (Section 4.1.3). The SMA would encompass all waters extending out 25 nm (46 km) from the US coastline from Providence/New London (Block Island Sound) south to Savannah, Georgia. Many ports in the mid-Atlantic host a high volume of vessel traffic. As this region is also a high-use area for migrating right whales, the whales transit this region twice a year.

The proposed MAUS SMA under Alternative 3 include the entire coastline out to 25 nm (46 km), whereas Alternative 6 only proposes speed restrictions in 20-nm (37-km)-wide SMAs around several important port areas. Therefore, compared to Alternative 6, Alternative 3 would provide additional protection for right whales traveling in waters from 20- to 25-nm (37- to 46-km) offshore. Although Alternative 3 includes waters between major port areas the additional coverage may not result in a much greater reduction in vessel strikes because large commercial vessels are concentrated in the vicinity of port areas (as they arrive and depart these ports) more than surrounding waters. However, Alternative 3 provides an additional month of restrictions during October while Alternative 6 only has restrictions in place from November 1 through April 30. Alternative 3 does not include DMAs to provide protection to whales occurring in May to September or in waters from 25 to 200 nm (46 to 370 km). Therefore, Alternative 3 may not provide sufficient protection to reduce the occurrence of ship strikes and aid the recovery of the right whale population.

4.1.3.3 SEUS

Reducing ship strikes in this region is particularly important because it is a calving area. Alternative 3, with a proposed SMA and associated speed restrictions effective from November 15 through April 15, would have a direct, long-term, positive impact on the recovery of the right whale population by reducing the number and severity of ship strikes in this habitat. The proposed SMA would include all waters in the Southeast Mandatory Ship Reporting System (MSRS) area (described in Section 2.2.3) and the Southeast critical habitat for right whales.

The Alternative 3 SMA encompasses the MSRS area and the critical habitat whereas Alternative 6 only proposes speed restrictions within the Southeast SMA (which extends just south of the MSRS area), but not in the critical habitat. Speed restrictions proposed under Alternative 3 are effective for five months, like under Alternative 6. However, Alternative 3 does not involve routing ships away from high right whale densities through identified shipping lanes. Alternative

[5] A recommended route is defined by the IMO as a route of undefined width, for the convenience of ships in transit, which is often marked by centerline buoys. The USCG adopted this IMO definition, which identifies the type of routing measure used in the alternatives. Recommended routes have been identified as an important ship strike risk-reduction tool, and are therefore discussed in this and other alternatives; they are sometimes referred to as shipping lanes.

3 only includes one ship strike reduction measure – vessel speed – and does not account for the distribution of whales that overlap with vessel traffic. Whales sighted outside the MSRS area or the critical habitat would not be protected under this alternative because DMAs are not included. For these reasons, Alternative 3 may not provide sufficient protection to significantly reduce the risk of ships strikes to aid the recovery of the right whale population.

4.1.4 Alternative 4 – Recommended Shipping Routes

Alternative 4 would have direct, long-term, positive effects on right whales in the SEUS and NEUS regions, and direct, long-term, adverse effects on right whales in the MAUS region.

4.1.4.1 NEUS

Implementing Alternative 4 would have direct, long-term impacts on the right whale population in the NEUS region. Alternative 4 proposes the year-round, voluntary use of recommended shipping routes for all vessels 65 ft (19.8 m) and longer. Year-round routes would afford protection to the high densities of right whales in Cape Cod bay from January through May and to the whales that are occasionally sighted during other months of the year. The recommended routes were established in November 2006; NOAA would monitor mariners' use of the routes, and consider making them mandatory if compliance is low. If utilized, recommended routes would move vessels away from aggregations of feeding right whales in the Cape Cod Bay critical habitat area, where density is high and whales are particularly vulnerable to ship strikes due to their behavior: Cape Cod Bay is an important feeding ground for right whales and research suggests that although right whales should be able to hear vessels, they may not avoid them when engaged in feeding or socializing behavior (Mayo *et al*., 2004; Nowacek *et al*., 2004).

In the NEUS, the recommended routes are generally consistent with current vessel traffic patterns, and with one exception, are located near the boundary of the critical habitat. While the two-way recommended track from the Cape Cod Canal to Provincetown routes vessels through the right whale critical habitat, the number of vessels currently using this route is minimal. Further, this traffic generally consists of slower-than-average vessels, including tugs and barges, and vessels entering Cape Cod Bay and/or the Canal from the Northeast and vice versa.

Nichols and Kite-Powell (2005) conducted a risk analysis of proposed recommended routes in Cape Cod Bay based on right whale sightings from 1998 to 2002 and vessel traffic data in Cape Cod Bay. The authors devised a model to estimate the number of ship/whale encounters that might occur assuming the whales remained at the surface and neither the ships nor the whales attempted to avoid collision. An encounter was considered to have occurred when a known number of vessels passed through an area of estimated right whale density. This model predicted that approximately 1.5 ship/whale encounters would occur in Cape Cod Bay annually. The proposed shipping lanes in Cape Cod Bay were then incorporated into the model to assess their effectiveness at reducing the potential for ship strikes. The authors concluded that the proposed lanes would reduce the potential for ship/whale encounters by 45 percent, from 1.5 to about 0.9 a year. They noted that the encounter rate and any reduction in the rate cannot be translated directly into actual ship *strikes* because diving and avoidance actions by whales and/or mariners were not included in the model. Therefore, these values are presented for informational purposes and are most likely an elevated estimate of annual ship strikes in Cape Cod Bay, as they assume whales are at the surface and neither the ships nor the whales seek to avoid a collision.

Although implementing the measures identified in Alternative 4 would reduce the risk of ship strikes from ships transiting through areas of high whale densities, it would only account for one factor of several that affect the occurrence and severity of ship strike. This alternative would not require vessels to reduce speed when traveling in shipping lanes, and, therefore, would not include the advantages associated with speed restrictions. Alternative 4 also does not include the use of DMAs, so it does not account for right whale sightings outside designated seasons and areas. Implementing only the measures identified in Alternative 4 likely would not reduce risk of ship strikes sufficiently to lead to an increase in the population growth rate.

4.1.4.2 MAUS

Recommended routes are not proposed in the approaches to mid-Atlantic ports, so conditions under Alternative 4 would be those identified for the No Action Alternative. Taking no action would have direct, long-term, adverse effects on right whales in the MAUS. With no proactive measures in place, right whales would remain vulnerable to collisions with ships.

4.1.4.3 SEUS

Implementing the measures identified in Alternative 4 would have direct, long-term, positive effects on right whales in the SEUS region. Year-round recommended routes in the SEUS are designed to separate vessel traffic from right whale aggregations, thus reducing vessel collisions. The routes were identified based on the following data: (1) viable approaches to the pilot buoys for the ports of Brunswick, Georgia and Jacksonville and Fernandina, Florida that avoid areas with relatively high densities of right whales and (2) right whale distribution and congregating areas around the approaches to the ports based on aerial survey data (Garrison, 2005).

Implementation of the actions identified in Alternative 4 for the SEUS would amount to the use and monitoring of the recommended shipping routes for the ports of Jacksonville, Fernandina, and Brunswick, which were established in November 2006. These ports currently have no officially- designated shipping lanes, though there are identifiable “high use” approaches. Traffic route patterns are derived from MSRS data from 1999 to 2001 (Ward-Geiger *et al*., 2005). The majority of traffic approaching Jacksonville enters from a southeast route, with considerable traffic also approaching from the northeast. Traffic patterns in Fernandina and Brunswick exhibit heavy vessel use primarily from the southeast to due east of the pilot buoy (Garrison, 2005).

A series of potential approaches into each of the ports was analyzed for a reduction in risk of a vessel-whale interaction based on modeled right whale density and distribution, and current vessel traffic patterns (Garrison, 2005). This risk factor was measured against the “status quo” risk level for each port. These proposed routes were submitted to the USCG for consideration of navigational safety and environmental risk reduction in its PARS. The USCG conducted the study and issued a report. Following release of the PARS report, slight changes were made to the routes to account for navigational hazards associated with fish havens, among others.

Figure 2-2 shows the final recommended routes for all three ports. When combined, it is estimated that the routes would reduce the risk of a vessel-whale interaction by approximately 40 percent and generally reduce the distance traveled when entering and exiting the ports. That is, whale exposure to ships would be reduced by virtue of the reduction in actual travel distances.

The final recommended routes for Jacksonville are just north of the prevailing traffic patterns into this port as reported to the MSRS in the 2000/2001 season. As a result, significant changes to vessel traffic patterns for those calling on Jacksonville are not expected.

Recommended routes into Fernandina are from the east-southeast. The majority of the traffic into Fernandina during the 2000/2001 season approached from the east or northeast; therefore, the lanes that provide the most protection for right whales would also result in a significant change in existing traffic patterns.

Recommended routes into Brunswick from due east and southeast would constitute a slight shift from existing traffic patterns. A high volume of vessel traffic approached the port from the southeast in 2000/2001 and only the due-east route would alter existing traffic patterns.

Reducing the number of vessels that transit in areas where right whales aggregate in the SEUS is important because this is a right whale calving and nursing area. Females are a vital reproductive component of the population. In 2004 and 2005 there were three instances where one ship strike resulted in the death of both a pregnant female and her fetus (Kraus *et al*., 2005). The death of a mother may result in two deaths, as a calf is unlikely to survive on its own. The reproductive potential of the mother for the remainder of her life – as well as that of the calf – is also lost to the population. Laist (2005, *unpublished data*) found that calves and juvenile whales were hit more often than adults, so the SEUS calving ground is a particularly important habitat to protect. Because Jacksonville has higher vessel traffic volumes than Brunswick or Fernandina, the shipping lanes for the port of Jacksonville have a higher relative conservation value than the other recommended routes. While the routing measures contained in Alternative 4 may have an overall positive effect on the right whale population, without speed restrictions and DMAs they may not provide sufficient protection as stand-alone measures to effectively reduce the occurrence of ship strikes.

4.1.5 Alternative 5 – Combination of Alternatives

Implementing Alternative 5, which combines the measures included in Alternatives 1 through 4, would have significant, direct, long-term benefits on the right whale population. This alternative includes the continuation of current measures, recommended shipping routes, large-scale speed restrictions, and DMAs. The positive impacts of these combined measures on the right whale population would be significant. Routing measures would shift traffic away from areas of relatively high whale density; speed restrictions in SMAs and DMAs would reduce the occurrence and severity of a ship strike; and DMAs would provide protective measures for unpredicted whale occurrences.

Of all action alternatives, Alternative 5 would provide the highest level of protection. It would significantly reduce the incidence and/or severity of ship strikes. If deaths and serious injuries are reduced, a higher probability exists that the population growth rate would increase, and as a result, bring the population closer to recovery.

4.1.5.1 NEUS

Implementing the measures identified in Alternative 5 in the NEUS would have direct, long-term, positive effects on the status of the population. All known right whale feeding grounds are located within the NEUS, and right whale densities can be relatively high in certain areas. While in the NEUS, right whales engage in feeding, socializing, and mating behavior that may reduce their awareness of certain threats and increase their susceptibility to ship strikes. For example, whales engaged in certain behaviors, such as skim feeding on the surface, may be less responsive to approaching ships (Laist *et al*., 2001). Both males and females utilize these feeding grounds year-round, but densities are highest from winter to fall. Implementing the combination of operational measures proposed under Alternative 5 would decrease the conflicts inherent between vessel traffic and high whale density areas and increase the chance of whale survival or avoidance by reducing ship speeds. The conservation value of the individual measures combined in Alternative 5 is described in Sections 4.1.2.1, 4.1.3.1, and 4.1.4.1. These measures would reduce the occurrence and/or severity of ship strikes, facilitating recovery.

DMAs would provide measures to protect right whales if they occur outside periods and/or locations of seasonal restrictions. DMAs may have greater conservation benefit to right whales in the NEUS than in the MAUS or SEUS because they are the only measures proposed for waters north of Massachusetts.

4.1.5.2 MAUS

Implementing the measures proposed in Alternative 5 would have direct, long-term, positive effects on right whales that occur in waters off the MAUS. Continuing existing protective actions, the use of DMAs, and speed restrictions with the proposed continuous 25-nm SMA would reduce the risk of ship strikes and facilitate population recovery. The conservation value of the individual measures combined in Alternative 5 is described in Sections 4.1.2.2, 4.1.3.2, and 4.1.4.2. The Alternative 5 measure likely to be the most beneficial to whales migrating through the MAUS would be proposed 25-nm SMA, in effect from October 1 to April 30. The majority of right whale sightings occur within 20 to 30 nm (37-56 km) of the coast; therefore, these restrictions would provide protective measures in whale high-use areas. As discussed in Section 4.1.3, fewer ship strikes occur at vessel speeds of 14 knots and less, and those that do occur usually result in fewer severe injuries than those that occur at speeds greater than 14 knots.

Implementing DMAs in the MAUS would benefit right whales when and where the proposed 25-nm SMA is not in effect. Survey effort has recently been expanded in the MAUS region, although these aerial surveys do not cover the entire region. Systematic surveys are flown off the coasts of Georgia, the Carolinas, Rhode Island, and part of Long Island, although the waters off Virginia north to New York are not covered. For DMAs to be effective in this region, an increase in survey effort would be necessary. Without the ability to detect right whales that might trigger DMAs, this operational measure might not prove effective as a management measure.

4.1.5.3 SEUS

Implementing the measures proposed in Alternative 5 would have major, direct, long-term, positive effects on right whales by providing protection in their only known calving and nursery area. As previously mentioned, females and their calves are two vital segments of the population. Preventing the death of one female could result in a larger boost to the population than saving a male (mature males are not generally found in the calving grounds), because of the female’s reproductive potential, and its importance to recovery.

The conservation value of the individual measures combined in Alternative 5 for the SEUS is described in Sections 4.1.2.3, 4.1.3.3, and 4.1.4.3. Speed restrictions in the proposed SMA would reduce the number and severity of ship strikes to females and calves. The recommended routes into the ports of Brunswick, Fernandina, and Jacksonville would shift vessel traffic away from areas where right whales typically aggregate.

DMAs would provide temporary measures to protect right whales when they occur outside of the times, or locations, of seasonal restrictions. DMAs are of particular importance in the SEUS with respect to protecting whales that occur around approaches to or in the vicinity of Port Canaveral, which is south of the MSRS and critical habitat, and would not have seasonal speed restrictions.

4.1.6 Alternative 6 – Proposed Action (Preferred Alternative)

Implementing the measures identified in Alternative 6, the proposed action, would have major, direct positive impacts on the North Atlantic right whale population during the five-year period the measures would be in effect. Voluntary DMAs are proposed for all areas in Alternative 6 (see Section 2.1.4), so the effects of this operational measure are discussed in this introduction rather than repeated for each of the three regions.

DMAs would apply where and when no SMA is in effect. Mariners would be notified about the establishment of a DMA via electronic and other customary maritime communication systems immediately following verification. Requesting vessels to reduce speed while transiting through a DMA or routing around a DMA would reduce the threat of ship strikes for the same reasons as discussed in Section 4.1.2.

The benefits of ship speed restrictions are similar for all areas where they are proposed (see Section 4.1.3). As mentioned earlier, this EIS analyzes three alternative speed restrictions – 10, 12, and 14 knots. For all alternatives, a 10-knot speed restriction would result in a greater reduction in the severity and occurrence of ship strikes; 12 knots would result in a moderate reduction; and 14 knots would result in the least reduction of the three speeds because data indicate that the probability of death or serious injury is less at lower speeds (Section 4.1.3). Speed restrictions would also reduce the likelihood that a whale would be pulled into the side or stern of the vessel by hydrodynamic forces because such forces are weaker at slower speeds. Whales would have additional time to avoid a vessel collision in a last-second flight response.

4.1.6.1 NEUS

Implementing Alternative 6 would have major, direct positive effects on the western population of North Atlantic right whales in the NEUS while the measures are in effect. The seasonal speed restrictions in the NEUS SMAs correspond to periods when there are predictable, high-density concentrations of right whales (Merrick, 2005b). This section describes the benefits of Alternative 6 to right whales in the different areas of the NEUS.

Cape Cod Bay

In the Cape Cod Bay area, the recommended shipping routes to and from the Cape Cod Canal, Boston, and Provincetown are expected to reduce the risk to whales by minimizing ship traffic in whale high-use areas. In addition, a speed restriction of 10, 12, or 14 knots throughout the CCB SMA from January 1 to May 15 would incrementally lessen the severity and occurrence of ship strikes. Reduction of ship strikes in the Cape Cod Bay area would contribute substantially to population recovery.

Off Race Point

Implementing the proposed measures under Alternative 6 would have positive effects on the right whale population, particularly feeding right whales, in the Off Race Point area. This area is of particular concern for vessel collisions because the Boston TSS concentrates ship traffic through this SMA. A speed restriction of 10, 12, or 14 knots from March 1 to April 30 would reduce the likelihood of serious injury or death, and whales would have additional time to avoid a vessel in a last-second flight response. If mariners elect to route around the Off Race Point area rather than limit their speed through it, this would further minimize ship strikes. Right whales congregate in the Off Race Point area for feeding and when traveling from Cape Cod Bay to the Great South Channel and other areas.

Great South Channel

Implementation of the proposed GSC SMA under Alternative 6 would significantly reduce the threat of ship strikes to feeding and socializing right whales. Large feeding aggregations of right whales are sighted routinely in this area, which is also designated critical habitat. Speed restrictions in the Great South Channel management area and critical habitat from April 1 to July 31 would result in major, positive effects on right whales. Data strongly suggest that vessels traveling at under 14 knots are less likely to seriously injure or kill whales during a collision than those traveling at 14 knots or faster (Laist *et al*., 2001; Pace and Silber, 2005).

Gulf of Maine

The Gulf of Maine includes all US waters north of other management areas for Cape Cod Bay, Off Race Point, and Great South Channel. It is anticipated that the proposed voluntary DMAs in this area would have a positive impact on the North Atlantic right whale population. DMAs provide measures to protect right whales if they occur outside the times or geographical boundaries of management areas, shipping lanes, or critical habitat. This measure is particularly important in the Gulf of Maine because DMAs would be the only operational measure in this area. Diversions around the DMAs or speed restrictions through them would reduce the threat of ship strikes, thereby aiding in the recovery of the population.

4.1.6.2 MAUS

Implementation of Alternative 6 in the MAUS would reduce the likelihood that right whales are struck or killed by vessels entering and leaving the following ports/areas:

- South and East of Block Island Sound
- New York/New Jersey
- Philadelphia, Pennsylvania, and Wilmington, Delaware
- Baltimore, Maryland
- Hampton Roads, Virginia
- Morehead City, Beaufort, and Wilmington, North Carolina
- Georgetown and Charleston, South Carolina
- Savannah, Georgia.

As a result, Alternative 6 would have major, direct positive effects on the western population of the North Atlantic right whale. The MAUS includes an area near the coast used by whales to travel between the northern and southern aggregation areas. Ships pass through the right whale high-use area to ports in this region, which places migrating right whales in danger of ship strikes. The general north-south direction of migrating right whales is in conflict with the east-west direction of vessels traveling to and from ports.

Operational measures proposed for the MAUS would reduce the threat of ship strikes by establishing speed restrictions in SMAs off several ports in the region (see Table 2-1). As previously noted, the level of protection would increase as the mandatory speed decreases: greatest at 10 knots and least at 14 knots. The speed restrictions would be in place from November 1 through April 30 to encompass the period when the whales, both northbound and southbound, typically migrate through the mid-Atlantic corridor. In Block Island Sound, the designated area is a rectangle with a 30-nm (56-km) width extending south and east of the mouth of the Sound. This SMA corresponds to the area where approximately 90 percent of all whale sightings occurred from 1972-2000 (NMFS, 2008, *unpublished*). South of Block Island Sound, the restrictions would cover waters within a 20-nm (37-km) radius from the COLREGS demarcation lines for the ports of New York/New Jersey, Philadelphia and Wilmington (Delaware Bay), Hampton Roads and Baltimore (Chesapeake Bay), and Morehead City and Beaufort, North Carolina. From Wilmington, North Carolina south to Brunswick, Georgia, there would be a continuous SMA extending 20-nm (37-km) from the shore. These SMAs include approximately 83 percent of right whale sightings (NMFS, 2008, *unpublished*). This continuous SMA (see Section 2.1.2.1) would provide significant conservation value for an aggregation of right whale sightings along the South Carolina coastline. Speed restrictions in the MAUS are important to reducing ship strikes because this region has the highest level of vessel traffic among the three regions. Almost 50 percent of the total vessel arrivals on the East Coast occur during the right whale migration season, when speed restrictions would be in place. Therefore, these restrictions would have a direct positive effect on the migrating right whale population.

4.1.6.3 SEUS

Implementation of Alternative 6 in the SEUS would have major direct positive effects on the western population of the North Atlantic right whale because it would reduce the threat of ship strikes in their only known calving and nursery area. Mothers and calves appear to be more prone to ship strikes than other individuals because they spend more time at the surface and because calves are not accomplished swimmers. This calving area is very important to the growth of the population. By reducing ship strikes of right whales in the SEUS, there is an enhanced probability of reducing deaths and the population would grow to a sustainable level because more calves and juveniles would live long enough to reach reproductive maturity. Given the right whale’s low fecundity, implementation of the operational measures in the critical habitat for calving is crucial to the survival of the species.

Under this alternative, recommended shipping routes near Jacksonville and Fernandina, Florida and Brunswick, Georgia would shorten travel times and avoid specific right whale aggregation areas. By limiting ship travel to specific shipping lanes into these ports, the probability of ships striking whales would be lowered. The recommended routes have been designed to cross areas with low densities of right whales. Therefore, it is expected that implementation of Alternative 6 would increase the survival rate of right whales by routing ships away from aggregation areas, especially critical in this calving area for pregnant females, mothers, juveniles, and calves. As discussed earlier, if compliance with the recommended routes is low, NMFS would consider making them mandatory.

Implementation of speed restrictions throughout the Southeast SMA and the recommended routes within the SMA also would help prevent ship strikes. The SEUS region has the second-highest level of vessel traffic among the three regions – 30 percent of total vessel arrivals on the East Coast occur when whales are present in this region during periods when SMAs would be in affect. The maximum speed allowed would be 10, 12, or 14 knots. The level of protection would increase as the mandatory speed decreases: greatest at 10 knots and least at 14 knots. Data suggest that vessels traveling at under 14 knots are less likely to seriously injure or kill whales in a collision than those traveling at 14 knots and faster (Laist *et al*., 2001; Pace and Silber, 2005). Moreover, whales would have additional time to avoid a vessel collision in a last-second flight response (Laist *et al*., 2001) (Section 4.1.3). The speed restrictions in the SEUS would be in effect from November 15 to April 15, consistent with the calving season.

4.2 Impacts on Other Marine Species

This section discusses the potential impacts of implementing the proposed vessel operational measures on living marine resources other than the western stock of the North Atlantic right whale. Potential impacts to several of the species described in Section 3.2 are not analyzed in this section for the following reasons. Impacts on the healthy marine mammal stocks listed in Section 3.2.1 are not analyzed, either because they are not affected by ship strikes or their range does not overlap with that of the right whale. For example, whereas minke and pilot whales and Atlantic white-sided dolphins occur in Cape Cod Bay in winter and spring, they are not high-risk species for ship strikes. While the coastal stock of bottlenose dolphins is depleted – and in some locations overlaps with right whales spatially and temporally (Section 3.2.2) – there are minimal records of serious injury and mortality from ship strikes, and this threat is not as well-pronounced or well-documented as are fisheries interactions for this species. Seabirds and protected anadromous and marine fish are not addressed in this section, as they would not be affected by the proposed operational measures. Seabirds are capable of avoiding oncoming vessels and there are no records of vessel strikes to seabirds. Likewise, fish are capable of avoiding oncoming vessels, and there are no records of vessel strikes to fish.

4.2.1 Alternative 1 – No Action Alternative

4.2.1.1 Other Marine Mammals

Alternative 1, the No Action Alternative, would continue to have indirect, long-term, negative impacts on marine mammals other than North Atlantic right whales. Ship strikes pose a threat to other large whales in the western North Atlantic (see Section 3.2.1), including endangered fin, humpback, sei, and sperm whales occurring in or near North Atlantic right whale habitat. The No Action Alternative would provide no further protection against ship strikes; therefore, other large whales would continue to be seriously injured or killed by ship strikes.

4.2.1.2 Sea Turtles

Although sea turtles, like whales, are subject to ship strikes (see Section 3.2.2), data are limited with respect to the relationship between vessel speed and the occurrence and severity of ship strike injuries. However as noted in the action alternatives, it is possible that under certain conditions, speed restrictions may reduce ship strikes to sea turtles. Under the No Action Alternative, this potential positive impact would not would occur. Ship strikes would be expected to continue causing injury and death. Data are unavailable on which of the five species of sea turtles occurring in or near North Atlantic right whale habitat are most susceptible to ship strikes.

4.2.2 Alternative 2 – Mandatory Dynamic Management Areas

4.2.2.1 Other Marine Mammals

Because DMAs are based specifically on sightings of right whale aggregations, implementation of a DMA would not significantly benefit other marine mammals, unless the animals occurred coincidentally within the waters of an established DMA. As the operational measures contained in Alternative 2 are not specifically designed to protect other marine mammals that occur in right whale habitat, they would only provide minimal spatial protective measures to reduce ship strikes to other marine mammal species.

4.2.2.2 Sea Turtles

Because DMAs are not specifically designed to protect sea turtles, the proposed measures contained in Alternative 2 would not significantly benefit sea turtles, unless they occur within the waters of a DMA. Vessels would either route around a DMA or transit at a specific speed through the DMA, reducing the potential for a collision with right whales. The chances of sea turtles occurring within a DMA are expected to be low due to differences in seasonal occurrence; therefore, any benefit would be minimal.

4.2.3 Alternative 3 – Speed Restrictions in Designated Areas

4.2.3.1 Other Marine Mammals

The measures proposed in Alternative 3 would have minor, indirect, long-term positive effects on other marine mammal species. Reduced vessel speeds would provide protection for other species whose habitats overlap with right whales. Humpback, fin, sei, and sperm whales are at risk of ship strikes and in some areas utilize similar habitats; therefore, speed reduction measures could also reduce ship strikes to other whale species to the extent that individuals of these species occur in the proposed speed restriction areas. Blue whales are also affected by ship strikes, although they are rarely found in the waters inhabited by right whales. Implementation of the proposed SAM East and West year-round speed restrictions areas would have a positive effect on humpback, fin, and sei whales, which are sighted frequently in Off Race Point and Great South Channel. Sperm whales tend to occur in deep, offshore waters, and generally would not be affected by speed restrictions in the NEUS.

In the MAUS, speed restrictions in the continuous 25-nm SMA would have a minor positive effect on humpback whales, as some individuals aggregate in waters off the mid-Atlantic as opposed to migrating to the subtropics in the winter. Fin whales also occur in mid-Atlantic waters in fall and winter, although they are typically found in deeper offshore waters than are right whales, and are unlikely to be affected by speed restrictions in the MAUS (NMFS, 2005f). Sperm whales generally occur in deeper, offshore waters than do right whales. This species may benefit from speed restrictions in the MAUS because the shelf break is closer to shore in the mid-Atlantic (near Cape Hatteras, North Carolina) than in the Northeast.

There have been a number of humpback whale sightings in coastal waters off the southeastern US in winter (NMFS, 2006). Therefore, humpback whales may benefit from measures in the SEUS. Sperm and fin whale habitat is primarily north of Cape Hatteras, and sei whales do not occur in waters south of Massachusetts. The northern portion of the Florida manatee range coincides with the SEUS, although in winter, when speed restrictions would be in place in this region, manatees are concentrated in areas off the coast of south Florida. Even though the speed restrictions identified in Alternative 3 extend further south than under Alternative 6 and include the southeast critical habitat for right whales, it is unlikely that this would result in a measurable benefit to manatees.

4.2.3.2 Sea Turtles

The measures proposed under Alternative 3 would have minor, indirect, long-term, positive effects on sea turtles if they happen to occur in designated speed-restricted areas. Except for Hazel *et al*. (2007) (Section 3.2.2), there is no known data on the severity and occurrence of ship collisions with sea turtles relative to vessel speed; however it is likely that any benefits right whales would derive from speed restrictions would also apply to sea turtles (Section 4.1.3). As the Hazel *et al*. (2007) study only focused on one species, the green turtle, utilized a significantly smaller 20-ft (6-m) aluminum boat, and recorded avoidance behavior, these results were not used as the basis for assessing impacts on sea turtles.

4.2.4 Alternative 4 – Recommended Shipping Routes

4.2.4.1 Other Marine Mammals

On balance, the potential positive and negative effects of the recommended routes under Alternative 4 would result in minimal impacts on other marine mammals. Other marine mammal species would be affected only to the extent that their habitat co-occurs with right whales in or around the established shipping routes. Recommended routes redistribute ship traffic to decrease the overlap between vessels and high right whale densities. However, because these measures are specifically designed to reduce the risk to right whales, benefits would be less likely for other species.

Humpback and fin whales occur seasonally within and north of Cape Cod Bay (NCCOS, 2006), and sei whales have occasionally been sighted in Cape Cod Bay (which likely corresponds with years of copepod abundance). Although the recommended routes are in place year-round, it is assumed that this protection would be maximized during the months when right whales are present (January 1 to May 15), as use of the routes is expected to be greatest when NOAA publicizes the presence of whales in Cape Cod Bay. In general, the recommended routes reduce the area in which vessels travel, thus reducing the risk of ship strikes in waters outside of the shipping lanes. Therefore, impacts on humpback, fin, and sei whales would be positive.

However, by the same logic, if a particular species aggregates within a shipping lane, the risk of ship strike within the lane may actually increase. Humpback and fin whales generally occur in the northern and eastern areas of Cape Cod Bay from January 1 to May 15, which overlaps with the Boston/Provincetown segment of the routes (Jaquet *et al*., 2005). However, Provincetown is not a busy commercial port – in 2004, there were 36 vessel arrivals in Provincetown, and only 11 of these arrivals occurred from January 1 through May 15, when use of the routes is expected to be greatest. Moreover, the majority of these vessels are relatively slow-moving tankers – their typical travel speeds are between 13 and 15 knots – so if they were involved in a ship strike, the severity would be less than with a relatively faster vessel. Therefore, the probability of net positive effects for whales outside the routes or net negative effects inside the routes is relatively low, and Alternative 4 is not expected to significantly affect other marine mammal populations as a whole.

Blue and sperm whales generally occur offshore, and are therefore unlikely to be affected by Alternative 4. The recommended routes in the SEUS would not affect humpback, fin, or sei whales, because they either do not occur in inshore waters in this region or their range does not extend this far south. Manatees would not benefit from the recommended shipping routes in the SEUS under Alternative 4, primarily because they occur inshore and are rarely sighted in northern Florida or Georgia in winter, when use of the shipping lanes is expected to be greater than in those months when right whales are not present.

4.2.4.2 Sea Turtles

Implementation of the recommended shipping routes included in Alternative 4 would have minimal effects on sea turtles that also occur in these areas. Of the sea turtles mentioned in Section 3.2.2, loggerheads, leatherbacks, Kemp's ridleys, and green turtles have been sighted in Cape Cod Bay, and the hawksbill would not be affected (C. Upite, e-mail communication, January 29, 2007). Typically, sea turtles inhabit Massachusetts waters from June to November, and although the recommend routes are in place year-round, this period does not overlap with the presence of right whales in Cape Cod Bay from January to May, when use of the routes is expected to be greatest. Thus, it is unlikely that these four species of sea turtles would be affected at all. However, they are occasionally sighted in January, at which time the shipping lanes in Cape Cod Bay would potentially benefit those present in the area but outside these lanes and, conversely, adversely affect individuals transiting waters inside the lanes. Therefore, the positive and negative impacts are likely to balance out, so that the measures in Alternative 4 are not expected to significantly affect sea turtles. The same logic applies for sea turtles in the SEUS. Alternative 4 would not affect sea turtles in waters of the MAUS, because there are no measures proposed there.

4.2.5 Alternative 5 – Combination of Alternatives

4.2.5.1 Other Marine Mammals

Implementation of the measures in Alternative 5 would have major, indirect, long-term, positive effects on marine mammal species other than right whales because they involve broad spatial and temporal vessel-speed restrictions that could potentially reduce the risk of vessel collisions with other marine mammals to the extent that their habitat overlaps with right whale habitat and/or restricted areas. As mentioned above, humpback, fin, and sei whales, and, to a lesser extent, sperm whales would benefit from the combination of measures in each alternative. Blue whales and manatees would not be affected by the measures in Alternative 5.

4.2.5.2 Sea Turtles

The combined measures described in Alternative 5 have the potential to have indirect, long-term, positive effects on sea turtles. Except for Alternative 1, the remaining Alternatives – 2, 3, and 4 – would have a modest positive impact on sea turtles, as each alternative includes one ship strike reduction measure. Therefore, the combination of these measures under Alternative 5 would potentially benefit endangered sea turtle species that have similar ranges as right whales. This is based on the assumption that sea turtles are less likely to be killed by a ship strike at lower vessel speeds, or have more time to avoid an oncoming vessel.

4.2.6 Alternative 6 – Proposed Action (Preferred Alternative)

4.2.6.1 Other Marine Mammals

Alternative 6, the proposed action, would have indirect, positive effects on other marine mammals during the five-year period when the measures would be in effect because it includes the following protection measures: SMAs, DMAs, and routing measures. Endangered fin and humpback whales would benefit the most from the implementation of the vessel operational measures because available records indicate that these are among the most commonly struck large whale species that occur in the western North Atlantic and because their ranges overlap with those of right whales. Sei whales would also benefit from the measures in the NEUS. Sperm whales would potentially benefit from speed restrictions in the MAUS; blue whales would not be affected.

Surveys from the Cetacean and Sea Turtle Assessment Program (1978-1985) and Manomet Center for Conservation Sciences (1980-1987), found fin whale presence in relatively high numbers north and east of Cape Cod and Great South Channel in spring and summer (Mahaffey, 2006). Therefore, the Off Race Point and Great South Channel SMAs in Alternative 6 would offer seasonal protection to fin whales. However, fin whales occurring off the coasts of Portsmouth and Portland in summer and fall would not be affected by Alternative 6. Humpback whales have also been seen in relatively high numbers near the Boston TSS in the Off Race Point and Great South Channel SMAs in all seasons except winter (Mahaffey, 2006). Thus, humpback whales would benefit from these SMAs from April through July, but would remain at risk from August through December, and around Stellwagen Bank and points north (Mahaffey, 2006). The recommended routes in Cape Cod Bay are not expected to significantly affect either species (Section 4.2.4.1).

As mentioned in Section 4.2.3.1 (Alternative 3), humpback, fin, and sperm whales would potentially benefit from seasonal speed restrictions in the 20-nm (37-km)-wide SMAs in the MAUS, although fin and sperm whales generally occur in deeper, offshore waters than do right whales.

Similar to Alternative 3, humpback whales may benefit from speed restrictions in the SEUS, while fin and sei whales have rarely, if ever, been sighted in waters slated for SMAs in the SEUS. The recommended routes are not expected to affect humpback whales because coastal Georgia and Florida are not typically-used habitat for the species. The northern reaches of Florida manatee habitat coincides with the SEUS region, although in winter, when speed restrictions are in place in this region, manatees are concentrated off the coast of south Florida.

4.2.6.2 Sea Turtles

As with Alternative 5, implementing the operational measures contained in Alternative 6 could potentially have indirect, positive effects on sea turtles during the five-year period when the measures would be in effect. The measures in Alternative 5 would result in a greater reduction in the risk of vessel collisions with sea turtles because speed restrictions are in place in larger areas and for longer time frames than would be provided under Alternative 6. However, the measures in Alternative 6 would provide some level of protection to sea turtles because it is likely that the factors reducing serious injuries and deaths of right whales would likely also benefit sea turtles.

4.3 Impacts on the Physical Environment

The following sections describe the impacts of the actions contained in each of the alternatives on bathymetry and substrate; water quality; air quality; and ocean noise. Assessment of the impacts on ocean noise is based on the assumption that engine noise levels generally decrease at reduced speeds. However, the relationship is not necessarily linear and is dependent on vessel class and engine type. Also, even if the total energy (or sound) emitted is lower at reduced speeds, the vessels are transiting a given space for a longer time, and more noise may be introduced into the ocean overall. However, measuring this would be difficult prior to establishing speed restrictions. Therefore, the impacts on ocean noise are reasonable expectations within the context of these assumptions.

4.3.1 Alternative 1 – No Action Alternative

4.3.1.1 Bathymetry and Substrate

The No Action Alternative would have no impact on ocean bathymetry and substrate. This alternative maintains NOAA’s current mitigation measures and does not propose any new regulatory measures. The current measures – aerial surveys, MSRS, outreach and education – have no effect on ocean bathymetry and substrate.

4.3.1.2 Water Quality

Implementing the No Action Alternative would have no impact on existing water quality as described in Section 3.3.2. Alternative 1 does not propose any new regulatory measures that could affect water quality.

4.3.1.3 Air Quality

Implementing Alternative 1 would not alter the air quality parameters described in Section 3.3.3. Emissions from vessels would remain the same, with neither improvement nor degradation. Total vessel emissions are expected to increase over time with the predicted increases in commercial shipping. Under the No Action Alternative, the minor, positive improvements in air quality that would accrue from reductions in ship speed in specified areas (as under Alternatives 2, 3, 5 and 6) would not occur.

4.3.1.4 Ocean Noise

Alternative 1 would have no impact on ocean noise because none of the nonregulatory ship strike mitigation measures included in this alternative would result in increases in introduced ocean noise levels relative to the status quo. Furthermore, most future research techniques or technological aids to prevent ship strikes are unlikely to generate significant negative environmental impacts on ocean noise levels. However, if steps are taken to use active sonar or otherwise introduce new noise sources to detect or deter right whales, then the requisite NMFS permitting process would be adhered to, which would address any environmental impacts at that time.

4.3.2 Alternative 2 – Mandatory Dynamic Management Areas

4.3.2.1 Bathymetry and Substrate

None of the measures proposed in Alternative 2 would have an impact on bathymetry and substrate because right whale protection measures all occur at the ocean surface. DMAs are temporary restrictions triggered when a certain concentration of right whales is sighted. Vessels would either route around these areas or transit at reduced speed through the DMA. There are no physical restrictions associated with DMAs, and the restricted area only occurs on the water surface.

4.3.2.2 Water Quality

Implementing right whale conservation measures identified in Alternative 2 would have negligible impacts on ocean water quality levels. Implementing a DMA would result in vessels changing course to navigate around the identified protection area or reducing speed through the area. Most right whales occur within 20 to 30 nm (37 to 56 km) of the coast (Knowlton *et al.*, 2002). Therefore, most DMAs would be implemented within US territorial waters where Federal regulations prohibit vessels from dumping untreated sewage, and state regulations may restrict vessels from dumping gray water. Both types of waste could reduce local water quality (as described in Section 3.3.2.3 and summarized in Table 3-5; US territorial seas extend to 12 nm [22 km] and the contiguous zone to 24 nm [44 km] from the coastline). Given that vessels would be in the same general area with or without the DMA; that DMAs are relatively small in area (15 nm [28 km]); that effective periods are temporary (15 days); and that changes in vessel operations and/or routes are minimal, it can be concluded that implementing DMAs will have little or no impact on water quality.

While creation of a DMA might result in vessels leaving US territorial seas to route around a DMA, the presence of the DMA would not increase the likelihood that the vessel captain would dump waste into the ocean. Unless traveling along the coast within territorial waters, the vessel navigating around a DMA would be steaming outbound from ports where the captain could have disposed of wastes or inbound from zones where the captain would have been able to dump wastes in accordance with US and MARPOL regulations.

There is a slight chance that vessels traveling along the coast within territorial waters might elect to dispose waste beyond territorial waters and the contiguous zone (24 nm [44 km]) if a DMA extended outside the limits. Beyond 24 nm (44 km), ships can discharge black water (sewage) and gray water (non-sewage wastewater). Discharging large quantities of untreated sewage in estuarine or shallow coastal waters might cause eutrophication, or an influx of high levels of nutrients that can lead to excessive plant growth, which depletes oxygen in the water. However, a small quantity of discharge offshore in the open ocean would have minimal effects on nutrient levels in the surrounding waters. Changes in water quality due to wastewater discharge would be limited to the immediate area of discharge, and effects would be short-term because the effluent would be diluted and dispersed (NPS, 2003).

There are several types of pollutants from marine engines that are released into the ocean. However, these pollutants would be widely dispersed in the ocean because the vessels are moving sources and water currents would transport and disperse the pollutants, thereby diluting the amount of pollutants in any given area. The effects of discharging oil are variable depending on the type, quantity and location of the spill, and can result in fatal or nonfatal long-term effects on animals and their habitat. Discharging bilge and ballast water that may include residual oil, lubricants, and fuel could potentially have a minor short-term effect on water quality, but discharge of these wastes is regulated (Section 3.3.2.3) (NPS, 2003).

Certain types of solid wastes may be disposed of outside of the 12-nm (22-km) territorial limit (Section 3.3.2.3), and should not have an adverse effect on water quality under this alternative, as there is a limited probability that implementing DMAs would result in an increase in the disposal of solid waste.

4.3.2.3 Air Quality

Implementing Alternative 2 would have minor, direct, short-term, positive impacts on air quality at sea. If a DMA is established, vessels would either transit around the area or reduce speed through the area. If the vessel reduces speed through the DMA, there would be a temporary reduction in smokestack emissions, or ship plume, emanating from the ships' engines. While slowing a ship's speed linearly increases the time of impact of a marine plume on a receptor and the emissions per mile, the amount of energy required to propel the ship through the water decreases as the cube of the speed (Section 3.3.3.3). Thus, the net effect of speed reductions would be to reduce the air emissions from each vessel affected as well as the total air emissions near the DMA precautionary area.

Another effect of reducing ship speed is that it increases the effective release height of the ship plume. This occurs because air movement around the stack tip is influenced by speed. The Briggs plume rise formula used by the EPA in its regulatory air quality models indicates that the final height of the emissions is dependent on the inverse wind speed under unstable air dispersion conditions and the inverse cube root of wind speed under stable air mass conditions (Briggs, 1972; Briggs, 1975). That is, the slower the ship moves, the higher the final effective release height of emissions. For ground-/sea-based receptors, this translates into lowered concentrations of smokestack emissions from ships operating at slower speeds.

An ongoing pollution prevention program in Los Angeles, California, demonstrates that slowing vessels down reduces the amount of certain pollutants emitted during vessels operations. The Port of Los Angeles and the Port's No Net Increase Task Force compiled a document that reviews initiatives and technologies to limit emissions from port-related activities. One of these measures is a voluntary speed reduction program (VSRP) that was implemented in 2001. A voluntary speed reduction (12 knots) within 20 nm (37 km) of the port is broadcast to captains calling at the Port of Los Angeles. Compliance in the first year was 48 percent, although this compliance represents any speed reduction from 22 knots (average speed without VSR), not necessarily a reduction to 12 knots. In 2005, approximately 70 percent of shipping lines calling at the ports were participating in the program (Port of Los Angeles, 2005).

With 100 percent compliance, the estimated reduction in nitrogen oxide (NO_x) emissions would be about 58 percent for the main engine, although the auxiliary engine emissions are estimated to increase (by approximately 7 percent). The reduction for particulate matter with an aerodynamic diameter less than or equal to 10 micrometers (PM_{10}) would be 57 percent for the main engine, and an increase again for the auxiliary engine by 8 percent. Auxiliary engine emissions increase due to increased transit time because of slower speeds. In a press release dated August 17, 2005, the Port of Los Angeles announced that the VSRP decreased daily NO_x emissions by about 1 ton, or 100 tons during the first quarter of 2005. There are plans to increase the compliance zone from 20 to 40 nm (37 to 74 km) (Port of Los Angeles, 2005).

Vessels routing around a DMA rather than slowing to go through it may add distance to their route but would remain at their customary speeds. This may cause the vessels to remain in the area longer, emitting engine exhausts; however, DMAs are temporary and should not occur more than several times a year in a particular area. Therefore, if vessels route around the DMA, overall impacts on air quality over the affected parts of the ocean should be short term and minimal.

4.3.2.4 Ocean Noise

Implementing the measures contained in Alternative 2 would potentially have minor, direct, short-term, positive effects on ocean noise levels. Implementation of a DMA would either temporarily redistribute noise around the precautionary area or reduce the level of noise if vessels transit through the area at a reduced speed. Depending on the type of engine, lower speeds generally result in lower noise emissions. An EIS prepared by the National Park Service (NPS) on cruise ship quotas and operating requirements in Glacier Bay, Alaska, cited a study[6] that found that underwater noise levels were considerably less when vessel speed limits were 10 knots, rather than 20 knots (Naval Surface Warfare Center [NSWC], 2000 *in* NPS, 2003).

4.3.3 Alternative 3 – Speed Restrictions in Designated Areas

4.3.3.1 Bathymetry and Substrate

None of the measures proposed in Alternative 3 would have an impact on bathymetry and substrate since they all take place on the ocean's surface. Slowing vessels down would result in less impact to surface water (slower speeds reduce the wake and bow wave), but this change would not affect the ocean floor.

4.3.3.2 Water Quality

Implementing the speed restrictions proposed in Alternative 3 would have negligible impacts on ocean water quality, as described in Section 4.3.2.2. Except for the seaward boundaries of the ALWTRP SAM East SMA (which covers the same area as the Great South Channel SMA), the MAUS continuous 25-nm SMA and the SMA in the SEUS region, most of the speed restrictions

[6] Kipple, B. 2002. *Glacier Bay Underwater Noise - Interim Report.* Naval Surface Warfare Center. Technical Report NSWCCD-71-TR-2002/579.

in Alternative 3 would be within the US territorial sea and the contiguous zone where discharges of wastes are regulated by international and domestic laws and policies, as described in Section 3.3.2.3. In addition, slowing vessels would not cause vessels to discharge greater volumes of effluent than they would at normal sea speeds. Vessels would be present in speed-restricted areas for a slightly longer time, and this might result in a slight increase in the number of times that wastes could be released in the speed-restricted areas. However, this slight increase is not expected to result in greater concentration of wastes in speed-restricted areas because it is expected that pollutants would disperse fairly rapidly, as ships are moving sources and pollutants would be dispersed by normal ocean processes such as currents, temperature gradients, and upwelling.

4.3.3.3 Air Quality

As described for Alternative 2 (Section 4.3.2.3), speed restrictions would have direct, short-term, positive impacts on air quality in the affected areas of the ocean. While speed restrictions would result in vessels transiting the proposed areas for a longer period, the overall impact still would lead to reductions in vessel emissions. This was demonstrated in the Glacier Bay EIS air quality analysis, where daily and annual emissions from speed-restricted vessels were measured relative to existing ambient air quality levels (NPS, 2003).

4.3.3.4 Ocean Noise

Implementing the operational measures and associated speed restrictions identified in Alternative 3 would potentially have direct, short- and long-term, positive impacts on the levels of ocean noise by reducing noise levels in the immediate areas when and where restrictions are proposed. As described in Section 4.3.2.4, most engines operate more quietly at lower-than-customary speeds. As a result, underwater noise levels would be reduced in the NEUS year-round, temporarily in the MAUS from October 1 to April 30, and in the SEUS from November 15 to April 15.

Although reduced speeds would increase the amount of time vessels are transiting in shipping lanes and other speed-restricted areas, the area of ocean affected by underwater noise would be smaller than if speed restrictions were not enacted. For example, a vessel traveling 10 to 14 knots is expected to generate sound over a smaller area than a vessel traveling 20 knots or faster because elevated noise energy radiates farther (NPS, 2003). Reduced speeds would directly benefit right whales (as well as other marine mammals) because quieter conditions would result in a reduced likelihood for disturbance and a reduction in the potential for masking. Masking (described in Section 3.1.6.2) can interfere with right whales' ability to communicate, which in turn could adversely affect various types of social behavior.

4.3.4 Alternative 4 – Recommended Shipping Routes

4.3.4.1 Bathymetry and Substrate

Implementing Alternative 4 would have no effect on bathymetry and substrate. Shifting the vessel traffic in Cape Cod Bay and the ports of Brunswick, Fernandina, and Jacksonville to several recommended shipping routes would only affect surface waters and would not alter the seafloor or substrate.

4.3.4.2 Water Quality

Implementing Alternative 4 would not have an impact on water quality in the NEUS, although the shipping routes outside of the 12-nm (22-km) territorial seas and the 24-nm (44-km) contiguous zone for the ports of Jacksonville, Fernandina, and Brunswick could potentially have minor adverse impacts on water quality in the SEUS. While this alternative would not cause any net increase in the discharge of pollutants, the vessels and their discharges would be more concentrated in the shipping routes in the NEUS and SEUS. Overall water quality in the port approach areas would not change but pollutants could be slightly more concentrated in the recommended shipping routes.

With respect to the proposed action, the main concern associated with an increase in water pollution is that it could affect right whale food sources and lead to increased levels of contaminants such as metals and toxic substances collecting in right whale tissues. (This would only be an issue in the NEUS, as right whales do not feed in the SEUS.) Increased levels of contaminants can have a direct effect on cetacean physiological systems, including reproduction, immune defense, endocrine functions, and possibly neural functions that control social and migratory behavior (NMFS, 2005a), although no study has indicated contaminant levels are sufficiently high to compromise these systems in right whales. Indirect effects could include the presence of pollutants in right whale prey. However, the recommended shipping routes are designed to avoid areas with high densities of right whales, and include the areas where their prey is most likely to occur and to attract the whales. Therefore, the slight potential increase in the concentration of pollutants in the recommended shipping routes is not expected to adversely affect right whale food sources or to lead to the bioaccumulation of pollutants in the right whales themselves. Any changes to water quality due to wastewater discharges would be limited to the area of discharge and would be short-term in nature because of the likely rapid dilution and dispersion.

Recommended shipping routes would not increase the risk of vessel-to-vessel collisions or accidental oil spills because the proposed lanes would be wide enough to allow vessels to avoid one another. This conclusion is supported by USCG analysis of the lanes for navigational safety in its PARS.

NEUS

Existing vessel traffic patterns in Cape Cod Bay would be altered[7] as a result of the recommended shipping routes. However, the recommended routes are within the territorial sea (12 nm [22 km]) where Federal law regulates the discharge of sewage and other waste into the ocean (see Section 3.3.2.3). Therefore, the discharge of untreated wastes in the recommended routes in Cape Cod Bay is prohibited, and there would be no adverse effects on water quality in the NEUS region.

SEUS

Implementing the measures proposed in Alternative 4 could potentially have minimal, direct, short-term, adverse effects on water quality in the approaches to the ports of Brunswick, Fernandina, and Jacksonville. There is potential for a temporary increase in the concentration of

[7] Northbound traffic enroute to Boston, the Gulf of Maine or Canada would be shifted west, along with southbound traffic traveling to the Cape Cod Canal (Russell *et al*., 2005), although traffic enroute to Provincetown from the Cape Cod Canal and vice versa closely follows current vessel traffic.

pollution in portions of the recommended routes seaward of waters with pollution restrictions, (beyond the 12-nm [22-km] and 24-nm [44-km] limits) where pollution regulations are less stringent than in waters inshore of these limits. This would result from higher vessel traffic in the lanes during the right whale calving season. Although the shipping lanes would concentrate vessel traffic, it is unlikely that mariners would intentionally release waste in the lanes instead of in other places and at other times during their voyage. As with recommended routes in Cape Cod Bay, the routes in the SEUS are designed to avoid areas of high right whale density, so that any potential increase in pollution or decrease in water quality would be outside important right whale aggregation areas.

4.3.4.3 Air Quality

Implementing the measures proposed in Alternative 4 would not have a significant impact on air quality. If recommended shipping routes are heavily utilized, then local air pollution may be concentrated at sea in these shipping lanes instead of dispersed throughout various routes. However, vessels are moving sources, and any emissions would be dispersed along with the forward motion of the vessel and other factors (see Section 3.3.3.3) would influence the transport and dispersion of emissions.

Any increase in emission concentrations resulting from nearby ships would last only a few minutes until either the ship or the plume centerline moves away. The magnitude of the transient emissions is directly dependent on the distance from the ship. For average concentrations from ship emissions to increase, the shipping density would have to increase significantly in a sustained manner to the point where there would be a large aggregation of ships in the immediate area. Because vessels would be traveling in shipping lanes, the rules of navigation would prevent vessels from traveling or passing too close to one another. Therefore, there should not be a significant change in air quality resulting from shipping lanes. Air quality in the ports would remain the same because the speed restrictions are only required seaward of the COLREGS line. There are more air quality issues in port areas, where vessels are stationary and there is additional machinery that can pollute the air.

4.3.4.4 Ocean Noise

Implementing the measures proposed in Alternative 4 would potentially have minimal, direct, short-term, adverse effects on ambient ocean noise levels in the recommended shipping routes, but would have minor, positive, short-term, direct effects on ocean noise levels outside the shipping routes where the vessels now transit in a more dispersed pattern. While the measures identified in this alternative would not alter the overall amount of underwater noise, vessels would be channeled into certain routes, which would redistribute (i.e., increase) vessel noise into those routes. Conversely, this alternative would decrease vessel noise levels outside the routes, where the whales are present. Therefore, this alternative would benefit right whales, because relatively high right whale densities occur outside the recommended routes, where vessel noise levels would be diminished as a result of use of the routes. A decrease in ambient noise would lessen the effects of potential disturbance and of the masking of right whale communication.

4.3.5 Alternative 5 – Combination of Alternatives

4.3.5.1 Bathymetry and Substrate

Alternative 5, which combines the measures from Alternatives 1, 2, 3, and 4, would not have an impact on bathymetry and substrate. The combination of current mitigation measures, DMAs, speed restrictions, and recommended shipping routes would not affect the seafloor because all actions occur at the ocean surface.

4.3.5.2 Water Quality

The measures in Alternative 5 would have negligible to minor adverse impacts on water quality. Implementing the combination of alternatives that comprise Alternative 5 would have similar effects on water quality to those described for Alternatives 2, 3, and 4. Water quality impacts would be negligible, with the exception of the proposed segments of shipping lanes in Brunswick, Fernandina, and Jacksonville that are seaward of 12 nm (22 km) and have the potential to concentrate vessel pollution instead of the pollutants' being distributed throughout various routes. This could have minor, adverse, short-term, direct effects on water quality in portions of the lanes that are located outside of waters with pollution regulations during the season when speed restrictions are proposed (see Section 3.3.2.3 for a description of the regulations).

While there may be an increase in the concentration of pollutants in portions of the shipping lanes, the number of vessels transiting the area would not change as a result of the operational measures in Alternative 5, and therefore there would be no net increase in pollutants – only the distribution of pollutants would change. As previously described, shifting vessel traffic away from areas with relatively-high right whale densities would have a positive impact on right whales by shifting the marine pollutants away from the whales and their habitat. Section 4.3.4.2 describes the impacts on animals resulting from decreased water quality.

Existing regulations, DMAs, and speed restrictions would have a negligible impact on water quality for the reasons discussed with regard to Alternatives 1, 2, and 3. The recommended shipping routes in Cape Cod Bay are within the 12-nm (22-km) territorial sea, and therefore impacts on water quality in this area would be negligible.

4.3.5.3 Air Quality

Implementing Alternative 5 would have minor, direct, long-term, positive effects on air quality. Alternatives 2 and 3 have the potential to actually reduce vessel emissions by slowing vessels, which would improve air quality. Alternative 4 would have neutral effects on air quality because even though emissions would be concentrated in the shipping lanes instead of being dispersed throughout various approaches to the ports, there would be no change in the actual amount of emissions. Therefore, there is a potential for minor positive effects on air quality. Furthermore, because Alternative 5 involves speed restrictions within the SEUS, and because research shows that lowering vessel speed can reduce emissions from certain vessel types, the reduced emissions at lower speeds may counter the increase in concentration of emissions in the recommended routes (Section 4.3.2.3).

4.3.5.4 Ocean Noise

On balance, implementing measures contained in Alternative 5 would potentially have minimal, direct, long-term, slightly positive effects on ocean noise levels. The DMAs proposed under Alternative 2 would have no impact or a slight positive impact on noise levels. Speed restrictions in Alternative 3 would have a positive effect by reducing noise levels, potentially canceling out the minor adverse effect of recommended routes in the SEUS (Alternative 4). Any changes in ocean noise levels resulting from implementing Alternative 5 would be minor.

4.3.6 Alternative 6 – Proposed Action (Preferred Alternative)

4.3.6.1 Bathymetry and Substrate

Measures proposed under Alternative 6 include voluntary DMAs, SMAS in the NEUS, MAUS, and SEUS regions, and recommended shipping routes in the NEUS and SEUS regions. Implementing these measures would not affect bathymetry and substrate in the areas affected because all of the operational measures occur at the ocean surface.

4.3.6.2 Water Quality

Implementing Alternative 6 measures would have negligible effects on water quality, with the exception of the proposed segments of shipping lanes in Brunswick, Fernandina, and Jacksonville that are seaward of 12 nm (22 km) and have the potential to concentrate vessel pollution instead of the pollutants' being distributed throughout various routes. This could have minor, direct, short-term, adverse effects on water quality in portions of the lanes that are located outside of waters with pollution regulations during the season when speed restrictions are proposed (see Section 3.3.2.3 for a description of the regulations).

While there may be an increase in the concentration of pollutants in portions of the recommended routes, the number of vessels transiting the area is not changing, therefore there would be no net increase in pollutants – it is only the distribution of pollutants that would change. As previously described, shifting vessel traffic away from important right whale aggregation areas would have a positive impact on right whales by shifting the marine pollutants away from whales and their habitat. Section 4.3.4.2 describes the impacts decreased water quality has on animals.

Existing regulations, DMAs, and speed restrictions would not have a measurable impact on water quality for the reasons discussed above for Alternatives 1, 2, and 3. The recommended shipping routes in Cape Cod Bay are within the 12-nm (22-km) territorial sea, and therefore no impacts on water quality are foreseen in this area.

4.3.6.3 Air Quality

The speed restrictions proposed under Alternative 6 would have minor, direct positive impacts on air quality in the vicinity of the proposed SMAs, DMAs, critical habitat, and recommended routes by reducing vessel air emissions for the duration of the measures. Research shows that slowing vessels can reduce emissions from certain vessel types and that the reduced emissions at slower speeds might counter the increase in concentration of emissions in the shipping lanes (Section 4.3.2.3).

There may be localized effects on air quality in some locations if vessels divert to alternate ports, depending on what mode of secondary transportation is needed to transfer cargo to its destination. However, as discussed in Section 4.4.3, only a small percentage of vessels are estimated to divert to other ports. Vessel operators can minimize potential adverse effects on air quality with engine modifications.

4.3.6.4 Ocean Noise

Implementing Alternative 6 measures would potentially lower noise levels in areas where ship speeds would be reduced, resulting in minor, direct positive impacts on ocean noise levels in the affected areas for the duration of the proposed measures. The speed restrictions proposed in the 20 nm (37 km) continuous SMA and the 20-nm- (37-km)-radius half circles around ports in the MAUS, and the 30 nm (56 km) SMA off Block Island Sound would have a direct positive effect on ocean noise. Vessels would slow to 10, 12, or 14 knots in these areas, effectively reducing the amount of introduced noise. Because SMAs would not concentrate ships into lanes, ship noise would remain widely distributed but lower in volume. Although reduced speeds would increase the amount of transit time in SMAs, the magnitude of underwater noise at any one point would be less than that associated with customary speeds.

As described in Section 4.3.2.4, DMAs would not adversely affect introduced vessel noise. Vessels 65 ft (19.8 m) and longer would reduce speed through the Great South Channel management area and critical habitat, which would reduce levels of ocean noise in these particular areas.

Alternative 6 would result in vessel noise being redistributed in the areas that have recommended routes for shipping traffic: Cape Cod Bay off Massachusetts, Jacksonville and Fernandina in Florida, and Brunswick, Georgia. Vessel noise would be concentrated in shipping lanes. However, because Alternative 6 proposes speed restrictions in the lanes located within SMAs, the overall level of noise would be reduced because engines operating at less-than-customary speeds will introduce less underwater noise. Alternative 6 would also reduce noise levels in areas outside shipping lanes where the vessels previously transited. Furthermore, noise would be substantially reduced in areas outside the shipping lanes, where right whale density is higher.

4.4 Impacts on the Socioeconomic Environment

This section describes the potential impacts to the maritime community from establishing the operational measures proposed under the various alternatives, including impacts to port areas and vessel operations. The analysis uses 2003 and 2004 vessel arrival data[8] and reflects the annual costs associated with the proposed measure as if they had been in place in 2003 and 2004.

[8] Vessel arrival data for 2005 through 2007 became available only after most of the work on the economic analysis had been completed. However, vessel arrival data for 2003 and 2004 continue to provide a suitable basis for identifying economic impacts, because annual variations in the composition and volume of vessel traffic are relatively modest. For example, while new and larger vessels come into service each year, these new vessels would not significantly alter the average vessel operating costs used in this analysis by type and size of vessel. Also, any annual growth in overall traffic would affect all the alternatives analyzed and pale in significance when compared to the large differences among the alternatives analyzed.

However, for the purposes of the FEIS, operating costs have been updated using 2008 fuel prices. As a result, in absolute terms, the economic impacts of all alternatives are higher than they were in the DEIS: this is primarily a result of the significant increase in the cost of fuel, not of any changes in the proposed operational measures (see Section 3.4.1.4). The discussion is divided into the following sections:

Section 4.4.1 describes the economic impacts on the maritime shipping industry of the US East Coast. The analysis in this section focuses on vessels that have one port of call on the East Coast. Port areas and vessel operations are discussed concurrently because the impacts are shared by both the shipping companies and port facilities.

Section 4.4.2 describes the additional direct economic impacts associated with vessels that make two to three stops along the East Coast in one trip or are involved in coastwise shipping. Only Alternatives 3, 5, and 6 would have effect associated with these multi-port vessel strings; Alternatives 2 and 4 would not have such additional direct impacts.

Section 4.4.3 describes potential indirect impacts, including diversion of traffic to other ports, increased intermodal costs due to missed rail and truck connections, and impacts on local economies.

Sections 4.4.4 to 4.4.9 describe impacts on commercial fishing vessels, passenger vessels, whale-watching vessels, charter vessels, all sectors, and environmental justice communities, respectively.

As previously noted, the analysis considers three alternative speeds: 10, 12, and 14 knots. However, because 10 knots is NMFS' proposed restriction, all economic impacts reflect a 10-knot speed restriction unless otherwise stated. Generally, the total impacts at 12 and 14 knots are also provided in the discussion for each alternative and details of the direct impacts of alternate speeds on the shipping industry by port area and alternative are provided in Section 4.4.1.8. A summary of the direct and indirect impacts on all maritime sectors is provided in Section 4.4.8.

4.4.1 Direct Impacts on Port Areas and Vessel Operations

The following pages summarize the findings of the economic analysis conducted for this FEIS. The details of the analysis are found in a separate *Economic Impact Report*. Several important assumptions apply to the analysis and are introduced at the appropriate points in the discussion.

Some industry representatives have commented that increased fuel consumption for vessels having to go faster to make up for time lost due to the proposed measures should be factored into the analysis. However, the analysis, by assuming that vessels would not speed up to make up time, includes maximum estimates for the delays incurred and, therefore, provides an upper limit estimate for the impacts. If vessel captains adjust voyages to make up for the delay by speeding up, the estimated economic impacts would need to be revised to reduce or exclude the cost applied for the time delayed.

Another comment was that vessels may burn less fuel operating at slower speeds and that these savings may offset some of the costs of delays. However, for economic reasons, vessel operators already operate at close to the vessel's optimal fuel efficiency and any savings in fuel costs can be assumed to be minimal and negligible.

4.4.1.1 Alternative 1 – No Action Alternative

Under the No Action Alternative, the shipping industry would be unaffected beyond the measures already in place and would not incur any additional economic impacts. The MSRS would remain in place to inform mariners of the presence of whales and NMFS would continue to provide right whale sighting and avoidance information to the National Ocean Service (NOS), to update the *US Coast Pilots* annually. Hence, there is no direct economic impact associated with this alternative.

The No Action Alternative would have no impact on port operations in any of the three regions. The MSRS and local notice to mariners are the only existing actions that are port-related, but they have no economic or other impacts on port operations. Although reporting is mandatory, speed advisories are voluntary and announcements broadcasted via the local notice to mariners are used at the mariner's discretion.

4.4.1.2 Alternative 2 – Mandatory Dynamic Management Areas

Alternative 2 would have a direct, long-term negative economic impact on vessel operations, estimated at $25.0 million annually based on 2003 data and $27.6 million annually based on 2004 data. The criteria for triggering a DMA and the resulting precautionary area are described in Section 2.1.4. DMAs could be established at any time of the year and in any location depending on whale occurrence. Assumptions were made to estimate the number of days per year that DMAs would be effective in each port area based on the frequency, timing, and location of whale sightings. The following two paragraphs describe the studies on which these assumptions are based.

Russell *et al*. (2005) estimated the annual expected duration of DMAs in the Northeast region and the Block Island Sound portions of the MAUS.[9] However, in calculating the incidence of DMAs, this report assumed that seasonal speed restrictions in designated areas, including SMAs, would be in effect.[10] Hence, DMAs in the report are only those that would occur outside the SMAs. For the southern Gulf of Maine, the report estimated an average of 2.3 DMAs per year. The economic analysis for this FEIS rounded this estimate up to an expected incidence of three DMAs per year (45 effective days) outside of the assumed speed restriction periods. A review of DAMs implemented as a part of the ALWTRP confirms the Russell *et al.* (2005) analysis: from 2002 to 2006, no more than three DAMs were implemented outside the SMA speed-restriction periods.[11] It was also assumed for the analysis that DMAs would be implemented for 50 percent of the time that the report assumed the SMA speed restrictions for the Boston shipping lanes near Race Point to be in effect (April 1 to May 15), or an additional 23 days. (While it could have been assumed that DMAs would be implemented for 100 percent of the time that these speed restrictions would be in place, the location-specific nature of the DMAs means that some DMAs would not fall within normal shipping lanes, and so traffic would not be affected. A study of right whale sightings from 1978 to 2003 shows that many of the sightings after May are more

[9] This reference is based on the May 2005 revised report, although there are also references to the original report (Russell *et al*., 2003).

[10] The report assumed the following seasonal speed-restricted periods: Great South Channel, April 1 to July 31; Cape Cod Bay critical habitat, January 1 to April 30; portion of Boston shipping lanes near Race Point, April 1 to May 15; offshore approaches to Block Island Sound, September and October and February to April; approaches to the ports of NY/NJ, September and October and February to April.

[11] http://www.nero.noaa.gov/whaletrp/plan/dam/index.html

centrally located within the Great South Channel critical habitat and would be west of current traffic patterns [Merrick, 2005b]). Thus, the economic impact analysis assumes 68 effective days per year for DMAs in the Northeast region, excluding Cape Cod Bay.

For Cape Cod Bay, the Russell *et al*. (2005) report predicts an average of 0.8 DMAs per year outside the period January 1 to April 30, the period when the report assumes an SMA to be in effect. This number has been rounded up to one per year (15 days). It was also assumed that DMAs would be implemented during the report's SMA period January 1 to April 30, for 75 percent of the time, or an additional 90 days. Therefore, a total of 105 effective DMA days have been assumed for Cape Cod Bay.

For the MAUS, a report by Knowlton *et al*. (2002) provided information on the spatial and temporal distribution of right whale sightings. Data from 1970 through 2002 were used for that study. With the exception of Savannah, all port areas showed an average of less than one right whale sighting per year. For the economic impact analysis, this was rounded up to one DMA period per year (15 days) for each port in the mid-Atlantic region except for Savannah. For Savannah, 75 days per year are assumed, as described below.

For the SEUS (here including Savannah), a recent NMFS internal draft report identified the incidence of DMAs in shipping lanes. The report uses data on right whale sightings from 1992 to 2001. The observed concentration of right whale sightings is consistent with proposed seasonal speed restrictions from November 15 to April 15. However, as previously discussed for the NEUS, not all DMAs would affect vessels traveling in shipping lanes into Southeast ports. Therefore, for the SEUS and Savannah, it has been assumed that DMAs would be implemented for 50 percent of the November 15-April 15 period, or 75 days per year.

These assumptions are summarized in Table 4-1.

Table 4-1
Effective DMA Days by Port Area

Port Area	Effective DMA Days
NEUS (excepting Cape Cod Bay)	68
NEUS Cape Cod Bay	105
MAUS (excepting Savannah, GA)	15
SEUS and Savannah, GA	75
Source: Nathan and Associates	

Direct Economic Impacts of Alternative 2

In all regions, mariners would be required to either proceed through a DMA at a restricted speed or route around the DMA. The direct impact of a DMA on vessel operations is the increased time required to transit through the DMA at the restricted speed.

Because NMFS would draw a square around each circular DMA buffer zone (in order to issue coordinates of the corners to mariners), the position of the DMA relative to the vessel routing would affect the effective distance to be traveled through the DMA. For example, a vessel that would route diagonally through the DMA square would have to traverse 56 nm (104 km) at the restricted speed; one crossing the square at mid-point on each side would travel 39.6 nm (73.3 km). In other cases, a vessel's route would require traversing a much smaller portion of a DMA square. For the purposes of the economic analysis, it was assumed that vessels would have to traverse an average of 39.6 nm (73.3 km) for each DMA, which reflects the diameter of a DMA for the base case scenario for a group of three whales. [12]

For a vessel typically traveling at an operating speed of 14 knots, it would be possible to cover the 39.6 nm (73.3 km) of a DMA in 170 minutes, a little under three hours. With a speed restriction of 10 knots, covering the distance would take 238 minutes, ,or nearly four hours, 68 minutes more than at 14 knots. In addition, vessels would need time to slow to the restricted speed prior to entering the DMA and time to speed up after leaving the DMA. A vessel normally traveling at an operating speed of 14 knots would take 18 minutes to slow down to 10 knots and speed up again to 14 knots, for a total delay of 86 minutes.

For the economic impact analysis, it has been assumed that most vessels would opt to proceed through a DMA with a speed restriction of 10 knots rather than to route around the DMA. A vessel normally traveling at an average speed of 14 knots would incur a delay of 170 minutes to travel the extra 39.6 nm (73.3 km) around the two sides of the square that circumscribes a DMA,[13] as compared to the 86-minute delay to go through the 39.6 nm (73.3 km) of the DMA at the restricted speed. (With a 10-knot speed restriction, vessels with an average operating speed in excess of 18 knots could benefit from routing around the DMA. Routing around the DMA would take an additional 132 minutes (39.6 nm divided by 18 knots), whereas going through the DMA at 10 knots would take an additional 106 minutes [238 minutes, versus the normal 132 minutes] plus 26 minutes for slowdown and speedup, for a total delay of 132 minutes, the same as routing around.)

Data Chart 4-1 presents the direct annual economic impact of Alternative 2 on the shipping industry with a 10-knot speed restriction based on 2003 conditions, using the estimated effective DMA days shown in Table 4-1. The total direct economic impact is estimated at $25.0 million annually, with the port area of Savannah being the most affected, at $6.9 million. Port Canaveral is second, at $3.9 million, followed by the port areas of New York/New Jersey and Jacksonville at $2.9 million. The direct economic impact for these four port areas totals $16.5 million annually, or 65.8 percent of the total for this alternative. In the NEUS, the port area of Boston has the greatest direct economic impact, estimated at $0.8 million in 2003. The port area of Portland has the second highest impact in the NEUS, estimated at $0.7 million.

Overall, under Alternative 2, containerships account for 47.0 percent of the total direct economic impact, with an estimate of $11.8 million annually. The vessel type with the next-largest economic impact is passenger vessels, at $5.1 million, followed by ro-ro (roll-on-roll-off) cargo ships, at $2.8 million. The port area of Port Canaveral accounts for 69.2 percent of the economic impact incurred by passenger vessels, at $3.5 million.

Data Chart 4-2 presents the direct annual economic impact of Alternative 2 at a 10-knot speed restriction based on 2004 conditions.

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[12] The 39.6 nm (73.3 km) distance is based on a core area with a radius of 4.8 nm (8.9 km), for a group of three whales, plus the buffer with a radius of 15 nm (27.8 km), for a total radius of 19.8 nm (36.7).

[13] While the two sides of a square that circumscribe a DMA are each 39.6 nm (73.3 km), the extra distance is only equal to one side of the square because if the vessel is in the area of a DMA, then it was already planning on sailing the 39.6 nm (73.3 km) through the DMA at regular speed.

Data Chart 4-1
Alternative 2: Direct Economic Impact on the Shipping Industry by Port Area and Type of Vessel, 2003 ($000s)

Port Area	Bulk Carriers	Combination Carriers	Containerships	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	7.7	-	13.4	-	30.4	-	-	-	-	-	-	-	51.6
Searsport, ME	6.0	0.8	-	-	-	371.8	-	0.5	16.0	71.4	0.8	-	467.4
Portland, ME	35.9	15.2	19.3	0.9	39.5	119.5	-	38.2	4.0	400.2	4.5	0.5	677.7
Portsmouth, NH	37.6	2.0	-	-	15.0	3.6	-	-	1.4	97.6	0.4	0.5	158.1
Northeastern US - Off Race Point													
Boston, MA	18.4	0.6	229.5	0.7	6.1	336.4	7.9	22.7	-	178.4	0.4	0.9	802.1
Salem, MA	4.8	-	-	-	-	3.6	-	-	-	1.0	-	-	9.3
Northeastern US - Cape Cod Bay	-	-	-	-	-	11.7	-	-	-	4.0	-	-	15.7
Mid-Atlantic Block Island Sound													
New Bedford, MA	8.7	-	0.1	-	3.1	-	4.8	-	0.5	1.8	-	-	18.9
Providence, RI	9.9	0.3	0.4	-	4.3	43.0	1.9	23.6	0.4	23.0	0.3	0.0	107.2
New London, CT	2.6	-	1.4	-	5.3	25.3	-	-	8.9	1.5	0.1	0.0	45.0
New Haven, CT	6.9	0.4	0.8	0.4	11.1	3.9	-	-	35.8	35.3	1.3	0.1	96.0
Bridgeport, CT	4.8	-	0.0	0.2	0.0	3.2	6.2	-	26.1	7.7	-	-	48.4
Long Island, NY	-	0.4	-	0.1	-	25.3	-	-	77.3	40.6	0.3	0.1	144.1
Mid-Atlantic Ports of New York/New Jersey	48.1	7.8	1,826.0	0.1	15.3	311.9	20.3	314.3	4.0	312.4	1.8	0.4	2,862.5
Mid-Atlantic Delaware Bay	37.4	3.8	200.7	2.8	37.9	29.8	261.1	45.0	1.9	210.3	1.5	0.1	832.3
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	43.9	1.5	235.1	-	59.8	51.3	3.0	274.2	0.9	38.0	1.4	1.7	710.8
Hampton Roads, VA	46.3	6.2	1,340.4	0.1	34.8	38.8	0.6	113.2	0.3	42.4	0.5	0.9	1,624.4
Mid-Atlantic Morehead City and Beaufort, NC	3.5	-	7.1	-	7.8	-	0.7	0.6	-	7.5	-	0.1	27.2
Mid-Atlantic Wilmington, NC	12.2	1.1	64.5	-	44.6	-	0.4	14.7	2.7	46.7	0.1	0.1	187.2
Mid-Atlantic Georgetown, SC	5.1	-	0.4	-	9.9	-	-	-	-	-	-	0.1	15.5
Mid-Atlantic Charleston, SC	20.3	0.3	1,180.9	-	39.8	47.3	3.2	89.6	2.4	41.4	1.3	0.3	1,426.8
Mid-Atlantic Savannah, GA	157.1	10.6	5,482.0	-	359.3	29.5	99.7	398.5	3.0	309.7	2.7	0.7	6,852.9
Southeastern US													
Brunswick, GA	41.2	-	81.8	-	100.9	3.9	37.0	484.5	-	3.8	-	-	753.1
Fernandina, FL	6.2	-	82.6	0.5	115.5	7.9	104.7	6.0	-	1.5	4.5	-	329.4
Jacksonville, FL	113.5	3.0	949.9	159.2	221.6	61.9	30.7	898.9	7.6	290.3	123.2	2.1	2,861.9
Port Canaveral, FL	56.3	1.3	39.0	3.1	89.1	3,529.6	94.0	52.0	2.6	27.2	6.3	0.5	3,901.1
Total	734.4	55.4	11,755.4	168.1	1,251.0	5,059.2	676.2	2,776.7	196.1	2,193.5	151.5	8.9	25,026.5

a/ Includes recreational vessels.
b/ Includes fishing vessels, industrial vessels, research vessels, and school ships.
Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in text.

Data Chart 4-2
Alternative 2: Direct Economic Impact on the Shipping Industry by Port Area and Type of Vessel, 2004 ($000s)

Port Area	Bulk Carriers	Combinat ion Carriers	Containers hips	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	10.6	-	13.5	-	63.2	-	-	-	-	-	-	-	87.3
Searsport, ME	4.1	-	10.9	0.9	1.6	424.6	-	1.0	7.8	66.3	3.3	-	520.4
Portland, ME	38.5	4.4	10.7	0.9	40.5	167.6	-	26.2	18.3	417.5	19.2	0.4	744.3
Portsmouth, NH	30.3	1.8	0.5	-	24.0	3.6	-	-	0.7	72.8	3.7	1.1	138.4
Northeastern US - Off Race Point													
Boston, MA	18.4	0.6	229.5	0.7	6.1	336.4	7.9	22.7	-	178.4	0.4	0.9	802.1
Salem, MA	6.0	-	-	-	-	29.4	-	-	-	-	-	-	35.4
Northeastern US - Cape Cod Bay	-	-	-	-	-	22.7	-	-	0.2	6.2	0.1	-	29.3
Mid-Atlantic Block Island Sound													
New Bedford, MA	8.2	-	-	-	2.8	1.6	3.5	0.2	-	1.6	-	-	17.9
Providence, RI	10.2	0.3	-	-	4.5	56.5	-	19.3	0.8	17.7	0.5	0.3	110.0
New London, CT	2.2	-	5.5	-	15.3	46.7	-	-	8.8	2.0	0.3	-	80.9
New Haven, CT	5.4	-	2.4	0.2	10.1	-	-	-	67.2	27.2	2.0	-	114.5
Bridgeport, CT	9.6	-	-	0.0	0.1	3.2	2.5	-	37.7	4.6	-	0.0	57.8
Long Island, NY	-	-	-	0.4	-	30.0	-	-	89.1	41.7	-	0.0	161.3
Mid-Atlantic Ports of New York/New Jersey	46.9	4.8	1,899.1	-	23.5	503.5	21.5	320.4	3.4	301.7	4.2	0.2	3,129.3
Mid-Atlantic Delaware Bay	44.3	1.5	193.2	4.0	56.7	38.8	243.3	45.4	0.5	226.8	4.9	0.2	859.6
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	56.4	1.1	261.7	-	63.1	94.0	5.4	281.0	0.8	58.4	1.2	0.7	823.9
Hampton Roads, VA	63.8	5.0	1,320.6	0.5	39.6	74.4	9.9	104.0	1.2	47.7	2.0	0.9	1,669.4
Mid-Atlantic Morehead City and Beaufort, NC	5.9	0.1	7.8	-	5.2	5.5	-	-	-	10.0	-	0.1	34.7
Mid-Atlantic Wilmington, NC	15.4	0.5	59.5	0.4	48.8	4.7	0.4	17.3	1.4	48.3	0.5	0.4	197.7
Mid-Atlantic Georgetown, SC	4.9	0.3	1.4	-	7.2	0.8	-	-	-	-	-	-	14.7
Mid-Atlantic Charleston, SC	19.5	0.4	1,241.1	0.8	52.1	62.8	3.7	83.8	1.9	40.6	3.5	0.4	1,510.3
Mid-Atlantic Savannah, GA	165.9	8.5	5,581.4	1.0	357.6	196.3	141.3	443.4	2.5	361.5	3.6	0.5	7,263.4
Southeastern US													
Brunswick, GA	45.8	-	29.2	-	109.3	31.6	33.5	481.1	-	0.9	-	0.9	732.1
Fernandina, FL	14.3	-	89.9	1.0	129.7	75.0	45.9	5.4	-	-	10.8	-	372.1
Jacksonville, FL	130.8	5.4	976.6	140.9	248.5	502.1	34.4	931.0	14.7	297.2	165.9	8.8	3,456.3
Port Canaveral, FL	76.3	-	43.9	8.0	122.1	4,125.3	79.1	71.3	12.8	46.4	29.7	0.9	4,615.7
Total	833.8	34.9	11,978.6	159.7	1,431.5	6,837.0	632.3	2,853.4	269.8	2,275.5	255.6	16.6	27,578.8

a/ Includes recreational vessels

b/ Includes fishing vessels, industrial vessels, research vessels, and school ships.

Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in text.

The total estimated economic impact would be about $27.6 million annually, roughly 10 percent higher than in 2003. This difference is due to the overall increase in US East Coast vessel arrivals of 7.3 percent in 2004, and particularly the 12.3 percent growth in vessel arrivals in the SEUS, which would be more affected by DMAs than the other regions. The rankings by port area and vessel type are the same as described for 2003 above, except that Jacksonville moved slightly ahead of New York/New Jersey. Figure 4-3 presents the impacts graphically.

At a 12-knot speed restriction, Alternative 2 would result in an economic impact of $17.7 million annually based on 2004 data. At a 14–knot speed restriction, the annual economic impact was estimated at $10.8million (2004 arrivals). See Data Chart 4-22 for the annual economic impact of 10, 12, and 14 knots by port area.

4.4.1.3 Alternative 3 – Speed Restrictions in Designated Areas

Implementing the speed restrictions specified in Alternative 3 would have a direct, long-term, adverse economic impact on vessel operations. Based on shipping industry activity in 2003 and 2004, with a 10-knot speed restriction, annual direct economic impacts would total an estimated $133.0 million and $142.5 million, respectively. The geographic areas and times at which speed restrictions would be implemented in each region are detailed in the description of Alternative 3 in Section 2.1. The effective proposed speed-restriction periods for each port area are depicted in Figure 4-4. In the NEUS region, restrictions would be effective year-round (365 days). Speed restrictions would be in place for 212 days per year in the MAUS, and 151 days per year for port areas in the SEUS.

As discussed in Chapter 3, the USCG Vessel Arrival database and ancillary data sets provide information on all vessel arrivals of 150 GRT or greater at US ports. Information in the database regarding the date of vessel arrival was used to determine the number of vessel arrivals in 2003 and 2004 that would have occurred during the proposed speed-restriction periods for each port area.

Data Chart 4-3 presents US East Coast arrivals of vessels for 2003 during the periods when speed restrictions would be in effect for each port area. In 2003 there were 14,935 vessel arrivals during such periods, approximately 58 percent of the total of 25,532 arrivals for 2003. While there is some seasonality in US East Coast vessel arrivals, the times at which speed restrictions would be effective include both peak and non-peak periods of vessel traffic; therefore, the percentage of restricted arrivals corresponds closely to the percentage of speed-restricted days per year.

The port area of New York/New Jersey had the greatest number of vessel arrivals during periods in which speed restrictions would be in place, with 3,103 arrivals in 2003, followed by the port areas of Hampton Roads (1,529 arrivals), Philadelphia (1,521 arrivals), Savannah (1,368 arrivals), Charleston (1,343 arrivals) and Baltimore (1,085 arrivals).[14] These six port areas accounted for 66.6 percent of the total US vessel arrivals during speed-restricted periods.

In terms of vessel type, containerships led in vessel arrivals during the proposed speed-restricted periods, with 4,937 arrivals in 2003. Tankers were the next most frequent, with 3,483 arrivals, followed by ro-ro cargo ships, with 1,713 arrivals, and bulk carriers, with 1,660 arrivals.

[14] In the tables in this chapter, the port area of Philadelphia, which includes Wilmington, Delaware, is included in the data presented for the port region of Mid-Atlantic Delaware Bay.

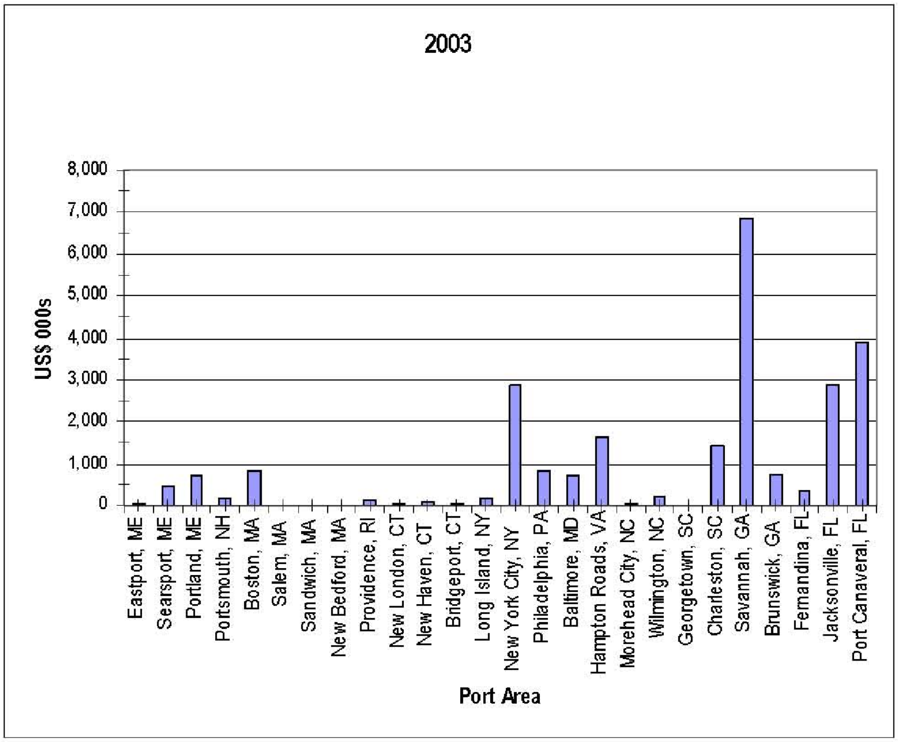
Data Chart 4-3
Alternative 3: US East Coast Restricted Vessel Arrivals by Port Area and Vessel Type, 2003

	Vessel Type												
Port Area	Bulk Carrier	Combination Carrier	Container Ship	Freight Barge	General Dry Cargo Ship	Passenger Ship	Refrigerated Cargo Ship	Ro-Ro Cargo Ship	Tank Barge	Tanker	Towing Vessel	Other a/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	16	-	5	-	19	-	-	-	-	-	-	-	40
Searsport, ME	14	1	-	-	-	66	-	1	23	89	2	-	196
Portland, ME	66	14	9	1	38	19	-	58	6	396	11	2	620
Portsmouth, NH	63	3	-	-	10	1	-	-	2	117	1	2	199
Northeastern US - Off Race Point													
Salem, MA	7	-	-	-	-	1	-	-	-	1	-	-	9
Boston, MA	34	1	77	2	8	94	4	33	-	225	1	4	483
Northeastern US - Cape Cod Bay													
Cape Cod, MA	-	-	-	-	-	9	-	-	-	13	-	-	22
Mid-Atlantic Block Island Sound													
New Bedford, MA	36	-	1	-	16	-	5	-	4	7			69
Providence, RI	49	1		-	13	14	3	45	1	74	1	1	202
New London, CT	12	-	2	-	4	20	-	-	47	5	1	-	91
New Haven, CT	38	-	1	1	17	2	-	-	152	110	10	-	331
Bridgeport, CT	17	-	-	2	2	1	32	-	108	30	-	-	192
Long Island, NY	-	1	-	2	-	19	-	-	318	144	2	1	487
Mid-Atlantic Ports of New York/New Jersey													
New York City, NY	209	19	1,381	1	31	53	14	405	25	950	11	4	3,103
Mid-Atlantic Delaware Bay													
Philadelphia, PA	206	7	287	6	131	16	266	85	11	493	12	1	1,521
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	188	6	217	-	107	22	3	401	2	122	5	12	1,085
Hampton Roads, VA	193	14	1,006	1	76	14	1	92	1	122	2	7	1,529
Mid-Atlantic Morehead City and Beaufort, NC													
Morehead City, NC	15	-	9	-	20	-	1	2	-	22	-	2	71
Mid-Atlantic Wilmington, NC													
Wilmington, NC	66	4	54	-	76	-	1	12	13	142	1	-	369
Mid-Atlantic Georgetown, SC													
Georgetown, SC	26	-	1	-	6	-	-	-	-	-	-	1	34
Mid-Atlantic Charleston, SC													
Charleston, SC	100	-	873	-	58	28	3	136	13	118	12	2	1,343
Mid-Atlantic Savannah, GA													
Savannah, GA	166	7	769	-	137	4	5	94	4	177	3	2	1,368
Southeastern US													
Brunswick, GA	33	-	11	-	14	1	5	112	-	2	-	-	178
Fernandina, FL	4	-	43	1	42	1	13	-	-	-	7	-	111
Jacksonville, FL	62	1	185	80	102	8	2	222	7	114	117	5	905
Port Canaveral, FL	40	-	6	8	37	223	26	15	3	10	8	1	377
All Port Regions	1,660	79	4,937	105	964	616	384	1,713	740	3,483	207	47	14,935

a/ Other includes fishing vessels, industrial vessels, research vessels, school ships.

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

Alternative 2: Direct Economic Impact on the
Shipping Industry by Port Area, 2003 and 2004 ($000s)



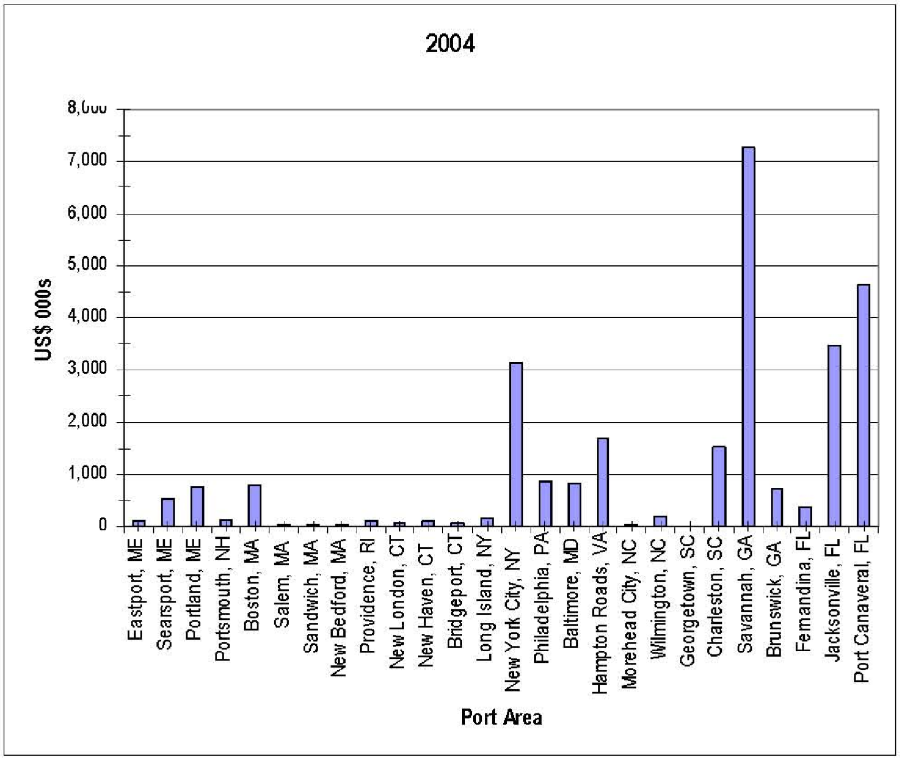


Figure 4-3

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Alternative 3: Proposed Speed Restrictions by Port Area

Source: NOAA

Figure 4-4

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In 2004, there were 15,815 vessel arrivals at US East Coast ports during the periods when speed restrictions are proposed for each port area, an increase of 5.9 percent over 2003 (Data Chart 4-4). The increase is less than the 7.3 percent for total US East Coast vessel arrivals in Chapter 3 (Section 3.4.1.4) for several reasons. First, the SEUS region, which recorded an increase of 12.3 percent in total vessel arrivals in 2004, is the region with the fewest speed-restricted days. Second, the port area of New York/New Jersey, with the largest number of annual vessel arrivals, recorded a growth of less than 0.4 percent in vessel arrivals during the proposed speed-restricted periods. Details on restricted-period US and foreign flag vessel arrivals by port area, vessel type, and vessel DWT size category are presented in Appendix E of the Economic Report.

Data Chart 4-5 presents the basis for determining the effective distance at which speed restrictions would apply for each port area. The locations of these areas are described in Section 2.2.3. The following paragraphs discuss the effective distance for the different port areas.

For port areas in the mid-Atlantic region, the speed restrictions would extend 25 nm (46 km) from the coast. However, independent researchers and stakeholders have indicated that due to vessel operating practices, the effective distance (i.e., the distance at which actual time delays would be incurred) may be less than distances specified in the operational measures. This is because at most port areas, vessels already slow down to approximately 8 to 10 knots at the pilot buoy for the pilot to board the vessel. In some instances, the proximity of the pilot buoys to the shore makes it impractical for the vessel to resume normal operating speed. Thus, the effective distance for speed restrictions, and the actual time delays, are lessened by the distance of the pilot buoy from the shore. The location of the pilot buoy relative to the harbor baseline or closing line is shown in Data Chart 4-5. For example, the pilot buoy for the port area of New York/New Jersey is 6.8 nm (12.6 km) from the harbor baseline. Thus, the distance from the edge of the speed-restricted area to the pilot buoy is only 18.2 nm (33.7 km).

It should be noted, however, that for the port area of New York/New Jersey and most other US East Coast port areas, vessels do not approach the port directly perpendicular to the coastline. Rather, mariners approaching from the north or south approach the port along the shortest possible track. For purposes of the economic impact analysis, it was assumed that vessels would travel through the speed-restricted areas on a typical 45-degree routing relative to the port entrance, until they reach the pilot buoy. Thus, for the port area of New York/New Jersey it is assumed that vessels would traverse 25.7 nm (47.6 km) through the speed-restricted area. This concept was applied to all port areas in the mid-Atlantic region.

Data Chart 4-5 indicates an additional effective distance of 54.9 nm (101.7 km) miles for the port area of New York/New Jersey. This is due to the year-round speed-restricted area – the combination of the expanded ALWTRP SAM West and SAM East zones – established in the NEUS region that some vessels would have to traverse either coming to the port area of New York/New Jersey from the north or departing to the north. It is estimated that vessels affected will need to traverse 54.9 nm (101.7 km) of speed-restricted area in the NEUS. This factor, though, only affects vessel arrivals into the port area of New York/New Jersey from the north or departures to north.

Data Chart 4-4
Alternative 3: US East Coast Restricted Vessel Arrivals by Port Area and Vessel Type, 2004

	Vessel Type												
Port Area	Bulk Carrier	Combination Carrier	Container Ship	Freight Barge	Dry Cargo Ship	Passenger Ship	Refrigerated Cargo Ship	Ro-Ro Cargo Ship	Tank Barge	Tanker	Towing Vessel	Other a/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	22	-	4	-	17	-	-	-	-	-	-	-	43
Searsport, ME	10	-	2	2	3	81	-	1	11	78	8	-	196
Portland, ME	71	4	4	1	28	26	-	37	26	395	47	2	641
Portsmouth, NH	51	3	1	-	16	1	-	-	1	87	9	4	173
Northeastern US - Off Race Point													
Salem, MA	9	-	-	-	-	6	-	-	-	-	-	-	15
Boston, MA	34	1	77	2	8	94	4	33	-	225	1	4	483
Northeastern US - Cape Cod Bay													
Cape Cod, MA	-	-	-	-	-	13	-	-	1	21	1	-	36
Mid-Atlantic Block Island Sound													
New Bedford, MA	31	-	-	-	14	-	4	1	-	6	-	-	56
Providence, RI	45	1	-	-	14	25	-	42	1	68	5	2	203
New London, CT	8	-	5	-	14	17	-	-	39	7	1	-	91
New Haven, CT	21	-	3	-	19	-	-	-	286	94	17	-	440
Bridgeport, CT	35	-	-	1	2	-	17	-	178	28	-	1	262
Long Island, NY	-	-	-	5	-	23	-	-	379	157	-	1	565
Mid-Atlantic Ports of New York/New Jersey													
New York City, NY	199	14	1,436	-	49	95	16	404	9	868	20	4	3,114
Mid-Atlantic Delaware Bay													
Philadelphia, PA	200	2	261	13	171	12	242	86	3	547	35	2	1,574
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	223	5	229	-	121	38	4	386	2	160	10	7	1,185
Hampton Roads, VA	254	13	986	3	93	37	5	90	1	133	12	11	1,638
Mid-Atlantic Morehead City and Beaufort, NC													
Morehead City, NC	23	1	9	-	13	4	-	-	-	32	-	1	83
Mid-Atlantic Wilmington, NC													
Wilmington, NC	67	3	48	-	73	4	-	17	9	152	2	2	377
Mid-Atlantic Georgetown, SC													
Georgetown, SC	26	2	2	-	12	1	-	-	-	-	-	-	43
Mid-Atlantic Charleston, SC													
Charleston, SC	84	1	949	2	66	51	3	128	4	117	19	6	1,430
Mid-Atlantic Savannah, GA													
Savannah, GA	174	8	760	-	124	35	10	107	1	206	5	1	1,431
Southeastern US													
Brunswick, GA	33	-	7	-	23	4	5	113	-	-	-	3	188
Fernandina, FL	12	-	30	2	50	6	6	1	-	-	11	-	118
Jacksonville, FL	66	2	204	74	91	43	2	231	9	120	154	14	1,010
Port Canaveral, FL	54		7	10	46	224	17	21	2	14	23	2	420
All Port Regions	1,752	60	5,024	115	1,067	840	335	1,698	962	3,515	380	67	15,815

a/ Other includes fishing vessels, industrial vessels, research vessels, school ships.

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

Data Chart 4-5
Alternative 3: Effective Distance of Speed Restrictions in Designated Areas

Port Area	Location of pilot buoy relative to harbor baseline or closing line	Distance Stated in NOI	Distance to pilot buoy	Diagonal of distance to pilot buoy	Additional effective distance a/	Slow down/speed up time
Northeastern US - Gulf of Maine						
Eastport, ME	n.a.	n.a.	n.a.	n.a.	54.9	Included
Searsport, ME	n.a.	n.a.	n.a.	n.a.	54.9	Included
Portland, ME	n.a.	n.a.	n.a.	n.a.	54.9	Included
Portsmouth, NH	n.a.	n.a.	n.a.	n.a.	54.9	Included
Northeastern US - Off Race Point						
Boston, MA	n.a.	n.a.	n.a.	n.a.	72.4	n.a.
Salem, MA	n.a.	n.a.	n.a.	n.a.	72.4	n.a.
Northeastern US - Cape Cod Bay	5.0	n.a.	n.a.	n.a.	59.2	n.a.
Mid-Atlantic Block Island Sound						
New Bedford, MA	n.a.	25	25	35.4	54.9	Included
Providence, RI	n.a.	25	25	35.4	54.9	Included
New London, CT	n.a.	25	25	35.4	54.9	Included
New Haven, CT	n.a.	25	25	35.4	54.9	Included
Bridgeport, CT	n.a.	25	25	35.4	54.9	Included
Long Island, NY	n.a.	25	25	35.4	54.9	Included
Mid-Atlantic Ports of New York/New Jersey	6.8	25	18.2	25.7	54.9	Included
Mid-Atlantic Delaware Bay	2.5	25	22.5	31.8	54.9	Included
Mid-Atlantic Chesapeake Bay						
Baltimore, MD	2.8	25	22.2	31.3	54.9	Included
Hampton Roads, VA	2.8	25	22.2	31.3	54.9	Included
Mid-Atlantic Morehead City and Beaufort, NC	6.7	25	18.3	25.9	n.a.	n.a.
Mid-Atlantic Wilmington, NC	4.1	25	20.9	29.6	n.a.	n.a.
Mid-Atlantic Georgetown, SC	5.6	25	19.4	27.4	n.a.	n.a.
Mid-Atlantic Charleston, SC	12.5	25	12.5	17.7	6.3	n.a.
Mid-Atlantic Savannah, GA	9.7	25	15.3	21.6	4.9	n.a.
Southeastern US						
Brunswick, GA	6.7	n.a.	n.a.	26.4	3.4	n.a.
Fernandina, FL	10.9	n.a.	n.a.	32.9	5.5	n.a.
Jacksonville, FL	4.2	n.a.	n.a.	30.9	n.a.	n.a.
Port Canaveral, FL	n.a.	n.a.	n.a.	4.5	n.a.	n.a.

a/ Defined and described in text for each port area.
Source: Nathan Associates as descibed in text.

Data on the actual number of vessel arrivals at the port area of New York/New Jersey by direction of approach and departure were not available for this study. These data would allow the economic analysis to evaluate the impacts on the actual percentage of vessels arriving from the north or departing to the north from the port of New York/New Jersey. Therefore, pursuant to Section 1502.22 of CEQ regulations, in the absence of complete data (these fields in the USCG vessel arrival database were incomplete), the economic analysis provides an estimate of the number of arrivals and departures from/to the north based on general knowledge of shipping patterns in the area and of movements along the US East Coast. For example, on some liner container trades, the port area of New York/New Jersey is the end of a northern string for routes that serve the Far East and the US East Coast via the Panama Canal. Once these vessels unload/load at the port area of New York/New Jersey, they depart to the south for the return trip. On the other hand, most liner vessels that call at the port area of New York/New Jersey from Europe arrive from the north and depart to the south for calls at other US East Cost ports before heading back. Based on these types of routing considerations, this analysis assumes that the measures would affect 30 percent of vessel arrivals in the port area of New York/New Jersey.[15]

The mid-Atlantic port areas of Philadelphia, Baltimore and Hampton Roads have been assumed to be equally affected by the year-round speed-restricted area established in the NEUS. Port areas south of Hampton Roads are assumed to be unaffected by this area, as vessels normally travel to the east of the SAMs in the NEUS.

Port areas in Block Island Sound are assumed to have 40 percent of their vessel arrivals affected by the SAMs in the NEUS.[16]

As discussed with respect to Alternative 2 (Section 4.4.1.2), another factor is the time for vessels to slow down from sea speed to restricted speed and later to return to sea speed. This would affect vessel arrivals at the port area of New York/New Jersey that would traverse the year-round speed-restricted area in the NEUS. Extra time has been included in the economic impact analysis for these vessels to slow down to restricted speed and to resume sea speed.

The additional distance shown in Data Chart 4-5 for the mid-Atlantic port areas of Charleston and Savannah was calculated as half of the distance of the pilot buoy to the harbor baseline. Pilots at these ports have indicated that without speed restrictions vessels would regain some speed (not sea speed) prior to entering the harbor baseline. Applying the speed restriction to more than half of this distance should approximate the extra delay incurred from the pilot buoy to the harbor baseline at these port areas.

[15] The determination of 30 percent is based on the following assumptions: 45 percent of vessels arrive from the south and depart to the south (no trips through the northeast speed-restricted area); 40 percent arrive from the north and depart to the south (one trip through the northeast speed-restricted area), 10 percent arrive from the south and depart to the north (one trip through the northeast speed-restricted area), and 5 percent arrive from the north and depart to the north (two trips through the northeast speed-restricted area). This results in a total factor of 60 percent, which is divided by two to account for vessel arrivals only. Later in the economic impact analysis the estimated impact on vessel arrivals is doubled to account for the impact on vessel departures.

[16] This assumption is premised on consideration of maritime shipping patterns similar to the discussion above for the port area of New York/New Jersey. The determination of 40 percent is based on the following assumptions: 45 percent of vessels arrive from the north and depart to the south (one trip through the northeast speed-restricted area); 30 percent arrive from the south and depart to the south (no trips through the northeast speed-restricted area), 15 percent arrive from the north and depart to the south (one trip through the northeast speed-restricted area), and 10 percent arrive from the north and depart to the north (two trips through the northeast speed-restricted area). This results in a total factor of 80 percent, which is cut in half to apply to vessel arrivals only.

For port areas in the NEUS region, year-round speed reductions are proposed within the expanded ALWTRP SAM zones, which have the same boundaries as the Off Race Point and Great South Channel SMAs. With the exception of Cape Cod Bay, vessels arriving at port areas in the NEUS region from the north would not be affected by the SAM zones. Primarily, the portion of the restricted area referred to as expanded SAM West zone would affect vessels arriving from the south. It is assumed that vessels arriving from the south and destined for Northeast port areas will attempt to minimize the impact of the speed restrictions by entering the existing Boston TSS at a point east of the southern tip of Cape Cod. From there, vessels will route at restricted speeds through the TSS (65 nm [120.4 km]). Vessels destined for Boston may regain some speed (but not sea speed) from the western end of the restricted area to the Boston pilot buoy (15 nm [27.8 km]). Similar to the treatment of Charleston and Savannah, it is assumed that applying speed restrictions to half of this distance should approximate the extra delay incurred by the vessel. Vessels arriving from the south and destined for Gulf of Maine ports will need to route 54.9 nm (101.7 km) through the SAM West area. These vessels will also be affected by the time to slow down prior to entering and upon leaving the SAM West area.

For Alternative 3, the effective distance of speed restrictions for port areas in the Southeast was determined by identifying typical access routes for each port and the distance from the intersection of those routes with the eastern edge of the MSRS WHALESSOUTH area to each port’s pilot buoy. For the port area of Brunswick, two routes were considered typical (as these routes were generally utilized prior to the establishment of the recommended routes) – one to the northeast of 21.8 nm (40.4 km) and one to the southeast of 28.4 nm (52.6 km). The southeast route was assumed to account for 70 percent of vessel traffic, resulting in a weighted average distance of 26.4 nm (49 km). An additional effective distance of 3.4 nm (6.3 km) was assumed to account for vessels not returning to sea speed over the 6.7 nm (12.4 km) from the pilot buoy to the coastline.

Two routes were typically used for the port area of Fernandina – a northeast route of 39.5 nm (73.1 km) and a southeast route of 26.3 nm (48.7 km). Traffic was assumed to be equally divided between the two routes, for an average distance of 32.9 nm (61 km). An additional effective distance of 5.5 nm (10.2 km) was assumed to account for vessels not returning to sea speed over the 10.9 nm (20.2 km) from the pilot buoy to the coastline. Three routes were typically used for the port area of Jacksonville – a northeast route of 39.4 nm (73 km) (10 percent of vessels), an easterly route of 26.3 nm (48.7 km) (30 percent), and a southeast route of 31.7 nm (58.7 km) (60 percent). The weighted average distance is 30.9 nm (57.2 km). For the port area of Port Canaveral, vessels utilized a single route of 4.5 nm (8.3 km) that passed through the right whale critical habitat area.

Data Chart 4-6
Alternative 3: Average Minutes of Delay per Vessel Arrival by Port Area and Type of Vessel, 2003

Port Area	Bulk Carriers	Combination Carriers	Containerships	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Weighted Average
Northeastern US - Gulf of Maine													
Eastport, ME	44.9	-	112.0	-	85.2	-	-	-	-	-	-	-	72.4
Searsport, ME	40.3	63.4	-	-	-	94.8	-	50.6	61.1	65.5	37.0	-	72.7
Portland, ME	48.7	64.6	110.2	84.5	78.2	97.4	-	57.3	59.8	68.9	37.0	37.0	66.8
Portsmouth, NH	52.2	55.3	-	-	85.8	83.3	-	-	62.3	66.5	37.0	37.0	62.4
Northeastern US - Off Race Point													
Boston, MA	63.6	67.7	149.0	68.4	85.1	110.0	107.9	78.2	-	85.0	48.9	48.9	97.8
Salem, MA	75.0	-	-	-	-	110.0	-	-	-	92.6	-	-	80.9
Northeastern US - Cape Cod Bay	-	-	-	-	-	93.5	-	-	-	75.4	-	-	82.8
Mid-Atlantic Block Island Sound													
New Bedford, MA	85.4	-	78.4	-	107.9	-	126.6	-	86.4	98.0	-	-	94.8
Providence, RI	79.9	100.1	-	-	122.5	149.2	133.0	150.6	84.3	103.4	57.4	57.4	112.5
New London, CT	79.7	-	185.3	-	146.1	129.0	-	-	91.4	102.2	57.4	-	102.8
New Haven, CT	78.5	-	188.7	58.5	136.3	129.0	-	-	93.8	100.8	57.4	-	95.8
Bridgeport, CT	92.4	-	-	43.1	-	108.7	-	-	75.9	75.4	-	-	63.7
Long Island, NY	-	100.1	-	58.5	-	129.0	-	-	91.7	98.3	57.4	57.4	94.7
Mid-Atlantic Ports of New York/New Jersey	59.1	71.8	134.1	75.1	80.5	111.5	118.0	116.4	66.9	77.1	42.2	42.2	106.9
Mid-Atlantic Delaware Bay	62.8	84.3	129.3	102.2	100.0	120.8	122.2	124.5	79.9	92.1	48.3	48.3	102.7
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	69.0	77.7	149.0	-	107.8	124.8	116.3	132.9	78.9	87.4	47.8	47.8	115.5
Hampton Roads, VA	69.3	83.4	152.1	85.0	103.2	127.5	121.7	144.6	80.5	88.0	47.8	47.8	132.1
Mid-Atlantic Morehead City and Beaufort, NC	32.5	-	73.7	-	49.2	-	35.4	68.5	-	46.5	-	25.9	47.7
Mid-Atlantic Wilmington, NC	37.2	46.6	92.1	-	66.1	-	65.2	90.1	49.9	52.5	29.6	-	59.4
Mid-Atlantic Georgetown, SC	36.1	-	82.5	-	74.8	-	-	-	-	-	-	27.4	44.0
Mid-Atlantic Charleston, SC	32.1	-	77.2	-	58.0	59.4	55.5	66.8	41.9	43.9	23.9	23.9	67.7
Mid-Atlantic Savannah, GA	32.5	39.3	84.6	-	55.6	62.4	89.0	73.8	43.6	47.9	26.5	26.5	69.3
Southeastern US													
Brunswick, GA	33.9	-	94.2	-	67.6	66.9	73.7	81.3	-	53.7	-	-	71.6
Fernandina, FL	62.6	-	84.5	39.1	69.2	86.3	97.6	-	-	-	38.4	-	76.2
Jacksonville, FL	43.9	47.0	82.6	64.6	54.2	74.4	73.4	82.9	54.5	56.5	30.9	30.9	64.6
Port Canaveral, FL	4.8	-	14.3	4.6	9.0	11.8	10.1	10.8	7.9	8.3	4.5	4.5	10.2
Total	55.0	69.6	117.4	61.9	77.3	72.5	101.2	106.2	84.8	76.5	34.1	40.9	91.1

a/ Includes recreational vessels

b/ Includes fishing vessels, industrial vessels, research vessels, and school ships.

Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in text.

Using the economic impact model, the minutes of delay incurred in each port area were identified, taking into account the distribution of vessel arrivals, normal vessel operating speeds, and the effective distance over which the restriction would apply. Data Chart 4-6 and Figure 4-5 present the average minutes of delay for a speed restriction of 10 knots per vessel arrival for each affected port area and vessel type in 2003.[17] The overall weighted average delay for all vessels in 2003 is 91 minutes per arrival.[18]

The longest average delay is experienced at the port area of Hampton Roads, with an average delay of 132 minutes per arrival. This is due to the predominance of large and fast containerships at the port area coupled with the relatively few arrivals of smaller and slower vessel types. The port areas of Baltimore (116 minutes), Providence (113 minutes), New York/New Jersey (107 minutes), Delaware Bay (103 minutes), and New London (103 minutes) are the other port areas with average delays in excess of 100 minutes. The port area of Port Canaveral, at 10 minutes, has the shortest average delay per vessel arrival, as the speed restriction would only be effective for 4.5 nm (8.3 km) from the eastern edge of the right whale critical habitat to the pilot buoy.

Containerships incur the longest average delay, with an average of 118 minutes per vessel arrival followed by ro-ro cargo ships (108 minutes), and refrigerated cargo vessels (102 minutes).

Alternative 3 would not have adverse, direct effects on port operations because all of the speed restrictions in designated areas would be in place over a fixed time period. Therefore, mariners would be able to schedule their arrival time at port ahead of time, based on whether or not restrictions are in place for a particular port region. This would require advanced schedule planning; the rulemaking process would allow sufficient time for schedule revisions prior to implementation in order to avoid delays in arriving at a port.

Direct Economic Impacts of Alternative 3

Data Chart 4-7 presents the estimated annual direct economic impact on the shipping industry of Alternative 3 with a 10-knot speed restriction based on 2003 conditions. The total direct economic impact is estimated at $133.0 million annually, with the largest impact on the port area of New York/New Jersey, at $36.6 million. The impact on the port area of Hampton Roads is second, at $24.5 million, followed by the port areas of Philadelphia at $13.5 million, Baltimore at $11.0 million, Savannah at $10.2 million, Charleston at $9.9 million, Boston at $4.2 million, Jacksonville at $3.6 million, and Portland at $3.4 million. The direct economic impact for these nine port areas totals $117.0 million, or 87.9 percent of the total for this alternative.

Containerships account for 54.1 percent of the total direct economic impact of Alternative 3, with an estimated $71.9 million. The next largest economic impact by vessel type is tankers, at $16.4 million, followed by ro-ro cargo ships, at $14.7 million, and passenger vessels, at $10.9 million.

Data Chart 4-8 presents the annual direct economic impact of a 10-knot speed restriction for Alternative 3 based on 2004 conditions.

[17] The average delay includes slowdown/speedup time for port areas in the Gulf of Maine divided by the number of vessel arrivals by type of vessel for each port area during proposed speed-restriction periods. It does not include slowdown/speedup time for port areas in the mid-Atlantic, as those delays would need to be divided into annual vessel arrivals at each port.

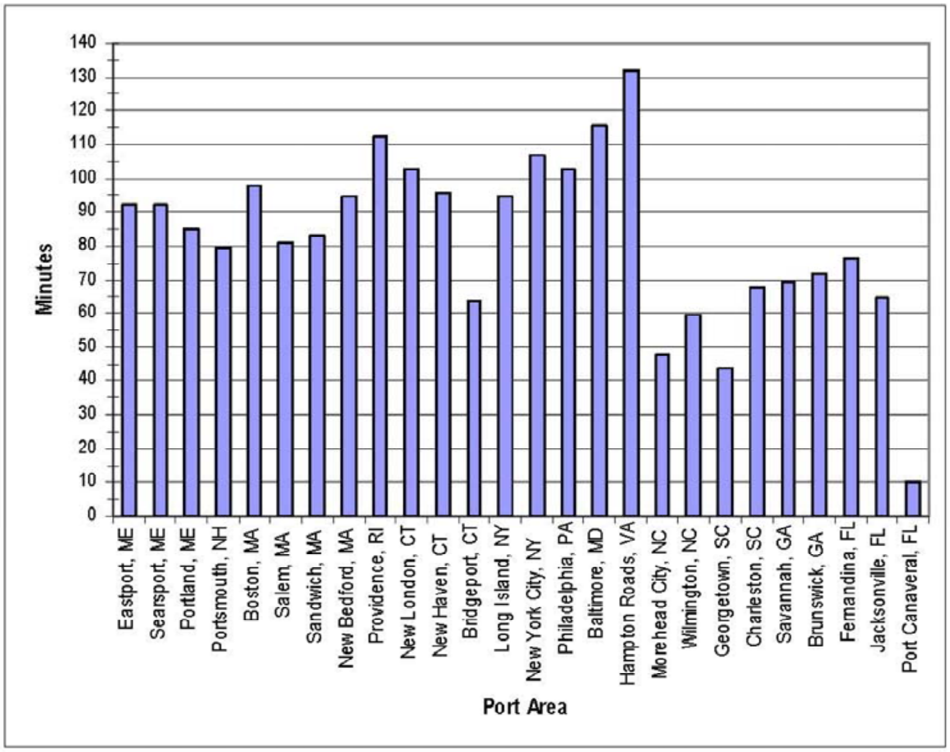
[18] As will be discussed later, vessels are assumed to incur similar delays when leaving each port area.

Data Chart 4-7
Alternative 3: Direct Economic Impact on the Shipping Industry by Port Area and Type of Vessel, 2003 ($000s)

Port Area	Bulk Carriers	Combination Carriers	Containerships	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	39.3	-	68.4	-	154.6	-	-	-	-	-	-	-	262.3
Searsport, ME	30.7	4.2	-	-	-	1,891.2	-	2.7	81.2	363.4	4.1	-	2,377.5
Portland, ME	182.6	77.4	98.3	4.6	201.1	607.7	-	194.5	20.6	2,035.3	22.8	2.4	3,447.2
Portsmouth, NH	191.3	10.4	-	-	76.1	18.2	-	-	7.3	496.3	2.1	2.4	804.1
Northeastern US - Off Race Point													
Boston, MA	97.6	3.2	1,214.7	3.6	32.5	1,780.2	41.8	119.9	-	944.1	2.2	4.5	4,244.4
Salem, MA	25.2	-	-	-	-	18.9	-	-	-	5.2	-	-	49.4
Northeastern US - Cape Cod Bay	-	-	-	-	-	161.8	-	-	-	54.7	-	-	216.5
Mid-Atlantic Block Island Sound													
New Bedford, MA	166.5	-	3.4	-	74.7	-	69.1	-	17.3	36.0	-	-	366.9
Providence, RI	202.2	6.5	-	-	77.5	581.1	45.7	434.0	4.2	439.6	2.9	1.5	1,795.2
New London, CT	49.3	-	44.2	-	60.6	500.9	-	-	218.9	28.8	2.9	-	905.4
New Haven, CT	152.7	-	25.3	1.5	189.2	50.1	-	-	731.3	623.0	28.5	-	1,801.7
Bridgeport, CT	90.2	-	-	2.3	-	20.9	-	-	413.3	120.7	-	-	647.4
Long Island, NY	-	6.5	-	3.1	-	475.8	-	-	1,485.2	872.6	5.7	1.8	2,850.6
Mid-Atlantic Ports of New York/New Jersey	646.2	89.2	24,866.6	2.4	138.4	1,775.4	303.5	4,221.3	85.1	4,441.1	23.2	4.4	36,596.9
Mid-Atlantic Delaware Bay	649.8	41.5	3,257.1	26.4	651.4	503.6	4,450.6	692.5	44.9	3,200.2	28.5	1.3	13,547.8
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	705.8	28.7	3,648.1	-	768.5	743.9	41.3	4,413.0	8.0	641.9	11.8	23.9	11,034.9
Hampton Roads, VA	743.4	77.9	20,353.1	2.7	476.4	557.6	14.9	1,588.6	4.1	662.0	4.7	14.6	24,500.1
Mid-Atlantic Morehead City and Beaufort, NC	21.6	-	57.9	-	51.1	-	3.0	7.9	-	50.5	-	1.2	193.2
Mid-Atlantic Wilmington, NC	109.5	9.7	550.9	-	386.6	-	6.3	111.7	29.9	372.3	1.3	-	1,578.3
Mid-Atlantic Georgetown, SC	42.0	-	5.9	-	49.5	-	-	-	-	-	-	0.8	98.2
Mid-Atlantic Charleston, SC	147.3	-	8,095.7	-	288.0	375.6	16.9	641.2	25.8	268.3	12.7	1.1	9,872.6
Mid-Atlantic Savannah, GA	235.5	13.6	8,190.7	-	513.5	48.6	144.0	564.2	7.9	428.6	3.5	1.2	10,151.3
Southeastern US													
Brunswick, GA	48.6	-	98.3	-	68.1	11.5	39.6	576.8	-	5.3	-	-	848.3
Fernandina, FL	12.2	-	165.5	0.9	186.2	14.9	139.4	-	-	-	11.8	-	530.9
Jacksonville, FL	127.8	2.4	1,141.6	193.1	320.4	122.1	15.2	1,124.4	18.3	332.4	159.5	3.6	3,560.7
Port Canaveral, FL	8.2	-	8.4	0.9	18.5	650.1	25.9	9.0	1.1	4.4	1.6	0.1	728.0
Total	4,725.6	371.0	71,894.0	241.5	4,783.0	10,910.1	5,357.4	14,701.5	3,204.3	16,426.8	329.7	64.9	133,009.9

a/ Includes recreational vessels.
b/ Includes fishing vessels, industrial vessels, research vessels, and school ships.
Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in text.

Alternative 3: Average Minutes of Delay per Vessel Arrival by Port Area and Type of Vessel, 2003



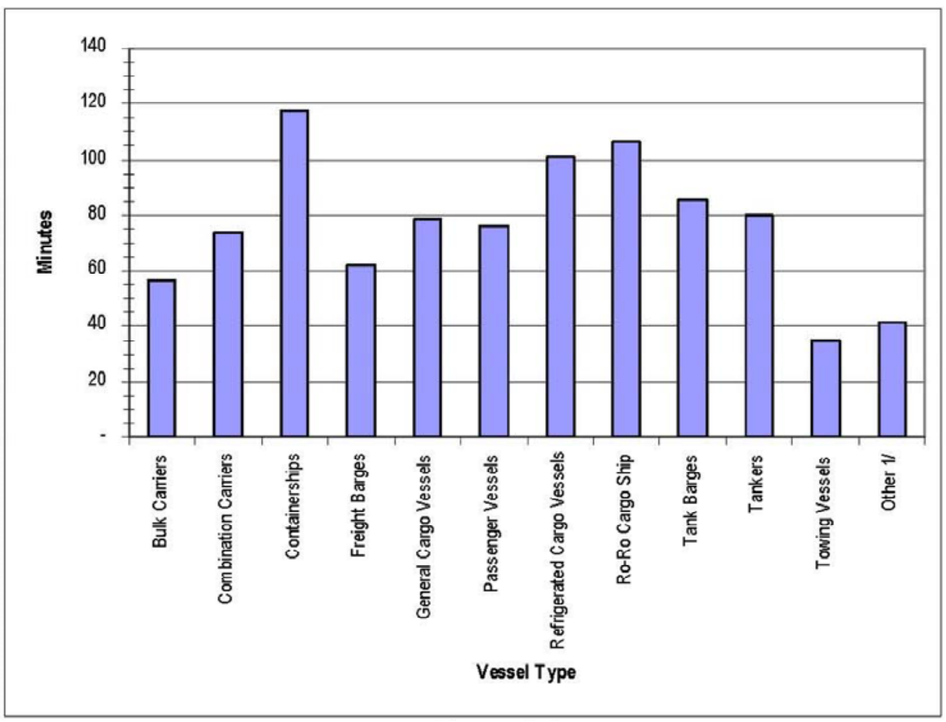


Figure 4-5

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Data Chart 4-8
Alternative 3: Direct Economic Impact on the Shipping Industry by Port Area and Type of Vessel, 2004 ($000s)

Port Area	Bulk Carriers	Combination Carriers	Containerships	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	54.0	-	68.6	-	321.4	-	-	-	-	-	-	-	444.0
Searsport, ME	20.8	-	55.3	4.5	8.2	2,159.9	-	4.9	39.6	337.3	16.6	-	2,647.1
Portland, ME	196.1	22.2	54.3	4.6	206.1	852.5	-	133.4	93.2	2,123.5	97.4	2.2	3,785.5
Portsmouth, NH	153.9	9.3	2.4	-	122.1	18.2	-	-	3.6	370.1	18.7	5.3	703.7
Northeastern US - Off Race Point													
Boston, MA	97.6	3.2	1,214.7	3.6	32.5	1,780.2	41.8	119.9	-	944.1	2.2	4.5	4,244.4
Salem, MA	31.8	-	-	-	-	155.4	-	-	-	-	-	-	187.2
Northeastern US - Cape Cod Bay	-	-	-	-	-	314.4	-	-	3.1	86.2	1.8	-	405.5
Mid-Atlantic Block Island Sound													
New Bedford, MA	145.1	-	-	-	46.3	-	55.3	6.8	-	31.3	-	-	284.7
Providence, RI	170.7	6.8	-	-	103.3	939.9	-	410.0	5.0	407.3	14.3	5.5	2,062.8
New London, CT	32.2	-	109.8	-	235.0	444.2	-	-	186.4	39.7	2.9	-	1,050.2
New Haven, CT	86.9	-	49.7	-	155.4	-	-	-	1,381.0	537.6	48.5	-	2,259.1
Bridgeport, CT	157.2	-	-	1.1	-	-	-	-	668.4	100.2	-	0.6	927.5
Long Island, NY	-	-	-	7.7	-	576.0	-	-	1,791.1	886.8	-	1.5	3,263.1
Mid-Atlantic Ports of New York/New Jersey	579.5	60.2	25,641.7	-	399.4	3,501.7	301.8	4,439.0	31.2	4,138.4	42.2	4.4	39,139.5
Mid-Atlantic Delaware Bay	642.0	9.9	3,006.5	60.4	940.7	296.6	4,216.7	702.1	13.5	3,495.3	83.2	2.8	13,469.7
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	844.1	24.8	3,883.8	-	974.0	1,196.5	78.0	4,384.6	8.2	893.0	23.6	11.3	12,321.9
Hampton Roads, VA	971.0	64.6	19,812.9	9.3	675.4	1,222.2	129.2	1,591.5	4.1	735.4	28.3	14.8	25,258.7
Mid-Atlantic Morehead City and Beaufort, NC	39.3	1.7	61.8	-	41.5	40.1	-	-	-	72.4	-	0.6	257.4
Mid-Atlantic Wilmington, NC	108.0	5.5	487.1	-	413.3	45.8	-	150.9	20.2	402.8	2.6	3.0	1,639.1
Mid-Atlantic Georgetown, SC	39.1	2.8	5.2	-	75.0	10.6	-	-	-	-	-	-	132.7
Mid-Atlantic Charleston, SC	138.8	0.8	8,469.2	4.7	330.1	554.7	29.8	592.6	8.0	266.6	20.1	3.6	10,418.9
Mid-Atlantic Savannah, GA	248.7	15.1	8,388.1	-	578.0	366.6	216.9	665.5	2.6	516.3	5.8	0.6	11,004.1
Southeastern US													
Brunswick, GA	48.0	-	50.3	-	120.8	46.1	41.5	606.6	-	-	-	2.5	915.9
Fernandina, FL	22.9	-	132.8	3.9	186.0	89.1	59.3	20.4	-	-	18.6	-	533.0
Jacksonville, FL	140.9	4.7	1,197.6	166.2	311.8	708.0	17.3	1,173.3	23.6	354.4	209.9	10.0	4,317.9
Port Canaveral, FL	13.1	-	10.7	1.1	27.5	708.0	16.3	14.5	0.8	6.4	4.6	0.2	803.2
Total	4,981.8	231.6	72,702.5	267.0	6,303.9	16,026.7	5,204.0	15,016.0	4,283.6	16,745.2	641.0	73.6	142,476.8

a/ Includes recreational vessels

b/ Includes fishing vessels, industrial vessels, research vessels, and school ships.

Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in text.

The total economic impact is $142.5 million annually based on 2004 data, roughly 7.1 percent higher than for 2003, which reflects the overall increase in US East Coast vessel arrivals. The rankings for the major vessel types are similar to those for 2003. The rankings for the leading port areas in 2004 are similar to those as described for 2003 above except that Jacksonville has moved ahead of Boston. Figure 4-6 presents the impacts graphically.

The annual direct economic impact of Alternative 3 (2004 data) at 12 knots would be $89.2 million, and, at 14 knots, $52.5 million. See Data Chart 4-22 for the economic impacts of 10, 12, and 14 knots for Alternative 3 by port area.

4.4.1.4 Alternative 4 – Recommended Shipping Routes

The implementation of Alternative 4 would have direct, long-term, adverse economic impacts on the shipping industry. Based on shipping industry activity in 2003, direct economic impacts would have totaled an estimated $2.3 million annually. The impact would have increased slightly in 2004, to $2.8 million. The impacts for Alternative 4 would be the same for 10, 12, and 14 knots, as no speed restrictions are included. This alternative would have the lowest economic impact of all the proposed alternatives.

The recommended routes and other operational measures included in Alternative 4 are described in Section 2.2.4. Figure 2-2 depicts the recommended routes in the SEUS, and Figure 2-14 depicts the routes in Cape Cod Bay. In general, Alternative 4 alters current vessel routing patterns to direct vessels away from areas where whales are known to aggregate.

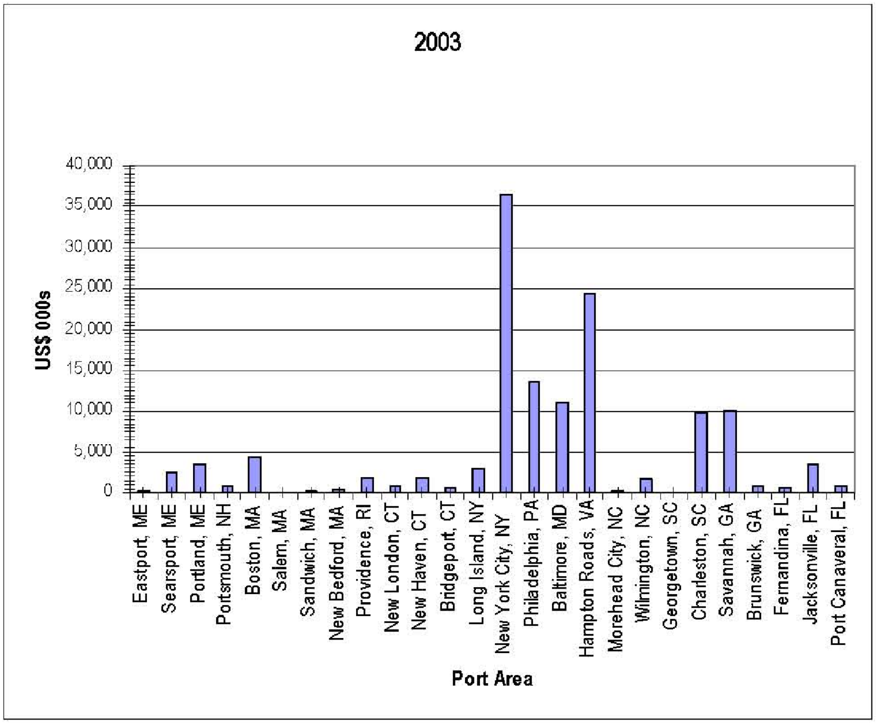
Section 4.4.1.3 summarizes existing vessel approach patterns for each port area. Because vessels arriving at these ports generally approach from the south or north, the approaches to the pilot buoys are approximately 40-65 degrees and 135-160 degrees from a line parallel to the coastline. Under Alternative 4, the preferred northeast and southeast access routes to each port are more level. Vessels are assumed to have to route parallel to the eastern boundary of the MSRS WHALESSOUTH until the intersection with the recommended route. The difference in the total distance between the current route and the use of the recommended route is then divided by the average operating speed of each type and size of vessel to determine the additional time associated with the use of the recommended shipping route. The economic impact is estimated by multiplying the additional time by the hourly operating cost for each type and size of vessel.

For the port area of Brunswick, the weighted-average additional distance from using the recommended access route is 6 nm (11 km); for the port area of Fernandina it is 10.5 nm (19.5 km); and for the port area of Jacksonville it is 10 nm (18.5 km).

The recommended shipping routes for Cape Cod Bay would not measurably affect shipping industry vessel operations because the recommended routes are not different from existing north-south shipping routes via the Cape Cod Canal to Boston. The economic impact of the recommended shipping routes for Cape Cod Bay on passenger and other vessels, particularly to Provincetown, is addressed later in the FEIS.

Alternative 4 would not have adverse effects on port operations because the exact location of the recommended routes are reflected in nautical charts that would be utilized during voyage planning. The recommended routes have already been established and are in effect year-round. Therefore, while these measures may add miles to a vessels' route, the restrictions would be known well ahead of time to allow for incorporation into vessel schedules and transit routes.

Alternative 3: Direct Economic Impact on the
Shipping Industry by Port Area, 2003 and 2004 ($000s)



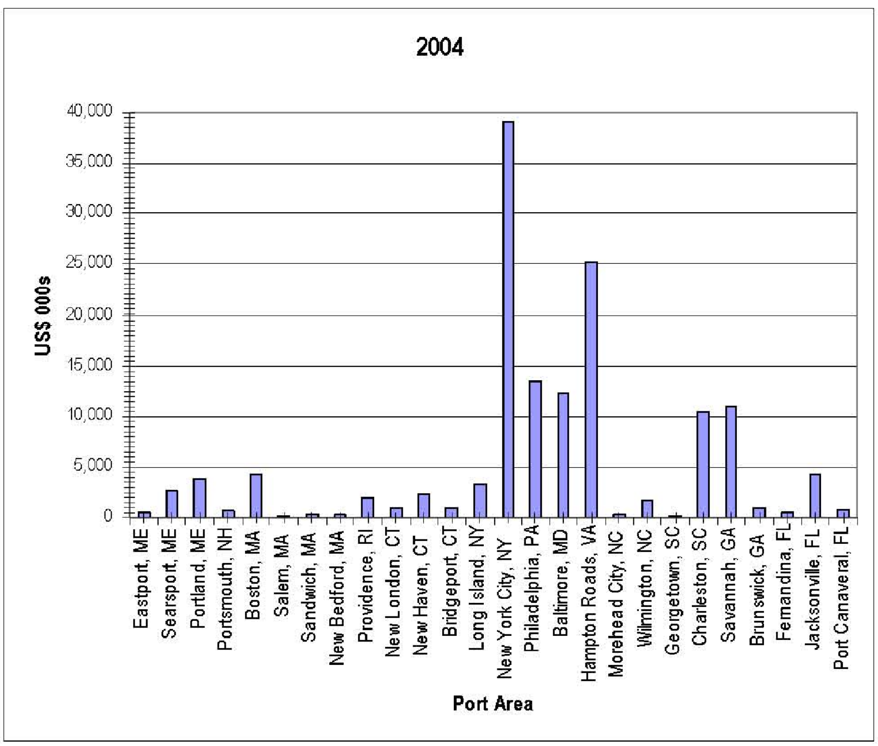


Figure 4-6

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Direct Economic Impacts of Alternative 4

Data Chart 4-9 presents the annual direct economic impact of Alternative 4 on the shipping industry based on 2003 conditions. For the Southeast port areas of Brunswick, Fernandina, and Jacksonville, the economic analysis assumed that all vessels would use the recommended routes between November 15 and April 15, when whales are present. The economic analysis also assumed that outside these dates, vessel operators would choose to sail via the most direct and economical access route to each port. The total direct economic impact of Alternative 4 is estimated at $2.3 million annually, with the port area of Jacksonville having the largest impact, at $1.9 million. The other port areas affected under this alternative – Brunswick and Fernandina – each had an economic impact of under $250,000.

Ro-ro cargo ships and containerships would have the highest direct economic impact, at approximately $0.6 million and $0.5 million, respectively, followed by towing vessels, general cargo vessels, and tankers, at roughly $0.3 million each.

Data Chart 4-10 presents the annual direct economic impact of Alternative 4 for 2004 conditions. The impact is estimated at $2.8 million, representing a 20-percent increase over 2003. This is due to the overall increase in vessel arrivals in the SEUS region and particularly in passenger vessels at Jacksonville. The ranking by port area is the same as described for 2003.

4.4.1.5 Alternative 5 – Combination of Alternatives

Implementation of Alternative 5 would have direct, long-term, adverse economic impacts on the shipping industry. These impacts would have totaled an estimated $137.0 million annually based on 2003 conditions and $147.2 million annually based on 2004 conditions.

Impact on Vessel Operations

Data Chart 4-11 presents the key assumptions used to analyze the impact of Alternative 5 on vessel operations. As Alternative 5 combines the measures included in alternatives 2, 3, and 4, some of these assumptions are discussed in the impacts section for these alternatives; the remaining assumptions are described in the following paragraphs. The data chart presents the basis for determining the effective distance at which speed restrictions would apply for each port area in a way that is similar to that previously done for Alternative 3. The diagonal distances to the buoy for the port areas of Brunswick, Fernandina, and Jacksonville differ from those of Alternative 3, however, because of the inclusion of the Alternative 4 recommended shipping routes, which reduces the distance traveled through the speed-restricted WHALESSOUTH reporting area of the MSRS. The speed restrictions were applied to the calculated distances to determine the additional time incurred by vessels.

The other new element for the three southeast port areas is the additional distance traveled parallel to the eastern boundary of the WHALESSOUTH area of the MSRS to the intersection with the recommended shipping routes, which generally have an east-west heading. In other words, vessels may transit longer distances to enter a recommended route. These distances are shown in Data Chart 4-11 as “Extra PARS”, which refers to the recommended routes. Speed restrictions do not apply to these distances and the additional time incurred is calculated using the average operating speed for each type and size of vessel.

Data Chart 4-9
Alternative 4: Direct Economic Impact on the Shipping Industry by Port Area and Type of Vessel, 2003 ($000s)

Port Area	Bulk Carriers	Combination Carriers	Containerships	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	-	-	-	-	-	-	-	-	-	-	-	-	-
Searsport, ME	-	-	-	-	-	-	-	-	-	-	-	-	-
Portland, ME	-	-	-	-	-	-	-	-	-	-	-	-	-
Portsmouth, NH	-	-	-	-	-	-	-	-	-	-	-	-	-
Northeastern US - Off Race Point													
Boston, MA	-	-	-	-	-	-	-	-	-	-	-	-	-
Salem, MA	-	-	-	-	-	-	-	-	-	-	-	-	-
Northeastern US - Cape Cod Bay	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Block Island Sound													
New Bedford, MA	-	-	-	-	-	-	-	-	-	-	-	-	-
Providence, RI	-	-	-	-	-	-	-	-	-	-	-	-	-
New London, CT	-	-	-	-	-	-	-	-	-	-	-	-	-
New Haven, CT	-	-	-	-	-	-	-	-	-	-	-	-	-
Bridgeport, CT	-	-	-	-	-	-	-	-	-	-	-	-	-
Long Island, NY	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Ports of New York/New Jersey	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Delaware Bay	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	-	-	-	-	-	-	-	-	-	-	-	-	-
Hampton Roads, VA	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Morehead City and Beaufort, NC	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Wilmington, NC	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Georgetown, SC	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Charleston, SC	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Savannah, GA	-	-	-	-	-	-	-	-	-	-	-	-	-
Southeastern US													
Brunswick, GA	40.6	-	17.6	-	19.3	3.9	11.3	136.3	-	2.5	-	-	231.4
Fernandina, FL	8.9	-	75.6	1.2	83.6	6.8	51.9	-	-	-	16.2	-	244.2
Jacksonville, FL	130.9	2.2	401.5	114.0	180.0	57.5	7.5	441.5	14.2	244.8	258.0	5.8	1,857.8
Port Canaveral, FL	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	180.3	2.2	494.7	115.2	282.8	68.1	70.7	577.8	14.2	247.3	274.2	5.8	2,333.4

a/ Includes recreational vessels.
b/ Includes fishing vessels, industrial vessels, research vessels, and school ships.
Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in text.

Data Chart 4-10
Alternative 4: Direct Economic Impact on the Shipping Industry by Port Area and Type of Vessel, 2004 ($000s)

Port Area	Bulk Carriers	Combination Carriers	Containerships	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	-	-	-	-	-	-	-	-	-	-	-	-	-
Searsport, ME	-	-	-	-	-	-	-	-	-	-	-	-	-
Portland, ME	-	-	-	-	-	-	-	-	-	-	-	-	-
Portsmouth, NH	-	-	-	-	-	-	-	-	-	-	-	-	-
Northeastern US - Off Race Point													
Boston, MA	-	-	-	-	-	-	-	-	-	-	-	-	-
Salem, MA	-	-	-	-	-	-	-	-	-	-	-	-	-
Northeastern US - Cape Cod Bay	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Block Island Sound													
New Bedford, MA	-	-	-	-	-	-	-	-	-	-	-	-	-
Providence, RI	-	-	-	-	-	-	-	-	-	-	-	-	-
New London, CT	-	-	-	-	-	-	-	-	-	-	-	-	-
New Haven, CT	-	-	-	-	-	-	-	-	-	-	-	-	-
Bridgeport, CT	-	-	-	-	-	-	-	-	-	-	-	-	-
Long Island, NY	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Ports of New York/New Jersey	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Delaware Bay	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	-	-	-	-	-	-	-	-	-	-	-	-	-
Hampton Roads, VA	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Morehead City and Beaufort, NC	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Wilmington, NC	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Georgetown, SC	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Charleston, SC	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Savannah, GA	-	-	-	-	-	-	-	-	-	-	-	-	-
Southeastern US													
Brunswick, GA	40.5	-	9.8	-	33.2	15.5	11.5	139.9	-	-	-	2.6	253.0
Fernandina, FL	25.3	-	54.8	2.5	89.5	40.7	23.7	4.4	-	-	25.5	-	266.3
Jacksonville, FL	139.6	4.5	437.4	102.8	167.4	320.3	7.6	458.7	18.3	258.9	339.6	16.3	2,271.3
Port Canaveral, FL	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	205.3	4.5	502.0	105.3	290.1	376.5	42.7	603.1	18.3	258.9	365.1	18.8	2,790.6

a/ Includes recreational vessels
b/ Includes fishing vessels, industrial vessels, research vessels, and school ships.
Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in text.

The DMA effective days assumed for each port area under Alternative 5 are presented in the last column of Data Chart 4-11. The implementation of one DMA per port area has been assumed for the NEUS region, taking into consideration the sighting of right whales in the Gulf of Maine outside of the speed-restricted SAM west (or Off Race Point) area. In the SEUS region, the implementation of one DMA per port area has also been assumed, taking into consideration the sighting of whales outside of the time periods established for speed-restricted designated areas.

Data Chart 4-11
Alternative 5: Effective Distance of Speed Restrictions in Designated Areas, Duration of DMAs and Extra PARS Distance by Port Area

Port Area	Location of pilot buoy relative to harbor baseline or closing line	Distance stated in NOI	Distance to pilot buoy	Diagonal distance to pilot buoy	Additional effective distance a/	Extra PARS	PARS Effective Days b/	Slow down/speed up time	DMA effective days
Northeastern US - Gulf of Maine									
Eastport, ME	n.a.	n.a.	n.a.	n.a.	54.9	0	0	Included	15
Searsport, ME	n.a.	n.a.	n.a.	n.a.	54.9	0	0	Included	15
Portland, ME	n.a.	n.a.	n.a.	n.a.	54.9	0	0	Included	15
Portsmouth, NH	n.a.	n.a.	n.a.	n.a.	54.9	0	0	Included	15
Northeastern US - Off Race Point									
Boston, MA	n.a.	n.a.	n.a.	n.a.	72.4	0	0	n.a.	15
Salem, MA	n.a.	n.a.	n.a.	n.a.	72.4	0	0	n.a.	15
Northeastern US - Cape Cod Bay	5.0	n.a.	n.a.	n.a.	59.2	0	365	n.a.	15
Mid-Atlantic Block Island Sound									
New Bedford, MA	n.a.	25	25	35.4	54.9	0	0	Included	0
Providence, RI	n.a.	25	25	35.4	54.9	0	0	Included	0
New London, CT	n.a.	25	25	35.4	54.9	0	0	Included	0
New Haven, CT	n.a.	25	25	35.4	54.9	0	0	Included	0
Bridgeport, CT	n.a.	25	25	35.4	54.9	0	0	Included	0
Long Island, NY	n.a.	25	25	35.4	54.9	0	0	Included	0
Mid-Atlantic Ports of New York/New Jersey	6.8	25	18.2	25.7	54.9	0	0	Included	0
Mid-Atlantic Delaware Bay	2.5	25	22.5	31.8	54.9	0	0	Included	0
Mid-Atlantic Chesapeake Bay									
Baltimore, MD	2.8	25	22.2	31.3	54.9	0	0	Included	0
Hampton Roads, VA	2.8	25	22.2	31.3	54.9	0	0	Included	0
Mid-Atlantic Morehead City and Beaufort, NC	6.7	25	18.3	25.9	n.a.	0	0	n.a.	0
Mid-Atlantic Wilmington, NC	4.1	25	20.9	29.6	n.a.	0	0	n.a.	0
Mid-Atlantic Georgetown, SC	5.6	25	19.4	27.4	n.a.	0	0	n.a.	0
Mid-Atlantic Charleston, SC	12.5	25	12.5	17.7	6.3	0	0	n.a.	0
Mid-Atlantic Savannah, GA	9.7	25	15.3	21.6	4.9	0	0	n.a.	0
Southeastern US									
Brunswick, GA	6.7	n.a.	n.a.	23.5	3.4	6.0	151	n.a.	15
Fernandina, FL	10.9	n.a.	n.a.	26.0	5.5	10.5	151	n.a.	15
Jacksonville, FL	4.2	n.a.	n.a.	27.0	n.a.	10.0	151	n.a.	15
Port Canaveral, FL	n.a.	n.a.	n.a.	4.5	n.a.	0	0	n.a.	15

a/ Defined and described in text for each port area.
b/ PARS effective days as described in the text for Alternative 4.
Source: Nathan Associates as descibed in text.

No DMAs for port areas in the mid-Atlantic region have been assumed outside of the period of speed restriction. The slowdown/speedup time for each port is as specified for Alternative 3. While not shown separately in Data Chart 4-11, each DMA also includes slowdown/speedup times as described for Alternative 2.

Direct Economic Impacts of Alternative 5

Data Chart 4-12 presents the annual direct economic impact on the shipping industry of Alternative 5 with a 10-knot speed restriction, based on 2003 conditions. The total direct economic impact is estimated at $137.0 million annually, with the port area of New York/New Jersey having the largest impact ($36.6 million). The port area of Hampton Roads is second at $24.5 million, followed by the port areas of Philadelphia at $13.5 million, Baltimore at $11.0 million, Savannah at $10.2 million, and Charleston at $9.9 million. The direct economic impact for these six port areas totals $105.7 million annually, or 77.2 percent of the total for this alternative.

Containerships account for 53 percent of the total direct economic impact of Alternative 5, with an estimated $72.6 million. The vessel type with the next-largest economic impact is tankers, at $16.9 million, followed by ro-ro cargo ships at $15.5 million and passenger vessels, at $11.9 million.

Data Chart 4-13 presents the annual direct economic impact of Alternative 5 based on 2004 conditions. The impact is $147.2 million, roughly 7.4 percent higher than 2003, which reflects the overall increase in US East Coast vessel arrivals. The rankings for the major vessel types are similar to 2003. The rankings for the leading port areas are the same as for 2003. Figure 4-7 presents the impacts graphically.

Under Alternative 5, the direct economic impact of a 12-knot speed restriction would be $92.8 million annually; with a 14-knot restriction, it would be $55.2 million (both are estimates based on 2004 conditions). (See Data Chart 4-22 for the economic impacts of 10, 12, and 14 knots by port area).

4.4.1.6 Alternative 6 – Proposed Action (Preferred Alternative)

Implementation of Alternative 6 would have direct adverse economic impacts on the shipping industry. With a 10-knot speed restriction, these impacts would have totaled an estimated $53.2 million in 2003 and $57.6 million in 2004.

Impact on Vessel Operations

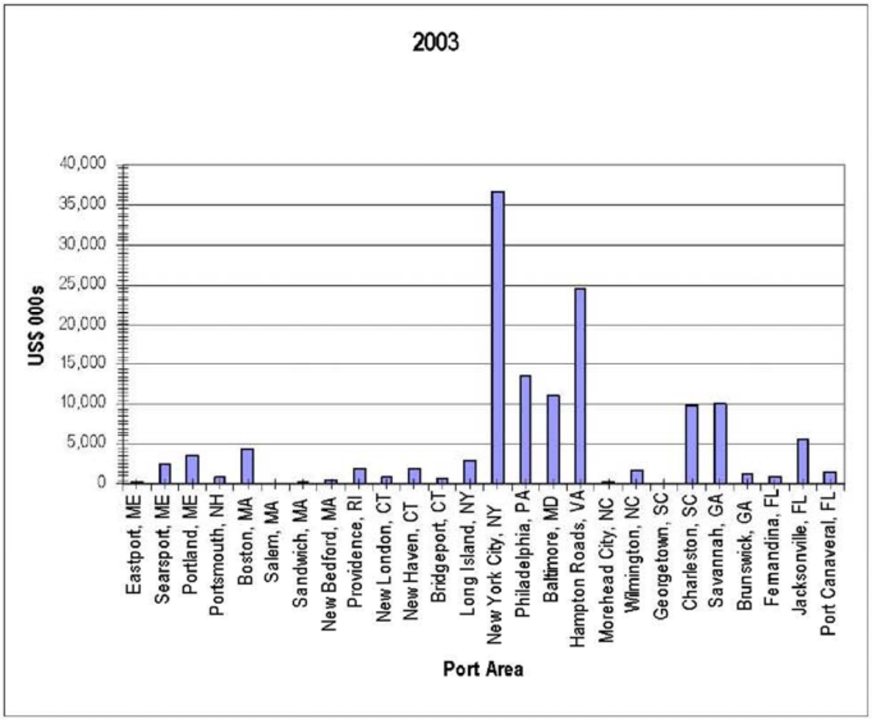
Figure 4-8 presents the months during which restrictions would apply under this alternative. SMAs are not proposed for specific port areas in the NEUS region; instead, the SMAs correspond with right whale feeding habitat. However, the analysis assumes that seasonal speed restrictions for the expanded Off Race Point management area would affect vessel arrivals at the port areas in the Northeast region. Alternative 6 does not include speed restrictions for the port area of Port Canaveral. DMAs would be implemented in all areas outside of the proposed seasonal speed-restricted periods.

Data Chart 4-12
Alternative 5: Direct Economic Impact on the Shipping Industry by Port Area and Type of Vessel, 2003 ($000s)

Port Area	Bulk Carriers	Combination Carriers	Containerships	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	41.0	-	71.4	-	161.3	-	-	-	-	-	-	-	273.7
Searsport, ME	32.1	4.4	-	-	-	1,973.2	-	2.8	84.8	379.1	4.3	-	2,480.6
Portland, ME	190.5	80.7	102.6	4.8	209.8	634.1	-	202.9	21.4	2,123.6	23.8	2.5	3,596.7
Portsmouth, NH	199.6	10.9	-	-	79.4	19.0	-	-	7.6	517.8	2.2	2.5	838.9
Northeastern US - Off Race Point													
Boston, MA	101.7	3.4	1,265.3	3.8	33.8	1,854.4	43.5	124.9	-	983.5	2.2	4.7	4,421.4
Salem, MA	26.3	-	-	-	-	19.7	-	-	-	5.4	-	-	51.4
Northeastern US - Cape Cod Bay	-	-	-	-	-	163.5	-	-	-	55.2	-	-	218.7
Mid-Atlantic Block Island Sound													
New Bedford, MA	166.5	-	3.4	-	74.7	-	69.1	-	17.3	36.0	-	-	366.9
Providence, RI	202.2	6.5	-	-	77.5	581.1	45.7	434.0	4.2	439.6	2.9	1.5	1,795.2
New London, CT	49.3	-	44.2	-	60.6	500.9	-	-	218.9	28.8	2.9	-	905.4
New Haven, CT	152.7	-	25.3	1.5	189.2	50.1	-	-	731.3	623.0	28.5	-	1,801.7
Bridgeport, CT	90.2	-	-	2.3	-	20.9	-	-	413.3	120.7	-	-	647.4
Long Island, NY	-	6.5	-	3.1	-	475.8	-	-	1,485.2	872.6	5.7	1.8	2,850.6
Mid-Atlantic Ports of New York/New Jersey	646.2	89.2	24,866.6	2.4	138.4	1,775.4	303.5	4,221.3	85.1	4,441.1	23.2	4.4	36,596.9
Mid-Atlantic Delaware Bay	649.8	41.5	3,257.1	26.4	651.4	503.6	4,450.6	692.5	44.9	3,200.2	28.5	1.3	13,547.8
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	705.8	28.7	3,648.1	-	768.5	743.9	41.3	4,413.0	8.0	641.9	11.8	23.9	11,034.9
Hampton Roads, VA	743.4	77.9	20,353.1	2.7	476.4	557.6	14.9	1,588.6	4.1	662.0	4.7	14.6	24,500.1
Mid-Atlantic Morehead City and Beaufort, NC	21.6	-	57.9	-	51.1	-	3.0	7.9	-	50.5	-	1.2	193.2
Mid-Atlantic Wilmington, NC	109.5	9.7	550.9	-	386.6	-	6.3	111.7	29.9	372.3	1.3	-	1,578.3
Mid-Atlantic Georgetown, SC	42.0	-	5.9	-	49.5	-	-	-	-	-	-	0.8	98.2
Mid-Atlantic Charleston, SC	147.3	-	8,095.7	-	288.0	375.6	16.9	641.2	25.8	268.3	12.7	1.1	9,872.6
Mid-Atlantic Savannah, GA	235.5	13.6	8,190.7	-	513.5	48.6	144.0	564.2	7.9	428.6	3.5	1.2	10,151.3
Southeastern US													
Brunswick, GA	93.7	-	124.6	-	102.3	15.3	55.3	765.4	-	8.2	-	-	1,164.8
Fernandina, FL	20.4	-	231.3	2.1	263.3	20.8	190.0	1.2	-	0.3	27.1	-	756.6
Jacksonville, FL	272.7	5.0	1,655.5	325.8	522.9	183.7	27.8	1,669.2	32.8	612.7	431.3	9.6	5,748.9
Port Canaveral, FL	19.4	0.3	16.2	1.5	36.3	1,356.0	44.7	19.4	1.7	9.8	2.8	0.2	1,508.2
Total	4,959.3	378.1	72,565.7	376.3	5,134.7	11,873.2	5,456.8	15,460.1	3,224.0	16,881.4	619.4	71.4	137,000.4

a/ Includes recreational vessels.
b/ Includes fishing vessels, industrial vessels, research vessels, and school ships.
Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in text.

Alternative 5: Direct Economic Impact on the
Shipping Industry by Port Area, 2003 and 2004 ($000s)



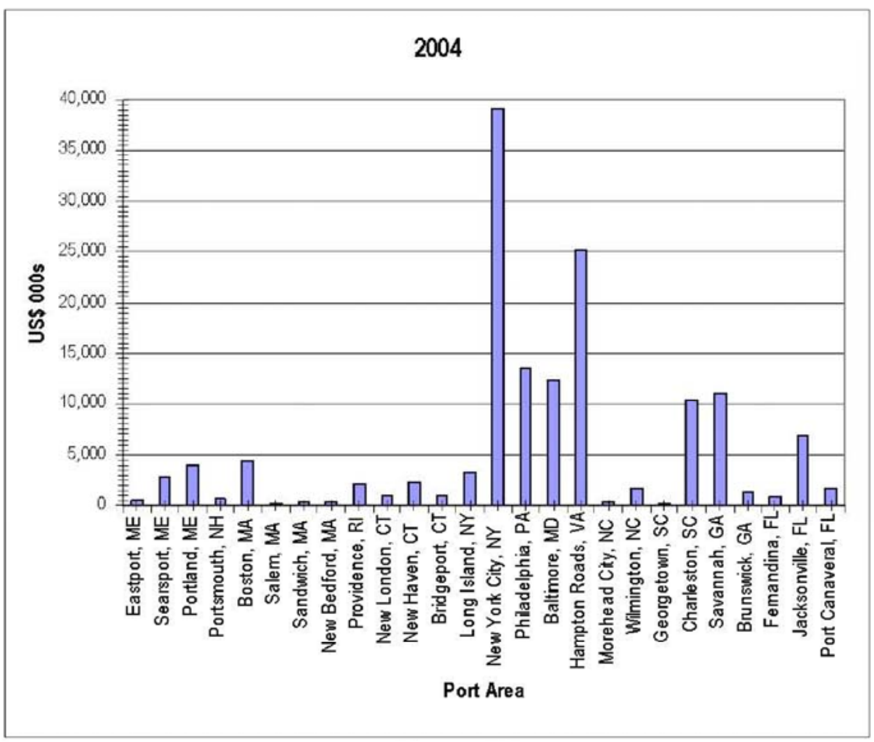


Figure 4-7

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Alternative 6: Proposed Seasonal Speed Restrictions by Port Area

a/ While seasonal speed restrictions are not proposed for the Northeastern US- Gulf of Maine, vessels approaching or departing these port areas are assumed to be affected by the seasonal speed restrictions proposed for the Northeastern US- Off Race Point.
Source: NOAA

Figure 4-8

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Data Chart 4-13
Alternative 5: Direct Economic Impact on the Shipping Industry by Port Area and Type of Vessel, 2004 ($000s)

Port Area	Bulk Carriers	Combinat ion Carriers	Containers hips	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	56.4	-	71.5	-	335.4	-	-	-	-	-	-	-	463.3
Searsport, ME	21.7	-	57.7	4.7	8.5	2,253.5	-	5.1	41.4	352.0	17.3	-	2,761.9
Portland, ME	204.6	23.2	56.7	4.8	215.1	889.5	-	139.2	97.2	2,215.6	101.7	2.3	3,949.7
Portsmouth, NH	160.6	9.7	2.5	-	127.4	19.0	-	-	3.8	386.1	19.5	5.6	734.2
Northeastern US - Off Race Point													
Boston, MA	101.7	3.4	1,265.3	3.8	33.8	1,854.4	43.5	124.9	-	983.5	2.2	4.7	4,421.4
Salem, MA	33.2	-	-	-	-	161.9	-	-	-	-	-	-	195.0
Northeastern US - Cape Cod Bay	-	-	-	-	-	317.7	-	-	3.1	87.1	1.8	-	409.7
Mid-Atlantic Block Island Sound													
New Bedford, MA	145.1	-	-	-	46.3	-	55.3	6.8	-	31.3	-	-	284.7
Providence, RI	170.7	6.8	-	-	103.3	939.9	-	410.0	5.0	407.3	14.3	5.5	2,062.8
New London, CT	32.2	-	109.8	-	235.0	444.2	-	-	186.4	39.7	2.9	-	1,050.2
New Haven, CT	86.9	-	49.7	-	155.4	-	-	-	1,381.0	537.6	48.5	-	2,259.1
Bridgeport, CT	157.2	-	-	1.1	-	-	-	-	668.4	100.2	-	0.6	927.5
Long Island, NY	-	-	-	7.7	-	576.0	-	-	1,791.1	886.8	-	1.5	3,263.1
Mid-Atlantic Ports of New York/New Jersey	579.5	60.2	25,641.7	-	399.4	3,501.7	301.8	4,439.0	31.2	4,138.4	42.2	4.4	39,139.5
Mid-Atlantic Delaware Bay	642.0	9.9	3,006.5	60.4	940.7	296.6	4,216.7	702.1	13.5	3,495.3	83.2	2.8	13,469.7
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	844.1	24.8	3,883.8	-	974.0	1,196.5	78.0	4,384.6	8.2	893.0	23.6	11.3	12,321.9
Hampton Roads, VA	971.0	64.6	19,812.9	9.3	675.4	1,222.2	129.2	1,591.5	4.1	735.4	28.3	14.8	25,258.7
Mid-Atlantic Morehead City and Beaufort, NC	39.3	1.7	61.8	-	41.5	40.1	-	-	-	72.4	-	0.6	257.4
Mid-Atlantic Wilmington, NC	108.0	5.5	487.1	-	413.3	45.8	-	150.9	20.2	402.8	2.6	3.0	1,639.1
Mid-Atlantic Georgetown, SC	39.1	2.8	5.2	-	75.0	10.6	-	-	-	-	-	-	132.7
Mid-Atlantic Charleston, SC	138.8	0.8	8,469.2	4.7	330.1	554.7	29.8	592.6	8.0	266.6	20.1	3.6	10,418.9
Mid-Atlantic Savannah, GA	248.7	15.1	8,388.1	-	578.0	366.6	216.9	665.5	2.6	516.3	5.8	0.6	11,004.1
Southeastern US													
Brunswick, GA	94.0	-	62.1	-	166.5	64.3	56.5	795.9	-	0.2	-	5.1	1,244.5
Fernandina, FL	47.3	-	184.4	6.0	271.9	130.6	82.7	22.6	-	-	43.3	-	788.9
Jacksonville, FL	297.0	10.0	1,748.9	285.9	507.7	1,080.6	30.6	1,738.5	43.3	648.7	568.5	27.4	6,987.0
Port Canaveral, FL	28.4	-	19.4	2.7	51.9	1,533.1	32.2	28.8	3.4	15.7	10.5	0.4	1,726.3
Total	5,247.5	238.4	73,384.5	390.9	6,685.6	17,499.4	5,273.2	15,797.9	4,311.8	17,211.9	1,036.1	94.1	147,171.3

a/ Includes recreational vessels
b/ Includes fishing vessels, industrial vessels, research vessels, and school ships.
Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in text.

For all port areas in the NEUS except Cape Cod Bay, the seasonal speed restrictions associated with the Off Race Point management area would be effective 61 days per year. For Cape Cod Bay, the seasonal speed restrictions within the management area would be effective 135 days. Speed restrictions associated with SMAs would be in place for 181 days per year for port areas in the MAUS region, and 151 days per year for the three affected port areas in the SEUS region.

Data Chart 4-14 presents arrivals of vessels for 2003 during the periods for which speed restrictions are proposed. In 2003 there were 11,498 vessel arrivals during speed-restricted periods, representing approximately 45 percent of the total of 25,532 arrivals for 2003. Although total arrivals increased in 2004, the percentage of arrivals during speed-restricted periods slightly decreased, to 43.4 percent. In both years, less than half the vessels calling at US East Coast ports would have been affected by the regulations. While there is some seasonality in US East Coast vessel arrivals, the proposed periods of speed restrictions include both peak and nonpeak periods of vessel traffic, so that the percentage of restricted arrivals corresponds closely to the percentage of speed-restricted days per year.

In terms of regions, NEUS vessel-arrival data indicate that vessel traffic is not at a peak period during the times when whales are present in the NEUS. Only 17 percent of the total vessel arrivals in the northeast occurred during a restricted period in 2004. (As previously stated, this is also influenced by the lower number of restricted days in the NEUS than in the other regions; 61 days in the Gulf of Maine and Off Race Point and 135 days in Cape Cod Bay). Therefore, only a small percentage of vessels and port areas in this region would be affected. In the MAUS, just about half – 49 percent – of the total vessel arrivals occur during restricted periods (181 days/year), hence this region would be the most affected by the proposed operational measures. The SEUS falls in between the other two regions, with one-third of the total vessel arrivals occurring during restricted periods, which also corresponds to the 151 days/year that speed restrictions are in place in the SEUS.

The port area of New York/New Jersey has the most vessel arrivals during speed-restricted periods, with 2,618 arrivals in 2003, followed by the port areas of Philadelphia (1,315 arrivals), Hampton Roads (1,298 arrivals), Savannah (1,157 arrivals), Charleston (1,140 arrivals), Baltimore (913 arrivals) and Jacksonville (905 arrivals). These seven port areas accounted for 81.3 percent of the total US vessel arrivals during periods with speed restrictions.

In terms of vessel type, containerships recorded the most vessel arrivals during proposed speed-restricted periods, with 4,165 arrivals in 2003. Tankers were the next most frequent, with 2,473 arrivals, followed by ro-ro cargo ships, with 1,444 arrivals, and bulk carriers, with 1,243 arrivals.

In 2004, there were 12,189 vessel arrivals at US East Coast ports during the periods when speed restrictions are proposed for each port area (Data Chart 4-15), an increase of 6.0 percent over 2003. The increase is lower than the 7.3 percent increase for total US East Coast vessel arrivals for several reasons. First, the SEUS region that recorded an increase of 12.3 percent in total vessel arrivals in 2004 is the region with the fewest speed-restricted days. Second, the port area of New York/New Jersey, which has the largest number of annual vessel arrivals, recorded no increase in vessel arrivals during proposed speed-restricted periods.

Data Chart 4-14
Alternative 6: US East Coast Restricted Vessel Arrivals by Port Area and Vessel Type, 2003

	Vessel Type												
Port Area	Bulk Carrier	Combination Carrier	Container Ship	Freight Barge	General Dry Cargo Ship	Passenger Ship	Refrigerated Cargo Ship	Ro-Ro Cargo Ship	Tank Barge	Tanker	Towing Vessel	Other a/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	3	-	1	-	3	-	-	-	-	-	-	-	7
Searsport, ME	2	-	-	-	-	-	-	-	-	18	-	-	20
Portland, ME	14	1	1	-	2	-	-	10	1	78	-	-	107
Portsmouth, NH	9	-	-	-	2	-	-	-	1	25	-	-	37
Northeastern US - Off Race Point													
Salem, MA	3	-	-	-	-	-	-	-	-	-	-	-	3
Boston, MA	7	-	20	-	2	-	-	10	-	72	-	1	112
Subtotal	10	0	20	0	2	0	0	10	0	72	0	1	115
Northeastern US - Cape Cod Bay													
Cape Cod, MA	-	-	-	-	-	3	-	-	-	6	-	-	9
Mid-Atlantic Block Island Sound													
New Bedford, MA	29	-	1	-	14	-	3	-	4	6	-	-	57
Providence, RI	41	1	-	-	11	-	3	38	1	62	1	-	158
New London, CT	9	-	2	-	4	17	-	-	41	4	1	-	78
New Haven, CT	31	-	1	1	14	1	-	-	136	96	8	-	288
Bridgeport, CT	13	-	-	-	1	1	29	-	94	25	-	-	163
Long Island, NY	-	1	-	-	-	15	-	-	281	122	2	1	422
Mid-Atlantic Ports of New York/New Jersey													
New York City, NY	172	17	1,172	1	28	14	10	347	25	820	9	3	2,618
Mid-Atlantic Delaware Bay													
Philadelphia, PA	179	7	246	5	116	1	246	72	11	420	12	-	1,315
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	153	4	183	-	95	12	3	347	2	101	4	9	913
Hampton Roads, VA	161	11	857	1	66	4	1	79	1	112	1	4	1,298
Mid-Atlantic Morehead City and Beaufort, NC													
Morehead City, NC	11	-	7	-	17	-	1	1	-	19	-	2	58
Mid-Atlantic Wilmington, NC													
Wilmington, NC	59	4	44	-	63	-	1	11	11	120	1	-	314
Mid-Atlantic Georgetown, SC													
Georgetown, SC	23	-	1	-	5	-	-	-	-	-	-	1	30
Mid-Atlantic Charleston, SC													
Charleston, SC	85	-	735	-	49	21	3	117	13	103	12	2	1,140
Mid-Atlantic Savannah, GA													
Savannah, GA	140	7	655	-	113	3	5	78	4	148	2	2	1,157
Southeastern US													
Brunswick, GA	33	-	11	-	14	1	5	112	-	2	-	-	178
Fernandina, FL	4	-	43	1	42	1	13	-	-	-	7	-	111
Jacksonville, FL	62	1	185	80	102	8	2	222	7	114	117	5	905
Port Canaveral, FL	-	-	-	-	-	-	-	-	-	-	-	-	0
All Port Regions	1,243	54	4,165	89	763	102	325	1,444	633	2,473	177	30	11,498

a/ Other includes fishing vessels, industrial vessels, research vessels, school ships.

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

Data Chart 4-15
Alternative 6: US East Coast Restricted Vessel Arrivals by Port Area and Vessel Type, 2004

Port Area	Vessel Type: Bulk Carrier	Combination Carrier	Container Ship	Freight Barge	General Dry Cargo Ship	Passenger Ship	Refrigerated Cargo Ship	Ro-Ro Cargo Ship	Tank Barge	Tanker	Towing Vessel	Other a/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	5	-	2	-	1	-	-	-	-	-	-	-	8
Searsport, ME	1	-	-	-	-	-	-	-	4	14	-	-	19
Portland, ME	13	-	-	-	2	1	-	11	10	69	5	-	111
Portsmouth, NH	8	1	-	-	3	-	-	-	-	11	1	2	26
Northeastern US - Off Race Point													
Salem, MA	-	-	-	-	-	-	-	-	-	-	-	-	0
Boston, MA	7	-	20	-	2	-	-	10	-	72	-	1	112
Northeastern US - Cape Cod Bay													
Cape Cod, MA	-	-	-	-	-	1	-	-	-	10	-	-	11
Mid-Atlantic Block Island Sound													
New Bedford, MA	26	-	-	-	11	-	4	1	-	5	-	-	47
Providence, RI	33	1	-	-	12	7	-	34	1	57	2	2	149
New London, CT	8	-	4	-	13	10	-	-	36	6	1	-	78
New Haven, CT	14	-	3	-	17	-	-	-	257	83	13	-	387
Bridgeport, CT	34	-	-	1	2	-	13	-	163	21	-	1	235
Long Island, NY	-	-	-	4	-	20	-	-	339	143	-	1	507
Mid-Atlantic Ports of New York/New Jersey													
New York City, NY	163	14	1,226	-	43	41	14	345	8	738	20	2	2,614
Mid-Atlantic Delaware Bay													
Philadelphia, PA	163	2	225	13	142	6	223	71	3	470	27	2	1,347
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	190	4	194	-	104	16	3	323	1	140	7	6	988
Hampton Roads, VA	219	13	840	2	81	24	5	76	1	116	11	9	1,397
Mid-Atlantic Morehead City and Beaufort, NC													
Morehead City, NC	18	1	8	-	13	4	-	-	-	28	-	-	72
Mid-Atlantic Wilmington, NC													
Wilmington, NC	53	3	42	-	66	3	-	14	9	129	1	-	320
Mid-Atlantic Georgetown, SC													
Georgetown, SC	22	1	2	-	11	1	-	-	-	-	-	-	37
Mid-Atlantic Charleston, SC													
Charleston, SC	67	1	798	-	56	42	3	108	4	101	16	5	1,201
Mid-Atlantic Savannah, GA													
Savannah, GA	136	7	648	-	99	33	10	93	1	176	3	1	1,207
Southeastern US													
Brunswick, GA	33	-	7	-	23	4	5	113	-	-	-	3	188
Fernandina, FL	12	-	30	2	50	6	6	1	-	-	11	-	118
Jacksonville, FL	66	2	204	74	91	43	2	231	9	120	154	14	1,010
Port Canaveral, FL	-	-	-	-	-	-	-	-	-	-	-	-	0
All Port Regions	1,291	50	4,253	96	842	262	288	1,431	846	2,509	272	49	12,189

a/ Other includes fishing vessels, industrial vessels, research vessels, school ships.

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

Data Chart 4-16 presents the key assumptions that were used to analyze the impact of Alternative 6 on vessel operations, including the basis for determining the effective distance over which speed restrictions would apply for each port area. The method used is similar to that used for Alternative 5; however, for Alternative 6, port area buffers would have a radius of 20 nm (37 km), except for the 30-nm (56 km) SMA off Block Island Sound, and, aside from the Wilmington, North Carolina to Savannah, Georgia segment, would not be parallel to the coastline. Hence, there was no need to determine the diagonal distance of recommended routes, as was done for Alternatives 3 and 5. The effective distance and days of seasonal speed restrictions and the extra distance resulting from the recommended routes that are shown in Data Chart 4-16 for the port areas of Brunswick, Fernandina and Jacksonville are the same as described for Alternative 5.

Data Chart 4-16
Alternative 6: Effective Distance of Seasonal Speed Restrictions and Duration of DMAs

Port Area	Location of pilot buoy relative to harbor	Distance Stated in Rule	Effective distance to pilot buoy	Diagonal of effective distance	Additional effective distance a/	Extra PARS Distance	PARS Effective Days b/	Slow down/speed up time	DMA effective days
Northeastern US - Gulf of Maine									
Eastport, ME	n.a.	n.a.	n.a.	n.a.	48.7	0	0	Included	45
Searsport, ME	n.a.	n.a.	n.a.	n.a.	48.7	0	0	Included	45
Portland, ME	n.a.	n.a.	n.a.	n.a.	48.7	0	0	Included	45
Portsmouth, NH	n.a.	n.a.	n.a.	n.a.	48.7	0	0	Included	45
Northeastern US - Off Race Point									
Boston, MA	n.a.	n.a.	n.a.	n.a.	62.4	0	0	n.a.	45
Salem, MA	n.a.	n.a.	n.a.	n.a.	62.4	0	0	n.a.	45
Northeastern US - Cape Cod Bay	5.0	n.a.	n.a.	n.a.	39.9	0	0	n.a.	45
Mid-Atlantic Block Island Sound									
New Bedford, MA	n.a.	30	30	n.a.	68.7	0	0	Included	0
Providence, RI	n.a.	30	30	n.a.	68.7	0	0	Included	0
New London, CT	n.a.	30	30	n.a.	54.9	0	0	Included	0
New Haven, CT	n.a.	30	30	n.a.	54.9	0	0	Included	0
Bridgeport, CT	n.a.	30	30	n.a.	54.9	0	0	Included	0
Long Island, NY	n.a.	30	30	n.a.	54.9	0	0	Included	0
Mid-Atlantic Ports of New York/New Jersey	6.8	20	13.2	n.a.	54.9	0	0	Included	0
Mid-Atlantic Delaware Bay	2.5	20	17.5	n.a.	54.9	0	0	Included	0
Mid-Atlantic Chesapeake Bay									
Baltimore, MD	2.8	20	17.15	n.a.	54.9	0	0	Included	0
Hampton Roads, VA	2.8	20	17.15	n.a.	54.9	0	0	Included	0
Mid-Atlantic Morehead City and Beaufort, NC	6.7	20	13.3	n.a.	n.a.	0	0	n.a.	0
Mid-Atlantic Wilmington, NC	4.1	20	15.9	n.a.	n.a.	0	0	n.a.	0
Mid-Atlantic Georgetown, SC	5.6	20	14.4	n.a.	n.a.	0	0	n.a.	0
Mid-Atlantic Charleston, SC	12.5	20	7.5	n.a.	6.3	0	0	n.a.	0
Mid-Atlantic Savannah, GA	9.7	20	10.3	n.a.	4.9	0	0	n.a.	0
Southeastern US									
Brunswick, GA	6.7	n.a.	n.a.	23.5	3.4	6.0	151	n.a.	15
Fernandina, FL	10.9	n.a.	n.a.	26.0	5.5	10.5	151	n.a.	15
Jacksonville, FL	4.2	n.a.	n.a.	27.0	n.a.	10.0	151	n.a.	15
Port Canaveral, FL	n.a.	n.a.	n.a.	n.a.	n.a.	0	0	n.a.	15

a/ Defined and described in text for each port area.
b/ PARS effective days as described in the text for Alternative 4.
Source: Nathan Associates as descibed in text.

The additional effective distance shown for port areas in the northeast and for some port areas in the mid-Atlantic is based on the calculation that vessel arrivals at these port areas would have to sail 54.9 nm (101.7 km) through the large speed-restricted area of a combined Off Race Point and Great South Channel SMAs. Both SMAs would be in effect from April 1 to April 30. Under Alternatives 3 and 5 this element was effective year-round, whereas under Alternative 6 it would be effective for 30 days only.[19]

For the port areas of Providence and New Bedford, an additional effective distance of 13.8 nm (25.6 km) was calculated from the northern boundary of the Block Island SMA to the pilot buoy for Narragansett Bay, as vessels would not be able to regain sea speed after passing through the SMA at a reduced speed. Combined with the 54.9 nm (101.7 km) distance for the Off Race Point and Great South Channel SMAs, this results in a total additional effective distance of 68.7 nm (127.2 km) as shown in Data Chart 4-16.

For the NEUS region, the additional effective distance shown in Data Chart 4-16 is based on an average of the effective distance from March 1 to March 30 (when only the Off Race Point management area is implemented) and the effective distance from April 1 to April 30 (when both the Off Race Point and Great South Channel management areas are implemented). For the Gulf of Maine port areas, the effective distance during March is estimated at 36.9 nm (68.3 km) and for April at 60.5 nm (112 km), resulting in an average effective distance of 48.7 nm (90.2 km). For the port areas of Boston and Salem, the effective distance for March is estimated at 52.4 nm (97 km) and for April at 72.4 nm (134 km), which yields the average effective distance of 62.4 nm (115.6 km) listed in Data Chart 4-16.

The DMA effective days assumed for each port area under Alternative 6 are presented in the last column of Data Chart 4-16. The implementation of three DMAs per port area was assumed for the NEUS region, taking into consideration the sighting of right whales in the Gulf of Maine, and for time periods outside of those specified for speed restrictions in the Off Race Point SMA. In the SEUS region, the implementation of one DMA per port area has been assumed, taking into consideration the sighting of whales outside of the time periods established for the Southeast SMA. No DMAs for port areas in the MAUS region have been assumed outside of the periods established for SMAs. While not shown separately in Data Chart 4-16, each DMA includes slowdown/speedup times as described in Alternative 2.

Data Chart 4-17 presents the average minutes of delay from speed restrictions associated with recommended shipping routes in the NEUS and SEUS and with SMAs in all three regions. The delays were estimated based on a 10-knot restriction per vessel arrival for each affected port area and vessel type in 2003.[20] The overall weighted average delay for all vessels is 53 minutes per arrival.

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[19] See the discussion under Alternative 3 regarding assumptions as to the percentage of vessel arrivals at mid-Atlantic port areas that would be affected.

[20] The average delay is based on the total minutes of delays for speed restrictions, extra PARS distance and slow-down/speed-up time, divided by the number of vessel arrivals by type of vessel for each port area during proposed seasonal speed-restriction periods. It does not include delays for DMAs, as those delays would need to be divided by the number of vessels affected by DMAs.

Data Chart 4-17
Alternative 6: Average Minutes of Delay for SMA Speed Restrictions at 10 knots per Vessel Arrival by Port Area and Type of Vessel, 2003

Port Area	Bulk Carriers	Combination Carriers	Containerships	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Weighted Average
Northeastern US - Gulf of Maine													
Eastport, ME	52.7	-	138.7	-	80.7	-	-	-	-	-	-	-	77.0
Searsport, ME	51.5	-	-	-	-	-	-	-	-	77.1	-	-	74.5
Portland, ME	58.2	74.8	94.7	-	95.7	-	-	68.8	69.4	79.8	-	-	76.3
Portsmouth, NH	61.8	-	-	-	106.1	-	-	-	72.3	77.1	-	-	74.8
Northeastern US - Off Race Point													
Boston, MA	52.8	-	129.4	-	65.6	-	-	62.7	-	75.3	-	42.2	81.9
Salem, MA	67.4	-	-	-	-	-	-	-	-	-	-	-	67.4
Northeastern US - Cape Cod Bay	-	-	-	-	-	89.8	-	-	-	75.5	-	-	80.3
Mid-Atlantic Block Island Sound													
New Bedford, MA	73.0	-	66.1	-	94.3	-	106.8	-	72.9	82.8	-	-	80.9
Providence, RI	68.4	84.4	-	-	102.5	-	112.2	127.5	71.1	86.9	48.4	-	93.1
New London, CT	48.2	-	111.6	-	88.0	77.8	-	-	55.0	61.0	34.6	-	62.4
New Haven, CT	47.6	-	113.7	35.3	83.5	77.8	-	-	56.6	60.9	34.6	-	57.9
Bridgeport, CT	55.4	-	-	-	-	49.3	-	-	34.1	33.8	-	-	29.6
Long Island, NY	-	60.3	-	-	-	77.8	-	-	55.2	59.1	34.6	34.6	57.0
Mid-Atlantic Ports of New York/New Jersey	24.5	29.8	55.9	31.3	33.8	47.7	50.1	48.3	27.9	32.1	17.6	17.6	44.5
Mid-Atlantic Delaware Bay	28.6	38.2	58.3	45.6	45.2	58.4	55.2	56.8	36.2	41.7	21.9	-	46.5
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	31.3	33.7	67.3	-	48.3	57.5	52.4	59.8	35.6	39.3	21.6	21.6	52.3
Hampton Roads, VA	31.1	37.6	68.5	38.3	46.5	57.0	54.8	65.2	36.3	39.6	21.6	21.6	59.5
Mid-Atlantic Morehead City and Beaufort, NC	16.3	-	36.4	-	25.0	-	18.2	36.6	-	23.8	-	13.3	24.0
Mid-Atlantic Wilmington, NC	20.2	25.1	49.3	-	35.0	-	35.1	48.2	26.9	28.3	15.9	-	31.7
Mid-Atlantic Georgetown, SC	19.2	-	43.3	-	39.4	-	-	-	-	-	-	14.4	23.2
Mid-Atlantic Charleston, SC	18.4	-	44.4	-	33.1	33.4	31.9	38.4	24.1	25.2	13.8	13.8	38.8
Mid-Atlantic Savannah, GA	18.5	22.5	48.3	-	31.6	34.1	50.9	42.2	24.9	27.4	15.2	15.2	39.6
Southeastern US													
Brunswick, GA	59.8	-	102.0	-	83.4	82.9	87.6	93.0	-	73.7	-	-	86.2
Fernandina, FL	97.2	-	109.2	84.4	100.8	110.1	116.3	-	-	-	84.0	-	104.6
Jacksonville, FL	84.2	85.9	105.4	95.5	89.8	100.9	100.4	105.6	90.0	91.1	77.0	77.0	95.6
Port Canaveral, FL	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	34.1	34.9	59.1	90.5	54.0	62.1	53.9	65.9	50.1	44.0	60.8	29.8	53.1

a/ Includes recreational vessels
b/ Includes fishing vessels, industrial vessels, research vessels, and school ships.
Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in text.

The longest average delays would be experienced at the southeast port areas of Fernandina (105 minutes) and Jacksonville (96 minutes), with Brunswick also showing a relatively long average delay (86 minutes); all are attributable to the combination of speed restrictions and recommended shipping routes. The port areas of Providence (93 minutes) and other port areas in Block Island Sound have above average delays due to the 30-nm (56-km) rectangular SMA proposed for that region. Boston (82 minutes) and other port areas in the northeast also have above average delays due to the longer period that the additional effective distance would apply (two months in the NEUS as compared to one month for the MAUS port areas).

Freight barges incur the longest average delay, with an average of 91 minutes per vessel arrival (see Figure 4-9). This is due to the specialized higher-speed freight barge service from Jacksonville to Puerto Rico. Other vessel types with above-average delays are ro-ro cargo ships (66 minutes), passenger vessels (62 minutes), towing vessels (61 minutes), containerships (59 minutes), general cargo, and refrigerated cargo vessels (both at 54 minutes).

It is important to note that the timing and duration of the proposed seasonal speed restrictions would be well known and that vessel itineraries for containerships and cruise vessels would be developed taking the delays into account. For example, shipping lines providing liner service to several East Coast ports would likely adjust their rotation of port calls and number of vessels deployed on that service to optimize vessel utilization while maintaining a weekly service.

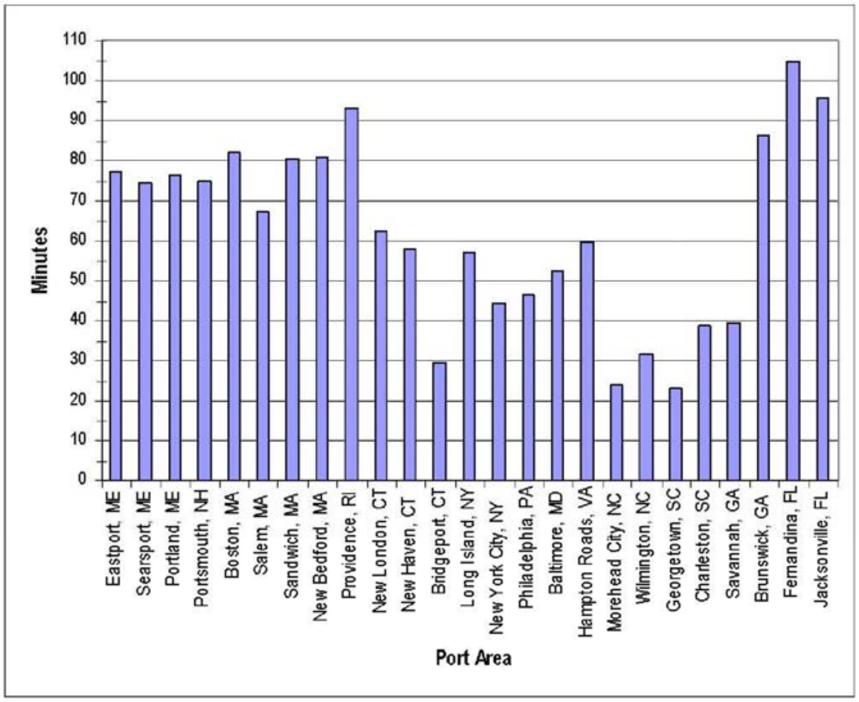
Cruise vessels would also adjust vessel itineraries, as necessary, to optimize vessel utilization. This could involve reducing the duration of port calls at offshore destinations or the elimination of an offshore port of call. For example, a seven-day cruise from Norfolk to Bermuda could easily adjust the scheduled time spent at ports of call in Bermuda, such as Hamilton, Saint George or King's Wharf. Similarly, four-day cruises from Jacksonville to the Bahamas or five-day cruises to the western Caribbean could make minor adjustments to the durations of stays at the corresponding ports of call.

Direct Economic Impacts of Alternative 6

Data Chart 4-18 presents the annual direct economic impact of Alternative 6 on the shipping industry based on 2003 conditions and with a 10-knot speed restriction. The impact is estimated at $53.2 million annually, with the port area of New York/New Jersey having the largest impact at $11.1 million. The port area of Hampton Roads is second at $8.3 million, followed by the port areas of Jacksonville at $5.5 million, Savannah at $4.9 million, Charleston at $4.8 million, Philadelphia at $4.7 million, and Baltimore at $3.7 million. The direct economic impact for these seven port areas totals $43.1 million annually, or 81.0 percent of the total for this alternative. No other port area had a direct economic impact over $1.3 million.

Containerships account for 52.4 percent of the total direct economic impact of Alternative 6, with an estimate of $27.9 million. The vessel type with the next-largest economic impact is ro-ro cargo ships at $7.0 million, followed by tankers at $6.5 million, passenger vessels at $2.6 million, general cargo vessels at $2.5 million, and refrigerated cargo vessels at $2.2 million.

Alternative 6: Average Minutes of Delay for SMA Speed Restrictions per Vessel Arrival by Port Area and Type of Vessel, 2003



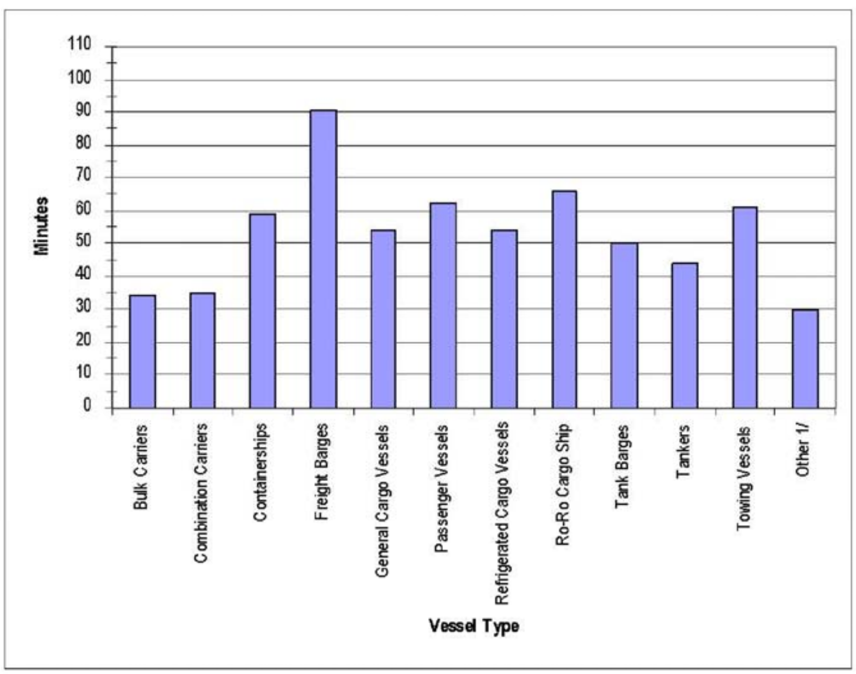


Figure 4-9

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Data Chart 4-18
Alternative 6: Direct Economic Impact of a 10-knot Speed Restriction on the Shipping Industry by Port Area and Type of Vessel, 2003 ($000s)

Port Area	Bulk Carriers	Combinati on Carriers	Containers hips	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	11.9	-	23.4	-	27.6	-	-	-	-	-	-	-	62.9
Searsport, ME	8.4	0.5	-	-	-	246.1	-	0.3	10.6	117.1	0.5	-	383.5
Portland, ME	60.7	15.1	16.9	0.6	39.4	79.1	-	56.6	5.8	632.0	3.0	0.3	909.5
Portsmouth, NH	50.8	1.4	-	-	22.2	2.4	-	-	4.3	161.1	0.3	0.3	242.7
Northeastern US - Off Race Point													
Boston, MA	28.4	0.4	431.7	0.5	8.1	222.6	5.2	42.4	-	389.6	0.3	1.5	1,130.8
Salem, MA	13.2	-	-	-	-	2.4	-	-	-	0.6	-	-	16.2
Northeastern US - Cape Cod Bay	-	-	-	-	-	51.4	-	-	-	27.1	-	-	78.4
Mid-Atlantic Block Island Sound													
New Bedford, MA	102.3	-	2.5	-	52.3	-	31.0	-	12.9	23.2	-	-	224.2
Providence, RI	129.0	4.8	-	-	43.1	-	34.2	276.8	3.1	274.5	2.1	-	767.6
New London, CT	19.8	-	23.6	-	32.4	227.6	-	-	101.8	12.0	1.5	-	418.7
New Haven, CT	67.2	-	13.5	0.8	91.7	13.4	-	-	349.8	291.9	12.2	-	840.5
Bridgeport, CT	36.6	-	-	-	-	8.5	-	-	144.6	40.4	-	-	230.2
Long Island, NY	-	3.5	-	-	-	200.8	-	-	701.1	389.9	3.0	1.0	1,299.3
Mid-Atlantic Ports of New York/New Jersey	194.7	29.2	7,780.0	0.9	48.3	183.5	88.4	1,310.0	31.3	1,406.2	7.0	1.2	11,080.7
Mid-Atlantic Delaware Bay	230.9	16.9	1,117.6	8.6	232.0	14.7	1,665.6	239.7	18.2	1,107.9	11.6	-	4,663.8
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	233.8	7.2	1,259.8	-	271.2	173.7	16.7	1,530.8	3.2	212.9	3.8	6.7	3,719.8
Hampton Roads, VA	249.4	24.4	7,015.0	1.1	170.0	61.1	6.0	544.0	1.7	244.3	1.0	3.2	8,321.1
Mid-Atlantic Morehead City and Beaufort, NC	7.9	-	20.7	-	21.7	-	1.6	2.2	-	22.2	-	0.6	76.9
Mid-Atlantic Wilmington, NC	53.4	5.2	241.8	-	166.3	-	3.4	54.2	13.7	169.1	0.7	-	707.7
Mid-Atlantic Georgetown, SC	19.9	-	3.1	-	22.3	-	-	-	-	-	-	0.4	45.7
Mid-Atlantic Charleston, SC	71.5	-	3,963.2	-	132.6	147.0	9.7	316.2	14.8	134.7	7.3	0.6	4,797.6
Mid-Atlantic Savannah, GA	113.0	7.8	3,991.4	-	235.3	17.6	82.4	266.1	4.5	205.4	1.3	0.7	4,925.5
Southeastern US													
Brunswick, GA	92.7	-	122.7	-	100.9	15.1	54.5	753.8	-	8.0	-	-	1,147.7
Fernandina, FL	20.1	-	227.9	2.1	259.4	20.5	187.1	1.2	-	0.3	26.8	-	745.5
Jacksonville, FL	265.2	4.9	1,589.0	314.5	504.3	176.5	26.9	1,603.7	31.7	593.3	422.0	9.4	5,541.5
Port Canaveral, FL	11.3	0.3	7.8	0.6	17.8	705.9	18.8	10.4	0.5	5.4	1.3	0.1	780.2
Total	2,092.2	121.5	27,851.6	329.7	2,498.8	2,569.9	2,231.6	7,008.5	1,453.6	6,469.2	505.7	26.1	53,158.3

a/ Includes recreational vessels.
b/ Includes fishing vessels, industrial vessels, research vessels, and school ships.
Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in text.

Data Chart 4-19 presents the annual direct economic impact of Alternative 6 based on 2004 conditions. The total impact is $57.6 million annually, roughly 8.3 percent more than for 2003 conditions, which reflects the overall increase in US East Coast vessel arrivals. The rankings for the major vessel types are similar to those for 2003, except for bulk carriers moving ahead of refrigerated cargo vessels. The rankings for the leading port areas also are the same as described for 2003. Figure 4-10 presents the impacts graphically. Based on 2004 conditions, the total direct economic impact of Alternative 6 with a 12-knot speed restriction would be $36.1 million annually; with a 14-knot restriction, it would be $21.5 million. See Data Chart 4-22 for the economic impacts of 10, 12, and 14 knots by port area for Alternative 6.

Data Chart 4-19
Alternative 6: Direct Economic Impact of a 10-knot Speed Restriction on the Shipping Industry by Port Area and Type of Vessel, 2004 ($000s)

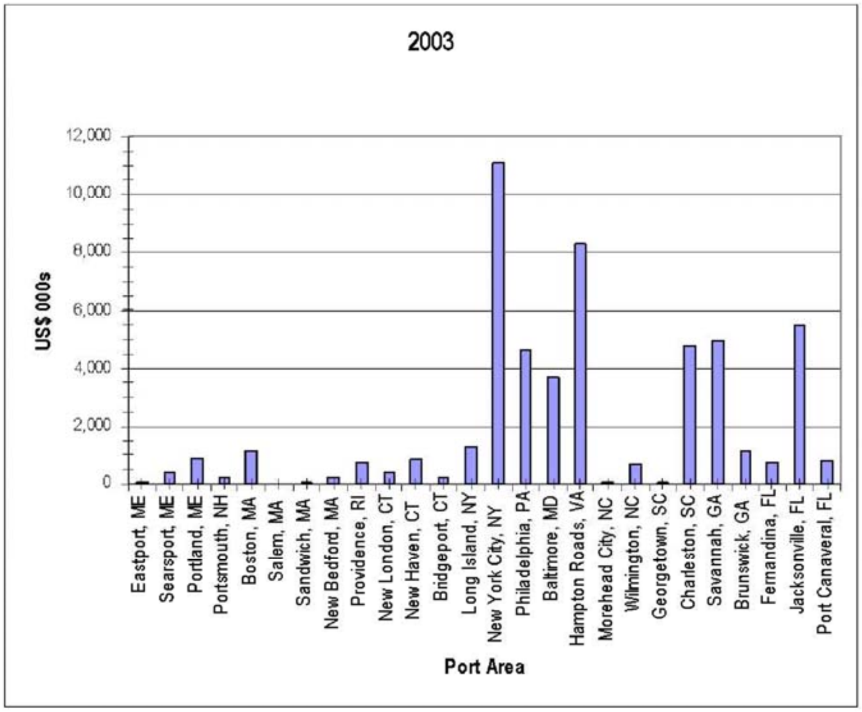
Port Area	Bulk Carriers	Combination Carriers	Containerships	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	19.5	-	40.2	-	59.1	-	-	-	-	-	-	-	118.8
Searsport, ME	5.8	-	7.2	0.6	1.1	281.0	-	0.6	18.2	99.6	2.2	-	416.2
Portland, ME	56.1	2.9	7.1	0.6	33.1	127.5	-	53.8	44.0	608.0	22.1	0.3	955.4
Portsmouth, NH	43.3	4.0	0.3	-	34.9	2.4	-	-	0.5	89.7	4.3	3.1	182.5
Northeastern US - Off Race Point													
Boston, MA	28.4	0.4	431.7	0.5	8.1	222.6	5.2	42.4	-	389.6	0.3	1.5	1,130.8
Salem, MA	4.0	-	-	-	-	19.4	-	-	-	-	-	-	23.4
Northeastern US - Cape Cod Bay	-	-	-	-	-	36.5	-	-	0.1	43.5	0.1	-	80.2
Mid-Atlantic Block Island Sound													
New Bedford, MA	88.8	-	-	-	27.5	-	41.3	5.1	-	19.7	-	-	182.4
Providence, RI	92.1	5.1	-	-	70.2	172.4	-	247.8	3.7	254.6	4.3	4.1	854.3
New London, CT	17.2	-	48.6	-	121.3	133.9	-	-	91.9	18.4	1.5	-	432.9
New Haven, CT	32.3	-	26.6	-	71.9	-	-	-	664.7	252.6	19.8	-	1,067.9
Bridgeport, CT	81.0	-	-	0.4	-	-	-	-	246.1	30.6	-	0.3	358.4
Long Island, NY	-	-	-	3.3	-	267.8	-	-	856.6	432.9	-	0.8	1,561.3
Mid-Atlantic Ports of New York/New Jersey	175.6	22.2	8,051.6	-	127.1	605.5	101.2	1,394.5	9.8	1,296.4	15.5	0.8	11,800.3
Mid-Atlantic Delaware Bay	211.1	4.0	1,051.6	24.5	315.5	69.6	1,573.4	236.5	5.5	1,219.8	26.1	1.1	4,738.8
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	289.1	8.0	1,338.3	-	357.7	213.3	26.9	1,477.6	1.7	315.6	6.7	4.0	4,038.7
Hampton Roads, VA	337.4	26.1	6,835.1	2.2	232.0	316.8	52.1	545.6	1.7	257.2	10.5	4.8	8,621.5
Mid-Atlantic Morehead City and Beaufort, NC	16.3	0.9	27.3	-	21.3	20.6	-	-	-	32.5	-	-	118.8
Mid-Atlantic Wilmington, NC	44.8	3.0	230.1	-	206.5	18.5	-	66.7	10.9	182.9	0.7	-	763.9
Mid-Atlantic Georgetown, SC	17.4	0.5	2.7	-	34.7	5.6	-	-	-	-	-	-	61.0
Mid-Atlantic Charleston, SC	63.3	0.5	4,118.8	-	162.1	247.1	17.1	285.4	4.6	132.4	9.7	1.7	5,042.7
Mid-Atlantic Savannah, GA	110.3	7.6	4,063.3	-	269.0	197.9	124.0	329.8	1.5	250.6	2.0	0.4	5,356.5
Southeastern US													
Brunswick, GA	93.0	-	61.1	-	164.0	63.4	55.7	783.6	-	0.2	-	5.0	1,226.0
Fernandina, FL	46.9	-	181.7	5.9	268.0	128.7	81.5	22.2	-	-	42.9	-	777.8
Jacksonville, FL	288.8	9.7	1,679.2	276.2	489.5	1,039.4	29.6	1,670.2	41.9	628.0	556.2	26.8	6,735.5
Port Canaveral, FL	15.3	-	8.8	1.6	24.4	825.1	15.8	14.3	2.6	9.3	5.9	0.2	923.1
Total	2,177.9	94.8	28,211.2	315.7	3,099.0	5,015.1	2,123.9	7,176.1	2,005.8	6,563.9	730.7	55.0	57,569.2

a/ Includes recreational vessels

b/ Includes fishing vessels, industrial vessels, research vessels, and school ships.

Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in text.

Alternative 6: Direct Economic Impact on the
Shipping Industry by Port Area, 2003 and 2004 ($000s)



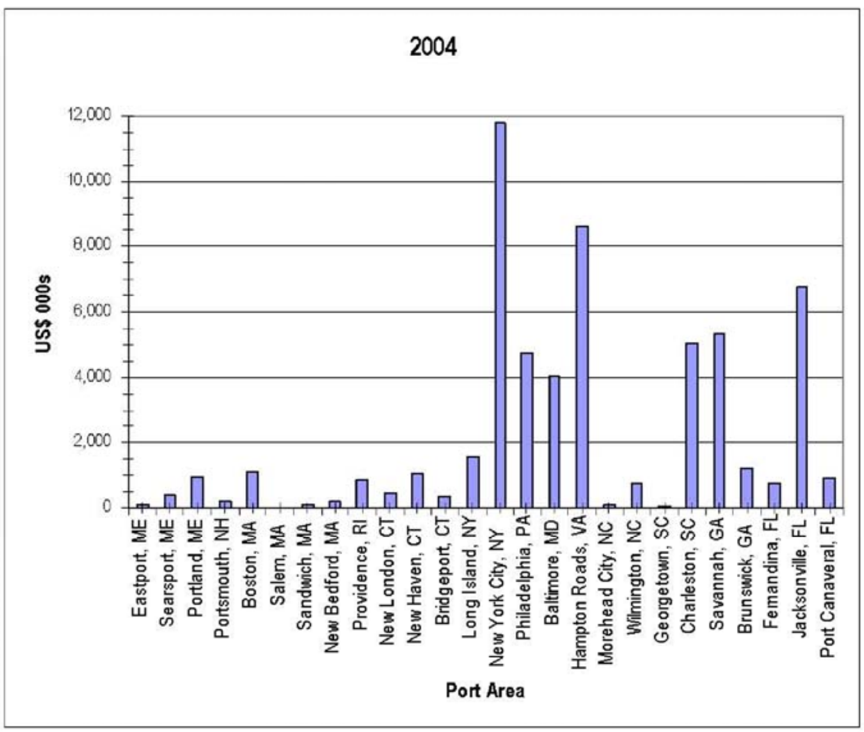


Figure 4-10

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4.4.1.7 Comparison of Direct Economic Impacts by Alternative

This section compares the direct economic impacts on the shipping industry by alternative for 2004 conditions with a 10-knot speed restriction, starting with the alternative with the largest impacts. Data Charts 4-20 and 4-21 present a comparison of the direct economic impacts by port area for each alternative based on 2003 and 2004 conditions, respectively. Impacts with 12- and 14-knot speed restrictions are addressed in Section 4.4.1.8.

- **Alternative 5 – Combination of Alternatives** would have the highest direct economic impact on the shipping industry, with an estimated $147.2 million annually. This alternative also would have the highest direct economic impact on US-flag vessels, at $17.9 million annually, and foreign-flag vessels, at $129.3 million annually. With the exception of Port Canaveral[21], this alternative would result in the highest direct economic impact on the shipping industry for each port area.
- **Alternative 3 – Speed Restrictions in Designated Areas** would have the second-highest direct economic impact on the shipping industry, with an estimated $142.5 million annually. This alternative also would have the second-highest direct economic impact on US-flag vessels, at $16.8 million annually, and foreign-flag vessels, at $125.7 million annually. This alternative would result in the second-highest direct economic impact on the port areas in the NEUS, and the highest economic impact (same as under Alternative 5) on the port areas in the MAUS. Economic impacts in the SEUS rank third or fourth.
- **Alternative 6 – Proposed Action** would have the third-highest direct economic impact on the shipping industry, with an estimated $57.6 million annually. This is more than half the direct economic impact of Alternative 5. Alternative 6 would have the third-highest direct economic impact on US-flag vessels, at $8.5 million annually, and foreign-flag vessels, at $49.0 million annually. This alternative would have the second-highest direct economic impact of all action alternatives for the southeast port areas of Brunswick, Fernandina and Jacksonville. For all other port areas, Alternative 6 ranks third, except Savannah, Salem, and Searsport, which all rank fourth. However, all economic impacts would cease when the measures expire, five years after their date of effectiveness.
- **Alternative 2 – Mandatory Dynamic Management Areas** ranks fourth in terms of direct economic impact on the shipping industry, with an estimated $27.6 million annually. This alternative also would have the fourth-highest direct economic impact on US-flag vessels, at $2.7 million annually, and foreign-flag vessels, at $24.9 million annually. For Port Canaveral, Alternative 2 results in the highest direct economic impact of all action alternatives, at $4.6 million annually. For the port areas of Savannah, Searsport, and Salem, this alternative ranks third; for all other port areas, it ranks fourth.

[21] Alternative 2 results in the highest direct economic impact for Port Canaveral, as the effective distance for the DMAs is 39.6 nautical miles for an assumed 75 days per year. Under Alternative 5, the effective distance for the seasonal speed restriction is limited to 4.5 nautical miles through the right whale critical habitat area and the DMAs are assumed to occur for only 15 days per year outside the seasonal speed-restriction periods.

Data Chart 4-20
Direct Economic Impact on the Shipping Industry for US and Foreign Flag Vessels by Port Area and Alternative, 2003 ($000s)

	Alternative 2			Alternative 3			Alternative 4			Alternative 5			Alternative 6		
Port Area	US	Foreign	Total	US	Foreign	Total	US	Foreign	Total	US	Foreign	Total	US	Foreign	Total
Northeastern US - Gulf of Maine															
Eastport, ME	-	51.6	51.6	-	262.3	262.3	-	-	-	-	273.7	273.7	-	62.9	62.9
Searsport, ME	24.1	443.3	467.4	122.7	2,254.8	2,377.5	-	-	-	128.0	2,352.6	2,480.6	24.1	359.5	383.5
Portland, ME	29.2	648.5	677.7	148.6	3,298.5	3,447.2	-	-	-	155.1	3,441.6	3,596.7	51.0	858.5	909.5
Portsmouth, NH	9.3	148.8	158.1	47.3	756.8	804.1	-	-	-	49.3	789.6	838.9	15.0	227.7	242.7
Northeastern US - Off Race Point															
Boston, MA	6.8	795.3	802.1	35.8	4,208.7	4,244.4	-	-	-	37.3	4,384.1	4,421.4	9.3	1,121.4	1,130.8
Salem, MA	0.6	8.7	9.3	3.1	46.3	49.4	-	-	-	3.2	48.2	51.4	0.4	15.9	16.2
	-	-	-	-	-	-	-	-	-	-	-	-			
Northeastern US - Cape Cod Bay	-	15.7	15.7	-	216.5	216.5	-	-	-	-	218.7	218.7	-	78.4	78.4
Mid-Atlantic Block Island Sound															
New Bedford, MA	2.8	16.1	18.9	72.5	294.3	366.9	-	-	-	72.5	294.3	366.9	48.1	176.1	224.2
Providence, RI	3.3	103.9	107.2	70.9	1,724.3	1,795.2	-	-	-	70.9	1,724.3	1,795.2	47.6	720.0	767.6
New London, CT	34.7	10.3	45.0	727.8	177.5	905.4	-	-	-	727.8	177.5	905.4	333.7	85.0	418.7
New Haven, CT	48.4	47.6	96.0	956.0	845.7	1,801.7	-	-	-	956.0	845.7	1,801.7	444.5	396.0	840.5
Bridgeport, CT	34.2	14.2	48.4	512.6	134.8	647.4	-	-	-	512.6	134.8	647.4	179.6	50.5	230.2
Long Island, NY	118.8	25.4	144.1	2,292.4	558.2	2,850.6	-	-	-	2,292.4	558.2	2,850.6	1,055.0	244.3	1,299.3
Mid-Atlantic Ports of New York/New Jersey	177.4	2,685.1	2,862.5	2,423.2	34,173.7	36,596.9	-	-	-	2,423.2	34,173.7	36,596.9	749.1	10,331.7	11,080.7
Mid-Atlantic Delaware Bay	17.1	815.2	832.3	242.5	13,305.4	13,547.8	-	-	-	242.5	13,305.4	13,547.8	86.3	4,577.5	4,663.8
Mid-Atlantic Chesapeake Bay															
Baltimore, MD	25.8	684.9	710.8	409.4	10,625.5	11,034.9	-	-	-	409.4	10,625.5	11,034.9	138.6	3,581.2	3,719.8
Hampton Roads, VA	159.4	1,465.0	1,624.4	2,412.3	22,087.8	24,500.1	-	-	-	2,412.3	22,087.8	24,500.1	835.3	7,485.8	8,321.1
Mid-Atlantic Morehead City and Beaufort, NC	2.5	24.7	27.2	12.7	180.6	193.2	-	-	-	12.7	180.6	193.2	4.7	72.2	76.9
Mid-Atlantic Wilmington, NC	17.1	170.0	187.2	130.9	1,447.4	1,578.3	-	-	-	130.9	1,447.4	1,578.3	57.4	650.4	707.7
Mid-Atlantic Georgetown, SC	0.1	15.4	15.5	0.8	97.4	98.2	-	-	-	0.8	97.4	98.2	0.4	45.3	45.7
Mid-Atlantic Charleston, SC	276.2	1,150.5	1,426.8	1,943.8	7,928.8	9,872.6	-	-	-	1,943.8	7,928.8	9,872.6	961.5	3,836.1	4,797.6
Mid-Atlantic Savannah, GA	171.3	6,681.6	6,852.9	260.1	9,891.2	10,151.3	-	-	-	260.1	9,891.2	10,151.3	142.6	4,782.9	4,925.5
Southeastern US															
Brunswick, GA	64.1	689.1	753.1	94.4	754.0	848.3	22.6	208.8	231.4	122.5	1,042.3	1,164.8	120.6	1,027.1	1,147.7
Fernandina, FL	9.5	319.9	329.4	27.6	503.3	530.9	24.2	220.0	244.2	49.3	707.3	756.6	48.7	696.8	745.5
Jacksonville, FL	878.3	1,983.5	2,861.9	1,082.9	2,477.9	3,560.7	691.6	1,166.2	1,857.8	1,876.6	3,872.3	5,748.9	1,813.5	3,728.0	5,541.5
Port Canaveral, FL	42.3	3,858.8	3,901.1	11.0	717.0	728.0	-	-	-	19.5	1,488.8	1,508.2	8.5	771.8	780.2
Total	2,153.4	22,873.1	25,026.5	14,041.2	118,968.7	133,009.9	738.4	1,595.0	2,333.4	14,908.6	122,091.8	137,000.4	7,175.4	45,982.9	53,158.3

Source: Nathan Associates Inc.

Data Chart 4-21
Direct Economic Impact on the Shipping Industry for US and Foreign Flag Vessels by Port Area and Alternative, 2004 ($000s)

	Alternative 2			Alternative 3			Alternative 4			Alternative 5			Alternative 6		
Port Area	US	Foreign	Total	US	Foreign	Total	US	Foreign	Total	US	Foreign	Total	US	Foreign	Total
Northeastern US - Gulf of Maine															
Eastport, ME	-	87.3	87.3	-	444.0	444.0	-	-	-	-	463.3	463.3	-	118.8	118.8
Searsport, ME	65.4	455.1	520.4	332.5	2,314.6	2,647.1	-	-	-	346.9	2,415.0	2,761.9	53.0	363.2	416.2
Portland, ME	70.0	674.3	744.3	355.9	3,429.6	3,785.5	-	-	-	371.3	3,578.4	3,949.7	93.6	861.8	955.4
Portsmouth, NH	5.8	132.5	138.4	29.6	674.1	703.7	-	-	-	30.9	703.4	734.2	3.8	178.6	182.5
Northeastern US - Off Race Point															
Boston, MA	6.8	795.3	802.1	35.8	4,208.7	4,244.4	-	-	-	37.3	4,384.1	4,421.4	9.3	1,121.4	1,130.8
Salem, MA	7.1	28.3	35.4	37.4	149.8	187.2	-	-	-	39.0	156.0	195.0	4.7	18.7	23.4
	-	-	-	-	-	-	-	-	-	-	-	-			
Northeastern US - Cape Cod Bay	2.2	27.1	29.3	30.9	374.6	405.5	-	-	-	31.2	378.4	409.7	1.0	79.2	80.2
Mid-Atlantic Block Island Sound															
New Bedford, MA	3.4	14.5	17.9	32.6	252.2	284.7	-	-	-	32.6	252.2	284.7	21.3	161.1	182.4
Providence, RI	10.2	99.9	110.0	141.7	1,921.1	2,062.8	-	-	-	141.7	1,921.1	2,062.8	68.7	785.7	854.3
New London, CT	51.6	29.2	80.9	612.4	437.8	1,050.2	-	-	-	612.4	437.8	1,050.2	236.5	196.4	432.9
New Haven, CT	74.6	39.9	114.5	1,538.1	721.0	2,259.1	-	-	-	1,538.1	721.0	2,259.1	737.1	330.8	1,067.9
Bridgeport, CT	45.1	12.6	57.8	765.1	162.4	927.5	-	-	-	765.1	162.4	927.5	275.4	83.1	358.4
Long Island, NY	136.0	25.3	161.3	2,781.7	481.4	3,263.1	-	-	-	2,781.7	481.4	3,263.1	1,328.5	232.8	1,561.3
Mid-Atlantic Ports of New York/New Jersey	179.0	2,950.3	3,129.3	2,414.6	36,724.9	39,139.5	-	-	-	2,414.6	36,724.9	39,139.5	721.9	11,078.4	11,800.3
Mid-Atlantic Delaware Bay	25.9	833.7	859.6	413.8	13,055.8	13,469.7	-	-	-	413.8	13,055.8	13,469.7	133.2	4,605.6	4,738.8
Mid-Atlantic Chesapeake Bay															
Baltimore, MD	35.3	788.6	823.9	493.4	11,828.5	12,321.9	-	-	-	493.4	11,828.5	12,321.9	157.8	3,880.9	4,038.7
Hampton Roads, VA	166.6	1,502.8	1,669.4	2,529.4	22,729.3	25,258.7	-	-	-	2,529.4	22,729.3	25,258.7	880.8	7,740.8	8,621.5
Mid-Atlantic Morehead City and Beaufort, NC	7.1	27.6	34.7	54.0	203.4	257.4	-	-	-	54.0	203.4	257.4	26.5	92.4	118.8
Mid-Atlantic Wilmington, NC	18.1	179.6	197.7	175.2	1,463.9	1,639.1	-	-	-	175.2	1,463.9	1,639.1	83.4	680.5	763.9
Mid-Atlantic Georgetown, SC	0.9	13.8	14.7	10.6	122.1	132.7	-	-	-	10.6	122.1	132.7	5.6	55.4	61.0
Mid-Atlantic Charleston, SC	317.2	1,193.1	1,510.3	2,191.7	8,227.3	10,418.9	-	-	-	2,191.7	8,227.3	10,418.9	1,076.7	3,966.1	5,042.7
Mid-Atlantic Savannah, GA	219.5	7,043.9	7,263.4	369.5	10,634.6	11,004.1	-	-	-	369.5	10,634.6	11,004.1	206.4	5,150.0	5,356.5
Southeastern US															
Brunswick, GA	109.8	622.3	732.1	155.5	760.3	915.9	42.0	211.0	253.0	207.4	1,037.1	1,244.5	204.3	1,021.7	1,226.0
Fernandina, FL	75.0	297.1	372.1	111.6	421.4	533.0	68.7	197.6	266.3	177.5	611.4	788.9	175.2	602.6	777.8
Jacksonville, FL	953.1	2,503.2	3,456.3	1,193.4	3,124.5	4,317.9	793.4	1,477.9	2,271.3	2,096.4	4,890.6	6,987.0	2,026.8	4,708.6	6,735.5
Port Canaveral, FL	92.7	4,523.0	4,615.7	13.1	790.1	803.2	-	-	-	31.6	1,694.7	1,726.3	18.5	904.6	923.1
Total	2,678.4	24,900.4	27,578.8	16,819.3	125,657.5	142,476.8	904.0	1,886.5	2,790.6	17,893.1	129,278.2	147,171.3	8,550.0	49,019.2	57,569.2

Source: Nathan Associates Inc.

- **Alternative 4 – Recommended Routes** would have the lowest direct economic impact of all the action alternatives, with an estimated $2.8 million annually. This alternative would have the lowest direct economic impact on US-flag vessels, at $0.9 million annually, and foreign-flag vessels, at $1.9 million annually.

4.4.1.8 Impacts of Alternative Speeds

In addition to the 10-knot speed restriction, the economic analysis also considered restrictions to 12 and 14 knots for each action alternatives. The findings of the analysis on the direct impacts to the shipping industry if these alternative speed restrictions were applied are summarized in this section. The estimated impacts were determined through a sensitivity analysis based on the range of speed restrictions. The dollar amounts refer to annual economic impact.

Data Chart 4-22 presents the results of the sensitivity analysis by port area based on 2004 conditions. The ranking of the alternatives in terms of economic impact relative to each other does not change with restricted speeds of 12 knots or 14 knots. A change in the speed restriction from 10 knots to 12 knots would generally reduce the direct economic impact of each alternative by 37 percent, whereas a change in the restricted speed from 10 knots to 14 knots would generally lower the direct economic impact of each alternative by more than 60 percent. [22]

The sensitivity analysis show that the level of speed restriction dramatically alters the level of direct economic impacts. For example, under Alternative 5, the impact would be $147.2 million annually with a 10-knot restriction and $55.2 million with a 14-knot restriction. For Alternative 6, the range is from $57.6 million to $21.5 million.

At a restricted speed of 12 knots, the annual direct economic impact on the shipping industry would be $92.8 million for Alternative 5; $89.2 million for Alternative 3; $36.0 million for Alternative 6; $17.7 million for Alternative 2; and $2.8 million for Alternative 4.

At a restricted speed of 14 knots, the annual direct economic impact on the shipping industry would be $55.2 million for Alternative 5; $52.5 million for Alternative 3; $21.5 million for Alternative 6; $10.8 million for Alternative 2; and $2.8 million for Alternative 4.

Data Chart 4-23 shows the sensitivity analysis results for each alternative using the economic impact of the 10-knot speed restriction as an index, i.e., the percentage of the direct economic impact of a 12-knot or 14-knot speed restriction relative to the that for a 10-knot speed restriction. The changes in economic impacts due to alternative speed restrictions are not uniformly incurred by all port areas. Port areas that are characterized by arrivals of slower vessels show a disproportionate decrease in economic impact when the restricted speed is changed from 10 knots to 12 knots, as fewer vessels would be affected at the higher limit. The port areas within Block Island Sound demonstrate this phenomenon. Other port areas, such as Charleston and Hampton Roads, where faster vessels make up a larger proportion of arrivals, do not show as dramatic a decrease in direct economic impacts at alternate restricted speeds of 12 knots. These port areas do not have many slower vessels that would only be affected at the slower restricted speed.

[22] The exception is Alternative 4, for which the impacts do not change with restricted speeds, as this alternative uses the time to cover the increased distance of recommended routes at normal vessel operating speed.

Data Chart 4-22
Direct Economic Impact on the Shipping Industry at Restricted Speeds of 10, 12 and 14 knots, 2004 ($000s)

	Alternative 2			Alternative 3			Alternative 4			Alternative 5			Alternative 6		
	Restriction speed in knots			Restriction speed in knots			Restriction speed in knots			Restriction speed in knots			Restriction speed in knots		
Port Area	10	12	14	10	12	14	10	12	14	10	12	14	10	12	14
Northeastern US - Gulf of Maine															
Eastport, ME	87.3	54.0	33.4	444.0	275.5	170.6	-	-	-	463.3	287.4	178.0	118.8	73.2	45.7
Searsport, ME	520.4	313.2	161.3	2,647.1	1,596.6	823.7	-	-	-	2,761.9	1,665.7	859.3	416.2	240.3	110.5
Portland, ME	744.3	380.4	136.3	3,785.5	1,938.7	696.4	-	-	-	3,949.7	2,022.6	726.4	955.4	464.6	138.0
Portsmouth, NH	138.4	60.9	13.9	703.7	310.5	70.9	-	-	-	734.2	323.9	74.0	182.5	79.6	18.2
Northeastern US - Off Race Point															
Boston, MA	802.1	460.0	217.7	4,244.4	2,339.7	1,065.9	-	-	-	4,421.4	2,441.2	1,113.9	1,130.8	630.8	291.6
Salem, MA	35.4	20.4	10.0	187.2	103.9	48.8	-	-	-	195.0	108.4	51.0	23.4	13.5	6.6
Northeastern US - Cape Cod Bay	29.3	20.4	11.6	405.5	234.9	114.3	-	-	-	409.7	237.8	116.0	80.2	44.5	18.0
Mid-Atlantic Block Island Sound															
New Bedford, MA	17.9	8.0	1.8	284.7	118.8	19.8	-	-	-	284.7	118.8	19.8	182.4	75.1	13.5
Providence, RI	110.0	63.0	31.4	2,062.8	1,144.2	534.5	-	-	-	2,062.8	1,144.2	534.5	854.3	438.8	176.4
New London, CT	80.9	46.5	21.6	1,050.2	585.3	261.6	-	-	-	1,050.2	585.3	261.6	432.9	234.1	101.3
New Haven, CT	114.5	49.2	6.3	2,259.1	944.3	106.2	-	-	-	2,259.1	944.3	106.2	1,067.9	441.4	48.9
Bridgeport, CT	57.8	23.0	2.1	927.5	332.1	3.1	-	-	-	927.5	332.1	3.1	358.4	125.1	1.3
Long Island, NY	161.3	71.0	11.2	3,263.1	1,397.3	208.0	-	-	-	3,263.1	1,397.3	208.0	1,561.3	655.4	94.9
Mid-Atlantic Ports of New York/New Jersey	3,129.3	2,118.0	1,375.0	39,139.5	26,088.1	16,704.8	-	-	-	39,139.5	26,088.1	16,704.8	11,800.3	7,743.8	4,891.4
Mid-Atlantic Delaware Bay	859.6	504.4	253.3	13,469.7	7,766.7	3,842.3	-	-	-	13,469.7	7,766.7	3,842.3	4,738.8	2,700.3	1,322.3
Mid-Atlantic Chesapeake Bay															
Baltimore, MD	823.9	530.3	319.5	12,321.9	7,773.2	4,601.6	-	-	-	12,321.9	7,773.2	4,601.6	4,038.7	2,511.4	1,469.6
Hampton Roads, VA	1,669.4	1,153.5	779.2	25,258.7	17,123.4	11,360.5	-	-	-	25,258.7	17,123.4	11,360.5	8,621.5	5,755.6	3,765.1
Mid-Atlantic Morehead City and Beaufort, NC	34.7	18.1	7.4	257.4	132.2	52.8	-	-	-	257.4	132.2	52.8	118.8	61.8	24.8
Mid-Atlantic Wilmington, NC	197.7	115.7	61.1	1,639.1	926.5	472.1	-	-	-	1,639.1	926.5	472.1	763.9	435.1	223.8
Mid-Atlantic Georgetown, SC	14.7	7.2	3.5	132.7	64.6	30.1	-	-	-	132.7	64.6	30.1	61.0	30.1	14.1
Mid-Atlantic Charleston, SC	1,510.3	1,053.2	717.3	10,418.9	6,979.3	4,566.4	-	-	-	10,418.9	6,979.3	4,566.4	5,042.7	3,379.2	2,212.4
Mid-Atlantic Savannah, GA	7,263.4	5,008.1	3,384.6	11,004.1	7,292.1	4,742.0	-	-	-	11,004.1	7,292.1	4,742.0	5,356.5	3,552.0	2,309.0
Southeastern US															
Brunswick, GA	732.1	459.4	273.7	915.9	556.9	321.2	253.0	253.0	253.0	1,244.5	839.4	560.3	1,226.0	828.2	553.8
Fernandina, FL	372.1	207.6	104.8	533.0	282.0	136.5	266.3	266.3	266.3	788.9	519.5	330.1	777.8	513.6	327.2
Jacksonville, FL	3,456.3	2,011.4	1,106.7	4,317.9	2,429.2	1,294.9	2,271.3	2,271.3	2,271.3	6,987.0	4,575.6	3,094.2	6,735.5	4,434.1	3,018.8
Port Canaveral, FL	4,615.7	2,943.9	1,737.1	803.2	493.5	281.2	-	-	-	1,726.3	1,082.3	628.6	923.1	588.8	347.4
Total	27,578.8	17,700.7	10,781.8	142,476.8	89,229.6	52,530.3	2,790.6	2,790.6	2,790.6	147,171.3	92,772.0	55,237.8	57,569.2	36,050.4	21,544.6

Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in text.

Data Chart 4-23
Direct Economic Impact on the Shipping Industry at Restricted Speeds of 10, 12 and 14 knots, 2004 (Indexed 10 Knots = 100)

	Alternative 2			Alternative 3			Alternative 4			Alternative 5			Alternative 6		
	Restriction speed in knots			Restriction speed in knots			Restriction speed in knots			Restriction speed in knots			Restriction speed in knots		
Port Area	10	12	14	10	12	14	10	12	14	10	12	14	10	12	14
Northeastern US - Gulf of Maine															
Eastport, ME	100.0	61.9	38.3	100.0	62.0	38.4	-	-	-	100.0	62.0	38.4	100.0	61.7	38.4
Searsport, ME	100.0	60.2	31.0	100.0	60.3	31.1	-	-	-	100.0	60.3	31.1	100.0	57.7	26.6
Portland, ME	100.0	51.1	18.3	100.0	51.2	18.4	-	-	-	100.0	51.2	18.4	100.0	48.6	14.4
Portsmouth, NH	100.0	44.0	10.0	100.0	44.1	10.1	-	-	-	100.0	44.1	10.1	100.0	43.6	10.0
Northeastern US - Off Race Point															
Boston, MA	100.0	57.3	27.1	100.0	55.1	25.1	-	-	-	100.0	55.2	25.2	100.0	55.8	25.8
Salem, MA	100.0	57.7	28.2	100.0	55.5	26.1	-	-	-	100.0	55.6	26.2	100.0	57.7	28.2
Northeastern US - Cape Cod Bay	100.0	69.5	39.4	100.0	57.9	28.2	-	-	-	100.0	58.0	28.3	100.0	55.5	22.5
Mid-Atlantic Block Island Sound															
New Bedford, MA	100.0	44.8	10.0	100.0	41.7	7.0	-	-	-	100.0	41.7	7.0	100.0	41.2	7.4
Providence, RI	100.0	57.3	28.6	100.0	55.5	25.9	-	-	-	100.0	55.5	25.9	100.0	51.4	20.7
New London, CT	100.0	57.5	26.8	100.0	55.7	24.9	-	-	-	100.0	55.7	24.9	100.0	54.1	23.4
New Haven, CT	100.0	42.9	5.5	100.0	41.8	4.7	-	-	-	100.0	41.8	4.7	100.0	41.3	4.6
Bridgeport, CT	100.0	39.8	3.6	100.0	35.8	0.3	-	-	-	100.0	35.8	0.3	100.0	34.9	0.4
Long Island, NY	100.0	44.0	7.0	100.0	42.8	6.4	-	-	-	100.0	42.8	6.4	100.0	42.0	6.1
Mid-Atlantic Ports of New York/New Jersey	100.0	67.7	43.9	100.0	66.7	42.7	-	-	-	100.0	66.7	42.7	100.0	65.6	41.5
Mid-Atlantic Delaware Bay	100.0	58.7	29.5	100.0	57.7	28.5	-	-	-	100.0	57.7	28.5	100.0	57.0	27.9
Mid-Atlantic Chesapeake Bay															
Baltimore, MD	100.0	64.4	38.8	100.0	63.1	37.3	-	-	-	100.0	63.1	37.3	100.0	62.2	36.4
Hampton Roads, VA	100.0	69.1	46.7	100.0	67.8	45.0	-	-	-	100.0	67.8	45.0	100.0	66.8	43.7
Mid-Atlantic Morehead City and Beaufort, NC	100.0	52.0	21.2	100.0	51.4	20.5	-	-	-	100.0	51.4	20.5	100.0	52.0	20.9
Mid-Atlantic Wilmington, NC	100.0	58.5	30.9	100.0	56.5	28.8	-	-	-	100.0	56.5	28.8	100.0	57.0	29.3
Mid-Atlantic Georgetown, SC	100.0	49.0	24.1	100.0	48.7	22.7	-	-	-	100.0	48.7	22.7	100.0	49.4	23.1
Mid-Atlantic Charleston, SC	100.0	69.7	47.5	100.0	67.0	43.8	-	-	-	100.0	67.0	43.8	100.0	67.0	43.9
Mid-Atlantic Savannah, GA	100.0	68.9	46.6	100.0	66.3	43.1	-	-	-	100.0	66.3	43.1	100.0	66.3	43.1
Southeastern US															
Brunswick, GA	100.0	62.7	37.4	100.0	60.8	35.1	100.0	100.0	100.0	100.0	67.4	45.0	100.0	67.5	45.2
Fernandina, FL	100.0	55.8	28.2	100.0	52.9	25.6	100.0	100.0	100.0	100.0	65.9	41.8	100.0	66.0	42.1
Jacksonville, FL	100.0	58.2	32.0	100.0	56.3	30.0	100.0	100.0	100.0	100.0	65.5	44.3	100.0	65.8	44.8
Port Canaveral, FL	100.0	63.8	37.6	100.0	61.4	35.0	-	-	-	100.0	62.7	36.4	100.0	63.8	37.6
Total	100.0	64.2	39.1	100.0	62.6	36.9	100.0	100.0	100.0	100.0	63.0	37.5	100.0	62.6	37.4

Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in text.

4.4.2 Additional Direct Economic Impacts on the Shipping Industry

This section describes additional direct economic impacts on the shipping industry relevant to vessels making multiple port calls on the US East Coast and to coastwise shipping vessels. The end of this section ties all of the direct economic costs on the shipping industry together, and describes the impacts relative to the value of US East Cost trade and ocean-freight costs.

Impacts on Vessels with Multiple Port Calls on the East Coast

Many of the vessels arrivals at US East Coast ports are part of a “string” of port calls by the vessel. For containerships, ro-ro cargo ships, and some specialty tankers, these multi-port calls constitute a scheduled cargo service offered by the shipping lines. Other types of vessels may have multiple US East Coast port calls as part of a coastwise cabotage service for delivering specialty chemicals or other products, or to lighten or top off in order to maximize vessel utilization.

Shipping industry representatives and port officials raised concerns during the stakeholder meetings regarding the cumulative effect of the proposed action and alternatives on vessels calling at multiple East Coast ports during speed-restricted periods. This section identifies the number of vessel arrivals at each port area that are part of a multi-port string during proposed restriction periods and estimates the additional direct economic impact on the shipping industry.

The USCG Vessel Arrival Database described in Chapter 3 was used to determine which vessels made multiple port calls along the US East Coast in 2003 and 2004. For purposes of this analysis, if a vessel arrived at another US East Coast port area within the two days following its arrival at the preceding US East Coast port, that arrival was considered to be a part of a multi-port string.[23]

Data Chart 4-24 lists sets of multi-port strings that occurred at least 20 times in 2003. Of the total of 4,278 occurrences of multi-port strings in 2003, those strings with at least 20 occurrences made up 2,760, or 65 percent, of the total observed. The multi-port string of New York/New Jersey–Hampton Roads–Charleston was the most frequent, with 293 occurrences, followed by the string of New York/New Jersey–Hampton Roads–Savannah, with 194 occurrences. The string of New York/New Jersey–Hampton Roads was third, with 151 occurrences.

Data Chart 4-25 presents a similar listing of US East Coast multi-port strings in 2004. Those strings with 20 or more occurrences accounted for 63 percent of the 4,461 total occurrences of multi-port strings that year. While some of the rankings change slightly, it is interesting to note that the port areas of New York/New Jersey or Hampton Roads are part of each of the top ten multi-port strings in both 2003 and 2004.

Other port areas with significant participation in multi-port strings each year include Charleston, Savannah, Baltimore, and Philadelphia.

[23] Vessels making multiple port calls within the same port area were not considered as part of a multi-port string, as they would not be passing through a speed-restricted area for the second port call.

Data Chart 4-24
US East Coast: Most Frequent Multi-Port Strings, 2003

Port Area 1	Port Area 2	Port Area 3	Port Area 4	Occurrences
New York City, NY	Hampton Roads, VA	Charleston, SC		293
New York City, NY	Hampton Roads, VA	Savannah, GA		194
New York City, NY	Hampton Roads, VA			151
Hampton Roads, VA	New York City, NY			143
New York City, NY	Baltimore, MD			139
New York City, NY	Philadelphia, PA			104
Charleston, SC	Hampton Roads, VA	New York City, NY		93
Baltimore, MD	New York City, NY			92
Savannah, GA	Hampton Roads, VA	New York City, NY		84
Savannah, GA	Hampton Roads, VA			76
Charleston, SC	Hampton Roads, VA			69
Charleston, SC	Jacksonville, FL			67
Savannah, GA	New York City, NY			65
Savannah, GA	Charleston, SC			58
Baltimore, MD	Hampton Roads, VA			54
Philadelphia, PA	Hampton Roads, VA			54
Charleston, SC	Wilmington, NC			53
Brunswick, GA	Charleston, SC			46
New York City, NY	Savannah, GA			46
Charleston, SC	New York City, NY			45
New York City, NY	Charleston, SC			43
Charleston, SC	Savannah, GA			41
Philadelphia, PA	New York City, NY			38
Hampton Roads, VA	Savannah, GA			38
Savannah, GA	Charleston, SC	Hampton Roads, VA	New York City, NY	37
Hampton Roads, VA	Charleston, SC			36
Jacksonville, FL	New York City, NY			36
Jacksonville, FL	Charleston, SC			35
Wilmington, NC	Savannah, GA			35
New York City, NY	Hampton Roads, VA	Charleston, SC	New York City, NY	33
Long Island, NY	New York City, NY			33
Philadelphia, PA	Baltimore, MD			28
Savannah, GA	Philadelphia, PA			28
New York City, NY	Baltimore, MD	Hampton Roads, VA		27
Jacksonville, FL	Baltimore, MD	New York City, NY		27
New York City, NY	Baltimore, MD	Savannah, GA		26
Hampton Roads, VA	Philadelphia, PA			26
Jacksonville, FL	Savannah, GA			26
New York City, NY	Baltimore, MD	Hampton Roads, VA	Charleston, SC	25
Hampton Roads, VA	Baltimore, MD			24
Portland, ME	Searsport, ME			24
New York City, NY	Savannah, GA	Hampton Roads, VA	New York City, NY	23
Jacksonville, FL	New York City, NY	Baltimore, MD		22
New York City, NY	Port Canaveral, FL			22
Savannah, GA	Jacksonville, FL			21
New York City, NY	Baltimore, MD	Charleston, SC		20
Hampton Roads, VA	Baltimore, MD	New York City, NY		20
Portland, ME	Boston, MA			20
New Haven, CT	New York City, NY			20
Subtotal				2,760
Other Strings				1,518
Total				4,278

Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in the text.

Data Chart 4-25
US East Coast: Most Frequent Multi-Port Strings, 2004

Port Area 1	Port Area 2	Port Area 3	Port Area 4	Occurrences
New York City, NY	Hampton Roads, VA	Charleston, SC		279
New York City, NY	Hampton Roads, VA	Savannah, GA		223
New York City, NY	Hampton Roads, VA			187
Charleston, SC	Hampton Roads, VA	New York City, NY		183
New York City, NY	Baltimore, MD			162
Baltimore, MD	New York City, NY			119
Charleston, SC	Hampton Roads, VA			100
New York City, NY	Philadelphia, PA			99
Hampton Roads, VA	New York City, NY			86
Savannah, GA	New York City, NY			83
Philadelphia, PA	Hampton Roads, VA			69
Savannah, GA	Charleston, SC			65
Charleston, SC	Jacksonville, FL			64
Savannah, GA	Hampton Roads, VA	New York City, NY		58
Jacksonville, FL	New York City, NY			51
Wilmington, NC	Savannah, GA			49
Charleston, SC	Savannah, GA			47
Savannah, GA	Charleston, SC	New York City, NY		45
New York City, NY	Charleston, SC			42
New York City, NY	Hampton Roads, VA	Charleston, SC	New York City, NY	42
New York City, NY	Savannah, GA			40
Hampton Roads, VA	Charleston, SC			39
Charleston, SC	Wilmington, NC			39
New York City, NY	Baltimore, MD	Hampton Roads, VA	Charleston, SC	38
Baltimore, MD	Hampton Roads, VA			38
Philadelphia, PA	New York City, NY			38
New York City, NY	Baltimore, MD	Hampton Roads, VA	New York City, NY	37
Savannah, GA	Philadelphia, PA			37
Hampton Roads, VA	Baltimore, MD			35
Hampton Roads, VA	Savannah, GA			35
Jacksonville, FL	Baltimore, MD	New York City, NY		31
Charleston, SC	Brunswick, GA			31
New York City, NY	Port Canaveral, FL			31
Savannah, GA	Hampton Roads, VA			30
Jacksonville, FL	Savannah, GA			29
New York City, NY	Baltimore, MD	Hampton Roads, VA		28
New York City, NY	Savannah, GA	Hampton Roads, VA	New York City, NY	28
Hampton Roads, VA	Baltimore, MD	New York City, NY		25
Brunswick, GA	Charleston, SC			23
Hampton Roads, VA	Philadelphia, PA			22
Portland, ME	Searsport, ME			22
New York City, NY	Wilmington, NC	Savannah, GA		22
Baltimore, MD	Philadelphia, PA			21
Long Island, NY	New York City, NY			20
Subtotal				2,792
Other Strings				1,669
Total				4,461

Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in the text.

The occurrences of multi-port strings presented above were based on total US East Coast vessel movements in 2003 and 2004. Additional economic impacts related to these strings are discussed below for each alternative. The main analysis is based on a speed restriction of 10 knots. Impacts with restrictions to 12 or 14 knots were also estimated and are summarized in Data Chart 4-43.

4.4.2.1 Alternative 1 – No Action Alternative

There would be no impacts on vessels making multiple port calls under Alternative 1.

4.4.2.2 Alternative 2 – Mandatory Dynamic Management Areas

There would be no impacts on vessels making multiple US East Coast port calls under Alternative 2. Due to its limited geographic scope at any one time, Alternative 2 would not generate an additional direct economic impact due to multi-port strings.

4.4.2.3 Alternative 3 – Speed Restrictions in Designated Areas

The additional direct economic impact on vessels making multiple US East Coast port calls under Alternative 3 was estimated at $11.3 million annually under 2003 conditions and $11.9 million annually under 2004 conditions[24].

Speed restrictions under Alternative 3 include restrictions that would be in place year-round in the NEUS, from October 1 through April 30 in the MAUS, and from November 15 through April 15 in the SEUS.

Data Chart 4-26 presents vessel arrivals in 2003 for port areas that are part of multi-port strings when at least two port areas in the string would have speed restrictions under Alternative 3. In 2003, 6,080 vessel arrivals fall into this category, with the 3,337 containership arrivals accounting for 55 percent of the total multi-port vessel arrivals during speed-restricted periods. Ro-ro cargo ships, with 1,052 arrivals (17 percent), and tankers, with 921 arrivals (15 percent), are the other vessel types with the most port calls as part of multi-port strings during restricted periods.

The 6,080 multi-port string restricted-period arrivals under 2003 conditions (see Data Chart 4-26) represent roughly 41 percent of total US East Coast Alternative 3 restricted-period arrivals (see Data Chart 4-3). For containerships, the multi-port string restricted arrivals represent 68 percent of the total containership restricted-period arrivals. For ro-ro cargo ships, the multi-port string restricted-period arrivals represent 61 percent of their total restricted-period arrivals in 2003.

The port area of New York/New Jersey has the greatest number of multi-port string restricted-period arrivals, with 1,489. The port area of Hampton Roads is second, with 1,083 arrivals, followed by the port areas of Charleston (737 arrivals), Savannah (631 arrivals), Baltimore (575 arrivals), and Philadelphia (345 arrivals).

[24] The same is true of Alternative 5, which includes the Alternative 3 speed restrictions and has no other source of multi-string additional impacts; therefore, the findings for Alternative 3 presented here also hold true for Alternative 5.

Data Chart 4-26
Alternatives 3 and 5: US East Coast Restricted Vessel Arrivals that are a part of a Multi-Port String, by Port Area and Vessel Type, 2003

	Vessel Type												
Port Area	Bulk Carriers	Combination Carriers	Container ships	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	5	-	-	-	6	-	-	-	-	-	-	-	11
Searsport, ME	-	1	-	-	-	56	-	1	-	32	-	-	90
Portland, ME	6	-	-	-	6	12	-	19	-	65	1	-	109
Portsmouth, NH	2	1	-	-	-	1	-	-	-	35	1	-	40
Northeastern US - Off Race Point													
Boston, MA	1	-	21	-	1	57	-	21	-	50	-	-	151
Salem, MA	1	-	-	-	-	1	-	-	-	1	-	-	3
Northeastern US - Cape Cod Bay													
Cape Cod, MA	-	-	-	-	-	8	-	-	-	5	-	-	13
Mid-Atlantic Block Island Sound													
New Bedford, MA	5	-	-	-	4	-	-	-	-	6	-	-	15
Providence, RI	3	1	-	-	3	14	2	25	-	25	-	-	73
New London, CT	5	-	2	-	2	1	-	-	1	3	-	-	14
New Haven, CT	10	-	1	-	6	-	-	-	11	36	2	-	66
Bridgeport, CT	3	-	-	-	-	-	7	-	9	13	-	-	32
Long Island, NY	-	1	-	-	-	1	-	-	8	51	-	-	61
Mid-Atlantic Ports of New York/New Jersey													
New York City, NY	14	5	965	-	5	25	8	263	6	194	4	-	1,489
Mid-Atlantic Delaware Bay													
Philadelphia, PA	32	-	122	1	21	7	7	48	2	99	6	-	345
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	24	-	195	-	14	14	-	271	-	53	2	2	575
Hampton Roads, VA	24	2	898	-	25	8	-	82	-	42	-	2	1,083
Mid-Atlantic Morehead City and Beaufort, NC													
Morehead City, NC	2	-	5	-	5	-	-	1	-	6	-	1	20
Mid-Atlantic Wilmington, NC													
Wilmington, NC	19	4	41	-	19	-	1	6	6	55	1	-	152
Mid-Atlantic Georgetown, SC													
Georgetown, SC	4	-	1	-	3	-	-	-	-	-	-	-	8
Mid-Atlantic Charleston, SC													
Charleston, SC	12	-	554	-	13	10	-	77	3	66	2	-	737
Mid-Atlantic Savannah, GA													
Savannah, GA	22	5	464	-	37	4	5	45	2	46	-	1	631
Southeastern US													
Brunswick, GA	7	-	6	-	3	1	-	70	-	-	-	-	87
Fernandina, FL	1	-	6	-	10	1	-	-	-	-	-	-	18
Jacksonville, FL	7	-	53	1	6	2	-	115	4	37	3	-	228
Port Canaveral, FL	3	-	3	-	7	5	-	8	1	1	1	-	29
All Port Regions	212	20	3,337	2	196	228	30	1,052	53	921	23	6	6,080

a/ Includes recreational vessels.

b/ Includes fishing vessels, industrial vessels, research vessels, and school ships.

Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in text.

Data Chart 4-27 presents multi-port string restricted-period arrivals under 2004 conditions. Compared to 2003 conditions, the total number of multi-port string restricted-period arrivals is higher by 5.5 percent, to 6,412 arrivals. The ranking by vessel type remains unchanged, with the exception of general cargo vessels moving ahead of bulk carriers into fifth place. In terms of vessel arrivals by port area, the rankings for the top eight port areas remain unchanged from 2003.

There are several way in which the cumulative effect of multiple port calls at restricted ports could affect a vessel. First, the delays incurred from speed restrictions at one port when combined with speed restrictions at a subsequent port may diminish the ability of the vessel to maintain its schedule and could result in missed tidal windows. Second, even brief delays in arrival at the second port could result in increased costs for scheduled, but unused, port labor. Third, some shipping lines suggested that the cumulative impact of three or four port calls at port areas with restrictions could cause them to rework vessel itineraries and could result in dropping one of the port calls in order to maintain a weekly service without having to add an additional vessel to the service.

However, these cumulative factors would not affect every vessel making multiple port calls at restricted ports. In addition, the impact may vary from an eight-hour delay due to a missed tidal window to incurring charges for unused labor if a vessel is late arriving at the port.[25] It is realistic to assume that shippers will revise their itineraries to account for the delays imposed by the speed restrictions and that occurrences of missed tidal widows will be rare. The economic analysis assumes an average additional delay of 36 minutes for each vessel arrival that is part of a multi-port string to account for this cumulative impact.[26] The economic value of this additional time has been calculated for each port area based on June 2008 vessel operating costs by type and size of vessel. The results by port area and type of vessel at a 10-knot speed restriction are presented in Data Chart 4-28 for 2003 conditions and Data Chart 4-29 for 2004 conditions.

As previously noted, the additional direct economic impact of multi-port strings on the shipping industry under 2003 conditions was estimated at $11.3 million annually. The port area of New York/New Jersey would have had the largest impact, at $2.9 million annually, followed by Hampton Roads, at $2.2 million, Charleston, at $1.5 million, Savannah, at $1.3 million, and Baltimore, at $0.9 million. Containerships account for 65 percent of the additional economic impact of multi-port strings.

[25] While tides occur on 12-hour cycles, it is assumed that a tidal window is open for two hours before and after high tide. This results in an 8-hour waiting period between tidal windows.

[26] Only a small proportion of vessel arrivals should be affected by this additional delay. It is estimated that 7.5 percent of vessels could be affected by as much as an additional 8-hour delay due to missing the tidal window. This results in an average additional delay per vessel of 36 minutes.

Data Chart 4-27
Alternatives 3 and 5: US East Coast Restricted Vessel Arrivals that are a Part of a Multi-Port String, by Port Area and Vessel Type, 2004

	Vessel Type												
Port Area	Bulk Carriers	Combination Carriers	Container ships	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	9	-	-	-	4	-	-	-	-	-	-	-	13
Searsport, ME	-	-	-	-	1	35	-	-	1	41	3	-	81
Portland, ME	13	-	-	-	7	16	-	14	2	59	6	-	117
Portsmouth, NH	4	2	-	-	2	1	-	-	-	24	1	-	34
Northeastern US - Off Race Point													
Boston, MA	1	-	6	-	-	19	-	15	-	29	-	-	70
Salem, MA	6	-	-	-	-	5	-	-	-	-	-	-	11
Northeastern US - Cape Cod Bay													
Cape Cod, MA	-	-	-	-	-	11	-	-	-	5	-	-	16
Mid-Atlantic Block Island Sound													
New Bedford, MA	10	-	-	-	3	-	-	-	-	6	-	-	19
Providence, RI	8	-	-	-	1	22	-	27	-	19	1	-	78
New London, CT	1	-	3	-	3	1	-	-	2	3	-	-	13
New Haven, CT	2	-	3	-	2	-	-	-	45	36	-	-	88
Bridgeport, CT	4	-	-	-	-	-	7	-	43	17	-	-	71
Long Island, NY	-	-	-	-	-	-	-	-	29	52	-	-	81
Mid-Atlantic Ports of New York/New Jersey													
New York City, NY	14	5	1,003	-	20	40	8	264	1	189	2	1	1,547
Mid-Atlantic Delaware Bay													
Philadelphia, PA	13	1	113	2	27	10	7	51	-	99	5	-	328
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	15	-	216	-	24	18	2	281	-	60	4	1	621
Hampton Roads, VA	24	3	921	-	33	14	4	82	-	48	2	2	1,133
Mid-Atlantic Morehead City and Beaufort, NC													
Morehead City, NC	3	1	3	-	3	4	-	-	-	12	-	1	27
Mid-Atlantic Wilmington, NC													
Wilmington, NC	16	2	40	-	31	4	-	12	-	66	1	1	173
Mid-Atlantic Georgetown, SC													
Georgetown, SC	7	-	-	-	2	1	-	-	-	-	-	-	10
Mid-Atlantic Charleston, SC													
Charleston, SC	4	-	616	-	23	23	2	76	-	70	1	1	816
Mid-Atlantic Savannah, GA													
Savannah, GA	11	4	463	-	30	18	8	50	-	58	1	1	644
Southeastern US													
Brunswick, GA	6	-	6	-	11	4	-	80	-	-	-	-	107
Fernandina, FL	1	-	15	-	9	5	1	1	-	-	-	-	32
Jacksonville, FL	5	-	54	2	10	6	-	110	-	56	2	-	245
Port Canaveral, FL	2	-	5	-	7	9	-	9	-	4	1	-	37
All Port Regions	179	18	3,467	4	253	266	39	1,072	123	953	30	8	6,412

a/ Includes recreational vessels.

b/ Includes fishing vessels, industrial vessels, research vessels, and school ships.

Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in text.

Data Chart 4-28
Alternatives 3 and 5: Additional Direct Economic Impact of Multi-Port Strings on the Shipping Industry, by Port Area and Vessel Type, 2003 ($000s)

Port Area	Vessel Type												
	Bulk Carriers	Combination Carriers	Container ships	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	3.9	-	-	-	7.0	-	-	-	-	-	-	-	10.9
Searsport, ME	-	0.9	-	-	-	241.7	-	0.8	-	30.7	-	-	274.1
Portland, ME	4.5	-	-	-	4.9	53.0	-	14.3	-	62.0	1.3	-	140.0
Portsmouth, NH	1.5	0.9	-	-	-	4.6	-	-	-	32.8	1.3	-	41.2
Northeastern US - Off Race Point													
Boston, MA	0.8	-	46.5	-	0.6	176.6	-	16.7	-	47.3	-	-	288.5
Salem, MA	1.0	-	-	-	-	3.1	-	-	-	1.0	-	-	5.1
Northeastern US - Cape Cod Bay													
Cape Cod, MA	-	-	-	-	-	26.2	-	-	-	5.0	-	-	31.3
Mid-Atlantic Block Island Sound													
New Bedford, MA	6.1	-	-	-	2.5	-	-	-	-	5.6	-	-	14.2
Providence, RI	2.4	1.0	-	-	1.9	61.3	3.7	26.4	-	25.2	-	-	121.8
New London, CT	4.1	-	3.8	-	3.2	4.6	-	-	1.3	3.3	-	-	20.4
New Haven, CT	8.2	-	2.1	-	9.6	-	-	-	14.8	39.9	2.6	-	77.3
Bridgeport, CT	2.6	-	-	-	-	-	13.9	-	12.1	16.3	-	-	44.8
Long Island, NY	-	1.0	-	-	-	4.6	-	-	10.7	61.0	-	-	77.4
Mid-Atlantic Ports of New York/New Jersey													
New York City, NY	11.4	4.9	2,142.3	-	4.1	108.9	23.5	377.8	8.1	207.4	5.2	-	2,893.7
Mid-Atlantic Delaware Bay													
Philadelphia, PA	25.3	-	211.4	1.2	21.0	28.1	32.6	51.2	2.7	103.3	7.9	-	484.6
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	19.3	-	358.4	-	12.8	59.2	-	371.4	-	51.3	2.6	2.8	877.8
Hampton Roads, VA	21.8	2.1	1,956.4	-	23.0	37.6	-	157.4	-	41.5	-	2.8	2,242.6
Mid-Atlantic Morehead City and Beaufort, NC													
Morehead City, NC	2.1	-	8.8	-	4.5	-	-	1.6	-	6.0	-	0.7	23.7
Mid-Atlantic Wilmington, NC													
Wilmington, NC	15.6	3.7	86.7	-	30.9	-	1.7	12.4	8.3	54.9	1.3	-	215.7
Mid-Atlantic Georgetown, SC													
Georgetown, SC	3.2	-	1.3	-	5.9	-	-	-	-	-	-	-	10.4
Mid-Atlantic Charleston, SC													
Charleston, SC	9.6	-	1,289.7	-	19.9	43.1	-	100.2	4.2	68.7	2.6	-	1,538.0
Mid-Atlantic Savannah, GA													
Savannah, GA	17.6	4.5	1,105.0	-	53.1	15.4	29.1	64.2	2.7	47.8	-	0.7	1,340.1
Southeastern US													
Brunswick, GA	5.5	-	10.9	-	5.2	4.6	-	88.4	-	-	-	-	114.5
Fernandina, FL	0.9	-	5.8	-	16.3	4.6	-	-	-	-	-	-	27.6
Jacksonville, FL	5.4	-	100.1	1.2	9.6	9.3	-	127.2	5.6	36.8	3.9	-	299.0
Port Canaveral, FL	2.3	-	5.7	-	8.4	22.9	-	7.7	1.4	0.9	1.3	-	50.6
All Port Regions	175.0	19.2	7,334.6	2.4	244.3	909.5	104.5	1,417.6	72.0	948.7	30.2	7.0	11,265.1

a/ Includes recreational vessels.

b/ Includes fishing vessels, industrial vessels, research vessels, and school ships.

Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in text.

Data Chart 4-29
Alternatives 3 and 5: Additional Direct Economic Impact of Multi-Port Strings on the Shipping Industry, by Port Area and Vessel Type, 2004 ($000s)

	Vessel Type												
Port Area	Bulk Carriers	Combination Carriers	Containerships	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	6.8	-	-	-	10.3	-	-	-	-	-	-	-	17.1
Searsport, ME	-	-	-	-	0.5	143.3	-	-	1.3	39.0	2.9	-	187.1
Portland, ME	10.0	-	-	-	10.9	79.4	-	10.5	2.6	56.5	5.3	-	175.3
Portsmouth, NH	3.3	1.7	-	-	2.8	4.6	-	-	-	21.6	0.8	-	34.8
Northeastern US - Off Race Point													
Boston, MA	0.7	-	13.9	-	-	58.9	-	11.3	-	25.9	-	-	110.7
Salem, MA	6.7	-	-	-	-	19.8	-	-	-	-	-	-	26.6
Northeastern US - Cape Cod Bay													
Cape Cod, MA	-	-	-	-	-	48.4	-	-	-	4.8	-	-	53.3
Mid-Atlantic Block Island Sound													
New Bedford, MA	11.3	-	-	-	1.9	-	-	-	-	5.1	-	-	18.2
Providence, RI	7.3	-	-	-	0.6	94.0	-	29.1	-	17.6	0.8	-	149.6
New London, CT	0.8	-	5.9	-	7.8	4.5	-	-	2.6	3.3	-	-	25.0
New Haven, CT	1.6	-	4.5	-	1.8	-	-	-	60.4	40.0	-	-	108.3
Bridgeport, CT	3.4	-	-	-	-	-	13.6	-	57.3	22.1	-	-	96.4
Long Island, NY	-	-	-	-	-	-	-	-	38.6	63.3	-	-	101.9
Mid-Atlantic Ports of New York/New Jersey													
New York City, NY	10.8	4.4	2,191.0	-	24.0	182.0	18.6	408.1	1.3	199.6	2.6	0.7	3,043.1
Mid-Atlantic Delaware Bay													
Philadelphia, PA	10.1	0.9	188.1	2.0	24.1	32.4	36.7	55.8	-	108.2	6.6	-	464.9
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	14.4	-	390.4	-	27.2	71.6	5.8	386.2	-	62.5	4.2	0.5	962.9
Hampton Roads, VA	22.4	2.6	1,985.6	-	33.5	60.7	11.6	163.3	-	46.2	2.6	1.2	2,329.7
Mid-Atlantic Morehead City and Beaufort, NC													
Morehead City, NC	2.8	0.8	5.7	-	3.9	18.6	-	-	-	10.9	-	0.7	43.4
Mid-Atlantic Wilmington, NC													
Wilmington, NC	13.3	1.8	79.8	-	50.3	17.0	-	23.9	-	66.3	1.3	0.7	254.4
Mid-Atlantic Georgetown, SC													
Georgetown, SC	5.6	-	-	-	2.3	4.6	-	-	-	-	-	-	12.6
Mid-Atlantic Charleston, SC													
Charleston, SC	3.1	-	1,371.1	-	31.7	90.6	5.8	98.5	-	69.8	0.8	0.7	1,672.0
Mid-Atlantic Savannah, GA													
Savannah, GA	8.9	3.6	1,116.0	-	54.5	77.3	40.7	72.4	-	58.1	1.3	0.7	1,433.4
Southeastern US													
Brunswick, GA	4.6	-	9.2	-	19.2	18.6	-	104.0	-	-	-	-	155.5
Fernandina, FL	0.8	-	14.4	-	17.7	23.2	2.0	2.8	-	-	-	-	61.0
Jacksonville, FL	3.9	-	95.0	2.0	10.8	26.3	-	122.8	-	56.0	2.6	-	319.4
Port Canaveral, FL	1.7	-	9.4	-	9.7	39.4	-	11.0	-	3.6	1.3	-	76.1
All Port Regions	154.4	15.8	7,480.1	4.0	345.5	1,115.2	134.8	1,499.8	164.3	980.4	33.1	5.1	11,932.6

a/ Includes recreational vessels.

b/ Includes fishing vessels, industrial vessels, research vessels, and school ships.

Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in text.

The additional direct economic impact of multi-port strings under 2004 conditions was estimated at $11.9 million annually. The ranking of the top six port areas in terms of largest impact is the same as under 2003 conditions.

The additional annual direct economic impact of multi-port strings in 2004 at a speed restriction of 12 knots would be $9.9 million, and, at 14 knots, $8.4 million. The impacts by alternative and restricted speed are presented in Data Chart 4-43.[27]

4.4.2.4 Alternative 4 – Recommended Shipping Routes

Under Alternative 4, there would be no impacts on vessels making multiple US East Coast port calls. Because of the limited geographic scope of the proposed measures at any time, Alternative 4 would not generate additional direct economic impacts.

4.4.2.5 Alternative 5 – Combination of Alternatives

The additional direct economic impact on vessels making multiple US East Coast port calls under Alternative 5 with a 10-knot speed restriction was estimated at $11.3 million annually for 2003 conditions and $11.9 million annually for 2004 conditions. With a 12-knot restriction, the impact would be $9.9 million (2004 conditions); with a 14-knot restriction, it would be $8.4 million (also 2004 conditions). See Section 4.4.2.3 for details.

4.4.2.6 Alternative 6 – Proposed Action (Preferred Alternative)

The additional annual direct economic impact on vessels making multiple US East Coast port calls under Alternative 6 was estimated at $8.7 million under 2003 conditions and $9.4 million under 2004 conditions.

Seasonal speed restrictions by port area under Alternative 6 would occur during March and April in the Off Race Point area, from January 1 through May 15 in Cape Cod Bay; and from April 1 through July 31 in Great South Channel; from November 1 through April 30 in the MAUS region; and from November 15 through April 15 in the SEUS region.

Data Chart 4-30 shows 2003 vessel arrivals for port areas with speed restrictions that are part of multi-port strings, when at least two port areas in the string would have speed restrictions under Alternative 6. In 2003, there were 4,829 such arrivals, with 2,870 containership arrivals accounting for 59 percent of the total. Ro-ro cargo ships, with 1,075 arrivals (22 percent), and tankers with 722 arrivals (15 percent), were the other vessel types with the most port calls as parts of multi-port strings during restricted periods.

The 4,829 multi-port string restricted-period arrivals in 2003 represented roughly 41 percent of the total US East Coast restricted-period vessel arrivals under Alternative 6 (see Data Chart 4-15). For containerships, the multi-port string restricted-period arrivals represented 69 percent of the total containership restricted-period arrivals. For ro-ro cargo ships the multi-port string restricted-period arrivals represented 73 percent of the total restricted-period arrivals.

[27] The impact at 12 knots was assumed to be 17 percent lower than the estimate at 10 knots. The impact at 14 knots was assumed to be 30 percent lower than the estimate at 10 knots. As explained above, it is realistic to assume that the shipping industry would revise itineraries to account for the known delays due to speed restrictions. The additional impact for multi-port vessel calls applies to more unknown delays that may occur. At a restricted speed of 12 or 14 knots, the overall known delays are shorter, thereby creating less opportunity for the unknown delays to occur. This factor was judged to be proportionate to the change in the restricted speed.

Data Chart 4-30
Alternative 6: US East Coast Restricted Vessel Arrivals that are a Part of Multi-Port String, by Port Area and Vessel Type, 2003

	Vessel Type												
Port Area	Bulk Carriers	Combination Carriers	Container ships	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	1	-	-	-	-	-	-	-	-	-	-	-	1
Searsport, ME	-	-	-	-	-	-	-	-	-	9	-	-	9
Portland, ME	1	-	-	-	-	-	-	5	-	20	-	-	26
Portsmouth, NH	-	-	-	-	-	-	-	-	-	15	-	-	15
Northeastern US - Off Race Point													
Boston, MA	1	-	9	-	1	-	-	7	-	26	-	-	44
Salem, MA	1	-	-	-	-	-	-	-	-	-	-	-	1
Northeastern US - Cape Cod Bay													
Cape Cod, MA	-	-	-	-	-	-	-	-	-	4	-	-	4
Mid-Atlantic Block Island Sound													
New Bedford, MA	3	-	-	-	4	-	-	-	-	5	-	-	12
Providence, RI	3	1	-	-	3	-	2	20	-	17	-	-	46
New London, CT	3	-	2	-	2	1	-	-	1	2	-	-	11
New Haven, CT	7	-	1	-	5	-	-	-	11	30	1	-	55
Bridgeport, CT	2	-	-	-	-	-	6	-	9	10	-	-	27
Long Island, NY	-	1	-	-	-	1	-	-	8	42	-	-	52
Mid-Atlantic Ports of New York/New Jersey													
New York City, NY	11	5	814	-	5	1	7	226	6	159	2	-	1,236
Mid-Atlantic Delaware Bay													
Philadelphia, PA	25	-	103	1	19	1	7	40	2	86	5	-	289
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	17	-	164	-	14	4	-	236	-	44	1	1	481
Hampton Roads, VA	18	2	764	-	22	1	-	69	-	35	-	1	912
Mid-Atlantic Morehead City and Beaufort, NC													
Morehead City, NC	2	-	3	-	3	-	-	1	-	4	-	1	14
Mid-Atlantic Wilmington, NC													
Wilmington, NC	18	4	33	-	12	-	1	5	6	46	1	-	126
Mid-Atlantic Georgetown, SC													
Georgetown, SC	4	-	1	-	2	-	-	-	-	-	-	-	7
Mid-Atlantic Charleston, SC													
Charleston, SC	10	-	459	-	10	4	-	75	3	57	2	-	620
Mid-Atlantic Savannah, GA													
Savannah, GA	16	5	387	-	29	2	5	37	2	39	-	1	523
Southeastern US													
Brunswick, GA	7	-	6	-	3	1	-	70	-	-	-	-	87
Fernandina, FL	1	-	6	-	10	1	-	-	-	-	-	-	18
Jacksonville, FL	5	-	53	1	6	-	-	107	3	36	2	-	213
Port Canaveral, FL	-	-	-	-	-	-	-	-	-	-	-	-	0
All Port Regions	169	18	2,870	3	169	19	28	1,075	54	722	16	4	4,829

a/ Includes recreational vessels.

b/ Includes fishing vessels, industrial vessels, research vessels, and school ships.

Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in text.

The port area of New York/New Jersey had the greatest number of 2003 multi-port string restricted-period arrivals, with 1,236 arrivals. The port area of Hampton Roads was second, with 912 arrivals, followed by the port areas of Charleston (620 arrivals), Savannah (523 arrivals), Baltimore (481 arrivals), and Philadelphia (289 arrivals).

Data Chart 4-31 presents the same data for 2004. The total number of multi-port string restricted arrivals increased by 6.6 percent to 5,147 arrivals. The ranking by type of vessel remained unchanged from 2003 with the exception of general cargo vessels moving ahead of bulk carriers for fourth place. In terms of vessel arrivals by port area, the rankings for the top eight port areas remained unchanged from 2003.

The additional direct economic impact of multi-port strings on the shipping industry based on 2003 conditions was estimated at $8.7 million annually (Data Chart 4-32). The port area of New York/New Jersey would have had the largest additional economic impact, at $2.4 million, followed by Hampton Roads at $1.9 million, Charleston at $1.3 million, Savannah at $1.1 million, and Baltimore at $0.7 million. Containerships accounted for 71 percent of the additional economic impact of multi-port strings.

The additional annual direct economic impact of multi-port strings in 2004 was estimated at $9.4 million (Data Chart 4-33). The ranking of the top six port areas in terms of largest impact is similar for 2004 to what it is for 2003.

With a 12-knot speed restriction, the additional annual direct economic impact of multi-port strings would be $7.8 million (2004 conditions); with a 14-knot restriction, it would be $6.6 million (2004 conditions). These impacts are included in Data Chart 4-43.

Re-routing of Southbound Coastwise Shipping

Alternatives 3, 5, and 6 would also have a direct effect on coastwise shipping. There would be no such impacts under Alternatives 1, 2, or 4.

Coastwise shipping, or cabotage trade, along the US East Coast has always been an important segment of the nation's maritime heritage. In recent years, attention focused on the development of coastwise shipping (also referred to as short-sea shipping) as a means of reducing highway congestion on the eastern seaboard. The benefits of coastwise shipping also include lowering transport and environmental costs and reducing demand for imported fuel. For these reasons, it is important that the speed restrictions not unduly affect the development of increased coastwise shipping.

However, for commercial and navigation purposes, it appears unlikely that speed restrictions would significantly affect coastwise shipping. Northbound vessels prefer to use the Gulf Stream further offshore and benefit from the enhanced operating speed and fuel efficiency. Southbound traffic routes closer to the East Coast – generally within 7 to 10 nm (13 to 18.5 km) of the shoreline. During the proposed seasonal management periods, masters of southbound vessels would likely route outside the seasonal speed-restricted areas, thereby incurring an overall increase in distance. This would affect southbound vessels between the entrance to the Chesapeake Bay and Port Canaveral.

Under Alternatives 3 and 5, the proposed speed restrictions would be in effect for a distance of 25 nm (46 km) from the coast along the entire mid-Atlantic coastline. Containerships and ro-ro cargo ships are the vessel types that would be most affected.

Data Chart 4-31
Alternative 6: US East Coast Restricted Vessel Arrivals that are a Part of Multi-Port String, by Port Area and Vessel Type, 2004

Port Area	Vessel Type												
	Bulk Carriers	Combination Carriers	Container ships	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	3	-	-	-	-	-	-	-	-	-	-	-	3
Searsport, ME	-	-	-	-	-	-	-	-	1	10	-	-	11
Portland, ME	3	-	-	-	1	-	-	5	2	19	-	-	30
Portsmouth, NH	-	1	-	-	-	-	-	-	-	6	-	-	7
Northeastern US - Off Race Point													
Boston, MA	-	-	3	-	-	-	-	5	-	11	-	-	19
Salem, MA	-	-	-	-	-	-	-	-	-	-	-	-	-
Northeastern US - Cape Cod Bay													
Cape Cod, MA	-	-	-	-	-	1	-	-	-	3	-	-	4
Mid-Atlantic Block Island Sound													
New Bedford, MA	8	-	-	-	2	-	-	-	-	5	-	-	15
Providence, RI	5	-	-	-	-	5	-	22	-	15	-	-	47
New London, CT	1	-	3	-	3	-	-	-	2	3	-	-	12
New Haven, CT	2	-	3	-	2	-	-	-	39	33	-	-	79
Bridgeport, CT	3	-	-	-	-	-	6	-	42	12	-	-	63
Long Island, NY	-	-	-	-	-	-	-	-	24	46	-	-	70
Mid-Atlantic Ports of New York/New Jersey													
New York City, NY	9	4	843	-	16	5	7	224	1	151	2	-	1,262
Mid-Atlantic Delaware Bay													
Philadelphia, PA	8	1	100	2	22	4	7	41	-	88	5	-	278
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	10	-	182	-	23	6	2	240	-	49	2	-	514
Hampton Roads, VA	19	3	779	-	28	8	4	69	-	40	2	-	952
Mid-Atlantic Morehead City and Beaufort, NC													
Morehead City, NC	3	1	3	-	3	4	-	-	-	10	-	-	24
Mid-Atlantic Wilmington, NC													
Wilmington, NC	13	2	33	-	23	3	-	10	-	58	1	-	143
Mid-Atlantic Georgetown, SC													
Georgetown, SC	6	-	-	-	2	1	-	-	-	-	-	-	9
Mid-Atlantic Charleston, SC													
Charleston, SC	4	-	519	-	20	14	2	69	-	60	-	1	689
Mid-Atlantic Savannah, GA													
Savannah, GA	8	4	390	-	23	15	8	42	-	52	1	1	544
Southeastern US													
Brunswick, GA	6	-	6	-	11	4	-	80	-	-	-	-	107
Fernandina, FL	-	-	15	-	9	5	1	1	-	-	-	-	31
Jacksonville, FL	5	-	54	2	10	6	-	103	-	53	1	-	234
Port Canaveral, FL	-	-	-	-	-	-	-	-	-	-	-	-	-
All Port Regions	127	16	3,008	6	228	96	38	1,095	111	777	15	2	5,147

a/ Includes recreational vessels.

b/ Includes fishing vessels, industrial vessels, research vessels, and school ships.

Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in text.

Data Chart 4-32
Alternative 6: Additional Direct Economic Impact on the Shipping Industry by Port Area and Vessel Type, 2003 ($000s)

	Vessel Type												
Port Area	Bulk Carriers	Combination Carriers	Container ships	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	0.7	-	-	-	-	-	-	-	-	-	-	-	0.7
Searsport, ME	-	-	-	-	-	-	-	-	-	8.9	-	-	8.9
Portland, ME	0.7	-	-	-	-	-	-	3.8	-	19.9	-	-	24.4
Portsmouth, NH	-	-	-	-	-	-	-	-	-	13.8	-	-	13.8
Northeastern US - Off Race Point													
Boston, MA	0.8	-	19.1	-	0.6	-	-	5.5	-	24.2	-	-	50.2
Salem, MA	1.0	-	-	-	-	-	-	-	-	-	-	-	1.0
Northeastern US - Cape Cod Bay													
Cape Cod, MA	-	-	-	-	-	-	-	-	-	4.0	-	-	4.0
Mid-Atlantic Block Island Sound													
New Bedford, MA	3.7	-	-	-	2.5	-	-	-	-	4.7	-	-	10.9
Providence, RI	2.4	1.0	-	-	1.9	-	3.7	21.3	-	17.7	-	-	48.0
New London, CT	2.4	-	3.8	-	3.2	4.6	-	-	1.3	2.3	-	-	17.7
New Haven, CT	5.8	-	2.1	-	7.1	-	-	-	14.8	33.0	1.3	-	64.1
Bridgeport, CT	1.7	-	-	-	-	-	11.9	-	12.1	13.1	-	-	38.8
Long Island, NY	-	1.0	-	-	-	4.6	-	-	10.7	49.7	-	-	66.1
Mid-Atlantic Ports of New York/New Jersey													
New York City, NY	8.9	4.9	1,813.1	-	4.1	4.5	21.5	317.1	8.1	168.7	2.6	-	2,353.7
Mid-Atlantic Delaware Bay													
Philadelphia, PA	20.0	-	177.8	1.2	18.6	4.5	32.6	42.5	2.7	87.8	6.6	-	394.4
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	13.7	-	305.4	-	12.8	18.1	-	321.4	-	41.7	1.3	1.4	715.8
Hampton Roads, VA	16.1	2.1	1,667.9	-	20.4	4.5	-	131.9	-	34.2	-	1.4	1,878.5
Mid-Atlantic Morehead City and Beaufort, NC													
Morehead City, NC	2.1	-	5.1	-	3.6	-	-	1.6	-	4.2	-	0.7	17.2
Mid-Atlantic Wilmington, NC													
Wilmington, NC	14.9	3.7	69.9	-	20.5	-	1.7	10.4	8.3	45.6	1.3	-	176.4
Mid-Atlantic Georgetown, SC													
Georgetown, SC	3.2	-	1.3	-	4.2	-	-	-	-	-	-	-	8.7
Mid-Atlantic Charleston, SC													
Charleston, SC	8.0	-	1,080.0	-	15.0	16.7	-	97.5	4.2	59.2	2.6	-	1,283.2
Mid-Atlantic Savannah, GA													
Savannah, GA	12.8	4.5	930.8	-	41.2	7.7	29.1	52.7	2.7	40.9	-	0.7	1,123.2
Southeastern US													
Brunswick, GA	5.5	-	10.9	-	5.2	4.6	-	88.4	-	-	-	-	114.5
Fernandina, FL	0.9	-	5.8	-	16.3	4.6	-	-	-	-	-	-	27.6
Jacksonville, FL	3.9	-	100.1	1.2	9.6	-	-	119.4	4.2	35.8	2.6	-	276.8
Port Canaveral, FL	-	-	-	-	-	-	-	-	-	-	-	-	-
All Port Regions	129.1	17.4	6,193.0	2.4	186.9	74.7	100.6	1,213.3	69.2	709.5	18.4	4.2	8,718.7

a/ Includes recreational vessels.

b/ Includes fishing vessels, industrial vessels, research vessels, and school ships.

Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in text.

Data Chart 4-33
Alternative 6: Additional Direct Economic Impact on the Shipping Industry by Port Area and Vessel Type, 2004 ($000s)

	Vessel Type												
Port Area	Bulk Carriers	Combination Carriers	Container ships	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	2.2	-	-	-	-	-	-	-	-	-	-	-	2.2
Searsport, ME	-	-	-	-	-	-	-	-	1.3	9.1	-	-	10.5
Portland, ME	2.2	-	-	-	0.6	-	-	3.8	2.6	19.1	-	-	28.3
Portsmouth, NH	-	0.9	-	-	-	-	-	-	-	5.4	-	-	6.2
Northeastern US - Off Race Point													
Boston, MA	-	-	6.9	-	-	-	-	3.8	-	10.0	-	-	20.6
Salem, MA	-	-	-	-	-	-	-	-	-	-	-	-	-
Northeastern US - Cape Cod Bay													
Cape Cod, MA	-	-	-	-	-	4.5	-	-	-	2.8	-	-	7.4
Mid-Atlantic Block Island Sound													
New Bedford, MA	9.1	-	-	-	1.3	-	-	-	-	4.2	-	-	14.6
Providence, RI	4.4	-	-	-	-	19.8	-	24.0	-	13.9	-	-	62.2
New London, CT	0.8	-	5.9	-	7.8	-	-	-	2.6	3.3	-	-	20.4
New Haven, CT	1.6	-	4.5	-	1.8	-	-	-	52.5	37.3	-	-	97.7
Bridgeport, CT	2.4	-	-	-	-	-	11.6	-	56.0	15.6	-	-	85.6
Long Island, NY	-	-	-	-	-	-	-	-	32.0	56.5	-	-	88.6
Mid-Atlantic Ports of New York/New Jersey													
New York City, NY	7.0	3.5	1,843.2	-	18.1	19.8	16.6	343.3	1.3	162.1	2.6	-	2,417.5
Mid-Atlantic Delaware Bay													
Philadelphia, PA	6.2	0.9	165.4	2.0	19.3	13.8	36.7	45.4	-	96.7	6.6	-	392.8
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	9.6	-	330.6	-	26.6	25.8	5.8	326.9	-	50.6	2.6	-	778.4
Hampton Roads, VA	18.3	2.6	1,686.8	-	26.7	33.6	11.6	137.6	-	38.2	2.6	-	1,958.1
Mid-Atlantic Morehead City and Beaufort, NC													
Morehead City, NC	2.8	0.8	5.7	-	3.9	18.6	-	-	-	9.1	-	-	40.9
Mid-Atlantic Wilmington, NC													
Wilmington, NC	10.8	1.8	66.3	-	41.0	13.9	-	19.7	-	58.9	1.3	-	213.8
Mid-Atlantic Georgetown, SC													
Georgetown, SC	4.8	-	-	-	2.3	4.6	-	-	-	-	-	-	11.8
Mid-Atlantic Charleston, SC													
Charleston, SC	3.1	-	1,165.4	-	28.7	61.2	5.8	90.4	-	59.8	-	0.7	1,415.0
Mid-Atlantic Savannah, GA													
Savannah, GA	6.4	3.6	936.7	-	43.7	68.0	40.7	61.6	-	51.9	1.3	0.7	1,214.8
Southeastern US													
Brunswick, GA	4.6	-	9.2	-	19.2	18.6	-	104.0	-	-	-	-	155.5
Fernandina, FL	-	-	14.4	-	17.7	23.2	2.0	2.8	-	-	-	-	60.1
Jacksonville, FL	3.9	-	95.0	2.0	10.8	26.3	-	116.0	-	53.2	1.3	-	308.5
Port Canaveral, FL	-	-	-	-	-	-	-	-	-	-	-	-	-
All Port Regions	100.3	14.1	6,335.9	4.0	269.4	351.7	130.8	1,279.3	148.4	757.9	18.4	1.4	9,411.5

a/ Includes recreational vessels.

b/ Includes fishing vessels, industrial vessels, research vessels, and school ships.

Source: Prepared by Nathan Associates Inc. based on analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in text.

In 2003, there were 4,142 restricted-period arrivals at East Coast port areas from Baltimore through Port Canaveral of containerships and ro-ro cargo ships providing coastal liner service in international trade and cabotage routes. Assuming half of these calls were in the southbound direction, and that the typical vessel made calls at three US East Coast ports per service, there would be about 690 southbound vessels that would need to route outside of the seasonal speed-restricted areas. Based on an increase in routing of 108 nm[28] (200 km) and an average operating speed of 20 knots, the containership would have an increased sailing time of 5.4 hours. Using an approximate average hourly operating cost at sea of $2,000, the estimated economic impact for each southbound vessel would be $10,800. under 2003 conditions, the additional economic impact for containerships for coastwise shipping would be $7.5 million. Under 2004 conditions, it would be $7.6 million.

Under Alternative 6, the proposed speed restrictions in the mid-Atlantic region would be implemented within a 30-nm (56-km)-wide rectangle at Block Island Sound; a 20-nm (37-km) radius around each port area from the ports of New York and New Jersey south to the ports of Morehead City and Beaufort, North Carolina; and finally a continuous 20-nm (37-km) area from Wilmington, North Carolina, south to the northern boundary of the Southeast SMA. The additional distance incurred by southbound vessels would be 56 nm (104 km).[29] In 2003, there were 3,688 containership and ro-ro cargo ship restricted-period arrivals at US East Coast port areas from Baltimore thorough Port Canaveral. Assuming half of these calls were in the southbound direction, and that the typical vessel made calls at three East Coast ports per service, there would be about 615 southbound vessels that would need to route outside of the seasonal speed-restricted areas. Based on an increase in routing of 56 nm (104 km) and an average operating speed of 20 knots, each containership would have increased sailing time of 2.8 hours. Using an average hourly operating cost at sea of $2,000, the estimated economic impact for each southbound vessel would be $5,600. For 2003 and 2004, the additional economic impact on containerships for coastwise shipping under Alternative 6 would be $3.4 million annually.

In some comments on the DEIS, it was argued that restrictions are proposed during winter months, when speed and schedules are already adversely affected by weather; therefore, economic impacts would be greater. However, to the degree that vessels are operating at slower speeds during winter months, winter-time speed restrictions would actually result in lesser economic impacts.

[28] To avoid speed restrictions when traveling between ports, the vessels are assumed to sail outside of the 25 nm (46 km) SMA instead of the typical 8 nm (15 km) offshore. Based on a diagonal routing to the pilot buoy, the 25 nm (46 km) becomes an effective 37 nm (67 km). However, the diagonal access for a routing 8 nm (15 km) offshore is 10 nm (19 km). Thus, the difference of 27 nm (50 km) is the additional distance incurred resulting from having to sail further offshore per arrival and departure at the intermediate port calls.

[29] Vessels calling at port areas with circular buffers would have to travel 20 nm (37 km) for diagonal access to the port as compared to a normal distance of 10 nm (19 km) for diagonal access. The extra distance of 10 nm (19 km) applies to both arrival and departure for a total additional distance of 20 nm (37 km). Vessels calling at port areas with a continuous buffer from the shoreline are assumed to have an additional distance of 18 nm (34 km) each way, for a total of 36 nm (67 km) for an arrival and departure. As there is an average of three port calls and hence two intermediate port calls per service, the analysis assumes one intermediate call per string at a port area with a circular buffer in the northern portion of the MAUS (e.g., Hampton Roads) and one intermediate call per string at a southern MAUS port area with a continuous buffer (e.g., Savannah), for a total additional distance of 56 nm (104 km).

Direct Economic Impact on the Shipping Industry Relative to the Value of US East Coast Trade and Ocean Freight Costs

Section 3.4.2 presents data collected by the US Census Bureau on the volume and value of goods carried by vessels calling at US East Coast ports. It also presents information on vessel import charges that 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 this section, the estimates of the direct economic impact on the shipping industry are compared to these indicators of the economic significance of US East Coast maritime activity.

Data Chart 4-34 shows, for each alternative, the significance of the estimated economic impact relative to the value of US East Coast trade in 2003 and 2004. This comparison is useful in determining whether increased shipping costs associated with the proposed operational measures would significantly affect the price and volume of traded goods via US East Coast ports. The direct economic impact on the shipping industry for each alternative is based on the base-case analyses presented in this chapter, including a speed restriction of 10 knots, unless otherwise stated. The value of trade merchandise is the same as reported in Chapter 3 for US East Coast imports and exports by Customs District and Port. In 2003, the total annual direct economic impact on the shipping industry of Alternative 5, the alternative with the greatest direct impact, would have been $155.8 million, while the value of US East Coast trade was $298.7 billion. This represents 0.052 percent of the value of traded merchandise in 2003 and 0.051 percent of the 2004 value. For other alternatives, the relative economic impact would be even smaller. In particular, for Alternative 6, it would be 0.022 percent (both in 2003 and 2004). These results indicate that implementation of the proposed operational measures would not have any measurable impact on the volume of merchandise traded through US East Coast ports.

To measure the significance of the proposed operational measures on the shipping industry, it is also instructive to compare the estimated direct economic impact with ocean freight costs associated with US East Coast trade. Ocean freight costs are considered as a proxy for shipping industry revenues. As indicated in Section 3.4.2, ocean freight charges averaged 5.3 percent of the value of imports. Given the composition of US trade, it is reasonable to assume that ocean freight charges would represent no less a percentage of the value of exports. Based on these factors, it is estimated that the direct economic impact on the shipping industry under Alternative 5 would represent less than one percent of the ocean freight costs for US East Coast trade in both 2003 and 2004. For other alternatives, the relative economic impact would be even smaller. For Alternative 6, in particular, the direct economic impact would represent about 0.4 percent of the ocean freight costs in both 2003 and 2004. These results indicate that the implementation of the proposed operational measures would have a minimal impact on the financial performance of the vessel operators calling at US East Coast ports.

Data Chart 4-34
Economic Impact as a Percentage Value of US East Coast Maritime Trade and Ocean Freight Costs, 2003 and 2004 ($ millions, unless otherwise specified)

Item	Alternative				
	2	3	4	5	6
2003					
Direct economic impact	25.0	133.0	2.3	137.0	53.2
Additonal direct economic impact due to cumulative effect of mulit-port strings	-	11.3	-	11.3	8.7
Direct economic impact of re-routing of southbound coastwise shipping	-	7.5	-	7.5	3.4
Total direct economic impact on shipping industry	25.0	151.8	2.3	155.8	65.3
Trade Merchandise Value	298,741	298,741	298,741	298,741	298,741
Total direct economic impact as a percent of trade value (%)	0.008%	0.051%	0.001%	0.052%	0.022%
Ocean Freight Costs	15,833	15,833	15,833	15,833	15,833
Total direct economic impact as a percent of ocean freight cost (%)	0.158%	0.959%	0.015%	0.984%	0.412%
2004					
Direct economic impact	27.6	142.5	2.8	147.2	57.6
Additonal direct economic impact due to cumulative effect of mulit-port strings	-	11.9	-	11.9	9.4
Direct economic impact of re-routing of southbound coastwise shipping	-	7.6	-	7.6	3.4
Total direct economic impact on shipping industry	27.6	162.0	2.8	166.7	70.4
Trade Merchandise Value	325,051	325,051	325,051	325,051	325,051
Total direct economic impact as a percent of trade value (%)	0.008%	0.050%	0.001%	0.051%	0.022%
Ocean Freight Costs	17,228	17,228	17,228	17,228	17,228
Total direct economic impact as a percent of ocean freight cost (%)	0.160%	0.940%	0.016%	0.968%	0.409%

Source: Prepared by Nathan Associates from U.S Census Bureau Foreign Trade Statistics for 2003 and 2004 and analysis of U.S. Coast Guard data on vessel calls at U.S. ports as described in text.

4.4.3 Indirect Economic Impacts

Depending on the nature and significance of the direct economic impact, it is possible that implementation of the proposed operational measures could also have indirect economic impacts. Potential indirect economic impacts were identified by port authorities, shipping industry representatives, and community leaders during the public stakeholder meetings. These impacts included:

- Increased intermodal costs due to missed rail and truck connections.
- Diversion of traffic to other ports.
- Impact on local economies of decreased income from jobs lost to traffic diversions.

It is important to note that the timing and duration of the proposed speed restrictions would be well known and that vessel itineraries could be developed taking the delays into account. Therefore, except for the potential establishment of DMAs, unexpected disruptions to the manufacturing and transport logistics systems should not occur as a result of the proposed measures.

Many factors influence a shipping line's decision to call at specific ports. These include the adequacy and suitability of port facilities and equipment; the ability of the terminal operator to quickly turn around the vessel; overall cargo demand; efficiency of intermodal transportation; port charges; and the port location relative to other ports and cargo markets. At the stakeholders meeting in Boston, there were particular concerns raised over the possibility of traffic diverting to other ports, such as Halifax, Nova Scotia.

In previous sections, the cost of increased vessel time from delays caused by the proposed speed restrictions were estimated. If cargo were to be diverted to other ports, it would be because the total additional costs associated with the new routes are less than the cost of delays to the current port. It would be double-counting to also include any additional overland transport costs to the estimated impact already presented.

The Maritime Administration (MARAD), an agency of the US Department of Transportation, has developed a Port Economic Impact Kit that allows users to assess the economic impact of port activity on a region's economy. The MARAD Port Economic Impact Kit uses an adaptation of input-output analysis that is a widely established tool for economic impact assessments. The model calculates the total economic impacts or multiplier effect of the deep-draft port industry and includes an indirect effect that reflects expenditures made by the supplying firms to meet the requirements of the deep-draft port industry as well as expenditures by firms stocking the supplying firms. The model also includes an induced effect that corresponds to the change in consumer spending that is generated by changes in labor income accruing to the workers in the deep-draft port industry as well as employment in the supplying businesses.

The MARAD Port Economic Impact Kit was applied in two recent studies on the economic implications of port calls in Boston.[30] These studies estimate that an average containership port call in Boston results in a positive economic impact for the region of approximately $900,000. This analysis used this estimate for the port area of Boston and other major ports to evaluate the impact of port calls diverted to Canadian ports.[31] For other port areas, such as Portland and Providence, that would generally have smaller vessels making port calls, this analysis used an estimate of $500,000 of total economic impact per port call.[32]

4.4.3.1 Alternative 1 – No Action Alternative

There would be no indirect economic impacts on local economies or vessel operations under the No Action Alternative

4.4.3.2 Alternative 2 – Mandatory Dynamic Management Areas

There would be no significant, indirect economic impacts on local economies or vessel operations associated with the use of DMAs in Alternative 2.

[30] Hauke Kite-Powell, Economic Implications of Possible Reductions in Boston Port Calls due to Ship Strike Management Measures, a report produced for NOAA National Marines Fisheries Service and MASSPORT, March 2005; and Leigh Fisher Associates, Economic Impact Study of Massachusetts Port Authority and Port of Boston facilities, prepared for MASSPORT and the Greater Boston Chamber of Commerce, Draft Technical Report, June 30, 2005.

[31] For purposes of this section, other major port areas are New York/New Jersey, Philadelphia, Baltimore, Hampton Roads, Charleston, Savannah, Jacksonville, and Port Canaveral.

[32] The indirect economic impact is relative to the volume of cargo diverted, hence the size of containerships and ro-ro vessels calling at major ports and others was used as an indicator of the indirect economic impact per vessel.

4.4.3.3 Alternative 3 – Speed Restrictions in Designated Areas

There would be indirect adverse effects on certain port areas and vessel operations as a result of implementing Alternative 3. For Alternative 3, the net indirect economic impact is estimated at $141.1 million annually for 2003 conditions and $139.4 annually for 2004 condition (speed restriction of 10 knots).

As described in Section 2.2.3, under Alternative 3, there would be year-round speed restrictions established for a large area eastward of Massachusetts Bay, which would extend through the Great South Channel critical habitat area. This would affect vessel traffic in the Northeast region and port areas from Hampton Roads northward in the mid-Atlantic region. As shown in Data Chart 4-6, the average delay for a containership in Boston would be 149 minutes per arrival and another 149 minutes per departure. A permanent delay of nearly 5 hours per call year-round would be sufficient for shippers and vessel operators to look at alternative ports such as Halifax, Nova Scotia, that would not be affected by the proposed regulations.

A good portion of a port's traffic is often considered captive to that port. For cargoes that are destined for the port's immediate hinterland, it would not make economic sense to call at a distant port and then ship the cargo back to the original destination via expensive land transport. However, most ports also accommodate traffic that is not destined for the immediate hinterland but is through-traffic that may have economically-attractive routing alternatives. Port areas in the northeast and northern parts of the mid-Atlantic region serve as gateways to inland population centers and industrial areas such as western New York, western Pennsylvania, Ohio, Indiana, Illinois, and Michigan. These areas may be served via the Canadian ports of Halifax, Nova Scotia and Montreal, Quebec, without incurring the delays caused by ship strike reduction measures.[33] These Canadian ports currently compete with northeastern US ports for cargo destined for the mideastern US. Speed restrictions implemented in the US could shift the current competitive balance to the advantage of Canadian ports, which would not affected by speed restrictions.

It can be assumed that with a speed restriction of 10 knots, 25 percent of the containership and ro-ro cargo ship calls at Northeast ports would divert to Canadian ports.[34] This rate of diversion is considered a mid-point of a range of possible rates from a high of 35 percent to a low of 15 percent. This relatively high rate of potential diversion is due to the permanent, year-round speed restrictions proposed under Alternative 3 and considers the portion of cargo at Northeast ports that is destined for inland areas that could realistically be served via Canadian ports.

Port areas in the Block Island area can be assumed to lose no more than 15 percent of their vessel calls during restricted periods. More of the cargo at these smaller ports is for the local market and they are not considered gateway ports to areas further inland. The port areas of New York/New Jersey, Philadelphia, Baltimore, and Hampton Roads can be assumed to lose three percent of their containership and ro-ro cargo ship vessel calls during restricted periods. The diversion rate for these port areas is lower for several reasons. First, the speed restrictions are seasonal in the

[33] Comments on the DEIS suggested that vessels may divert to other US ports in addition to those diverting to Canada. While this is possible, for the total economic impact analysis, only diversions to non-US ports are included. For diversions to ports within the US, the negative economic impact for one US port would be offset by gains in another US port.

[34] Other types of vessels are less likely to divert, as their cargoes are more likely destined for the port's immediate hinterland.

MAUS; second, due to the size of the local market, most vessels must call at the port area of New York/New Jersey; and third, due to the distance involved, Canadian ports are a less viable alternative for most of the cargo handled at MAUS ports.

The analysis also assumes that a 10-knot speed restriction under Alternative 3 would lead to the diversion of five percent of the containership and ro-ro cargo ship calls from the port area of Savannah during restricted periods. The speed restrictions would be in effect in Savannah for 212 days, as compared to 151 days for the nearby southeastern port areas of Brunswick, Fernandina, and Jacksonville. As Jacksonville is by far the largest and most important of these three alternative ports, this analysis assumes that 50 percent of the diverted Savannah calls would be handled at Jacksonville. Brunswick and Fernandina, which are smaller ports but closer to the Savannah hinterland, are each assumed to capture 25 percent of the diverted calls from Savannah.

On the other hand, the analysis assumes that 15 percent of the restricted-period cruise-vessel calls at Jacksonville would divert to the nearby port area of Port Canaveral. The assumption is based on a more than 2.4-hour savings per vessel call, as the effective distance of speed restrictions in Port Canaveral would be only 4.5 nm (8.3 km) compared to the 30.9 nm (57.2 km) at Jacksonville.

Data Chart 4-35 presents the assumed diversion rates under Alternative 3 (as well as the other alternatives) with restricted speeds of 10, 12, and 14 knots.

Data Chart 4-35
Percentage of Restricted Period Vessel Calls Assumed to be Diverted, by Alternative and Port Area

	Alternative 3			Alternative 4			Alternative 5			Alternative 6		
	Restricted speed in knots			Restricted speed in knots			Restricted speed in knots			Restricted speed in knots		
Port Area	10	12	14	10	12	14	10	12	14	10	12	14
Northeastern US	25.0%	20.0%	15.0%	-	-	-	27.0%	22.0%	17.0%	15.0%	10.0%	7.0%
Mid-Atlantic Block Island Sound	15.0%	10.0%	5.0%	-	-	-	16.0%	11.0%	6.0%	3.0%	2.0%	1.0%
Selected Mid-Atlantic Ports a/	3.0%	1.5%	0.5%	-	-	-	3.5%	1.7%	0.7%	1.5%	0.5%	0.1%
Savannah, GA	5.0%	3.0%	1.0%	-	-	-	-	-	-	-	-	-
Brunswick, GA	-	-	-	5.0%	3.0%	1.5%	-	-	-	3.0%	2.0%	1.0%
Fernandina, FL	-	-	-	5.0%	3.0%	1.5%	-	-	-	3.0%	2.0%	1.0%
Jacksonville, FL	15.0%	10.0%	5.0%	15.0%	10.0%	5.0%	40.0%	30.0%	20.0%	40.0%	30.0%	20.0%

a/ Includes port areas of New York/New Jersey, Philadelphia, Baltimore and Hampton Roads.

Source: Prepared by Nathan Assoicates as described in text.

For Alternative 3, the net indirect economic impact was estimated at $141.1 million annually under 2003 conditions (see Data Chart 4-36). The port areas of New York/New Jersey ($48.2 million), Savannah ($38.8 million), Boston ($24.8 million), and Hampton Roads ($29.6 million) would have the largest annual indirect economic impacts. Note that the port areas of Jacksonville, Brunswick, Fernandina, and Port Canaveral show a positive net economic impact (indicated by dollar amounts in parentheses) as they would gain vessel calls diverted from Savannah. The economic impact of Alternative 3 under 2004 conditions is $139.4 million annually (Data Chart 4-37).

The annual economic impact of port diversions under 2004 conditions would be $139.4 million with a 10-knot restriction; $79.6 million with a 12-knot restriction; and $37.3 million with a 14-knot restriction (Data Chart 4-37).

Data Chart 4-36
Indirect Economic Impact of Port Diversions by Alternative, Restricted Speed, and Port Area, 2003 ($000s)

	Alternative 2			Alternative 3			Alternative 4			Alternative 5			Alternative 6		
	Restricted speed in knots			Restricted speed in knots			Restricted speed in knots			Restricted speed in knots			Restricted speed in knots		
Port Area	10	12	14	10	12	14	10	12	14	10	12	14	10	12	14
Northeastern US - Gulf of Maine															
Eastport, ME	-	-	-	625	500	375	-	-	-	675	550	425	75	50	35
Searsport, ME	-	-	-	125	100	75	-	-	-	135	110	85	-	-	-
Portland, ME	-	-	-	8,375	6,700	5,025	-	-	-	9,045	7,370	5,695	825	550	385
Portsmouth, NH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Northeastern US - Off Race Point															
Boston, MA	-	-	-	24,750	19,800	14,850	-	-	-	26,730	21,780	16,830	(700)	(150)	(10)
Salem, MA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Northeastern US - Cape Cod Bay															
Cape Cod, MA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Block Island Sound															
New Bedford, MA	-	-	-	75	50	25	-	-	-	80	55	30	15	10	5
Providence, RI	-	-	-	3,375	2,250	1,125	-	-	-	3,600	2,475	1,350	4,750	2,850	1,900
New London, CT	-	-	-	150	100	50	-	-	-	160	110	60	30	20	10
New Haven, CT	-	-	-	75	50	25	-	-	-	80	55	30	15	10	5
Bridgeport, CT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Long Island, NY	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Ports of New York/New Jersey															
New York City, NY	-	-	-	48,222	24,111	8,037	-	-	-	56,259	27,326	11,252	20,507	6,836	1,367
Mid-Atlantic Delaware Bay															
Philadelphia, PA	-	-	-	10,044	5,022	1,674	-	-	-	11,718	5,692	2,344	4,293	1,431	286
Mid-Atlantic Chesapeake Bay															
Baltimore, MD	-	-	-	16,686	8,343	2,781	-	-	-	19,467	9,455	3,893	7,155	2,385	477
Hampton Roads, VA	-	-	-	29,646	14,823	4,941	-	-	-	34,587	16,799	6,917	12,636	4,212	842
Mid-Atlantic Morehead City and Beaufort, NC															
Morehead City, NC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Wilmington, NC															
Wilmington, NC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Georgetown, SC															
Georgetown, SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Charleston, SC															
Charleston, SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Savannah, GA															
Savannah, GA	-	-	-	38,835	23,301	7,767	(4,150)	(2,490)	(1,245)	-	-	-	(2,490)	(1,660)	(830)
Southeastern US															
Brunswick, GA	-	-	-	(9,709)	(5,825)	(1,942)	3,075	1,845	923	-	-	-	1,845	1,230	615
Fernandina, FL	-	-	-	(9,709)	(5,825)	(1,942)	1,075	645	323	-	-	-	645	430	215
Jacksonville, FL	-	-	-	(19,418)	(11,651)	(3,884)	1,080	720	360	2,880	2,160	1,440	2,880	2,160	1,440
Port Canaveral, FL	-	-	-	(1,080)	(720)	(360)	(1,080)	(720)	(360)	(2,880)	(2,160)	(1,440)	(2,880)	(2,160)	(1,440)
All Port Areas	-	-	-	141,068	81,129	38,623	-	-	-	162,536	91,777	48,911	49,601	18,204	5,303

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

Data Chart 4-37
Indirect Economic Impact of Port Diversions by Alternative, Restricted Speed, and Port Area, 2004 ($000s)

	Alternative 2			Alternative 3			Alternative 4			Alternative 5			Alternative 6		
	Restricted speed in knots			Restricted speed in knots			Restricted speed in knots			Restricted speed in knots			Restricted speed in knots		
Port Area	10	12	14	10	12	14	10	12	14	10	12	14	10	12	14
Northeastern US - Gulf of Maine															
Eastport, ME	-	-	-	500	400	300	-	-	-	540	440	340	150	100	70
Searsport, ME	-	-	-	375	300	225	-	-	-	405	330	255	-	-	-
Portland, ME	-	-	-	5,125	4,100	3,075	-	-	-	5,535	4,510	3,485	825	550	385
Portsmouth, NH	-	-	-	125	100	75	-	-	-	135	110	85	-	-	-
Northeastern US - Off Race Point															
Boston, MA	-	-	-	24,750	19,800	14,850	-	-	-	26,730	21,780	16,830	(200)	150	190
Salem, MA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Northeastern US - Cape Cod Bay															
Cape Cod, MA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Block Island Sound															
New Bedford, MA	-	-	-	75	50	25	-	-	-	80	55	30	15	10	5
Providence, RI	-	-	-	3,150	2,100	1,050	-	-	-	3,360	2,310	1,260	4,250	2,550	1,700
New London, CT	-	-	-	375	250	125	-	-	-	400	275	150	60	40	20
New Haven, CT	-	-	-	225	150	75	-	-	-	240	165	90	45	30	15
Bridgeport, CT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Long Island, NY	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Ports of New York/New Jersey															
New York City, NY	-	-	-	49,680	24,840	8,280	-	-	-	57,960	28,152	11,592	21,209	7,070	1,414
Mid-Atlantic Delaware Bay															
Philadelphia, PA	-	-	-	9,369	4,685	1,562	-	-	-	10,931	5,309	2,186	3,996	1,332	266
Mid-Atlantic Chesapeake Bay															
Baltimore, MD	-	-	-	16,605	8,303	2,768	-	-	-	19,373	9,410	3,875	6,980	2,327	465
Hampton Roads, VA	-	-	-	29,052	14,526	4,842	-	-	-	33,894	16,463	6,779	12,366	4,122	824
Mid-Atlantic Morehead City and Beaufort, NC															
Morehead City, NC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Wilmington, NC															
Wilmington, NC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Georgetown, SC															
Georgetown, SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Charleston, SC															
Charleston, SC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mid-Atlantic Savannah, GA															
Savannah, GA	-	-	-	39,015	23,409	7,803	(3,775)	(2,265)	(1,133)	-	-	-	(2,265)	(1,510)	(755)
Southeastern US															
Brunswick, GA	-	-	-	(9,754)	(5,852)	(1,951)	3,000	1,800	900	-	-	-	1,800	1,200	600
Fernandina, FL	-	-	-	(9,754)	(5,852)	(1,951)	775	465	233	-	-	-	465	310	155
Jacksonville, FL	-	-	-	(13,703)	(7,835)	(1,967)	5,805	3,870	1,935	15,480	11,610	7,740	15,480	11,610	7,740
Port Canaveral, FL	-	-	-	(5,805)	(3,870)	(1,935)	(5,805)	(3,870)	(1,935)	(15,480)	(11,610)	(7,740)	(15,480)	(11,610)	(7,740)
All Port Areas	-	-	-	139,406	79,603	37,251	-	-	-	159,582	89,308	46,956	49,695	18,280	5,355

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

4.4.3.4 Alternative 4 – Recommended Shipping Routes

While there may be minor, indirect adverse economic impacts on certain ports in the SEUS region, the overall economic impact of Alternative 4 would be negligible. Modest delays would be experienced at the port areas of Brunswick and Fernandina due to the increased distance associated with the use of recommended routes. Because of these delays, it can be assumed that 5 percent of the containership and ro-ro cargo ship calls at these two port areas would divert to the port area of Savannah, which would have no proposed operational measures. The reason for the relatively small rate of diversion is that much of the cargo handled at these ports is destined for the local market and not easily diverted to other ports. Under Alternative 4, cruise vessels can again be assumed to divert to Port Canaveral, where no operational measures are proposed under this alternative. From the perspective of the national economy, there are no net indirect economic impacts under Alternative 4. The diverted vessel calls at the southeastern port areas of Brunswick, Fernandina, and Jacksonville would be offset by the gains in vessels calling at the port areas of Savannah and Port Canaveral.

4.4.3.5 Alternative 5 – Combination of Alternatives

There would be indirect, long-term adverse effects on certain port areas and vessel operations under Alternative 5. The net indirect economic impact at 10 knots was estimated at $162.5 million annually (2003 conditions) and $159.6 million (2004 conditions).

Under this alternative, the rates of diversion for the affected port areas in the Northeast and mid-Atlantic regions would be similar to those under Alternative 3, except that the additional impact of DMAs and recommended routes can be assumed to slightly increase the rate of diversion. The port area of Savannah would not incur any diversions under Alternative 5 because the delays associated with the increased recommended routes for the southeast port areas would offset the speed restrictions into Savannah. The port area of Jacksonville would be affected twice as much under Alternative 5 relative to Port Canaveral. First, Jacksonville would be subject to the increased distance associated with the use of recommended routes, and second, the speed restrictions would be in effect for 30.9 nm (57.2 km) as compared to the 4.5 nm (8.3 km) at Port Canaveral. For these reasons, it can be assumed that as much as 40 percent of the restricted-period cruise vessel calls would divert from Jacksonville to Port Canaveral.

The 2003 estimated annual impact under Alternative 5 ($162.5 million) would be about 15 percent higher than that under Alternative 3 (see Data Chart 4-36). Rankings would be similar to those under Alternative 3 (Section 4.4.3.3) with the exception of Savannah. The 2004 annual net indirect impact would be $159.6 million (Data Chart 4-37).

The diversion rates for Alternative 5 would vary with the speed restriction (Data Chart 4-35), so there would be a lower economic impact at a speed restriction of 12 knots ($89.3 million annually) and a still lower one at 14 knots ($47.0 million annually) (2004 conditions, see Data Chart 4-37).

4.4.3.6 Alternative 6 – Proposed Action (Preferred Alternative)

There would be indirect adverse impacts on certain port areas and vessel operations under Alternative 6. For this alternative, the annual net indirect economic impact at a restricted speed of 10 knots would be $49.6 million for 2003 conditions and $49.7 million for 2004 conditions.

Under Alternative 6, the effective speed restrictions in the combined SMAs in the NEUS would be in effect during the month of April.[35] Shipping lines are not likely to alter their regular service pattern for delays that are incurred for one month per year. Thus, while Alternative 3 was assumed to cause a diversion rate of 25 percent, Alternative 6 is assumed to cause a lower diversion rate of 15 percent for containerships and ro-ro cargo ships during the restricted period.[36] For the port areas in Block Island Sound, the analysis assumed a diversion rate of only three percent for containerships and ro-ro cargo ships due to the limited duration of the large speed-restriction area. For the affected mid-Atlantic ports, a diversion of 1.5 percent of restricted-period containership and ro-ro cargo ship vessel calls was assumed.

An additional diversion was assumed to occur under Alternative 6 for the port area of Providence. This port area would have speed restrictions in effect for 181 days, as compared to 61 days for the port area of Boston. Therefore, it was assumed that 20 percent of the containership and ro-ro cargo ship restricted-period calls at Providence would divert to the nearby port area of Boston.

The southeastern ports of Brunswick and Fernandina were assumed to have three percent of their restricted-period arrivals of containerships and ro-ro cargo ships diverted to Savannah as the effect of the use of recommended routes creates additional delays relative to Savannah. Finally, 40 percent of the restricted-period cruise-vessel calls at Jacksonville were assumed to divert to Port Canaveral, as that port would not affected by speed restrictions or the use of recommended routes.

Under Alternative 6, the net indirect economic would be $49.6 million annually based on 2003 conditions. The largest impacts would occur in the port areas of New York/New Jersey ($20.5 million annually), Hampton Roads ($12.6 million annually), Baltimore ($7.2 million annually), Providence ($4.8 million annually), Philadelphia ($4.3 million annually), Jacksonville ($2.9 million annually), and Brunswick ($1.8 million annually). Three port areas would experience a net indirect economic impact gain: Port Canaveral ($2.9 million annually), Savannah ($2.5 million annually), and Boston ($0.7 million annually) (Data Chart 4-36).

Data Chart 4-37 shows the estimated annual indirect economic impacts under 2004 conditions. In general, they match closely those calculated for 2003. The slight decrease in the 2004 impact at certain port areas reflects the decline in containership and ro-ro vessel arrivals during the period when seasonal speed restrictions would be in effect. It is interesting to note the large increase in impact in Jacksonville, where cruise-vessel arrivals increased substantially.

With a speed restriction of 12 knots, the annual indirect economic impact of Alternative 6 (2004 conditions) would be $18.3 million; with a 14-knot restriction, it would be $5.4 million.

4.4.3.7 Summary of All Direct and Indirect Economic Impacts on the Shipping Industry and Port Areas

The annual direct, additional direct, and indirect economic impacts on the shipping industry are summarized in Table 4-2.

[35] Speed restrictions would be in effect for other months in the NEUS but not in the large combined area encompassing Off Race Point and Great South Channel SMAs.

[36] For Alternative 6, speed restrictions would be in place for the months of March and April, so that the 15-percent diversion only applies to vessel calls during those months.

Table 4-2
Summary of All Impacts by Alternative at 10, 12, and 14 knots, 2003 and 2004 (millions of dollars per year)

Item	Alternative 2 Restriction speed (knots)			Alternative 3 Restriction speed (knots)			Alternative 4 Restriction speed (knots)			Alternative 5 Restriction speed (knots)			Alternative 6 Restriction speed (knots)		
	10	12	14	10	12	14	10	12	14	10	12	14	10	12	14
2003															
Direct economic impact															
Shipping industry vessels	25.0	16.1	9.8	133	83.6	49.5	2.3	2.3	2.3	137	86.7	51.8	53.2	33.4	20
Cumulative effect of multi-port strings	-	-	-	11.3	9.4	7.9	-	-	-	11.3	9.4	7.9	8.7	7.2	6.1
Re-routing of southbound coastwise shipping	-	-	-	7.5	7.5	7.5	-	-	-	7.5	7.5	7.5	3.4	3.4	3.4
Subtotal direct economic impact	25.0	16.1	9.8	151.8	100.5	64.9	2.3	2.3	2.3	155.8	103.6	67.2	65.3	44.0	29.5
Indirect economic impact of port diversions	-	-	-	141.6	81.5	38.8	-	-	-	162.5	91.8	48.9	49.6	18.2	5.3
Total economic impact	25.0	16.1	9.8	293.4	181.9	103.7	2.3	2.3	2.3	318.3	195.3	116.1	114.9	62.2	34.8
2004															
Direct economic impact															
Shipping industry vessels	27.6	17.7	10.8	142.5	89.2	52.5	2.8	2.8	2.8	147.2	92.8	55.2	57.6	36.1	21.5
Cumulative effect of multi-port strings	-	-	-	11.9	9.9	8.4	-	-	-	11.9	9.9	8.4	9.4	7.8	6.6
Re-routing of southbound coastwise shipping	-	-	-	7.6	7.6	7.6	-	-	-	7.6	7.6	7.6	3.4	3.4	3.4
Subtotal direct economic impact	27.6	17.7	10.8	162	106.7	68.5	2.8	2.8	2.8	166.7	110.3	71.2	70.4	47.3	31.5
Indirect economic impact of port diversions	-	-	-	139.4	79.6	37.3	-	-	-	159.6	89.3	47	49.7	18.3	5.4
Total economic impact	27.6	17.7	10.8	301.4	186.3	106	2.8	2.8	2.8	326.3	199.6	118	120.1	65.6	36.9

Source: Prepared by Nathan Associates as described in text.

4.4.4 Impacts on Commercial Fishing Vessels

Commercial fishing is a multimillion-dollar industry along the US East Coast. In 2003, commercial fish landings at US East Coast ports totaled $651 million; in 2004, it totaled $689 million (see Data Chart 3-5). The port of New Bedford, MA is the leading US port in terms of the value of commercial fish landings, with $206.5 million in 2004.

The proposed operational measures would apply only to vessels with a length of at least 65 ft (19.8 m). The USCG data exclude commercial fishing vessels less than 150 GRT; however, the analysis factored in fishing vessels over 65 ft (19.8 m) in length but weighing less than 150 GRT using information provided by NMFS' database of commercial fishing permits. In the southeast region, approximately 84 percent of the fishing vessels over 65 ft (19.8 m) weigh less than 150 tons; in the northeast region, nearly 67 percent of the fishing vessels over 65 ft (19.8 m) weigh less than 150 tons (Section 3.4.3).

The estimated annual economic impact of the proposed operational measures on commercial fishing vessels based on 2003 conditions and for speed restriction of 10 and 12 knots is presented in Data Chart 4-38 (only those alternatives that would have a noticeable impacts are included). The analysis assumed that the commercial fishing vessels would be affected for an effective distance of 25 nm (46 km) under Alternatives 3 and 5, and 20 nm (37 km) under Alternative 6 each way as they steam to and from fishing areas.

Many commercial fishing vessels steam at 10 knots or below and would not be affected by the proposed operational measures. The typical steaming speed for faster commercial fishing vessels generally does not exceed 12 knots and these vessels are not expected to be affected by speed restriction of 12 knots or more.

4.4.4.1 Alternative 1 – No Action Alternative

Under the No Action Alternative, there would be no impact on the commercial fishing industry. The ship strike reduction measures currently in place would remain unchanged, vessels would continue to go unregulated beyond the measures already in place, and the threat of ship strikes would remain unchanged. All vessels would still be required to adhere to the 500-yd (457-m) no-approach rule for right whales.

Data Chart 4-38
Estimated Economic Impact of Proposed Operational Measures on Commercial Fishing Vessels by Region, 2003

	Alternatives 3 and 5		Alternative 6	
Item	Northeast Region	Southeast Region	Northeast Region	Southeast Region
Commercial fishing permits for vessels over 65 ft LOA and under 150 GRT	572	290	572	290
Percent with steaming speed over 10 knots	40%	40%	40%	40%
Vessels potentially affected by speed restrictions	229	116	229	116
Typical steaming speed of affected vessels (knots)	12	12	12	12
Number of trips per year per vessel	20	20	20	20
Minutes of delay per trip with restricted speed of				
12 knots	-	-	-	-
10 knots	50.0	50.0	38.0	38.0
Operating cost per hour of steaming (dollars)	300	300	300	300
Estimated impact per year with restricted speed (dollars)				
12 knots	-	-	-	-
10 knots	1,144,000	580,000	869,440	440,800

Source: Prepared by Nathan Associates Inc.

4.4.4.2 Alternative 2 – Mandatory Dynamic Management Areas

As noted above, many fishing vessels operate at 10 knots or less and, therefore, only a limited number of vessels (those traveling at more than 10 knots) would have to slow down through a DMA under Alternative 2. A captain would have the discretion to route around the DMA instead of slowing down through it, in which case the vessel could incur additional costs in fuel due to the additional distance. However, it can be assumed that the captain would choose the lower-cost option, minimizing any effects. Thus, economic impacts on the commercial fishing industry under Alternative 2 are expected to be negligible. Unlike DAM restrictions under the ALWTRP, there are no fishing-gear regulations associated with DMAs under Alternative 2. However, if a DMA was implemented in an area covered by the ALWTRP regulations, then a dual-DAM/DMA might be designated to reduce the risk of both fishing-gear entanglement and ship strike. In this case, fishermen would have to adhere to the restrictions associated with both measures.

4.4.4.3 Alternative 3 – Speed Restrictions in Designated Areas

Only those commercial fishing vessels traveling at speeds higher than 10 knots would be adversely affected by the speed restrictions proposed under this alternative. These vessels would remain at sea for longer periods and thus burn more fuel (a delay in arriving at the dock or processing plant should not result in any additional costs, however). The estimated impact on commercial fishing vessels (2003 conditions) would be $1.1 million annually in the NEUS region and $0.6 million annually in the SEUS region. Combined, these impacts represent less than 0.3 percent of the total East Coast fishery landings in 2003.

4.4.4.4 Alternative 4 – Recommended Shipping Routes

Alternative 4 would have a negligible effect on fishing vessels operations. The recommended routes into the ports of Brunswick, Jacksonville, and Port Canaveral in the SEUS are not expected to affect commercial fishing vessel either because these vessels are destined for fishing grounds or the locations of fixed gear such as lobster pots and do not regularly utilize shipping lanes. Shipping lanes are developed for use by vessels calling at large, commercial-shipping, whereas fishing vessels generally dock at smaller ports.

Fishing vessels in the Cape Cod Canal could be affected if they utilize the recommended routes. Vessels concentrating fishing effort within Cape Cod Bay and outside of the lanes would not be affected. Affected vessels would remain at sea for a longer time, possibly burning more fuel, potentially resulting in higher costs. For the same reasons as mentioned under Alternative 2 (Section 4.4.4.2), any impacts are expected to be negligible.

4.4.4.5 Alternative 5 – Combination of Alternatives

Adverse impact on commercial fishing vessels under Alternative 5 would be the same as under Alternative 3: $1.1 million annually in the NEUS region and $0.6 million annually in the SEUS region (2003 conditions) because the relevant restrictions under this alternative are those proposed under Alternative 3. Other restrictions proposed under Alternative 5 are those proposed under Alternatives 2 and 4, and, as noted above, these restrictions would have no noticeable effects on fishing vessels.

4.4.4.6 Alternative 6 – Proposed Action (Preferred Alternative)

Under Alternative 6 (10-knot speed restriction), the expected adverse economic impact on commercial fishing vessels was estimated at $0.9 million annually for the NEUS region and $0.4 million annually for the SEUS region (2003 conditions). The combined annual impact of $1.3 million represents less than 0.2 percent of the East Coast commercial fishery landings total for 2003 and 2004, and 2005.

Only fishing vessels 65 ft (19.8 m) long or more would be affected, and among those, only those vessels traveling at speeds more than 10 knots, which represent only 40 percent of the total. When compared to the total annual revenue generated in 2004 by these affected vessels only, the estimated annual impact amounts to 0.5 percent of this revenue.

There would be no impact on fishing vessels if a speed limit of 12 knots or more is implemented.

4.4.5 Impacts on Passenger Vessels

The following sections describe the economic impacts of the proposed operational measures on specific types of other vessels.

4.4.5.1 Cruise Industry

The proposed measures would affect the vast majority of cruise ships, since they are longer than 65 ft (19.8 m). Effects on the cruise industry are covered in Sections 4.4.1 and 4.4.3, as cruise vessels are included in the USCG Vessel Arrival Database.

4.4.5.2 Ferry Boat Industry

The vast majority of passenger vessels operating along the US East Coast sail within the COLREGS lines and would not be affected by the proposed operational measures. However, in the southern New England area, a well-developed passenger-ferry sector operates beyond the COLREGS line and would be subject to the proposed measures. A list of major southern New England passenger-ferry operators, routes served, and service characteristics are presented in Data Chart 4-39; a complete inventory of ferry vessel operations is included in Appendix E.

Passenger-ferry operations in southern New England generally fall into two categories: fast ferry service, with vessel speeds ranging from 24 to 39 knots; and regular ferry service, with vessel speeds from 12 to 16 knots. As shown in Data Chart 4-39, there are nine operators providing fast ferry service on eight routes with 11 vessels. Key destinations include Provincetown, Block Island, Nantucket, and Martha's Vineyard, while major origin points include Boston, New London, Hyannis, Harwich, Point Judith, and Quonset Point. Regular ferry service is provided by eight operators on 11 routes with 16 vessels. These ferries serve many of the same origins and destinations as the fast ferry service. Additional origin points include Plymouth, Falmouth, and Woods Hole.

Data Chart 4-39
Southern New England Ferry Operators, 2005

Operator	Route	Vessel Speed (knots)	Distance (nm)	Summer Schedule	Average Adult Fare ($)
Fast Ferries					
Bay State Cruises	Boston-Provincetown	30	50	6 trips daily	32
Boston Harbor Cruises	Boston-Provincetown	39	50	4 trips daily	30
Cross Sound Ferry Service	New London-Block Island	35	30	10 trips daily	15
Cross Sound Ferry Service	New London-Orient Point LI	30	16	12 trips daily	15
Freedom Cruise Line	Harwich-Nantucket	24	30	6 trips daily	26
Hy-Line Cruises	Hyannis- Nantucket	30	27	10 trips daily	31
Hy-Line Cruises	Hyannis-Martha's Vineyard	24	20	8 trips daily	14
Island High Speed Ferry	Point Judith-Block Island	33	11	12 trips daily	15
New England Fast Ferry	New Bedford- Martha's Vineyard	30	30	10 trips daily	25
Steamship Authority	Hyannis- Nantucket	30	27	10 trips daily	28
Vineyard Fast Ferry	Quonset Point-Martha's Vineyard	33	50	4 trips daily	30
Regular Ferries					
Bay State Cruises	Boston-Provincetown	16	50	2 trips Sat and Sun	15
Capt. John Boats	Plymouth-Provincetown	14	25	2 trips daily	18
Cross Sound Ferry Service	New London-Orient Point LI	13	16	30 trips daily	10
Hy-Line Cruises	Hyannis- Nantucket	15	27	6 trips daily	16
Hy-Line Cruises	Hyannis-Martha's Vineyard	12	20	6 trips daily	16
Hy-Line Cruises	Nantucket-Martha's Vineyrd	16	20	6 trips daily	16
Interstate Navigation Company	Point Judith-Block Island	12	11	8 trips daily	10
Interstate Navigation Company	Newport-Block Island	12	22	2 trips daily	12
Patriot Party Boats	Falmouth- Martha's Vineyard	15	5	8 trips daily	7
Pied Piper	Falmouth-Edgartown	12	9	6 trips daily	15
Steamship Authority	Woods Hole-Martha's Vineyard	12	7	32 trips daily	6
Steamship Authority	Hyannis- Nantucket	12	27	12 trips daily	14

Source: Prepared by Nathan Associates from data on operator websites and selected interviews.

Alternative 1– No Action Alternative

There would be no impact on passenger ferry service under Alternative 1.

Alternative 2 – Mandatory Dynamic Management Areas

Under Alternative 2, there would potentially be direct, long-term, adverse effects on passenger-ferry service. This alternative calls for establishing a DMA over a 39.6-nm (73-km) square based on the trigger conditions described in Section 2.1.4. Interviews with passenger-ferry operators identified their particular concern in the case of a DMA implemented during the peak summer season. For a fast ferry operator, a DMA directly along their route would result in the suspension of service for the entire period that the DMA is in effect. There are three reasons for this. First, the demand for fast ferries (which normally operate at 24 to 39 knots) would virtually disappear if the ferries were restricted to a speed of 10 knots. Second, any remaining demand would not be sufficient to cover vessel operating costs. Third, many of the handling and comfort characteristics of fast ferries would suffer at these reduced speeds.

Assuming 100 percent compliance with voluntary DMAs, the estimated net economic loss from the implementation of a single DMA for the eleven identified fast ferry operators would be $2.2 million annually (see Data Chart 4-40a).[37] This estimate is based on a daily operating cost of a fast ferry vessel of $13,320 (excluding fuel costs). Some operators have stated that the loss of income and profits from a single 15-day DMA during peak season would cause them to go out of business. However, it can be assumed that many of the fast ferry operators, who also operate regular ferries, would be able to remain in business, as they would generate some incremental profits from passengers who would have otherwise used the fast ferry service.[38]

Operators of regular ferry services would also be affected by DMAs. For these operators, it is estimated that a speed restriction of 10 knots would cause an average delay of 30 minutes for each ferry trip.[39] The 118 daily trips of regular ferry services would incur additional costs of $5.9 million annually as a result of a single DMA. With a restricted speed of 12 knots, the average delay would be 20 minutes and the impact $3.9 million annually. With a restricted speed of 14 knots, the average delay would be six minutes and the estimated impact $2.0 million annually.

Alternative 3 – Speed Restrictions in Designated Areas[40]

There would be direct, long-term, adverse effects on passenger ferry service as a result of implementing Alternative 3. Under this alternative, speed restrictions would be in place year-round in Cape Cod Bay and for the months of October to April in Block Island Sound. It can be assumed that the two fast ferry operations from Boston to Provincetown would cease and be replaced by regular ferry service. Overall ferry demand would likely diminish as passengers curtail day trips or seek alternative modes of transport. Fast ferry operators would either sell their vessels or deploy them in other routes. While a loss for the distressed sale of the vessels may be

[37] This same estimate applies to alternate restricted speeds of 10, 12 and 14 knots, as it is assumed that the fast ferry service would be temporarily suspended under any of those speeds.
[38] It is very difficult to estimate the portion of passenger demand that would be lost to cancellations during a DMA. Relevant factors include the purpose of the trip; the availability of alternative ferry origins that may not be affected by the DMA; availability of other economically viable transport modes; and competing entertainment options.
[39] This analysis assumes that on average, only half of a DMA area would affect the ferry vessel's route, hence the effective distance of the DMA would be approximately 20 nm (37 km).
[40] The analysis in this section for Alternative 3 also applies to Alternative 5.

incurred, this would not represent a recurring annual economic impact and is not included in this assessment.

Data Chart 4-40a
Estimated Economic Impact of Proposed Operational Measures on Southern New England Ferry Operators, 2005 ($)

Type of vessel and alternative	Restricted speed in knots 10	12	14
Fast Ferries			
Alternative 2	2,178,000	2,178,000	2,178,000
Alternative 3	7,128,000	7,128,000	7,128,000
Alternative 6	2,577,600	2,577,600	2,577,600
Regular Ferries			
Alternative 2	5,900,000	3,933,333	1,966,667
Alternative 3	5,900,000	3,933,333	1,180,000
Alternative 6	6,031,250	3,989,583	1,985,417
Total			
Alternative 2	8,078,000	6,111,333	4,144,667
Alternative 3	13,028,000	11,061,333	8,308,000
Alternative 6	8,608,850	6,567,183	4,563,017

Source: Prepared by Nathan Associates from data on operator websites and selected interviews.

The proposed speed restrictions for Block Island Sound would be in effect outside the peak summer season. In this area, it can be assumed that the nine fast ferry operators would lose an average of 30 business days per year.[41] The economic impact of suspending operations for these 30 days for these nine operators was estimated to be $7.1 million annually.

Regular ferries would incur average delays of approximately 30 minutes per trip with a speed restriction of 10 knots. Since the restrictions would be during the off-peak season, it is expected that these delays would be absorbed in the more open ferry schedule without losing any round-trip daily service. The estimated incremental cost of the delays would be $5.9 million annually. With a 12-knot restriction, it would be $3.9 million; with a 14-knot restriction, $1.2 million.

Alternative 4 – Recommended Shipping Routes

There would be no economic impact on passenger ferry services under Alternative 4. Ferry vessels use routes distinct from the shipping lanes and would not be affected.

Alternative 5 – Combination of Alternatives

Impacts under this alternative would be the same as under Alternative 3 because the relevant restrictions under this alternative are those also proposed under Alternative 3.

Alternative 6 – Proposed Action (Preferred Alternative)

Under Alternative 6, speed restrictions in Cape Cod Bay would be implemented from January 1 through May 15 only and the fast ferry service from Boston to Provincetown would remain in operation. Speed restrictions in Block Island Sound would be in force from November 1 through

[41] While regular ferry service is year-round, the high-speed Block Island ferry only operates from mid-April through mid-October. Thus the 30 days of lost business consists of 15 days from October 1- 15 and 15 days from April 16 - 30.

April 30. However, the speed-restricted area would not extend to the shoreline and, therefore, would not affect fast ferry operations.[42] DMAs would also be implemented under Alternative 6; their economic impact may be estimated in the same manner as it was for Alternative 2. The estimated economic impact for fast ferry service under Alternative 6 would be similar to that under Alternative 2 with an increment from the speed restrictions proposed on the Boston-Provincetown route from January 1 through May 15. The annual impact is estimated to be $2.6 million. This is a conservative estimate, as it assumes 100 percent compliance. However, DMAs under Alternative 6 would be voluntary. Lower levels of compliance would result in a proportionately lower impact.

For regular ferries, the economic impact would also be similar to that of Alternative 2 with an increment for speed restrictions proposed on the Boston-Provincetown route from January 1 through May 15. The estimated impact would be is $6.0 million annually at 10-knot ($4.0 million annually at 12 knots and $2.0 million annually at 14 knots).

From information provided by industry members, the annual revenue for passenger ferries that would be affected by the proposed measures has been estimated based on an average of $40,000 per vessel per day during a peak season of 120 days. On this basis, the annual impact on affected high-speed ferry operators would amount to 4.9 percent of the annual revenue generated by the affected vessels; the impact on affected regular-speed ferry operators would amount to 7.9 percent of the annual revenue of the affected vessels. Again, these numbers assume 100 percent compliance with voluntary DMAs. Should ferry operators choose not to comply with DMA speed restrictions, however, then annual economic impacts would be $400,000 for high-speed ferries, or less than one percent of annual revenues; and $132,000 for regular-speed ferries, or about 0.2 percent of annual revenues.

Finally, it should be noted that the large majority of passenger ferries operate within the COLREG lines, and therefore, would not be affected at all by the proposed measures. Out of 172 ferry routes on the East Coast in 2000, only 10 crossed segments of the Atlantic Ocean. Therefore, the expected impacts of the proposed measures in relation to the annual revenues of the entire East Coast passenger ferry industry would be minimal.

4.4.5.3 Impacts on Ferry Passengers

The proposed operational measures would have a direct economic impact on ferry passengers whose travel time would be increased because of speed restrictions. As recognized by the US Department of Transportation (USDOT), time saved from travel may be devoted to other activities, such as remunerative work or recreation. USDOT guidelines recommend that hourly values of travel-time be used in all economic analyses of transportation regulatory actions. Specific values are recommended for local travel and intercity travel and whether the travel is for business or personal purposes.

The USDOT guidelines recommend using the median household income divided by 2,000 hours as the basis for valuation of intercity business travel time, and 70 percent of that value for intercity personal travel time. Based on 2000 Census data, these hourly values amount to $21.20 for intercity business travel and $14.80 for intercity personal travel. Based on Census Bureau

[42] The rectangular area proposed has its northern limits running approximately in a line from Montauk to the southwestern coast of Block Island.

data for 2005, the hourly value of intercity business travel time is $23.16 and intercity personal travel time is $16.21. The more recent values have been used in this analysis.

The estimated economic impact of proposed operational measures on Southern New England ferry passengers is presented in Data Chart 4-40b. The estimates shown are based on the same assumptions as those underlying the estimates of impact on ferry operators, described above. However, for those alternatives that would cause fast ferries to cease operations, it was assumed that the fast ferry passengers would divert to regular ferries. In this case, the delay in travel time for former fast ferry passengers would consist of two components (1) the extra time required by the slower average speed of regular ferries versus fast ferries for the portion of the trip not affected by speed restrictions and (2) the extra time required by the proposed speed restrictions where they would apply. As an illustration, a fast ferry trip that previously took 1 hour to travel 30 nm (56 km) at 30 knots would, with implementation of speed restrictions, take 2.6 hours: 2 hours to traverse the average effective distance of a DMA of 20 nm (37 km) at 10 knots plus 0.6 hours to transit the remaining 10 nm (19 km) at an average speed of 15 knots instead of 30.

Data Chart 4-40b
Estimated Economic Impact of Proposed Operational Measures on Southern New England Ferry Passengers, 2005 ($)

Type of vessel and alternative	Restricted speed in knots 10	12	14
Fast Ferries			
Alternative 2	3,221,251	2,516,603	2,013,282
Alternative 3	6,862,666	5,453,368	4,446,727
Alternative 6	3,571,387	2,790,146	2,232,117
Regular Ferries			
Alternative 2	1,291,127	859,890	258,225
Alternative 3	5,164,506	3,439,561	1,032,901
Alternative 6	1,619,379	1,078,506	323,876
Total			
Alternative 2	4,512,378	3,376,493	2,271,507
Alternative 3	12,027,172	8,892,929	5,479,628
Alternative 6	5,190,766	3,868,653	2,555,993

Source: Prepared by Nathan Associates as decribed in text.

Alternative 1– No Action Alternative

There would be no impact on ferry passengers under Alternative 1.

Alternative 2 – Mandatory Dynamic Management Areas

Under Alternative 2, the estimated economic impact on fast ferry passengers of a speed restriction at 10 knots would be $3.2 million annually. This is based on an assumed average of 90 passengers per trip incurring a delay of 1.6 hours for 92 fast ferry trips per day over 15 days and an hourly value of passenger time of $16.21. With a speed restriction of 12 knots, the estimated delay would be 1.25 hours and the estimated economic impact $2.5 million annually. With a speed restriction of 14 knots, the estimated delay would be 1 hour and the estimated economic impact $2.0 million annually.

For regular ferries, the estimated annual economic impact with a 10-knot restriction would be $1.3 million (based on a delay of 30 minutes for 90 passengers on 118 daily trips over 15 days). At 12 knots, the estimated delay would be 20 minutes and the annual impact $0.9 million; at 14 knots, the estimated delay would be 6 minutes and the estimated annual impact $0.3 million.

Alternative 3 – Speed Restrictions in Designated Areas

Under Alternative 3, it can be assumed that the nine fast ferry operators in the Block Island Sound area would suspend operations for 30 days per year and their passengers would divert to regular ferries. The two fast ferry operations from Boston to Provincetown would cease and be replaced by regular ferry service. For the purposes of the passenger impact analysis, 120 days per year of peak operation for the Boston-Provincetown services were assumed. The resulting impact on fast ferry passengers would be $6.9 million annually at 10 knots, $5.5 million annually at 12 knots, and $4.4 million annually at 14 knots.

For regular ferries, the impact would be similar to that of Alternative 2, except that regular ferry operations can be assumed to be affected for 60 days a year. The resulting annual economic impact would be $5.2 million at 10 knots, $3.4 million at 12 knots, and $1.0 million at 14 knots.

Alternative 4 – Recommended Shipping Routes

There would be no economic impact on ferry passengers under Alternative 4.

Alternative 5 – Combination of Alternatives

Impacts under this alternative would be the same as under Alternative 3 as the relevant factors are those that are also part of that alternative.

Alternative 6 – Proposed Action (Preferred Alternative)

Under Alternative 6, the impact would be the same as under Alternative 2 for fast ferry passengers affected by the DMAs. However, there would be an additional impact of 15 days during early May for the two fast ferries operating from Boston to Provincetown that together account for 10 trips daily. The total estimated annual economic impact on fast ferry passengers would be $3.6million at 10 knots, $2.8 million at 12 knots, and $2.2 million at 14 knots.

For regular ferries, the economic impact again would be the same as that of Alternative 2 with an increment for speed restrictions during 30 daily trips on the Boston-Provincetown route over 15 days. The total annual impact would be $1.6 million at 10 knots, $1.1 million at 12 knots, and $0.3 million at 14 knots.

The above estimates assume 100 percent compliance with DMAs. However, under Alternative 6, DMAs would be voluntary, and ferry operators may choose not to comply with them. In that case, impacts would be less than estimated.

4.4.6 Impacts on Whale-Watching Vessels

Like the passenger ferry industry, the whale-watching industry can be categorized into operations that deploy fast vessels traveling at speeds of 25 to 38 knots and operations that deploy slower, regular vessels traveling at speeds of 16 to 20 knots. Data Chart 4-41 presents information for the major whale-watching operators in Massachusetts Bay. There are four operators of fast vessels; two are based in Boston, one in Barnstable, and one in Provincetown (two vessels). There are five operators of regular-speed vessels; they are based in Newburyport, Boston, Gloucester, Plymouth (six vessels), and Provincetown (four vessels). A survey of whale-watching operators in New England indicated that the majority of whale-watching vessels are 65 ft (19.8 m) and longer, and, therefore, would be affected by the proposed operational measures.

4.4.6.1 Alternative 1 – No Action Alternative

The No Action Alternative would have an indirect effect on the whale-watching industry. Whale-watching vessels derive profit from transporting customers to whale habitats with the intention of sighting one or more whales. In order to please and retain customers, they prefer that whales are sighted at least once on every trip. The larger the whale population – including right whales – the higher the probability that one or more animals will be sighted on any given trip. No new operational measures are proposed in Alternative 1, and the current measures have proved ineffective at reducing the amount of ship strikes to whales. Therefore, under this alternative, the right whale population would continue to decline, which would reduce the probability that right whales would be sighted regularly. However, most whale-watching trips do not target right whales only and the adverse effect is expected to be negligible.

Data Chart 4-41
Massachusetts Bay Whale Watching Operators, 2005

Operator	Location	Vessel Speed	Vessels
High-Speed Vessels			
Boston Harbor Cruises	Boston, MA	37	1
Hyannis Whale Watcher Cruises	Barnstable, MA	38	1
New England Aquarium	Boston, MA	25	1
Portuguese Princess Excursions	Provincetown, MA	25	2
Regular Speed Vessel			
Massachusetts Bay Lines	Boston, MA	18	1
Capt. John Boats	Plymouth, MA	17	6
Newburyport Whale Watch	Newburtyport, MA	20	1
Yankee Whale Watching	Gloucester, MA	20	1
Dolphin Fleet of Provincetown	Provincetown, MA	16	4

Source: Prepared by Nathan Associates from data on operator websites and selected interviews.

4.4.6.2 Alternative 2 – Mandatory Dynamic Management Areas

Implementing Alternative 2 would have direct adverse effects on whale-watching vessels that are 65 ft (19.8 m) or more in length and operate in the vicinity of designated DMAs. It can be assumed that high-speed vessels would suspend operations when DMAs are in effect along their route: communications with persons in the whale-watching industry indicated that it would not be economically viable to operate a high-speed vessel at less than half its normal operating speed. The estimated economic impact from the suspension of five high-speed vessels for a single 15-day DMA would be $0.4 million annually.[43] For regular-speed vessels, the analysis assumed 100 percent compliance with the DMAs.[44] Under this assumption, the estimated economic impact of a 10-knot restriction would be $0.9 million annually for the 13 regular-speed vessels, which would incur a 54-minute delay each way for two trips per day. At 12 knots, the estimated economic impact would be $0.5 million annually; at 14 knots, it would be $0.3 million.

The estimated economic impact of Alternative 2 are high for the industry as a whole, but actual impacts may in fact be less for several reasons. Individual vessels would have the option of altering their destination based on the occurrence of a DMA and operators of high-speed vessels, assumed in the analysis to be suspending their operations in case of DMA, indicated that they likely would choose to travel to alternate sighting grounds or target another whale species. The analysis also assumed that regular-speed whale-watching vessels over 65 ft (19.8 m) would need to reduce their speed when transiting through a DMA. However, if whales were located in a DMA, it is likely that a nearby whale-watching vessel would already be traveling at a slow speed to allow its passengers to look and take pictures. If a DMA were designated in an area the vessel would have to traverse to reach a particular destination, the captain could route around the area or seek other potential whale-watching spots that day in order to avoid delays. All these factors are likely to minimize actual impacts.

Conversely, because the number of effective DMA-days in the northeast (excluding Cape Cod Bay) was estimated to be 68 per year (in Cap Cod Bay, it was estimated to be 105 days per year) (see Table 4-1) and the impact analysis above is based on a single DMA, actual impacts could be higher than estimated if multiple DMAs are designated in the same year. However, each DMA would likely not affect every whale-watching operators every time, minimizing the potential for substantially higher impacts than estimated.

4.4.6.3 Alternative 3 – Speed Restrictions in Designated Areas[45]

Alternative 3 would have direct adverse effects on whale-watching vessels 65 ft (19.8 m) and longer along the US East Coast. Under this alternative, the proposed year-round speed restrictions in the Northeast region and Cape Cod Bay would render high-speed whale-watching vessels unprofitable, with the consequence that they might be sold or diverted into other service. As this would not be a recurring cost, potential loss associated with the sale of the vessel is not included in this economic assessment. It also can be assumed that regular-speed whale-watching vessels would be put into service to replace the high-speed vessels. However, demand for whale-watching from locations such as Boston would likely diminish because the additional time required to reach whale feeding areas is likely to discourage passengers. It is possible that some of the demand would divert to other whale-watching operations located closer to the feeding areas.

Regular-speed whale-watching vessels would be subject to the year-round speed restrictions extending 25 nm (46 km) from the coastline and in Cape Cod Bay. It is estimated that, with a 10-knot restriction, the 13 regular-speed vessels operating in that area would incur a 54-minute delay each way for two round-trips daily during a 90-day summer whale-watching period. On

[43] Calculated based on a $13,320 daily operating costs excluding fuel times 15 days for 5 vessels.
[44] This analysis assumes that on average, only half of a DMA would affect the whale-watching vessel's route, hence the effective distance of the DMA would be approximately 20 nm (37 km).
[45] This analysis also applies to Alternative 5.

this basis, the annual economic impact of the alternative was estimated to be $5.6 million (it would be $3.1 million at 12 knots and $1.9 million at 14 knots) (see Data Chart 4-42).

Speed restrictions proposed in the mid-Atlantic from October 1 to April 30 would extend out 25 nm (46 km), which would include the majority of the right whale migratory corridor. In the Southeast, speed restrictions from November 15 through April 15 in the MSRS WHALESSOUTH reporting area and critical habitat would also affect the majority of whale-watching trips if the vessel is 65 ft (19.8 m) or longer and if the designated speed limit is lower than the average vessel operating speed. Due to the seasonal nature of the speed restrictions in the MAUS and SEUS and the small number of whale watching operators in these regions, it is expected that any economic impact on the whale-watching industry could be avoided or would be negligible.

Data Chart 4-42
Estimated Economic Impact of Proposed Operational Measures on Massachusetts Bay Whale Watching Operators, 2005 ($)

Type of vessel and alternative	Restricted speed in knots 10	12	14
High-Speed Vessels			
Alternative 2	399,600	399,600	399,600
Alternative 3	-	-	-
Alternative 6	399,600	399,600	399,600
Regular Speed Vessel			
Alternative 2	936,000	520,000	312,000
Alternative 3	5,616,000	3,120,000	1,872,000
Alternative 6	936,000	520,000	312,000
Total			
Alternative 2	1,335,600	919,600	711,600
Alternative 3	5,616,000	3,120,000	1,872,000
Alternative 6	1,335,600	919,600	711,600

Source: Prepared by Nathan Associates from data on operator websites and selected interviews.

4.4.6.4 Alternative 4 – Recommended Shipping Routes

Alternative 4 would not affect whale-watching operations. The recommended shipping lanes into the Cape Cod Bay, Brunswick, Fernandina, and Jacksonville port areas are primarily for use by commercial shipping vessels, not smaller passenger vessels such as whale-watching vessels, which typically are based in smaller harbors.

4.4.6.5 Alternative 5 – Combination of Alternatives

Alternative 5 would have the same direct, long-term, adverse effects on whale-watching vessels 65 ft (19.8 m) and longer as Alternative 3 (see Section 4.4.6.3) because the relevant measures would be the same.

4.4.6.6 Alternative 6 – Proposed Action (Preferred Alternative)

Alternative 6 would have direct adverse impacts on whale-watching vessels 65 ft (19.8 m) and longer. Under this alternative, speed restrictions for Cape Cod Bay would be in place from

January 1 through May 15. Therefore, the peak summer whale-watching season would not be affected. Similarly, speed restrictions for an extended Off Race Point are proposed for March through April only. Thus, the economic impact of Alternative 6 can be considered the same as those of Alternative 2, as they would result primarily from the implementation of DMAs. Total impacts would be $1.3 million annually at 10 knots, $0.9 million annually at 12 knots, and $0.7 million annually at 14 knots (see Data Chart 4-42). These estimates assume 100 percent compliance. Since DMAs would be voluntary, lower levels of compliance would result in proportionately lower impacts.

With the exception of the New England Aquarium, all the potentially affected whale-watching operators are small economic entities. Considering these small operators only, the annual impacts would amount to an estimated 4.2 percent of the total annual revenue generated by the affected high-speed vessels and 3.8 percent of the revenue generated by affected regular-speed vessels. (using information from the industry, annual revenue was estimated based on an average revenue of $16,000 a day per vessel for a peak season of 120 days).

However, only a small minority of the total number of whale watching operations (approximately 13 percent) and of vessels (approximately 7 percent) would be affected. Also, all above estimates conservatively assume full compliance with DMAs. Should vessel operators choose not to observe the voluntary speed restrictions, as they would be free to do, there would be no impacts at all.

Because the number of whale-watching operators in the MAUS and SEUS regions is minimal, the impact of the proposed operational measures on the whale-watching industry in these areas is expected to be negligible.

4.4.7 Impacts on Charter Vessel Operations

During stakeholder meetings, representatives of the charter fishing industry raised concerns about the negative effects speed restrictions may have on their industry. In some areas, charter vessels travel up to 50 nm (92.6 km) offshore to reach prime fishing areas. At vessel speeds of up to 17 knots, they can reach their destination in less than three hours. A speed restriction of 10 knots over 20 nm (37 km), as would happen under Alternative 6, would add about 100 minutes to the roundtrip and could severely affect client demand and reduce the competitiveness of the larger headboats (more than 65 ft [19.8 m]), particularly for the half-day (6-hour trips) and full-day (11- to 12-hour trips) charters. It is likely that vessels less than 65 ft (19.8 m) long would increase their share of this market, partially offsetting the overall impact. For extended full-day charters (18- to 24-hour trips), headboats longer than 65 ft (19.8 m) would incur additional costs associated with the 100-minute increase in roundtrip travel time.

4.4.7.1 Alternative 1 – No Action Alternative

The No Action Alternative would have no effect on charter vessels or the charter industry.

4.4.7.2 Alternative 2 – Mandatory Dynamic Management Areas

Under Alternative 2, DMAs would potentially affect larger charter vessels (65 ft [19.8 m] and longer) only. However, these vessels could either route around the DMA or reduce their speed through it. It can be assumed they would choose the option that would be the most time- and cost-efficient, thus minimizing, though not eliminating, any resulting time penalty. Overall, impacts are expected to be negligible.

4.4.7.3 Alternative 3 – Speed Restrictions in Designated Areas

Under Alternative 3, a speed restriction of 10 knots over 25 nm (46 km) would have minor, direct, long-term, adverse economic impacts on charter vessels, amounting to an estimated $1.0 million annually. The annual impact would be $598,000 with a 12-knot speed restriction and $299,000 with a 14-knot restriction. As already noted, only headboats 65 ft (19.8 m) longer would be affected.

4.4.7.4 Alternative 4 – Recommended Shipping Routes

There would be no impacts on charter vessels under Alternative 4.

4.4.7.5 Alternative 5 – Combination of Alternatives

The impacts under Alternative 5 – $1.0 million annually at 10 knots, $598,000 at 12 knots, and $299,000 at 14 knots – would be the same as under Alternative 3.

4.4.7.6 Alternative 6 – Proposed Action (Preferred Alternative)

Under Alternative 6, it is estimated that the economic impact of a speed restriction of 10 knots for these vessels over 20 nm (37 km) would be approximately $796,000 annually.[46] At a 12-knot speed restriction, the estimated annual impact would be $480,000; at 14 knots, it would be $240,000.

Based on an estimated annual revenue for a charter fishing headboat of $504,000 (assuming 90 charters with 80 passengers paying $70 each), the annual impact for a 10-knot speed restriction would represent 3.9 percent of the annual revenue generated by the potentially affected boats. However, the proportional impact would be much less when compared to the total revenue generated by the charter fishing industry since most of the industry's fleet consists of boats less than 65 ft (19.8 m) long, which would not be affected by the proposed measures.

4.4.8 Indirect Economic Impact of Other Market Segments on the Local Economy

Industry representatives and other parties expressed concern that implementation of the proposed operational measures on passenger ferries, whale-watching vessels and charter fishing vessels would also have an indirect economic impact on local communities. For example, operators of fast ferries between Boston and Provincetown stated that suspension of their services due to the implementation of a DMA during peak season would seriously affect tourism-related businesses in Provincetown. However, members of the passenger ferry industry have also expressed concerns about their ability to compete with car travel, suggesting that it is likely that in the absence of convenient ferry service, passengers would select a different mode of transportation to travel to Provincetown. If that is the case, any indirect economic impacts on the local economy

[46] This calculation assumes 40 headboat vessels with 30 roundtrips during the off-season months for fishing – November through April – and an hourly steaming operating cost of $400. The calculations do not include any offsetting impact of revenue gains by operators of smaller charter fishing vessels.

can be expected to be limited. These indirect impacts may increase slightly if the high price of gas makes car travel less desirable; however, high energy prices would also affect the cost of travelling by ferry.

Similarly, whale-watching operators and tourism officials in the Greater Boston area expressed concerns that visitors would cut their trip short or cancel their visit to the region entirely because of potential impacts from implementation of a DMA. However, unlike the passenger ferry operators that have to operate on a fixed route, whale-watching operators under most circumstances could alter their route to avoid the DMA and select routes and destinations where whales other than right whales could be observed. In addition, operators of vessels under 65 ft (19.8 m) in length would likely be available to serve customers desiring to observe right whales within the DMA area (these vessels would still be required to comply with the 500-yd (457-m) no-approach regulation). In this case, the implementation of a DMA might actually generate additional business for whale-watching operators. Overall, tourists would have sufficient attractive alternatives and are not expected to cut short or cancel their visit to the region due to the proposed operational measures.

The proposed operational measures for the mid-Atlantic region would be effective from November through April and would not fall within the peak months for charter fishing. In addition, it is expected that customers lost to the larger headboats would be served by charter fishing operators with smaller vessels. For these reasons, any indirect economic impacts on the local communities are expected to be minimal.

4.4.9 Summary of the Direct and Indirect Economic Impacts on all Maritime Sectors

This section summarizes the annual economic impacts of the alternatives considered in this FEIS based on 2004 conditions with a 10-knot speed restriction (impacts for 12 and 14 knots also are briefly stated). Data Chart 4-43 presents the annual direct and indirect economic impacts by alternative and speed restriction for both 2003 and 2004 conditions.

- **Alternative 5** would have the largest estimated annual economic impact, at an estimated $359.7 million, including $200.1 million in direct impacts and $159.6 million in indirect impacts. Speed restrictions year-round would have substantial repercussions through the northeast region port areas and the northern mid-Atlantic port areas. The combination of DMAs, recommended routes and speed restrictions also would contribute substantially to the impacts. The brunt of the impacts would be borne by the commercial shipping industry, with a combined direct economic impact of $166.7 million annually. This represents 83 percent of the total direct economic impact. The total annual economic impact with a speed restriction of 12 knots would be $223.3 million; with a speed restriction of 14 knots, it would be $134.1 million.
- **Alternative 3** would have the second-largest annual economic impact, estimated at $334.8 million annually. The direct economic impact would be $195.4 million and the indirect economic impact $139.4 million. The total annual economic impact with a speed restriction of 12 knots would be $210 million; with a speed restriction of 14 knots, it would be $121.7 million.

- **Alternative 6** (**Proposed Action**) would have the third-largest total annual economic impact, with an estimated $137.3 million per-year, for five years, including $87.6 million in direct impact and $49.7 million in indirect impact. The total annual economic impact with a speed restriction of 12 knots would be $77.4 million; with a speed restriction of 14 knots, it would be $45 million. Impacts would cease five years after the measures' date of effectiveness.
- **Alternative 2** ranks fourth in terms of total economic impact, with an estimated $41.5 million annually. This alternative would not have indirect impact. The total annual economic impact with a speed restriction of 12 knots would be $28.1 million; with a speed restriction of 14 knots, it would be $17.9 million.
- **Alternative 4** would have the lowest total economic impact, with an estimated $2.8 million annually for 10, 12, and 14 knots. This alternative would consist only of the use of recommended routes; negative secondary impacts on some port areas would be offset by gains to others.

Table 4-3 summarizes the potential impacts of Alternative 6 (the proposed action) on industries other than the shipping industry measured as a percentage of the annual revenue generated by the affected activities in 2004. The numbers are the same as those calculated to assess impacts to small economic entities in the economic impact report because, with one exception, these industries consist entirely of such entities. The exception is the whale watching industry, because one operator, the New England Aquarium, is not a small entity, and, therefore, is not taken into account in the table. The Aquarium accounts for one affected vessel out of 18. It should also be noted that the estimates shown in Table 4-3 are quite conservative because (1) they only take into account revenues generated by the affected vessels whereas these vessels represent only a minority of the vessels operated by each industry and (2) they assume full compliance with voluntary DMAs, whereas it is likely that at least some operators would choose not to observe the recommended speed restriction.

Table 4-3
Estimated Economic Impacts of Alternative 6 on Industries Other Than the Shipping Industry

Industry	Estimated Annual Economic Impact ($ Million)	Economic Impact as a % of Annual Revenues[1]
Commercial Fishing	1.3	0.5%
Passenger Ferries		
High-speed Vessels	2.6	4.9%
Regular-speed Vessels	6	7.9%
Whale Watching		
High-speed Vessels	0.3	4.2%
Regular-speed Vessels	0.9	3.8%
Charter Vessels	0.796	3.9%

1. Based on estimated 2004 revenues from the affected operations only. Impacts as a percentage of the total annual revenue of each industry would be smaller.

Data Chart 4-43
Total Direct and Secondary Economic Impact by Alternative and Restriction Speed, 2003 and 2004 ($000s)

	Alternative 2			Alternative 3			Alternative 4			Alternative 5			Alternative 6		
	Restriction speed in knots			Restriction speed in knots			Restriction speed in knots			Restriction speed in knots			Restriction speed in knots		
Item	10	12	14	10	12	14	10	12	14	10	12	14	10	12	14
2003															
Direct economic impact															
Shipping industry vessels	25,026.5	16,119.0	9,829.8	133,009.9	83,641.1	49,461.4	2,333.4	2,333.4	2,333.4	137,000.4	86,678.1	51,755.2	53,158.3	33,423.8	20,007.9
Cumulative effect of multi-port strings	-	-	-	11,265.1	9,350.0	7,885.6	-	-	-	11,265.1	9,350.0	7,885.6	8,718.7	7,236.5	6,103.1
Re-routing of southbound coastwise shipping	-	-	-	7,500.0	7,500.0	7,500.0	-	-	-	7,500.0	7,500.0	7,500.0	3,400.0	3,400.0	3,400.0
Commercial fishing vessels	-	-	-	1,724.0	-	-	-	-	-	1,724.0	-	-	1,310.2	-	-
Charter fishing vessels	-	-	-	1,000.0	597.6	298.8	-	-	-	1,000.0	597.6	298.8	796.0	480.0	240.0
Passenger ferries	8,078.0	6,111.3	4,144.7	13,028.0	11,061.3	8,308.0	-	-	-	13,028.0	11,061.3	8,308.0	8,608.9	6,567.2	4,563.0
Pasengers' time on passenger ferries	4,512.4	3,376.5	2,271.5	12,027.2	8,892.9	5,479.6				12,027.2	8,892.9	5,479.6	5,190.8	3,868.7	2,556.0
Whale watching vessels	1,335.6	919.6	711.6	5,616.0	3,120.0	1,872.0	-	-	-	5,616.0	3,120.0	1,872.0	1,335.6	919.6	711.6
Subtotal direct economic impact	38,952.5	26,526.4	16,957.6	185,170.2	124,162.9	80,805.4	2,333.4	2,333.4	2,333.4	189,160.7	127,199.9	83,099.1	82,518.5	55,895.8	37,581.6
Indirect economic impact of port diversions	-	-	-	141,608.0	81,489.0	38,803.0	-	-	-	162,536.0	91,777.2	48,911.2	49,600.5	18,203.5	5,302.7
Total economic impact	38,952.5	26,526.4	16,957.6	326,778.2	205,651.9	119,608.4	2,333.4	2,333.4	2,333.4	351,696.7	218,977.1	132,010.3	132,119.0	74,099.3	42,884.3
2004															
Direct economic impact															
Shipping industry vessels	27,578.8	17,700.7	10,781.8	142,476.8	89,229.6	52,530.3	2,790.6	2,790.6	2,790.6	147,171.3	92,772.0	55,237.8	57,569.2	36,050.4	21,544.6
Cumulative effect of multi-port strings	-	-	-	11,932.6	9,904.1	8,352.8	-	-	-	11,932.6	9,904.1	8,352.8	9,411.5	7,811.5	6,588.1
Re-routing of southbound coastwise shipping	-	-	-	7,600.0	7,600.0	7,600.0	-	-	-	7,600.0	7,600.0	7,600.0	3,400.0	3,400.0	3,400.0
Commercial fishing vessels	-	-	-	1,724.0	-	-	-	-	-	1,724.0	-	-	1,310.2	-	-
Charter fishing vessels	-	-	-	1,000.0	597.6	298.8	-	-	-	1,000.0	597.6	298.8	796.0	480.0	240.0
Passenger ferries	8,078.0	6,111.3	4,144.7	13,028.0	11,061.3	8,308.0	-	-	-	13,028.0	11,061.3	8,308.0	8,608.9	6,567.2	4,563.0
Pasengers' time on passenger ferries	4,512.4	3,376.5	2,271.5	12,027.2	8,892.9	5,479.6	-	-	-	12,027.2	8,892.9	5,479.6	5,190.8	3,868.7	2,556.0
Whale watching vessels	1,335.6	919.6	711.6	5,616.0	3,120.0	1,872.0	-	-	-	5,616.0	3,120.0	1,872.0	1,335.6	919.6	711.6
Subtotal direct economic impact	41,504.8	28,108.1	17,909.6	195,404.6	130,405.4	84,441.6	2,790.6	2,790.6	2,790.6	200,099.1	133,947.9	87,149.0	87,622.2	59,097.4	39,603.2
Indirect economic impact of port diversions	-	-	-	139,406.0	79,603.0	37,251.0	-	-	-	159,582.0	89,308.4	46,956.4	49,695.0	18,280.0	5,355.0
Total economic impact	41,504.8	28,108.1	17,909.6	334,810.6	210,008.4	121,692.6	2,790.6	2,790.6	2,790.6	359,681.1	223,256.3	134,105.4	137,317.2	77,377.4	44,958.2

Source: Prepared by Nathan Associates as described in text.

4.4.10 Impacts on Environmental Justice

The proposed operational measures evaluated in this FEIS were developed based on the range of the right whale and vessel traffic patterns; they do not specifically target any one port community. Depending on the alternative, the 26 port areas considered here would experience negligible to minor adverse economic impacts (only economic impacts have any potential to raise economic justice issues). Within each port area, these impacts would not be localized and limited to or focused on specific minority or poor neighborhoods. Rather, they would be distributed throughout the entire region and local economy. The activities and businesses likely to be directly or indirectly affected by the proposed action are varied and are not disproportionately identified with a given ethnic or economic minority. Therefore, within each port area, the economic impacts of the proposed action would not likely disproportionately affect minority or low-income populations.

However, as shown in Section 3.4.8.2, 10 of the 26 port areas considered in this EIS have a higher percentage of minority or low-income residents than the United States as a whole and, as such, qualify as environmental justice communities, warranting closer scrutiny. Of these 10 areas, six – New York City, Hampton Roads, Georgetown, Charleston, Baltimore, and Savannah – have a minority population greater than the United States or representing more than 50 percent of the area's total population and four – Eastport, Morehead City, Wilmington, and Brunswick[47] – have a higher percentage of residents living below the poverty line than the United States as a whole. If any of these ten areas experienced proportionately greater impacts than the other 16 areas, the proposed action could raise issues of environmental justice.

Because of the wide differences in size and economic activities between the areas, comparison of economic impacts among the 26 affected port areas is not easily made. To allow for such a comparison, an index must be defined. For the purposes of this analysis, this index is the ratio of the estimated direct economic impacts on the shipping industry (in dollars) to the total value (in dollars) of the merchandise shipped to and from a given port area in 2004 as shown in Data Chart 3-3b. While this index does not incorporate all economic impacts, the direct impacts on the shipping industry represent a sufficient component of those impacts to provide a reliable ranking of, and allow for a meaningful comparison among, potential economic impacts to the 26 port areas under each of the six alternatives considered.

4.4.10.1 Alternative 1 – No Action Alternative

Under this alternative, existing mitigation measures would continue, and none of the operational measures would be implemented. Therefore, there would be no change to existing socioeconomic conditions and no potential for environmental justice issues.

4.4.10.2 Alternative 2 – Mandatory Dynamic Management Areas

Table 4-4 shows how each port area would be affected under Alternative 2 using the previously defined index. The areas are ranked based on the intensity of impacts as measured by the index (in descending order) with the ten areas that are environmental justice communities shown in boldface.

[47] The cities of Georgetown, Charleston, and Savannah occur in both categories, and are not counted twice.

Table 4-4
Relative Intensity of Economic Impacts by Port Area – Alternative 2

Port Area	Economic Impact Index[1]	Port Area	Economic Impact Index[1]
Cape Cod, MA	7.325	**Brunswick, GA**	0.012
Port Canaveral, FL	0.866	Boston, MA	0.012
Searsport, ME	0.131	New Haven, CT	0.011
Fernandina, FL	0.127	*All Areas*	*0.008*
Salem, MA	0.105	**Wilmington, NC**	**0.008**
Eastport, ME	**0.075**	**Morehead City, NC**	**0.006**
Bridgeport, CT	0.068	**Hampton Roads, VA**	**0.004**
Portland, ME	0.051	Providence, RI	0.004
New London, CT	0.029	**Charleston, SC**	**0.003**
Savannah, GA	**0.028**	**New York, NY[2]**	0.003
Jacksonville, FL	0.025	Philadelphia, PA	**0.003**
Portsmouth, NH	0.019	**Baltimore, MD**	**0.003**
Georgetown, SC	**0.015**	Long Island, NY[2]	N/A[2]
New Bedford, MA	0.013		

Notes:

1. Direct impacts on the shipping industry as a percentage of total 2004 merchandise value for each port. Impacts calculated for the 10-knot speed restriction were used.

2. For the purposes of this analysis, New York and Long Island are factored together.

As can be seen, only four of the ten environmental justice areas have an impact index superior to that of the areas together. Even in those cases, while the impacts would be relatively high compared to those on the areas as a whole, they would remain very small in absolute terms – for instance, annual direct impacts on the shipping industry at Eastport would amount to $87,300. They would also remain small in relative terms – impacts on Eastport, the most heavily affected of all ten environmental justice areas, would still represent seven-hundredths of one percent of the value of all merchandise traded at the port in 2004. Additionally, as already noted, within each area, impacts would not specifically affect any particular ethnic or economic group since the shipping and other industries likely to be affected are not disproportionately identified with such groups and the cost of the proposed action would be spread across private companies, the port city and surrounding jurisdictions, and the consumer. Therefore, Alternative 2 would not raise substantial issues of environmental justice.

4.4.10.3 Alternative 3 – Speed Restrictions in Designated Areas

Table 4-5 shows how each port area would be affected under Alternative 3 using the same method as previously defined.

Alternative 3 has a higher economic impact than Alternative 2. There is one additional environmental justice area affected, and four out of ten environmental justice areas would experience relatively heavier impacts than all the areas taken together. However, as under Alternative 2, these impacts would remain small compared to the overall activity of each port area and they would not target specific minority or low-income groups. On this basis, Alternative 3 would not raise substantial issues of environmental justice.

Table 4-5
Relative Intensity of Economic Impacts by Port Area – Alternative 3

Port Area	Economic Impact Index[1]	Port Area	Economic Impact Index[1]
Cape Cod, MA	101.375	**Hampton Roads, VA**	**0.067**
Bridgeport, CT	1.098	**Wilmington, NC**	**0.062**
Searsport, ME	0.668	Boston, MA	0.061
Salem, MA	0.555	Philadelphia, PA	**0.044**
Eastport, ME	**0.384**	*All Areas*	*0.044*
New London, CT	0.377	**Morehead City, NC**	0.044
Portland, ME	0.258	**Savannah, GA**	**0.042**
New Haven, CT	0.221	**Baltimore, MD**	**0.039**
New Bedford, MA	0.206	**New York, NY[2]**	**0.037**
Fernandina, FL	0.182	Jacksonville, FL	0.032
Port Canaveral, FL	0.151	**Charleston, SC**	**0.022**
Georgetown, SC	**0.133**	**Brunswick, GA**	**0.015**
Portsmouth, NH	0.096	Long Island, NY[2]	N/A[2]
Providence, RI	0.071		

Notes:

1. Direct impacts on the shipping industry as a percentage of total 2004 merchandise value for each port. Impacts calculated for the 10-knot speed restriction were used.

2. For the purposes of this analysis, New York and Long Island are factored together.

Table 4-6
Relative Intensity of Economic Impacts by Port Area – Alternative 4

Port Area	Economic Impact Index[1]	Port Area	Economic Impact Index[1]
Fernandina, FL	0.091	Providence, RI	0
Jacksonville, FL	0.017	**Wilmington, NC**	**0**
Brunswick, GA	**0.004**	**Eastport, ME**	**0**
All Areas	*0.001*	Cape Cod, MA	0
Boston, MA	0	**Savannah, GA**	**0**
Salem, MA	0	Philadelphia, PA	0
Portland, ME	0	**Baltimore, MD**	**0**
New Haven, CT	0	**Morehead City, NC**	**0**
New Bedford, MA	0	**New York, NY[2]**	**0**
Port Canaveral, FL	0	**Charleston, SC**	**0**
Searsport, ME	0	Bridgeport, CT	0
Georgetown, SC	**0**	New London, CT	0
Portsmouth, NH	0	Long Island, NY[2]	N/A[2]
Hampton Roads, VA	**0**		

Notes:

1. Direct impacts on the shipping industry as a percentage of total 2004 merchandise value for each port. Impacts calculated for the 10-knot speed restriction were used.

2. For the purposes of this analysis, New York and Long Island are factored together.

4.4.10.4 Alternative 4 – Recommended Shipping Routes

Table 4-6 shows how each port area would be affected under Alternative 4 using the index previously defined. The areas are ranked based on the intensity of impacts as measured by the index, with the ten areas that are environmental justice communities shown in boldface. Under this alternative, Brunswick is the only environmental justice community that would incur economic impacts. However, these impacts would be very minor – $253,000 per year, or four-thousandths of one percent of the port's total 2004 merchandise value and, as previously noted, would not target any specific ethnic or low-income community. Therefore, Alternative 4 would not raise substantial issues of environmental justice.

4.4.10.5 Alternative 5 – Combination of Alternatives

Table 4-7 shows how each port area would be affected under Alternative 5 using the same method as previously defined.

Under Alternative 5, four out of ten environmental justice areas would experience relatively heavier impacts than all the areas taken together. However, these impacts would remain small compared to the overall activity of each port area (though less so than under Alternatives 2, 3, or 4), and they would not target specific minority or low-income groups. On this basis, Alternative 5 would not raise substantial issues of environmental justice.

Table 4-7
Relative Intensity of Economic Impacts by Port Area – Alternative 5

Port Area	Economic Impact Index[1]	Port Area	Economic Impact Index[1]
Cape Cod, MA	102.425	**Hampton Roads, VA**	**0.067**
Bridgeport, CT	1.098	Boston, MA	0.064
Searsport, ME	0.697	**Wilmington, NC**	**0.062**
Salem, MA	0.579	Jacksonville, Fl	0.051
Eastport, ME	**0.400**	*All Areas*	*0.045*
New London, CT	0.377	Philadelphia, PA	0.044
Port Canaveral, FL	0.324	**Morehead City, NC**	**0.044**
Portland, ME	0.270	**Savannah, GA**	**0.042**
Fernandina, FL	0.270	**Baltimore, MD**	**0.039**
New Haven, CT	0.221	**New York, NY[2]**	**0.037**
New Bedford, MA	0.206	**Charleston, SC**	**0.022**
Georgetown, SC	**0.133**	**Brunswick, GA**	**0.020**
Portsmouth, NH	0.100	Long Island, NY[2]	N/A[2]
Providence, RI	0.071		

Notes:

1. Direct impacts on the shipping industry as a percentage of total 2004 merchandise value for each port. Impacts calculated for the 10-knot speed restriction were used.

2. For the purposes of this analysis, New York and Long Island are factored together.

4.4.10.6 Alternative 6 – Proposed Action (Preferred Alternative)

Table 4-8 shows how each port area would be affected under Alternative 6.

Under Alternative 6, seven of the ten environmental justice areas would experience impacts heavier than the impacts on the 26 areas taken together. However, in all cases, these impacts would be very small, and would only be incurred during the five-year period the measures would be in effect; for example, impacts in Eastport, the most affected of the ten environmental justice areas, would represent one tenth of one percent of the port's 2004 total merchandise value. Additionally, as already noted, within each area, impacts would not specifically affect any particular ethnic or economic group since the shipping and other industries likely to be affected are not disproportionately identified with such groups and the cost of the proposed action would be spread across private companies, the port city and surrounding jurisdictions, and the consumer. Therefore, Alternative 6 would not raise substantial issues of environmental justice.

Table 4-8
Relative Intensity of Economic Impacts by Port Area – Alternative 6

Port Area	Economic Impact Index[1]	Port Area	Economic Impact Index[1]
Cape Cod, MA	20.050	**Wilmington, NC**	**0.029**
Bridgeport, CT	0.424	Portsmouth, NH	0.025
Fernandina, FL	0.266	**Hampton Roads, VA**	**0.023**
Port Canaveral, FL	0.173	**Savannah, GA**	**0.020**
New London, CT	0.155	**Morehead City, NC**	**0.020**
New Bedford, MA	0.132	**Brunswick, GA**	**0.020**
Searsport, ME	0.105	*All Areas*	*0.018*
New Haven, CT	0.104	Boston, MA	0.016
Eastport, ME	**0.103**	Philadelphia, PA	0.016
Salem, MA	0.069	**Baltimore, MD**	**0.013**
Portland, ME	0.065	**New York, NY[2]**	**0.012**
Georgetown, SC	**0.061**	**Charleston, SC**	**0.011**
Jacksonville, FL	0.049	Long Island, NY[2]	N/A[2]
Providence, RI	0.029		

Notes:

1. Direct impacts on the shipping industry as a percentage of total 2004 merchandise value for each port. Impacts calculated for the 10-knot speed restriction were used.

2. For the purposes of this analysis, New York and Long Island are factored together.

4.5 Impacts on Cultural Resources

As described in Section 3.5, no cultural resources have been identified on the ocean surface in areas that would be affected by the proposed action and alternatives. Therefore, there would be no impacts to cultural resources. The proposed actions are limited to speed restrictions, spatial closures, and re-routing of ships to recommended routes. Furthermore, the USCG conducted the PARS to analyze any existing “navigational hazards” in the recommended routes. Any cultural resource located on the ocean surface would have been considered a hazard to navigation, hence the lanes were not designated in an area with potential hazards.

Consultation with the Advisory Council on Historic Preservation, a NOAA Marine Archeologist, and NOAA General Counsels, resulted in a consensus that the proposed operational measures in the alternatives have no potential to affect any cultural resources or historic properties.[48]

4.6 Regulatory Impacts

The proposed action and alternatives would comply with EO 12898 (Section 1.6.1). A Regulatory Impact Review/Regulatory Impact Analysis is provided in Chapter 5, in compliance with EO 12866 (Section 1.6.2). The Final Regulatory Flexibility Analysis will be included in the Final Rule, in accordance with the Regulatory Flexibility Act (RFA). A discussion of impacts resulting from the implementation of the operational measures on minorities and low-income environmental justice communities is included in Section 4.4.10. The ESA, MMPA, and other relevant legislation are discussed in the following sections.

4.6.1 Endangered Species Act

4.6.1.1 No Action Alternative

The No Action Alternative would not be consistent with the objectives of the ESA. The ESA prohibits the "taking" of any listed species (see Section 1.7.1). Under the No Action Alternative, the "taking" of right whales as a result of ship strikes would continue, and the population would not recover. The *Recovery Plan for the North Atlantic Right Whale*, which is required by the ESA, identifies downlisting the species from endangered to threatened as an intermediate goal. The ultimate goal is to promote the recovery of North Atlantic right whales to a level sufficient to warrant their removal from the list of endangered and threatened wildlife and plants. Under Alternative 1, ship strikes would continue and the right whale population would not be expected to increase, therefore neither goal would be reached. The western population of the North Atlantic right whale would continue to face extinction under this alternative.

4.6.1.2 Action Alternatives

Implementing any of the action Alternatives 2 through 6, each of which contain one or more operational measure(s) aimed at reducing right whale mortalities by ship strikes, would reduce the number of "takes" under the ESA, and increase the probability that the population will recover. Under these alternatives, NMFS would be consistent with the objectives of the ESA to protect North Atlantic right whales, and the species would have a significantly increased chance of recovery and survival. Alternatives 5 and 6, which combine operational measures, would result in a higher probability of population recovery and have the potential to meet the intermediate goal of the Recovery Plan to downlist right whales to threatened in a more timely matter than the alternatives that propose only one operational measure.

[48] Consensus gained through personal communication (via e-mail) with Bruce Terrell, Marine Archeologist, NOAA/National Marine Sanctuary Program, Mary Elliot Rolle, NOAA/General Counsel for Ocean Services, Ole Varmer, NOAA/General Counsel International Law, and Dr. Tom McCulloch, Archeologist, ACHP.

4.6.2 Marine Mammal Protection Act

4.6.2.1 No Action Alternative

The No Action Alternative would be inconsistent with the objectives of the MMPA. The MMPA also prohibits the "taking" of marine mammals without authorization (see Section 1.7.2).[49] The existing measures contained in this alternative have not effectively reduced ship strikes that "take" marine mammals. Under the No Action Alternative, the endangered North Atlantic right whale, which is also a depleted marine mammal species under the act, would not be protected from the threat of ship strikes. The western population of the North Atlantic right whale would continue to face extinction.

4.6.2.2 Action Alternatives

Implementing any of the action Alternatives 2 through 6, which each contain one or more operational measures aimed at reducing right whale mortalities by ship strikes, would reduce the number of "takes" under the MMPA, and increase the probability that the population will recover. These alternatives are consistent with the objectives of the MMPA to protect North Atlantic right whales, and the species would have a significantly increased chance of recovery and survival. Alternatives 5 and 6, which combine operational measures, would result in a higher probability of population recovery and have the potential to bring the right whale population to levels reaching Optimum Sustainable Population (see Section 3.2.1).

4.6.3 Ports and Waterways Safety Act

4.6.3.1 No Action Alternative

Under the No Action Alternative, vessel traffic would continue to route through critical habitat and migratory corridors without any regard to the presence of whales. There would be no known additional action taken by the USCG under the Ports and Waterways Safety Act of 1972, beyond actions they are currently taking for the preservation of right whales and other marine species.

4.6.3.2 Action Alternatives

The USCG made recommendations on NOAA's proposed shipping routes through the PARS study. Recommended shipping routes are included in Alternatives 4, 5, and 6. Through conducting the PARS, the USCG has fulfilled its mandate to protect the marine environment under the Ports and Waterways Safety Act of 1972. These recommended routes will protect the right whale and other marine species while ensuring navigational safety. The Vessel Traffic Service (VTS) system may also be expanded into additional port areas in order to disseminate information concerning the NMFS rulemaking.

[49] The definition of 'taking' varies slightly from the MMPA to the ESA.

4.6.4 Regulatory Flexibility Act

4.6.4.1 No Action Alternative

Under the No Action Alternative, NMFS would not propose any regulatory measures and there would be no subsequent effects that could have a significant economic impact on small entities. Therefore, analysis under the Regulatory Flexibility Act would be unnecessary.

4.6.4.2 Action Alternatives

Inclusion of speed restrictions in the final rule require NMFS to prepare a final regulatory flexibility analysis (FRFA). The FRFA utilizes the US Small Business Administration's (SBA) small business-size standards, which correspond to the North American Industry Classification System Codes (NAICS). The SBA defines a small business in the deep-sea freight transportation sector as a firm with 500 or fewer employees. The SBA defines a small business in the commercial fishing sector as a firm with gross revenues up to $4.0 million. All directly regulated sectors are assessed in the FRFA. Based on these standards and industry data on firm size, the number of small entities in the affected industries are identified and the impacts are quantified. The FRFA will be included in the Final Rule.

4.6.5 Coastal Zone Management Act

4.6.5.1 No Action Alternative

Implementing the No Action Alternative would not adversely affect any land or water uses in the states' coastal zone. None of the existing mitigation measures that would continue under Alternative 1 have an effect on state coastal waters, therefore there would be no impacts with respect to the Coastal Zone Management Act (CZMA).

4.6.5.2 Action Alternatives

The operational measures in the alternatives would not affect land uses within state waters (out to 3 nm [6 km]), but the measures may affect water uses and resources, as defined in Section 304 (10) and (18) of the CZMA. The SEUS management area extends out to approximately 30 nm (56 km) offshore. The MAUS SMAs are proposed 20-25 nm (37-46 km) offshore into state waters in some cases, although only speed restrictions are proposed. In the NEUS, the GSC management area is offshore, and there are not any permanent measures proposed in the Gulf of Maine. The Off Race Point management area runs adjacent to the eastern land side of Cape Cod, although only speed restrictions are proposed in this area, which would not affect coastal or inland waters. The Cape Cod Bay management area does include state waters, and may affect coastal uses, but the proposed measures for this area – speed restrictions and recommended shipping routes – would not have a physical effect on coastal waters.

While several of the operational measures contained in the alternatives may be implemented within state waters (3 nm [5.6 km]), the actual associated action – speed restrictions – would have neutral or positive effects on a state's coastal zone. Reducing the speed of ships into certain ports and other management areas would affect vessel traffic, although it would not interfere with public access or right of passage in state waters. The majority of the applicable state policies include a policy to conserve endangered and threatened wildlife, which is the main objective of the proposed measures, thus resulting in a positive impact on the policies of the state coastal zone management programs.

Given this situation, and following an evaluation of applicable state-enforceable policies, NMFS determined that the implementation of the alternatives would be consistent to the maximum extent practicable with the enforceable policies of the coastal zone management programs of the states included within the geographic scope of the rulemaking. These states are Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, and Florida. The 'Consistency Determination' letters were submitted to the states, along with the proposed rule and a copy of the DEIS, for review and concurrence by the responsible state agencies under Section 307 of the CZMA. NMFS received concurrence from nine of the 15 states, and after the 60-day review period, NMFS assumed concurrence from the remaining states, as stated in the letter. A copy of the consistency determination letter and the state responses is provided in Appendix F.

4.6.6 National Marine Sanctuaries Act

4.6.6.1 No Action Alternatives

Implementing the No Action Alternative would not affect any resources in Stellwagen Bank National Marine Sanctuary (SBNMS) or Gray's Reef National Marine Sanctuary (GRNMS), and therefore there would be no impact on the resources protected by the National Marine Sanctuaries Act (NMSA).

4.6.6.2 Action Alternatives

The majority of SBNMS overlaps with the Off Race Point and Cape Cod Bay SMAs, and therefore implementation of the rule should be consistent with the NMSA's mandate to prohibit the destruction, loss of, or injury to any sanctuary resource (16 U.S.C. § 1443). While the operational measures in the action alternatives would affect sanctuary resources, including right whales and other endangered baleen whales, the impacts are expected to be beneficial. As mentioned in Section 4.2, species such as fin and humpback whales, which are also threatened by ship strikes, would be afforded protection by the seasonal speed restrictions. While the SMAs may not provide protection for the entire season in which these species are present or sufficient coverage to protect their entire habitat, partial protection is still a postive impact relative to the status quo, by which there are no mandatory speed restrictions anywhere within SBNMS. Therefore, implementation of any of the action alternatives would not result in the destruction, loss of, or injury to any sanctuary resource relative to status quo (No Action Alternative).

Gray's Reef, which is located 17.5 nm (32 km) off Sapelo Island, Georgia, between Savannah and Brunswick, overlaps with the Southeast SMA. For similar reasons to those mentioned above for SBNMS, implementation of any of the action alternatives would not adversely affect GRNMS.

4.6.7 Effects Analysis on Other Resources

4.6.7.1 Possible Conflicts Between the Proposed Action and the Objectives of Federal, Regional, State and Local Land Use Plans, Policies, and Controls for the Area Concerned

Local land use plans are not applicable, as the proposed action and alternatives occur in state and Federal waters. There are several Federal agencies with jurisdiction in the EEZ. The USCG is coordinating on the vessel operational measures, specifically the PARS, to identify recommended routes. Throughout this process, the USCG has not notified NMFS of any conflict between the proposed action and other USCG policies. As all sovereign vessels are exempt from the operational measures, there are no foreseeable conflicts with the policies of other Federal agencies, or their vessels or operations. NMFS has had numerous meetings with the Navy and has accepted written comments from Navy personnel on the ANPR, NOI to prepare a DEIS, proposed rule, and DEIS. The National Ocean Service's National Marine Sanctuary Program (NMSP) has two sanctuaries within the scope of the rulemaking: Stellwagen Bank and Gray's Reef. A coordination letter was sent to these sanctuaries along with a copy of the DEIS to ensure consistency with their policies. NMFS received a comment letter from the NMSP on October 5, 2006, and addressed their comments in the FEIS (see Appendix C).

The state coastal zone management programs were provided with consistency determination letters under the CZMA. A copy of this letter, along with the state responses, is provided in Appendix F. All nine states that responded to the consistency determination concurred with NMFS' determination (Section 4.6.5.2). Massachusetts was the only state to raise concerns. In response to their concerns, NMFS granted an exemption to state enforcement vessels (see Section 1.4).

States that have environmental clearinghouses were sent a coordination letter along with the DEIS to ensure consistency with other environmental protection divisions within the agency. Georgia, South Carolina, North Carolina, Maryland, Rhode Island, and Florida responded to this coordination letter, and included any comments provided by applicable state agencies. The only states that provided comments were Maryland and Florida, and these comments were also formally submitted to NMFS during the comment period on the DEIS. Their comments are addressed in the FEIS (Appendix C).

4.6.7.2 Public Health and Safety

NMFS would identify exemptions from the operational measures in the final rule. These exemptions would be granted if a situation persists where public safety is at risk (e.g., where oceanographic, hydrographic, or meteorological conditions restrict the maneuverability of the vessel). Exemptions are also granted for Federal and state law-enforcement vessels involved in enforcement or human safety activities. Therefore, the proposed action and alternatives would have a negligible effect on public safety. If anything, the reduced vessel emissions at sea attributable to reduced speeds would have a positive impact on public health, although local and regional weather patterns would determine the transport and dispersion of any marine emissions, so that it is difficult to predict the location of these positive effects on air quality and public health. Additionally, maritime safety would be increased slightly because reduced vessel speeds in the affected areas would tend to decrease the risk of collisions between vessels or with natural or man-made obstacles, e.g. rocks, shoals, buoys. Hong Kong provides an example in which vessel speed was reduced for safety. In June 2007, the Government of the Hong Kong Special Administrative Region implemented vessel speed restrictions of five knots, applying to all vessels, in numerous ports and port entrances throughout most of Hong Kong and neighboring waters to enhance navigational and human safety (Hong Kong Special Administrative Region, 2007).

With respect to routing measures, the PARS considered safety and navigational hazards in evaluating the recommended routes; routes were not established in locations that posed a threat to mariner safety. Regarding speed restrictions, some commenters have argued that they will increase navigational and human safety, although a number of industry and Federal sources indicate that the speeds being considered would not a priori endanger vessels or mariners. However, the final rule would include exceptions for navigational safety in inclement weather conditions.

4.6.7.3 Energy Requirements and Conservation Potential

Estimated 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 (Corbett and Koehler, 2003). Table 4-9 provides a profile of the world fleet, main engine power and the percentage of energy demand by vessel type. The cargo fleet accounts for the large majority of fuel consumption (66 percent), while the noncargo fleet uses 20 percent and the military accounts for the remaining 14 percent. This review includes estimates for the world fleet, as such data is readily available and is used as a standard measure for this research. As similar data is unavailable for the US East Coast, these estimates are provided for general background information on vessel energy requirements.

Many factors determine fuel consumption by marine vessels, including:

- **Engine Type, Age, and Condition.** Newer engines tend to use less fuel than older ones. Fuel consumption of marine diesel engines has decreased rapidly over the past 30 years, and modern engines can use more than 25 percent less fuel than an older engine (Georgakaki *et al.*, 2005). Fuel consumption also varies according to the vessel type and engine loads. "Average fuel consumption is a composite of the fuel-usage rates at various engine loads. In general, cargo ships have more fuel-efficient, larger engines than nontransport ships (fishing and factory vessels, research and supply ships, tugboats). Typical fleet[50] average fuel consumption rates were 206 g/kWh for transport ships and 221 g/kWh for nontransport ships…" (Corbett and Koehler, 2003).
- **Climatic and Sea Conditions.** Traveling into the wind or in rough seas will increase fuel requirements.

[50] Fleet refers to the world's merchant fleet, using ship registry data from Lloyd's Maritime Information System, 2002.

Table 4-9
Profile of World Fleet, Number of Main Engines, and Main Engine Power[a]

Ship Type	Number of Ships	Percent of Fleet	Number of Main Engines	Percent of Main Engines	Installed Power (MW)	Percent of Total Power	Percent of Energy Demand
Cargo Fleet							
Container vessels	2662	2%	2755	2%	43,764	10%	13%
General cargo vessels	23,739	22%	31,331	21%	72,314	16%	22%
Tankers	9098	8%	10,258	7%	48,386	11%	15%
Bulk/combined carriers	8353	8%	8781	6%	51,251	11%	16%
Noncargo Fleet							
Passenger	8370	8%	15,646	10%	19,523	4%	6%
Fishing vessels	23,371	22%	24,009	16%	18,474	4%	6%
Tugboats	9348	9%	16,000	11%	19,116	4%	5%
Other (research, supply)	3719	3%	7500	5%	10,265	2%	3%
Registered fleet total	88,660	82%	116,280	77%	280,093	62%	86%
Military vessels	19,646	18%	34,663	23%	172,478	38%	14%
World fleet total	108,306	100%	150,913	100%	452,571	100%	100%

Note:
[a]The world fleet represents internationally-registered vessels greater than 100 gross tons; the cargo fleet represents vessels whose main purpose is transporting cargo for trade. Percent of energy demand mainly adjusts for reduced activity (in loads and hours) by military vessels under typical operations.
Source: Corbett and Koehler, 2003.

- **Hull Type and Condition.** Long, thin vessels consume less fuel per given speed than broad vessels. A smooth hull will also meet less resistance than a rough one. The cruise line Costa Crociere estimates it can achieve fuel savings of about three percent by applying a silicone-base coating to its cruise ships (Cruise Industry News, 2006).
- **Speed.** For any given vessel, speed is probably the single most important factor influencing fuel consumption. Doubling the speed of a vessel increases fuel consumption three times and, conversely, decreasing the speed of a vessel by one half decreases the fuel consumption by one third. The Food and Agricultural Organization of the United Nations has estimated that a six-percent reduction in speed (from 9 to 8.5 knots) can result in a fuel savings of approximately 11 percent for fishing vessels (Wilson, 1999).

While there are many variables determining fuel consumption, the information above indicates that speed is the most important factor. It also is the only variable the operational measures would affect. Therefore, in general, the speed restrictions proposed along the East Coast would slightly reduce vessel energy consumption. This reduction would vary according to the type of vessel, the load, and engine type and size. Routing measures such as recommended routes, and the option of routing around a DMA instead of slowing down, would likely increase fuel consumption with the increase in distance traveled. However, the recommended routes do not significantly diverge from current vessel traffic patterns, and DMAs are temporary and occur in a finite area, which can also be transited at reduced speeds to avoid extra distance. Weighing the benefits of fuel consumption resulting from large-scale speed restrictions with the disadvantages of the routing measures in three states is likely to result in slight net benefits. Although fuel savings could be significant for specific vessels in certain areas at given times, the cumulative reduction in fuel use for all vessels is very difficult to estimate and is likely to be small.

4.6.7.4 Natural or Depletable Resource Requirements and Conservation Potential

Decreased fuel consumption resulting from speed reductions would have a very minor, direct, long-term, positive impact on depletable US and world petroleum resources. Although the fuel savings could be significant for individual marine vessels operating in the area, savings are unlikely to be significant compared to global or US petroleum demand and supply.

4.6.7.5 Urban Quality, Historic and Cultural Resources, and the Design of the Built Environment

The proposed action involves measures at sea and includes no urban areas or areas with a built environment. Cultural resources are discussed in Sections 3.5 and 4.5.

4.6.7.6 Relationships Between Local Short-term Use of Man's Environment and the Maintenance and Enhancement of Long-term Productivity

The proposed action would not impact the short-term use of man's environment. To the contrary, it would lessen the impact of the maritime industry on ocean resources by reducing the number and severity of right whale ship strikes. In the long-term, economic impacts on the industry would not be significant and productivity would not be substantially affected. While the shipping industry's initial adaptation to the new regulations would have a cost, after the first year the regulations are implemented, the proposed measures would become standard operating procedures and result in incrementally less costs to the industry over time.

4.6.7.7 Irreversible and Irretrievable Commitments of Resources which would be Involved in the Proposed Action should it be Implemented

The proposed action would result in an irretrievable commitment of resources in terms of the man-hours the industry would initially have to commit in adapting to the operational measures and integrating the speed restrictions and recommended routes into their voyage-planning on a seasonal basis. As the regulations would not change after the initial implementation, the human resources utilized to plan for the new regulations would only be necessary during the first year of implementation.

The proposed action would also require an irretrievable commitment of man-hours from the government in monitoring and enforcement of the operational measures. However, NOAA intends to use existing technology (to the extent practicable) to monitor compliance, which could potentially be used to supplement existing enforcement capabilities, so the amount of additional man-hours required for this particular action would be minimal.

4.6.7.8 Unavoidable Adverse Environmental Effects of the Proposed Action

The only unavoidable adverse effects of the proposed action on the natural environment are the potential minor, adverse effects on water quality in the SEUS, resulting from concentrating vessels in recommended routes. This is based on the premise that water pollution regulations are less stringent seaward of 12-24 nm (22-44 km), and the shipping lanes extend to approximately 30 nm (56 km) offshore. Although it is possible that there would be an increase in the concentration of pollution in these waters, it is unlikely that mariners would specifically discharge wastewater and other pollutants in the offshore sections of the shipping lanes instead of elsewhere during their voyage. Any effects would be short-term, as use of the routes is expected to be greater when right whales occur in these waters – from November 15 through April 15.

The proposed action also results in unavoidable adverse effects on the human environment in the form of compliance costs. The level of the economic impact varies depending on the limit for the speed restrictions. A speed restriction of 10 knots has the highest economic impact, followed by 12, and then by 14 knots. The economic effects are unavoidable, but necessary to the implementation of the operational measures. NMFS will make efforts to inform the affected industries of the operational measures, and allow sufficient time for the industry to adapt to the new regulations and integrate the measures into their voyage-planning in order to minimize the economic impacts as much as possible through planning.

4.7 Cumulative Effects

NEPA requires the inclusion of a cumulative effects analysis in EIS. CEQ's regulations for implementing NEPA define cumulative effects as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions" regardless of what agency (local, state, Federal or non-Federal) or person undertakes other actions (40 CFR § 1508.7). CEQ's guidelines for evaluating cumulative effects emphasize the growing evidence that "the most devastating environmental effects may result not from the direct effect of a particular action, but from the combination of individually minor effects of multiple actions over time" (CEQ, 1997). The purpose of the cumulative effects analysis is to ensure that a decision on the proposed action is not made in isolation without considering other past, present, and future influences on the affected resources.

This section analyzes the cumulative effects of implementing the alternatives on the biological, economic, and social-resource components of the affected environment. The baseline against which the cumulative effects are measured is the affected environment as described in Chapter 3, "Affected Environment." The geographic scope is defined by the areas described in Chapters 1 and 2. Cumulative effects will be addressed with respect to the physical, biological, and human environment.

4.7.1 Cumulative Effects on the Physical Environment

4.7.1.1 Air Quality

Climate Change

Air emissions from shipboard combustion engines are largely composed of the following gases that contribute to the greenhouse effect: carbon dioxide, methane, and nitrous oxide. Each greenhouse gas differs in its capacity to absorb and retain heat in the atmosphere. Methane, for example, traps over 21 times more heat per molecule than carbon dioxide, and nitrous oxide absorbs 270 times more heat per molecule than carbon dioxide. The greenhouse effect is the rise in temperature that Earth is experiencing because increasing amounts of these three gases are trapping energy from the sun in the atmosphere. Without these gases, heat would escape into space and the Earth's average temperature would be about 60 degrees Fahrenheit colder (EPA, 2005b).

Human-induced climate change, caused by increasing greenhouse concentrations, has the potential to introduce additional pressures on right whales. Key changes that may accompany global warming include increased precipitation, increased ocean temperature, decreased sea ice coverage, and changes in ocean salinity. Climate change effects of this nature have the potential to influence many aspects of an ecosystem, including habitat, food webs, and species interactions (NMFS, 2005a).

A number of studies review and discuss the likely impacts of global climate change on cetaceans, marine mammals, and marine environments in general. Evaluations of the direct effects of climate change on whales are generally confined to cetaceans in the Arctic and Antarctic regions, where the impacts of climate change are expected to be the strongest. It is possible, however, that the indirect effects of climate change on prey availability and cetacean habitat will be more widespread, and could affect North Atlantic right whales. For example, climate change could exacerbate existing stresses on fish stocks that are already overfished and indirectly affect prey availability (e.g., prey common to fish and whales) for large whale species. Increasing [ocean] temperatures could alter ocean upwelling patterns, fostering increased blooms of dinoflagellates that produce biotoxins. Increased precipitation is also associated with higher temperatures, which could result in more pollutant runoff to coastal waters, and elevating cetacean exposure to chemical contaminants (NMFS, 2005a).

Habitat shifts are another possible implication of climate change. Walther *et al*. (2002) examined recent shifts of marine communities in response to rising water temperatures, concluding that most cetaceans will experience poleward shifts in prey distributions.[51] Distributional habitat shifts may also occur at the local level, but these are highly dependent on complex local attributes as well as ocean current and weather patterns. Such factors also influence the occurrence, distribution, and relative abundance of right whale prey. Baleen whales are highly mobile species, migrating annually from food-rich areas at high latitudes to breeding areas at low latitudes. It is postulated that baleen whales use currents, salinity, and temperature cues to locate regions of high prey abundance and thus may be less affected by climatic habitat shifts than by a general reduction in prey availability.[52] Nevertheless, any general depression of high-latitude prey production and/or poleward shift of feeding grounds could place additional stress on migrating whales. For some whale species, these small changes may have little material effect, but for species already vulnerable because of existing anthropogenic and natural threats, such as the North Atlantic right whale, these changes could be significant obstacles to species survival (NMFS, 2005a).

EPA (2005b) reports that actions are taking place "at every level to reduce, to avoid, and to better understand the risks associated with climate change." Cities and states across the country have prepared greenhouse gas inventories and are actively pursuing programs and policies to reduce greenhouse gas emissions. Nationally, the US Global Change Research Program is

[51] For example, a doubling of greenhouse gases from pre-industrial times could reduce sea ice in the Southern Hemisphere by more than 40 percent. This could produce adverse effects on the abundance of krill, the primary source of food for whales in this area.

[52] Evidence suggests a strong relationship between right whale distribution and threshold densities of calanoid copepods (Finzi *et al*., 1999). For example, right whales do not appear to utilize Cape Cod Bay as a foraging ground unless the densities of copepods are above certain minima (Kenney *et al*., 2001).

coordinating the world's most extensive research effort on climate change. EPA and other Federal agencies are actively engaging the private sector, states, and local governments in partnerships to address global warming, while at the same time, strengthening their economies. For more information, consult the US Climate Action Report (US Department of State, May 2002). Globally, countries around the world have expressed a firm commitment to strengthening international responses to the risks of climate change. The US is working under the auspices of the United Nations Framework Convention on Climate Change to increase international action (EPA, 2005b).

Routing Measures

As mentioned in Section 1.4, the establishment of an Area to be Avoided (ATBA) and changes to the Boston Traffic Separation Scheme (TSS) have/will occur independently of the proposed rulemaking, thus, the measures were removed from all alternatives in the FEIS, and are analyzed in several sections of the cumulative effects analysis.

The modifications to the northern leg of the TSS were implemented in July 2007, and the changes to the southern leg of the TSS and the establishment of an ATBA would occur 2009 if approved by the IMO. These routing measures would not affect air quality; if/when established, these measures would merely redistribute emissions.

Further, the USCG generally does not conduct NEPA analysis on these routing measures. Figure 2-1 of the USCG Commandant Instruction (COMDTINST) M16475.1D lists actions that are categorically excluded from analysis under NEPA, including promulgation of "Regulations in aid of navigation, such as those concerning rules of the road, International Regulations for the Prevention of Collisions at Sea (COLREGS), bridge-to-bridge communications, vessel traffic services, and marking of navigation systems" (Section 34 (i)). As Rule 10 of COLREGS stipulates the navigational rules for vessels operating in TSSs, it is the basis used for categorically excluding amendments to TSSs from NEPA analysis (67 FR 53740; 65 FR 53911).

As the majority of the analysis on these routing measures had already been completed for the DEIS, the respective cumulative impact sections provide a description of the impacts on the physical (Section 4.7.1) and biological environments (Section 4.7.2.5), and a quantitative economic impact (Section 4.7.3.4) for each measure. Therefore, readers interested in the cumulative economic impact can add the impact of one or both of these measures to the economic impact of the preferred alternative.

4.7.1.2 Ocean Noise Levels

Whales, dolphins, and other marine mammals rely, to a large extent, on their hearing to locate food, find mates, and keep groups together. Large whales communicate primarily using low-frequency sounds (typically below 1,000 Hz) that are capable of propagating long distances through water (Richardson, 1995). The growing amount of noise within this low-frequency range from ships and other sources represents an additional potential threat to large whales. Noise may disrupt and inhibit feeding and communication that facilitates reproduction; disturb or otherwise disrupt use of calving grounds, feeding grounds, or migratory routes; or, in the worst case, cause direct auditory damage and death (NMFS, 2005a). Noise sources include ship and boat propeller and engine noise; drilling, blasting, and dredging; acoustic deterrent devices used by fish farms and fishing vessels; airguns used in seismic exploration; and the use of low- and mid-frequency sonar in military operations. In recent years, low- and mid- frequency sonar have garnered attention from both the scientific community and the general public. Quantifying the impact of acoustic emissions, however, has been difficult, and its effect on marine mammals is not well understood (NMFS, 2005a).

There is a need for additional data on the impact of chronic noise exposure on cetacean health. Potential impacts from undersea noise vary from no effect to possible disturbance to temporary hearing loss or long-term behavioral changes that may reduce whale survival and reproduction. One response of particular concern is the potential for the displacement of cetacean populations from certain locations because of high levels of anthropogenic noise (NMFS, 2005a).

As described in Section 3.3.4, the main sources of anthropogenic ocean noise in the Atlantic Ocean are shipping; offshore drilling and mineral exploration activities; and military exercises. The direct and indirect impacts of the proposed action on shipping noise are described in Section 4.3.

Offshore Drilling and Mineral Exploration Noise

The Minerals Management Service is the lead Federal agency charged with managing offshore oil exploration and leasing. From 1976 to 1983, ten oil and gas lease sales were held in the Atlantic outer continental shelf area. On the blocks leased during that period, 47 exploratory wells were drilled, but hydrocarbons were discovered in only five of the wells drilled. The last of these natural gas and oil leases was relinquished in 2000, and currently there are no leases for oil and gas in existence off the Atlantic coast. However, exploration for sand and gravel deposits is presently occurring on the outer continental shelf of several Atlantic states (MMS, 2005).

Noise from Seismic Exploration for Scientific Research

Federal agencies, such as the National Science Foundation (NSF), provide funding to academic institutions and research facilities to conduct seismic research in the ocean. Seismic research focuses on the geology and geophysics of the seafloor, including earthquake and submarine volcano processes, and undersea landslides. The equipment used for the seismic programs includes multibeam bathymetric sonars, bottom-profiling sonars, acoustic current profilers, and airguns. Airguns emit strong pulses of compressed air that result in sound pulses ~ 0.1 second in duration near the source, to ~ 1.0 second at a distance. Airguns are often used in arrays and towed 98 to 164 ft (30 to 50 m) behind the ship. Seismic surveys introduce low-frequency sound (peak energy typically < 250 Hz) into the ocean. These devices are used to obtain information on the seafloor, the composition of sediments, locations of mineral deposits below the substrate, and ocean currents and circulation patterns.

Noise from airguns and other seismic sources can have potentially adverse effects on marine mammals, sea turtles, fish, and other marine resources. The effects range from no response, to habituation, behavioral changes, masking or hearing impairment, and other physical effects. To minimize or avoid adverse effects of seismic operations on marine resources, monitoring and mitigation methods are incorporated into the research programs. NSF and NMFS are currently conducting a programmatic EIS/OEIS on the environmental impacts of seismic operations conducted from NSF’s primary seismic ship, the R/V Marcus G. Langseth. The programmatic EIS/OEIS will address the planned program as a whole, rather than assessing individual cruises separately.

Shipping and Vessel Noise

Shipping has been a constant source of anthropogenic noise in the ocean since the inception of motorized waterborne commerce and transportation, and will continue to increase with the steady increase in commercial shipping. From 1985 to 1999, world seaborne trade increased 50 percent to approximately five billion tons, and is estimated to account for 90 percent of world trade (Westwood *et al*., 2002). A modern-day supertanker cruising at 17 knots produces sounds of 190 decibels (dB) or more with peak energy below 500 Hz. Midsized ships such as tugboats and ferries are quieter, producing source levels around 150 to 170 dB in the same frequency range (NRC, 2003; Jasny *et al*., 2005).

The ATBA in the Great South Channel critical habitat would not affect levels of ocean noise; it would merely temporarily redistribute vessel noise away from this location. The shift and narrowing of the Boston TSS would also redistribute noise slightly north of the existing TSS, removing a concentration of vessel traffic and noise from aggregations of baleen whales sighted in and near the existing TSS.

Noise from Military Activities

Although direct, unequivocal evidence has not been obtained, there are increasing indications that military activities have the potential to disturb, injure, or kill marine mammals. In 1996 six right whale deaths were recorded in waters adjacent to the Southeast critical habitat area (one death resulted from a ship strike). The Navy maintains a base adjacent to this area and uses offshore waters for gunnery exercises. Because several of the carcasses were found near a Navy gunnery range, it was suspected that some deaths were related to underwater explosions, but no conclusive link was established (NMFS, 2005a). The Navy currently has mitigation measures in place to prevent similar events from reoccurring (Appendix A).

Undersea Warfare Training Range

The Navy is proposing to build a 500 nm^2 (1,713 km^2) undersea-warfare training range, approximately 57 nm (105 km) off the East Coast of the US. The impacts of this project are described in the initial *Draft Overseas Environmental Impact Statement/Environmental Impact Statement for the Undersea Warfare Training Range* (DoN, 2005a). The EIS assesses alternative sites for the range off the coast of northeastern Florida and northeastern Virginia. The area selected for the range would be fitted with undersea cables and sensor nodes (underwater acoustic transducer[53] devices), which would be used for antisubmarine warfare training. The transducer nodes would receive and transmit acoustic signals from ships operating within the site. Training events would involve submarines, ships, and aircraft. The training exercises would utilize both passive and active mid-frequency (1 to 10 kHz) sonar (maximum source levels ~ 235 dB). Since the initial DEIS has been published, the Navy has published a notice of intent to prepare a revised EIS (72 FR 54105; September 21, 2007).

In the DEIS, the Navy considers the potential noise effects of the undersea warfare training range on marine mammals, including the right whale. The preferred location for the training range off southeastern North Carolina would be located more than 47 nm (87 km) offshore. As 63.8 percent of North Atlantic right whales sightings are within 10 nm (18.5 km) of the coast, with 94.1 percent reported within 30 nm (56 km) of the coast (Kraus *et al.*, 1993 *in* DoN, 2005a; Knowlton *et al*., 2002), the DEIS concludes that there would be no significant impacts on right

[53] A transducer is an instrument that converts one form of energy to another.

whales if the preferred alternative were selected. However, this finding was questioned by scientists, government agencies and non-governmental organizations through comments on the DEIS. NMFS specifically suggested the need for "further analysis of right whale sightings in this area…to evaluate the potential impacts of the preferred alternative" in their comment letter to the Navy, dated January 30, 2006. Until these analyses are conducted, the cumulative effects of this action on right whales are unknown.

If the Navy were to pick the alternative northeastern Florida site, which overlaps with right whale critical habitat for calving from December through April, the DEIS projects that some disturbance of right whales would occur from active acoustic sources when in use. The DEIS concludes that while momentary disturbance from active acoustics is likely, right whales would not "exhibit long-term displacement in the area of the proposed range, nor would the overall migratory pattern be significantly affected." If this alternative were to be selected, the Navy would initiate ESA Section 7 consultation with NMFS to develop mitigation measures (DoN, 2005a).

In summary, the cumulative effects of the three primary sources of anthropogenic noise discussed in this section, in addition to other natural and anthropogenic threats to right whales, might result in long-term adverse impacts on the health of the right whale population. Cumulative impacts are difficult to analyze without greater understanding of the effects of noise on right whale hearing and behavior.

The need for NMFS to take action on noise pollution and acoustic impacts was first identified in 1987, when it was determined that the intense sounds from an acoustic source could potentially harass marine mammals and was therefore subject to the take provisions of the MMPA. In 1995, the agency formed the NMFS Acoustics Program. Today, the program is:

- Working with panels of acoustics experts to develop new or updated Noise Exposure Criteria for marine mammals, fish and sea turtles.
- Funding research to address critical data needed to improve and expand Noise Exposure Criteria.
- Developing acoustic-exposure policy guidelines for NOAA.
- Leading efforts to develop a global passive-acoustic noise-monitoring network in key marine environments.
- Continuing to work cooperatively with the shipping industry to address the emerging issue of shipping noise and marine mammals, which was the subject of the May 2004 international symposium and an upcoming symposium in May 2007 on vessel- quieting technology.
- Providing technical analysis for NOAA's Incidental Take Authorizations involving human sound sources.

Information on the NMFS Acoustics Program may be found at:
http://www.nmfs.noaa.gov/pr/acoustics/

4.7.1.3 Water Quality

As described in Section 3.3.2, "Water Quality," research suggests that pollution in the marine environment adversely affects marine mammals. While not directly killing cetaceans, pollutants are believed to cause sub-lethal direct effects that may alter cetacean physiology, including reproduction, immune defense, endocrine system functions, and possibly neural systems that control social and migratory behavior. Indirectly, water pollutants can affect the numbers and diversity of cetacean prey species and lead to bioaccumulation in whales from eating contaminated prey. Whales are particularly vulnerable to chemical pollutants because they are long-lived, have extensive fat stores (where chemicals accumulate), and toothed whales are often at the top of the food chain. Although little direct evidence of the link between chemical pollution and cetaceans is available, evidence of the adverse effects of pollution on terrestrial species and non-cetacean marine mammals is sufficient to warrant concern about similar impacts on cetacean species.

As the human population along the East Coast continues to expand, the amount of sewage and industrial waste that reaches ocean waters, particularly in the shallow coastal waters favored by right whales, could also continue to grow. Any increase in pollutants in coastal waters could magnify negative effects on right whales, impairing their health and impeding recovery of their population.

Working to control water pollution are an array of laws, as follows:

- **Clean Water Act –** Controls pollution in the nation’s waterways by controlling point and nonpoint discharges.
- **Coastal Zone Management Act –** Encourages environmentally sound development in coastal areas.
- **Marine Protection, Research, and Sanctuaries Act of 1972 –** Regulates ocean disposal of materials.
- **Oil Pollution Act of 1990 –** Ensures that parties responsible for spills or releases of oil or other hazardous substances are liable for damages and cleanup.
- **MARPOL Conventions –** International conventions that control pollution of the marine environment by ships.

Agencies responsible for administering these laws are continuously seeking better enforcement tools and funding to reduce sources of pollution, such as by upgrading and building new sewage treatment plants. Continuing enforcement will serve to contain existing and future water pollution, but to the extent that ocean waters continue to be polluted, pollutants will have negative effects on cetaceans (NMFS, 2005a). The following paragraph discusses a specific US action with respect to water quality.

NMFS’ broader set of operational measures to reduce ship strikes to right whales have the potential for cumulative impacts on water quality. Shifting the Boston TSS would have a negligible effect on water quality outside the territorial sea. The 12-degree northern rotation in the Boston TSS adds 3.75 nm (6.9 km) to the trip for vessels traveling to or from points south in the TSS (see Figure 4-11, The Previous and Existing Traffic Separation Scheme in the Approach to Boston) (Wiley, 2005, *unpublished data*). Prior to July 1, 2007, the northern segment of the current TSS was completely within the contiguous zone and was located almost entirely within the territorial sea, where there are strict regulations on ocean dumping. The shift resulted in a slight increase in the section of the TSS that lies outside the territorial sea in the contiguous zone. While there are fewer restrictions with respect to vessel discharges outside of 12 nm (22 km) in the contiguous zone than within 12 nm (22 km) only a small section of the TSS is affected. The shift and narrowing of the TSS are not expected to change the number of vessels that use these lanes and would add only minutes to the trip. Furthermore, this shift routes vessels away from an area where whales are sighted frequently, so that any potential increase in pollution would be removed from areas with high densities of whales.

4.7.2 Cumulative Effects on the Biological Environment

4.7.2.1 Commercial Whaling

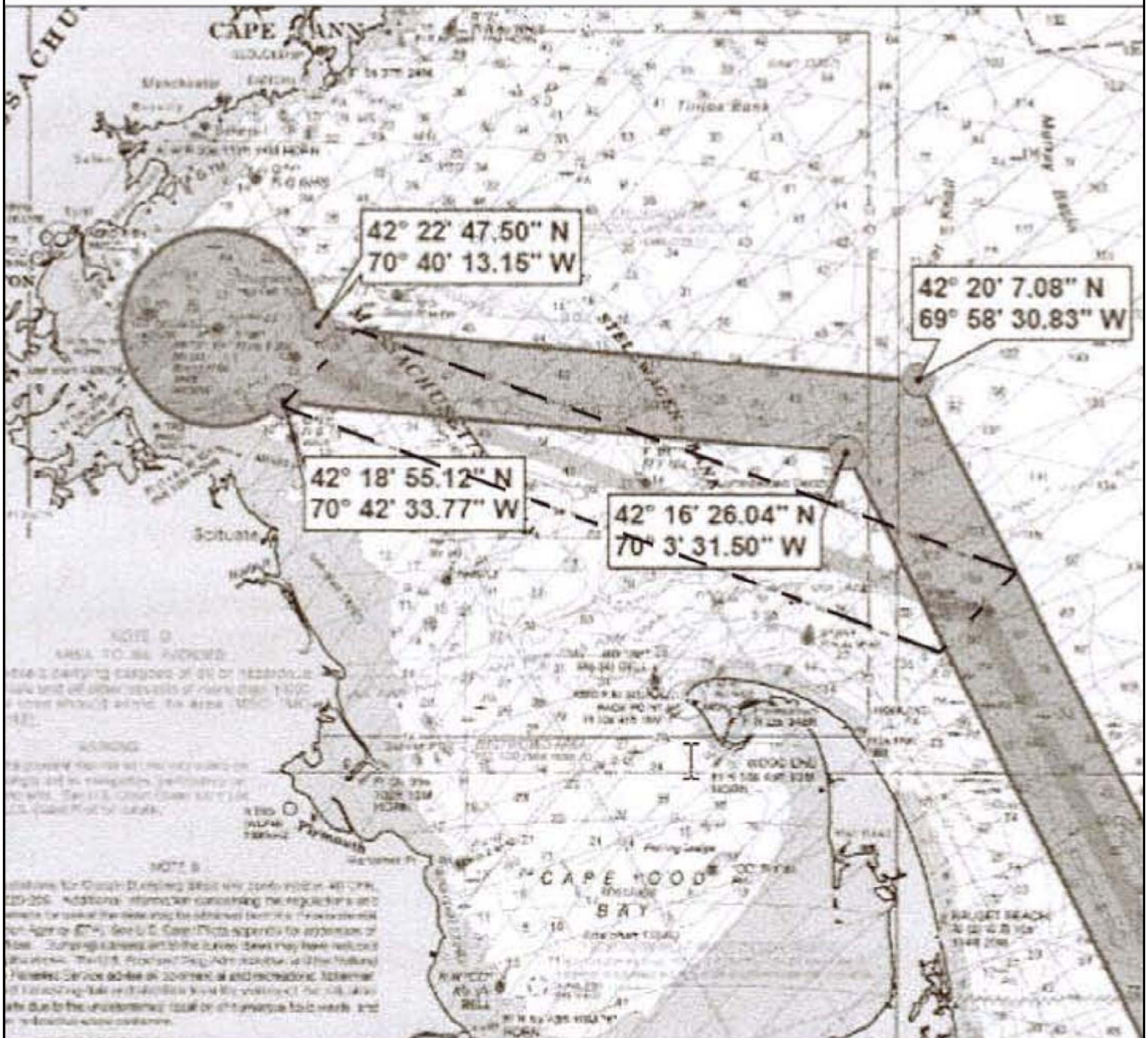
Commercial whaling may have started as early as 800 A.D. in Scandinavia, and is known to have been practiced by the Basques off the coast of France and Spain as early as the 12th century. Early whaling, utilizing hand-held harpoons, targeted slow-swimming species like right whales and bowhead whales. With the development of steam-driven vessels and, in 1868, the invention of the explosive harpoon gun, the age of modern whaling began. These innovations in whaling technology allowed whalers to target faster-swimming species, such as blue, fin, and sei whales (NMFS, 2005a).

The International Whaling Commission (IWC) was established in 1946 to regulate whaling and thus ensure the sustainability of the whaling industry (Cooke, 1995; Holt, 1999). The IWC originally negotiated harvest quotas with member nations based on estimates of whale populations. These quotas were set too high, however, and the system eventually proved incapable of preventing overexploitation (Gambell, 1999). By the early 1980s, the organization had shifted its focus from whaling regulation to whale conservation. The result was the 1982 approval of a temporary, voluntary ban on commercial whaling, which came into effect in 1986 and remains in effect to this day. As a result of this ban, most IWC members have ceased whaling entirely; only Denmark, Iceland, and Norway continue any form of whaling in the North Atlantic, and the number of whales taken by these nations has been greatly reduced (NMFS, 2005a).

North Atlantic right whales were the first target of commercial whaling and, consequently, the first large whale species to be hunted to near extinction by such efforts. Whalers targeted this species for several reasons, including the presence of right whales in near coastal waters, the relatively slow speed at which they swim, their tendency to float when dead, and the high yield of commercially valuable products (e.g., oil and baleen) they provided. These factors also contributed to the whale’s common name, which is said to have originated from the English whalers who designated this species of whale as the “right” – that is, correct – whale to hunt. More than 800 years of uncontrolled and intense commercial whaling is the primary reason that the population of right whales has declined to its present-day critical level (NMFS, 2005a).

The commercial harvest of right whales in substantial numbers began in the 1500s with Basque whalers in the Strait of Belle Isle region off Newfoundland (Aguilar, 1986). As the stocks in these waters became depleted, hunting efforts shifted to the Labrador and New England coasts. In total, between the 11th and 17th centuries, an estimated 25,000 to 40,000 North Atlantic right whales are believed to have been taken. This early period of intense whaling may have resulted in a significant reduction in the stock of right whales by the time colonists in the Plymouth area began hunting them in the 1600s. Nonetheless, a modest but persistent whaling effort along the coast of what is now the eastern United States continued. One record from January 1700, for example, reports 29 right whales killed in Cape Cod Bay in a single day (Reeves and Mitchell, 1987; NMFS, 2005a).

The Previous and Existing Traffic Separation Scheme in the Approach to Boston*



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*Note: The previous TSS is depicted with dashed lines and the existing TSS is shaded. Coordinates identify endpoints for the existing TSS (effective 1 July 2007).

Figure 4-11

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The League of Nations adopted a resolution banning all harvesting of right whales in 1935. At that time, it was thought that fewer than 100 right whales survived in the western Atlantic (NMFS, 2001a *in* NMFS, 2005a).

4.7.2.2 The Atlantic Large Whale Take Reduction Plan (ALWTRP)

Fishing gear entanglement is a primary cause of anthropogenic mortality to large whales, including right whales, as discussed in Section 1.1. Whales and other marine species may become entangled in fishing gear such as nets, traps, and pots that are left in the water from hours to days. They may become so entangled that they are unable to swim to the surface to breathe; entanglements may result in long-term effects, such as starvation in cases where lines are wrapped around the mouth, or in a whale becoming debilitated as it drags the gear for days or weeks. Studying entanglements from 1997 to 2001, Waring *et al.* (2003) found that the species suffering serious injury most frequently, in descending order, were humpback, right, minke, and fin whales. Fatal entanglements most frequently involved, in descending order, minke, humpback, right, and fin whales. The annual right whale mortality rate resulting from entanglements was 1.2 in 2003. As this number exceeds the PBR levels for right whales (see Section 1.1.1), NMFS took action to reduce mortality from entanglements.

The Atlantic Large Whale Take Reduction Team (ALWTRT) is one of several take-reduction teams (TRTs) established by NMFS in 1996 to help develop plans to reduce the number of whales entangled by fishing gear along the Atlantic coast. The ALWTRT is composed of fishermen, scientists, conservationists, and state and Federal officials. TRTs were established as advisory teams under the MMPA.

The MMPA requires Take Reduction Plans (TRPs) for strategic marine mammals stocks that interact with Category I or II fisheries (see Section 1.1.2.2). The right whale is considered a strategic stock because its human-caused mortality exceeds the PBR level and it is listed as endangered under the ESA. Therefore, the ALWTRT helped NMFS develop the ALWTRP that was published in November 1997 as an interim final rule. A final rule was published in February 1999. The plan addresses right, humpback, fin, and minke whales. The plan described in the final rule was intended to be an evolving plan that would change as whale researchers learn more about the status of whale stocks and gain a clearer understanding of how and where entanglements occur. NMFS retained the ALWTRT as a feature of the plan, to help the agency monitor progress and advise on needed improvements. NMFS proposed broad-based gear modifications to the ALWTRP in June 2005 and the final rule was published in October 2007 (see Section 1.7.2) to further reduce entanglements.

The ALWTRP and proposed amendments would have a beneficial cumulative effect on the right whale population. Reducing both of the primary causes of human-induced mortality – entanglement and ship strikes – will have significant beneficial effects on the population. Ship strike and entanglement reduction measures should have a measurable impact on the population status by reducing the mortality rate and allowing the population to recover and eventually reach sustainable population levels.

4.7.2.3 Whale Watching

The popularity of whale watching is growing, and with it the number of vessels that seek out whales for viewing, and consequently there are concerns about their short-term and long-term effects on whale behavior and populations (IFAW *et al.*, 1995). It is estimated that the industry attracts more than nine million participants a year in 87 countries, generating revenue of one billion US dollars (Hoyt, 2001). Whale watching tends to concentrate on whale aggregations and aggregation areas, such as those used for feeding. When large numbers of vessels descend on one area and "when some approach too closely, move too quickly, operate too noisily, or pursue animals, performance of life processes in wild cetaceans may be interrupted" (Lien, 2001). A number of studies have shown that whale watching has short-term impacts on whales by, for example, startling them and temporarily driving them away from feeding patches or distracting them from socializing, but studies of long-term effects are lacking (Amaral and Carlson, 2005).

Amaral and Carlson (2005) reviewed the literature – 204 articles – on whale-watching impacts worldwide. They note that whale watching may enhance environmental tourism, regional economics, environmental education and research but that it is critical to avoid negative impacts on whales being watched, which can include acoustic disturbance, increased energy expenditure, exclusion from habitats, and vessel strikes. The authors reviewed the impact of whale watching on many types of whale behavior, such as time feeding, time diving, tail slaps, group cohesion, respiration, time spent traveling, etc. Whale responses were elicited most often by the speed and direction of the whale-watching boats. None of the studies specifically looked at impacts on Northern right whales, with one exception, and that was Watkins (1986).

Watkins (1986) studied the impact of whale watching in Cape Cod Bay on four species of baleen whales, including Northern right, minke, humpback and fin whales. Watkins reviewed cruise and experiment logs both prior to and after 1976, they year of the advent of whale-watching in the area, to document any changes in whale behavior. He found that minke whales changed from frequent positive interest in vessels to generally uninterested reactions; finback whales changed from mostly negative to uninterested reactions; humpback whales dramatically changed from mixed responses that were often negative to often strongly positive reactions; but right whales continued their behavior with little change. He noted that the whales studied seemed to react primarily to underwater sound, but also to light reflectivity and tactile sensations. Watkins theorized that the type of activities in which right whales engage influences their sensitivity to and tendency to avoid noise disturbance and vessel activity (Watkins, 1986).

Most studies of the impact of whale watching on whales focus on short-term disruptions to their behavior. Studies of long-term impacts are needed to determine whether whale-watching activities could create long-term negative changes to whale behavior and biology, such as by driving them from productive feeding grounds or by causing them to exert energy needed for migration and reproduction to avoid whale-watching vessels (IFAW *et al*., 1995). Such studies would allow more-complete assessment, making the cumulative effects clearer. Meanwhile, many regions and countries have developed whale-watching guidelines to reduce pressure on whales and avoid negative effects. A compilation of such guidelines can be found in Carlson (2003).

4.7.2.4 Habitat Destruction

Several human activities that may adversely affect right whale habitat have already been discussed, including fishing; anthropogenic noise; contaminants; oil and gas exploration and development; and other energy-related development. There are few data regarding the possible indirect adverse effects of these types of human activities on right whales. However, it is possible that certain activities that degrade right whale habitat may be slowing population recovery. Studies are needed to determine if various activities are affecting right whales and right whale productivity (NMFS, 2005b). This section describes several of these topics and also introduces coastal development as a possible cause of habitat destruction.

A continued threat to the coastal habitat of the right whale in the western North Atlantic is the undersea exploration and development of mineral deposits, as well as the dredging of major shipping channels. Section 4.7.1.2 describes offshore drilling and exploration specifically with respect to noise, and this section describes the general effects. Although oil exploration has occurred in the past, NMFS is not aware of any current plans to explore or develop oil resources in this region. If these activities occur, there may be consequent adverse effects to the right whale population by vessel movements, noise, spills, or effluents. These activities may possibly result in disturbance of the whales or their prey, and/or disruption of the habitat, and should be subject to ESA Section 7 consultations (NMFS, 2005b).

Right whales also occur in areas where dredging and its associated disposal operations occur on a regular basis, such as along the southeastern US coast. The USACE has responsibility/oversight for many of these dredging and disposal operations and has consulted with NMFS under Section 7 of the ESA on these activities (Appendix A). As a result, engaging in dredging operations and related activities requires protective measures, such as posting lookouts on dredge vessels and adherence to recommended precautionary guidelines for operations to reduce the risk of collision (NMFS, 2005b).

Coastal development of waterfront property, marinas, and other recreational facilities is a threat to right whale habitat. This type of development introduces vessel traffic and other human activities that may adversely affect right whales. One example is the development of a gated subdivision and marinas at Cumberland Harbor in Georgia. The marinas would hold up to 800 boats, and while these would be small, recreational vessels, a vessel of this size class has been recently implicated in a right whale ship strike. In this case, boaters will receive outreach materials on right whales and endangered species and Federal regulations will be enforced to mitigate the impacts of these marinas (Bynum, 2005). Other examples include Liberty Harbor in Brunswick, Georgia, and Lane Fernandina Marina in Fernandina Beach, Florida. Both of these expansion projects include conservation measures to reduce ship strikes.

It is unknown to what extent these activities may disturb or otherwise affect right whales. It appears that whale behavior and the type of activity in which they are engaged influence right whale sensitivity to, and tendency to avoid, noise disturbance and vessel activity (Watkins 1986; NMFS, 1991 *in* NMFS, 2005b), but more studies are needed.

In the *Recovery Plan for the North Atlantic Right Whale* (NMFS, 2005b), NMFS identified the need to conduct studies to determine the direct and indirect effects of activities and impacts associated with coastal development on the distribution, behavior, and productivity of right whales. The activities studied should include, but not be limited to, sewage outfall; dredging activities (and associated plumes); dredge spoils; dumping; habitat alteration; noise; oil and gas exploration and development; and aquaculture activities, including effects on prey species as well as on right whales directly. As the impacts are identified, NMFS will take steps to minimize identified adverse effects from coastal development (NMFS, 2005b).

Cape Wind Project

Cape Wind Associates has proposed an offshore wind-energy project that consists of the installation and operation of 130 Wind Turbine Generators (WTGs) on Horseshoe Shoal in

Nantucket Sound. The wind-generated energy produced by the WTGs would be transmitted via a submarine transmission cable system to the electric service platform, which would transform and transmit the electric power to the shore via alternating current submarine cable circuits (USACE, 2004). The USACE published a DEIS on this project in November 2004, a marine biological assessment in May 2004 which assessed the impacts of the project on threatened and endangered marine species, and a final environmental impact review in February 2007. The facility is expected to be operational in 2010.

The Cape Wind project has the potential to disturb right whales and their habitat. The project will introduce vessel traffic during the construction of the project and then regularly thereafter for operation and maintenance. Increased vessel traffic may disrupt right whale behavior, increase the probability of vessel strikes, and may result in acoustic harassment, although minimal data exist on the effects of vessel noise on right whales. However, there have been very few whale sightings in Nantucket Sound, and the bathymetric and oceanographic features that are conducive to dense aggregations of prey are not as prevalent in Nantucket Sound as they are in other feeding grounds, such as Stellwagen Bank, Jeffreys Ledge, Browns and Bacaro Banks, and in the Great South Channel (Kenney and Winn, 1986 *in* USACE, 2004). Only seven records exist of right whales occurring in Nantucket Sound since the early 1900s; whales are more common offshore to the east of Nantucket Island than in the Sound (USACE, 2004). Given the rare occurrence of right whales in Nantucket Sound, the probability of cumulative, adverse effects to right whales is low.

4.7.2.5 NMFS' Other Measures to Reduce Ship Strikes to Right Whales

Nonregulatory Measures

Four additional nonregulatory measures being undertaken by NMFS will also have a long-term, positive cumulative impact on right whale recovery through various means to reduce the threat of ship strikes. These measures include the following elements:

1. Continue ongoing conservation and research activities to reduce the threat of ship strikes.
2. Develop and implement additional mariner education and outreach programs.
3. Conduct Section 7 consultations, as appropriate, with Federal agencies that operate or authorize the use of vessels in waters inhabited by right whales.
4. Develop a right whale conservation agreement with the Government of Canada.

Continuing ongoing research and conservation activities, described in Section 1.2.1, in addition to the vessel operational measures, will increase the level of right whale protective measures. The grant program will continue to fund studies of new technologies, right whale biology and habitat parameters, and identification of new and expanded ship strike mitigation measures. The MSRS will continue to provide data on vessel traffic information. The northeastern and southeastern right whale recovery plan implementation teams will continue to educate mariners about the threat of ship strikes, and as elements of the program are implemented the teams may help disseminate information to mariners. Current enhanced outreach and education efforts, including updating and disseminating navigational charts, brochures, placards and other publications to educate mariners about the vulnerability of right whales to ship strikes, will further the program objectives.

Mariner awareness is a key component to reducing the threat of ship strikes. While feedback from current efforts indicates that the maritime community is increasingly aware of the problem, NMFS is developing and implementing a comprehensive education and outreach program for mariners and the general boating public which highlights the severity of the ship strike problem and provides steps that can be taken the reduce the threat. NMFS has compiled a comprehensive list of tasks to raise mariner awareness that targets all segments of the recreational and commercial shipping industries, other agencies, and the general public. Tasks include developing curricula for maritime training academies; providing training modules for captain re-licensing; providing advice on voyage planning for domestic and foreign-flagged vessels; and ensuring all east coast pilots have material to distribute. Key groups, such as the implementation teams and others, are assisting in reviewing, prioritizing, and performing the tasks.

Conducting ESA Section 7 consultations (see Section 1.7.3) would establish separate agency-specific ship strike reduction measures to cover vessels owned or operated by, or under contract to, Federal agencies that would be exempt from the speed restrictions. These vessels are exempted because the national security, navigational, and human safety missions of some agencies may be compromised by mandatory vessel-speed restrictions. NMFS will use Section 7 consultations to assess vessel activities authorized, funded or carried out by Federal agencies. NMFS will review actions, including those subject to the conditions of existing Biological Opinions (e.g., see Appendix A), that involve vessel operations of relevant Federal agencies (i.e., the USACE, EPA, MARAD, MMS, NOAA Corps, USCG, and US Navy) and determine whether to recommend initiation or re-initiation of Section 7 consultation to ensure those activities are not jeopardizing the continued existence of right whales or destroying or adversely modifying their critical habitat.

Development of a right whale conservation agreement with the government of Canada would be aimed at extending protection measures into Canadian right whale habitat, thereby strengthening the overall effectiveness of NMFS' right whale conservation measures. As North Atlantic right whales are transnational in distribution, NOAA intends, with the appropriate Federal agency or agencies, to initiate negotiation of a bilateral conservation agreement with Canada to ensure that, to the extent possible, protection measures are consistent across the border and as rigorous as possible. Although the specific language of such an agreement has not been identified, NOAA has already communicated the need for an agreement and cooperative efforts to Canadian officials.

United States Proposed Measures to the International Maritime Organization

The US prepared and submitted a proposal to the IMO in April 2006 to reconfigure the TSS that services Boston, Massachusetts. The proposed realignment was developed jointly by NMFS and NOS' National Marine Sanctuaries Program, and analyzed by the USCG regarding navigational safety. The proposal submitted by the USCG on behalf of the US included a 12-degree shift in the northern leg and narrowing the two traffic lanes by approximately 0.5 mi (0.8 km) each (Figure 4-11). The separation zone between the two lanes would remain unchanged at its current 1.0-mi (1.6-km) width. The realignment is expected to provide a significant reduction in ship strikes to right whales and other baleen whale species occurring in the area, with minimal impact to mariners using the TSS. The TSS is expected to reduce the risk of ship strikes to right whales by 58 percent, and by 81 percent to other baleen whales occurring in the area. The IMO's subcommittee on Safety and Navigation reviewed the proposal in July 2006 and the Maritime

Safety Committee endorsed the proposal in December 2006. The changes in the TSS were implemented in July 2007. The shifted segment is defined by the following coordinates:

Location	Latitude (N)	Longitude (W)
NW Corner	42° 22' 47.50"	070° 40' 13.15"
NE Corner	42° 20' 7.08"	069° 58' 30.83"
SW Corner	42° 18' 55.12"	070° 42' 33.77"
SE Corner	42° 16' 26.04"	070° 03' 31.50"

The United States submitted two additional vessel routing proposals to the IMO in April 2008. One proposal is to narrow each lane of the southern leg of the Boston TSS from 2.0 mi (3.2 km) to 1.5 mi (2.4 km), leaving the western boundary of the TSS and the width of the mile separation zone unchanged. The second proposal is to establish a 7,450-km^2 (4,269-mi^2) ATBA in the Great South Channel critical habitat exclusive of the Boston TSS. Vessels over 300 GRT would voluntarily avoid this area from April through July. Similar to the concept of shipping lanes, this measure would reduce the co-occurrence of right whales and ships, thus significantly reducing the possibility of ship strikes. Vessels less than 300 GRT, but 65 ft (19.8 m) and longer transiting the area would be required to abide by the speed restrictions of the Great South Channel SMA. The ATBA would be bound by the following coordinates:

Latitude (N)	Longitude (W)
41° 44.4'	069° 33.6'
42° 10.0'	068° 31.0'
41° 38.0'	068° 13.0'
41° 1.2'	069° 4.2'

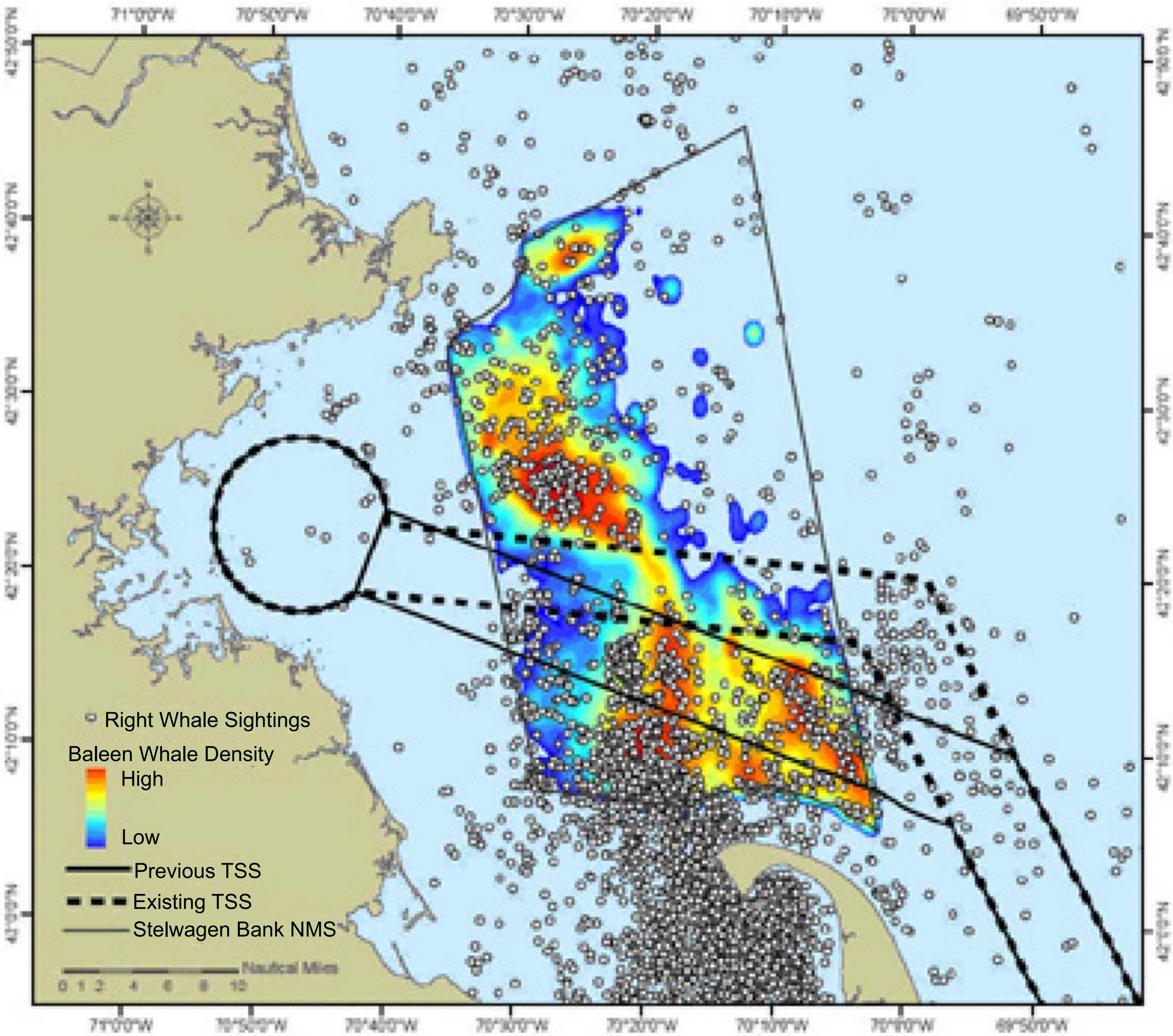
The highest density of traffic within the ATBA follows a route originating from the southwest corner to the northeast corner. (Traffic densities within the TSS are higher, although the TSS is not included in the ATBA.)

Impacts on Right Whales

Some of the modifications to the TSS have already been implemented and additional changes to the TSS would occur in the reasonably foreseeable future; these actions would have a positive impact on right whales. The shift in the Boston TSS places the TSS north of an area of known high whale density (see Figure 4-12, Distribution of Right Whales Relative to the Previous and Existing Boston TSS). Biologists estimate that changes to the TSS would result in a significant reduction in the risk of ship strikes of right whales (United States, 2006). Narrowing the lanes in the southern leg of the Boston TSS from 2 nm (3.7 km) to 1.5 nm (2.8 km) would translate to a reduction in the relative risk of ship strike by 11 percent (Merrick and Cole, 2007). Therefore, changes in the TSS would have a direct positive impact on the right whale population in the NEUS.

The ATBA in the Great South Channel would route vessels of 300 GRT and greater around an important feeding ground from April 1 to July 31 (see Figure 4-13, Right Whale Sightings and Ship Traffic Density in Great South Channel from April through July, 1999 to 2005). Vessels under 300 GRT but 65 ft (19.8 m) or more in length would have to reduce speed through the Great South Channel SMA as a result of speed restrictions contained in the rulemaking. Cumulatively, the majority of vessels would either be traveling at reduced speeds through the

Distribution of Right Whales Relative to the Previous and Existing Boston TSS



*Note: Baleen Whale Density is also depicted.

Figure 4-12

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Right Whale Sightings and Ship Traffic Density in the Great South Channel
April - July, 1999 - 2005

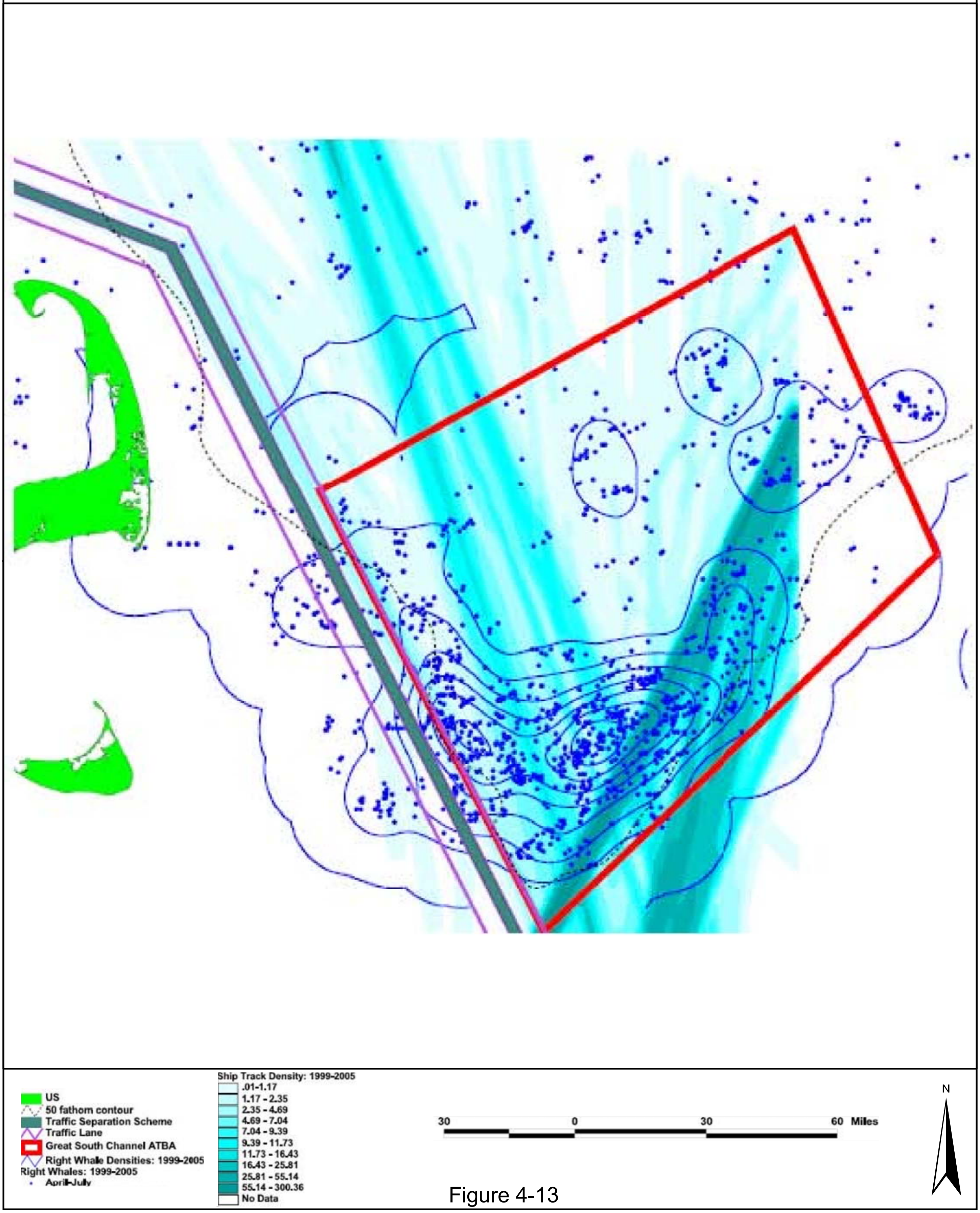

Figure 4-13

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Great South Channel or transiting around the critical habitat area, thus reducing the occurrence and/or severity of a ship strike. Using vessel traffic data from the MSRS and right whale sightings data, Merrick and Cole (2007) developed a model to identify areas of highest relative risk for right whale-vessel interactions for specific polygons within the MSRS, specifically the ATBA. Based on these data, the model predicted that creation of an ATBA could reduce interactions between right whales and vessels by 63 percent. Relative risk of ship strikes with fin and humpback whales would also be reduced.

Impacts on Other Marine Species

The shift in the Boston TSS (Figure 4-12) would have positive impacts on humpback, fin, and sei whales, which, on the basis of thousands of observations of these species in the current TSS from whale-watching platforms from the years 1979 to 2002, are known to occur in this area. The change in the TSS shifted the shipping lane north of an area that has a high density of whale sightings. The shift is expected to result in an 81 percent[54] reduction of ships encountering other large whales. Mahaffey (2006) modeled ship strike risk in the Northeast, and determined that fin and humpback whales have a high risk factor within the Boston TSS from April through June and July through September. Therefore, these species would receive seasonal protection through the speed restrictions associated with the Off Race Point and Great South Channel SMAs, as the TSS overlaps with these areas.

The ecological basis for the change in the TSS is the difference in whale densities in and around the TSS, which is attributable to the composition of the substrate in this area. The substrate under the current TSS consists primarily of sand, over which the preferred forage species of these whales occurs. The seafloor under the TSS consists primarily of gravel and, to a lesser extent, sand, therefore reducing prey densities in the proposed TSS and thereby the occurrence of whales feeding in this area (United States, 2006; Merrick, 2005b). In addition, the narrowing of the lanes would serve to reduce the overlap between large whales and ships.

The impacts of the ATBA and the TSS on the physical environment are provided in Section 4.7.1. The economic impacts of the ATBA and TSS are provided in Section 4.7.3.4.

4.7.2.6 Other Navy Training Exercises

There are various training exercises conducted by the Navy in the Atlantic Ocean aside from the sonar-related activities discussed in Section 4.7.1.2. Some of these programs occur offshore, away from right whale habitat, while other activities overlap with right whale habitat. This section provides information on a few representative programs that may occur in right whale habitat, but is not an exhaustive account of all Navy training exercises. In addition to these activities, the Navy has a suite of regularly-occurring activities within the Boston Complex in the Gulf of Maine (see Section 3.4.7). The Navy has initiated informal consultation on these activities under Section 7 of the ESA, and has implemented interim measures for ongoing activities in coordination with NMFS to minimize the impacts on protected species. These activities are coordinated by the Brunswick Naval Base, and are not discussed in detail in this section, as the Brunswick Naval Base is on the Base Realignment and Closure list for closure, and when this occurs, these exercises will be relocated.

[54] This number also includes minke whale sightings.

Sinking Exercises (SINKEX)

The Navy proposes to conduct Sinking Exercises (SINKEXs), off the coasts of Virginia, North Carolina, and South Carolina. During a SINKEX, a vessel is used as a target or test platform against which the Navy fires live and inert ordnance in order to sink the vessel. The primary purpose of this program is to train Fleet personnel in the use of live weapons against a representative target. In accordance with the Navy's permit under the Marine Protection, Research, and Sanctuaries Act, the SINKEX must be conducted at a distance of greater than 50 nm (92.6 km) from shore and in waters deeper than 6,000 ft (1,830 m). The SINKEX program follows the contours of the shore (as reflected by the boundary of the EEZ), and is generally greater than 200 nm (370 km) offshore (DoN, 2005b).

Very few right whale sightings occur beyond the continental shelf. The Navy's Biological Assessment reviewed the seasonal occurrence of right whales in the proposed site and found the following: a possible occurrence in the spring and fall; unknown in the winter; absent in the summer. The Navy selected the proposed SINKEX location based on several factors, including areas with a low likelihood of encountering an endangered species. However, transiting from port to the SINKEX location crosses the right whale migratory corridor, which increases the potential for vessel collisions. To this end, the Navy adopted mitigation measures to reduce the potential for collisions; Appendix A describes these measures in detail. In addition to these mitigation measures, the Navy developed a monitoring plan to minimize the probability of affecting any protected species or shipping vessels in the vicinity of an exercise (DoN, 2005b). This action would take place in the reasonably foreseeable future, although given the information above, the SINKEX program should not have significant effects on right whales.

Previous informal Section 7 consultations under the ESA with the NMFS' Northeast Regional Office (NERO) and Southeast Regional Office (SERO) have determined that the SINKEX program was not likely to adversely affect listed species. The Navy has completed Section 7 consultation for this SINKEX program in the western Atlantic Ocean. NMFS concluded that the proposed action is not likely to jeopardize the continued existence of threatened or endangered species in the action area. The proposed location for SINKEXs does not contain designated critical habitat and therefore SINKEXs are not likely to adversely modify critical habitat.

Virtual At-Sea Training/Integrated Maritime Portable Acoustic Scoring & Simulator (VAST/IMPASS) System

The Virtual At-Sea Training/Integrated Maritime Portable Acoustic Scoring & Simulator (VAST/IMPASS) System for firing exercises is a portable gunnery-scoring system to be used within and seaward of already established Navy Operating Areas (OPAREAs) off the East Coast and Gulf of Mexico. The proposed action will take place in waters farther than 12 nm (22.2 km) from shore. The Virginia Capes Operating Area (VACAPES OPAREA) is located in the coastal and offshore waters of the Atlantic, adjacent to Delaware, Maryland, Virginia, and North Carolina. The western boundary of the VACAPES OPAREA is located approximately 3 nm (5.6 km) off the coastline in the territorial waters of the US, and the remainder of the OPAREA to the east is located in the US EEZ (DoN, 2001a in DoN, 2004). The Cherry Point (CHPT) OPAREA is located in the nearshore and offshore waters of North Carolina. The western boundary of the OPAREA is located approximately 3 nm (5.6 km) off the coast at the boundary between North Carolina State waters and US territorial waters. The Jacksonville and Charleston (JAX/CHASN) OPAREA is located in the South Atlantic Bight, off the coasts of North Carolina, South

Carolina, Georgia, and northeastern Florida. The majority of the western boundary of the JAX/CHASN OPAREA is located approximately 3 nm (5.6 km) off the Southeast coast, except for the area off southern Georgia and northern Florida, where the boundary lies from 3 to 7 nm (5.6 to 13 km) from shore (DoN, 2004).

From fall through spring, North Atlantic right whales are expected to occur in continental shelf waters throughout the East Coast OPAREAs (DoN, 2001a; 2002a; 2002b *in* DoN, 2004). Estimated densities of right whales are highest in winter (0.9 to 1.7 whales/1,000 km^2 [386 mi^2]) in the three East Coast OPAREAs. Right whale occurrences are concentrated in nearshore waters of JAX/CHASN OPAREA during the fall and winter (DoN, 2002b). During the summer, right whales occur further north, on their feeding grounds (density of 0 whales/1,000 km^2 [386 mi^2]); however, there are sightings in the JAX/CHASN OPAREA during summer (DoN, 2004). Right whale sightings in very deep offshore waters of the western North Atlantic are infrequent. There is limited evidence, however, suggesting that there may be a regular offshore component of their distributional and migratory cycle (DoN, 2004).

Potential impacts to right whales and other endangered species resulting from the proposed use of the VAST/IMPASS system include collisions with Navy vessels, acoustic and explosive impacts from detonation of explosive ordnance, and acoustic impacts of gun blasts. Based on analysis in the BA, the Navy determined that the proposed action would either have no effects (muzzle blast noise from air to water and noise from sonic boom of the shell) on endangered species or negligible effects (gun noise transmitted through ship hull and physical injury from the exploding shell and debris). Based on the mitigation measures listed below, collisions with right whales are not expected (DoN, 2004).

The Navy developed a marine mammal and sea turtle mitigation plan to minimize the risk of impacts to these animals. The mitigation plan includes the following measures:

1. Pre-exercise monitoring of the target area using high-power binoculars prior to the event, during deployment of the sonobuoy array, and during return to the firing position.
2. Ships would not fire on the target if any marine mammals or sea turtles are detected within or approaching the impact area. Operations would be suspended until the impact area is clear of marine mammals or sea turtles.
3. Post-exercise monitoring of the entire impact range for the presence of marine mammals and sea turtles would take place using high-power binoculars and the naked eye during the retrieval of the sonobuoy array following each firing exercise.
4. The visibility must be such that the fall of the shot is visible from the firing ship during the exercise.
5. The VAST/IMPASS system would be used only during daylight hours and only in Beaufort Sea State 3 or less. Calm sea states and good lighting conditions contribute to high visibility conditions, making it easier to spot any marine mammal or sea turtle in the area.
6. If marine mammals or sea turtles are detected in the vicinity of the Navy vessel, personnel would increase vigilance and take reasonable and practicable actions to avoid collisions and activities that might result in close interaction of Navy assets and protected species. Actions may include changing speed and/or direction and are dictated by environmental and other conditions. No firing will occur if marine mammals are detected within 66 yards (60 m) of the vessel.

7. The exercise will not be conducted in an area of biological significance and the exercise will not be conducted if sargassum is detected in the impact area (DoN, 2004).

The Navy determined that the proposed action may affect but is not likely to adversely affect right whales. The proposed action is not likely to result in the destruction or adverse modification of North Atlantic right whale critical habitat, as the action will be conducted in a manner consistent with the restrictions in the existing BO issued by NMFS in May 1997 (Appendix A). The Navy is planning to undergo Section 7 consultations for the VAST/IMPASS System. As the consultation is not completed, it has yet to be determined whether NMFS concurs with the Navy's findings in this BA.

4.7.2.7 Liquefied Natural Gas (LNG) Terminals and Deepwater Ports

The LNG industry has been steadily growing, and to accommodate this growth new marine-based LNG facilities are being proposed internationally. These facilities convert the state of LNG from a liquid to a gas and transport the natural gas to customers through a network of pipelines. Section 4.7.3.1 summarizes the four existing LNG facilities, four approved by the Federal Energy Regulatory Commission (FERC) (two of which are expansions of existing facilities), four proposed to FERC, one proposed to MARAD/USCG, and one approved by MARAD/USCG on the East Coast (as of June 2008).

This section describes the five approved projects mentioned above – the four inshore terminals, and the approved offshore deepwater port. While all the proposed facilities would increase vessel traffic on the East Coast, only two of these proposals are for offshore deepwater ports that would be located in right whale habitat. Four proposals are inshore and would affect vessel traffic if approved, although as these projects are in various stages of the application and environmental processes, vessel traffic information is not available for all of the proposals. Although there are five active proposals, it is possible that only a few of these proposals will be licensed by the Federal Government. Out of the 40 LNG proposals in North America, industry analysts predict that only 12 will ever be built (FERC, 2006a).

Approved Inshore LNG Terminals

Four inshore proposals have been approved by FERC since publication of the DEIS, and will likely be constructed or expanded in the reasonably forseeable future. These projects are described below, based on findings from the FEISs issued by FERC, and BOs issued by NMFS. The four inshore terminals proposed to FERC but not yet approved are not described in this section. These include terminals proposed in Pleasant Point, Robbinston, and Calais, Maine and Baltimore, Maryland. The one offshore proposal, Safe Harbor Energy, offshore of New York is also not described this this section.

Crown Landing LNG - Logan Township, New Jersey

FERC has approved Crown Landing LNG's proposal for a new LNG facility in the Delaware River, New Jersey. Based on a navigation-simulation study conducted by Moffatt & Nichol International on behalf of Crown Landing, the LNG facility would generate an additional 150 LNG ships per year. FERC determined that the project is not likely to adversely affect the North Atlantic right whale, and initiated Section 7 consultation with NMFS. NMFS completed the Crown Landing BO on May 23, 2006 and concurred with FERC's determination for whales. The applicants agreed to adhere to the seasonal speed restrictions in the ship strike reduction proposed rule as an interim measure until final regulations are issued (FERC, 2006c).

Dominion LNG - Cove Point, Maryland

FERC approved a proposal by Dominion Cove Point LNG to expand the existing LNG import terminal in Calvert County, Maryland. The expansion would increase LNG tanker visits from 90 to 120 ships per year, to approximately 200 per year. The FEIS states that right whale occurrences in the Chesapeake Bay are rare, although these vessels must transit right whale habitat in the Atlantic in order to call on the Cove Point Terminal, and there is potential for ship strikes by an LNG Vessel. To mitigate the potential for ship strikes, FERC notes that when implemented, LNG vessels would be required to abide by NMFS ship strike regulations. In the interim, the agency recommends that Dominion should incorporate the following voluntary NMFS guidelines into its Terminal Use Agreement with LNG ship operators (FERC, 2006c). In all coastal and offshore waters along the East Coast of the U.S. and Canada:

- If a right whale sighting is reported within 20 nautical miles of a ship's position, post a lookout familiar with spotting whales.
- If a right whale is sighted from the ship, or reported along the intended track of a large vessel, mariners should exercise caution and proceed at a slow, safe speed when within a few miles of the sighting location, bearing in mind that reduced speed may minimize the risk of ship strikes.
- Do not assume right whales will move out of your way. Right whales, generally slow moving, seldom travel faster than 5-6 knots. Consistent with safe navigation, maneuver around observed right whales or recently reported sighting locations. It is illegal to approach closer than 500 yards of any right whale (see 50 CFR 222.32, Chapter 2).
- Any whale accidentally struck, any dead whale carcass spotted, and any whale observed entangled in fishing gear should be reported immediately to the U.S. or Canadian Coast Guard noting the precise location and time of the accident or sighting.

In addition to the guidelines above, Cove Point implemented their own ship strike mitigation plan, which includes 10-knot speed advisories from November through April within 30 nm (56 km) of the Chesapeake Bay entrance. Based on these mitigation measures, FERC determined that the project is not likely to adversely affect North Atlantic right whales. The informal Section 7 consultation with NMFS concluded that the LNG terminal is not likely to adversely affect right whales.

Weaver's Cove LNG - Fall River, Massachusetts

FERC has approved a proposal by Weaver's Cove Energy to construct an LNG terminal in Taunton River, Massachusetts. Due to recent changes in plans, Weaver's Cove Energy proposed a change in the number of anticipated ship deliveries from 50 to 70, to 120 a year, by vessels small enough to fit through the opening of the Brightman Street Bridge (FERC, 2006b). The FEIS issued by FERC addressed the potential for ship strikes resulting from the increase in vessel traffic transiting Narragansett Bay, and the agency recommended that Weaver's Cove Energy should coordinate with NMFS to determine appropriate speed-restriction measures to minimize impacts on right whales. If the vessels adhere with the measures in the NMFS-proposed rulemaking, then FERC concludes that the project is not likely to adversely affect North Atlantic right whales (FERC, 2006c). Due to the changes in the original plans, Section 7 consultation with NMFS will be re-initiated.

EL Paso - Southern LNG - Elba Island, Georgia

This LNG terminal on Elba Island, Georgia is already an existing terminal (see Section 4.7.3.1 for a description of current operations at this terminal); however El Paso - Southern LNG submitted a proposal to FERC to expand this terminal. Southern LNG has agreed to notify LNG terminals via an automated identification system (AIS) to slow to 10 knots or less when consistent with safe navigation. The AIS is currently operational and sends an AIS message to all incoming vessels. Current AIS data is being archived until a live feed to NOAA's Southeast Regional Office AIS network is achieved. Informal Section 7 consultation has been completed on this terminal and NOAA has concluded that the project would not likely to adversely affect Right Whales.

Offshore LNG Deepwater Ports

The two offshore facilities addressed in detail in this section that would have potential impacts on right whales are the Neptune and Northeast Gateway Deepwater Ports. Neptune has been approved and construction started in July 2008, and Northeast Gateway is fully operational. This section addresses the cumulative impacts of constructing/operating these facilities and the increase in vessel traffic generated by the proposed LNG terminals on right whales in the reasonably foreseeable future.

Neptune LNG

The Neptune LNG terminal is being built approximately 22 mi (35 km) northeast of Boston, Massachusetts, in a water depth of approximately 260 ft (79 m). One unloading buoy system at the deepwater port would moor up to two shuttle regasification vessels (SRVs). There would be an initial increase in vessel traffic in Massachusetts Bay during the construction of the terminal and installation of a 10.9-mi (17.5-km) pipeline that would connect to the existing Algonquin HubLine™ natural gas pipeline (Neptune LNG, LLC, 2005). The Deepwater Port license application includes estimates of the vessel traffic from operations (including construction); support vessels are estimated to take 61 round trips per year, SRVs would take approximately 50 round trips per year, and pilot vessels would also take 50 round trips per year, accompanying the SRVs (Neptune LNG, LLC, 2005). Therefore, this facility would increase vessel traffic by approximately 161 round trips (322 one-way trips) per year.

The USCG and MARAD published a notice of availability for the FEIS on November 2, 2006 (71 FR 64606), and the record of decision (ROD) has been approved with conditions. In their scoping comments on the NOI to prepare an EIS for the Neptune LNG Deepwater Port, NOAA specifically requested that the EIS consider the potential impacts of the construction and operation of the terminal on endangered species, including right whales. While the FEIS does consider the potential impacts of this vessel traffic and construction on right whales, the findings of the BO supercede the conclusions in the FEIS.

In addition to the FEIS, these agencies consulted with NMFS under Section 7 of the ESA. The BO resulting from this consultation determined that the action may adversely affect but is not likely to jeopardize right whales or adversely modify or destroy critical habitat. During this process, the applicant and the agencies agreed to the following mitigation measures (which are not specific terms and conditions of the BO): seasonal speed restrictions of 10 knots or less, in accordance with the proposed rule to reduce ship strikes to right whales; year round speed restrictions in the Off Race Point SMA; and installation of passive acoustic detection buoys (to determine the presence of calling whales) in the portion of the Boston TSS that passes through SBNMS. Right whale detections through the buoys or reports from the Sighting Advisory System will be monitored prior to entering the area, and appropriate action will be taken in response to active sightings. Also, Neptune vessels will enter the Boston TSS as soon as practicable and remain in the TSS until the Boston Harbor Precautionary Area (see Figure 4-11).

Northeast Gateway

The Northeast Gateway LNG terminal is located offshore in Massachusetts Bay, approximately 13 mi (21 km) south-southeast of the city of Gloucester, Massachusetts, in Federal waters approximately 270 to 290 ft (82 to 88 m) in depth. The natural gas is delivered to shore by a new 16.4-mi (26.4-km) pipeline from the deepwater port to the existing Algonquin HubLine™ pipeline (Northeast Gateway Energy Bridge, LLC, 2005). As with the Neptune project, the construction and operation of this terminal will increase vessel traffic over current levels. The Deepwater Port license application states that there would be an estimated 55 to 62 Energy Bridge™ regasification vessels (EBRV) arrivals per year. In addition, support vessels would take one trip per week, or 52 trips per year. Therefore, this facility would increase vessel traffic by 162 to 176 round trips (324 to 352 one-way trips) per year (Northeast Gateway Energy Bridge, LLC, 2005).

The USGC and MARAD published a notice of availability for the FEIS on October 26, 2006 (71 FR 62657), and the ROD has been approved with conditions. In addition to commenting on the NOI, NOAA also provided comments to assist the USCG with their completeness determination and recommended the collection of additional data for further analyses that will be necessary to evaluate the impacts on NOAA's trust resources. These comments include NOAA's concern that the Northeast Gateway project would negatively impact conservation within SBNMS, specifically with respect to NOAA's plans to reconfigure the Boston TSS to reduce the risks of collisions between ships and endangered whales. NOAA issued an Incidental Harrassment Authorization (IHA) on May 14, 2007 (72 FR 27077), which contained various monitoring and mitigation measures to prevent ship strikes to right whales.

Northeast Gateway did include some mitigation measures in its application. The applicant expressly states that "EBRV speed while transiting outer Massachusetts Bay will be less than the sea speed of the vessel because the vessel will be slowing down in preparation for docking at the Northeast Port. In addition, Northeast Gateway will observe seasonal speed restrictions while transiting through or in the TSS adjacent to the Great South Channel and Off Race Point to minimize potential ship strikes on whales" (Northeast Gateway Energy Bridge, LLC, 2005). NOAA's comment letter reiterated that while speed may reduce the number of strikes, speed reduction alone will not reduce the risk of ship strike to zero, and the additional vessel traffic is expected to increase the risk of ship strike mortalities in SBNMS.

Another topic addressed with respect to right whales is the planned construction period of late summer to early spring, which overlaps with the high-use period of right whales in the area, primarily from January through April. The actual construction period has since been changed to May through November to avoid this seasonal aggregation. Construction commenced in May 2007 and was completed in November 2007. Also, noise during construction and the potential for entanglement by fishing gear displaced by LNG sites pose additional threats to right whales. These topics have been analyzed in the EIS and Section 7 consultations.

The BO for Northeast Gateway also came to a finding that the project may adversely affect, but is not likely to jeopardize right whales or adversely modify or destroy critical habitat. Through the Section 7 consultation process, the applicant and agencies voluntarily committed to the following mitigation measures: a seasonal 10-knot speed restriction in the Off Race Point and Great South Channel SMAs; a year-round 12-knot speed restriction in the Boston TSS; and these vessels will enter the TSS as soon as practicable, and remain in the TSS until they need to divert to transit north to the deepwater port.

There is also one proposed offshore proposal for a pipeline from the Bahamas to Port Everglades in Fort Lauderdale, Florida. If approved, the Suez Calypso LNG project would not significantly affect right whales because they generally do not occur this far south in Florida.

4.7.2.8 Port Expansion Projects

Proposed Marine Container Terminal at the Charleston Naval Complex

The South Carolina State Ports Authority (SCSPA) is proposing to develop a marine container terminal at the south end of the Charleston Naval Complex, on the Cooper River in Charleston Harbor, South Carolina. The proposed terminal is designed to handle primarily containerized cargo. The marine container terminal development covers 288.1 acres (ac) (116.6 hectares [ha]) and will support cargo-marshalling areas, cargo-processing areas, cargo-handling facilities, and related terminal operating facilities. Construction on the new terminal is expected to be completed in 2013, although it is not expected to reach full capacity until 2025 (USACE, 2006e).

The USACE released a FEIS on this project on December 12, 2006. The FEIS estimates that the new terminal will result in an increase of 650 vessel calls per year at full capacity (USACE, 2006e). This represents a 12 percent increase in arrivals from the estimate of 5,000 vessel transits per year, as reported from the Charleston Branch Pilots Association.

The USACE initiated Section 7 consultation on this project with NOAA’s SERO and the SCSPA agreed to fund aerial surveys for right whales approximately 30 nm (56 km) north and south of the port of Charleston approach and out to 25 nm (46 km) for five years. This is an interim measure until the proposed right whale ship strike reduction measures are implemented, at which time the funding for the aerial surveys will be discontinued. The port of Charleston also participates in education and outreach activities to raise awareness among mariners. These harm-avoidance measures will reduce the potential for ship strikes, and thus NOAA concluded that the project’s shipping-related effects on right whales are discountable or insignificant.

Proposed Marine Container Terminal at the Port of Jacksonville

The Jacksonville Port Authority proposes to construct a two-berth marine container terminal on the western side of Dames Point along the St. Johns River in Florida. The new container terminal is scheduled for completion in December 2008 or early 2009 with operations expected to begin late 2008 or early 2009. The new terminal is expected to increase vessel traffic by approximately nine percent at full capacity. This is a nine-percent increase over the current estimate of 4,350 annual vessel transits of the Jacksonville Harbor.

As the permitting agency, the USACE initiated Section 7 consultation under the ESA on the effects of this project on threatened and endangered species under NMFS’ jurisdiction. NMFS concluded that the increase in vessel traffic will not affect right whale critical habitat and that the effects on right whales are discountable or insignificant. The latter finding is based on current harm-avoidance measures employed by the port of Jacksonville and NMFS. The port authority provides educational materials to their client shipping companies and vessel captains, and will ensure that these parties are aware of current and future protection measures, such as the MSRS and the ship strike reduction rulemaking. In addition, the applicant volunteered to supplement hydrographic surveys for the areas off the coasts of Florida and Georgia where NOAA is implementing recommended shipping lanes to route vessels away from high densities of right whales.

Maersk Marine Container Terminal, Portsmouth, VA (APM Terminals VA, Inc.)

APM Terminals has built a privately-owned marine container terminal along the Elizabeth River in the City of Portsmouth, Virginia. The terminal includes 4,000 ft (1,219 m) of berthing facilities along the Elizabeth River, and a 291-acre container terminal (on 576 acres of land) marine container facility adjacent to the berthing facilities, and road and rail infrastructure to access the terminal. Waterborne access to the facility is provided via Craney Island Reach, which currently provides deepwater access for vessel traffic utilizing numerous existing terminal facilities located on the Elizabeth River (USACE, 2003). Construction was completed by 2007.

The purpose of this project is to accommodate vessels with a larger carrying capacity. The current types of vessels calling at the existing APM terminal are known as Panamax vessels and larger, Post-Panamax vessels, which are expected to be replaced by Suezmax vessels. It is expected that Suezmax vessels will be introduced in the next three years and will utilize the proposed facility. These vessels will increase container carrying capacity by replacing smaller Panamax vessels without affecting the current number of vessel movements in Hampton Roads. Therefore, this facility is not expected to increase the number of vessels transiting the Elizabeth River in Hampton Roads (USACE, 2003). The environmental assessment prepared for this project does not address impacts on right whales.

Craney Island Dredged Material Management Area, Hampton Roads

The Virginia Port Authority (VPA) is proposing an eastward expansion of the Craney Island Dredged Material Management Area and subsequent development of a marine containerized cargo terminal complex on the new cell. The Norfolk District of the USACE has prepared a FEIS on the impacts of this project.

The first phase of this project would result in an additional 470 vessel calls to the Port of Hampton Roads in 2018. In 2050, when the terminal reaches build-out, shipping traffic in the Hampton Roads Harbor System is expected to increase by nine to 15 vessel calls per week, for a total of 770 vessel calls per year. The USACE concluded that the increases in vessel traffic related to the proposed eastward expansion and container terminal project are not likely to affect listed marine mammals (USACE, 2006b). Although the USACE provided NMFS with this conclusion in a letter dated January 5, 2006, since the terminal is not actually scheduled to be built until 2016, NMFS found that there was insufficient information to draw a conclusion about whales, and too much uncertainty in predicting the actual volume of shipping traffic, the vessel routes, and the status of whales. NMFS requested that the USACE reinitiate consultation when more project details were available.

Navigation Channel Deepening in the Port of Savannah

The Georgia Ports Authority (GPA) is proposing to deepen the Savannah River navigation channel from 42 ft (12.8 m) mean low water to a maximum depth of 48 ft (14.6 m). In order to receive a permit for construction, the USACE must complete a Tier II EIS, a final mitigation plan and an incremental analysis of the channel depths from 42 to 48 ft (12.8 to 14.6 m). The Tier I EIS did not include estimates of increased vessel traffic as a result of the harbor-deepening project and the USACE published a Final Tier II EIS in March 2008. The Biological Assessment prepared by GPA follows the mitigation measures outlined in the 1995 Biological Opinion for navigation channels in the Southeast and concludes that the project is not likely to affect right whales (GPA, 2006).

Proposed Construction of a Disposal Site for Dredged Material in Baltimore Harbor

The USACE constructed a disposal site for dredged material in the middle branch of the Patapsco River, at Masonville, Baltimore City. The new site began to supplement the current dredged-material disposal containment facilities at Hart-Miller Island and Cox Creek in 2007. The USACE prepared a DEIS that indicated barge traffic would temporarily increase during construction and dredged-material placement operations, although it does not provide an estimate of the expected increase in vessel traffic entering the Delaware Bay after construction is completed (USACE, 2006a).

Summary

While these accounts of port expansion projects are not exhaustive, they do represent the majority of large projects in East Coast ports that will affect the amount of vessel traffic transiting through right whale habitat.

These projects demonstrate the importance of ship strike reduction measures to mitigate an increase in vessel traffic from the increase in capacity of existing ports, and also the predicted increase due to the popularity of waterborne commerce. The timing of these port-expansion projects is in the reasonably foreseeable future, and they will reach full capacity at different times, spreading out the impacts. Nevertheless, an increase in the number of transiting vessels will increase the risk of ship strikes to right whales. While the individual consultations conducted on a portion of these projects came to findings of ‘not likely to adversely affect right whales’, the cumulative impacts of all the port-expansion projects on the East Coast have not been quantitatively analyzed. However, given that the additional vessels calling at these new facilities in the near future would be required to abide by speed restrictions in the rulemaking, there should not be significant, negative effects from these projects. In the future, when these ports reach full capacity, NMFS may reconsider the operational measures against the new baseline, and make appropriate adjustments for the increase in vessel traffic.

4.7.3 Cumulative Effects on the Human Environment

4.7.3.1 Liquefied Natural Gas Vessels

When LNG vessels approach offshore platforms and ports, they impose restrictions on other vessels. Pursuant to the regulations of the Deepwater Port Act, the USCG is authorized to establish a safety zone around deepwater ports. Therefore, there is a 1,640-ft (500-m) safety zone around LNG terminals in which unauthorized vessels are prohibited from anchoring or transiting at any time (33 CFR 147). There is also a 2.2-mi (3.5-km)-radius precautionary area from the center of the terminal to alert prudent vessel operators of the possible presence of maneuvering LNG carriers in the safety zone around the port.

There are several existing and proposed LNG terminals along the US East Coast. In the Northeast, there are three proposed inshore LNG sites, one existing offshore LNG site and one approved and currently under construction, one inshore site approved by FERC, and one existing. Northeast Gateway LNG is fully operational, and is located approximately 10 mi (16 km) offshore of Gloucester, Massachusetts. The Suez-Neptune LNG terminal is being built approximately 22 mi (35 km) northeast of Boston. In northern Maine, an inshore Quoddy Bay terminal at Pleasant Point, a Downeast terminal in Robbinston, and a BP terminal in Calais have been proposed to FERC. Weaver's Cove in the Taunton River, near Fall River, Massachusetts has been approved. The existing LNG site is in Everett, Massachusetts.

In the mid-Atlantic, there is only one existing terminal – in Cove Point, which is located in Calvert County, MD. In April 2005, Dominion CP LNG submitted an application to expand the terminal, and FERC has since approved this expansion. Several new terminals have been proposed to FERC, including a proposal for Long Island Sound, NY, by Broadwater Energy, and Sparrows Point in Baltimore, by AES Corp. The Crown Landing LNG facility in the Delaware River, NJ, has been approved by FERC.

In the Southeast, there is one existing terminal – on Elba Island, in Chatham County, Georgia, 5 mi (8 km) downstream from Savannah, Georgia. El Paso and Southern LNG submitted a proposal to FERC to expand this terminal. The area around this LNG terminal in the Savannah River is designated a Regulated Navigation Area by the USCG (33 CFR 165.756). This prohibits all vessels 1,600 GRT or greater, except those that are moored, from approaching within 2 nm (3.7 km) of a LNG tankship that is underway within the RNA without the permission of the Captain of the Port. This closes the port down to other vessels for an hour or more during the arrival and departure of a tankship (W. Penberty, personal communication, November 15, 2005). However, it does take an LNG vessel up to 24 hours to unload, so it is unlikely that other commercial shipping vessels would be affected by delays from both the arrival and departure of LNG tankships. There is also one proposed offshore proposal for a pipeline from the Bahamas to Port Everglades in Fort Lauderdale, Florida. If approved, this project would not significantly affect right whales because they generally do not occur this far south in Florida.

There is potential for cumulative effects on the shipping industry in the form of additional delays into ports if vessels are delayed by speed restrictions or other operational measures included in the alternatives, and by LNG restrictions associated with the aforementioned safety zones. The additive effects of these delays could result in an increase in the economic cost to the commercial shipping industry and/or the port. However, these existing and proposed deepwater ports would be located outside of shipping fairways and navigation channels. If the proposed LNG terminal is an inshore terminal, it would increase vessel traffic around the site and/or port. Given that the proposed sites are not yet approved, there is no way to analyze the potential impacts of the occurrence of ship strikes. This may be possible in the future if the sites are approved, and if specific vessel routes and arrival data become available.

4.7.3.2 United States Coast Guard Restrictions

The Coast Guard has a lead role in providing homeland security in US harbors and ports and along the coastlines. Commercial, tanker, passenger, and merchant vessels have all been subject to increased security measures enforced by the USCG. As part of its missions for both national security and law enforcement, the Coast Guard may board vessels at any time. The agency is authorized to board vessels subject to the jurisdiction of the US, upon the high seas, and upon waters over which the US has jurisdiction. In these waters, the agency is authorized to make inquires, examinations, inspections, searches, seizures, and arrests (14 U.S.C. § 89) (USCG, 2005).

Potential cumulative effects could result from a vessel that is operating under speed restrictions or other operational measures in the alternatives and is boarded by the USCG. The vessel would have to reduce its speed further or come to a complete stop while the Coast Guard officers board and inspect the vessel, crew, cargo, and documentation. This would result in additional delays in arriving at a port.

4.7.3.3 Vessels Restricted to Daylight Only and Tidal Windows

Certain vessels are restricted to entering ports during daylight hours only, and other deep-draft vessels may also be restricted by tidal windows in parts of the East Coast that have changes in water depth due to tides. LNG vessels are subject to tidal restrictions coming into Boston, and nighttime transit restrictions in Boston Harbor. There are similar nighttime transit restrictions approaching the Cove Point LNG site in Maryland, and vessels are required to arrive at the Cape Henry Pilot Station at the mouth of Chesapeake Bay at least eight hours prior to dusk or to wait until the following day.

The port of Savannah is in the process of a harbor-deepening project that will be completed around 2013, and until then vessels need to plan for appropriate tidal windows to call at the port. LNG vessels are affecting the schedule of port traffic into Savannah as well. Port traffic is restricted one hour before LNG vessels enter the harbor and up to two hours after. Southern LNG reactivated in 2001, and LNG vessel calls have increased from one in 2001 to 41 in 2004. This increase is expected to continue to the point where there could be over 100 annual vessel calls as early as 2008, resulting in additional delays (W. Penberthy, personal communication, November 15, 2005).

LNG vessels may have additional delays if DMAs are implemented in or around the approaches to these ports, but the actual number of DMAs that could be triggered each year is minimal, the restrictions are temporary, and the vessels may chose to route around the precautionary area to save time instead of slowing down through the area. If LNG vessels are transiting in areas with SMAs or shipping lanes with speed restrictions, the times and areas would be known well ahead of time to allow the company to plan ahead or avoid these delays.

4.7.3.4 Other Federal Actions Resulting in an Economic Impact to the Industries Affected by the Proposed Action and Alternatives

There are several other current and reasonably foreseeable actions by Federal agencies that may have economic impacts on similar groups of stakeholders that are affected by the vessel operational measures to reduce ship strikes to right whales. If these actions are taken in the future, there would be a cumulative economic burden on specific industries.

Cape Wind Project

The Cape Wind project (described in Section 4.7.2.4) may have minimal temporary adverse effects on marine navigation in the immediate vicinity of construction operations. Temporary restrictions during construction would be implemented to protect public safety. Once operational, the large spaces – minimum 0.34-nm [0.63-km] by 0.54-nm [1.0-km] spacing – would allow vessels not restricted by depth to navigate between the WTGs. Once installed, the submarine cables would not affect navigation, as the cables would be buried at a minimum depth of 6 ft (1.8 m) below the seabed. Although there may be temporary adverse effects during construction, it is not expected that the operation of the Wind Park and the installation of the inner-array and submarine cable systems would substantially adversely impact general commercial/recreational vessel navigation or ferry operations in this area of Nantucket Sound in the long term (USACE, 2004).

Economic Effects of ALWTRP on the Fishing Industry

As discussed in Section 4.7.2.2, the proposed modifications to the ALWTRP regulations would have a positive effect on the recovery of the right whale. However, these proposed modifications would also have an economic impact on the fishing industry in the northeastern and mid-Atlantic US.

The following is an excerpt from the FEIS for amending the ALWTRP (NMFS, 2007a).

> [Table 4-10] presents the results of the economic impact analysis for Alternatives 1 through 6 Final (Preferred). As the [table] indicates, the incremental costs the alternatives would impose on the commercial fishing industry range from zero in the case of Alternative 1, the no action alternative, to approximately $19.2 million per year under Alternatives 2, 3*, 4, and 6 Draft*. The preferred alternative would impose incremental costs of approximately $13.4 million per year. In the case of Alternatives 2, 3*, 4, 6 Draft*, and 6 Final (Preferred), the impact of the new standards on lobster trap/pot vessels accounts for between 92 and 93 percent of estimated compliance costs; impacts on gillnet vessels account for between 4 and 5 percent of the total, and impacts on other trap/pot vessels account for the remaining 2 to 3 percent. The analysis suggests that Alternative 5 would impose incremental compliance costs of approximately $1.3 million annually. In this case, the impact of the new standards on lobster trap/pot vessels accounts for approximately 79 percent of estimated compliance costs; impacts on gillnet vessels account for 14 percent of the total, and impacts on other trap/pot vessels account for the remaining 7 percent.

Table 4-10
Estimated Increase in Annualized ALWTRP Compliance Costs: All Affected Fisheries (2007 dollars)

Regulatory Alternative	Lobster Trap/Pot	Other Trap/Pot	Gillnet	Total
Alternative 1 (No Action)	$0	$0	$0	N.A.
Alternative 2	$17,939,000	$448,900	$844,500	$19,232,400
Alternative 3*	$17,894,600	$453,500	$835,100	$19,183,200
Alternative 4	$17,939,000	$448,900	$842,900	$19,230,800
Alternative 5	$1,001,700	$91,300	$178,500	$1,271,400
Alternative 6 Draft*	$17,906,300	$453,800	$835,600	$19,195,600
Alternative 6 Final (Preferred)	$12,288,000	$393,000	$717,300	$13,398,300
Key: * = Specified as a Preferred Alternative in the DEIS. Note: Totals may not sum due to rounding.				

The cumulative effects analysis chapter of the ALWTRP FEIS also includes a detailed description of the major fisheries affected by the regulatory alternatives, including current and past regulations. Please refer to Section 9.4.3 of the ALWTRP FEIS for additional cumulative effects on the fishing industry.

Southeast Gillnet Rule under the ALWTRP

NMFS issued a temporary emergency rule and a proposed rule in the *Federal Register* on November 15, 2006 (71 FR 66469), and a final rule was published June 25, 2007 (72 FR 34632). The final rule prohibits gillnet fishing or gillnet possession during annual restricted periods (November 15 – April 15) associated with the right whale calving season in the Southeast US Restricted Area and in waters within 35 nm (65 km) of the South Carolina coast. Exemptions to the fishing prohibitions are for strikenet fishing for sharks and gillnet fishing for Spanish mackerel south of 29º00' N latitude. An exemption to the prohibition on the possession of gillnet gear is provided for transiting through the area if gear is stowed in accordance with this rule. This action is required to meet the goals of the MMPA and ESA, and is necessary to protect North Atlantic right whales from serious injury or mortality from entanglement in gillnet gear in their calving area in Atlantic Ocean waters off the Southeast US. NMFS is taking this action based on its determination that a right whale mortality, documented on January 22, 2006, was the result of an entanglement by gillnet gear within the Southeast US Restricted Area. This action is consistent with the ALTWRP regulations at 50 CFR 229.32(g) and is necessary to protect North Atlantic right whales from further serious injury or mortality in the Southeast US Restricted Area from entanglement in gillnet gear.

Under the ESA temporary emergency rule, NMFS prohibited gillnet fishing or gillnet possession in Atlantic Ocean waters west of 80º00' W longitude between 29º00' N. latitude (just south of New Smyrna Beach, Florida) and 32º00' N latitude (the approximate state boundary between Georgia and South Carolina) and within 35 nm (65 km) of the South Carolina coast. The emergency rule was in effect from November 15, 2006, through April 15, 2007, and the final rule was effective for the following calving season. Environmental assessments (EAs) on the rules are available at *www.nero.noaa.gov/whaletrp*. These EAs analyze the biological and socioeconomic impacts of the rulemaking.

The impacts of the Southeast gillnet and ALWTRP proposed rules have the potential for cumulative effects on the fishing industry when combined with the impacts from the ship-strike reduction rule. These vessel operational measures would have minimal impacts on the fishing industry at a 12-knot speed restriction, but there are minor adverse economic impacts at a 10-knot speed restriction. See Section 4.4.4 for a detailed description of economic impacts on the fishing industry. Only vessels 65 ft (19.8 m) and greater are subject to the speed restrictions, therefore only a small subset – i.e., vessels 65 ft (19.8 m) and longer with an average operating speed greater than 10 knots – would be affected by the ship strike rule and potentially the ALWTRP rule. This is in contrast to fishing vessels less than 65 ft (19.8 m), which would only be affected by the ALWTRP regulations. If a 10-knot speed restriction is imposed, then there would be minor direct, cumulative, adverse economic impacts on this subset of the fishing industry.

Marine Diesel Engine Emission Standards

The EPA published a Final Rule in the *Federal Register* on February 28, 2003 (40 CFR 9745) to adopt emission standards for new marine diesel engines installed on vessels flagged or registered in the US with displacement at or greater than 30 liters per cylinder, also known as Category 3 marine diesel engines. The current Tier I standards implemented in these regulations will apply until the EPA adopts a second Tier of standards in a future rulemaking, which should be completed by April 27, 2007. The Tier II standards will consider the state of technology that may permit deeper emission reductions and the status of international action for more stringent standards. Similar emission standards for marine engines with per-cylinder displacement of less than 30 liters – also known as Category 1 and 2 marine diesel engines – were published in an ANPR in the *Federal Register* on June 29, 2004. EPA published the proposed rule for these standards on April 3, 2007. The final rule was published on May 6, 2008 (73 FR 25098). These standards are expected to result in significant reductions of NO_x and PM, and are expected to benefit public health. Refer to Section 3.3.3 for a description of the effects of these emissions on air quality. However, these standards also have compliance costs for the industry as there are requirements for engine design, maintenance, and repair. Six categories of potentially affected industries were identified in the final rule. One of these categories – Water Transportation, freight and passenger – is also affected by the operational measures.

Anti-Fouling System Regulations

The IMO adopted the International Convention on the Control of Harmful Anti-fouling Systems on Ships in October 2001; and was entered into force in September, 2008. Anti-fouling paints are used to coat the bottoms of ships to prevent marine organisms, including algae and mollusks (barnacles), from attaching to the hull, which slows down the ship and increases fuel consumption. The paint kills these organisms, but also leaches into the water, harming other marine organisms and affecting the environment. One type of anti-fouling paint contains the organotin tributylin (TBT) that has been proven extremely harmful to the environment. The IMO adopted a resolution in 1990 to recommend that governments adopt measures to eliminate the use of anti-fouling paint containing TBT. This convention goes a step further, prohibiting the use of any harmful organotins in anti-fouling paints used on ships and establishing, by January 2008, a mechanism to prevent the potential use of other harmful substances in anti-fouling systems. Although there are no Federal regulations implementing this convention, the EPA issued notices of availability for water-quality and aquatic-life criteria for TBT, to provide recommendations to States on their water quality standards or regulations. Therefore, TBT is regulated at the state level. Regulations on the use of anti-fouling paint would result in minimal economic impacts on the affected maritime industries as the old, harmful paints will be phased out, and new vessels and those requiring a new coat of anti-fouling paint would be required to apply paint that complies with their state laws and regulations.

Ballast Water Regulations

The IMO adopted the International Convention for the Control and Management of Ships' Ballast Water and Sediments in February 2004; it has not yet entered into force. The USCG is drafting regulations to develop ballast-water discharge standards, which would require vessels to have systems with which to treat ballast water before discharge. This action has potential economic impacts on the shipping industry, although data will not be available until the regulatory analysis on the ballast-water discharge standards is complete.

International Routing Measures

The 12-degree northern rotation of the Boston TSS increases its length by 3.75 nm (6.9 km). This analysis assumes that 60 percent of vessel arrivals in Boston would be affected by this change.[55] Had this revision to the Boston TSS been in place in 2003, the direct economic impact on the shipping industry would have been approximately $205,000, with the port area of Boston accounting for 98 percent of the impact; the remaining economic impact is $3,000 for the port area of Salem. In 2004, the estimated direct economic impact would have been $210,000. Tables that present the economic impact by port area and vessel type are included in Appendix F of the Economic Impact Report.

The second component of the amendment would narrow each lane of the TSS from 2.0 mi (3.2 km) to 1.5 mi (2.4 km) in width, with the separation zone between the two lanes remaining unchanged at its current 1.0-mi (1.6-km) width. This component would not impact vessel operations in terms of travel distance or time and hence does not result in any additional economic impact.

With the designation of the Great South Channel critical habitat area as an ATBA, vessels would be expected to voluntarily avoid the area from April 1 to July 31. Vessels under 300 GRT but 65 ft (19.8 m) or more in length would be subject to uniform speed restrictions within the ATBA, in compliance with the speed restrictions in the rule. The ATBA for the Great South Channel critical habitat is not expected to have an additional economic impact, as the timing of the ATBA coincides with the seasonal management area for the Great South Channel under the proposed rule. Accordingly, due to the speed restrictions, vessels heading to ports in the NEUS would have already chosen to avoid this area and are assumed to route either to the west and use the TSS, and vessels heading to Europe would route to the southeast and east of the Great South Channel critical habitat.

4.7.3.5 Summary of the Cumulative Impacts with Respect to Right Whale Population Recovery

Despite the cumulative impacts of the natural and anthropogenic actions previously mentioned, the operational measures to reduce the occurrence and severity of ship strikes are expected to have a positive effect on the right whale population. Ship strikes are the leading anthropogenic cause of mortality of right whales, followed by fishing gear entanglement. When the ship strike measures are coupled with the fisheries regulations of the ALWTRP and other conservation measures, the mortality rate should decrease. As mentioned in Section 4.1, the efficiency of these measures is based on current levels of shipping. Should shipping significantly increase – as expected in the future – then the measures would be reconsidered to account for the higher risk of ship strikes resulting from a larger global fleet of vessels.

4.8 Comparison of the Impacts of the Alternatives

This section provides a comparison of the impacts for each alternative by the resource area. Please note that when referring to the impacts of Alternative 6, they would only apply during the five-year period of effectiveness. A summary of this comparison is also provided in table format in Table 4-11.

[55] The determination of 60 percent is based on the following assumptions: 45 percent of vessels arrive from the north and depart to the south (one trip through the TSS); 30 percent arrive from the south and depart to the south (two trips through the TSS); 15 percent arrive from the north and depart to the south (one trip through the TSS); and 10 percent arrive from the north and depart to the north (no trips through the TSS). This results in a total factor of 120 percent, which is cut in half to apply to vessel arrivals only.

Alternative 1, the No Action alternative, would have negative impacts on the right whale population and other marine species, as ship strikes would continue to occur at current levels or even increase in the future as waterborne commerce increases, as it has been shown that the status quo is not providing sufficient protection. Alternatives 2, 3, and 4 each propose one main type of operational measure aimed at reducing ship strikes – DMAs, speed restrictions in designated areas, and recommended shipping routes, respectively. These alternatives would offer more protection to right whales than Alternative 1, and less than Alternatives 5 and 6, which propose a combination of operational measures. Alternative 2 would not specifically benefit other marine species, whereas Alternatives 3 and 4 would provide minor benefits.

Alternative 6 would provide a higher level of protection to right whales and other marine species for the duration of the measures. This alternative includes multiple ship strike reduction measures, including DMAs, speed restrictions in the NEUS, MAUS, and SEUS SMAs, and, recommended routes only that would also feature speed restrictions due to their location within the SMAs. Alternative 5 would provide the highest level of protection to right whales and other marine species, as it combines the measures from Alternatives 1 through 4 and accounts for all available ship strike reduction measures, expanded areas with speed restrictions, and year-round speed restrictions in the NEUS, as opposed to the seasonal restrictions proposed in Alternative 6.

Alternative 1 would have no effects on the physical environment. None of the alternatives affect bathymetry and substrate, as all alternatives would only affect the ocean surface. Alternative 4 would not affect water quality in the NEUS. Alternatives 2, 3 (in all areas), and 5 (in the NEUS) would have negligible impacts on water quality, whereas Alternatives 4 and 6 would have minor adverse effects on water quality in the SEUS. This is a result of concentrating vessel traffic in shipping lanes outside of 12 to 24 nm (22 to 46 km), where water quality regulations are less stringent. Alternative 5 would have negligible to minor adverse effects on water quality; negligible for speed restrictions (including speed restrictions proposed within DMAs) and minor for the same reason mentioned above for the shipping lanes in the SEUS. Alternative 4 would have no overall effect on air quality. Alternatives 2, 5, and 6 would have only minor, positive impacts on air quality due to reduced emissions. Alternative 3 would have a direct, positive effect on air quality. Alternatives 2, 4, 5, and 6 would potentially have minor positive impacts on the levels of ocean noise, and Alternative 3 potentially would have slightly more of a positive effect on ocean noise levels, due to larger-scale speed restrictions that would reduce vessel noise.

Refer to Section 4.4 for a thorough discussion of the direct and indirect impacts for all affected sectors. All numbers in this paragraph and the following ones are annual estimates based on 2004 conditions. Alternative 1 would not affect the maritime industry. Alternative 4 would have the smallest economic impact on the maritime industry, with $2.8 million for all three speed restrictions analyzed. Alternative 2 follows, with $41.5 million (10 knots), $28.1 million (12 knots), and $17.9 million 914 knots). Alternative 6 falls in the middle, at $137.3 million (10 knots), $77.4 million (12 knots), and $45 million (14 knots). Alternative 3 would have the second-highest impact, at $334.8 million (10 knots), $210 million (12 knots), and $121.7 million (14 knots). Alternative 5 would have the highest economic impact, at $359.7 million (10 knots), $223.3 million (12 knots), and $134.1 million (14 knots) (see Data Chart 4-43).

With respect to the shipping industry, Alternative 4 would have the smallest impact at $2.8 million for all three speed restrictions. Alternative 2 follows, with $27.6 million (10 knots), $17.7 million (12 knots), and $10.8 million (14 knots). Alternative 6 would have impacts amounting to $120.1 million (10 knots), $65.6 million (12 knots), and $36.9 million (14 knots).

Alternative 3 would have the fourth-greatest impact, with $301.4 million (10 knots), $186.3 million (12 knots), and $106 million (14 knots). Alternative 5 would have the greatest economic impact, with $326.3 million (10 knots), $199.6 million (12 knots), and $118 million (14 knots) (see Table 4-2).

At a speed restriction of 12 or 14 knots, there would not be any adverse economic impacts on commercial fishing vessels for any of the alternatives. At a speed restriction of 10 knots, Alternatives 3, 5, and 6 would have minor, adverse economic effects on this industry: Alternatives 3 and 5 would cost the industry $1.7 million, and Alternative 6 would cost $1.3 million (see Data Chart 4-43).

Alternative 4 would not affect ferry vessels. Alternative 2 would have the smallest economic impact on ferries, at $8.1 million (10 knots), $6.1 million (12 knots), and $4.1 million (14 knots). Alternative 6 follows, with $8.6 million (10 knots), $6.6 million (12 knots), and $4.6 million (14 knots). Alternatives 3 and 5 would have the highest economic impact, at $13 million (10 knots), $11.1 million (12 knots), and $8.3 million (14 knots).

Similarly, Alternative 4 would have no impact on ferry passengers. Alternative 3 and 5 would have the largest adverse impact, amounting to $12 million with a 10-knot speed restriction, $8.9 million with a 12-knot restriction, and $5.5 million with a 14-knot restriction. Alternative 6 would have the second largest effect, with a estimated $5.2 million at 10 knots, $3.9 million at 12 knots, and $2.5 million at 14 knots. Alternative 2 would have effects that would be slightly less than those of Alternative 6: $4.5 million at 10 knots; $3.4 million at 12 knots; and $2.3 million at 14 knots.

Alternative 4 would not affect whale-watching vessels. Alternatives 2 and 6 would have the smallest economic impact on whale-watching vessels – $1.3 million at 10 knots, $0.9 million at 12 knots, and $0.7 million at 14 knots. Alternatives 3 and 5 would have a higher economic impact, at $5.6 million at 10 knots, $3.1 million at 12 knots, and $1.9 million at 14 knots.

Alternatives 2 and 4 would not affect charter vessels. Alternatives 3 and 5 would have the smallest economic impact on charter vessels – $1.0 million at 10 knots, $598,000 at a 12 knots, and $299,000 at 14 knots. Alternative 6 would have an economic impact of $796,000 at 10 knots, $480,000 at 12 knots, and $240,000 at 14 knots.

None of the alternatives would have disproportionate effects on environmental justice communities. None of the alternatives would have an effect on cultural resources.

4.9 Mitigation Measures

Mitigation measures are not addressed separately in this FEIS as the objective of the proposed action and alternatives is to have a long-term, positive effect on the environment by reducing the likelihood of death and serious injury to right whales resulting from ship strikes, thereby contributing positively to the recovery of the population. In essence, the operational measures contained in the proposed action and alternatives are mitigation measures in themselves. The preferred alternative balances the biological benefit to right whales and the economic impact that results from the measures. Ship strike reduction measures are essential to the recovery of the species. NMFS will evaluate the effectiveness of the ship strike reduction measures through monitoring and enforcement, which will be addressed in the final rule. If right whale ship strikes continue, NMFS will modify these measures as appropriate. The FRFA will identify potential mitigation measures for small businesses and alternative actions are mentioned throughout the economic impact section, so vessel operators are aware of the least-cost option(s) and other actions they can take to avoid economic hardship.

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Table 4-11
Summary Matrix of Impacts

Impact Area	Alternative 1: No Action	Alternative 2: Mandatory Dynamic Management Areas	Alternative 3: Speed Restrictions in Designated Areas	Alternative 4: Recommended Shipping Routes	Alternative 5: Combination of Alternatives 1-4	Alternative 6: Proposed Action
North Atlantic Right Whale	There would be significant, direct, long-term, negative effects on the right whale population and recovery status. Ship strikes would continue and possibly even increase with the predicted rise in shipping in the future.	There would be minor, direct, long-term, positive effects on the right whale population as a result of implementing DMAs.	**10 Knots** There would be major, direct, long-term, positive effects on right whale recovery with a speed limit of 10 knots. **12 knots** There would be direct, long-term, positive effects on right whale recovery with a speed limit of 12 knots. **14 Knots** There would only be minor, direct, long-term, positive effects on right whale recovery because a speed limit of 14 knots would not provide sufficient protection against ship strikes.	**NEUS** There would be direct, long-term, positive effects on right whale recovery due to the proposed shipping lanes in the NEUS. **MAUS** There would be direct, long-term, adverse effects on right whale recovery in the MAUS because there are no proposed shipping lanes in this region. **SEUS** There would be direct, long-term, positive effects on right whale recovery due to the proposed shipping lanes in the SEUS.	There would be significant, direct, long-term, positive effects on right whale population recovery in all three regions by combining Alternatives 1-4, as the additive effects of current conservation measures, DMAs, speed restrictions and shipping lanes would significantly reduce the probability of ship strike. Generally, the level of positive effects increases as the speed limit decreases, i.e., major benefits at 10 knots to minor benefits at 14 knots.	There would be major, direct, positive effects on right whale population recovery in all three regions as a result of implementing the operational measures contained in Alternative 6. Generally, the level of positive effects increases as the speed limit decreases, i.e., major benefits at 10 knots to minor benefits at 14 knots.
Other Marine Species	**Other Marine Mammals** There would be indirect, long-term, adverse effects on other marine mammals from implementing the No Action Alternative. **Sea Turtles** Any positive impacts on sea turtles that would result from the proposed measures would not occur under the No Action alternative. None of the alternatives are expected to affect seabirds or protected anadromous and marine fish, and therefore they are not mentioned in this table.	**Other Marine Mammals** There would be no significant effects on other marine mammals from the use of DMAs because they are based on right whale sightings. **Sea Turtles** There would be no significant effects on sea turtles from a DMA implementation because it is based on right whale sightings.	**Other Marine Mammals** There would be minor, indirect, long-term beneficial effects on other marine mammals from speed restrictions if they occur in the designated areas. **Sea Turtles** There would potentially be minor, indirect, long-term, beneficial effects on sea turtles from speed restrictions if they occur in the designated areas.	**Other Marine Mammals** There would be no significant effects on other marine mammals from the recommended shipping routes. **Sea Turtles** There would be no significant effects on sea turtles from the recommended shipping routes.	**Other Marine Mammals** There would be major, indirect, long-term, positive effects on other marine mammals from implementing broad spatial and temporal speed restrictions and recommended shipping routes. Only marine mammals that occur in the restricted areas and routes would benefit from these operational measures. **Sea Turtles** There would potentially be an indirect, long-term, positive effect on sea turtles from implementing broad spatial and temporal speed restrictions and recommended shipping routes. Only sea turtles that occur in the restricted areas and routes would benefit from these operational measures.	**Other Marine Mammals** There would be indirect, positive effects on other marine mammals as a result of implementing the operational measures contained in Alternative 6. Only marine mammals that occur in the restricted areas and routes would benefit from these operational measures. **Sea Turtles** There would potentially be indirect, positive effects on sea turtles as a result of implementing the operational measures in Alternative 6. Only sea turtles that occur in the restricted areas and routes would benefit from these operational measures.
Physical Environment	**Bathymetry and Substrate** There would be no effects on Bathymetry and substrate from the No Action Alternative. **Water Quality** There would be no effects on ocean water quality from the No Action Alternative. **Air Quality** There would be no effects on air quality from the No Action Alternative. **Ocean Noise** There would be no effects on ocean noise from the No Action Alternative.	**Bathymetry and Substrate** There would be no effects on bathymetry and substrate from implementing DMAs. **Water Quality** There would be negligible effects on ocean water quality from implementing DMAs. **Air Quality** There would be minor, direct, short-term, positive impacts on air quality at sea from implementing DMAs if vessels transit through DMAs at a reduced speed. **Ocean Noise**	**Bathymetry and Substrate** There would be no effects on bathymetry and substrate from implementing speed restrictions in designated areas. **Water Quality** There would be a negligible amount of effects on ocean water quality from implementing speed restrictions. **Air Quality** There would be a direct, short-term, positive impact on air quality in the designated areas where vessels transit through at reduced speeds. **Ocean Noise**	**Bathymetry and Substrate** There would be no effects on bathymetry and substrate from implementing recommended shipping routes. **Water Quality** There would be no impacts on water quality in the NEUS, and potentially minor, adverse impacts in the SEUS region due to the concentration of vessel traffic in the shipping lanes. **Air Quality** There would be no significant, long-term impacts on air quality as a result of instituting shipping lanes. While vessel emissions may be	**Bathymetry and Substrate** There would be no effects on bathymetry and substrate as a result of combining the measures in Alternatives 1-4. **Water Quality** There would be negligible to minor adverse effects on water quality as a result of combining DMAs, speed restrictions and recommended shipping routes. See Alternative 4. **Air Quality** By combining the positive effects on air quality from Alternatives 2 and 3 and the overall neutral effects of Alternative 4, implementing Alternative	**Bathymetry and Substrate** There would be no effects on bathymetry and substrate as a result of implementing the operational measures contained in Alternative 6. **Water Quality** There would be negligible impacts on water quality in the NEUS, and potentially minor, adverse impacts on the SEUS region due to the concentration of vessel traffic in the shipping lanes. **Air Quality** There would be minor, direct, positive effects on air quality as a result of speed restrictions in SMAs, DMAs,

Table 4-11
Summary Matrix of Impacts

Impact Area	Alternative 1: No Action	Alternative 2: Mandatory Dynamic Management Areas	Alternative 3: Speed Restrictions in Designated Areas	Alternative 4: Recommended Shipping Routes	Alternative 5: Combination of Alternatives 1-4	Alternative 6: Proposed Action
		There would potentially be minor, direct, short-term, positive effects on ocean noise levels from implementing DMAs. Noise would be temporarily reduced if the vessel reduces speed through the DMA.	There would potentially be direct, short- and long-term, positive impacts on the levels of ocean noise by reducing noise levels in the immediate areas where restrictions are proposed. There would be long-term impacts in the NEUS, where speed restrictions are proposed year-round, and short-term elsewhere.	concentrated in these lanes, there would be no change in the overall amount of emissions. **Ocean Noise** There would potentially be minimal, direct, short-term, adverse effects on ambient noise levels in the ocean as a result of routing vessels into recommended shipping routes.	5 would have minor, direct, long-term, positive effects on air quality. **Ocean Noise** Combining the positive effects on ocean noise from Alternatives 2 and 3 and the adverse effects of Alternative 4 would potentially have minimal, direct, long-term, slightly positive effects on ocean noise.	critical habitat, and shipping lanes. **Ocean Noise** There would potentially be a minor, direct, positive impact on ocean noise as a result of speed restrictions in the shipping lanes and SMAs that would lower noise levels in the ocean.
Port Areas and Vessel Operations	There would no impacts on port areas and vessel operations from the No Action Alternative.	There would be adverse economic impacts because slowing down through a DMA or routing around a DMA would result in additional time spent at sea, which translates to higher costs. Impacts (all estimates based on 2004 conditions): **10 knots** Annual direct impact: $27.6 million. **12 knots** Annual direct impact: $17.7 million. **14 knots** Annual direct impact: $10.8 million. No additional direct impacts or indirect impacts.	There would be adverse economic impacts on port areas and vessel operations because speed restrictions would affect vessel arrival times, which affect vessel costs. Impacts (all estimates based on 2004 conditions): **10 knots** Annual direct impact: $142.5 million. Additional annual direct impact: $19.5 million. Annual Indirect impact: $139.4 million. Total annual impacts: $301.4 million. **12 knots** Annual direct impact: $89.2 million. Additional annual direct impact: $17.5 million. Annual indirect impacts: $79.6 million. Total annual impacts: $186.3 million. **14 knots** Annual direct impact: $52.5. Additional annual direct impact: $16 million. Annual indirect impact: $37.3 million. Total annual impacts: $106 million.	Adverse economic impacts would occur if vessels deviate from their original routes to travel in the recommended shipping routes, which would add extra mileage to voyages. Impacts (all estimates based on 2004 conditions): **10 knots** Annual direct impact: $2.8 million. **12 knots** Annual direct impact: $2.8 million. **14 knots** Annual direct impact: $2.8 million. No additional direct impacts or indirect impacts.	There would be adverse economic impacts for the same reasons as stated under Alternatives 1 through 4. Impacts (all estimates based on 2004 conditions): **10 knots** Annual direct impact: $147.2 million. Additional annual direct impact: $19.5 million. Annual indirect impacts: $159.6. Total annual impacts: $326.3 million. **12 knots** Annual direct impact: $92.8 million. Additional annual direct impact: $17.5 million. Annual indirect impact: $89.3 million. Total annual impacts: $199.6 million. **14 knots** Annual direct impact: $55.2 million. Additional annual direct impact: $16 million. Annual indirect impact: $47.0 million. Total annual impacts: $118 million.	There would be adverse economic impacts because slowing down through a SMA or a DMA and deviating to travel in the recommended shipping routes would result in additional time spent at sea, which translates to higher costs. Impacts (all estimates based on 2004 conditions): **10 knots** Annual direct impact: $57.6 million. Additional annual direct impact: $12.8 million. Annual indirect impact: $49.7 million. Total annual impacts: $120.1 million. **12 knots** Annual direct impact: $36.1 million. Additional annual direct impact: $11.2 million. Annual indirect impact: $18.3 million. Total annual impacts: $65.6 million. **14 knots** Annual direct impact: $21.5 million. Additional annual direct impact: $10 million. Annual indirect impact: $5.4 million. Total annual impacts: $36.9 million.
Commercial Fishing Vessels	There would be no impacts on commercial fishing vessels under the No Action Alternative.	There would be negligible impacts at a 10-, 12-, or 14-knot speed restriction.	There would be no adverse impacts at 12- and 14-knot speed restriction. With a 10-knot restriction, there would be an adverse estimated at $1.7 million annually.	There would be negligible impacts at a 10-, 12-, or 14-knot speed restriction.	There would be no adverse impacts at 12- and 14-knot speed restriction. With a 10-knot restriction, there would be an adverse estimated at $1.7 million annually.	There would be no adverse impacts at a speed restriction of 12 or 14 knots. With a 10-knot restriction, there would be an adverse estimated at $1.3 million annually.
Ferry Vessels	There would be no impacts on ferry vessels under the No Action Alternative.	There would be a direct adverse impact: 10 knots: $8.1 million annually. 12 knots: $6.1 million annually. 14 knots: $4.1 million annually. (Estimates based on 2004 conditions)	There would be a direct adverse impact: 10 knots: $13 million annually. 12 knots: $11.1 million annually. 14 knots: $8.3 million annually. (Estimates based on 2004 conditions)	There would be no impacts.	There would be a direct adverse impact: 10 knots: $13 million annually. 12 knots: $11.1 million annually. 14 knots: $8.3 millions annually. (Estimates based on 2004 conditions)	There would be a direct adverse impact: 10 knots: $8.6 million annually. 12 knots: $6.6 million annually. 14 knots: $4.6 million annually. (Estimates based on 2004 conditions)

Table 4-11
Summary Matrix of Impacts

Impact Area	Alternative 1: No Action	Alternative 2: Mandatory Dynamic Management Areas	Alternative 3: Speed Restrictions in Designated Areas	Alternative 4: Recommended Shipping Routes	Alternative 5: Combination of Alternatives 1-4	Alternative 6: Proposed Action
Ferry Passengers	There would be no impacts on ferry passengers	There would be adverse impacts in southern New England: 10 knots: $4.5 million annually. 12 knots: $3.4 million annually. 14 knots: $2.3 million annually.	There would be adverse impacts in southern New England: 10 knots: $12 million annually. 12 knots: $8.9 million annually. 14 knots: $5.5 million annually.	There would be no impacts on ferry passengers.	There would be adverse impacts in southern New England: 10 knots: $12 million annually. 12 knots: $8.9 million annually. 14 knots: $5.5 million annually.	There would be adverse impacts in southern New England: 10 knots: $5.2 million annually. 12 knots: $3.9 million annually. 14 knots: $2.5 million annually.
Whale-Watching Vessels	There would be no impacts on whale-watching vessel operations under the No Action Alternative.	There would be direct adverse impacts: 10 knots: $1.3 million annually. 12 knots: $0.9 million annually. 14 knots: $0.7 million annually. (Estimates based on 2004 conditions)	There would be direct adverse impacts: 10 knots: $5.6 million annually. 12 knots: $3.1 million annually. 14 knots: $1.9 million annually. (Estimates based on 2004 conditions)	There would be no effects on whale-watching vessel operations.	There would be direct adverse impacts: 10 knots: $5.6 million annually. 12 knots: $3.1 million annually. 14 knots: $1.9 million annually.	There would be direct adverse impacts: 10 knots: $1.3 million annually. 12 knots: $0.9 million annually. 14 knots: $0.7 million annually.
Charter Vessels	There would be no impacts on charter vessel operations under the No Action Alternative.	There would be no impacts on charter vessel operations.	There would be direct adverse economic impacts: 10 knots: $1.0 million annually. 12 knots: $598,000 annually. 14 knots: $299,000 annually. (Estimates based on 2004 conditions)	There would be no impacts on charter vessel operations.	There would be direct adverse economic impacts: 10 knots: $1.0 million annually. 12 knots: $598,000 annually. 14 knots: $299,000 annually. (Estimates based on 2004 conditions)	There would be direct adverse economic impacts: 10 knots: $796,000 annually. 12 knots: $480,000 annually. 14 knots: $240,000 annually. (Estimates based on 2004 conditions)
Environmental Justice	There would be no impacts on environmental justice communities.	No low-income or minority populations would be disproportionately affected. Alternative 2 does not raise environmental justice concerns under EO 12898.	No low-income or minority populations would be disproportionately affected. Alternative 3 does not raise environmental justice concerns under EO 12898.	No low-income or minority populations would be disproportionately affected. Alternative 4 does not raise environmental justice concerns under EO 12898.	No low-income or minority populations would be disproportionately affected. Alternative 5 does not raise environmental justice concerns under EO 12898.	Under Alternative 6, no low-income or minority populations would be disproportionately affected. Alternative 6 does not raise environmental justice concerns under EO 12898.
Cultural Resources	There would be no impacts on cultural resources.	There would be no impacts on cultural resources.	There would be no impacts on cultural resources.	There would be no impacts on cultural resources.	There would be no impacts on cultural resources.	There would be no impacts on cultural resources.

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5 REGULATORY IMPACT REVIEW

5.1 Introduction and Background

The Regulatory Impact Review/Regulatory Impact Assessment (RIR/RIA) provides an assessment of the costs and benefits of this proposed action (Alternative 6) and other alternatives in accordance with Executive Order 12866 and its guidelines established in OMB Circular A-4. Executive Order 12866 states:

> Federal agencies should promulgate only such regulations as are required by law, are necessary to interpret the law, or are made necessary by compelling public need, such as material failures of private markets to protect or improve the health and safety of the public, the environment, or the well-being of the American people. In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider. Further, in choosing among alternative regulatory approaches, agencies should select those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach.

The statement of purpose and need for the proposed action is as follows:

The purpose of the proposed action is to reduce the occurrence and severity of vessel collisions with North Atlantic right whales, thereby contributing to the recovery and sustainability of the species while minimizing adverse effects on the shipping industry and maritime commerce.

NMFS has authority under both the ESA and the MMPA to protect the endangered North Atlantic right whale. Although various measures to reduce ship strikes (described in Section 1.2.1) have been in place for several years, these measures have not significantly reduced the number of vessel collisions with right whales. A continued lack of recovery, and possibly extinction, will occur if deaths from ship strikes are not reduced. Therefore, additional action is needed for NMFS to fulfill its responsibility. Collision with vessels is the primary anthropogenic cause of serious injuries and deaths to right whales. Therefore, NMFS is proposing to reduce this threat by taking the regulatory approach expected to be most effective at facilitating population recovery. The proposed vessel operational measures would impose regulatory speed restrictions and provide for nonregulatory routing measures on specific vessel classes to reduce the ship strike threat to right whales without imposing undue economic burdens on the shipping industry. The combination of speed restrictions and reducing the co-occurrence of right whales and vessel traffic is expected to be an effective means to reduce the number and severity of ship strikes and promote population growth and recovery.

The RIR/RIA also serves as a basis for determining whether a proposed action is a “significant regulatory action” under the criteria provided in Executive Order 12866. This RIR/RIA summarizes the effects of the proposed action (Alternative 6) and other alternatives that NMFS is considering to reduce right whale ship strikes and to aid in the recovery of the right whale population. Multiple chapters of the Final EIS (FEIS) and economic analysis contain all the elements of the RIR/RIA, and the relevant sections are referenced.

5.2 List of Alternatives Considered

Chapter 2 of the FEIS contains more detailed information on the operational measures considered and the alternatives evaluated. The operational measures are described in Section 2.1. Alternatives are described in Section 2.2. The alternatives are listed here for reference throughout the remainder of this RIR/RIA.

- Alternative 1: No Action Alternative
- Alternative 2: Mandatory Dynamic Management Areas (DMAs)
- Alternative 3: Speed Restrictions in Designated Areas
- Alternative 4: Recommended Shipping Routes
- Alternative 5: Combination of Alternatives
- Alternative 6: Proposed Action (Preferred Alternative)

Alternatives 5 and 6 differ in that the designated areas included in Alternative 5 are generally larger and the restrictions in force for longer time periods than those in Alternative 6. The measures would apply only to vessels 65 ft (19.8 m) long and more (see Section 1.4 for exceptions).

5.3 Benefits and Impacts of Management Alternatives

5.3.1 Description of Benefits

The benefits of reducing the risk of right whale mortality caused by ship strikes are expected to be considerable. Because ship strikes are the leading anthropogenic cause of right whale mortalities (Section 1.1.2), adopting measures to reduce the incidences of ship strikes will aid in the recovery of this highly endangered species. However, monetary estimates of these benefits are currently unavailable; therefore, the discussion of these benefits specific to right whales is qualitative.

The full range of values of right whale recovery includes use values and nonuse values. Use values include those values associated with whale-watching trips or other viewing opportunities. Nonuse values include those values placed on knowing that right whales remain for future generations (bequest value) and values placed on knowing that right whales will continue to survive (existence value).

While each of the action alternatives – Alternatives 2, 3, 4, 5, and 6 – are expected to result in a reduction in the number of North Atlantic right whale "takes" under the ESA and the MMPA, the positive, long-term effects on the right whale population would vary depending upon the alternative. The benefits will be described briefly in this RIR/RIA; Section 4.1 describes the benefits of adopting each of these alternatives in greater detail.

Alternative 1, the No Action Alternative, would have significant, direct, long-term negative effects on the right whale population because no additional measures would be taken to reduce the incidences of ship strikes. Alternative 2 would have a positive effect on right whale population since it would lower the potential for ship strikes. However, it would provide only a temporary measure, triggered when right whales are sighted in aggregations of three or more (Clapham and Pace, 2001). Furthermore, the ability to detect the presence of right whales for triggering a DMA is limited. This measure, by itself, may not be sufficient to prevent the significant number of deaths per year necessary to help the right whale population to recover. Alternative 3 would also lower the potential for ship strikes resulting in injury and death, by requiring vessels to slow down to 10 knots in predetermined, designated areas defined based on the right whale's behavioral and migratory patterns. Alternative 4 would lower the potential for ship strikes through the use of recommended shipping routes to reduce the likelihood of overlap of ships and right whales, but does not call for a reduction of vessel speed. The benefits to right whales would only be seen in the Northeast and Southeast, since the mid-Atlantic ports would not contain recommended routes. Therefore, among the action alternatives, Alternative 4 appears to be the alternative that would contribute the least to the goal of right whale recovery. Alternative 5 would be the most beneficial to the goal of right whale recovery among the action alternatives. Alternative 5 contains DMAs, speed restrictions in designated areas, and recommended shipping routes – a combination of the measures of Alternatives 1, 2, 3, and 4 – and, therefore, it would address a wider variety of scenarios in which ship strikes may occur than would each of the single-measure alternatives which it incorporates. Alternative 6, the proposed action and preferred alternative, would also be highly beneficial to the recovery of the right whale population as it also is designed to address the various ship strike scenarios that might occur. However, because the seasonal management areas included in Alternative 6 would be in place for a shorter span of time than under Alternative 5, and because the Alternative 6 measure would expire five years from their date of effectiveness, Alternative 6 would not be as beneficial to the recovery of the right whale population as Alternative 5. However, it would be more beneficial to the recovery goal than Alternatives 2 or 4. It is not clear whether Alternative 6 would provide greater conservation benefit than Alternative 3, since Alternative 3 consists of seasonal management areas that are generally larger in size than those of Alternative 6, but does not include DMAs. On the other hand, while the DMAs do add conservation value to Alternative 6, due to the voluntary nature of DMAs in Alternative 6 the extent to which they would benefit the conservation of right whales depends on the degree of compliance.

5.3.2 Description of Affected Parties and Types of Impacts

The RIR/RIA reports the results of the economic analysis performed in support of this proposed action. The economic analysis, which will be publicly available online at *http://www.nmfs.noaa.gov/pr/* and through other channels, provides greater detail on the methodology used to produce the estimates. The analysis uses the most recently available data on vessel activities to predict impacts to commercial shipping vessels, commercial fishing vessels, charter fishing vessels, passenger ferries, and whale-watching vessels traveling in the North Atlantic that are 65 ft (19.8 m) or greater in overall length.

Commercial shipping vessels arriving at one or more of 26 East Coast port areas were categorized into eleven vessel types: bulk carriers, combination carriers, containerships, freight barges, general cargo vessels, passenger vessels, refrigerated cargo vessels, ro-ro cargo vessels, tank barges, tank ships, and towing vessels. The economic impacts to the commercial shipping industry include direct and indirect impacts.[1] The direct impacts include costs due to vessels slowing down or rerouting in compliance with the proposed actions as well as additional costs borne by vessels making multi-port calls along the eastern seaboard and/or participating in coastwise cabotage service. The indirect economic impacts include port-specific impacts due to ship traffic diverting to other ports.

5.3.2.1 Direct Impacts to Commercial Shipping Industry

The direct impacts from multi-port calls were also evaluated in response to concerns raised by shipping industry representatives and port officials during stakeholder meetings regarding the aggregate effects of the proposed vessel operational measures and alternative actions on vessels calling at multiple US East Coast ports during restricted periods. The economic analysis addresses these costs by identifying which vessel arrivals at each port area were part of a multi-port string during proposed restricted periods and estimating the additional direct economic impact on the shipping industry.

Other direct costs to the shipping industry are expected to result from the rerouting of coastwise shipping, in particular, southbound shipping. In recent years, attention has been focused on the further development of coastwise shipping (also referred to as short-sea shipping) as a means of reducing highway congestion on the eastern seaboard. However, for commercial and navigational purposes, it appears unlikely that the speed restriction would significantly affect coastwise shipping. Northbound vessels prefer to use the Gulf Stream further offshore. Southbound traffic travels closer to the US East Coast – generally, within 7 to 10 nm (13 to 19 km) of the shoreline. However, during the proposed seasonal management periods, southbound vessels are likely to route outside of seasonal speed-restricted areas, incurring an overall increase in distance (and costs). This affects southbound vessels between the entrance to the Chesapeake Bay and Port Canaveral.

[1] Data from various sources were used to best capture current vessels' arrival activities at various East Coast ports. These included the US Coast Guard (USCG)'s vessel arrivals database, the US Department of Transportation's National Ferry Database, NMFS' data on commercial fishery landings, and Hoyt, Erich, Whale Watching 2000: Worldwide Tourism Numbers, Expenditures and Expanding Socioeconomic Benefits, 2000.

5.3.2.2 Indirect Impacts to Commercial Shipping Industry

Indirect economic impacts of the proposed operational measures include costs from diverting ship traffic to other ports. Many of these potential costs were identified by port authorities, shipping industry representatives, and community leaders during the public stakeholder meetings. Potential indirect economic impacts include diversion of traffic to other ports; increased intermodal costs due to missed rail and truck connections; and the impact on local economies of decreased income from port-specific job losses that may occur due to ship traffic diverting to other ports.

5.3.2.3 Impacts to Other Commercial Operations

While the commercial shipping industry is predicted to incur the greatest impact from the proposed action and the action alternatives, other industries are expected to be affected as well. The following briefly describes ways in which these other operations may also be affected by the proposed action and alternatives.

Commercial fishing vessels may be affected, depending on normal operating speed. Many commercial fishing vessels steam to/from fishing areas at speeds of 10 knots or below and would not be affected by the proposed measures. Those that operate at speeds exceeding 10 knots would be affected by the proposed speed restriction of 10 knots.

In terms of the charter fishing industry, only a small segment of the industry referred to as headboats is expected to be affected.[2] This segment of the charter fishing industry often uses vessels measuring 80 ft (24.4 m) in length or greater that can accommodate 60 to 100 passengers. These vessels travel up to 50 nm (93 km) offshore, then stop and anchor in locations that attract a particular species of fish. An increase in roundtrip steaming time of approximately 100 minutes would reduce the competitiveness of the larger headboats relative to smaller vessels, but it is expected that vessels less than 65 ft (19.8 m) in overall length would increase their share of the market.

Passenger ferries operating along the Atlantic coast generally sail landward of the COLREGS demarcation lines described in Section 2.1.2.2 and as such will not be affected by the proposed operational measures of any of the alternatives considered in this RIR/RIA. However, in the southern New England area, there is a well-developed passenger ferry sector that operates seaward of the COLREGS line and hence is subject to the proposed operational measures. Passenger ferry operations in southern New England generally fall into two categories – fast-ferry service, with vessel speeds ranging from 24 to 39 knots, and regular ferry service, with vessel speeds of from 12 to 16 knots. These ferry operations would be affected by the proposed speed restriction of 10 knots. Additional impacts are borne by the passengers themselves due to the increased travel time.

The whale-watching industry can also be categorized into operations that deploy high-speed vessels, with speeds ranging from 25 to 38 knots, and operations that deploy regular-speed

[2] The vast majority consists of modern and well-equipped fishing boats of less than 65 ft (19.8 m) length overall (LOA) and thus would not be subject to the speed restrictions or other operational measures.

vessels, with speeds of from 16 to 20 knots. A survey of whale-watching operators in New England indicated that the majority of whale-watching vessels are 65 ft (19.8 m) or greater in length. Therefore, the majority of operators would be affected by the operational measures.

Table 5-1 lists the estimated economic impacts by industry for each action alternative; it includes economic impacts at the proposed 10-knot speed restriction, and, because NMFS invited comments on a 12-knot and 14-knot speed restriction in the proposed rule, the impacts of these higher speed restrictions as well. The following sections summarize the estimated economic impacts of the proposed action and alternatives. The economic impacts are estimated using 2004 vessel data unless otherwise indicated.

5.3.3 Alternative 1: No Action Alternative

Under this alternative, NMFS would continue to implement existing measures and programs – largely nonregulatory – to reduce the likelihood of mortality from ship strikes. Alternative 1 does not include any new operational measures that would affect the shipping industry and hence there is no direct or indirect economic impact associated with this alternative.

5.3.4 Alternative 2: Mandatory Dynamic Management Areas

Alternative 2 would directly affect the commercial-shipping, passenger-ferry and whale-watching industries.[3] The estimated impacts are as follows.

5.3.4.1 Estimated Direct Economic Impact

Shipping Industry

In all regions, mariners would have the option of either routing around the DMA or proceeding through it at a restricted speed. The direct impact of a DMA on vessel operations is the increased time required to transit through the DMA at the restricted speed. A DMA triggered by a sighting of a group of three whales would have a diameter of 39.6 nm (73.3 km). For a vessel with an average operating speed of 10 knots, it would normally be able to traverse the 39.6 nm (73.3 km) of a DMA in 238 minutes, or nearly four hours. In addition, the vessel will need time to slow to the restricted speed prior to entering the DMA and to speed up again after leaving the DMA. Some faster-moving vessels may opt to save time by routing around the DMA to continue traveling at the higher speed, rather than slowing down to 10 knots and then speeding up again.

[3] It is assumed that similar restrictions on commercial fishing activities would have been triggered by operational measures under the existing Atlantic Large Whale Take Reduction Plan (ALWTRP) and therefore, that commercial fishing would not face additional impacts from DMAs under Alternatives 2, 3, 5 or 6.

Table 5-1
Total Direct and Indirect Economic Costs by Alternative and Restriction Speed, 2004 ($000s)

	Action Alternative												
	2			**3**			**4**	**5**			**6**		
	Speed Restriction (knots)												
	10	**12**	**14**	**10**	**12**	**14**	**10, 12, or 14**	**10**	**12**	**14**	**10**	**12**	**14**
Direct Economic Impact													
Shipping industry vessels	27,578.8	17,700.7	10,781.8	142,476.8	89,229.6	52,530.3	2,790.6	147,171.3	92,772.0	55,237.8	57,569.2	36,050.4	21,544.6
Cumulative effect of multi-port strings				11,932.6	9,904.1	8,352.8		11,932.6	9,904.1	8,352.8	9,411.5	7811.5	6,588.1
Rerouting of southbound Coastwise shipping				7,600.0	7,600.0	7,600.0		7,600.0	7,600.0	7,600.0	3,400.0	3,400.0	3,400.0
Commercial fishing vessels				1,724.0				1,724.0			1,310.2		
Charter fishing vessels				1,000.0	597.6	298.8		1,000.0	597.6	298.8	796.0	480.0	240.0
Passenger ferries	8,078.0	6,111.3	4,144.7	13,028.0	11,061.3	8,308.0		13,028.0	11,061.3	8,308.0	8,608.9	6,567.2	4,563.0
Ferry passengers	4,512.4	3,376.5	2,271.5	12,027.2	8,892.9	5,479.6		12,027.2	8,892.9	5,479.6	5,190.8	3,868.7	2,556.0
Whale-watching vessels	1,335.6	919.6	711.6	5,616.0	3,120.0	1,872.0		5,616.0	3,120.0	1,872.0	1,335.6	919.6	711.6
Subtotal direct economic impact	**41,504.8**	**28,108.1**	**17,909.6**	**195,404.6**	**130,405.4**	**84,441.6**	**2,790.6**	**200,099.1**	**133,947.9**	**87,149.0**	**87,622.2**	**59,097.4**	**39,603.2**
Indirect Economic Impact													
Port diversions				**139,406.0**	**79,603.0**	**37,251.0**		**159,582.0**	**89,308.4**	**46,956.0**	**49,695.0**	**18,280.0**	**5,355.0**
Total economic impact	**41,504.8**	**28,108.1**	**17,909.6**	**334,810.6**	**210,008.4**	**121,692.6**	**2,790.6**	**359,681.1**	**223,256.3**	**134,105.4**	**137,317.2**	**77,377.4**	**44,958.2**

The total direct economic impact to the shipping industry of DMAs implemented at a 10-knot speed restriction under Alternative 2, using 2004 data on vessel arrivals and departures, is estimated at $27.6 million. Of the affected ports, the port area of Savannah is estimated to experience the highest impact ($7.3 million), followed by the port areas of Port Canaveral ($4.6 million), Jacksonville ($3.5 million), and New York/New Jersey ($3.1 million). The direct economic impact for these four port areas is expected to be about $18.5 million, or 67 percent of the total impacts among all ports for this alternative. No additional direct impacts from multi-port strings or rerouting of southbound coastwise shipping are expected, nor are indirect impacts due to port diversions expected.

Passenger Ferries

Interviews with passenger ferry operators identified their particular concern as a situation in which a DMA would be implemented in a ferry's customary route in New England waters during the peak summer season. For fast-ferry operators, a DMA implemented directly along their route would result in the suspension of service for the entire period the DMA is in effect. There are several reasons for this conclusion. First, the demand for fast ferries – those that normally operate at speeds of between 24 and 39 knots would virtually disappear if the ferries were restricted to 10 knots. Second, any remaining demand would not be sufficient to cover vessel operating costs. Third, many handling and comfort characteristics of fast ferries would suffer at reduced speeds.

The net economic loss of the implementation of a single DMA is estimated to be $2.2 million for the eleven fast-ferry operators in New England.[4] This is based on a daily operating cost of a fast-ferry vessel of $13,320 excluding fuel costs. Some operators have stated that the loss of income and profits from a single 15-day DMA during peak season would cause them to go out of business. However, many of the fast-ferry operators who also operate regular ferries would be able to remain in business with the increase in demand for regular ferries from passengers that would have otherwise used the fast ferry service.[5]

DMAs would also potentially affect operators of regular ferry services if the DMAs were implemented along their customary route. For these operators, it is assumed that a speed restriction of 10 knots would cause an average delay of 30 minutes for each ferry trip. The 118 daily trips of regular ferry services would incur total additional costs of $5.9 million for the duration of a single DMA. Therefore the total economic impact on regular and fast speed passenger ferries for 2004 is estimate to be $8.1 million.

[4] This same estimate applies to restricted speeds of 10, 12 and 14 knots, as it is assumed that fast-ferry service would be temporarily suspended under any of those speeds.

[5] It is very difficult to estimate the portion of passenger demand that would be lost to cancellation of ferry travel plans during a DMA. Relevant factors include the purpose of the trip, the availability of alternative ferry origins that may not be affected by the DMA, the availability of other economically viable transport modes, and competing entertainment options.

Ferry Passengers

The estimated economic impact to fast ferry passengers of implementing Alternative 2 at 10 knots is estimated at $3.2 million. This is based on an assumed average of 90 passengers per trip incurring a delay of 1.6 hours for 92 fast ferry trips per day over 15 days and an hourly value of passenger time of $16.21. The value of time lost due to travel delays for passengers of regular ferries is estimated to be $1.3 million. This is based on the average delay of 30 minutes for 90 passengers on 118 daily trips over the 15 days of the DMA. Total impact is $4.5 million.

Whale-Watching Vessels

Under Alternative 2, the high-speed whale-watching vessels are likely to suspend operations during periods when DMAs are implemented along their route. The estimated economic impact of the suspension of five high-speed whale-watching vessels for a single 15-day DMA is $0.4 million.[6] For regular-speed whale-watching vessels, the estimated economic impact at 10 knots is $0.9 million for 13 vessels facing delays in both directions for two trips daily. Therefore, the total economic impact is $1.3 million.

5.3.5 Alternative 3: Speed Restrictions in Designated Areas

Alternative 3 is expected to impact all industries.

5.3.5.1 Estimated Direct Economic Impact

Shipping Industry

The total direct economic impact to the shipping industry due to speed restrictions in designated areas for all vessels 65 ft (19.8 m) or greater in overall length is estimated to be $142.5 million. The port area of New York/New Jersey is expected to experience the largest impact, at $39.1 million, followed by the port area of Hampton Roads, at $25.3 million.

Multi-Port Calls

As described in Section 3.4, vessels calling in at least two ports with speed restrictions bear additional impacts for a variety of reasons spelled out in the economic analysis provided along with the FEIS. SMAs included in Alternative 3 are much larger in size and encompass multiple ports simultaneously, compared with single DMAs implemented under Alternative 2. Therefore, vessels making multi-port calls will be affected under Alternative 3, whereas they would not be affected under Alternative 2. Seasonal speed restrictions under Alternative 3 include speed restrictions year-round in the Northeastern US; from October 1 through April 30 for the mid-Atlantic region; and from November 15 through April 15 for the Southeastern US.

[6] Calculated at $13,320 daily operating costs excluding fuel times 15 days for five vessels.

The analysis assumes an average additional delay of 36 minutes for each vessel arrival as part of a multi-port string to account for the various additional impacts that may occur. The economic value of this additional time has been calculated for each port area based on 2006 vessel operating costs by type and size of vessel. Additional direct economic impact of multi-port strings on the shipping industry is estimated at $11.9 million for the proposed 10-knot speed restriction.

Rerouting of Southbound Coastwise Shipping

The proposed speed restrictions included in Alternative 3 are expected to result in rerouting of southbound coastwise shipping. Speed restrictions would be in effect for a distance of 25 nm (46 km) from the entire mid-Atlantic coastline. Containerships and ro-ro cargo ships would be most affected by proposed speed restrictions. In 2003, there were 4,142 containership and ro-ro cargo ship arrivals into US East Coast port areas from Baltimore through Port Canaveral during the time when seasonal speed restrictions would be in place. Assuming half of these calls were southbound, and that the typical vessel made calls at three US East Coast ports per service, there would be about 690 southbound vessels that may choose to route outside of the seasonal speed-restricted areas rather than proceed through the restricted areas at a slower speed. Based on an increase in routing of 108 nm (200 km)[7] and an average operating speed of 20 knots, a containership would have an increased sailing time of 5.4 hours. Using an average hourly operating cost at sea of $2,000, the estimated economic impact for each southbound vessel would be $10,800. The additional economic impact for containerships for coastwise shipping under Alternative 3 is estimated at $7.5 million.

Commercial Fishing Vessels

Had the proposed seasonal speed restrictions under Alternative 3 been in place in 2003, the impact on commercial fishing vessels is estimated to be $1.1 million for the Northeast region and $580,000 for the Southeast region, for a total impact of $1.7 million.

Charter Fishing Vessels

The annual economic impact of Alternative 3 on charter fishing vessels is estimated at $1 million.

Passenger Ferries

The two fast-ferry operations from Boston to Provincetown would cease and be replaced by regular ferry service. However, overall ferry demand would diminish as passengers curtail day trips or seek alternative transport modes. It is assumed that the fast-ferry operators would either sell their vessels or deploy them on other routes. While a loss for the distressed sale of the vessels may be incurred, this would not represent a recurring annual economic impact and is not included in this assessment.

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[7] The vessels are assumed to sail at a distance of 25 nm (46 km) offshore instead of 8 nm (15 km). Based on a diagonal routing to the further offshore sailing route, an additional distance of 27 nm (50 km) is assumed per arrival and departure at the intermediate port calls.

The proposed speed restrictions for Block Island Sound are outside the peak summer season. Hence, it is assumed that the nine fast-ferry operators in this area would lose an average of 30 business days per year. The economic impact of suspending fast-ferry operations for these 30 days for these nine operators is estimated to be $7.1 million annually.

Regular ferries will incur average delays of approximately 30 minutes per trip with a speed restriction of 10 knots. As the restrictions are during the off-peak season for Block Island Sound, these delays can be absorbed in the more open ferry schedule without losing any round-trip daily service. The estimated incremental delay costs for regular-speed ferries are estimated to be about $5.9 million annually at 10 knots. The total impact of both fast- and regular- speed ferries is $13 million.

Ferry Passengers

In terms of economic impacts to ferry passengers, it is assumed that the nine fast ferry operators in the Block Island Sound area would suspend operations for 30 days per year and their passengers would divert to regular ferries. The two fast ferry operations from Boston to Provincetown would cease and be replaced by regular ferry service. The value to passengers of time lost due to travel delays is estimated to be $6.9 million. For regular speed ferries, the impact is similar to that described for Alternative 2, except that regular ferry operations are assumed to be affected for 60 days per year. The resulting economic impact on regular ferry passengers is estimated at $5.2 million. The total economic impact for ferry passengers is estimated to be $12 million.

Whale-Watching Vessels

Under Alternative 3, the year-round speed restrictions in the Northeast region and Cape Cod Bay would likely render the operation of high-speed whale-watching vessels unprofitable, causing these vessels to cease operation. As this would not be a recurring economic cost, any loss associated with the sale of vessels is not included in this economic assessment. It is very likely that regular-speed whale-watching vessels would be put into service in their place. However, demand for whale watching from locations such as Boston would diminish, as the additional time required to reach whale feeding areas would discourage some passengers. It is possible some of this demand would divert to other whale-watching operations located closer to the feeding areas.

Regular-speed whale-watching vessels would be subject to the year-round speed restrictions extending 25 nm (46 km) from the Northeast region coastline and in Cape Cod Bay. It is assumed that at 10 knots, the 13 regular-speed vessels would incur a 54-minute delay each way for two round-trips daily during a 90-day summer whale-watching period. Annual economic impacts to the whale-watching industry are estimated to be $5.6 million under the 10-knot speed restriction.

5.3.5.2 Indirect Economic Impacts of Port Diversions

Under Alternative 3, year-round speed restrictions would be established for a large area east of Massachusetts Bay and would extend through the Great South Channel critical habitat area. This speed-restricted area would significantly affect vessel traffic in the Northeast region. The delay for a containership arrival into Boston would average 149 minutes, with an additional 149 minutes delay for departure. A recurring delay of nearly five hours per call year-round would be sufficient for shippers and vessel operators to consider alternative ports, such as Halifax or Montreal, which would not be affected by this alternative action. Similarly, ports in which speed restrictions are in place for a longer duration than for other nearby ports will face diversion of vessel traffic. The indirect economic impact of port diversions is estimated to be $139.4 million at the 10-knot speed restriction.

5.3.6 Alternative 4: Recommended Shipping Routes

Alternative 4 is anticipated to impact only the commercial shipping industry.

5.3.6.1 Estimated Direct Economic Impact

The direct economic impact of the use of recommended routes implemented under Alternative 4 on the shipping industry is estimated to be about $2.8 million annually. The port area of Jacksonville is expected to experience the largest impact, at $2.3 million. The two other port areas affected under this alternative, Brunswick and Fernandina, are expected to experience economic impacts of $253,000 and $266,300 respectively.

5.3.6.2 Indirect Economic Impacts of Port Diversions

Under Alternative 4, the port areas of Brunswick and Fernandina would experience delays due to the increased distance associated with the use of recommended routes. Because of these delays, it is assumed that five percent of the containership and ro-ro cargo ship calls at these two port areas would divert to the port area of Savannah, for which no operational measures have been proposed. Some passenger cruise vessels are likely to divert to Port Canaveral for that same reason. While Alternative 4 would result in port-specific impacts, the economic impacts to the nation as a whole are expected to be negligible, since the diverted vessel calls at the Southeastern port areas of Brunswick, Fernandina and Jacksonville would be offset by the gains in vessels calling at the port areas of Savannah and Port Canaveral.

5.3.7 Alternative 5: Combination of Alternatives

Alternative 5 is expected to impact all of the industries described in Section 3.2. Because this alternative incorporates elements of Alternatives 1, 2, 3, and 4, discussion of the impacts has already been provided in greater detail earlier, and will not be repeated in this section.

5.3.7.1 Estimated Direct Economic Impact

Shipping Industry

The total direct economic impact of Alternative 5 to the shipping industry at the 10-knot speed restriction is estimated to be $147.2 million.

Multi-Port Calls

Vessels calling at two or more ports for which seasonal speed restrictions are in force face an additional source of impacts as part of Alternative 5; these impacts were described in detail in Alternative 3. The additional direct economic impact of multi-port strings on the shipping industry is estimated to be $11.9 million for the proposed 10-knot speed restriction.

Rerouting of Southbound Coastwise Shipping

As is the case for multi-port calls, the speed restriction in designated areas that is part of Alternative 5 is the primary cause of the re-routing of coastwise vessels and was described in greater detail in Alternative 3. This annual impact is estimated to be $7.6 million for the 10-knot speed restriction.

Commercial Fishing Vessels

As with Alternative 3, a speed restriction of 10 knots has an estimated impact on commercial fishing vessels of approximately $1.1 million for the Northeast region and $580,000 for the Southeast region, for a total impact of $1.7 million.

Charter Fishing Vessels

As with Alternative 3, a seasonal speed restriction is estimated to have an annual economic impact of $1 million on charter fishing vessels.

Passenger Ferries

The economic impacts to passenger ferries are comparable to those of Alternative 3, and are estimated to be approximately $13 million.

Ferry Passengers

Impacts to passengers of both fast ferries and regular speed ferries are an estimated $12 million.

Whale-Watching Vessels

As is the case for Alternative 3, regular-speed whale-watching vessels would be subject to the year-round speed restrictions extending 25 nm (46 km) from the Northeast region coastline and in Cape Cod Bay. It is assumed that at 10 knots, the 13 regular-speed vessels would incur a 54-minute delay each way for two round-trips daily during a 90-day summer whale-watching period. The estimated economic impact to regular-speed whale-watching vessels is $5.6 million annually.

5.3.7.2 Indirect Economic Impacts of Port Diversions

Under Alternative 5, the rates of diversion for the affected port areas in the Northeast and mid-Atlantic regions are similar to those under Alternative 3, except that the additional impact of DMAs and the use of recommended routes are assumed to increase the rate of diversion slightly. The indirect economic impact of port diversions is expected to be $159.6 million.

5.3.8 Alternative 6 – Proposed Action (Preferred Alternative)

Alternative 6, the proposed action, is expected to impact all of the industries described in Section 3.2. Because this alternative incorporates elements of Alternatives 1, 2, and 4, the detailed discussions of the impacts that were provided earlier will not be repeated in this section. The SMAs proposed under Alternative 6 are generally of shorter duration than those proposed under Alternative 3 and 5, with the exception of the port areas located in the Southeast (Brunswick, GA, Fernandina, FL, Jacksonville, FL, and Port Canaveral, FL). The major difference in the implementation of DMAs under Alternatives 2 and 5 and the implementation of DMAs under Alternative 6 is that under Alternative 6, compliance with speed restrictions for DMAs is voluntary. The estimates for the economic impacts under Alternative 6 are based on the assumption of 100-percent voluntary compliance for the DMAs, which will overstate impacts if there is less than full compliance with this measure. The operational measures proposed under Alternative 6 would expire five years after their date of effectiveness. The economic impacts described here are those that are likely to occur each year that the rule is in effect.

5.3.8.1 Estimated Direct Economic Impact

Shipping Industry

Direct annual economic impact to commercial shipping is estimated at $57.6 million at the 10-knot speed restriction. The following port areas may expect the greatest impact: New York/New Jersey ($11.8 million), Hampton Roads, VA ($8.6 million), Jacksonville, FL ($6.7 million), Savannah, GA ($5.4 million) and Charleston, SC ($5.0 million).

Multi-port Calls

The speed restriction in designated areas as part of Alternative 5 leads to additional impacts to vessels calling at two or more restricted ports. The sources of impacts were described more fully in Alternative 3. However, under Alternative 6, the extent of the impact is lower, given that speed restrictions are in place for a smaller portion of the year in most port areas relative to Alternatives 3 and 5. The 2004 vessel arrival database indicates the total number of multi-port-string restricted arrivals to be 5,147. The additional direct economic impact of multi-port strings on the shipping industry due to the 10-knot speed restriction is estimated at $9.4 million.

Rerouting of Southbound Coastwise Shipping

For Alternative 6, the proposed speed restrictions in the mid-Atlantic region would be implemented for a 20 nm (37 km) buffer zone radiating out from each port area north of Wilmington, NC, except for the 30-nm (56-km) rectangular SMA offshore of Block Island Sound. A continuous 20 nm (37 km) buffer would be implemented from Wilmington, NC through Savannah, GA to the northern boundary of the Southeast SMA. The additional distance incurred by southbound vessels would be 56 nm (104 km).[8] The 2003 vessel traffic database indicated that 3,688 containerships and ro-ro cargo ships would have traveled through speed-restricted US East Coast port areas ranging from Baltimore, MD through Port Canaveral, FL had the restrictions been in place. Assuming half of these calls were southbound and that the typical vessel made calls at three US East Coast ports per service, there would have been about 615 southbound vessels that were likely to route outside of the seasonal speed-restricted areas rather than proceed through the restricted areas at a lower speed. Based on an increase in routing of 56 nm (104 km) and an average operating speed of 20 knots, the containerships would have increased sailing time by 2.8 hours. Using an average hourly operating cost at sea of $2,000, the estimated economic impact for each southbound vessel would be $5,600. For 2003 and 2004, the additional economic impact for containerships for coastwise shipping under Alternative 6 is estimated at $3.4 million.

Commercial Fishing Vessels

Using 2003 data and an estimated average hourly operating cost of $300, the estimated impact at 10 knots on commercial fishing vessels under Alternative 6 is estimated to be $869,440 for the Northeast region and $440,800 for the Southeast region. The combined Northeast and Southeast regional economic impact of about $1.3 million is less than two-tenths of one percent of the US East Coast commercial fishery landings of $801 million in 2005.

Charter Fishing Vessels

It is estimated that the annual economic impact of a speed restriction of 10 knots for charter fishing vessels for Alternative 6 would be approximately $796,000.

Passenger Ferries

Under Alternative 6, speed restrictions for Cape Cod Bay are implemented from January 1 through May 15. As such, the fast-ferry service from Boston to Provincetown would remain in operation. Speed restrictions for Block Island Sound would be in force from November 1 through April 30. However, the speed-restricted area for Block Island Sound under Alternative 6

[8] Vessels calling at port areas with circular buffers will have to travel 20 nm (37 km) for a diagonal access to the port as compared to a normal distance of 10 nm (19 km) for the diagonal access. The extra distance of 10 nm (19 km) applies to each arrival and departure for a total additional distance of 20 nm (37 km). Vessels calling at port areas with a continuous buffer from the shoreline are assumed to have an additional distance of 18 nm (34 km) each way, for a total of 36 nm (67 km) for an arrival and departure. One intermediate call at each type of port area per string is assumed, for a total additional distance of 56 nm (104 km).

would not extend to the shoreline and would not impact fast-ferry operations.[9] DMAs would also be implemented under Alternative 6, and their economic impacts are estimated to be the same as they are under Alternative 2 above. The estimated economic impact on fast-ferry service under Alternative 6 is thus similar to Alternative 2, with an increment for speed restrictions on the Boston-Provincetown route from January 1 through May 15. The resulting estimated annual economic impact to high-speed ferries is $2.6 million.

For regular ferries, the economic impact for Alternative 6 is again similar to that for Alternative 2, with an increment for speed restrictions on the Boston-Provincetown route from January 1 through May 15. The estimated economic impact is $6.0 million for a 10-knot speed restriction. The combined impacts to the high-speed and regular-speed passenger ferries bring the total estimated economic impacts to $8.6 million, assuming 100 percent compliance with voluntary DMAs.

Ferry Passengers

Economic impact borne by regular-speed ferry passengers is similar to that described in Alternative 2 with an increment for speed restrictions for 30 daily trips on the Boston-Provincetown route over 15 days. The estimated economic impact on regular ferry passengers is $1.6 million. In terms of economic impacts to fast ferry passengers, the impact from the DMA component of Alternative 6 is similar to that described for Alternative 2. However, there is an additional impact of 15 days during early-May for the two fast ferries operating from Boston to Provincetown that together have 10 trips daily. The estimated economic impact on fast ferry passengers is estimated at $3.6 million. The total economic impact to ferry passengers is $5.2 million

Whale watching vessels

Under Alternative 6, speed restrictions for Cape Cod Bay are implemented from January 1 through May 15. Hence, the peak summer whale-watching season would not be affected for high-speed or regular-speed vessels. Similarly, the speed restrictions for the Off Race Point area proposed for March through April would not impact the whale-watching season. Accordingly, the economic impact of Alterative 6 is assumed to be the same as that of Alternative 2 due to the implementation of DMAs, for a total impact of $1.3 million, assuming 100 percent compliance with voluntary DMAs.

5.3.8.2 Indirect Economic Impacts of Port Diversions

Under Alternative 6, speed restrictions for both the Off Race Point area and the Great South Channel in the Northeast would be in effect during the months of March and April, causing many ships to route around this large area during that time.[10] The diversion is assumed to be 15

[9] The rectangular area proposed has its northern limits running approximately in a line from Montauk to the southwestern coast of Block Island.

[10] Speed restrictions will be in effect for other months in the Northeast region, but not for the large combined area encompassing Massachusetts Bay and the Great South Channel critical habitat area.

percent for containerships and ro-ro cargo ships during the restricted period.[11] For port areas in Block Island Sound, three percent of containerships and ro-ro cargo ships are assumed to divert to other port areas to avoid speed-restricted areas. For the affected mid-Atlantic ports, 1.5 percent of restricted-period containership and ro-ro cargo ship vessel calls are assumed to divert to other port areas.

Additional diversions away from the port area of Providence may also occur under Alternative 6. This port area has speed restrictions in effect for 181 days, as compared to 61 days for the port area of Boston. Therefore, 20 percent of the containership and ro-ro cargo ship restricted-period calls at Providence are assumed to divert to the nearby port area of Boston.

The Southeast ports of Brunswick and Fernandina are assumed to have three percent of their restricted-period arrivals of containerships and ro-ro cargo ships diverted to Savannah as the effect of the use of recommended routes creates additional delays relative to Savannah. Finally, 40 percent of the restricted-period cruise vessel calls at Jacksonville are assumed to divert to Port Canaveral, as that port would not be affected by speed restrictions or the use of recommended routes.

The indirect economic impact of port diversions is estimated to be $49.7 million for the 10-knot speed restriction. The largest negative indirect impacts are generated in the port areas of New York/New Jersey ($21.2 million), Jacksonville, FL ($15.5 million) and Hampton Roads, VA ($12.4 million). The following port areas are expected to experience a positive indirect economic impact: Port Canaveral, FL ($15.5 million) and Savannah, GA ($2.3 million).

5.4 Summary of Alternatives

This section summarizes the findings regarding the economic impact of the proposed operational measures and alternatives on US East Coast maritime activity. A tabulation of economic impacts by industry is provided in Table 5-1. Impacts for speed restrictions of 12 and 14 knots, as well as for 10 knots, are included in the table, as NMFS accepted comments on the 12- and 14-knot speed restrictions.

- Alternative 5 would have the largest estimated economic effect in terms of direct economic impact, indirect economic impact and total economic impact. Based upon the most recent available data (2004), the total economic impact of Alternative 5 at a speed restriction of 10 knots was estimated to be $360 million annually. The operational measure of speed restrictions year-round under Alternative 5 (and Alternative 3) would have substantial repercussions through the Northeast region port areas and the northern mid-Atlantic port areas. The combination of DMAs, recommended routes, and speed restrictions also contributes to the substantial total economic impact for Alternative 5.
- Alternative 3 would have the second-largest estimated annual economic impact, of $335 million annually with a speed restriction of 10 knots. The direct economic impact is

[11] For Alternative 6, speed restrictions are only in place for the months of March and April thus the 10 percent diversion only applies to vessel calls during those months.

estimated at $195 million annually while the indirect economic impact is estimated at $139 million annually.

- Alternative 6 –proposed action – would have the third-largest estimated total economic impact, at just over $137 million annually with a speed restriction of 10 knots. This is comprised of $88 million in direct economic impacts and $50 million in indirect economic impacts.
- Alternative 2 ranks fourth in terms of the largest estimated total economic impact, with an annual impact of $42 million for a speed restriction of 10 knots. This alternative would not have any indirect economic impact; vessel calls are unlikely to be diverted to Canadian ports.
- Alternative 4 would have the lowest estimated total economic impact, at $2.8 million annually. This alternative consists only of the use of recommended routes, and port areas that may incur negative indirect economic impacts were offset by port areas with gains.

5.5 Determination of Significant Regulatory Action

Executive Order 12866 defines a "significant regulatory action" as one that is likely to result in a rule that may:

1. Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local or tribal governments or communities;

2. Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

3. Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or

4. Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

Based upon the most recently available data, the annual direct and indirect economic impacts are estimated to be $137.3 million for the preferred alternative at the 10-knot speed restriction. This estimate is based on the following direct economic impacts: shipping industry vessels ($57.6 million), cumulative effect of multi-port strings ($9.4 million), rerouting of southbound coastwise shipping ($3.4 million), commercial fishing vessels ($1.3 million), charter fishing vessels ($0.8 million), passenger ferries ($8.6 million), ferry passengers ($5.2 million), whale-watching vessels ($1.3 million); it also includes the indirect economic impact of port diversions ($49.7 million). The estimated annual economic impact exceeds $100 million. Therefore, the proposed rule would be considered an economically significant regulatory action for the purposes of E.O. 12866.

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