4 ENVIRONMENTAL IMPACTS

This chapter evaluates the potential direct, indirect, and cumulative impacts of implementing the operational measures of the *North Atlantic Right Whale Ship Strike Reduction Strategy* to reduce ship strikes of North Atlantic right whales on the affected environment described in Chapter 3. This chapter compares the impact of the No Action Alternative with the impacts that would occur with implementation of any of the five action alternatives under consideration by NMFS.

4.1 Biological Impacts on the North Atlantic Right Whale

The proposed action would have major, direct, long-term, positive effects on the western population of the North Atlantic right whale. NMFS has designed the proposed operational measures to reduce the threat of ship strikes as a major cause of right whale mortality and serious injury. NMFS expects that implementation of the proposed action will result in fewer right whale deaths, and therefore, will 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, it has also been suggested that the mortality rate has increased between 1980 and 1998 to a level of 4 (±1 percent) (Kraus *et al.*, 2005). If survivorship continues to decline at current rates, the Caswell *et al*. (1999) models predict extinction in less than 200 years. By reducing the number of right whale deaths, the population growth rate would rise. In addition, if it were to rise and remain above 1.00—replacement level—the population would no longer be facing extinction in the long run.

Fujiwara and Caswell (2001) developed a model, which predicted that preventing the death of just one whale a year would 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 a year would result in an increasing population growth rate. Analysis from this model also shows that the decline in population growth rate is mainly a result of reduced survival probability rates for mother whales. The operational measures proposed for the SEUS region, the sole calving ground for right whale mothers and calves, in particular, 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, one can assume that each action alternative has some potential to prevent at least one death or serious injury a year, which would have a positive impact on the population. Preventing nonnatural mortalities will bring right whales closer to the potential

[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).

biological removal (PBR) levels for the population (Section 1.1.1), and ultimately help the population grow towards 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 1.6.1 and 1.6.2) under the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA). This reduction would have substantial to major, direct, positive, long-term effects on the right whale 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 for each alternative the potential biological impacts on the North Atlantic right whale that would result from implementing the No Action Alternative or the action alternatives. The impacts are analyzed by region (the boundaries of the regions are described in Section 1.3):

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

Note that in the following discussions of the biological impacts of the proposed operational measures by alternative, the analysis is largely qualitative in nature. At this stage of research, there are too many unknowns to be able to develop an accurate quantitative model to project the number or percentage of ship strikes the alternatives would prevent, and conversely how much this decrease in ship strikes would increase the population growth rate.[3] Among the array of data necessary to develop this model would be real time information on the exact location and number of vessels and the exact location, number, and depth of right whales in the water column, in addition to historic data. Research would also be necessary on whale behavior, including differing reactions to approaching vessels based on various activities such as feeding, mating, sleeping, and on the impact of speed on a whale's ability to avoid an oncoming vessel. NMFS plans to fund research in these areas.

Some of the criteria used to evaluate the effects of the alternatives qualitatively on the right whale population include:

- Previous right whale sighting data.
- Vessel operating speeds.
- Ability of whale to avoid a vessel.
- 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 ocean 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 precautionary measures 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 continue at the same rate, or more likely, increase with the predicted increase in commercial shipping. Applying the predictions from Caswell, Fujiwara, and Brault's modeling (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 them particularly susceptible to ship strikes. When right whales are engaged in 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. The majority (approximately 24 percent) of recorded ship strikes to large whales internationally occurred in the North Atlantic (US and Canadian waters). While this could be a function of the amount of traffic, it may also be an artifact of higher reporting rates in this region. Without new operational measures to protect the whales in this region, vessel strikes would continue and would threaten the small existing 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. Five known right whale deaths from ship strikes occurred between 1999 to 2003 alone (Cole *et al*., 2005), and ship strike mortalities continued with 2 in 2004 (right whale deaths in 2005 are currently being analyzed) (Cole *et al*., 2006). Taking no additional actions would lead to significant, direct, long-term, negative impacts in all areas of the NEUS by hindering the survival and recovery of the western population of the North Atlantic right whale. The No Action Alternative would not effectively contribute to the recovery of the North Atlantic right whale; thus it would not meet the purpose and need of the proposed action.

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; however, 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 is in conflict 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.

Despite the conservation measures currently in place under the No Action Alternative, continuing 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 (Sections 3.4.1.4).

Any vessel strike, especially those that result 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, or calves, members of the population that are 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 the western population of North Atlantic right whales. 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 within the critical habitat for calving in the SEUS 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 on pregnant females, new mothers, calves, and juveniles—each one an important contributing members to the recovery of the population.

Young whales are particularly vulnerable to ship strikes. Calves and juveniles are much more susceptible than full-size adults to serious injury or death from ship strikes; one contributing factor may be that they spend more time at the surface than adults do. Of 16 right whale mortalities by ship strike recorded between 1970 and 1999, almost one-third (31 percent or five individuals) were calves and juveniles, and three more were two years old or younger (Knowlton and Kraus, 2001). Over the same period, of 56 documented right whales seriously injured[4] by ship strikes or entanglement, more than one third were calves or juveniles (Knowlton and Kraus, 2001). Smaller whales are also more difficult to sight at sea and, therefore, to avoid. Vessels of all sizes, including smaller vessels, can seriously harm calves and juveniles. In addition, a vessel strike to a new mother leaves a calf alone, which most likely leads to the death of the calf as well. 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 100 to 200 years (Section 1.1.1).

4.1.2 Alternative 2 – 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. However, because the only operational measure proposed under Alternative 2 is the use of DMAs, this alternative is less likely to reduce ship strikes sufficiently to promote population

[4] The serious injury criteria is described in Knowlton and Kraus, 2001.

recovery than the other action alternatives. Speed restrictions associated with DMAs would be expected to reduce the severity of ship strikes, although unlike Alternatives 4, 5, and 6, this alternative does not reduce the co-occurrence of whales and vessels, except if mariners choose to route around a DMA. Furthermore, whereas the other alternatives capitalize on the known occurrence of whales at certain times of the year with SMAs, implementing DMAs only would result in less certainty that these aggregations would be sighted and protected. The probability of whales being sighted is contingent on the available resources at the time, including being available to fly aerial surveys (which are weather limited), funding, and the timing of the publication of the location of the DMA in the *Federal Register*. Therefore, any limitations in these resources could prevent or slow the sighting of whales that need protection.

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 mariner to avoid collision and reduce the severity of a ship strike, or 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 whales, when they are located within a TSS, a shipping lane, or a 30 nm port entrance zone in the MAUS, and do not appear to show evidence of continued coast-wise transit. 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). When right whale sightings trigger a DMA, the restrictions are expected to be in place for 15 days and then 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 (e.g., 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. However, the effectiveness of DMAs in protecting right whales in the NEUS is limited by an inability to locate them by aerial surveys when rough seas and extreme weather conditions prevail. Routine aerial surveys are flown over this area to locate aggregations of right whales, but the Northeast is more prone to rough sea states than the other regions. Rough sea states may inhibit the ability to see a whale at the surface, and whales below the surface may remain unseen. As a result, DMAs may not be put into effect because whales may not be spotted by an aerial survey during rough sea state conditions. In addition, whales are submerged and undetectable the majority of the time. 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 DMAs would have minor, direct, long-term, positive effects on right whales in the MAUS. Aerial surveys to identify aggregations of right whales are not conducted as frequently in the MAUS as in the NEUS and SEUS; without the ability to identify right whales 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 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 to identify aggregations of whales. Although implementing DMAs 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 because of limitations of the effectiveness of aerial surveys 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 EIS analyzes establishing ship speed restrictions of 10, 12, and 14 knots. Generally, lower speed restrictions 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 following background information on the relationship between vessel speed and the severity and occurrence of ship strikes.

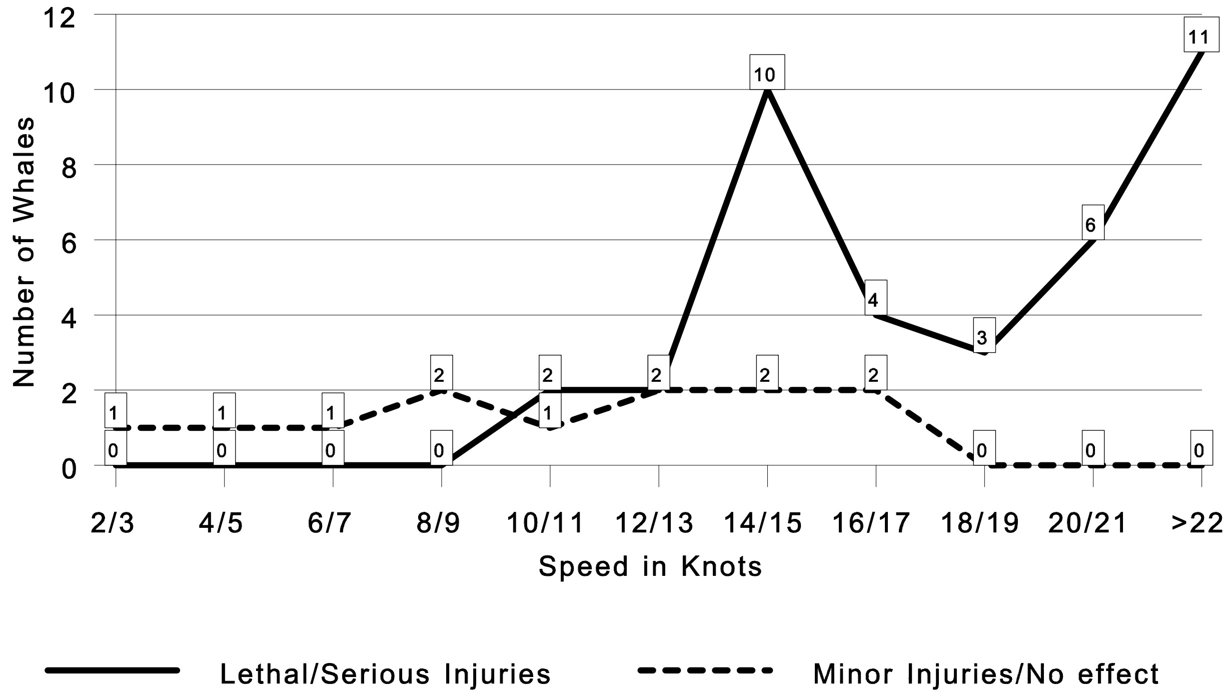
An examination of all known ship strikes indicates vessel speed is a principal factor. Records of right whale ship strikes (Knowlton and Kraus, 2001) and large whale ship strike records (Laist *et al*., 2001; Jensen and Silber, 2003) have been compiled. In assessing records in which vessel speed was 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 13 knots (Figure 4-1).

In perhaps the most complete summary to date, Jensen and Silber (2003) detailed 292 records of known or probable ship strikes of all large whale species from 1975 to 2002. In nearly 20 percent (58 cases) of the records, ship speed at the time of collision was known. Operating speeds of vessels that struck whales ranged from 2–51 knots with an average speed of 18.1 knots. The majority (79 percent) of these strikes occurred at speeds of 13 knots or greater. When the 58 reports are grouped by speed, the greatest number of vessels were traveling in the range of 13–15 knots, followed by a speed range of 16–18 knots, and 22–24 knots, respectively (Jensen and Silber, 2003).

Of the 58 cases, 19 (32.8 percent) resulted in serious injury (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) to the whale and 20 (34.5 percent) resulted in death. Therefore, in total, 39 (67.2 percent) ship strikes in which ship speed was known resulted in serious injury or death. The average 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 a whale 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. Interpretation of the logistic regression graph used to obtain these probabilities indicates that there is a 100 percent probability of serious injury or death

Vessel Speed versus Whale Injury Type[1]



Source: Laist *et al*., 2001 & Jensen and Silber, 2003 (Based on 50 Records)

Figure 4-1

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[1] Lethal Injuries = collision reports describing observation of a dead whale
Serious Injuries = collision reports citing evidence of bleeding wounds
Minor Injuries = collision reports describing a non-bleeding wounds
No Apparent Effect = collision reports noting observations of whales swimming away after a collision with no report of observed wounds

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around 25 knots and faster. In a related study, Vanderlaan and Taggart (*in review*) 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 9 knots, 80 percent at 15 knots, and 100 percent at 21 knots or greater.

Similar studies of the occurrence and severity of strikes relative to vessel speed have been reported for other species. Speed zones were adopted in Florida in the early 2000s to reduce manatee injuries resulting from collisions with boats. Laist and Shaw (2006) recently assessed the effectiveness of these speed zones at reducing watercraft-related manatee deaths. Watercraft related manatee deaths declined in the specific areas assessed in the paper, and the authors reported that this decline reflected 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). A separate study on the impact energy required to break manatee bones suggests that ship strikes can cause bone fractures that may inflict fatal injuries to manatees in a range of 13–15 miles per hour (Clifton, 2005). The boats analyzed in this research were smaller, 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 occurred in whales when the ship was within 100 yards 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 a whale is struck (Laist *et al*., 2001). A reduction in speed from 18 knots to 12 knots would give whales an additional 2.6 seconds (at a distance of 50 m) to avoid the vessel in this flight response (Laist, 2005-*unpublished data*).

Another factor in the likelihood of a vessel-whale collision related to speed is the hydrodynamic forces in play when a whale tries to avoid the vessel.[5] Knowlton et al. (1998) developed a hydrodynamic model that considered the effect of ship speeds of 10, 15, and 20 knots on a moving whale that was 3 meters 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 a passive 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. However, if a whale appears (i.e., surfaces from a dive) after this initial flow of water away from the boat, it can be drawn into the ship along the length 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).

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 because of 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

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

knots. Physical damage to vessels results in repair costs and economic loss due to lost 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 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 to 14 knots (Laist *et al*., 2001). Through interpretation of the logistic regression graph that shows the relationship between serious injury and vessel speed, there is approximately a 60 percent prediction 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 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 area used by Seasonal Area Management (SAM) zones and critical habitat as designated in the Atlantic Large Whale Take Reduction Plan (ALWTRP) (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 with regard to approaching ships and therefore 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 sighted outside of the SAM zones. Alternative 3 also does not include recommended routes[6], as with 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 does not account for two key measures (DMAs and routing measures) that provide additional protection.

4.1.3.2 MAUS

Alternative 3, which proposes speed restrictions from October 1 through April 30 off the US mid-Atlantic coast, would have direct, long-term, positive impacts on the recovery of the right whale population by reducing the number and severity of ship strikes (Section 4.1.3). This area would include 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 generate a high volume of vessel traffic. This region is also a high use are for migrating right whales, so the whales transit this region twice a year.

The speed restrictions in Alternative 3 include the entire coastline out to 25 nm (46 km), whereas Alternative 6 only proposes speed restrictions in 30-nm-wide SMAs around several important port areas. Although Alternative 3 covers a larger area than Alternative 6, 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 more than surrounding waters. In addition, data indicate that right whales often occur within 30 nm (56 km) of the coast, and Alternative 3 only extends out to 25 nm (46 km). However, Alternative 3 provides an additional month of restrictions during October, as Alternative 6 only has restrictions from November 1 through April 30. This alternative does not include DMAs to provide protection to whales sighted in the months of May to September or in waters from 25 to 200 nm. Therefore, as a stand-alone measure in the MAUS, ship speed restrictions alone 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

Alternative 3, which proposes speed restrictions from December 1 through March 31 off the SEUS, 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 right whale calving habitat. This area would include all waters within the Southeast mandatory ship reporting system (MSRS) WHALESSOUTH reporting area (described in Section 2.2.3) and the southeastern US right whale critical habitat (Figure 1-3). Reducing ship strikes in this region is particularly important because it is a calving area, and there are several busy ports in Georgia and Florida.

Alternative 3 includes speed restrictions in the MSRS WHALESSOUTH reporting area and the southeastern right whale critical habitat (Figure 1-1), whereas Alternative 6 only proposes speed restrictions within Southeast SMA (which extends just south of the MSRS area), but not in the

[6] 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 centreline buoys. The USCG adopted this term, which identifies the type of routing measure used in the alternatives. Recommended routes are essentially shipping lanes; therefore the two terms will be used synonomously throughout the EIS.

critical habitat. However, the speed restrictions proposed under Alternative 3 are only effective for four months whereas those proposed under Alternative 6 are effective for five months. The speed restrictions in Alternative 3 have advantages over Alternative 6 for the reasons previously mentioned; however, this alternative does not attempt to route ships away from high-density areas of right whales through identified shipping lanes. Therefore, Alternative 3 only addresses one mitigation measure—speed—and does not account for the distribution of whales that overlap with vessel traffic. Whales that are sighted outside of the MSRS reporting area or the critical habitat would not be protected under this alternative because DMAs are not included. As a stand-alone measure, 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 to right whales in the SEUS and NEUS regions, and direct, long-term, adverse effects on right whale in the MAUS region.

4.1.4.1 NEUS

Implementing Alternative 4 would have direct, long-term benefits to the right whale population in the NEUS region because of recommended routes, an area to be avoided (ATBA), and the proposed shift in the Boston TSS. The ATBA in the Great South Channel would route vessels (300 GRT and greater) around another important feeding ground from April 1 to July 31, and vessels under 300 GRT but 65 ft (19.8 m) or more in length would have to reduce speed through the ATBA. Also, the proposed shift in the Boston TSS (Figure 2-14) would place the TSS north of an area of known high whale density. Biologists estimate the shift of the TSS would result in at least a 58 percent reduction in the encounters between ships and right whales, thus leading to a significant reduction in the risk of ship strikes of right whales (SBNMS, *unpublished data)*. Further, narrowing the lanes from two miles to one and a half miles reduces the overlap between right whales and ships. Therefore, shifting the TSS would have a direct positive impact on the right whale population in the NEUS.

Alternative 4 proposes the use of recommended shipping routes for all vessels 65 feet and longer from January 1 to May 15. These shipping lanes would route vessels away from feeding right whale aggregations in the Cape Cod Bay Critical Habitat area, where whales are particularly vulnerable to ship strikes due to their behavior in this area. 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 proposed shipping lanes are generally consistent with current vessel traffic patterns, except for vessel traffic leaving the Cape Cod Canal en route to Provincetown, which 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.

To compare current conditions with the conditions likely to prevail if the proposed shipping lanes were implemented, researchers in the Northeast developed a risk analysis study based on right whale sightings from 1998 to 2002 and vessel traffic data in Cape Cod Bay from the USACE (Nichols and Kite-Powell, 2005). These data were entered into 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 counted as occurring when a known number of vessels passed through defined study areas of estimated right whale density. This model estimated that approximately 1.5 ship/whale encounters would occur in Cape Cod Bay annually. Next, the proposed shipping lanes in Cape Cod Bay were incorporated into the model to assess the effectiveness of the proposed routing measures at reducing the potential for ship strikes. Based on this model, Nichols and Kite-Powell projected that the proposed lanes could reduce the potential for ship/whale encounters by 45 percent, from 1.5 to 0.9 a year. The authors note that the encounter value and reduction cannot be translated directly into actual ship *strikes* because whale diving behavior and avoidance actions by whales and/or mariners were not included in the model due to a lack of data. Therefore, these values are presented for informational purposes and are most likely a conservative estimate of annual ship strikes in Cape Cod Bay, as they assume whales are at the surface and neither the ships nor the whales sought to avoid a collision.

Although implementing 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; therefore, if a vessel collided with a whale in a shipping lane, the severity of the strike would presumably be greater than if there were speed restrictions associated with the lanes as in Alternative 6. Alternative 4 also does not include the use of DMAs as an operational measure, so it does not account for right whale sightings outside designated seasons and areas. Implementing Alternative 4 as a stand-alone measure may not have the potential to reduce ship strikes enough to result in an increase in the population growth rate.

4.1.4.2 MAUS

There are no shipping lanes proposed in the approaches to mid-Atlantic ports; therefore, conditions under Alternative 4 would be the same as the no action conditions. Therefore, 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 be vulnerable to collisions with ships.

4.1.4.3 SEUS

Implementing Alternative 4 would have direct, long-term, positive effects on right whales in the SEUS region. The proposed shipping lanes in the SEUS were designed to separate vessel traffic and right whale aggregations, thus reducing vessel collisions. The lanes were identified based on the following data: (1) the approaches to pilot buoys of the three major ports in the SEUS that avoid areas with relatively high right whale occurrence and (2) right whale distribution and congregating areas around the approaches to the ports based on aerial survey data (NMFS, *unpublished data*).

Implementing Alternative 4 in the SEUS region would result in establishing shipping routes for the ports of Jacksonville and Fernandina, Florida, and Brunswick, Georgia. These ports currently have no officially designated shipping lanes; however, there are “high use” approaches to these ports, currently used by the maritime community. Traffic route patterns are derived from reports into the MSRS called in by vessels entering the MSRS reporting area from 1999 to 2001 (Ward-Geiger *et al*., 2005). The majority of traffic approaching Jacksonville enters from a southeast route, and there is also high traffic volume approaching from the northeast. Traffic patterns in Fernandina and Brunswick also exhibit heavy vessel use from the southeast to due east of the pilot Buoy (Garrison, 2005). By restricting this vessel traffic to specific lanes that avoid right whale high-use areas, the probability of vessel-whale interactions would be significantly reduced in the SEUS calving area.

A series of approach lanes into each of the ports was analyzed for a reduction in risk (of a vessel-whale interaction) based on modeled right whale density and spatial distribution, and current vessel traffic patterns (Garrison, 2005). This risk factor was measured against the “status quo” risk level for each port. One or more of these approaches with the largest reduction of risk will be established as voluntary, recommended route(s). An analysis of the routes is the subject of a Port Access Routes Study (PARS) by the USCG.

The approaches in Jacksonville that reduce the risk of a vessel-whale interaction the most enter the MSRS boundary from the southeast, and are oriented in more of an eastern direction than southern, which reduces the distance traveled through the MSRS (Figure 2-1). Concentrating traffic into these lanes (shown by green lines in Figure 2-1) is expected to reduce the likelihood of interactions by 22 to 27 percent (Garrison, 2005). These lanes are just north of the prevailing traffic patterns into Jacksonville reported to the 2000/2001 MSRS; therefore, there would not be a drastic shift in vessel traffic for vessels approaching from the south and east.

Approaches from the east-southeast into Fernandina would reduce the risk of a vessel-whale interaction (Figure 2-2). Lanes in this general area (shown by green lines) are expected to reduce the risk by 24 to 32 percent relative to the status quo. The lane with the risk reduction factor of 32 percent would provide the most protection to whales. The majority of the traffic into Fernandina during the 2000/2001 season approached from the east or northeast; therefore, the lanes that would provide higher levels of protection to right whales would also result in a significant change in existing traffic patterns.

The approaches into Brunswick with the greatest conservation value approach from due east, and would result in a reduction of risk from 10 to 16 percent (Figure 2-2). A high volume of vessel traffic approached the port from the southeast in 2000/2001, so there would be a slight shift from existing traffic patterns.

Reducing the number of vessels that transit in areas where right whales aggregate in the SEUS is important because this region is a right whale calving and nursing area. Females are a vital segment of the population. In 2004 and 2005 there have been four instances where one ship strike resulted in the death of both the pregnant female and the fetus. The death of a mother with a young calf may result in two deaths as the calf is unlikely to survive on its own. The reproductive potential of the mother for the remainder of her life is also a loss 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. Jacksonville has higher vessel traffic volumes than Brunswick or Fernandina; therefore, the proposed shipping lanes for the port of Jacksonville may be the most effective at reducing ship strikes in the area. While Alternative 4 may have an overall positive effect on the right whale population, without speed restrictions and DMAs, it may not provide sufficient protection as a stand-alone measure to effectively reduce the occurrence of ship strikes.

4.1.5 Alternative 5 – Combination of Alternatives

Implementing Alternative 5, which combines all of the measures in Alternatives 1 to 4, would have significant, direct, long-term benefits on the right whale population. This alternative combines all of the following operational measures that are being considered: continuing current measures, recommended shipping routes, shifting the Boston TSS, large-scale speed restrictions, DMAs, and the ATBA. These account for all of the measures identified in the EIS that reduce the risk or occurrence of ship strikes, and considered together, their positive impacts on the right whale population would be substantial. Routing measures would shift traffic away from areas of relatively high whale density; speed restrictions in SMAs and DMAs are expected to reduce the occurrence and perhaps the severity of a ship strike; and DMAs would provide protective measures for unpredicted whale occurrences.

Alternative 5 would provide the highest level of protection to the right whale population as the measures mentioned above cover larger areas for longer periods than the other alternatives. This alternative would significantly reduce the amount and/or severity of ship strikes. If deaths and serious injuries are reduced, a higher probability exists that the population growth rate would increase. An increase in the population growth rate would increase the number of whales in the population, which would bring them closer to recovery and farther from extinction.

4.1.5.1 NEUS

Implementing 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 behaviors that may reduce their awareness of certain threats and increase their susceptibility to ship strike. 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). Implementing the combination of the operational measures 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. Refer to Alternative 2 (Section 4.1.2.1), Alternative 3 (Section 4.1.3.1), and Alternative 4 (Section 4.1.4.1) for a discussion of the conservation value of the individual measures that are combined in Alternative 5. These measures would reduce the occurrence and/or severity of ship strike, which would help the population to recover to a sustainable population size. Both males and females utilize these feeding grounds from winter to fall. Fortunately, for both vessel operators and whales, the peak shipping season does not correspond with the peak feeding season. Based on the vessel arrival data from 2004, only 17 percent of vessel arrivals in the NEUS would have occurred during a time when a SMA was implemented.

DMAs would provide measures to protect right whales if they are sighted outside of the periods and 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 proposed for the entire Gulf of

Maine, which has additional operational measures only in the southern boundary of the region, off the coast of Massachusetts. Therefore, DMAs are the only operational measures in the unregulated waters north of Massachusetts.

4.1.5.2 MAUS

Implementing 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 would reduce the risk of ship strikes and facilitate population recovery. The Alternative 5 measure likely to be the most beneficial to whales migrating through the MAUS would be speed restrictions from October 1 to April 30, extending out to 25 nm (46.3 km). The majority of right whale sightings occur within 30 nm 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 speeds 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. The MAUS had more vessel traffic (49 percent) arriving during proposed restricted periods in 2004 than either the NEUS or SEUS. Almost half the vessels arriving at MAUS ports throughout the year would transit through the MAUS coastal areas when the whales are present.

Implementing DMAs in the MAUS would benefit right whales in times when seasonal speed restrictions along the mid-Atlantic coast (out to 25 nm) were not in place and if right whales were to occur outside of this area. As of the spring 2006 migration, there were no systematic aerial surveys taking place in the entire MAUS. For DMAs to be effective in this region, there would need to be an increase in survey effort. Without the ability to identify right whales that might trigger DMAs, this operational measure might not prove effective as a management measure.

4.1.5.3 SEUS

Implementing Alternative 5 would have major, direct, long-term, positive effects on right whales by providing protections in their only known calving and nursery area. As previously mentioned (Section 4.1.4.3), females and their calves are two vital segments of the population to protect. Saving 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).

Alternative 5 proposes seasonal speed restrictions in the Southeast MSRS WHALESOUTH reporting area and in the southeastern US critical habitat. These speed restrictions would reduce the number and severity of ship strikes to females and calves in the SEUS. The proposed shipping lanes into the ports of Brunswick, Fernandina, and Jacksonville were designed to shift vessel traffic away from areas where right whales typically aggregate. Approximately one-third of vessel arrivals in southeastern ports in 2004 occurred during the peak right whale migration time (Nov.15–Apr.15), demonstrating the importance of regulations in this region. Therefore, implementing measures to reduce ship speeds and the confluence of whales and ships would reduce the risk of ship strikes and lead to an increase in the survival rate of females and calves.

Implementing DMAs in the SEUS would have direct, long-term, positive impacts on right whales. DMAs provide temporary measures to protect right whales when they are sighted outside of the times for or locations of seasonal restrictions and shipping lanes. DMAs are of particular importance in the SEUS with respect to protecting whales that occur around the approaches to or in the vicinity of Port Canaveral, which is south of the Southeast MSRS and critical habitat, and does not have seasonal speed restrictions.

4.1.6 Alternative 6 (Preferred) – Right Whale Ship Strike Reduction Strategy

Implementing Alternative 6, the preferred alternative, would have major, direct, long-term, positive impacts on the North Atlantic right whale population. DMAs are proposed for all areas in Alternative 6, so the effects of this operational measure are discussed in this introduction rather than repeated for each of the three regions. Restrictions would be imposed on mariners when whales are sighted in an area or time period not covered by seasonal restrictions. Requiring 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 discussed in Section 4.1.2.

The benefits of ship speed restrictions are similar for all areas where they are proposed (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 higher 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 (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, long-term, positive effects on the western population of North Atlantic right whales in the NEUS. This section describes the benefits of Alternative 6 to right whales in each of their critical habitats in the NEUS, as defined in Chapter 2.

Cape Cod Bay

In the Cape Cod Bay area, implementing the recommended shipping routes to and from the Cape Cod Canal, Boston, and Provincetown would minimize the risk of ships striking whales because the newly defined routes would minimize ship traffic in whale high-use areas. In addition, a speed restriction of 10, 12, or 14 knots throughout the Cape Cod Bay SMA would incrementally lessen the severity and occurrence of ship striks. Reduction of ship strikes in the Cape Cod Bay area would contribute substantially to population recovery.

Off Race Point

Implementing Alternative 6 would result in 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 vessel traffic through it. A speed restriction of 10, 12, or 14 knots would facilitate the sighting of right whales, 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 rectangular area for feeding, and it is significantly less likely that a ship would strike a right whale outside that area.

Great South Channel

Implementation of the proposed operational measures for the Great South Channel under Alternative 6 would significantly reduce the threat of ship strikes to feeding and socializing right whales. Large aggregations of right whales are sighted annually in this important feeding habitat, which is also designated critical habitat. Right whales in the Great South Channel management area and critical habitat would experience major positive effects because all vessels 65 feet and greater would adhere to speed restrictions. Data strongly suggest that vessels traveling under 14 knots are less likely to seriously injure or kill whales during a collision than those traveling 14 knots or faster (Laist *et al*., 2001; Pace and Silber, 2005).

Gulf of Maine

It is anticipated that the proposed DMAs would have a positive impact on the North Atlantic right whale population because restrictions would be imposed on mariners when whales are sighted in the area. DMAs provide measures to protect right whales if they are sighted outside of the timeframes of seasonal restrictions or outside the geographical boundaries of management areas, shipping lanes, or critical habitat. This measure is particularly important in the Gulf of Maine because DMAs are the only operational measure in this area. The Gulf of Maine includes all US waters north of other management areas for Cape Cod Bay, Off Race Point, and Great South Channel. Route diversions around the DMA and speed restrictions through the precautionary area would reduce the threat of ship strikes for the reasons previously cited in Section 4.1.2. The protective measures provided by a DMA would reduce the risk of ship strikes in the Gulf of Maine, 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 would be 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

Alternative 6 would have major, direct, long-term, positive effects on the western population of the North Atlantic right whale in the MAUS. 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 (10, 12, or 14 knots) in SMAs off several ports in the region (see Table 2-1). The speed restrictions would be in place from November 1 through April 30 to encompass the period when the whales, both northbound and southbound, would typically migrate through the mid-Atlantic corridor. These restrictions would cover waters in a 30 nm radius from each port area (except for Block Island Sound), which corresponds to the area where almost 95 percent of all whale sightings occur (Knowlton *et al.*, 2002). Implementation of speed restrictions would lessen hydrodynamic forces surrounding the vessel that tend to draw whales toward the hull, increase the opportunity for a whale to be sighted, and might allow the ship time to divert its path to avoid it, or reduce the severity if a strike does occur.

Speed restrictions in the MAUS are vital to reducing the probability of ship strikes because this region has the highest amount 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 would have major, direct, long-term, 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 adults because they spend more time at the surface and because the calf is not yet an accomplished swimmer. This calving area is highly important for 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, new recommended shipping routes near Jacksonville and Fernandina, Florida, and Brunswick, Georgia, would be established to minimize the extent of the critical habitat and migratory corridor which ships traverse. By limiting ship travel to specific shipping lanes into these ports, the probability of ships striking whales would be lowered. The proposed 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 decreasing the concentration of ship traffic in the whales’ critical habitat and migratory corridor, especially critical in this calving area for pregnant females, mothers, juveniles, and calves.

Implementation of speed restrictions throughout the Southeast SMA and the recommended routes within the SMA would also help prevent ship strikes. The SEUS region has the second highest amount 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. Data suggest that vessels traveling under 14 knots are less likely to seriously injure or kill whales in a collision than those traveling 14 knots and greater (Laist *et al.*, 2001; Pace and Silber, 2005). Also, whales would have additional time to avoid a vessel collision in a last-second flight response (Section 4.1.3).

The speed restrictions in the SEUS would be seasonal (November 15 to April 15) to correspond with the calving season, which is concentrated December through March.

Implementation of this group of operational measures in the SEUS would likely reduce the number of ship strikes and allow more pregnant females, mothers, juveniles, and calves to survive. Their survival would contribute positively to the population's status and likely result in population growth if operational measures in other geographic areas were implemented as well. A reduction in the chance of a ship strike in the SEUS would have a major positive, long-term impact on the recovery of the western stock of North Atlantic right whale.

4.2 Impacts on Other Marine Species

This section discusses the potential impacts of the implementation of the alternatives on living marine resources other than the western stock of the North Atlantic right whale. 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 is no evidence of regular vessel strikes to this taxonomic group. Like seabirds, fish are capable of avoiding oncoming vessels, and there is no evidence of a threat of vessel strikes to this type of animal.

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 other marine mammals as well as on North Atlantic right whales. Ship strikes also pose a threat to other large whales in the western North Atlantic (see Section 3.2.1). Fin, humpback, and sperm whales are the endangered species occurring in or near North Atlantic right whale habitat that are most susceptible to ship strikes among large whales. 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

Like whales, sea turtles are subject to ship strikes (Section 3.2.2). Alternative 1, the No Action Alternative, would have indirect, long term, negative impacts on sea turtles because the number of vessel strikes of sea turtles along the US East Coast would not be reduced. Ship strikes would be expected to continue at the current rate, causing continued injury and death. Data are unavailable with respect to which of the five species of sea turtles occurring in or near North Atlantic right whale habitat are more susceptible to ship strikes than the other.

4.2.2 Alternative 2 – Dynamic Management Areas

4.2.2.1 Other Marine Mammals

Because DMAs are specifically based on sightings of right whale aggregations, implementation of a DMA would not significantly benefit other marine mammals, unless they occur within the waters of a DMA. As Alternative 2 does not target other marine mammals that occur in right whale habitat, it 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. Boats would either route around this area or transit at a specific speed through the area, reducing the potential for a vessel collision with right whales. The chances of sea turtles occurring in these waters when a DMA is implemented are low; therefore, any benefit would be minimal.

4.2.3 Alternative 3 – Speed Restrictions in Designated Areas

4.2.3.1 Other Marine Mammals

Alternative 3 would have minor, indirect, long-term positive effects on other marine mammals. Reduced vessel speeds would provide protection for other species whose habitats overlap with right whales. Humpback, fin, and sperm whales are at risk of ship strikes and share similar habitat; therefore, speed reduction measures could also reduce ship strikes to other species of whales to the extent that they are found in the speed-restricted areas. Speed restrictions are protective because they may result in weaker hydrodynamic forces that pull animals toward vessels. Speed restrictions also increase the probability of sightings by the mariners and give animals and mariners more time to avoid interaction. The Off Race Point SAM zone as designated by the ALWTRP and proposed as a potential area for speed restrictions in Alternative 3 would have a positive effect on humpback, fin, and sei whales, which are sighted more in the Off Race Point area than in Cape Cod Bay. Slowing ships down would result in a lower occurrence of ship strikes and fewer fatal collisions. In 41 records of ship strikes where speed at the time of impact was known, no ship strikes were recorded below 10 knots and only 11 percent of ship strikes resulted in lethal or severe injuries when vessels were moving at 10 to 14 knots (Laist *et al*., 2001).

4.2.3.2 Sea Turtles

Speed restrictions would have minor, indirect, long-term, positive effects on sea turtles if they happen to occur in the designated speed restricted areas and are threatened with being struck by a ship. The factors influencing fewer serious injuries and deaths of right whales at lower speeds may have the same role in aiding turtles (Section 4.1.3). Therefore, the severity and occurrence of vessel collisions with sea turtles would likely be reduced.

4.2.4 Alternative 4 – Recommended Shipping Routes

4.2.4.1 Other Marine Mammals

Implementation of Alternative 4 could have minor, indirect, long-term, positive impacts on other marine mammals to the extent that their habitat overlaps with the occurrence of right whales in or around the lanes. Humpback, fin, sperm, and sei whales could potentially benefit from the implementation of shipping lanes. Recommended shipping routes and the ATBA redistribute ship traffic to avoid right whale aggregation areas. However, because these measures are specifically targeted toward reducing the risk to right whales, benefits would be less likely for other species.

If the proposed shift in the Boston TSS (Figure 2-15) were implemented, there would be indirect, long-term, positive impacts on humpback, fin, and sei whales, which are known to occur in this area based on thousands of observations of these species in the current TSS from whale watching platforms from 1979–2002. The proposed change in the TSS would shift the shipping lane north of an area that has a high density of whale sightings. The shift would result in an 81 percent[7] reduction of ships encountering other large whales. The ecological basis for the difference in whale densities is primarily due to the difference of substrate of this area. The substrate under the current TSS consists of a large percentage of sand, which supports the preferred forage species of these whales. The substrate on the seafloor of the proposed TSS consists of a large percentage of gravel and a lower percentage of sand, therefore reducing the availability of food in the proposed TSS and the occurrence of whales feeding in this area (SBNMS, *unpublished data*; Merrick, 2005). Further, narrowing the lanes reduces the overlap between large whales and ships. Therefore, the proposed changes to the TSS would result in a higher reduction in the probability of ship strikes of humpback, fin, minke, and sei whales than the recommended routes and the ATBA.

4.2.4.2 Sea Turtles

Implementation of the recommended shipping routes, TSS, and ATBA, included in Alternative 4 would have a minor, indirect, long-term, positive effect on sea turtles that also occur in these areas.

4.2.5 Alternative 5 – Combination of Alternatives

4.2.5.1 Other Marine Mammals

Implementation of Alternative 5 would have major, indirect, long-term, positive effects on other marine mammals because it proposes broad spatial and temporal 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. Given that other marine mammals occur in right whale habitat, these measures would have some degree of positive effect on other species. As mentioned in Section 4.2.4.1, the shift in the TSS would have an indirect significant positive effect on other species of large whales that occur in these waters.

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, each reducing one factor of the risk of ship strike. Therefore, the combination of the same measures under Alternative 5 would

[7] This number also includes minke whale sightings.

potentially benefit endangered sea turtle species that have similar geographical ranges to right whales.

4.2.6 Alternative 6 (Preferred) – Right Whale Ship Strike Reduction Strategy

4.2.6.1 Other Marine Mammals

Alternative 6, the preferred alternative, would have indirect, long-term, positive effects on other marine mammals because it includes the following mitigation measures: speed restrictions, routing measures, and DMAs. Endangered fin and humpback whales would benefit the most from the implementation of the strategy's operational measures because they are the most commonly struck large whale species that occur in the western North Atlantic.

4.2.6.2 Sea Turtles

As with Alternative 5, implementing the operational measures contained in Alternative 6 could potentially have indirect, long-term, positive effects on sea turtles. 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, Alternative 6 would provide some level of protection to sea turtles that occur within the SMAs and DMAs in this alternative.

4.3 Impacts on the Physical Environment

The following sections describe the impacts of the alternatives on bathymetry and substrate, water quality, air quality, and ocean noise. The 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 specific to vessel class and engine type. Different types of vessels generate varying noise levels at certain speeds. Also, even if the total energy (or sound) emitted is lower due to slower speeds, the vessels are transiting the ocean for a longer period of time, therefore there may be a greater overall input of energy into the ocean. It would be difficult to accurately test this assumption until after the measures are implemented, so until that time the impacts on ocean noise are reasonable expectations within the context of the assumption.

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 and currents 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 increase in commercial shipping in the future. Under the No Action Alternative, the minor, positive improvements in air quality that would accrue from reductions in ship speed in specified areas (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 have any effect on ocean noise levels. Further, most future research techniques or technological aides to prevent ship strikes are unlikely to generate significant negative environmental impacts on ocean noise levels. However, if technology developed in the future utilizes active sonar or otherwise creates noise in order 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 – 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 the right whale conservation measures 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. The majority of right whales are found within 30 nm (55.6 km) of the coast (Knowlton *et al*., 2002). Therefore, most DMAs would be implemented within US territorial waters where vessels are prohibited from dumping untreated wastes that 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 [44.5 km] from the coastline). Also supporting the likelihood that implementing DMAs would have little to no impact on water quality are that vessels would have been in the same general area with or without the DMA; the small area of DMAs (15 nm [27.8

km]); the temporary nature of these restrictions (15 days); and the minimal change in vessel operations and/or routes.

While creation of a DMA might result in vessels leaving US territorial seas to route around a DMA, the presence of the DMA does not affect the likelihood that the vessel captain would dump wastes 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 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 of wastes beyond territorial waters and the contiguous zone (24 nm [44.5 km]) if a DMA extended outside the limits. Beyond 24 nm (44.5 km), ships can discharge blackwater (sewage) and graywater (nonsewage 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; however, discharge of these wastes is regulated (Section 3.3.2.3) (NPS, 2003).

Certain types of solid wastes may be disposed of outside of 12 nm (22.2 km) (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 triggered, 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 US 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. 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 on-going pollution prevention program in Los Angeles, California, is demonstrating that slowing vessels down reduces the amount of certain pollutants emitted during vessels operations. The Port of Los Angeles and the No Net Increase Task Force compiled a document that reviews initiatives and technologies to achieve no net increase in 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 NO_x emissions would be 57.6 percent for the main engine, although the auxiliary engine emissions are estimated to increase (6.7 percent). The reduction for PM_{10} would be 57 percent for the main engine, and an increase again for the auxiliary engine by 8.1 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 1.1 tons, 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. In an EIS prepared by the National Park Service (NPS) on cruise ship quotas and operating requirements in Glacier Bay, Alaska, a study (*Underwater Noise Interim Report*), is cited which found that 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 Seasonal Area Management [SAM] East zone, the MAUS speed restricted area, and the Southeast restricted waters, most of the speed restrictions 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 slightly longer amounts of 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 because 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 of time, 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 against existing ambient air quality levels (NPS, 2003).

4.3.3.4 Ocean Noise

Implementing the 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 slower speeds. Noise levels would be reduced in the NEUS year round, and temporarily in the MAUS from October 1 to April 30, and in the SEUS from December 1 through March 31.

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 less. 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 the louder noise generated at a higher speed radiates farther (NPS, 2003). Reduced speeds would directly benefit right whales (as well as other marine mammals) because quieter conditions would result in a reduction in masking.

Masking (described in Section 3.1.6.2) can interfere with right whales' ability to communicate and may even result in avoiding areas with high levels of ambient noise.

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 current, widely distributed 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. Furthermore, the PARS will identify navigational hazards, if any, and mariners use nautical charts that identify any such features. Restricting travel through the ATBA and shifting the Boston TSS would have no effect on the water column, ocean bottom features, or sediments.

4.3.4.2 Water Quality

Implementing Alternative 4 would have negligible impacts on water quality with the exception of the shipping routes outside 12 - 24 nm proposed for the ports of Jacksonville, Fernandina, and Brunswick where minor adverse impacts could potentially occur. 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 proposed 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/leads and toxic substances collecting in right whale tissues. Increased levels of contaminants can have a direct effect on cetacean physiological systems, including reproduction, immune defense, endocrine system, 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 entail the presence of pollutants in right whale prey. However, the recommended shipping routes would be located to avoid areas where right whales congregate, and this would 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 bioaccumulate 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 other vessels and the USCG reviewed the lanes for navigational safety through the PARS.

NEUS

Existing vessel traffic patterns in Cape Cod Bay would be altered[8] as a result of the recommended shipping routes that would officially concentrate vessel traffic inside the lane from January 1 to May 15. However, the proposed lanes are within the territorial sea (12 nm [22 km]) where Federal law regulates the discharge of sewage and other waste into the ocean (Section 3.3.2.3). Therefore, the discharge of untreated wastes in the shipping lanes in the Cape Cod Bay is prohibited, and there would be no adverse effects on water quality in the NEUS region.

Shifting the Boston TSS would have a negligible effect on water quality outside the territorial sea. A 12 degree northern rotation in the Boston TSS would add 3.75 nm (6.9 km) to the trip for vessels traveling to or from points south in the TSS (Figure 4-2) (Wiley, 2005 –*unpublished data*). This segment of the current TSS is completely within the contiguous zone and lies almost entirely within the territorial sea, where there are strict regulations on ocean dumping. The proposed shift would result 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 it, only a small section of the TSS would be affected. This alternative is not expected to change the number of vessels that use these lanes and would add only minutes to the trip. Furthermore, this shift would route vessels away from an area where whales are sighted frequently; therefore, any potential increase in pollution would be removed from high-density areas of whales.

SEUS

Implementing Alternative 4 could potentially have minimal, direct, short-term, adverse effects on water quality in the approaches to the ports of Brunswick or Fernandina. There is potential for a temporary increase in the concentration of pollution in portions of the recommended routes seaward of waters with pollution restrictions, (beyond 12-24 nm [22-44 km]) where pollution regulations are less stringent than in waters inshore of these limits. This would result from higher vessel traffic in the lanes between November 15 and April 15, when seasonal restrictions are in place. Although the shipping lanes would concentrate vessel traffic, it is unlikely that mariners would intentionally release waste in the lanes instead of other places and time during their voyage. As with proposed shipping lanes in Cape Cod Bay, the lanes in the SEUS were designed to avoid areas of high right whale density, therefore 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 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 (Section 3.3.3.3) would influence the transport and dispersion of emissions.

[8] Northbound traffic enroute to Boston, Gulf of Maine or Canada would be shifted west, along with southbound traffic travelling to the Cape Cod Canal, and vessels enroute to or from Provincetown would be routed north-by-northwest then southeast (Russel *et al*., 2005)

Any increase in emission concentrations resulting from nearby ships would last only a few minutes either until the ship moves away or as 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 other ships. 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 because vessels are no longer moving and there is additional machinery that can pollute the air. The ATBA in the Great South Channel and the Boston TSS would not affect air quality either; these measures would merely redistribute emissions during the operational season (January 1 to April 30).

4.3.4.4 Ocean Noise

Implementing Alternative 4 would potentially have minimal, direct, short-term, adverse effects on ambient ocean noise levels in the proposed shipping lanes, but would have minor, positive, short-term, direct effects on ocean noise levels outside the shipping lanes where the vessels now transit in a more dispersed pattern. While this alternative would not alter the amount of noise, vessels would be concentrated in shipping lanes, which would redistribute the vessel noise into shipping lanes. This has the potential to temporarily increase ambient ocean noise levels within these shipping lanes. Conversely, this alternative would decrease ambient noise levels outside of the shipping lanes, where the whales are present. Therefore, this alternative would benefit right whales, because the majority of right whale sightings occur outside of the shipping lanes, where ambient noise levels would decrease. A decrease in ambient noise would lessen the effects of masking on right whale communication. The ATBA in the Great South Channel and the Boston TSS would not affect levels of ocean noise; these measures would merely temporarily redistribute vessel noise.

4.3.5 Alternative 5 – Combination of Measures

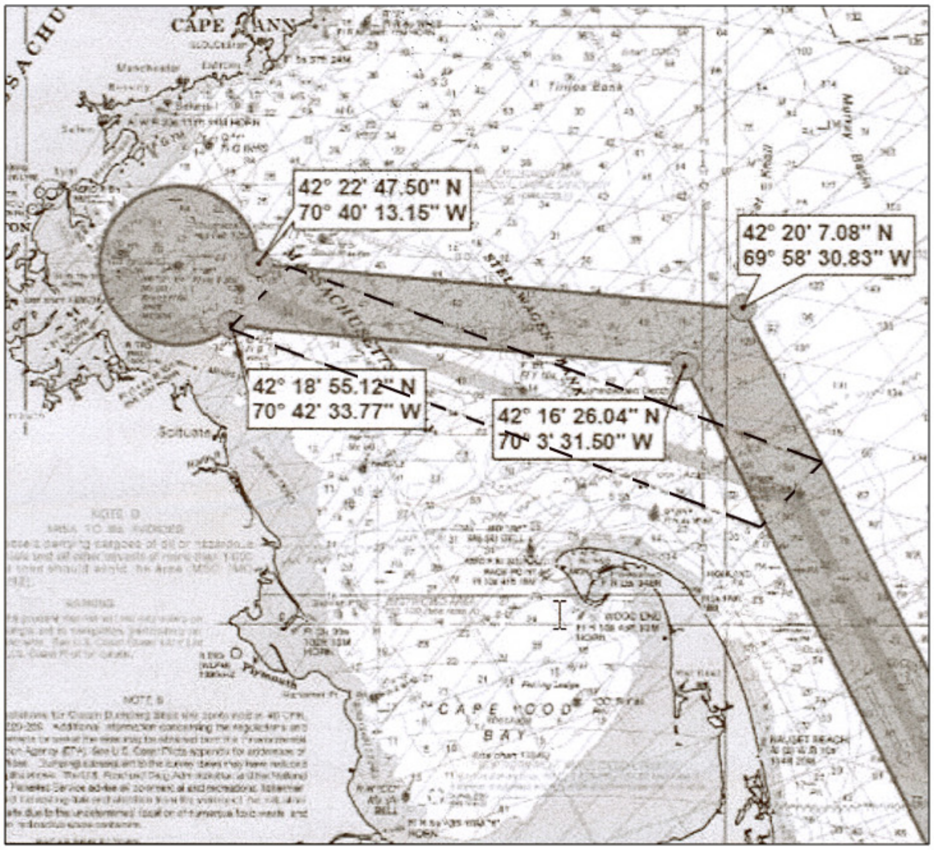
4.3.5.1 Bathymetry and Substrate

Alternative 5, which combines the measures from Alternative 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

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 (22.2 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

The Current and Proposed Traffic Separation Scheme
in the Approach to Boston*



**Note: The current TSS is depicted with dashed lines and the proposed TSS is shaded. Coordinates identify endpoints for the proposed TSS.*	**Figure 4-2**

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 designated lanes, the number of vessels transiting the area is not changing, therefore there would be no net increase in pollutants—only the distribution of pollutants 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 their habitat. Section 4.3.4.2 describes the impacts on plant and animal life from decreased water quality.

Existing regulations, DMAs, and speed restrictions would have a negligible impact on water quality for the reasons described under Alternative 1, 2, and 3. The recommended shipping routes in Cape Cod Bay are within the 12 nm (22 km) territorial sea; 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, since Alternative 5 would result in speed restrictions within the shipping lanes in the SEUS, and research shows that slowing vessels can reduce emissions from certain vessel types, the reduced emissions at slower speeds may counter the increase in concentration of emissions in the lanes (Section 4.3.2.3).

4.3.5.4 Ocean Noise

On balance, implementing Alternative 5 would potentially have minimal, direct, long-term, slightly positive effects on ocean noise levels. Alternative 2 would have no impact or a slight positive impact on noise levels. Alternative 3 would have a positive effect by reducing noise levels, potentially canceling out the minor adverse effect of Alternative 4. Any changes in ocean noise levels resulting from implementing Alternative 5 would be minor.

4.3.6 Alternative 6 (Preferred) –Right Whale Ship Strike Reduction Strategy

4.3.6.1 Bathymetry and Substrate

Alternative 6 contains the operational measures described in NOAA’s right whale ship strike reduction strategy. These measures include DMAs, speed restrictions in the Great South Channel, Off Race Point, and Cape Cod Bay management areas, recommended shipping routes in the NEUS and SEUS with uniform speed restriction, and SMAs 30 nm (56 km) around ports in the mid-Atlantic. Implementing Alternative 6 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 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 designated lanes, the number of vessels transiting the area is not changing, therefore there would be no net increase in pollutants—only the distribution of pollutants 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 their habitat. Section 4.3.4.2 describes the impacts on plant and animal life from decreased water quality.

Existing regulations, DMAs, and speed restrictions would not have a measurable impact on water quality for the aforementioned reasons in Alternatives 1–3. The recommended shipping routes in Cape Cod Bay are within the 12 nm (22 km) territorial sea; 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, long-term, positive impacts on air quality in the vicinity of the proposed SMAs, DMAs, critical habitat, and shipping lanes by slowing vessel speeds, thus reducing vessel air emissions. 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 the 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. Some of these adverse effects could be mitigated by engine modifications.

4.3.6.4 Ocean Noise

Implementing Alternative 6 would potentially lower noise levels in areas where ship speeds would be reduced resulting in minor, direct, long-term, positive impacts on ocean noise levels in the affected areas. The SMAs proposed in 30-nm (56 km) buffers around ports in the MAUS would have a direct positive effect on ocean noise. Vessels would slow to 10-, 12-, or 14-knot speeds in these buffer zones around the port areas, effectively reducing the amount of noise generated. SMAs would not concentrate ships into lanes so that ship noise would remain widely distributed but lower in volume. Although reduced speeds would increase the amount of time vessels are transiting in SMAs, the magnitude of underwater noise at any one point would be less.

As described in Section 4.3.2.4, DMAs would not have an effect on levels of ocean noise. Vessels 65 feet and greater would reduce speed through the Great South Channel management area and critical habitat, which would reduce levels of ocean noise in these areas.

Alternative 6 would result in ocean 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 these lanes as well, the overall level of noise would be reduced because slower speeds generate less noise. Alternative 6 would also reduce noise levels in areas outside of the shipping lanes where the vessels previously transited. Furthermore, noise would be substantially reduced in areas outside the shipping lanes, where right whale sightings are more dense.

4.4 Impacts on the Socioeconomic Environment

Section 4.4 describes the potential impacts of the alternatives on the maritime community, including port areas and vessel operations, and 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 impacts in this section are focused 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 on the shipping industry due to vessels that make two to three stops along the East Coast in one trip, and vessels involved in coastwise shipping. Only alternatives 3, 5, and 6 would affect these multi-port vessel strings; alternatives 2 and 4 do not result in additional direct impacts on the operations of these vessels.

Section 4.4.3 describes any indirect impacts resulting from the alternatives. Potential indirect impacts include 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 4.4.8 describe the impacts on commercial fishing vessels, passenger vessels, whale watching vessels, charter vessels, and environmental justice communities, respectively.

As stated in Chapters 2 and 3, this DEIS analyzes three alternative speeds: 10, 12, and 14 knots. As 12 knots is in the middle of this range, it is used as the base case scenario for impacts in this Section. Therefore, all economic impacts reflect a 12-knot speed restriction unless otherwise stated. Generally, the total impacts at 10 and 14 knots are also provided in the discussion for each alternative, and then the 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 4.4.7.7.

4.4.1 Direct Impacts on Port Areas and Vessel Operations

4.4.1.1 Alternative 1 – No Action Alternative

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

The No Action Alternative would not have any impact on port operations in any of the three regions. The MSRS and local notice to mariners are the only existing operational measures that are port-related; however, they have no economic or other impacts on port operations. Although reporting is mandatory, compliance with speed advisories under the MSRS is voluntary, and the announcements broadcasted via the local notice to mariners are used at the mariner's discretion.

4.4.1.2 Alternative 2 – Dynamic Management Areas

Alternative 2 would have a direct negative economic impact on vessel operations, estimated at $9.8 million in 2003 and $10.8 million in 2004. The triggers for a DMA and the resulting precautionary area are described in Section 2.2.2. DMAs would be implemented at any time of the year depending on whale sightings. Assumptions were made to estimate the number of days per year that DMAs would be effective in each port area based on research conducted on the frequency, timing, and location of whale sightings. The following two paragraphs explain the research on which these assumptions are based.

A report written by Russell *et al*. (2005) estimated the annual expected duration of DMAs in the Northeast region and the Block Island Sound portions of the mid-Atlantic region.[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, the incidences of DMAs contained in the report are only those that would occur outside of proposed SMAs. For the southern Gulf of Maine, the report estimated an average of 2.3 DMAs per year. The economic analysis for this EIS rounded this estimate up to an expected incidence of three DMAs per year (45 effective days) outside of the assumed speed restriction periods. It was also assumed that DMAs would be implemented for 50 percent of the time that speed restrictions are proposed for the Boston shipping lanes near Race Point (April 1–May 15), or an additional 23 days.

One might assume that DMAs would be effective for 100 percent of the proposed speed restriction periods; however, the location specific nature of the DMAs means that some DMAs that would have been implemented during periods with seasonal speed restriction would not fall within normal shipping lanes. Recent research on right whale sightings from 1978 through 2003 shows that many of the sightings after May appear to be more centrally located within the Great

[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-July 31; Cape Cod Bay critical habitat, January 1-April 30; portion of Boston shipping lanes near Race Point, April 1-May 15; offshore approaches to Block Island Sound, September-October and February-April; approaches to the ports of NY/NJ, September-October and February-April.

South Channel critical habitat and would be west of normal shipping lanes (Merrick, 2005). Hence, as can be seen in Table 4-1, the economic impact analysis assumes 68 effective days per year for DMAs in the Northeast region (excluding Cape Cod Bay).

Table 4-1
Effective DMA Days by Port Area

Port Area	Effective DMA Days
NEUS – (except Cape Cod Bay)	68
NEUS – Cape Cod Bay	105
MAUS (except Savannah, GA)	15
SEUS and Savannah, GA	75

Source: Nathan and Associates

For Cape Cod Bay in the NEUS region, the abovementioned report shows an average of 0.8 DMAs per year for Cape Cod Bay outside of the seasonal ATBA period of January 1–April 30. This number has been rounded up to one per year (15 days). Due to the concentration of right whale sightings in Cape Cod Bay, it is assumed that DMAs would have also been implemented for 75 percent of the seasonal ATBA that would affect shipping lanes, or an additional 90 days of effective DMAs. Hence 105 effective DMA days have been assumed for Cape Cod Bay.

For the MAUS region, a report by Knowlton *et al*. (2002) provides information on the spatial and temporal distribution of right whale sightings. Data from 1970 through 2002 were used for this 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, one DMA period per year (15 days) is assumed for each port in the mid-Atlantic region (except for Savannah). For Savannah, 75 days per year are assumed as specified in the following discussion of the Southeast region.

For the SEUS region, a recent NMFS internal draft report was utilized to identify the incidence of DMAs in shipping lanes. The report uses data on right whale sightings from 1992–2001. The concentration of right whale sightings appears consistent with the proposed seasonal speed restriction period of November 15–April 15. As previously discussed for the NEUS region, not all DMAs implemented in the region will affect the shipping lanes into Southeast ports. For the Southeast region and Savannah, it is assumed that DMAs would be implemented for 50 percent of proposed seasonal speed restriction period or 75 days per year.

Alternative 2 would not have adverse effects on port operations because there are no permanent locations for DMA restrictions, and this particular measure is not aimed specifically at reducing risk in port areas. There is a slight chance that one or more DMAs would be implemented in the vicinity of a port area. In this case, vessels would route around the DMA or transit through it at a slow speed. These restrictions would be in place for approximately 15 days, and would only be continued if whales were still sighted in the area.

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. For a vessel with an average operating speed of 14 knots, it would normally be possible to cover the 39.6 nm (73 km) of a DMA in 170 minutes. With a speed restriction of 12 knots, covering the distance would take 198 minutes, an increase of 28 minutes. At a 10-knot speed restriction, it would take 238 minutes, or nearly four hours to cover the distance. 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 with an average operating speed of 14 knots would take eight additional minutes to slow down to 12 knots and speedup for a total delay of 36 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 12 knots rather than to route around the DMA. At an average speed of 14 knots, a vessel would incur a delay of 170 minutes to route the extra 39.6 nm (73 km) around the two sides of the square that circumscribes a DMA, as compared to the 36-minute delay to go through the DMA at the restricted speed.

Only vessels with an average operating speed in excess of 21 knots would benefit from routing around the DMA instead of proceeding through at a restricted speed of 12 knots. For example, a vessel with an average operating speed of 24 knots would incur a delay of 99 minutes to route around a DMA as compared to a delay of 129 minutes to pass through the DMA.

With a speed restriction of 10 knots, vessels with an average operating speed in excess of 18 knots would benefit from routing around the DMA. Routing around the DMA would take an additional 132 minutes, whereas going through the DMA at 10 knots would take 238 minutes

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 alters the effective distance to be traveled. For example, a vessel that would route diagonally through the DMA square would have to traverse 56 nm (104 km) at the restricted speed rather than the 39.6 nm for a vessel crossing the DMA at the mid-points of each side of the square. This phenomenon is perhaps offset by the fact that some vessels' routes will require them to pass only through a portion of a DMA. The economic analysis assumes that vessels would have to traverse an average of 39.6 nm (73 km) for each DMA.

Data Chart 4-1 presents the direct economic impact of DMAs at a 12-knot speed restriction on the shipping industry in 2003. The total direct economic impact is estimated at $9.8 million with the port area of Savannah being the most affected at $2.8 million. Port Canaveral is second at $1.5 million, followed by the port areas of New York/New Jersey at $1.2 million and Jacksonville at $1.1 million. The direct economic impact for these four port areas totals $6.6 million or 66.7 percent of the total for this alternative.

In the NEUS region, the port area of Boston has the greatest direct economic impact, estimated at $0.3 million in 2003. The port area of Portland has an estimated impact of $0.2 million.

Overall, under Alternative 2, containerships account for 50.3 percent of the total direct economic impact with an estimate of $5.0 million. The vessel type with the next largest economic impact is passenger vessels at $2.0 million followed by ro-ro (roll-on-roll-off) cargo ships at $1.1 million. The port area of Port Canaveral accounts for 70 percent of the economic impact incurred by passenger vessels at $1.4 million.

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	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	1.0	-	5.7	-	12.5	-	-	-	-	-	-	-	19.2
Searsport, ME	0.6	0.2	-	-	-	148.7	-	0.1	4.5	22.2	-	-	176.4
Portland, ME	6.0	4.3	8.2	0.3	15.4	48.3	-	9.7	1.1	132.5	-	-	225.7
Portsmouth, NH	7.3	0.5	-	-	6.1	1.3	-	-	0.4	30.9	-	-	46.5
Northeastern US - Off Race Point													
Boston, MA	2.9	0.1	97.0	0.1	2.2	125.1	2.9	6.0	-	54.3	-	-	290.7
Salem, MA	1.1	-	-	-	-	1.3	-	-	-	0.3	-	-	2.8
Northeastern US - Cape Cod Bay	-	-	-	-	-	5.2	-	-	-	1.5	-	-	6.7
Mid-Atlantic Block Island Sound													
New Bedford, MA	2.0	-	0.0	-	1.0	-	1.8	-	0.1	0.5	-	-	5.4
Providence, RI	1.8	0.1	0.1	-	1.6	17.2	0.7	9.7	0.1	7.4	-	-	38.7
New London, CT	0.5	-	0.6	-	2.2	9.4	-	-	2.4	0.5	-	-	15.6
New Haven, CT	1.2	0.1	0.3	0.1	4.6	1.5	-	-	10.0	11.0	-	-	28.8
Bridgeport, CT	1.2	-	0.0	0.0	0.0	1.2	2.9	-	7.1	2.1	-	-	14.5
Long Island, NY	-	0.1	-	0.0	-	9.4	-	-	20.9	12.2	-	-	42.6
Mid-Atlantic Ports of New York/New Jersey	9.4	2.1	772.8	0.0	5.9	125.9	8.5	130.7	1.1	101.4	-	-	1,157.8
Mid-Atlantic Delaware Bay	6.3	1.1	82.6	1.0	14.2	11.8	105.4	18.2	0.5	71.0	-	-	312.2
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	9.6	0.4	100.0	-	24.1	20.6	1.2	114.5	0.3	12.3	-	-	282.9
Hampton Roads, VA	10.1	1.7	567.4	0.0	13.7	15.5	0.2	47.8	0.1	13.9	-	-	670.4
Mid-Atlantic Morehead City and Beaufort, NC	0.6	-	3.0	-	3.0	-	0.2	0.3	-	2.3	-	-	9.4
Mid-Atlantic Wilmington, NC	1.8	0.3	27.3	-	18.5	-	0.2	6.2	0.8	14.6	-	-	69.7
Mid-Atlantic Georgetown, SC	0.8	-	0.2	-	4.2	-	-	-	-	-	-	-	5.2
Mid-Atlantic Charleston, SC	3.7	0.0	501.1	-	16.7	18.8	1.2	37.4	0.7	13.4	-	-	593.1
Mid-Atlantic Savannah, GA	21.9	2.3	2,318.3	-	145.1	11.4	42.3	166.7	0.9	98.9	-	-	2,807.7
Southeastern US													
Brunswick, GA	4.7	-	34.6	-	41.9	1.5	14.8	201.4	-	1.2	-	-	300.1
Fernandina, FL	1.4	-	30.5	0.0	43.0	2.9	41.9	2.4	-	0.4	-	-	122.5
Jacksonville, FL	23.4	0.7	389.6	57.9	78.9	24.1	12.1	371.5	2.3	93.7	-	-	1,054.3
Port Canaveral, FL	7.3	0.2	16.3	0.0	34.3	1,418.1	35.1	20.6	0.8	8.9	-	-	1,541.6
Total	126.8	14.2	4,955.7	59.6	489.1	2,019.1	271.3	1,143.1	54.0	707.5	-	-	9,840.3

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 4-2 presents the direct economic impact of Alternative 2 at 12 knots, estimated for 2004. The total economic impact would be $10.8 million, roughly 10 percent higher than in 2003. This 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 region, which is more affected by DMAs. The rankings by port area and vessel type are the same as described for 2003 above. Figure 4-3 presents graphically the direct economic impact by port area for 2003 and 2004.

At a 10-knot speed restriction, Alternative 2 would result in an economic impact of $17.0 million in 2004. At 14 knots, the economic impact was estimated at $6.5 million in 2004. See Data Chart 4-22 for the economic impact of 10, 12, and 14 knots by port area.

4.4.1.3 Alternative 3 – Speed Restrictions in Designated Areas

Implementing 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 12-knot speed restriction, direct economic impacts would total an estimated $50.5 million for 2003 and $53.9 million in 2004. The geographic areas and time periods in which speed restrictions would be implemented in each region are detailed in the description of Alternative 3 in Section 2.2.3. The effective proposed speed restriction periods for each port area are depicted in Figure 4-4. For all port areas in the NEUS region, the restrictions would be effective year-round (365 days). Speed restrictions would be in place for 212 days per year in the MAUS region, and 121 days per year for port areas in the SEUS region.

As described 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 seasonal speed restriction periods for each port area.

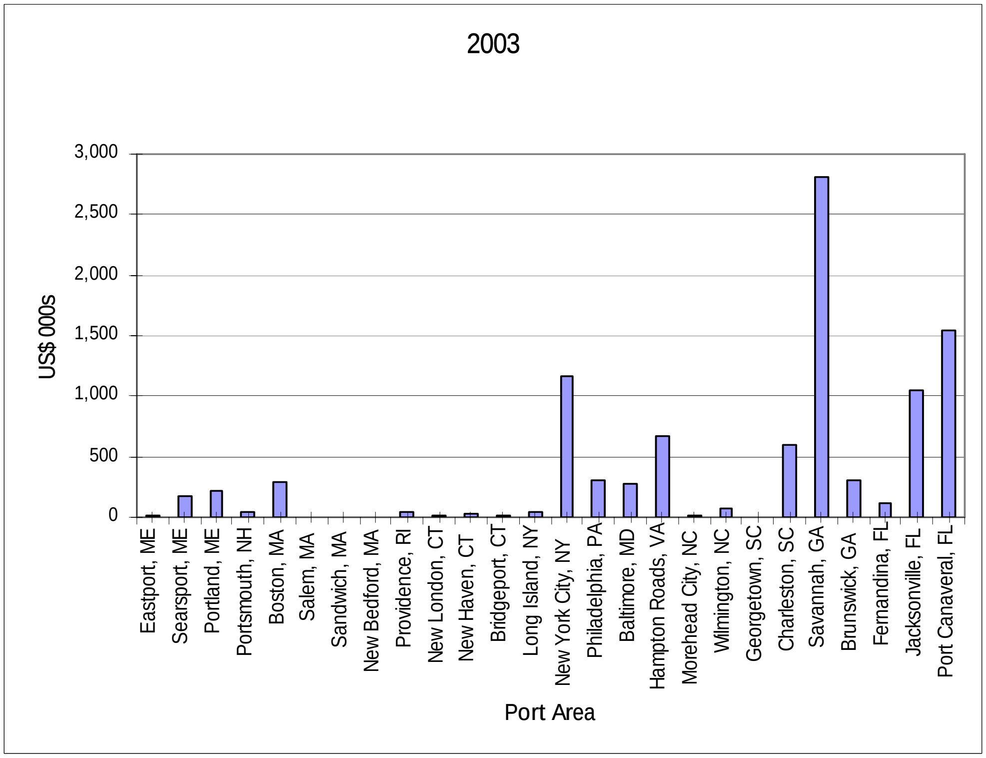
Data Chart 4-3 presents US East Coast arrivals of vessels for 2003 during the periods when speed restrictions are proposed for each port area. In 2003 there were 14,603 vessel arrivals during speed restricted periods, approximately 57 percent of the total of 25,532 arrivals for 2003. While there is some seasonality in US East Coast vessel arrivals, the proposed periods of speed restrictions include both peak periods and nonpeak periods, and hence 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 most vessel arrivals during speed restricted periods with 3,103 arrivals in 2003 followed by the port areas of Hampton Roads (1,529), Philadelphia (1,521 arrivals), Savannah (1,368 arrivals), Charleston (1,343 arrivals) and Baltimore (1,085 arrivals).[11] These six port areas accounted for 68.1 percent of the total US vessel arrivals during speed restricted periods.

In terms of vessel type, containerships recorded the most vessel arrivals during the proposed speed restricted periods with 4,900 arrivals in 2003. Tankers were the next most frequent with 3,458 arrivals followed by bulk carriers with 1,636 arrivals and ro-ro cargo ships with 1,632 arrivals.

[11] The port area of Philadelphia, which includes Wilmington, DE, is included in the data presented for the port region of Mid-Atlantic Delaware Bay in tables in this chapter.

Alternative 2: Direct Economic Impact on the Shipping Industry by Port Area, 2003 and 2004 ($000s)



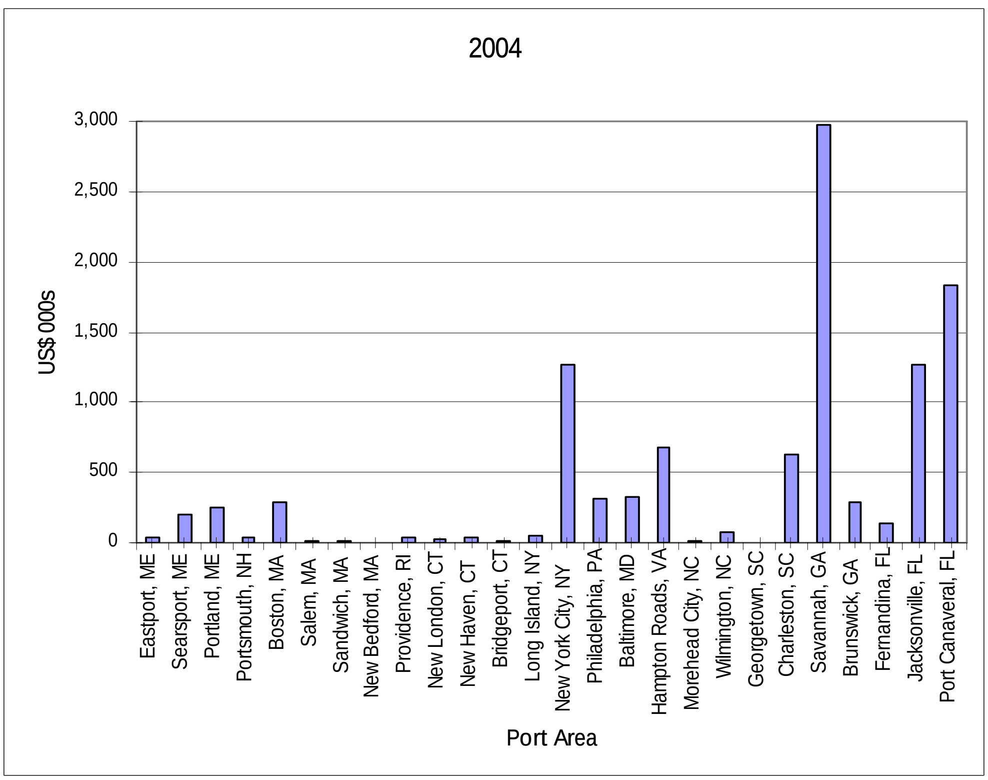


Figure 4-3

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Alternative 3: Proposed Seasonal Speed Restrictions by Port Area

Source: NOAA.

Figure 4-4

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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	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	1.3	-	5.8	-	27.6	-	-	-	-	-	-	-	34.7
Searsport, ME	0.4	-	4.5	0.2	0.5	168.1	-	0.4	2.2	21.2	-	-	197.7
Portland, ME	6.5	1.2	4.4	0.3	16.6	67.7	-	7.2	5.2	139.8	-	-	249.1
Portsmouth, NH	5.8	0.3	0.1	-	9.8	1.3	-	-	0.2	23.1	-	-	40.7
Northeastern US - Off Race Point													
Boston, MA	2.9	0.1	97.0	0.1	2.2	125.1	2.9	6.0	-	54.3	-	-	290.7
Salem, MA	1.3	-	-	-	-	11.5	-	-	-	-	-	-	12.9
Northeastern US - Cape Cod Bay	-	-	-	-	-	10.5	-	-	0.1	2.4	-	-	12.9
Mid-Atlantic Block Island Sound													
New Bedford, MA	1.9	-	-	-	0.9	0.6	1.3	0.1	-	0.5	-	-	5.2
Providence, RI	1.6	0.1	-	-	1.7	22.6	-	7.9	0.2	5.7	-	-	39.8
New London, CT	0.4	-	2.4	-	6.6	17.5	-	-	2.5	0.6	-	-	30.0
New Haven, CT	1.1	-	1.0	0.0	4.1	-	-	-	18.7	8.4	-	-	33.3
Bridgeport, CT	2.0	-	-	0.0	0.0	1.2	1.1	-	10.0	1.1	-	-	15.4
Long Island, NY	-	-	-	0.0	-	11.2	-	-	24.3	12.5	-	-	47.9
Mid-Atlantic Ports of New York/New Jersey	8.3	1.2	803.9	-	9.6	204.9	9.0	133.5	0.9	98.6	-	-	1,270.1
Mid-Atlantic Delaware Bay	7.9	0.4	79.5	1.5	21.6	15.4	98.3	18.4	0.2	76.4	-	-	319.6
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	12.5	0.3	111.7	-	25.6	37.7	2.2	117.4	0.2	19.2	-	-	326.8
Hampton Roads, VA	14.1	1.3	559.3	0.1	15.8	29.5	4.2	43.7	0.3	15.7	-	-	684.1
Mid-Atlantic Morehead City and Beaufort, NC	1.0	0.0	3.3	-	2.0	2.1	-	-	-	3.1	-	-	11.6
Mid-Atlantic Wilmington, NC	2.3	0.1	25.3	0.2	20.2	1.8	0.2	7.4	0.4	15.2	-	-	73.0
Mid-Atlantic Georgetown, SC	0.7	0.0	0.6	-	3.0	0.3	-	-	-	-	-	-	4.6
Mid-Atlantic Charleston, SC	3.9	0.1	527.5	0.3	21.8	24.3	1.5	35.0	0.6	13.1	-	-	628.0
Mid-Atlantic Savannah, GA	23.7	1.7	2,360.3	0.4	147.3	73.2	59.9	186.0	0.7	116.0	-	-	2,969.3
Southeastern US													
Brunswick, GA	5.7	-	12.4	-	44.9	11.7	13.3	201.1	-	0.3	-	-	289.4
Fernandina, FL	1.6	-	34.4	0.3	48.9	27.9	17.8	2.3	-	-	-	-	133.1
Jacksonville, FL	28.0	1.2	393.4	49.8	94.6	198.4	13.5	385.8	4.5	96.3	-	-	1,265.6
Port Canaveral, FL	12.0	-	18.8	0.1	49.0	1,674.5	29.0	28.0	3.9	15.1	-	-	1,830.5
Total	147.0	8.1	5,045.7	53.3	574.4	2,738.9	254.4	1,180.1	75.2	738.7	-	-	10,815.9

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.

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	28	-	9	-	11	1	4	84	-	-	-	-	137
Fernandina, FL	3	-	37	1	31	1	12	-	-	-	6	-	91
Jacksonville, FL	51	-	156	59	75	4	2	172	6	93	92	4	714
Port Canaveral, FL	33	-	6	7	26	173	24	12	2	8	6		297
All Port Regions	1,636	78	4,900	83	912	562	380	1,632	738	3,458	179	45	14,603

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.

In 2004, there were 15,444 vessel arrivals at US East Coast ports during the periods when speed restrictions are proposed for each port area, an increase of 5.8 percent over 2003 (Data Chart 4-4). The increase is lower than the 7.3 percent shown 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 proposed speed restricted periods.

Data Chart 4-5 presents the basis for determining the effective distance that speed restrictions would apply for each port area. The location of these areas is 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, Alternative 3 specifies that speed restrictions would extend 25 nm (46 km) from the coastline. However, independent researchers and stakeholders have indicated that due to vessel operating practices, the effective distance of the proposed seasonal speed restrictions may be less than distances specified in the operational measures. This is because at most port areas, vessels already slow down to 8–10 knots at the pilot buoy for the pilot to board the vessel. In most 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 over which the proposed seasonal speed restrictions would apply is 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 more on a diagonal routing. For purposes of the economic impact analysis, it is assumed that vessels would travel through the speed restricted areas on a 45 degree routing until they reach the pilot buoy. Thus, for the port area of New York/New Jersey it is assumed that vessel 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 large year-round speed restricted area established in the NEUS region that some vessels will 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 areas in the Northeast. This factor, though, only affects vessel arrivals into the port area of New York/ New Jersey from the north or departures to north. This analysis assumes that it would affect 30 percent of vessel arrivals in the port area of New York/New Jersey.[12]

[12] The determination of 30 percent is based on the following assumptions: 45 percent arrive from the south and depart to the south (0 trips through the northeast speed restricted area); 40 percent arrive from the north and depart to the south (1 trip through the northeast speed restricted area), 10 percent of vessel arrive from the south and depart to the north south (1 trip through the northeast speed restricted area), 5 percent arrive from the north and depart to the north south (2 trips through the northeast speed restricted area). This results in a total factor of 60 percent which

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	26	-	7	-	14	1	5	93	-	-	-	3	149
Fernandina, FL	11	-	26	2	40	2	4	1	-	-	8	-	94
Jacksonville, FL	54	2	161	62	76	30	2	183	6	90	120	9	795
Port Canaveral, FL	40		6	8	32	180	11	18	2	12	17	1	327
All Port Regions	1,718	60	4,976	101	1,019	776	327	1,627	959	3,483	337	61	15,444

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.

is cut in half to apply to 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.

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.

The mid-Atlantic port areas of Philadelphia, Baltimore and Hampton Roads have been assumed to be equally affected by the year-round large speed restricted area established in the NEUS region. Port areas south of Hampton Roads are assumed not to be affected, as vessels normally travel to the east of the NEUS region restricted area.

Port areas in Block Island Sound are assumed to have 40 percent of their vessel arrivals affected by the large speed restricted area in the Northeast region.[13]

As discussed under Alternative 2 (Section 4.4.1.2), another element of the impact on vessel operations is the time for vessels to slow down from sea speed to restricted speed and later to speed back up 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 areas in the NEUS region. 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 the 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.

For port areas in the NEUS region, the operational measures (Section 2.2.3) did not specify a specific distance over which speed restrictions would be implemented. Rather, broad geographic areas (ALWTRP SAM zones) were delineated. With the exception of Cape Cod Bay, vessels arriving at port areas in the NEUS region from the north would not be affected by proposed speed restriction areas. 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 recommended routes for each port and the distance from the intersection of those routes with the eastern edge of the MSRS WHALESOUTH area to each port's pilot buoy. For the port area of Brunswick, two routes were considered typical, one to the

[13] The determination of 40 percent is based on the following assumptions: 45 percent arrive from the north and depart to the south (1 trip through the northeast speed restricted area); 30 percent arrive from the south and depart to the south (0 trips through the northeast speed restricted area), 15 percent arrive from the north and depart to the north south (1 trips through the northeast speed restricted area) and 10 percent of vessel arrive from the north and depart to the north (2 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.

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 being able to regain speed over the 6.7 nm (12.4 km) from the pilot buoy to the coastline.

Two recommended routes were 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 being able to regain speed over the 10.9 nm (20.2 km) from the pilot buoy to the coastline.

Three recommended routes were 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, a single route of 4.5 nm (8.3 km) was used through the right whale critical habitat area.

Using the economic impact model, the minutes of delay that would be incurred in each port area have been 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 presents the average minutes of delay for a speed restriction of 12 knots per vessel arrival for each affected port area and vessel type in 2003.[14] The overall average delay for all vessels in 2003 is 52 minutes per arrival.[15] These delays are also depicted in Figure 4-5.

The longest average delay is experienced at the port area of Hampton Roads with an average delay of 84 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 (68 minutes) and New York/New Jersey (65 minutes) are the other port areas with average delays in excess of an hour. The port area of Port Canaveral at 6 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 80 minutes per vessel arrival followed by ro-ro cargo ships (68 minutes), refrigerated cargo vessels (61 minutes), and passenger vessels (46 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.

[14] The average delay is based on the total minutes of delays for speed restrictions, 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 slow down speedup time for port areas in the mid-Atlantic as those delays would need to be divided into annual vessel arrivals at each port.
[15] As will be discussed later, vessels are assumed to incur similar delays when leaving each port area.

Data Chart 4-6
Alternative 3: Average Minutes of Delay per Vessel Arrival by Port Area and Type of Vessel, 2003

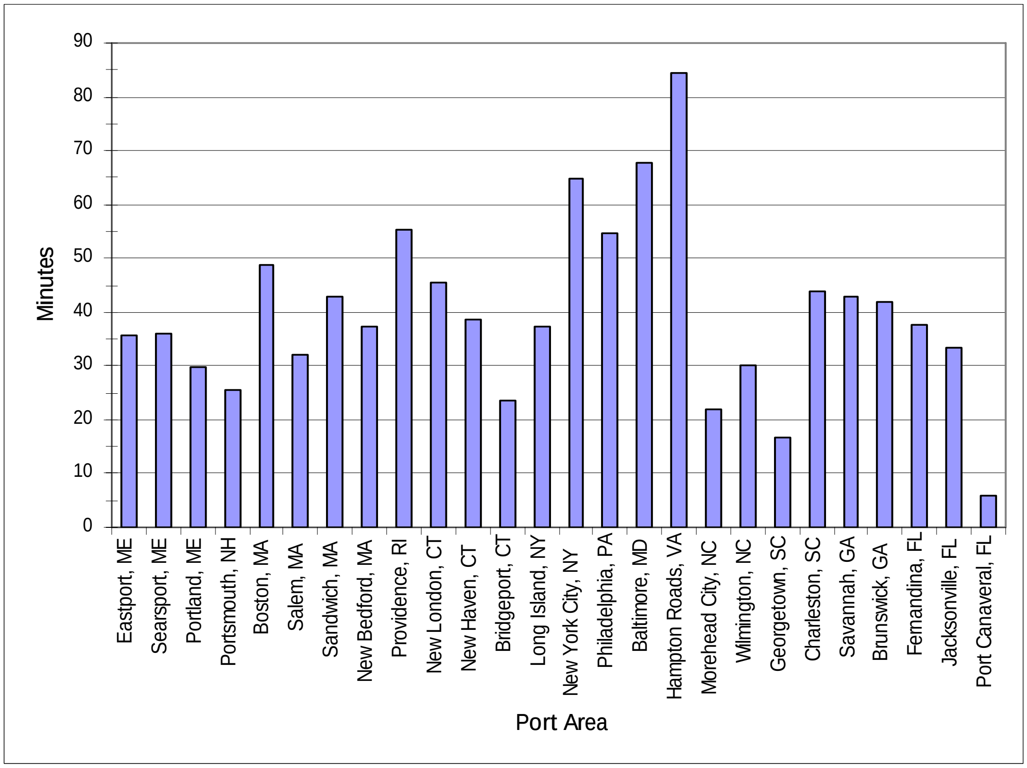
Port Area	Bulk Carriers	Combination Carriers	Containerships	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	8.3	-	75.0	-	48.2	-	-	-	-	-	-	-	35.6
Searsport, ME	6.1	26.4	-	-	-	57.8	-	13.6	24.1	28.5	-	-	35.9
Portland, ME	12.0	27.6	73.2	47.5	41.2	60.4	-	20.3	22.8	31.9	-	-	29.9
Portsmouth, NH	15.2	18.3	-	-	48.8	46.3	-	-	25.3	29.5	-	-	25.4
Northeastern US - Off Race Point													
Boston, MA	14.7	18.8	100.1	19.5	36.2	61.1	59.0	29.3	-	36.1	-	-	48.9
Salem, MA	26.1	-	-	-	-	61.1	-	-	-	43.7	-	-	32.0
Northeastern US - Cape Cod Bay	-	-	-	-	-	53.6	-	-	-	35.5	-	-	42.9
Mid-Atlantic Block Island Sound													
New Bedford, MA	28.0	-	21.1	-	50.5	-	69.2	-	29.1	40.6	-	-	37.5
Providence, RI	22.8	42.7	-	-	65.2	91.8	75.7	93.3	27.0	46.0	-	-	55.2
New London, CT	22.3	-	127.9	-	88.7	71.7	-	-	34.1	44.8	-	-	45.5
New Haven, CT	21.1	-	131.3	1.2	79.0	71.7	-	-	36.5	43.4	-	-	38.5
Bridgeport, CT	35.0	-	-	0.9	-	60.4	-	-	28.1	27.6	-	-	23.5
Long Island, NY	-	42.7	-	1.2	-	71.7	-	-	34.3	40.9	-	-	37.4
Mid-Atlantic Ports of New York/New Jersey	17.0	29.6	91.9	32.9	38.3	69.3	75.7	74.2	24.6	34.9	-	-	64.7
Mid-Atlantic Delaware Bay	15.3	36.0	80.9	53.8	51.7	72.5	73.9	76.2	31.5	43.8	-	-	54.5
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	21.8	29.9	101.1	-	59.9	77.0	68.5	85.1	31.1	39.6	-	-	67.8
Hampton Roads, VA	22.4	35.6	104.3	37.2	55.4	79.7	73.8	96.8	32.7	40.2	-	-	84.4
Mid-Atlantic Morehead City and Beaufort, NC	7.3	-	47.9	-	23.4	-	9.5	42.6	-	20.6	-	-	21.9
Mid-Atlantic Wilmington, NC	8.6	17.1	62.5	-	36.5	-	35.7	60.6	20.3	23.0	-	-	30.0
Mid-Atlantic Georgetown, SC	8.6	-	55.0	-	47.4	-	-	-	-	-	-	-	16.6
Mid-Atlantic Charleston, SC	8.5	-	53.3	-	34.1	35.5	31.6	42.9	17.9	20.0	-	-	43.8
Mid-Atlantic Savannah, GA	6.7	12.8	58.1	-	29.1	35.9	62.5	47.3	17.1	21.4	-	-	42.9
Southeastern US													
Brunswick, GA	6.0	-	64.0	-	39.0	37.2	43.4	51.9	-	-	-	-	41.9
Fernandina, FL	23.2	-	45.8	0.8	29.3	47.9	59.2	-	-	-	-	-	37.7
Jacksonville, FL	12.8	-	51.0	33.3	23.1	45.1	42.5	51.3	23.6	25.6	-	-	33.5
Port Canaveral, FL	0.6	-	9.8	0.1	4.6	7.3	5.6	6.6	3.5	3.9	-	-	5.8
Total	15.5	-	79.9	29.5	41.5	46.1	61.4	67.6	32.2	34.5	-	-	52.2

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 3: Average Minutes of Delay per Vessel Arrival by Port Area and Type of Vessel, 2003



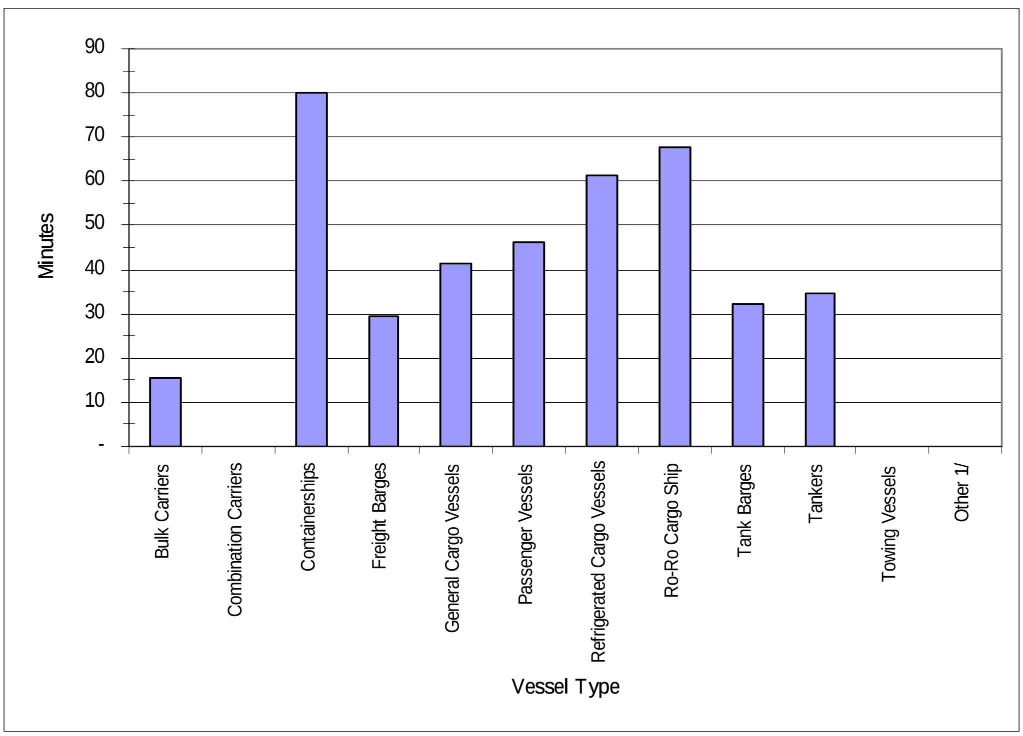


Figure 4-5

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Direct Economic Impact of Alternative 3

Data Chart 4-7 presents the estimated direct economic impact of 12-knot speed restrictions in designated areas under Alternative 3 on the shipping industry in 2003. The total direct economic impact is estimated at $50.5 million with the largest impact on the port area of New York/New Jersey at $14.5 million. The impact on the port area of Hampton Roads is second at $9.9 million, followed by the port areas of Philadelphia at $5.0 million, Baltimore at $4.3 million, Savannah at $4.0 million, Charleston at $3.9 million, Boston at $1.5 million, and Portland at $1.2 million. The direct economic impact for these eight port areas totals $44.3 million or 87.8 percent of the total for this alternative.

Containerships account for 58.6 percent of the total direct economic impact of Alternative 3 with an estimated $29.6 million. The next largest economic impact by vessel type is ro-ro cargo ships at $5.8 million followed by tankers at $5.2 million and passenger vessels at $4.1 million.

Data Chart 4-8 presents the direct economic impact of a 12-knot speed restriction for Alternative 3 for 2004. The total economic impact is $53.9 million for 2004, roughly 6.8 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, with passenger vessels moving ahead of tankers due to the stronger growth in passenger vessel arrivals.

Figure 4-6 presents graphically the direct economic impact by port area for 2003 and 2004. The rankings for the leading port areas in 2004 are the same as described for 2003 above.

The direct economic impact of Alternative 3 for 2004 at 10 knots is $86.8 million and $31.2 million at 14 knots. 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

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 $1.0 million. The impact would have increased slightly in 2004 at $1.1 million. The impacts for Alternative 4 would be the same for 10, 12, and 14 knots as there are no speed restrictions proposed. 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.

A draft report out of the NMFS' Southeast Fisheries Science Center has evaluated a range of alternative approaches to each port based on how well each would reduce the risk of vessel-whale interactions (Garrison, 2005). NMFS and the USCG PARS have not yet identified the specific approach routes for each port; for the purposes of the economic impact analysis for this DEIS, a Northeast and a Southeast approach to each port have been selected as representative of the final routes that are selected.[16] Accordingly, the economic impact will be assessed based on the following routes in the Garrison paper: route 36 and route

[16] The PARS report was released on May 24, 2006; however, the recommendations in the report are not final until comments are considered, therefore the specific routes will be analyzed in the Final EIS.

Data Chart 4-7
Alternative 3: Direct Economic Impact on the Shipping Industry by Port Area and Type of Vessel, 2003 ($000s)

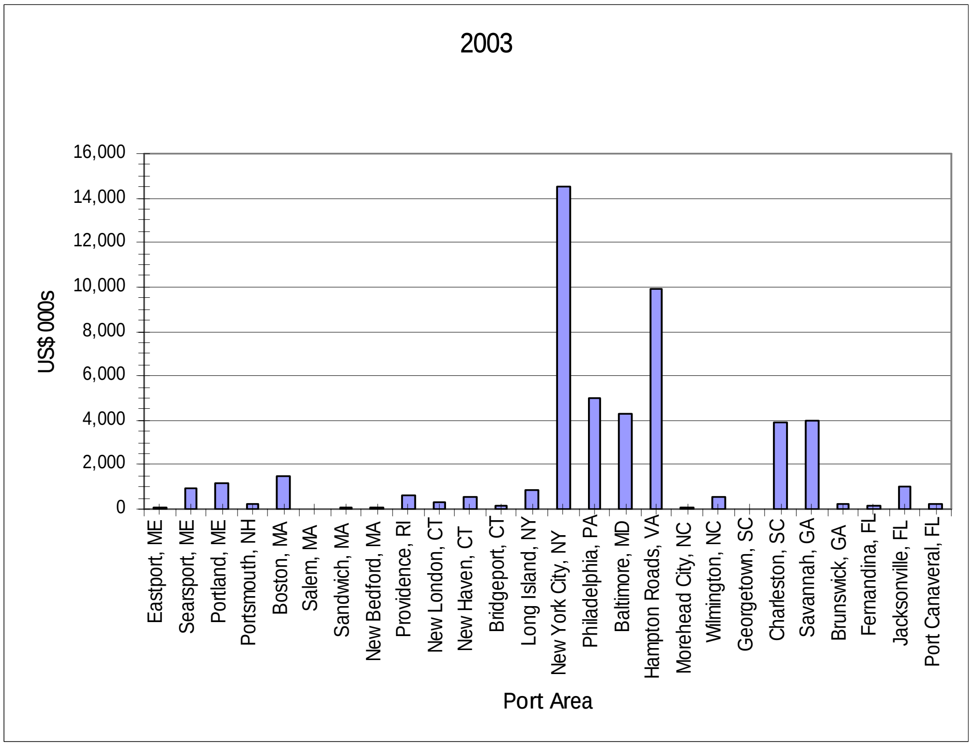
Port Area	Bulk Carriers	Combination Carriers	Containerships	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	5.0	-	29.1	-	63.9	-	-	-	-	-	-	-	98.0
Searsport, ME	3.3	1.2	-	-	-	757.9	-	0.5	22.9	113.2	-	-	898.9
Portland, ME	30.6	21.7	41.9	1.8	78.3	246.2	-	49.4	5.6	675.1	-	-	1,150.6
Portsmouth, NH	37.2	2.3	-	-	31.1	6.8	-	-	2.1	157.5	-	-	237.0
Northeastern US - Off Race Point													
Boston, MA	15.0	0.6	493.5	0.7	11.0	636.2	14.7	30.8	-	276.4	-	-	1,478.8
Salem, MA	5.6	-	-	-	-	6.8	-	-	-	1.7	-	-	14.1
Northeastern US - Cape Cod Bay	-	-	-	-	-	59.5	-	-	-	17.5	-	-	77.1
Mid-Atlantic Block Island Sound													
New Bedford, MA	36.2	-	0.6	-	25.3	-	24.9	-	4.1	10.5	-	-	101.4
Providence, RI	38.1	1.8	-	-	28.6	229.7	17.1	174.2	0.9	137.4	-	-	628.0
New London, CT	9.1	-	18.6	-	25.3	183.1	-	-	57.4	8.9	-	-	302.3
New Haven, CT	27.2	-	10.6	0.0	76.9	18.3	-	-	199.9	189.0	-	-	521.9
Bridgeport, CT	22.5	-	-	0.0	-	7.6	-	-	107.4	31.6	-	-	169.2
Long Island, NY	-	1.8	-	0.0	-	173.9	-	-	391.2	261.1	-	-	828.0
Mid-Atlantic Ports of New York/New Jersey	124.0	23.9	10,349.5	0.7	50.2	707.4	124.6	1,726.4	22.1	1,413.1	-	-	14,541.9
Mid-Atlantic Delaware Bay	106.3	11.4	1,316.6	9.5	238.5	196.2	1,756.1	275.6	12.4	1,062.2	-	-	4,984.7
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	150.8	7.2	1,522.8	-	301.8	293.5	15.9	1,807.2	2.2	204.1	-	-	4,305.5
Hampton Roads, VA	162.7	21.5	8,453.6	0.8	182.4	222.7	5.9	659.1	1.2	212.1	-	-	9,921.9
Mid-Atlantic Morehead City and Beaufort, NC	3.2	-	23.3	-	18.2	-	0.5	3.1	-	15.4	-	-	63.7
Mid-Atlantic Wilmington, NC	16.9	2.3	224.4	-	152.4	-	2.2	45.6	8.4	111.9	-	-	564.0
Mid-Atlantic Georgetown, SC	6.7	-	2.4	-	20.5	-	-	-	-	-	-	-	29.6
Mid-Atlantic Charleston, SC	25.6	-	3,301.3	-	116.0	142.7	6.2	257.9	7.6	83.6	-	-	3,940.8
Mid-Atlantic Savannah, GA	32.0	2.8	3,326.5	-	197.3	17.9	58.7	226.7	2.1	131.4	-	-	3,995.4
Southeastern US													
Brunswick, GA	5.0	-	32.2	-	20.4	4.1	11.9	175.7	-	-	-	-	249.2
Fernandina, FL	2.1	-	50.4	0.0	48.8	5.3	49.7	-	-	-	-	-	156.3
Jacksonville, FL	20.2	-	373.2	48.5	84.0	24.7	5.7	336.5	4.7	84.0	-	-	981.4
Port Canaveral, FL	0.6	-	3.4	0.0	5.2	196.0	8.4	2.9	0.2	1.1	-	-	218.0
Total	885.9	98.5	29,573.9	62.0	1,775.9	4,136.5	2,102.3	5,771.3	852.5	5,198.8	-	-	50,457.7

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.

Alternative 3: Direct Economic Impact on the Shipping Industry by Port Area, 2003 and 2004



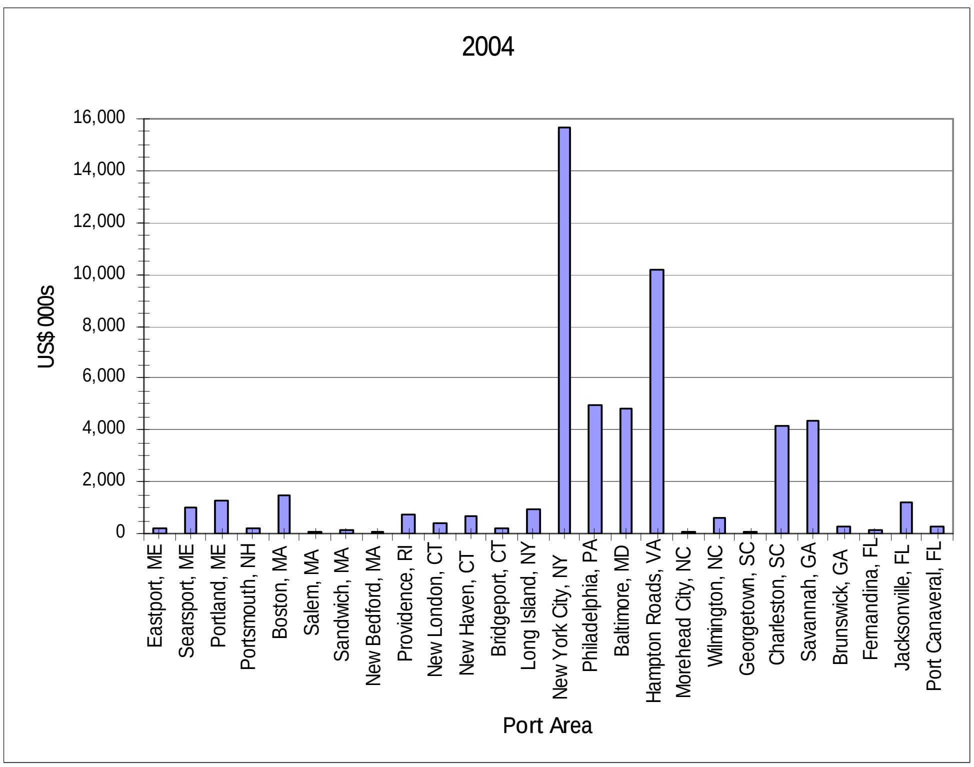


Figure 4-6

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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	6.6	-	29.4	-	140.8	-	-	-	-	-	-	-	176.8
Searsport, ME	2.1	-	23.1	1.2	2.6	857.0	-	1.8	11.4	108.2	-	-	1,007.6
Portland, ME	33.3	6.2	22.6	1.8	84.4	345.1	-	36.8	26.7	712.8	-	-	1,269.6
Portsmouth, NH	29.6	1.7	0.4	-	49.8	6.8	-	-	1.1	117.9	-	-	207.3
Northeastern US - Off Race Point													
Boston, MA	15.0	0.6	493.5	0.7	11.0	636.2	14.7	30.8	-	276.4	-	-	1,478.8
Salem, MA	6.8	-	-	-	-	58.7	-	-	-	-	-	-	65.5
Northeastern US - Cape Cod Bay	-	-	-	-	-	120.9	-	-	0.9	27.5	-	-	149.2
Mid-Atlantic Block Island Sound													
New Bedford, MA	31.9	-	-	-	13.3	-	19.9	2.4	-	9.2	-	-	76.8
Providence, RI	27.2	1.9	-	-	39.8	366.9	-	164.8	1.4	128.3	-	-	730.3
New London, CT	6.4	-	46.2	-	98.5	163.7	-	-	50.6	12.2	-	-	377.7
New Haven, CT	16.6	-	20.9	-	60.6	-	-	-	378.8	163.7	-	-	640.6
Bridgeport, CT	32.5	-	-	0.0	-	-	-	-	169.4	23.4	-	-	225.3
Long Island, NY	-	-	-	0.1	-	210.5	-	-	478.5	254.2	-	-	943.4
Mid-Atlantic Ports of New York/New Jersey	101.3	15.3	10,677.8	-	161.3	1,398.2	124.6	1,820.5	8.1	1,329.0	-	-	15,636.1
Mid-Atlantic Delaware Bay	109.6	2.4	1,215.4	22.0	352.1	111.7	1,669.7	278.3	4.0	1,155.9	-	-	4,921.2
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	181.7	6.5	1,627.0	-	388.5	468.0	31.7	1,797.8	2.3	286.6	-	-	4,790.1
Hampton Roads, VA	211.3	16.5	8,235.1	2.9	264.6	480.4	54.2	657.4	1.2	236.6	-	-	10,160.2
Mid-Atlantic Morehead City and Beaufort, NC	7.6	0.3	25.1	-	15.6	14.3	-	-	-	21.9	-	-	84.8
Mid-Atlantic Wilmington, NC	15.0	1.0	198.8	-	164.4	16.4	-	61.7	5.5	121.7	-	-	584.6
Mid-Atlantic Georgetown, SC	5.5	0.3	1.8	-	30.5	3.8	-	-	-	-	-	-	42.0
Mid-Atlantic Charleston, SC	28.6	-	3,459.1	1.7	132.8	204.2	12.1	237.7	2.4	83.0	-	-	4,161.6
Mid-Atlantic Savannah, GA	34.7	3.0	3,410.5	-	228.7	131.6	88.2	268.2	0.8	159.6	-	-	4,325.3
Southeastern US													
Brunswick, GA	4.6	-	20.5	-	33.0	4.1	16.0	204.0	-	-	-	-	282.1
Fernandina, FL	2.2	-	38.7	1.1	51.0	10.6	14.1	8.3	-	-	-	-	126.1
Jacksonville, FL	23.7	1.0	374.3	46.9	86.1	192.9	6.7	369.6	4.7	83.1	-	-	1,189.0
Port Canaveral, FL	1.3	-	3.8	0.0	6.0	222.4	3.7	4.8	0.2	1.7	-	-	244.0
Total	935.1	56.7	29,924.1	78.5	2,415.7	6,024.4	2,055.4	5,945.0	1,148.1	5,312.8	-	-	53,895.7

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.

48 for Jacksonville (Figure 2-1), route 28 and route 46 for Fernandina Beach, and route 18 and route 25 for Brunswick (Figure 2-2). These routes appear to combine the lowest ship strike risk values with the likelihood of lower levels of economic impact.

Section 4.4.1.3 identifies the existing pattern of vessel approaches to each port area. Because vessels arriving at these ports generally approach from the south or north, the current approaches to the pilot buoys are approximately 40–65 degrees and 135–160 degrees from a parallel line to the coastline. Under Alternative 4, the preferred Northeast and Southeast access routes to each port are flatter, at approximately 60–80 degrees and 120–145 degrees. Vessels are assumed to have to route parallel to the eastern boundary of the MSRS WHALESSOUTH until the intersection of 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 time 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 3.2 nm (6 km); for the port area of Fernandina it is 3.7 nm (6.9 km); and for the port area of Jacksonville it is 7.1 nm (13 km).

The 12 degree northerly shift of the Boston TSS would increase vessel routings by 3.75 nm (6.9 km). It is assumed that 60 percent of vessel arrivals in Boston would be affected by the proposed change.[17]

The ATBA for the Great South Channel is not expected to have a measurable impact on vessel operations because most shipping industry vessels currently route to either the west or southeast of the area.

The recommended shipping routes for Cape Cod Bay also 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 DEIS.

Alternative 4 would not have adverse effects on port operations because the exact location of the recommended routes, ATBA, and TSS would be reflected in current nautical charts that would be utilized during voyage planning. The specific times that these measures would be operational would also be known ahead of time. 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.

[17] The determination of 60 percent is based on the following assumptions: 45 percent arrive from the north and depart to the south (1 trip through the TSS); 30 percent arrive from the south and depart to the south (2 trips through the TSS), 15 percent arrive from the north and depart to the north south (1 trip through the TSS) and 10 percent of vessel arrive from the north and depart to the north (0 trips through the TSS). This results in a total factor of 120 percent which is cut in half to apply to vessel arrivals only.

Direct Economic Impact of Alternative 4

Data Chart 4-9 presents the direct economic impact of Alternative 4 on the shipping industry for 2003. The total direct economic impact is estimated at $1.0 million with the port area of Jacksonville having the largest impact of $0.6 million, followed by the port area of Boston at $0.4 million. The three other port areas affected under this alternative—Brunswick, Fernandina, and Salem each had an economic impact of under $60,000.

Containerships, ro-ro cargo ships, and tankers, and passenger vessels have the highest direct economic impact at approximately $0.2 million each, followed by general cargo vessels and bulk carriers at roughly $0.1 million each.

Data Chart 4-10 presents the direct economic impact of Alternative 4 for 2004. The total economic impact is estimated at $1.1 million in 2004, representing an 11.6 percent increase over 2003. This is due to the overall increase in vessel arrivals in the SEUS region and particularly passenger vessels at Jacksonville. The ranking by port area is the same as described for 2003. In 2004, passenger vessels jump ahead into first place, while containerships fall to third place and tankers drop to fourth place. As mentioned earlier, the economic impacts for Alternative 4 are the same for 10, 12, and 14 knots, as there are no speed restrictions proposed.

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. Based on shipping industry activity in 2003 and 2004, direct economic impacts would have totaled an estimated $52.4 million in 2003 and $56.1 million in 2004.

Impact on Vessel Operations

Data Chart 4-11 presents the key assumptions used to analyze the impact of Alternative 5 on vessel operations. The table presents the basis for determining the effective distance that speed restrictions would apply for each port area similar to that previously shown in Data Chart 4-5 for Alternative 3. Note that the diagonal distances to the buoy for the port areas of Brunswick, Fernandina, and Jacksonville differ from those of Alternative 3. This is due to the inclusion from Alternative 4 of the recommended shipping routes for these ports that reduces the distance traveled through the speed-restricted WHALESSOUTH reporting area of the MSRS. The speed restrictions were applied to these distances to determine the additional time incurred by vessels.

The other new element for these three Southeast port areas is the additional distance that is traveled parallel to the eastern boundary of the WHALESSOUTH area of the MSRS until the intersection of the recommended shipping routes, which generally have an east-west heading. In other words, vessels may transit farther distances to enter a recommended route. These distances are shown in Data Chart 4-11 as “Extra PARS (which refers to the recommended routes) or TSS Distance (which refers to the Boston TSS).” Speed restrictions do not apply to these distances and the additional time incurred is calculated using the averaging 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	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	-	-	-	-	-	-	-	-	-	-	-	-	-
Searsport, ME	-	-	-	-	-	-	-	-	-	-	-	-	-
Portland, ME	-	-	-	-	-	-	-	-	-	-	-	-	-
Portsmouth, NH	-	-	-	-	-	-	-	-	-	-	-	-	-
Northeastern US - Off Race Point													
Boston, MA	16.9	0.5	49.0	0.6	3.1	146.4	3.5	15.5	-	120.6	-	-	356.1
Salem, MA	3.6	-	-	-	-	1.6	-	-	-	0.6	-	-	5.7
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	6.4	-	4.5	-	5.1	1.3	3.1	34.4	-	-	-	-	54.9
Fernandina, FL	1.5	-	14.8	0.3	14.1	1.5	10.7	-	-	-	-	-	42.9
Jacksonville, FL	47.7	-	147.2	38.8	61.6	13.3	3.4	152.0	5.9	96.8	-	-	566.7
Port Canaveral, FL	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	76.0	0.5	215.5	39.7	83.9	164.1	20.7	201.9	5.9	218.0	-	-	1,026.3

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 4-10
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	16.9	0.5	49.0	0.6	3.1	146.4	3.5	15.5	-	120.6	-	-	356.1
Salem, MA	4.6	-	-	-	-	10.6	-	-	-	-	-	-	15.2
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	5.9	-	3.2	-	7.6	1.3	3.9	38.7	-	-	-	-	60.7
Fernandina, FL	5.2	-	10.4	0.6	16.2	3.1	3.5	0.9	-	-	-	-	40.0
Jacksonville, FL	49.7	2.0	151.6	40.0	62.4	101.4	3.4	162.7	5.9	94.1	-	-	673.3
Port Canaveral, FL	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	82.3	2.5	214.3	41.1	89.3	262.8	14.4	217.8	5.9	214.8	-	-	1,145.2

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.

Data Chart 4-11
Alternative 5: Effective Distance of Speed Restrictions in Designated Areas, Duration of DMAs and Extra PARS or TSS Distances 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 or TSS Distance	PARS or TSS Effective Days	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	3.75	365	n.a.	15
Salem, MA	n.a.	n.a.	n.a.	n.a.	72.4	3.75	365	n.a.	15
Northeastern US - Cape Cod Bay	5.0	n.a.	n.a.	n.a.	59.2	0	120	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.	24.1	3.4	5.5	121	n.a.	15
Fernandina, FL	10.9	n.a.	n.a.	26.8	5.5	9.8	121	n.a.	15
Jacksonville, FL	4.2	n.a.	n.a.	28.8	n.a.	9.2	121	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.
Source: Nathan Associates as descibed 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. No DMAs for port areas in the mid-Atlantic region have been assumed outside of the periods established for speed-restricted areas. The slow-down/speed-up time for each port is as specified for Alternative 3. While not shown separately in Data Chart 4-11, each DMA also includes slow-down/speed-up time as described in Alternative 2.

Direct Economic Impacts of Alternative 5

Data Chart 4-12 presents the direct economic impact of the combination of 12-knot speed restrictions in designated areas, DMAs, and the use of recommended routes implemented under Alternative 5 on the shipping industry estimated for 2003. The total direct economic impact is estimated at $52.4 million with the port area of New York/New Jersey having the largest impact of $14.5 million. The port area of Hampton Roads is second at $9.9 million, followed by the port areas of Philadelphia at $5.0 million, Baltimore at $4.3 million, Savannah at $4.0 million, and Charleston at $3.9 million. The direct economic impact for these six port areas totals $41.7 million or 79.5 percent of the total for this alternative.

Containerships account for 57.1 percent of the total direct economic impact of Alternative 5 with an estimate of $29.9 million. The vessel type with the next largest economic impact is ro-ro cargo ships at $6.1 million followed by tankers at $5.5 million and passenger vessels at $4.7 million.

Data Chart 4-13 presents the direct economic impact of Alternative 5 for 2004. The total direct economic impact is $56.1 million for 2004, roughly 7.0 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 except for passenger vessels moving ahead of tankers and ro-ro cargo ships into second position due to the stronger growth in passenger vessel arrivals.

Figure 4-7 presents graphically the direct economic impact by port area for 2003 and 2004. The rankings for the leading port areas are the same as just described for 2003.

Under Alternative 5, the direct economic impact of a 10-knot speed restriction is $89.7 million, and $32.9 million at 14 knots, both in 2004. See Data Chart 4-22 for the economic impacts of 10, 12, and 14 knots by port area for Alternative 5.

4.4.1.6 Alternative 6 (Preferred) – Right Whale Ship Strike Reduction Strategy

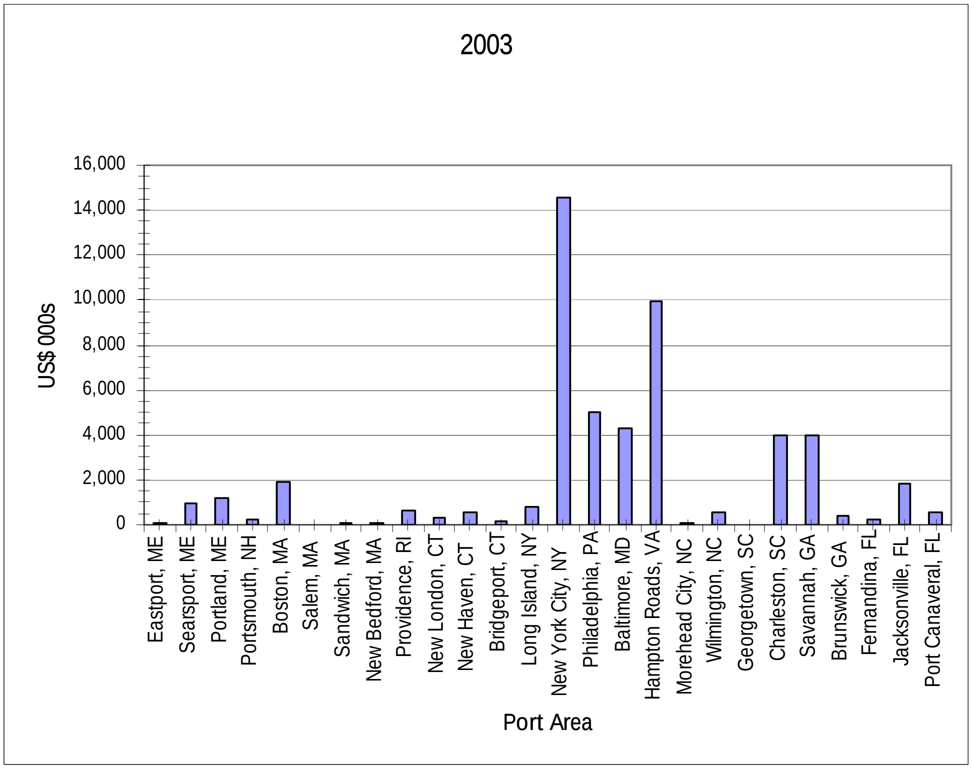
Implementation of Alternative 6 would have direct, long-term, adverse economic impacts on the shipping industry. Based on shipping industry activity in 2003 and 2004 and considering the impacts of implementing the proposed operational measures with a 12-knot speed restriction, direct economic impacts would have totaled an estimated $28.7 million in 2003 and $30.9 million in 2004. This ranks third in terms of economic impact among the six alternatives considered in this EIS.

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	5.3	-	30.3	-	66.7	-	-	-	-	-	-	-	102.2
Searsport, ME	3.4	1.2	-	-	-	790.7	-	0.5	23.9	118.1	-	-	937.8
Portland, ME	31.9	22.7	43.7	1.8	81.6	256.8	-	51.5	5.9	704.3	-	-	1,200.4
Portsmouth, NH	38.8	2.4	-	-	32.5	7.1	-	-	2.2	164.3	-	-	247.3
Northeastern US - Off Race Point													
Boston, MA	32.5	1.1	563.9	1.3	14.5	810.2	18.9	47.5	-	409.0	-	-	1,899.1
Salem, MA	9.4	-	-	-	-	8.6	-	-	-	2.3	-	-	20.4
Northeastern US - Cape Cod Bay	-	-	-	-	-	60.3	-	-	-	17.8	-	-	78.0
Mid-Atlantic Block Island Sound													
New Bedford, MA	36.2	-	0.6	-	25.3	-	24.9	-	4.1	10.5	-	-	101.4
Providence, RI	38.1	1.8	-	-	28.6	229.7	17.1	174.2	0.9	137.4	-	-	628.0
New London, CT	9.1	-	18.6	-	25.3	183.1	-	-	57.4	8.9	-	-	302.3
New Haven, CT	27.2	-	10.6	0.0	76.9	18.3	-	-	199.9	189.0	-	-	521.9
Bridgeport, CT	22.5	-	-	0.0	-	7.6	-	-	107.4	31.6	-	-	169.2
Long Island, NY	-	1.8	-	0.0	-	173.9	-	-	391.2	261.1	-	-	828.0
Mid-Atlantic Ports of New York/New Jersey	124.0	23.9	10,349.5	0.7	50.2	707.4	124.6	1,726.4	22.1	1,413.1	-	-	14,541.9
Mid-Atlantic Delaware Bay	106.3	11.4	1,316.6	9.5	238.5	196.2	1,756.1	275.6	12.4	1,062.2	-	-	4,984.7
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	150.8	7.2	1,522.8	-	301.8	293.5	15.9	1,807.2	2.2	204.1	-	-	4,305.5
Hampton Roads, VA	162.7	21.5	8,453.6	0.8	182.4	222.7	5.9	659.1	1.2	212.1	-	-	9,921.9
Mid-Atlantic Morehead City and Beaufort, NC	3.2	-	23.3	-	18.2	-	0.5	3.1	-	15.4	-	-	63.7
Mid-Atlantic Wilmington, NC	16.9	2.3	224.4	-	152.4	-	2.2	45.6	8.4	111.9	-	-	564.0
Mid-Atlantic Georgetown, SC	6.7	-	2.4	-	20.5	-	-	-	-	-	-	-	29.6
Mid-Atlantic Charleston, SC	25.6	-	3,301.3	-	116.0	142.7	6.2	257.9	7.6	83.6	-	-	3,940.8
Mid-Atlantic Savannah, GA	32.0	2.8	3,326.5	-	197.3	17.9	58.7	226.7	2.1	131.4	-	-	3,995.4
Southeastern US													
Brunswick, GA	16.5	-	44.4	-	36.1	6.4	19.2	261.5	-	0.2	-	-	384.3
Fernandina, FL	6.0	-	87.5	0.8	86.9	9.1	78.6	0.5	-	0.1	-	-	269.5
Jacksonville, FL	85.2	0.1	616.4	107.1	173.8	45.1	12.1	584.9	12.5	222.5	-	-	1,859.8
Port Canaveral, FL	2.1	0.0	6.7	0.0	12.1	479.6	15.4	7.0	0.4	2.9	-	-	526.3
Total	992.4	100.3	29,943.3	122.1	1,937.5	4,666.9	2,156.2	6,129.1	861.8	5,513.9	-	-	52,423.5

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.

Alternative 5: Direct Economic Impact on the Shipping Industry by Port Area, 2003 and 2004 ($000s)



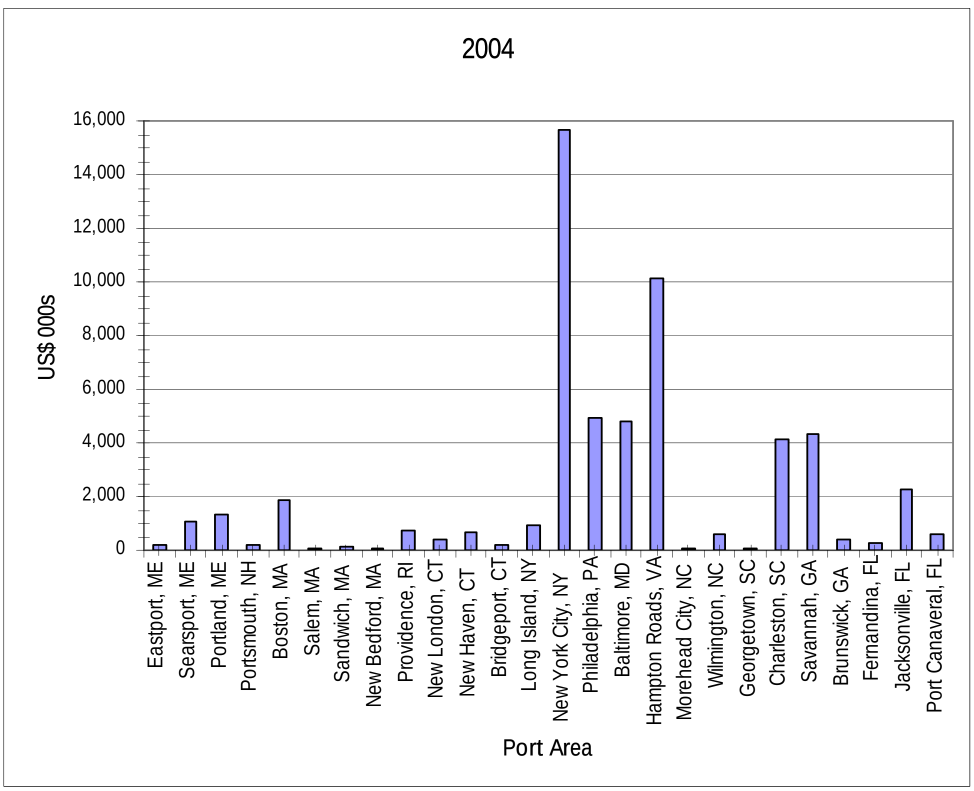


Figure 4-7

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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	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	6.9	-	30.7	-	146.9	-	-	-	-	-	-	-	184.5
Searsport, ME	2.2	-	24.1	1.3	2.7	894.1	-	1.9	11.9	112.9	-	-	1,051.2
Portland, ME	34.8	6.5	23.5	1.8	88.0	360.0	-	38.4	27.8	743.6	-	-	1,324.5
Portsmouth, NH	30.8	1.8	0.5	-	52.0	7.1	-	-	1.1	123.0	-	-	216.2
Northeastern US - Off Race Point													
Boston, MA	32.5	1.1	563.9	1.3	14.5	810.2	18.9	47.5	-	409.0	-	-	1,899.1
Salem, MA	11.7	-	-	-	-	71.8	-	-	-	-	-	-	83.5
Northeastern US - Cape Cod Bay	-	-	-	-	-	122.4	-	-	0.9	27.8	-	-	151.1
Mid-Atlantic Block Island Sound													
New Bedford, MA	31.9	-	-	-	13.3	-	19.9	2.4	-	9.2	-	-	76.8
Providence, RI	27.2	1.9	-	-	39.8	366.9	-	164.8	1.4	128.3	-	-	730.3
New London, CT	6.4	-	46.2	-	98.5	163.7	-	-	50.6	12.2	-	-	377.7
New Haven, CT	16.6	-	20.9	-	60.6	-	-	-	378.8	163.7	-	-	640.6
Bridgeport, CT	32.5	-	-	0.0	-	-	-	-	169.4	23.4	-	-	225.3
Long Island, NY	-	-	-	0.1	-	210.5	-	-	478.5	254.2	-	-	943.4
Mid-Atlantic Ports of New York/New Jersey	101.3	15.3	10,677.8	-	161.3	1,398.2	124.6	1,820.5	8.1	1,329.0	-	-	15,636.1
Mid-Atlantic Delaware Bay	109.6	2.4	1,215.4	22.0	352.1	111.7	1,669.7	278.3	4.0	1,155.9	-	-	4,921.2
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	181.7	6.5	1,627.0	-	388.5	468.0	31.7	1,797.8	2.3	286.6	-	-	4,790.1
Hampton Roads, VA	211.3	16.5	8,235.1	2.9	264.6	480.4	54.2	657.4	1.2	236.6	-	-	10,160.2
Mid-Atlantic Morehead City and Beaufort, NC	7.6	0.3	25.1	-	15.6	14.3	-	-	-	21.9	-	-	84.8
Mid-Atlantic Wilmington, NC	15.0	1.0	198.8	-	164.4	16.4	-	61.7	5.5	121.7	-	-	584.6
Mid-Atlantic Georgetown, SC	5.5	0.3	1.8	-	30.5	3.8	-	-	-	-	-	-	42.0
Mid-Atlantic Charleston, SC	28.6	-	3,459.1	1.7	132.8	204.2	12.1	237.7	2.4	83.0	-	-	4,161.6
Mid-Atlantic Savannah, GA	34.7	3.0	3,410.5	-	228.7	131.6	88.2	268.2	0.8	159.6	-	-	4,325.3
Southeastern US													
Brunswick, GA	15.6	-	26.9	-	52.4	8.4	24.1	294.9	-	0.1	-	-	422.4
Fernandina, FL	16.0	-	67.0	2.5	95.7	22.6	24.8	9.8	-	-	-	-	238.5
Jacksonville, FL	92.0	3.8	624.0	105.4	180.0	351.0	13.4	632.5	12.9	218.7	-	-	2,233.8
Port Canaveral, FL	3.7	-	7.5	0.0	15.8	557.3	9.5	10.4	1.0	4.7	-	-	610.1
Total	1,056.1	60.4	30,286.0	139.2	2,599.1	6,774.6	2,090.9	6,324.5	1,158.8	5,625.1	-	-	56,114.6

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.

Impact on Vessel Operations

Figure 4-8 presents the periods for proposed seasonal speed restrictions by port area. SMAs have not been proposed for specific port areas in the NEUS region, instead the SMAs correspond with right whale 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. Note that this alternative does not include speed restrictions for the port area of Port Canaveral. DMAs will be implemented in all areas outside of the proposed seasonal speed restricted periods.

For all port areas in the NEUS (excluding 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 and the recommended shipping routes 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 152 days per year for the three affected port areas and in the SEUS region.

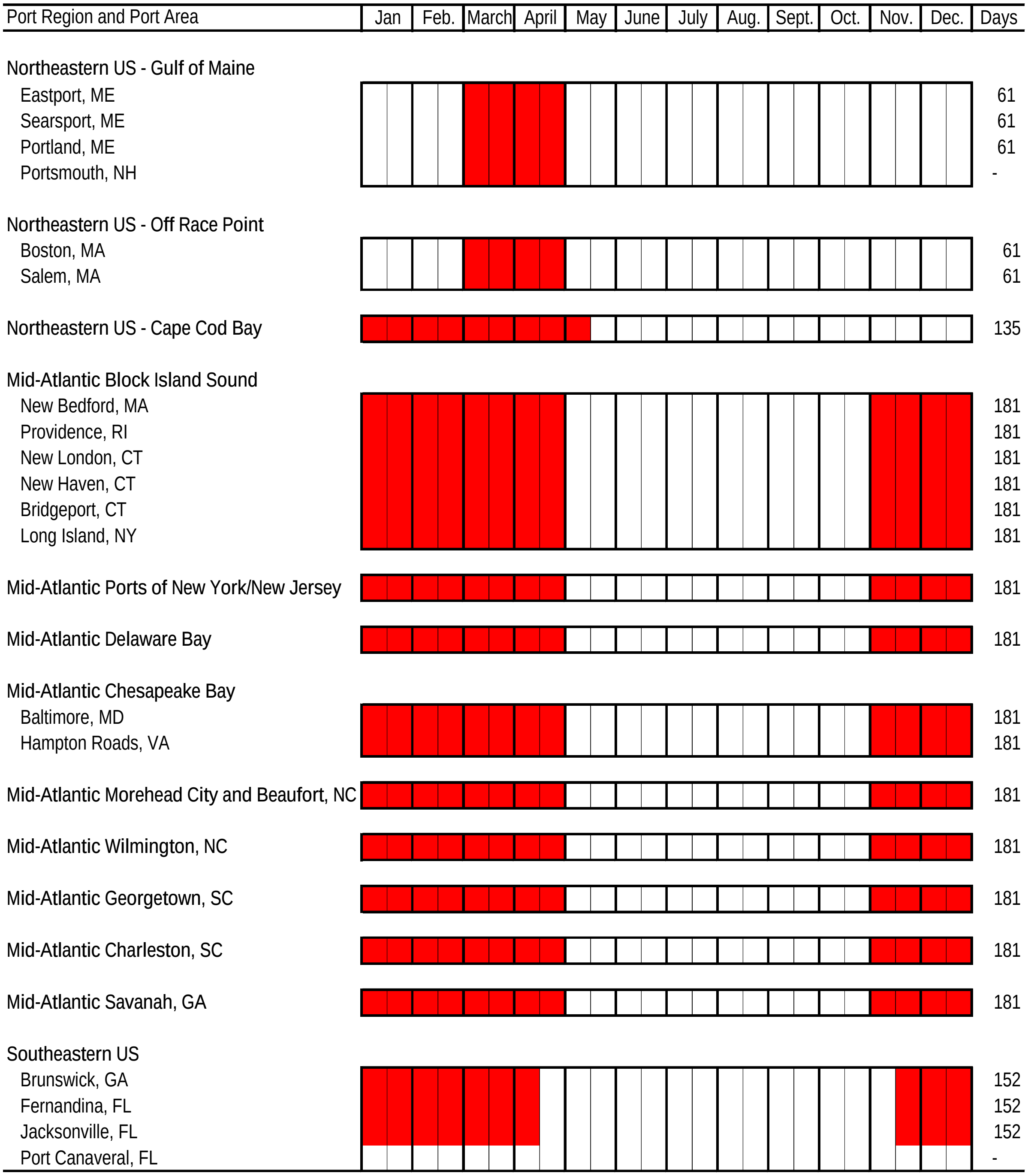
Data Chart 4-14 presents US East Coast arrivals of vessels for 2003 during the periods when speed restrictions are proposed for SMAs established at each port area. In 2003 there were 11,498 vessel arrivals during speed restricted periods, representing approximately 45 percent of the total of 25,532 arrivals for 2003 presented in Chapter 3. 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 periods and nonpeak periods and hence the percentage of restricted arrivals corresponds closely to the percentage of speed restricted days per year.

In terms of port 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 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 152 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.

Alternative 6: Proposed Seasonal Speed Restrictions by Port Area



Source: NOAA.

Figure 4-8

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Data Chart 4-14
Alternative 6: US East Coast Restricted Vessel Arrivals by Port Area and Vessel Type, 2003

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	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.

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 shown for total US East Coast vessel arrivals in Chapter 3 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 with the largest number of annual vessel arrivals recorded no increase in vessel arrivals during proposed speed restricted periods.

Data Chart 4-16 presents the key assumptions that are used to analyze the impact of the operational measures in Alternative 6 on vessel operations. The table presents the basis for determining the effective distance that speed restrictions would apply for each port area similar to that previously shown in Data Chart 4-11 for Alternative 5. However, for Alternative 6, port area buffers will have a radius of 30 nm (56 km) and will not be parallel to the coastline as in Alternatives 3 and 5. Hence there is no need to determine the diagonal distance of recommended routes as was calculated for Alternatives 3 and 5.

The effective distance of seasonal speed restrictions and the extra distance resulting from the recommended routes is shown in Data Chart 4-16 for the port areas of Brunswick, Fernandina and Jacksonville are the same as described for Alternative 5. However, the effective period is one month longer.

The additional effective distance shown for port areas in the northeast and for some port areas in the mid-Atlantic is based on the assumption that vessel arrivals at these port areas will have to traverse 54.9 nm (101.7 km) through the large speed restricted area of a combined Off Race Point and Great South Channel management areas that will be implemented from April 1 to April 30. Under Alternatives 3 and 5 this element was effective year-round; under Alternative 6 it is only effective for 30 days and only applies to vessel arrivals that would need to pass through the area.[18]

For the port areas of Providence and New Bedford, an additional effective distance of 13.8 nm (25.6 km) has been assumed 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 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), as listed in Data Chart 4-16. 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.

[18] See the discussion under Alternative 3 regarding assumptions as to the percentage of vessel arrivals at mid-Atlantic port areas that would be affected.

Data Chart 4-15
Alternative 6: 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	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
Alternative 6: Effective Distance of Seasonal Speed Restrictions and Duration of DMAs

Port Area	Location of pilot buoy relative to harbor	Distance Stated in NOI	Effective distance to pilot buoy	Diagonal of effective distance	Additional effective distance a/	Extra PARS Distance	PARS Effective Days	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	30	23.2	n.a.	54.9	0	0	Included	0
Mid-Atlantic Delaware Bay	2.5	30	27.5	n.a.	54.9	0	0	Included	0
Mid-Atlantic Chesapeake Bay									
Baltimore, MD	2.8	30	27.2	n.a.	54.9	0	0	Included	0
Hampton Roads, VA	2.8	30	27.2	n.a.	54.9	0	0	Included	0
Mid-Atlantic Morehead City and Beaufort, NC	6.7	30	23.3	n.a.	n.a.	0	0	n.a.	0
Mid-Atlantic Wilmington, NC	4.1	30	25.9	n.a.	n.a.	0	0	n.a.	0
Mid-Atlantic Georgetown, SC	5.6	30	24.4	n.a.	n.a.	0	0	n.a.	0
Mid-Atlantic Charleston, SC	12.5	30	17.5	n.a.	6.3	0	0	n.a.	0
Mid-Atlantic Savannah, GA	9.7	30	20.3	n.a.	4.9	0	0	n.a.	0
Southeastern US									
Brunswick, GA	6.7	n.a.	n.a.	24.1	3.4	5.5	151	n.a.	15
Fernandina, FL	10.9	n.a.	n.a.	26.8	5.5	9.8	151	n.a.	15
Jacksonville, FL	4.2	n.a.	n.a.	28.8	n.a.	9.2	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.
Source: Nathan Associates as descibed in text.

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 has been 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 slow-down/speed-up times as described in Alternative 2.

Data Chart 4-17 presents the average minutes of delay for speed restrictions associated with recommended shipping routes in the NEUS and SEUS and SMAs in all three regions. The delays are shown at 12 knots per vessel arrival for each affected port area and vessel type in 2003.[19] The overall average delay for all vessels in 2003 is 43 minutes per arrival.

The longest average delay at 12 knots is experienced at the port areas of Fernandina (68 minutes) and Jacksonville (61 minutes), and Brunswick (57 minutes) due to the combination of speed restrictions and the delays caused by the recommended shipping routes. The port area of Hampton Roads has an average delay of 56 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. Other port areas with above average delays include Baltimore (45 minutes), Providence (45 minutes), and Charleston (43 minutes).

Freight barges incur the longest average delay with an average of 64 minutes per vessel arrival (Figure 4-9). This is due the specialized higher-speed freight barge service from Jacksonville to Puerto Rico. Other vessel types with above average delays are containerships (61 minutes), ro-ro cargo ships (57 minutes), refrigerated cargo vessels (46 minutes), and passenger vessels (46 minutes).

The average minutes of delay for speed restrictions of 10 knots per vessel arrival for each affected port area and vessel type in 2003 is 73 minutes per arrival, a 30-minute increase from 12 knots.

The longest average delay at 10 knots is experienced at the port areas of Fernandina (103 minutes), Jacksonville (96 minutes), and Brunswick (86 minutes) due to the combination of speed restrictions and the delays caused by the recommended routes. The port area of Hampton Roads has an average delay of 87 minutes per arrival. Other port areas with more than 80 minutes of delays include Providence (93 minutes), Boston (82 minutes), New Bedford (81 minutes), and Cape Cod Bay (80 minutes).

Freight barges also incur the longest average delay at 10 knots, with 93 minutes per vessel arrival. Other vessel types with above average delays are containerships (89 minutes), ro-ro cargo ships (87 minutes), passenger vessels (76 minutes) and refrigerated cargo vessels (75 minutes).

[19] 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 vessels affected by DMAs.

Data Chart 4-17
Alternative 6: Average Minutes of Delay for SMA Speed Restrictions at 12 knots per Vessel Arrival by Port Area and Type of Vessel, 2003

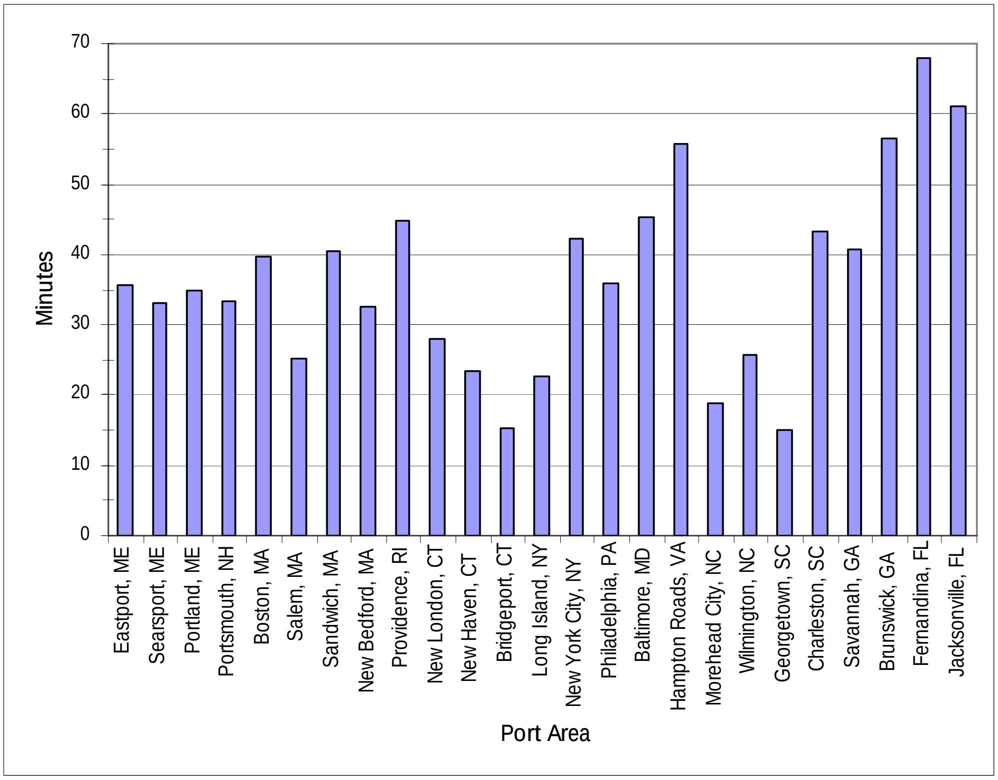
Port Area	Bulk Carriers	Combination Carriers	Container ships	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	10.3	-	100.3	-	39.6	-	-	-	-	-	-	-	35.7
Searsport, ME	9.0	-	-	-	-	-	-	-	-	35.8	-	-	33.1
Portland, ME	16.5	33.4	54.2	-	55.3	-	-	27.1	27.7	38.7	-	-	35.0
Portsmouth, NH	19.8	-	-	-	66.2	-	-	-	30.7	35.8	-	-	33.4
Northeastern US - Off Race Point													
Boston, MA	10.6	-	87.2	-	23.4	-	-	20.5	-	33.1	-	-	39.7
Salem, MA	25.2	-	-	-	-	-	-	-	-	-	-	-	25.2
Northeastern US - Cape Cod Bay	-	-	-	-	-	49.9	-	-	-	35.6	-	-	40.4
Mid-Atlantic Block Island Sound													
New Bedford, MA	24.7	-	17.8	-	46.1	-	58.6	-	24.6	34.6	-	-	32.6
Providence, RI	20.1	36.1	-	-	54.3	-	64.0	79.4	22.8	38.6	-	-	44.8
New London, CT	13.7	-	77.4	-	53.7	43.4	-	-	20.5	26.5	-	-	27.9
New Haven, CT	13.1	-	79.5	0.7	49.1	43.4	-	-	22.1	26.4	-	-	23.5
Bridgeport, CT	20.9	-	-	-	-	40.0	-	-	18.4	18.0	-	-	15.3
Long Island, NY	-	25.8	-	-	-	43.4	-	-	20.7	24.6	-	-	22.5
Mid-Atlantic Ports of New York/New Jersey	11.0	19.3	60.3	21.6	25.5	47.3	51.1	48.4	16.2	22.8	-	-	42.3
Mid-Atlantic Delaware Bay	10.4	23.8	53.2	34.6	34.1	53.3	48.7	51.0	20.9	29.0	-	-	36.0
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	14.6	17.9	67.2	-	39.3	52.8	45.3	56.2	20.6	26.1	-	-	45.2
Hampton Roads, VA	14.6	23.6	69.0	24.6	36.7	52.1	48.9	64.1	21.7	26.5	-	-	55.9
Mid-Atlantic Morehead City and Beaufort, NC	6.0	-	40.5	-	20.5	-	8.6	40.8	-	18.5	-	-	18.9
Mid-Atlantic Wilmington, NC	7.8	15.0	54.4	-	31.2	-	31.3	52.7	17.9	20.1	-	-	25.8
Mid-Atlantic Georgetown, SC	8.2	-	48.9	-	42.3	-	-	-	-	-	-	-	15.0
Mid-Atlantic Charleston, SC	8.3	-	52.9	-	33.4	33.9	31.3	42.5	17.8	19.8	-	-	43.3
Mid-Atlantic Savannah, GA	6.2	12.1	55.0	-	27.3	31.4	59.4	44.9	16.2	20.4	-	-	40.7
Southeastern US													
Brunswick, GA	20.5	-	75.0	-	55.4	54.9	59.9	65.5	-	45.2	-	-	56.5
Fernandina, FL	63.2	-	76.0	49.5	67.1	77.1	83.7	-	-	-	-	-	68.1
Jacksonville, FL	53.6	56.2	78.8	67.3	60.8	73.6	73.0	79.0	61.0	62.2	-	-	61.1
Port Canaveral, FL	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	14.3	20.8	60.9	63.6	39.9	46.1	46.2	57.1	20.9	27.2	-	-	42.7

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.

Alternative 6: Average Minutes of Delay for SMA Speed Restrictions per Vessel Arrival by Port Area and Type of Vessel, 2003



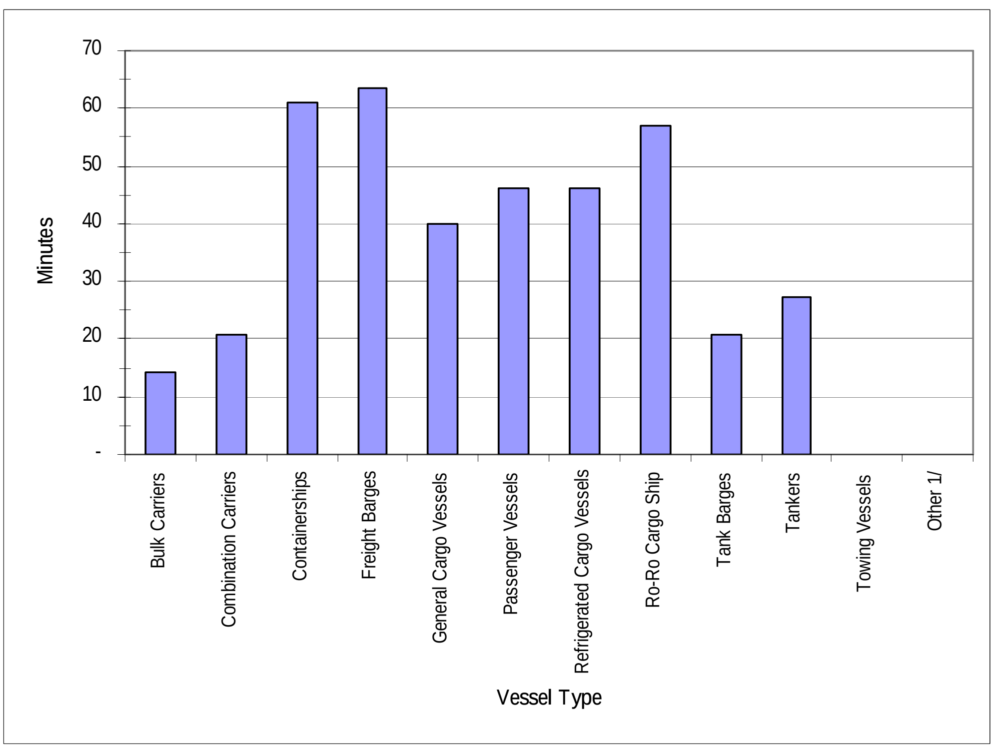


Figure 4-9

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Direct Economic Impact of Alternative 6

Data Chart 4-18 presents the direct economic impact of the Alternative 6 combination of speed restrictions in SMAs, DMAs, and recommended routes on the shipping industry in 2003 at 12 knots. The total direct economic impact at 12 knots is estimated at $28.7 million with the port area of New York/New Jersey having the largest impact of $6.8 million. The port area of Hampton Roads is second at $4.9 million, followed by the port areas of Charleston at $3.3 million, Savannah at $3.2 million, Philadelphia at $2.5 million, Jacksonville at $2.3 million, and Baltimore at $2.1 million. The direct economic impact for these seven port areas totals $25.0 million or 87.2 percent of the total for this alternative. No other port area had a direct economic impact over $0.5 million.

Containerships account for 60.4 percent of the total direct economic impact of Alternative 6 with an estimate of $17.3 million. The vessel type with the next largest economic impact is ro-ro cargo ships at $3.8 million followed by tankers at $2.7 million, general cargo vessels at $1.3 million, refrigerated cargo vessels at $1.2 million and passenger vessels at $1.1 million.

Data Chart 4-19 presents the direct economic impact of Alternative 6 in 2004. The total direct economic impact is $30.9 million in 2004, roughly 7.5 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 with passenger vessels moving ahead of general cargo ships and refrigerated cargo vessels due to the stronger growth in passenger vessel arrivals.

Figure 4-10 presents graphically the direct economic impact by port area for 2003 and 2004. The rankings for the leading port areas are the same as described for 2003 above with the exception of the port area of Savannah moving ahead of the port area of Charleston and the port area of Jacksonville moving ahead of the port area of Baltimore.

The direct economic impact of the combination of speed restrictions and DMAs under Alternative 6 at 10 knots in 2003 is estimated at $45.8 million. As with 12 knots, the port area of New York/New Jersey has the largest impact at $10.5 million. The port area of Hampton Roads is second at $7.2 million, followed by the port areas of Charleston and Savannah at $4.9 million, Philadelphia at $4.3 million, Jacksonville at $3.6 million, and Baltimore at $3.4 million. The direct economic impact for these seven port areas totals $38.8 million or 84.8 percent of the total for this alternative. No other port area had a direct economic impact over $0.9 million.

Containerships account for 54.5 percent of the total direct economic impact of Alternative 6 at 10 knots with an estimate of $24.9 million. The vessel type with the next largest economic impact is ro-ro cargo ships at $5.7 million followed by tankers at $5.7 million, general cargo vessels at $2.1 million, refrigerated cargo vessels at $2.0 million and passenger vessels at $1.8 million.

The total direct economic impact of Alternative 6 at 10 knots in 2004 is $49.4 million in 2004, roughly 8.0 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 with passenger vessels moving ahead of general cargo ships and refrigerated cargo vessels due to the stronger growth in passenger vessel arrivals.

The rankings for the leading port areas in 2004 are the same as described for 2003 above with the exception of the port area of Savannah moving ahead of the port area of Charleston and the port area of Jacksonville moving ahead of the port area of Baltimore.

The total direct economic impact of Alternative 6 at 14 knots is $18.4 million in 2004.

Data Chart 4-18
Alternative 6: Direct Economic Impact of a 12-knot Speed Restriction on the Shipping Industry by Port Area and Type of Vessel, 2003 ($000s)

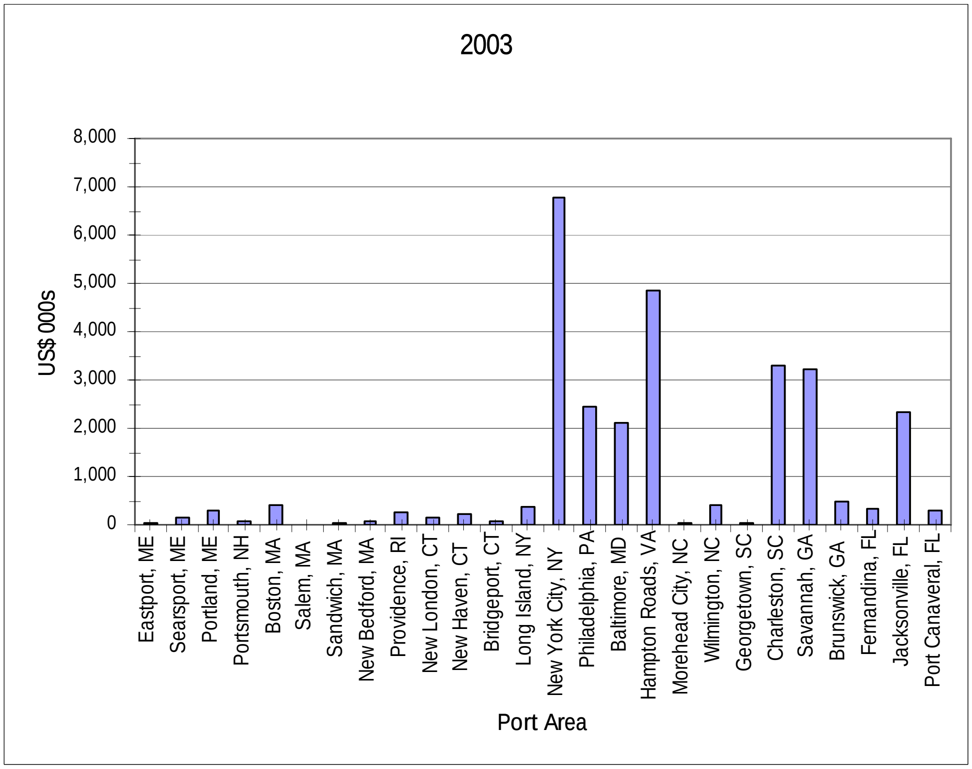
Port Area	Bulk Carriers	Combination Carriers	Container ships	Freight Barges	General Cargo Vessels	Passenger Vessels a/	Refrigerated Cargo Vessels	Ro-Ro Cargo Ship	Tank Barges	Tankers	Towing Vessels	Other b/	Total
Northeastern US - Gulf of Maine													
Eastport, ME	1.5	-	10.0	-	10.7	-	-	-	-	-	-	-	22.3
Searsport, ME	0.9	0.1	-	-	-	98.4	-	0.1	3.0	36.9	-	-	139.4
Portland, ME	10.8	4.3	6.9	0.2	15.5	32.0	-	14.7	1.6	209.9	-	-	296.0
Portsmouth, NH	10.2	0.3	-	-	9.1	0.9	-	-	1.2	51.2	-	-	72.9
Northeastern US - Off Race Point													
Boston, MA	4.1	0.1	178.0	0.1	2.5	82.8	1.9	10.0	-	117.9	-	-	397.3
Salem, MA	3.1	-	-	-	-	0.9	-	-	-	0.2	-	-	4.2
Northeastern US - Cape Cod Bay	-	-	-	-	-	18.8	-	-	-	8.8	-	-	27.6
Mid-Atlantic Block Island Sound													
New Bedford, MA	22.4	-	0.4	-	17.8	-	10.9	-	3.0	6.6	-	-	61.2
Providence, RI	24.4	1.3	-	-	15.2	-	12.5	109.2	0.7	83.8	-	-	247.2
New London, CT	3.6	-	9.8	-	13.3	81.7	-	-	26.1	3.6	-	-	138.0
New Haven, CT	11.9	-	5.6	0.0	36.9	4.8	-	-	93.9	87.2	-	-	240.4
Bridgeport, CT	8.9	-	-	-	-	4.4	-	-	53.8	15.1	-	-	82.3
Long Island, NY	-	0.9	-	-	-	72.1	-	-	181.2	114.1	-	-	368.3
Mid-Atlantic Ports of New York/New Jersey	56.9	12.0	4,980.7	0.4	27.2	113.2	56.0	823.4	12.5	687.4	-	-	6,769.7
Mid-Atlantic Delaware Bay	54.8	6.6	646.1	4.4	121.3	8.4	939.8	136.9	7.2	526.5	-	-	2,452.0
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	72.4	2.4	756.6	-	152.9	99.3	9.2	901.8	1.3	97.2	-	-	2,093.1
Hampton Roads, VA	78.1	9.7	4,191.8	0.5	93.9	35.0	3.4	324.9	0.7	112.5	-	-	4,850.4
Mid-Atlantic Morehead City and Beaufort, NC	1.9	-	14.5	-	13.4	-	0.5	1.6	-	11.8	-	-	43.7
Mid-Atlantic Wilmington, NC	13.6	2.0	160.2	-	106.3	-	1.9	36.0	6.2	82.8	-	-	409.1
Mid-Atlantic Georgetown, SC	5.6	-	2.2	-	15.6	-	-	-	-	-	-	-	23.4
Mid-Atlantic Charleston, SC	21.1	-	2,790.3	-	91.8	95.3	6.1	219.6	7.5	72.5	-	-	3,304.4
Mid-Atlantic Savannah, GA	25.1	2.7	2,689.8	-	149.4	10.4	55.7	177.5	2.0	104.6	-	-	3,217.2
Southeastern US													
Brunswick, GA	20.6	-	53.9	-	44.6	6.4	23.5	331.4	-	3.3	-	-	483.7
Fernandina, FL	8.1	-	100.7	0.8	117.0	9.1	84.5	0.5	-	0.1	-	-	320.6
Jacksonville, FL	103.2	1.9	727.4	142.5	230.4	80.9	12.1	745.9	14.5	268.8	-	-	2,327.6
Port Canaveral, FL	1.5	0.0	3.3	0.0	6.9	283.6	7.0	4.1	0.2	1.8	-	-	308.3
Total	564.9	44.5	17,328.2	148.9	1,291.6	1,138.3	1,225.2	3,837.6	416.7	2,704.6	-	-	28,700.5

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.

Alternative 6: Direct Economic Impact on the Shipping Industry by Port Area, 2003 and 2004 ($000s)



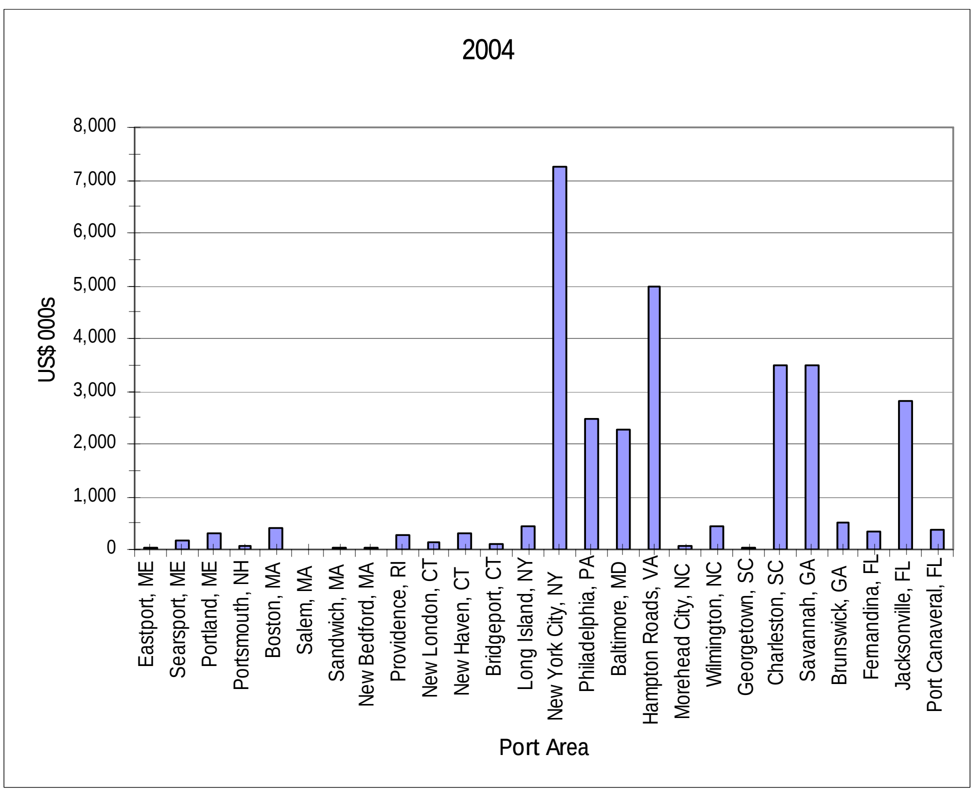


Figure 4-10

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Data Chart 4-19
Alternative 6: Direct Economic Impact of a 12-knot Speed Restriction on the Shipping Industry by Port Area and Type of Vessel, 2004 ($000s)

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	2.9	-	17.3	-	25.9	-	-	-	-	-	-	-	46.0
Searsport, ME	1.0	-	3.0	0.2	0.3	111.3	-	0.2	5.2	32.1	-	-	153.3
Portland, ME	9.0	0.8	2.9	0.2	13.2	51.0	-	14.8	12.4	203.8	-	-	308.2
Portsmouth, NH	8.7	0.7	0.1	-	14.1	0.9	-	-	0.1	28.4	-	-	53.0
Northeastern US - Off Race Point													
Boston, MA	4.1	0.1	178.0	0.1	2.5	82.8	1.9	10.0	-	117.9	-	-	397.3
Salem, MA	0.9	-	-	-	-	7.6	-	-	-	-	-	-	8.5
Northeastern US - Cape Cod Bay	-	-	-	-	-	14.9	-	-	0.0	14.0	-	-	29.0
Mid-Atlantic Block Island Sound													
New Bedford, MA	18.6	-	-	-	7.9	-	14.6	1.8	-	5.7	-	-	48.6
Providence, RI	13.9	1.4	-	-	26.8	64.9	-	97.6	1.0	78.7	-	-	284.3
New London, CT	3.4	-	20.1	-	50.0	48.0	-	-	24.5	5.6	-	-	151.6
New Haven, CT	6.4	-	11.0	-	27.4	-	-	-	179.4	75.3	-	-	299.4
Bridgeport, CT	16.3	-	-	0.0	-	-	-	-	89.3	10.4	-	-	116.1
Long Island, NY	-	-	-	0.0	-	96.1	-	-	224.8	121.6	-	-	442.6
Mid-Atlantic Ports of New York/New Jersey	47.7	8.7	5,157.1	-	78.8	374.4	64.5	879.8	3.8	640.3	-	-	7,255.0
Mid-Atlantic Delaware Bay	51.1	1.4	609.0	12.8	169.0	38.4	891.2	134.3	2.3	577.4	-	-	2,487.0
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	89.3	3.0	807.0	-	206.8	120.7	16.0	871.9	0.7	145.7	-	-	2,261.1
Hampton Roads, VA	105.3	9.6	4,088.1	0.9	130.4	179.2	31.5	324.8	0.7	118.8	-	-	4,989.1
Mid-Atlantic Morehead City and Beaufort, NC	5.8	0.3	19.4	-	14.0	12.9	-	-	-	17.1	-	-	69.5
Mid-Atlantic Wilmington, NC	9.6	0.9	152.8	-	134.2	10.8	-	44.4	4.9	89.7	-	-	447.2
Mid-Atlantic Georgetown, SC	4.3	-	1.6	-	23.9	3.4	-	-	-	-	-	-	33.1
Mid-Atlantic Charleston, SC	22.3	-	2,905.5	-	112.7	155.6	12.0	197.6	2.4	71.2	-	-	3,479.2
Mid-Atlantic Savannah, GA	24.9	2.6	2,743.0	-	177.1	118.0	83.7	220.7	0.8	128.4	-	-	3,499.2
Southeastern US													
Brunswick, GA	20.4	-	26.9	-	73.1	26.7	24.1	345.3	-	0.1	-	-	516.5
Fernandina, FL	17.3	-	80.4	2.5	119.7	56.8	36.5	9.8	-	-	-	-	323.0
Jacksonville, FL	110.9	3.8	765.6	124.0	225.5	475.1	13.4	777.6	19.0	285.2	-	-	2,800.1
Port Canaveral, FL	2.4	-	3.8	0.0	9.8	334.9	5.8	5.6	0.8	3.0	-	-	366.1
Total	596.4	33.1	17,592.3	140.8	1,642.8	2,384.3	1,195.2	3,936.3	572.1	2,770.6	-	-	30,863.9

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.

4.4.1.7 Comparison of Direct Economic Impacts by Alternative

This section compares the direct economic impact on the shipping industry resulting from the operational measures proposed in Alternatives 2 through Alternative 6 by port area for 2003 and 2004. The estimated direct economic impact for US-flag and foreign-flag vessels is also presented. The alternatives are discussed in descending order in terms of highest direct economic impact in 2003 at a 12-knot speed restriction. Section 4.4.1.8 provides information on the 10- and 14-knot speed restrictions, which have the same ranking at 12 knots.

- **Alternative 5 – Combination of Alternatives** has the highest direct economic impact on the shipping industry estimated at $52.4 million in 2003 (Data Chart 4-20). This alternative also has the highest direct economic impact on US-flag vessels at $5.0 million and foreign–flag vessels at $47.4 million in 2003. With the exception of port areas in the SEUS, this alternative results in the highest direct economic impact on the shipping industry for each port area. It ranks second highest for the ports of the SEUS.
- **Alternative 3 – Speed Restrictions in Designated Areas** has the second highest direct economic impact on the shipping industry estimated at $50.5 million in 2003. This alternative also has the second highest direct economic impact on US-flag vessels at $4.7 million and foreign-flag vessels at $45.7 million in 2003. With the exception of the four port areas in the Southeastern US, this alternative results in the second highest direct economic impact on the shipping industry for each port area. For the port area of Fernandina, the direct economic impact under Alternative 3 is third highest among the alternatives studied. For the other Southeast port areas, the impact under this alternative is the fourth highest.
- **Alternative 6 (Preferred) – NOAA Ship Strike Reduction Strategy** has the third highest direct economic impact on the shipping industry estimated at $28.7 million in 2003. This is slightly more than half of the direct economic impact estimated for Alternative 5. Alternative 6 also has the third highest direct economic impact on US-flag vessels at $3.2 million and foreign-flag vessels at $25.5 million in 2003. This alternative has the highest direct economic impact of the alternatives proposed for the Southeast port areas of Brunswick, Fernandina and Jacksonville. For all other port areas, Alternative 6 ranks third in terms of highest direct economic impact.
- **Alternative 2 – Dynamic Management Areas** ranks fourth in terms of highest direct economic impact on the shipping industry estimated at $9.8 million in 2003. This alternative also has the fourth highest direct economic impact on US-flag vessels at $0.8 million and foreign-flag vessels at $9.1 million in 2003. For the port area of Port Canaveral, Alternative 2 results in the highest direct economic impact of the alternatives proposed at $1.5 million. For the port areas of Brunswick and Jacksonville this alternative ranks third; for all other port areas it ranks fourth.
- **Alternative 4 – Recommended Routes** has the lowest direct economic impact of the proposed alternatives estimated at $1.0 million in 2003. This alternative also has the lowest direct economic impact on US-flag vessels at $0.2 million and foreign-flag vessels at $0.9 million in 2003.

Data Chart 4-21 presents a comparison of the direct economic impact of the operational measures on US and foreign flag vessels by port area for each alternative for 2004. The relative ranking of each alternative is the same as described for 2003 with the minor exception that Alternative 2 moves into the third rank for the port area of Fernandina.

4.4.1.8 Impacts of Alternate Speeds

The EIS considers speeds of 10, 12, and 14 knots for all speed restrictions under each of the alternatives. The economic impact analysis uses 12 knots as the base case assumption. However, this section provides one component of the estimated direct economic impact to the shipping industry at a 10-knot and 14-knot speed restriction. The estimated impacts are obtained 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 for 2004. The ranking of the alternatives in terms of economic impact does not change with restricted speeds of 10 knots or 14 knots. A change in the speed restriction from 12 knots to 10 knots would generally increase the direct economic impact of each alternative by 60 percent, whereas a change in the restricted speed from 12 knots to 14 knots would generally lower the direct economic impact of each alternative by 40 percent.[20]

The results of the sensitivity analysis show that alternative restricted speed levels dramatically alter the direct economic impact. For example, under Alternative 5, the direct economic impact ranges from $32.9 million dollars with a restricted speed of 14 knots to $89.7 million at 10 knots. For Alternative 6, the range is from $18.4 million to $49.4 million.

At a restricted speed of 10 knots, the direct economic impact on the shipping industry is $89.7 million for Alternative 5; $86.8 million for Alternative 3; $49.4 million dollars for Alternative 6; $17.0 million dollars for Alternative 2; and $1.1 million for Alternative 4.

At a restricted speed of 14 knots, the direct economic impact on the shipping industry is $32.9 million for Alternative 5; $31.2 million for Alternative 3; $18.4 million dollars for Alternative 6; $6.5 million dollars for Alternative 2; and $1.1 million for Alternative 4.

Data Chart 4-23 displays the sensitivity analysis results for each alternative using the economic impact of the 12-knot speed restriction as an index. Thus this Data Chart shows the percent change in direct economic impact of a 10-knot or 14-knot speed restriction from the impact presented for a 12-knot speed restriction. It is evident that 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 increase in economic impact when the restricted speed is changed from 12 knots to 10 knots since a greater number of vessels become affected. The port areas within Block Island Sound demonstrate this phenomenon. Other port areas such as Charleston and Hampton Roads, whose arrivals consist more of faster vessels do not show as dramatic an increase in direct economic impacts at alternative restricted speeds of 10 knots. This is because the economic impact at 12 knots is more significant for these port areas than those with arrivals of slower vessels and in relative terms do not have many slower vessels that are only affected at the slower restricted speed.

[20] The exception is Alternative 4 that does not change with restricted speeds as this alternative uses the time to cover the increased distance of recommended routes at normal vessel operating speed.

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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	-	19.2	19.2	-	98.0	98.0	-	-	-	-	102.2	102.2	-	22.3	22.3
Searsport, ME	7.3	169.0	176.4	37.4	861.5	898.9	-	-	-	39.1	898.8	937.8	7.5	131.9	139.4
Portland, ME	7.1	218.6	225.7	36.2	1,114.4	1,150.6	-	-	-	37.7	1,162.6	1,200.4	13.2	282.8	296.0
Portsmouth, NH	3.0	43.5	46.5	15.3	221.7	237.0	-	-	-	16.0	231.3	247.3	5.2	67.6	72.9
Northeastern US - Off Race Point															
Boston, MA	1.9	288.8	290.7	9.5	1,469.3	1,478.8	3.7	352.4	356.1	13.6	1,885.5	1,899.1	2.4	394.9	397.3
Salem, MA	0.1	2.7	2.8	0.5	13.5	14.1	0.5	5.2	5.7	1.1	19.3	20.4	0.1	4.2	4.2
	-	-	-	-	-	-	-	-	-	-	-	-			
Northeastern US - Cape Cod Bay	-	6.7	6.7	-	77.1	77.1	-	-	-	-	78.0	78.0	-	27.6	27.6
Mid-Atlantic Block Island Sound															
New Bedford, MA	0.6	4.8	5.4	15.3	86.2	101.4	-	-	-	15.3	86.2	101.4	10.1	51.1	61.2
Providence, RI	1.0	37.7	38.7	19.8	608.1	628.0	-	-	-	19.8	608.1	628.0	13.2	233.9	247.2
New London, CT	11.9	3.7	15.6	242.0	60.3	302.3	-	-	-	242.0	60.3	302.3	108.6	29.4	138.0
New Haven, CT	13.3	15.5	28.8	255.1	266.8	521.9	-	-	-	255.1	266.8	521.9	116.1	124.2	240.4
Bridgeport, CT	9.3	5.2	14.5	132.2	37.0	169.2	-	-	-	132.2	37.0	169.2	66.8	15.5	82.3
Long Island, NY	34.0	8.6	42.6	642.1	185.9	828.0	-	-	-	642.1	185.9	828.0	288.7	79.6	368.3
Mid-Atlantic Ports of New York/New Jersey	69.4	1,088.4	1,157.8	919.8	13,622.0	14,541.9	-	-	-	919.8	13,622.0	14,541.9	434.6	6,335.2	6,769.7
Mid-Atlantic Delaware Bay	5.0	307.2	312.2	65.3	4,919.4	4,984.7	-	-	-	65.3	4,919.4	4,984.7	32.3	2,419.8	2,452.0
Mid-Atlantic Chesapeake Bay															
Baltimore, MD	10.1	272.7	282.9	158.6	4,146.9	4,305.5	-	-	-	158.6	4,146.9	4,305.5	78.0	2,015.1	2,093.1
Hampton Roads, VA	65.5	604.9	670.4	976.1	8,945.8	9,921.9	-	-	-	976.1	8,945.8	9,921.9	487.4	4,363.0	4,850.4
Mid-Atlantic Morehead City and Beaufort, NC	0.8	8.6	9.4	4.2	59.5	63.7	-	-	-	4.2	59.5	63.7	2.6	41.1	43.7
Mid-Atlantic Wilmington, NC	5.8	63.9	69.7	40.2	523.9	564.0	-	-	-	40.2	523.9	564.0	28.4	380.7	409.1
Mid-Atlantic Georgetown, SC	-	5.2	5.2	-	29.6	29.6	-	-	-	-	29.6	29.6	-	23.4	23.4
Mid-Atlantic Charleston, SC	115.4	477.6	593.1	778.5	3,162.3	3,940.8	-	-	-	778.5	3,162.3	3,940.8	663.5	2,640.9	3,304.4
Mid-Atlantic Savannah, GA	65.9	2,741.8	2,807.7	95.5	3,899.9	3,995.4	-	-	-	95.5	3,899.9	3,995.4	87.9	3,129.3	3,217.2
Southeastern US															
Brunswick, GA	26.7	273.3	300.1	31.6	217.6	249.2	6.4	48.5	54.9	45.5	338.8	384.3	53.1	430.6	483.7
Fernandina, FL	1.6	120.9	122.5	5.3	151.0	156.3	1.8	41.1	42.9	9.6	259.9	269.5	9.6	311.0	320.6
Jacksonville, FL	297.3	757.0	1,054.3	252.2	729.2	981.4	144.6	422.0	566.7	481.9	1,377.9	1,859.8	643.4	1,684.2	2,327.6
Port Canaveral, FL	10.8	1,530.8	1,541.6	1.2	216.8	218.0	-	-	-	3.3	523.0	526.3	2.2	306.2	308.3
Total	763.8	9,076.5	9,840.3	4,734.0	45,723.7	50,457.7	157.0	869.3	1,026.3	4,992.5	47,431.0	52,423.5	3,155.0	25,545.5	28,700.5

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	-	34.7	34.7	-	176.8	176.8	-	-	-	-	184.5	184.5	-	46.0	46.0
Searsport, ME	22.5	175.1	197.7	114.8	892.7	1,007.6	-	-	-	119.8	931.3	1,051.2	17.7	135.6	153.3
Portland, ME	16.8	232.3	249.1	85.5	1,184.0	1,269.6	-	-	-	89.2	1,235.3	1,324.5	21.6	286.5	308.2
Portsmouth, NH	2.0	38.7	40.7	10.1	197.1	207.3	-	-	-	10.6	205.7	216.2	1.3	51.7	53.0
Northeastern US - Off Race Point															
Boston, MA	1.9	288.8	290.7	9.5	1,469.3	1,478.8	3.7	352.4	356.1	13.6	1,885.5	1,899.1	2.4	394.9	397.3
Salem, MA	2.0	10.9	12.9	10.0	55.4	65.5	4.6	10.6	15.2	15.0	68.5	83.5	1.3	7.2	8.5
	-	-	-	-	-	-	-	-	-	-	-	-			
Northeastern US - Cape Cod Bay	1.0	12.0	12.9	11.0	138.2	149.2	-	-	-	11.2	139.9	151.1	0.4	28.6	29.0
Mid-Atlantic Block Island Sound															
New Bedford, MA	0.9	4.2	5.2	5.9	70.9	76.8	-	-	-	5.9	70.9	76.8	3.8	44.8	48.6
Providence, RI	3.5	36.2	39.8	46.6	683.8	730.3	-	-	-	46.6	683.8	730.3	23.0	261.4	284.3
New London, CT	18.2	11.8	30.0	203.2	174.5	377.7	-	-	-	203.2	174.5	377.7	75.0	76.6	151.6
New Haven, CT	20.0	13.3	33.3	407.0	233.5	640.6	-	-	-	407.0	233.5	640.6	192.7	106.7	299.4
Bridgeport, CT	12.1	3.3	15.4	191.2	34.2	225.3	-	-	-	191.2	34.2	225.3	98.8	17.2	116.1
Long Island, NY	39.3	8.6	47.9	782.5	160.9	943.4	-	-	-	782.5	160.9	943.4	366.0	76.6	442.6
Mid-Atlantic Ports of New York/New Jersey	69.6	1,200.5	1,270.1	929.9	14,706.3	15,636.1	-	-	-	929.9	14,706.3	15,636.1	428.7	6,826.3	7,255.0
Mid-Atlantic Delaware Bay	6.8	312.8	319.6	106.1	4,815.1	4,921.2	-	-	-	106.1	4,815.1	4,921.2	49.0	2,437.9	2,487.0
Mid-Atlantic Chesapeake Bay															
Baltimore, MD	13.5	313.2	326.8	181.0	4,609.1	4,790.1	-	-	-	181.0	4,609.1	4,790.1	82.5	2,178.6	2,261.1
Hampton Roads, VA	67.5	616.6	684.1	1,007.6	9,152.6	10,160.2	-	-	-	1,007.6	9,152.6	10,160.2	504.4	4,484.7	4,989.1
Mid-Atlantic Morehead City and Beaufort, NC	2.4	9.2	11.6	17.4	67.4	84.8	-	-	-	17.4	67.4	84.8	15.3	54.2	69.5
Mid-Atlantic Wilmington, NC	5.8	67.2	73.0	55.0	529.5	584.6	-	-	-	55.0	529.5	584.6	43.2	403.9	447.2
Mid-Atlantic Georgetown, SC	0.3	4.3	4.6	3.8	38.2	42.0	-	-	-	3.8	38.2	42.0	3.4	29.8	33.1
Mid-Atlantic Charleston, SC	131.7	496.3	628.0	877.1	3,284.5	4,161.6	-	-	-	877.1	3,284.5	4,161.6	743.6	2,735.6	3,479.2
Mid-Atlantic Savannah, GA	77.3	2,892.0	2,969.3	126.6	4,198.7	4,325.3	-	-	-	126.6	4,198.7	4,325.3	118.0	3,381.2	3,499.2
Southeastern US															
Brunswick, GA	44.3	245.1	289.4	35.2	246.9	282.1	7.1	53.5	60.7	53.6	368.8	422.4	86.8	429.7	516.5
Fernandina, FL	23.8	109.3	133.1	11.7	114.3	126.1	3.7	36.3	40.0	24.3	214.2	238.5	58.4	264.5	323.0
Jacksonville, FL	311.2	954.4	1,265.6	280.9	908.1	1,189.0	157.3	516.0	673.3	527.9	1,705.9	2,233.8	681.8	2,118.3	2,800.1
Port Canaveral, FL	18.1	1,812.4	1,830.5	2.5	241.5	244.0	-	-	-	6.1	603.9	610.1	3.6	362.5	366.1
Total	912.6	9,903.3	10,815.9	5,512.1	48,383.6	53,895.7	176.3	968.9	1,145.2	5,812.0	50,302.6	56,114.6	3,622.9	27,241.0	30,863.9

Source: Nathan Associates Inc.

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	56.1	34.7	21.4	285.1	176.8	109.4	-	-	-	297.5	184.5	114.1	74.8	46.0	28.6
Searsport, ME	330.1	197.7	100.6	1,679.2	1,007.6	514.0	-	-	-	1,752.0	1,051.2	536.2	267.5	153.3	69.2
Portland, ME	490.6	249.1	87.2	2,495.2	1,269.6	445.1	-	-	-	2,603.4	1,324.5	464.4	636.1	308.2	89.6
Portsmouth, NH	92.2	40.7	9.2	468.9	207.3	47.0	-	-	-	489.2	216.2	49.0	121.3	53.0	12.1
Northeastern US - Off Race Point															
Boston, MA	511.7	290.7	134.4	2,707.8	1,478.8	658.1	356.1	356.1	356.1	3,178.5	1,899.1	981.3	721.4	397.3	177.6
Salem, MA	22.3	12.9	6.3	118.1	65.5	30.7	15.2	15.2	15.2	138.2	83.5	43.2	14.8	8.5	4.1
Northeastern US - Cape Cod Bay	18.7	12.9	7.3	258.9	149.2	71.9	-	-	-	261.5	151.1	72.9	52.5	29.0	11.5
Mid-Atlantic Block Island Sound															
New Bedford, MA	11.6	5.2	1.2	183.8	76.8	12.8	-	-	-	183.8	76.8	12.8	117.8	48.6	8.7
Providence, RI	69.9	39.8	19.5	1,323.2	730.3	337.0	-	-	-	1,323.2	730.3	337.0	555.7	284.3	112.7
New London, CT	52.3	30.0	13.8	681.5	377.7	166.4	-	-	-	681.5	377.7	166.4	282.0	151.6	64.5
New Haven, CT	77.8	33.3	4.1	1,536.2	640.6	69.5	-	-	-	1,536.2	640.6	69.5	726.5	299.4	31.9
Bridgeport, CT	38.9	15.4	1.3	628.8	225.3	2.0	-	-	-	628.8	225.3	2.0	330.5	116.1	1.1
Long Island, NY	109.2	47.9	7.3	2,211.6	943.4	136.1	-	-	-	2,211.6	943.4	136.1	1,058.4	442.6	62.1
Mid-Atlantic Ports of New York/New Jersey	1,889.4	1,270.1	815.6	23,626.3	15,636.1	9,897.9	-	-	-	23,626.3	15,636.1	9,897.9	11,161.0	7,255.0	4,519.8
Mid-Atlantic Delaware Bay	548.6	319.6	157.7	8,597.9	4,921.2	2,392.2	-	-	-	8,597.9	4,921.2	2,392.2	4,403.4	2,487.0	1,194.9
Mid-Atlantic Chesapeake Bay															
Baltimore, MD	510.4	326.8	195.1	7,634.9	4,790.1	2,809.4	-	-	-	7,634.9	4,790.1	2,809.4	3,662.7	2,261.1	1,308.6
Hampton Roads, VA	994.7	684.1	459.3	15,056.8	10,160.2	6,699.3	-	-	-	15,056.8	10,160.2	6,699.3	7,520.4	4,989.1	3,238.5
Mid-Atlantic Morehead City and Beaufort, NC	22.5	11.6	4.6	166.2	84.8	33.1	-	-	-	166.2	84.8	33.1	134.6	69.5	27.3
Mid-Atlantic Wilmington, NC	125.9	73.0	37.7	1,044.5	584.6	291.4	-	-	-	1,044.5	584.6	291.4	792.7	447.2	225.1
Mid-Atlantic Georgetown, SC	9.4	4.6	2.3	85.8	42.0	19.7	-	-	-	85.8	42.0	19.7	66.9	33.1	15.6
Mid-Atlantic Charleston, SC	904.1	628.0	425.6	6,236.0	4,161.6	2,708.7	-	-	-	6,236.0	4,161.6	2,708.7	5,211.7	3,479.2	2,265.9
Mid-Atlantic Savannah, GA	4,331.5	2,969.3	1,990.8	6,564.6	4,325.3	2,790.8	-	-	-	6,564.6	4,325.3	2,790.8	5,306.5	3,499.2	2,257.0
Southeastern US															
Brunswick, GA	461.9	289.4	172.1	460.2	282.1	165.2	60.7	60.7	60.7	631.2	422.4	280.9	771.5	516.5	341.6
Fernandina, FL	239.5	133.1	67.0	243.4	126.1	59.9	40.0	40.0	40.0	370.3	238.5	145.8	496.9	323.0	203.1
Jacksonville, FL	2,194.5	1,265.6	689.8	2,130.8	1,189.0	630.5	673.3	673.3	673.3	3,473.4	2,233.8	1,480.8	4,344.2	2,800.1	1,868.8
Port Canaveral, FL	2,875.6	1,830.5	1,078.0	397.1	244.0	139.0	-	-	-	972.2	610.1	354.6	575.1	366.1	215.6
Total	16,989.3	10,815.9	6,509.1	86,822.9	53,895.7	31,237.0	1,145.2	1,145.2	1,145.2	89,745.6	56,114.6	32,889.4	49,406.8	30,863.9	18,355.3

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 12 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	161.6	100.0	61.7	161.2	100.0	61.8	-	-	-	161.3	100.0	61.8	162.6	100.0	62.1
Searsport, ME	167.0	100.0	50.9	166.7	100.0	51.0	-	-	-	166.7	100.0	51.0	174.5	100.0	45.1
Portland, ME	197.0	100.0	35.0	196.5	100.0	35.1	-	-	-	196.6	100.0	35.1	206.4	100.0	29.1
Portsmouth, NH	226.7	100.0	22.6	226.2	100.0	22.7	-	-	-	226.3	100.0	22.7	228.9	100.0	22.7
Northeastern US - Off Race Point															
Boston, MA	176.0	100.0	46.2	183.1	100.0	44.5	100.0	100.0	100.0	167.4	100.0	51.7	181.6	100.0	44.7
Salem, MA	173.4	100.0	48.7	180.4	100.0	46.8	100.0	100.0	100.0	165.6	100.0	51.7	173.4	100.0	48.7
Northeastern US - Cape Cod Bay	144.6	100.0	56.2	173.4	100.0	48.1	-	-	-	173.1	100.0	48.2	181.4	100.0	39.6
Mid-Atlantic Block Island Sound															
New Bedford, MA	222.9	100.0	22.4	239.3	100.0	16.7	-	-	-	239.3	100.0	16.7	242.6	100.0	17.9
Providence, RI	175.7	100.0	49.1	181.2	100.0	46.1	-	-	-	181.2	100.0	46.1	195.4	100.0	39.6
New London, CT	174.4	100.0	46.1	180.4	100.0	44.1	-	-	-	180.4	100.0	44.1	186.0	100.0	42.6
New Haven, CT	233.5	100.0	12.3	239.8	100.0	10.8	-	-	-	239.8	100.0	10.8	242.6	100.0	10.6
Bridgeport, CT	251.9	100.0	8.7	279.0	100.0	0.9	-	-	-	279.0	100.0	0.9	284.7	100.0	0.9
Long Island, NY	227.9	100.0	15.3	234.4	100.0	14.4	-	-	-	234.4	100.0	14.4	239.2	100.0	14.0
Mid-Atlantic Ports of New York/New Jersey	148.8	100.0	64.2	151.1	100.0	63.3	-	-	-	151.1	100.0	63.3	153.8	100.0	62.3
Mid-Atlantic Delaware Bay	171.7	100.0	49.3	174.7	100.0	48.6	-	-	-	174.7	100.0	48.6	177.1	100.0	48.0
Mid-Atlantic Chesapeake Bay															
Baltimore, MD	156.2	100.0	59.7	159.4	100.0	58.7	-	-	-	159.4	100.0	58.7	162.0	100.0	57.9
Hampton Roads, VA	145.4	100.0	67.1	148.2	100.0	65.9	-	-	-	148.2	100.0	65.9	150.7	100.0	64.9
Mid-Atlantic Morehead City and Beaufort, NC	193.4	100.0	39.7	196.0	100.0	39.0	-	-	-	196.0	100.0	39.0	193.6	100.0	39.3
Mid-Atlantic Wilmington, NC	172.6	100.0	51.7	178.7	100.0	49.8	-	-	-	178.7	100.0	49.8	177.3	100.0	50.3
Mid-Atlantic Georgetown, SC	203.6	100.0	49.2	204.5	100.0	46.8	-	-	-	204.5	100.0	46.8	201.8	100.0	46.9
Mid-Atlantic Charleston, SC	143.9	100.0	67.8	149.8	100.0	65.1	-	-	-	149.8	100.0	65.1	149.8	100.0	65.1
Mid-Atlantic Savannah, GA	145.9	100.0	67.0	151.8	100.0	64.5	-	-	-	151.8	100.0	64.5	151.7	100.0	64.5
Southeastern US															
Brunswick, GA	159.6	100.0	59.5	163.2	100.0	58.6	100.0	100.0	100.0	149.4	100.0	66.5	149.4	100.0	66.1
Fernandina, FL	179.9	100.0	50.3	193.1	100.0	47.5	100.0	100.0	100.0	155.3	100.0	61.1	153.8	100.0	62.9
Jacksonville, FL	173.4	100.0	54.5	179.2	100.0	53.0	100.0	100.0	100.0	155.5	100.0	66.3	155.1	100.0	66.7
Port Canaveral, FL	157.1	100.0	58.9	162.8	100.0	57.0	-	-	-	159.4	100.0	58.1	157.1	100.0	58.9
Total	157.1	100.0	60.2	161.1	100.0	58.0	100.0	100.0	100.0	159.9	100.0	58.6	160.1	100.0	59.5

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 as result of vessels making multiple port calls on the US East Coast and on 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 occur as 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 at 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 operational measures of the Strategy 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 next two days after its arrival at the preceding US East Coast port, that arrival was considered to be a part of a multi-port string.[21]

Data Chart 4-24 lists sets of multi-port strings that occurred at least 20 times in 2003. Of the total 4,278 occurrences of multi-port strings in 2003, those strings with at least 20 occurrences totaled 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 in 2003 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 in 2003.

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 2003 and 2004.

Other port areas with significant participation in multi-port strings each year include Charleston, Savannah, Baltimore, and Philadelphia.

[21] 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 is based on total US East Coast vessel movements in 2003 and 2004. In the following sections, the impacts are examined for each of the proposed alternatives. The same text and data charts are applicable for Alternatives 3 and 5 (which includes Alternative 3), and are described first in Section 4.4.2.3, and referenced in Section 4.4.2.5.

As with the other sections, this discussion provides details of the economic impact at the base case scenario of a 12-knot speed restriction. The economic impacts of 10- and 14-knot speed restrictions were estimated for 2003 and 2004 and can be referenced in Data Chart 4-43. The impact of a 10-knot speed restriction was assumed to be 20 percent higher than the estimate at 12 knots. The impact of a 14-knot speed restriction was assumed to be 16 percent lower than the estimate at 12 knots.

4.4.2.1 Alternative 1 – No Action Alternative

There are no impacts on vessels making multiple port calls for Alternative 1.

4.4.2.2 Alternative 2 – Dynamic Management Areas

There are no impacts on vessels making multiple US East Coast port calls for Alternative 2. Due to the limited geographic scope at any single point in 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 $5.7 million in 2003 and $6.0 million in 2004.

Seasonal speed restrictions by port area under Alternative 3 were presented earlier in Figure 4-4. They include speed restrictions which would be in place year round in the NEUS, from October 1 through April 30 for the MAUS, and from December 1 through March 31 for the SEUS. The same seasonal speed restrictions apply for Alternative 5, along with other operational measures.[22]

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 contained speed restrictions. In 2003, 5,955 vessel arrivals fell into this category with the 3,383 containerships arrivals accounting for 57 percent of the total multi-port vessel arrivals during speed-restricted periods. Ro-ro cargo ships with 1,143 arrivals (19 percent) and tankers with 931 arrivals (16 percent) were the other vessel types with the most port calls as part of multi-port strings during restricted periods.

These 5,955 multi-port string restricted arrivals in 2003 represent roughly 39 percent of total US East Coast Alternative 3 restricted vessel arrivals (see Data Chart 4-3). For containerships, the multi-port string restricted arrivals represents 66 percent of the total containership restricted period arrivals. For ro-ro cargo ships, the multi-port string restricted arrivals represents 62 percent of those vessels total restricted arrivals in 2003.

The port area of New York/New Jersey had the most multi-port string restricted arrivals with 1,483 arrivals in 2003. The port area of Hampton Roads was second with 1,081 arrivals, followed by the port areas of Charleston (722 arrivals), Savannah (624 arrivals), Baltimore (570 arrivals), and Philadelphia (343 arrivals).

[22] For simplicity, this section refers to Alternative 3; however, the comments apply equally to 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	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	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	23	8	259	6	194	4	-	1,483
Mid-Atlantic Delaware Bay													
Philadelphia, PA	32	-	122	-	21	7	7	48	2	99	5	-	343
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	24	-	195	-	13	14	-	267	-	53	2	2	570
Hampton Roads, VA	23	2	898	-	25	8	-	82	-	41	-	2	1,081
Mid-Atlantic Morehead City and Beaufort, NC													
Morehead City, NC	2	-	5	-	5	-	-	1	-	5	-	1	19
Mid-Atlantic Wilmington, NC													
Wilmington, NC	19	4	41	-	18	-	1	6	6	54	1	-	150
Mid-Atlantic Georgetown, SC													
Georgetown, SC	4	-	1	-	3	-	-	-	-	-	-	-	8
Mid-Atlantic Charleston, SC													
Charleston, SC	11	-	550	-	13	10	-	69	3	64	2	-	722
Mid-Atlantic Savannah, GA													
Savannah, GA	21	5	464	-	34	4	5	45	2	43	-	1	624
Southeastern US													
Brunswick, GA	6	-	5	-	3	1	-	53	-	-	-	-	68
Fernandina, FL	-	-	6	-	7	1	-	-	-	-	-	-	14
Jacksonville, FL	6	-	45	-	4	-	-	91	3	28	1	-	178
Port Canaveral, FL	2	-	3	-	5	1	-	6	-	-	-	-	17
All Port Areas	205	20	3,324	0	184	220	30	993	51	903	19	6	5,955

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 similar information for 2004. The total number of multi-port string restricted arrivals increased by 5.6 percent to 6,287 arrivals. The ranking by vessel type remained unchanged from 2003 with the exception of general cargo vessels moving ahead of bulk carriers for fifth place. In terms of vessel arrivals by port area, the rankings for the top eight port areas remained unchanged from 2003.

Additional Direct Economic Impact

There are several reasons why the cumulative effect of multiple port calls at restricted ports could affect a vessel more than the sum of the individual direct impacts presented in the prior sections. 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 felt 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 of 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 will 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. It is realistic to assume that the shipping industry 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 30 minutes for each vessel arrival that is part of a multi-port string to account for this cumulative impact. The economic value of this additional time has been calculated for each port area based on the 2005 vessel operating costs by type and size of vessel. The results by port area and type of vessel at a 12-knot speed restriction are presented in Data Chart 4-28 for 2003 and Data Chart 4-29 for 2004.

The additional direct economic impact of multi-port strings on the shipping industry in 2003 is estimated at $5.7 million. The port area of New York/New Jersey has the largest additional economic impact at $1.4 million followed by Hampton Roads at $1.1 million, Charleston at $0.8 million, Savannah at $0.7 million, and Baltimore at $0.4 million. Containerships accounted for 64 percent of the additional economic impact of multi-port strings in 2003.

The additional direct economic impact of multi-port strings in 2004 is estimated at $6.0 million. The ranking of the top six port areas in terms of largest impact remains unchanged from 2003.

The additional direct economic impact of multi-port strings in 2004 at a speed restriction of 10 knots is $7.2 million and $5.0 million at 14 knots. The impacts by alternative and restricted speed can be compared in Data Chart 4-43.

4.4.2.4 Alternative 4 – Recommended Shipping Routes

There are no impacts on vessels making multiple US East Coast port calls for Alternative 4. Due to the limited geographic scope at any single point in time, Alternative 4 would not generate an additional direct economic impact due to multi-port strings.

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

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	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	-	-	-	-	-	6	-	43	17	-	-	70
Long Island, NY	-	-	-	-	-	-	-	-	29	52	-	-	81
Mid-Atlantic Ports of New York/New Jersey													
New York City, NY	14	5	1,003	-	20	39	8	261	1	189	2	1	1,543
Mid-Atlantic Delaware Bay													
Philadelphia, PA	13	1	112	2	26	10	7	51	-	99	5	-	326
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	15	-	216	-	24	18	2	278	-	60	4	1	618
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	39	-	28	4	-	12	-	64	1	1	167
Mid-Atlantic Georgetown, SC													
Georgetown, SC	7	-	-	-	2	1	-	-	-	-	-	-	10
Mid-Atlantic Charleston, SC													
Charleston, SC	4	-	610	-	22	22	2	71	-	67	1	1	800
Mid-Atlantic Savannah, GA													
Savannah, GA	10	4	462	-	29	16	8	50	-	56	1	1	637
Southeastern US													
Brunswick, GA	5	-	6	-	7	1	-	68	-	-	-	-	87
Fernandina, FL	1	-	12	-	7	2	-	1	-	-	-	-	23
Jacksonville, FL	5	-	42	2	7	2	-	93	-	42	2	-	195
Port Canaveral, FL	2	-	4	-	4	7	-	8	-	4	1	-	30
All Port Regions	190	18	3,506	6	260	262	37	1,201	123	978	33	8	6,287

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

	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	2.1	-	-	-	3.8	-	-	-	-	-	-	-	5.9
Searsport, ME	-	0.5	-	-	-	126.4	-	0.4	-	17.9	-	-	145.2
Portland, ME	2.4	-	-	-	2.7	27.5	-	7.7	-	36.3	0.9	-	77.5
Portsmouth, NH	0.8	0.5	-	-	-	3.1	-	-	-	19.1	0.9	-	24.3
Northeastern US - Off Race Point													
Boston, MA	0.4	-	22.8	-	0.3	94.7	-	9.0	-	27.4	-	-	154.6
Salem, MA	0.5	-	-	-	-	1.7	-	-	-	0.6	-	-	2.8
Northeastern US - Cape Cod Bay													
Cape Cod, MA	-	-	-	-	-	14.0	-	-	-	2.9	-	-	16.8
Mid-Atlantic Block Island Sound													
New Bedford, MA	3.9	-	-	-	1.4	-	-	-	-	3.3	-	-	8.5
Providence, RI	1.3	0.5	-	-	1.0	31.8	2.0	14.1	-	14.9	-	-	65.6
New London, CT	2.2	-	1.9	-	1.8	3.1	-	-	0.9	2.0	-	-	11.7
New Haven, CT	4.3	-	1.1	-	5.3	-	-	-	9.8	24.6	1.7	-	46.8
Bridgeport, CT	1.4	-	-	-	-	-	7.3	-	8.0	10.6	-	-	27.3
Long Island, NY	-	0.5	-	-	-	3.1	-	-	7.1	35.7	-	-	46.4
Mid-Atlantic Ports of New York/New Jersey													
New York City, NY	6.1	2.6	1,050.9	-	2.2	51.8	11.9	191.0	5.3	123.2	3.5	-	1,448.6
Mid-Atlantic Delaware Bay													
Philadelphia, PA	13.4	-	105.0	-	11.4	14.7	15.9	26.9	1.8	60.4	4.3	-	253.9
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	10.2	-	178.3	-	6.7	30.9	-	189.9	-	29.8	1.7	1.5	449.0
Hampton Roads, VA	11.8	1.1	965.9	-	12.5	19.4	-	78.4	-	23.2	-	1.5	1,113.8
Mid-Atlantic Morehead City and Beaufort, NC													
Morehead City, NC	1.2	-	4.4	-	2.4	-	-	1.0	-	3.1	-	0.5	12.6
Mid-Atlantic Wilmington, NC													
Wilmington, NC	8.4	2.0	42.7	-	16.4	-	0.9	6.2	5.5	31.5	0.9	-	114.5
Mid-Atlantic Georgetown, SC													
Georgetown, SC	1.7	-	0.7	-	3.2	-	-	-	-	-	-	-	5.6
Mid-Atlantic Charleston, SC													
Charleston, SC	4.7	-	632.9	-	10.8	22.4	-	48.3	2.8	39.8	1.7	-	763.3
Mid-Atlantic Savannah, GA													
Savannah, GA	8.8	2.4	536.9	-	25.7	8.7	14.1	33.0	1.8	26.4	-	0.5	658.3
Southeastern US													
Brunswick, GA	2.4	-	4.5	-	2.8	3.1	-	36.6	-	-	-	-	49.3
Fernandina, FL	-	-	3.0	-	5.4	3.1	-	-	-	-	-	-	11.5
Jacksonville, FL	2.5	-	41.8	-	4.0	-	-	53.2	2.8	15.3	0.9	-	120.4
Port Canaveral, FL	0.8	-	2.8	-	3.0	2.4	-	3.1	-	-	-	-	12.0
All Port Regions	91.2	10.2	3,595.3	0.0	123.0	461.7	52.2	698.7	45.8	547.9	16.5	4.0	5,646.4

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 4-29
Alternatives 3 and 5: Additional Direct Economic Impact of Multi-Port Strings on the Shipping Industry, by Port Area and Vessel Type, 2004

	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	3.6	-	-	-	5.6	-	-	-	-	-	-	-	9.2
Searsport, ME	-	-	-	-	0.3	77.5	-	-	0.9	22.6	1.8	-	103.1
Portland, ME	5.3	-	-	-	6.0	42.7	-	5.7	1.8	32.9	3.1	-	97.5
Portsmouth, NH	1.8	0.9	-	-	1.5	3.1	-	-	-	12.3	0.5	-	20.0
Northeastern US - Off Race Point													
Boston, MA	0.4	-	6.8	-	-	31.6	-	6.1	-	14.8	-	-	59.6
Salem, MA	4.1	-	-	-	-	10.4	-	-	-	-	-	-	14.5
Northeastern US - Cape Cod Bay													
Cape Cod, MA	-	-	-	-	-	25.2	-	-	-	2.8	-	-	27.9
Mid-Atlantic Block Island Sound													
New Bedford, MA	6.8	-	-	-	1.0	-	-	-	-	2.9	-	-	10.8
Providence, RI	4.1	-	-	-	0.3	49.6	-	15.8	-	10.2	0.5	-	80.5
New London, CT	0.4	-	2.9	-	4.2	2.4	-	-	1.8	2.0	-	-	13.7
New Haven, CT	0.9	-	2.3	-	1.0	-	-	-	40.0	24.9	-	-	69.0
Bridgeport, CT	1.8	-	-	-	-	-	6.2	-	37.9	14.5	-	-	60.4
Long Island, NY	-	-	-	-	-	-	-	-	25.6	38.2	-	-	63.7
Mid-Atlantic Ports of New York/New Jersey													
New York City, NY	5.7	2.3	1,075.8	-	13.1	92.4	9.7	206.2	0.9	118.2	1.7	0.5	1,526.5
Mid-Atlantic Delaware Bay													
Philadelphia, PA	5.4	0.5	93.3	1.3	12.9	17.3	17.8	29.2	-	64.3	4.3	-	246.4
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	8.3	-	194.8	-	14.8	37.5	3.0	198.9	-	36.8	2.6	0.3	497.0
Hampton Roads, VA	12.6	1.4	982.5	-	18.4	32.8	5.9	81.3	-	26.9	1.7	0.7	1,164.1
Mid-Atlantic Morehead City and Beaufort, NC													
Morehead City, NC	1.6	0.4	2.8	-	2.1	12.2	-	-	-	6.2	-	0.5	25.9
Mid-Atlantic Wilmington, NC													
Wilmington, NC	7.2	1.0	38.5	-	25.3	10.8	-	11.9	-	37.7	0.9	0.5	133.7
Mid-Atlantic Georgetown, SC													
Georgetown, SC	2.9	-	-	-	1.3	3.1	-	-	-	-	-	-	7.3
Mid-Atlantic Charleston, SC													
Charleston, SC	1.6	-	676.8	-	16.1	49.7	3.0	49.6	-	38.9	0.5	0.5	836.7
Mid-Atlantic Savannah, GA													
Savannah, GA	4.3	1.9	539.6	-	28.3	42.6	19.9	37.0	-	32.7	0.9	0.5	707.5
Southeastern US													
Brunswick, GA	2.0	-	4.7	-	6.7	3.1	-	47.9	-	-	-	-	64.3
Fernandina, FL	0.4	-	5.7	-	8.0	6.1	-	1.4	-	-	-	-	21.5
Jacksonville, FL	2.0	-	36.8	1.3	3.7	4.7	-	55.4	-	24.3	1.7	-	130.1
Port Canaveral, FL	0.9	-	3.7	-	3.1	16.5	-	5.2	-	2.1	0.9	-	32.3
All Port Regions	89.6	8.3	3,717.8	3.9	195.1	601.6	65.5	861.4	108.7	592.6	23.7	3.3	6,023.2

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.

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 at 12 knots was estimated at $5.7 million in 2003 and $6.0 million in 2004. The additional direct economic impact of multi-port strings in 2004 at a speed restriction of 10 knots is $7.2 million and $5.0 million at 14 knots. As these impacts are the same as Alternative 3, the description in Section 4.4.2.3 also applies to Alternative 5.

4.4.2.6 Alternative 6 (Preferred) – Right Whale Ship Strike Reduction Strategy

The additional direct economic impact on vessels making multiple US East Coast port calls under Alternative 6 was estimated at $4.4 million in 2003 and $4.8 million in 2004.

Seasonal speed restrictions by port area under Alternative 6 were presented earlier in Figure 4-8. They include speed restrictions during March and April in the NEUS, from November 1 through April 30 for the MAUS region, and from November 15 through April 15 for the SEUS.

Data Chart 4-30 presents vessel arrivals in 2003 for port areas with speed restrictions that are part of multi-port strings when at least two port areas in the string contained speed restrictions. In 2003, there were 4,829 such total vessel arrivals with the 2,870 containerships arrivals accounting for 59 percent of the total multi-port vessel arrivals during speed restricted periods. 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 part of multi-port strings during restricted periods.

The total of 4,829 multi-port string restricted arrivals in 2003 represents roughly 41 percent of total US East Coast Alternative 6 restricted vessel arrivals (see Data Chart 4-15). For containerships, the multi-port string restricted arrivals represents 69 percent of the total containership restricted period arrivals. For ro-ro cargo ships the multi-port string restricted arrivals represents 73 percent of those vessels total restricted arrivals in 2003.

The port area of New York/New Jersey had the most multi-port string restricted arrivals with 1,236 arrivals in 2003. 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 similar information 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.

Additional Direct Economic Impact

The additional direct economic impact of multi-port strings on the shipping industry in 2003 is estimated at $4.4 million (Data Chart 4-32). The port area of New York/New Jersey has the largest additional economic impact at $1.2 million followed by Hampton Roads at $0.9 million, Charleston at $0.6 million, Savannah at $0.5 million, and Baltimore at $0.4 million. Containerships accounted for 69 percent of the additional economic impact of multi-port strings in 2003.

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

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	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.

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

	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	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

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	0.4	-	-	-	-	-	-	-	-	-	-	-	0.4
Searsport, ME	-	-	-	-	-	-	-	-	-	5.2	-	-	5.2
Portland, ME	0.4	-	-	-	-	-	-	2.0	-	11.8	-	-	14.2
Portsmouth, NH	-	-	-	-	-	-	-	-	-	8.0	-	-	8.0
Northeastern US - Off Race Point													
Boston, MA	0.4	-	9.4	-	0.3	-	-	3.0	-	13.9	-	-	27.0
Salem, MA	0.5	-	-	-	-	-	-	-	-	-	-	-	0.5
Northeastern US - Cape Cod Bay													
Cape Cod, MA	-	-	-	-	-	-	-	-	-	2.3	-	-	2.3
Mid-Atlantic Block Island Sound													
New Bedford, MA	2.3	-	-	-	1.4	-	-	-	-	2.8	-	-	6.5
Providence, RI	1.3	0.5	-	-	1.0	-	2.0	11.4	-	10.6	-	-	26.8
New London, CT	1.3	-	1.9	-	1.8	3.1	-	-	0.9	1.5	-	-	10.3
New Haven, CT	3.1	-	1.1	-	3.8	-	-	-	9.8	20.3	0.9	-	38.9
Bridgeport, CT	0.9	-	-	-	-	-	6.3	-	8.0	8.7	-	-	23.9
Long Island, NY	-	0.5	-	-	-	3.1	-	-	7.1	29.1	-	-	39.8
Mid-Atlantic Ports of New York/New Jersey													
New York City, NY	4.7	2.6	889.0	-	2.2	2.4	10.9	162.6	5.3	100.1	1.7	-	1,181.5
Mid-Atlantic Delaware Bay													
Philadelphia, PA	10.6	-	88.4	0.8	10.1	2.4	15.9	22.3	1.8	51.0	4.3	-	207.7
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	7.3	-	151.6	-	7.0	9.4	-	166.8	-	24.0	0.9	0.8	367.7
Hampton Roads, VA	8.9	1.1	823.3	-	11.1	2.4	-	65.7	-	19.9	-	0.8	933.1
Mid-Atlantic Morehead City and Beaufort, NC													
Morehead City, NC	1.2	-	2.5	-	2.0	-	-	1.0	-	2.5	-	0.5	9.7
Mid-Atlantic Wilmington, NC													
Wilmington, NC	8.0	2.0	34.5	-	11.2	-	0.9	5.1	5.5	26.8	0.9	-	94.8
Mid-Atlantic Georgetown, SC													
Georgetown, SC	1.7	-	0.7	-	2.3	-	-	-	-	-	-	-	4.6
Mid-Atlantic Charleston, SC													
Charleston, SC	4.2	-	531.6	-	8.2	8.7	-	52.3	2.8	35.3	1.7	-	644.8
Mid-Atlantic Savannah, GA													
Savannah, GA	6.8	2.4	452.1	-	22.5	4.7	14.1	27.2	1.8	24.4	-	0.5	556.3
Southeastern US													
Brunswick, GA	2.9	-	5.4	-	2.8	3.1	-	47.9	-	-	-	-	62.1
Fernandina, FL	0.5	-	3.0	-	8.9	3.1	-	-	-	-	-	-	15.4
Jacksonville, FL	2.1	-	49.7	0.8	5.2	-	-	62.9	2.8	20.9	1.7	-	146.0
Port Canaveral, FL	-	-	-	-	-	-	-	-	-	-	-	-	0.0
All Port Regions	74.9	9.2	3,102.1	2.3	118.8	48.2	50.1	740.9	48.5	440.0	13.9	2.4	4,427.7

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.

The additional direct economic impact of multi-port strings in 2004 is estimated at $4.8 million (Data Chart 4-33). The ranking of the top six port areas in terms of largest impact remains unchanged from 2003.

The additional direct economic impact of multi-port strings in 2004 at a 10-knot speed restriction is $5.8 million and $4.1 million at 14 knots. These impacts at alternate speeds are presented in Data Chart 4-41, along with direct and indirect economic impacts.

Re-routing of Southbound Coastwise Shipping

Some of the operational measures would have a direct effect on coastwise shipping. There are no impacts on coastwise shipping under Alternatives 1, 2, or 4; therefore, impacts are only described for Alternatives 3, 5, and 6.

Coastwise shipping or cabotage trade along the US East Coast has always been an important segment of our nation's maritime heritage. 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. Benefits of coastwise shipping also include lowering transport and environmental costs and reducing our 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 7–10 nm (13-18.5 km) of the shoreline. However, during the proposed seasonal management periods, masters of southbound vessels would likely route outside of seasonal speed-restricted areas incurring an overall increase in distance. This affects southbound vessels between the entrance to the Chesapeake Bay and Port Canaveral.

For Alternatives 3 and 5, the proposed speed restrictions would be in effect for a distance of 25 nm (46.3 km) from the coastline along the entire mid-Atlantic coastline. Containerships and ro-ro cargo ships are the vessel types that would be most affected by speed restrictions at intermediate seasonal speed-restricted areas. In 2003, there were 4,142 containership and ro-ro cargo ship restricted period arrivals at East Coast port areas from Baltimore through Port Canaveral. 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[23] and an average operating speed of 20 knots, the containership would have an increased sailing time of 5.4 hours. Using an average hourly operating cost at sea of $1,000, the estimated economic impact for each southbound vessel would be $5,400. For 2003, the additional economic impact for containerships for coastwise shipping under Alternative 3 is estimated at $3.7 million. In 2004, the same assumptions result in an estimated economic impact of $3.8 million.

[23] The vessels are assumed to sail at a distance of 25 nm offshore instead of 8 nm. Based on a diagonal routing to the further offshore sailing route an additional distance of 27 nm is assumed per arrival and departure at the intermediate port calls.

Data Chart 4-33
Alternative 6: Additional Direct Economic Impact on the Shipping Industry 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	0.4	-	-	-	-	-	-	-	-	-	-	-	0.4
Searsport, ME	-	-	-	-	-	-	-	-	-	5.2	-	-	5.2
Portland, ME	0.4	-	-	-	-	-	-	2.0	-	11.8	-	-	14.2
Portsmouth, NH	-	-	-	-	-	-	-	-	-	8.0	-	-	8.0
Northeastern US - Off Race Point													
Boston, MA	0.4	-	9.4	-	0.3	-	-	3.0	-	13.9	-	-	27.0
Salem, MA	0.5	-	-	-	-	-	-	-	-	-	-	-	0.5
Northeastern US - Cape Cod Bay													
Cape Cod, MA	-	-	-	-	-	-	-	-	-	2.3	-	-	2.3
Mid-Atlantic Block Island Sound													
New Bedford, MA	2.3	-	-	-	1.4	-	-	-	-	2.8	-	-	6.5
Providence, RI	1.3	0.5	-	-	1.0	-	2.0	11.4	-	10.6	-	-	26.8
New London, CT	1.3	-	1.9	-	1.8	3.1	-	-	0.9	1.5	-	-	10.3
New Haven, CT	3.1	-	1.1	-	3.8	-	-	-	9.8	20.3	0.9	-	38.9
Bridgeport, CT	0.9	-	-	-	-	-	6.3	-	8.0	8.7	-	-	23.9
Long Island, NY	-	0.5	-	-	-	3.1	-	-	7.1	29.1	-	-	39.8
Mid-Atlantic Ports of New York/New Jersey													
New York City, NY	4.7	2.6	889.0	-	2.2	2.4	10.9	162.6	5.3	100.1	1.7	-	1,181.5
Mid-Atlantic Delaware Bay													
Philadelphia, PA	10.6	-	88.4	0.8	10.1	2.4	15.9	22.3	1.8	51.0	4.3	-	207.7
Mid-Atlantic Chesapeake Bay													
Baltimore, MD	7.3	-	151.6	-	7.0	9.4	-	166.8	-	24.0	0.9	0.8	367.7
Hampton Roads, VA	8.9	1.1	823.3	-	11.1	2.4	-	65.7	-	19.9	-	0.8	933.1
Mid-Atlantic Morehead City and Beaufort, NC													
Morehead City, NC	1.2	-	2.5	-	2.0	-	-	1.0	-	2.5	-	0.5	9.7
Mid-Atlantic Wilmington, NC													
Wilmington, NC	8.0	2.0	34.5	-	11.2	-	0.9	5.1	5.5	26.8	0.9	-	94.8
Mid-Atlantic Georgetown, SC													
Georgetown, SC	1.7	-	0.7	-	2.3	-	-	-	-	-	-	-	4.6
Mid-Atlantic Charleston, SC													
Charleston, SC	4.2	-	531.6	-	8.2	8.7	-	52.3	2.8	35.3	1.7	-	644.8
Mid-Atlantic Savannah, GA													
Savannah, GA	6.8	2.4	452.1	-	22.5	4.7	14.1	27.2	1.8	24.4	-	0.5	556.3
Southeastern US													
Brunswick, GA	2.9	-	5.4	-	2.8	3.1	-	47.9	-	-	-	-	62.1
Fernandina, FL	0.5	-	3.0	-	8.9	3.1	-	-	-	-	-	-	15.4
Jacksonville, FL	2.1	-	49.7	0.8	5.2	-	-	62.9	2.8	20.9	1.7	-	146.0
Port Canaveral, FL	-	-	-	-	-	-	-	-	-	-	-	-	0.0
All Port Regions	74.9	9.2	3,102.1	2.3	118.8	48.2	50.1	740.9	48.5	440.0	13.9	2.4	4,427.7

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.

For Alternative 6, the proposed speed restrictions in the mid-Atlantic region would be implemented for the 30 nm (56 km) radius around each port area. Hence, the additional distance incurred by southbound vessels would be 80 nm (148 km) (20 nm per arrival and departure at intermediate port calls). 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 80 nm (148 km)[23] and an average operating speed of 20 knots, the containership would have increased sailing time of 4 hours. Using an average hourly operating cost at sea of $1,000, the estimated economic impact for each southbound vessel would be $4,000. For 2003 and 2004, the additional economic impact for containerships for coastwise shipping under Alternative 6 is estimated at $2.5 million.

Direct Economic Impact on the Shipping Industry Relative to the Value of US East Coast Trade and Ocean Freight Costs

Chapter 3 (Section 3.4.2), presents data collected by the US Census Bureau on 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 presents for each port area the significance of the estimated economic impact of the operational measures relative to the value of US East Coast trade in 2003 and 2004. This comparison is useful to determine 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 12 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 is of Alternative 5 is $61.8 million while the value of US East Coast trade is $298.7 billion. Thus the direct economic impact represents two-hundredths of one percent of the value of traded merchandise in 2003. For other alternatives the direct economic impact is even smaller. For example, Alternative 6 has a direct economic impact of $35.6 million in 2003, which translates into one one-hundredth of one percent, and remains less than two-hundredths (0.018 percent) at 10 knots. 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 operational measures on the shipping industry, it is interesting 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. Section 3.4.2 states that ocean freight charges averaged 5.3 percent of the value of imports. Given the composition of our trade, it is reasonable to assume that ocean freight charges would represent no less than the same percentage of the value of our exports. Based on these factors, it is estimated that the direct economic impact on the shipping industry for Alternative 5 represents less than four-tenths of one percent of the ocean freight costs for US East Coast trade. For other alternatives the relative economic impact is even smaller. For Alternative 6, the direct economic impact represents only two-tenths of one percent of the ocean freight costs. Even at a 10-knot speed restriction, Alternative 6 represents less than four-tenths of one percent (0.335 percent) in 2004. These results indicate that the implementation of the proposed operational measures would have an insignificant impact on the financial performance of the vessel operators calling at US East Coast ports.

Data Chart 4-34
Economic Impact as a Percent Value of US East Coast Maritime Trade and Ocean Freight Costs, 2003 and 2004

	Alternative				
Item	2	3	4	5	6
2003					
Direct economic impact	9.8	50.5	1.0	52.4	28.7
Additonal direct economic impact due to cumulative effect of mulit-port strings	-	5.7	-	5.7	4.4
Direct economic impact of re-routing of southbound coastwise shipping	-	3.7	-	3.7	2.5
Total direct economic impact on shipping industry	9.8	59.9	1.0	61.8	35.6
Trade Merchandise Value	298,741	298,741	298,741	298,741	298,741
Total direct economic impact as a percent of trade value (%)	0.003%	0.020%	0.000%	0.021%	0.012%
Ocean Freight Costs	15,833	15,833	15,833	15,833	15,833
Total direct economic impact as a percent of ocean freight cost (%)	0.062%	0.378%	0.006%	0.390%	0.225%
2004					
Direct economic impact	10.8	53.9	1.1	56.1	30.8
Additonal direct economic impact due to cumulative effect of mulit-port strings	-	6.0	-	6.0	4.8
Direct economic impact of re-routing of southbound coastwise shipping	-	3.8	-	3.8	2.5
Total direct economic impact on shipping industry	10.8	63.7	1.1	65.9	38.1
Trade Merchandise Value	325,051	325,051	325,051	325,051	325,051
Total direct economic impact as a percent of trade value (%)	0.003%	0.020%	0.000%	0.020%	0.012%
Ocean Freight Costs	17,228	17,228	17,228	17,228	17,228
Total direct economic impact as a percent of ocean freight cost (%)	0.063%	0.370%	0.006%	0.383%	0.221%

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 have indirect economic impacts. Potential indirect economic impacts were raised 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.
- Impact on local economies of decreased income from jobs lost to traffic diversions.

There are many factors that 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 turnaround 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 was particular concern raised over the possibility of traffic diverting to other ports such as Halifax.

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 undertaking economic impact assessments. The model calculates the total economic impacts or multiplier effect on 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 of the economic implications of port calls in Boston.[24] 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 and to estimate the impact of port calls diverted to Canadian ports.[25] For other port areas such as Portland and Providence that would generally have smaller vessels calling at the port, this analysis used an estimate of $500,000 of total economic impact per port call.

The indirect economic impact of port diversions in 2003 by alternative, port area, and restricted speed is presented in Data Chart 4-35.

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 – 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.

[24] Haute 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 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.

[25] For purposes of this section, other major port areas are New York/New Jersey, Philadelphia, Baltimore, Hampton Roads, Charleston, Savannah, Jacksonville and Port Canaveral.

Data Chart 4-35
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	(3,250)	(1,950)	(975)	-	-	-	(2,490)	(1,660)	(830)
Southeastern US															
Brunswick, GA	-	-	-	(9,709)	(5,825)	(1,942)	2,325	1,395	698	-	-	-	1,845	1,230	615
Fernandina, FL	-	-	-	(9,709)	(5,825)	(1,942)	925	555	278	-	-	-	645	430	215
Jacksonville, FL	-	-	-	(19,418)	(11,651)	(3,884)	540	360	180	1,440	1,080	720	2,880	2,160	1,440
Port Canaveral, FL	-	-	-	(540)	(360)	(180)	(540)	(360)	(180)	(1,440)	(1,080)	(720)	(2,880)	(2,160)	(1,440)
All Port Areas	-	-	-	141,608	81,489	38,803	-	-	-	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.

4.4.3.3 Alternative 3 – Speed Restrictions in Designated Areas

There would be indirect, long-term, 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 a total of $81.5 million in 2003 at a speed restriction of 12 knots. The port areas of New York/New Jersey ($24.1 million), Savannah ($23.3 million), Boston ($19.8 million) and Hampton Roads ($14.8 million) have the largest indirect economic impacts. Note that the port areas of Jacksonville, Brunswick, and Fernandina show a positive net economic impact (in parentheses) as they gain vessel calls diverted from Savannah.

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 speed-restricted area would significantly 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 minutes of delay for a containership in Boston would be 100 minutes per arrival and another 100 minutes per departure. A permanent delay of 3.3 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 does not make economic sense to call at a distant port and then to ship back to the port via expensive land transport. However, most ports also accommodate traffic that is not destined for its 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 and Montreal, Quebec, without incurring delays caused by the right whale ship strike reduction measures.

Alternative 3 assumes that 20 percent of the containership and ro-ro cargo ship calls at Northeast ports would divert to Canadian ports with a speed restriction of 12 knots.[26] Port areas in the Block Island area are assumed to lose 10 percent of their vessel calls during restricted periods while the port areas of New York/New Jersey, Philadelphia, Baltimore, and Hampton Roads are assumed to lose 1.5 percent of their containership and ro-ro cargo ship vessel calls during restricted periods.

The economic analysis also assumes that a 12-knot speed restriction under Alternative 3 would lead to the diversion of three 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 121 days for the nearby Southeastern port areas of Brunswick, Fernandina, and Jacksonville. This analysis assumes that 25 percent of the diverted Savannah calls would be handled each at Brunswick and Fernandina and the remaining half of the diverted calls would be handled at Jacksonville.

[26] Other types of vessels are less likely to divert as their cargo are more likely to be for the port’s immediate hinterland.

On the other hand, the analysis assumes that ten percent of the restricted period cruise vessel calls at Jacksonville would divert to the nearby port area of Port Canaveral under Alternative 3. The diversion is due to over 2.4 hour savings per vessel call since the effective distance of speed restrictions in Port Canaveral is only 4.5 nm (8.3 km) compared to the 30.9 nm (57.2 km) at Jacksonville.

Data Chart 4-36 presents the assumed diversion rates for Alternative 3 with restricted speeds of 10 knots and 14 knots. The economic impact of port diversions in 2003 at 10 knots is $141.6 million and $38.8 million at a 14-knot speed restriction (Data Chart 4-35).

Data Chart 4-36
Percent 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.

4.4.3.4 Alternative 4 – Recommended Shipping Routes

While there may be minor, indirect, long-term, adverse economic impacts on certain ports in the SEUS region, the overall economic impact of Alternative 4 is negligible. The port areas of Brunswick and Fernandina would have delays due to the increased distance associated with the use of recommended routes. Because of these delays, it is assumed that 3 percent of the containership and ro-ro cargo ship calls at these two port areas would divert to the port area of Savannah, which has no proposed operational measures. Under Alternative 4, cruise vessels are assumed to divert again to Port Canaveral where no operational measures have been proposed.

From the perspective of the national economy, there are no indirect economic impacts under Alternative 4. The diverted vessel call at the southeastern port areas of Brunswick, Fernandina, and Jacksonville are offset by the gains in vessels calling at the port areas of Savannah and Port Canaveral.

4.4.3.5 Alternative 5 – Combination of Measures

There would be indirect, long-term, adverse effects on certain port areas and vessel operations under Alternative 5. The indirect economic impact at a speed limit of 12 knots is estimated at $91.8 million in 2003, which is about 13 percent higher than under Alternative 3. The ranking of results is similar to Alternative 3 (Section 4.4.3.3) with the exception that the port of Savannah is not assumed to have vessel calls diverted to the southeastern ports.

Under Alternative 5, the rates of diversion for the affected port areas in the Northeast and mid-Atlantic regions are similar to Alternative 3, except that the additional impact of DMAs and recommended routes is assumed to slightly increase the rate of diversion. The port area of Savannah is assumed not to incur any diversions under Alternative 5 as the delays associated with the increased recommended routes for the Southeast port areas are assumed to offset the longer duration of speed restrictions at Savannah. The port area of Jacksonville would be disadvantaged 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 the analysis assumes that 30 percent of the restricted period cruise vessel calls would divert from Jacksonville to Port Canaveral.

The diversion rates for Alternative 5 vary by speed restriction (Data Chart 4-36), thus there is a higher economic impact at a speed restriction of 10 knots ($162.5 million) and a lower impact at 14 knots ($48.9 million) in 2003 (Data Chart 4-35).

4.4.3.6 Alternative 6 (Preferred) – Right Whale Ship Strike Reduction Strategy

There would be indirect, long-term, adverse impacts on certain port areas and vessel operations under Alternative 6. For this alternative, the net indirect economic impact at a restricted speed of 12 knots is estimated at $18.2 million. The largest indirect economic losses would be generated in the port areas of New York/New Jersey ($6.8 million), Hampton Roads ($4.2 million), Providence ($2.9 million), Baltimore ($2.4 million), Philadelphia ($1.4 million), and Brunswick ($1.2 million). Two port areas would experience a net indirect economic impact gain: Port Canaveral ($2.2 million) and Savannah ($1.7 million).

Data Chart 4-37 presents the estimated indirect economic impacts for 2004. In general, the estimated indirect economic impacts match closely with those described for 2003. It is interesting to note the large increase in secondary economic impact in Jacksonville under Alternative 6 in 2004 as cruise vessel arrivals increased substantially.

Under Alternative 6, the speed restrictions for a large area in the Northeast will be in effect during the month of April.[27] Hence, the diversion is assumed to be 10 percent for containerships and ro-ro cargo ships during the restricted period.[28] For the port areas in Block Island Sound, the analysis assumes a diversion rate of two 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 0.5 percent of restricted period containership and ro-ro cargo ship vessel calls has been assumed.

An additional diversion was assumed to occur under Alternative 6 for the port area of Providence. This port area has speed restrictions in effect for 181 days as compared to 61 days for the port area of Boston. Hence it is assumed that 15 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 are assumed to have two 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, 30 percent of the restricted period cruise vessel calls at Jacksonville are assumed to divert to Port Canaveral as that port is not affected by speed restrictions or the use of recommended routes.

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[27] Speed restrictions will be in effect for other months in the Northeast region but not the large combined area encompassing Off Race Point and Great South Channel SMAs.

[28] 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.

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	(3,175)	(1,905)	(953)	-	-	-	(2,265)	(1,510)	(755)
Southeastern US															
Brunswick, GA	-	-	-	(9,754)	(5,852)	(1,951)	2,500	1,500	750	-	-	-	1,800	1,200	600
Fernandina, FL	-	-	-	(9,754)	(5,852)	(1,951)	675	405	203	-	-	-	465	310	155
Jacksonville, FL	-	-	-	(15,458)	(9,005)	(2,552)	4,050	2,700	1,350	10,800	8,100	5,400	15,480	11,610	7,740
Port Canaveral, FL	-	-	-	(4,050)	(2,700)	(1,350)	(4,050)	(2,700)	(1,350)	(10,800)	(8,100)	(5,400)	(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.

At a speed restriction of 10 knots, the economic impact increases to $49.6 million in 2003, and is only $5.3 million at 14 knots. Data Chart 4-35 presents these impacts by alternative, restricted speed, and port area for 2003.

4.4.3.7 Summary of All Direct and Indirect Economic Impacts on the Shipping Industry and Port Areas

As mentioned in Section 4.4.1, there are several types of impacts on port areas and vessel operations. The total of all the direct, additional direct, and indirect economic impacts on the shipping industry is summarized in Table 4-2. The ranking of the alternatives is the same as mentioned in Section 4.4.1.7.

4.4.4 Impacts on Commercial Fishing Vessels

Commercial fishing is a multimillion dollar industry along the US East Coast. In 2004, commercial fish landings at US East Coast ports totaled $706 million (Data Chart 3-5). The port of New Bedford, MA is the leading US port in terms of value of commercial fish landings with $206.5 million in 2004.

The operational measures of the right whale ship strike reduction strategy and alternatives apply to vessels with a length of 65 feet and greater. Because the USCG data excludes commercial fishing vessels less than 150 GRT, the analysis also evaluated data that included fishing vessels over 65 feet in length and weigh less than 150 GRT, using information provided by NMFS' database of commercial fishing permits. Section 3.4.3 identified that for the Southeast region approximately 84 percent of the fishing vessels over 65 feet are less than 150 tons. For the Northeast region, nearly 67 percent of the fishing vessels over 65 feet are less than 150 tons.

The estimated economic impact of the operational measures on commercial fishing vessels in 2003 at 10 and 12 knots is presented in Data Chart 4-38. The analysis is based on the fishing permits issued in the Northeast and Southeast regions to vessels over 65 feet of LOA and under 150 GRT. The analysis assumes that the commercial fishing vessels are affected for an effective distance of 25 nm (46.3 km) under Alternatives 3 and 5, and 30 nm (56 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 operational measures if they were implemented at a 12-knot speed restriction. The typical steaming speed for other commercial fishing vessels is assumed at 12 knots. Based on these assumptions, the commercial fishing vessels would not be affected by alternative speed restrictions of 12 knots or higher. However, these vessels would be affected by the proposed alternative speed restrictions of 10 knots; therefore, all the economic impacts in the following sections would only occur if a 10-knot speed limit were implemented.

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 these measures already in place, and the threat of ship strikes would remain unchanged. All vessels would still be required to adhere to the 500-yard no approach rule for right whales.

Table 4-2
Summary of All Impacts by Alternative at 10, 12, and 14 knots, 2003 and 2004 (millions of dollars)

	Alternative 2			Alternative 3			Alternative 4			Alternative 5			Alternative 6		
	Restriction speed(knots)			Restriction speed(knots)			Restriction speed(knots)			Restriction speed(knots)			Restriction speed(knots)		
Item	10	12	14	10	12	14	10	12	14	10	12	14	10	12	14
2003															
Direct economic impact															
Shipping industry vessels	15.4	9.8	5.9	81.0	50.5	29.4	1.0	1.0	1.0	83.5	52.4	30.8	45.8	28.7	17.1
Cumulative effect of multi-port strings	-	-	-	6.8	5.6	4.7	-	-	-	6.8	5.6	4.7	5.3	4.4	3.7
Re-routing of southbound coastwise shipping	-	-	-	3.7	3.7	3.7	-	-	-	3.7	3.7	3.7	2.5	2.5	2.5
Subtotal direct economic impact	15.4	9.8	5.9	91.4	59.8	37.8	1.0	1.0	1.0	94.0	61.8	39.3	53.6	35.6	23.3
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	15.4	9.8	5.9	233.1	141.3	76.6	1.0	1.0	1.0	256.5	153.5	88.2	103.2	53.8	28.6
2004															
Direct economic impact															
Shipping industry vessels	17.0	10.8	6.5	86.8	53.9	31.2	1.1	1.1	1.1	89.7	56.1	32.9	49.4	30.9	18.4
Cumulative effect of multi-port strings	-	-	-	7.2	6.0	5.1	-	-	-	7.2	6.0	5.1	5.8	4.8	4.1
Re-routing of southbound coastwise shipping	-	-	-	3.8	3.8	3.8	-	-	-	3.8	3.8	3.8	2.5	2.5	2.5
Subtotal direct economic impact	17.0	10.8	6.5	97.9	63.7	40.1	1.1	1.1	1.1	100.8	65.9	41.7	57.7	38.2	24.9
Indirect economic impact of port diversions	-	-	-	139.4	79.6	37.3	-	-	-	159.6	89.3	47.0	49.7	18.3	5.4
Total economic impact	17.0	10.8	6.5	237.3	143.3	77.3	1.1	1.1	1.1	260.4	155.2	88.7	107.4	56.5	30.3

Source: Prepared by Nathan Associates as described in text.

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Data Chart 4-38
Estimated Economic Impact of Proposed Operational Measures on Commercial Fishing Vessels by Region, 2003

Item	Alternatives 3 and 5 Northeast Region	Alternatives 3 and 5 Southeast Region	Alternative 6 Northeast Region	Alternative 6 Southeast Region
Commercial fishing permits for vessel 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	60.0	60.0
Operating cost per hour of steaming (dollars)	150	150	150	150
Estimated impact per year with restricted speed (dollars)				
12 knots	-	-	-	-
10 knots	572,000	290,000	686,400	348,000

Source: Prepared by Nathan Associates Inc.

4.4.4.2 Alternative 2 – Dynamic Management Areas

Under Alternative 2, commercial fishing vessels 65 feet and greater would not be affected by DMA implementation because captains would have the option of transiting slowly through a DMA precautionary area at a reduced speed. Since the majority of fishing vessels operate at an average of 10 knots, only a select few fishing vessels would have to slow down through a precautionary area. Unlike DAM restrictions under the ALWTRP, there are not any associated fishing gear regulations associated with DMAs in Alternative 2. However, if the DMA is implemented in an area covered by the ALWTRP regulations, then a dual-DAM/DMA may be implemented 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. In the case of a DMA implementation, a captain also has the discretion to route around the DMA, instead of slowing down to transit through the precautionary area. If this option is utilized, then the vessel could incur additional costs in fuel due to the added mileage onto their trip. Although it is assumed that the captain would chose the smallest cost alternative, thus there would be minimal adverse effects, if any. Therefore, there are negligible economic impacts on the commercial fishing industry under Alternative 2.

4.4.4.3 Alternative 3 – Speed Restrictions in Designated Areas

Commercial fishing vessels would not be adversely affected by speed restrictions unless they normally travel at speeds over an average of 12 knots. Vessels that may take fishing trips further offshore and travel at speeds in excess of 12 knots would be slightly affected by Alternative 3. These vessels would remain at sea for longer periods and thus burn more fuel; however, a delay in arriving at the dock or processing plant should not result in any additional costs. With a 10-

knot speed restriction, the estimated impact on commercial fishing vessels in 2003 under Alternative 3 would be $572,000 in the NEUS region, and $290,000 in the SEUS region.

4.4.4.4 Alternative 4 – Recommended Shipping Routes

Alternative 4 would have a negligible effect on fishing vessel operations that utilize the recommended routes in Cape Cod Bay and the ATBA in the Great South Channel. The recommended routes into the ports of Brunswick, Jacksonville, and Port Canaveral in the SEUS should not have an impact on commercial fishing vessel operations because their trips are destined for fishing grounds or the location of fixed gear such as lobster pots, and these vessels do not regularly utilize shipping lanes. Shipping lanes and TSSs are developed for use by vessels calling at specific ports, and fishing vessels generally dock at smaller ports that are separate from larger commercial shipping ports.

Fishing vessels utilizing the Cape Cod Canal would be affected by Alternative 4 if they utilize the recommended routes (Figure 2-12). However if they are concentrating fishing effort within Cape Cod Bay and outside of the lanes, vessels would not adhere to these measures and would not be adversely affected. The majority of fishing vessels are under the weight threshold of 300 GRT for complying with the ATBA (Section 3.4.3), therefore they would not be required to route around the ATBA. Vessels over 65 feet, however would have to transit through the area at a reduced speed, regardless of the vessel weight. Faster fishing vessels could potentially be affected by this measure and would remain at sea for a longer time, possibly burning more fuel, resulting in higher costs; however, as mentioned most of these vessels travel at 10 knots or below. Due to the circumstances mentioned above and the options available to a captain, there are no estimated economic impacts on this industry under Alternative 4.

4.4.4.5 Alternative 5 – Combination of Measures

Under Alternative 5, commercial fishing vessels would not be adversely affected by speed restrictions unless they normally travel at speeds averaging 12 knots or greater. With a 10-knot speed restriction, the estimated adverse impact on commercial fishing vessels in 2003 under Alternative 3 is $572,000 in the NEUS region and $290,000 in the SEUS region.

4.4.4.6 Alternative 6 (Preferred) –Right Whale Ship Strike Reduction Strategy

Under Alternative 6, the estimated adverse economic impact in 2003 on commercial fishing vessels is estimated at $686,000 for the NEUS region and $348,000 for the SEUS region at a speed of 10 knots. The combined NEUS and SEUS regional economic impact of slightly more than $1 million is approximately two-tenths of one percent of the US East Coast commercial fishery landings of $628.2 million in 2003. There would be no impact on vessels if a speed limit of 12 knots is implemented. As the majority of commercial fishing vessels travel at 10 knots or less, there would be minor, if any, impacts on these slower vessels under Alternative 6.

4.4.5 Impacts on Passenger Vessels

The following sections describe the economic impact of the operational measures of the strategy on specific types of other vessels operating within the geographic scope of the strategy.

4.4.5.1 Cruise Industries

The proposed action and alternatives would affect the vast majority of cruise ships since they are longer than 65 ft (19.8 m). The effects on the cruise industry are included in Sections 4.4.1 and 4.4.3, as cruise vessels are included in the USCG arrival database. Please refer to these sections for a description of the operational and economic impacts on the cruise industry by alternative.

4.4.5.2 Ferry Boat Industry

As described in Section 3.4.4.2, the vast majority of passenger vessels operating along the US East Coast sail within the COLREGS lines and thus would not be affected by the proposed operational measures in the alternatives. However, in the southern New England area, a well-developed passenger ferry sector operates beyond the COLREGS line and hence is subject to being affected by the proposed operational measures. A list of major southern New England passenger ferry operators, routes served and service characteristics are presented in Data Chart 4-39 and a complete inventory of ferry vessel operations is included in Appendix E.

Data Chart 4-39
Southern New England Ferry Operators, 2005

Operator	Route	Vessel Speed	Distance	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 Comapny	Point Judith-Block Island	12	11	8 trips daily	10
Interstate Navigation Comapny	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.

Passenger ferry operations in southern New England generally fall into two categories: fast ferry service with vessel speeds ranging from 24–39 knots and regular ferry service with vessel speeds from 12–16 knots. As shown in Data Chart 4-39 there are nine operators providing fast ferry service on eight routes utilizing eleven vessels. Key destinations include Provincetown, Block Island, Nantucket, and Martha's Vineyard, while important origins include Boston, New London, Hyannis, Harwich, Point Judith, and Quonset Point.

Eight operators on 11 routes provide regular ferry service utilizing 16 vessels. Vessel speeds range from 12–16 knots and serve many of the same origins and destinations as the fast ferry service. Additional origins served by regular ferries include Plymouth, Falmouth, and Woods Hole.

Alternative 1– No Action Alternative

There would be no impact on passenger ferry service because of Alternative 1.

Alternative 2 – 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) buffer square based on the trigger conditions described in Section 2.1.4. Interviews with passenger ferry operators identified their particular concern of the situation where a DMA would be implemented during the peak summer season. For a fast ferry operator, a DMA implemented directly along their route would result in the suspension of service for the entire period that the DMA is in effect. There are several reasons for this conclusion. First, the demand for fast ferries that normally operate between 24–39 knots would virtually disappear if the ferries were restricted to speed ranging from 10–14 knots. Second, any remaining demand would not be sufficient to cover vessel operating costs, and third, many of the handling and comfort characteristics of fast ferries would suffer at these reduced speeds.

The analysis estimates the net economic loss of the implementation of a single DMA for these eleven fast ferry operators at $2.2 million (Data Chart 4-40).[29] 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, the analysis assumes 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 that would have otherwise used the fast ferry service.[30]

Operators of regular ferry services would also be affected by the DMAs. For these operators it is assumed that a speed restriction of 12 knots would cause an average delay of 20 minutes for each ferry trip. The 118 daily trips of regular ferry services would incur additional costs of $2.0 million for the implementation of a single DMA. With a restricted speed of 10 knots, the average delay increases to 30 minutes and the estimated economic impact to regular speed ferries is $3.0

[29] This same estimate applies to alternative 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

[30] It is very difficult to estimate the portion of passenger demand that would cancel their travel by ferry entirely 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.

million. With a restricted speed of 14 knots, the average delay is 6 minutes and the estimated economic is $1.0 million.

Data Chart 4-40
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	3,564,000	3,564,000	3,564,000
Alternative 6	2,577,600	2,577,600	2,577,600
Regular Ferries			
Alternative 2	2,950,000	1,966,667	983,333
Alternative 3	2,950,000	1,966,667	590,000
Alternative 6	3,015,625	1,994,792	992,708
Total			
Alternative 2	5,128,000	4,144,667	3,161,333
Alternative 3	6,514,000	5,530,667	4,154,000
Alternative 6	5,593,225	4,572,392	3,570,308

Source: Prepared by Nathan Associates from data on operator websites and selected interviews.

Alternative 3 – Speed Restrictions in Designated Areas

There would be direct, long-term, adverse effects on passenger ferry service from implementing Alternative 3. Under Alternative 3, speed restrictions would be in place year round in Cape Cod Bay and for the months of October–April for Block Island Sound.[31] 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 in 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.

Fortunately, 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 operations for these 30 days for these nine operators is calculated as double the impact of the DMA previously described. The resulting estimate is $3.6 million annually.

Regular ferries will incur average delays of approximately 20 minutes per trip with a speed restriction of 12 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 cost of the delay is $2.0 million annually at 12 knots, $3.0 million at 10 knots, and $0.6 million at 14 knots.

[31] The analysis in this section for Alternative 3 also applies to Alternative 5.

Alternative 4 – Recommended Shipping Routes

There would be no economic impact on passenger ferry services under Alternative 4. Ferry vessels have separate routes from the shipping lanes and other routing measures contained in this alternative; therefore, ferry service would not be affected.

Alternative 5 – Combination of Measures

There would be direct, long-term, adverse effects on passenger ferry service under Alternative 5. This alternative has the same economic impacts as Alternative 3.

Alternative 6 (Preferred) – Right Whale Ship Strike Reduction Strategy

Under Alternative 6, speed restrictions for Cape Cod Bay would be 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 from November 1 through April 30. However, the speed-restricted area for Block Island Sound under Alternative 6 would not extend to the shoreline and hence would not affect fast ferry operations.[32] DMAs would also be implemented under Alternative 6 and the economic impact of those are estimated the same as under Alternative 2. The estimated economic impact for fast ferry service under Alternative 6 is thus similar to Alternative 2, with an increment for speed restrictions on the Boston-Provincetown route during January through May 15. The resulting estimated economic impact is $2.6 million annually.

For regular ferries, the economic impact for Alternative 6 is again similar to Alternative 2, with an increment for speed restrictions on the Boston-Provincetown route during January through May 15. The estimated economic impact is $2.0 million at 12 knots, $3.0 million at 10 knots, and $1.0 million at 14 knots.

4.4.6 Impacts on Whale Watching Vessels

The whale watching industry can also be categorized into operations that deploy high-speed vessels ranging from 25 to 38 knots; and operations that deploy regular speed vessels with speeds from 16 to 20 knots. Data Chart 4-41 presents information for the major whale watching operators in Massachusetts Bay. There are four operators of high-speed vessels; two are based in Boston, one in Barnstable, and one in Provincetown (two vessels). There are five operators of regular speed vessels that have operations 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 feet (19.8 m) and greater, therefore the majority of operators would be affected by the operational measures.

4.4.6.1 Alternative 1 – No Action Alternative

The No Action Alternative would have negligible, indirect effects on the whale watching industry. Whale watching vessels derive profits from bringing 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 higher the population number of whales,

[32] The rectangular area proposed has its northern limits running approximately in a line from Montauk to the southwestern coast of Block Island.

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.

and specifically right whales, the higher the probability that they would be sighted on a regular basis. No further operational measures are proposed in Alternative 1, and the current mitigation measures have proved ineffective at reducing the amount of ship strikes with whales. Therefore, the right whale population would continue to decline, which would reduce the probability that right whales would be sighted regularly on whale watching trips. However, most whale watching trips are not solely targeted on spotting right whales, thus passengers would still benefit from sighting other whale species, and there would not be a noticeable effect on the whale watching industry as a whole.

4.4.6.2 Alternative 2 – Dynamic Management Areas

Implementing Alternative 2 would have direct, long-term, adverse effects on whale watching vessels that are 65 feet in length and greater operating in the vicinity of DMAs. Under Alternative 2, the high-speed vessels are assumed to suspend operations during periods when DMAs are implemented 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 of normal operating speed. The estimated economic impact of the suspension of five high-speed vessels for a single 15-day DMA is $0.4 million.[33] For regular speed vessels, the estimated economic impact at 12 knots is $0.3 million for the 13 regular speed vessels, which incur a 30-minute delay each way for two trips per day. At 10 knots, the estimated economic impact to regular speed whale watching vessels is $0.5 million and at 14 knots $0.2 million.

The economic impact of Alternative 2 is high for the industry as a whole, although individual vessels have the option to alter their destination based on the occurrence of a DMA, which would reduce the economic impacts. High-speed ferry operators indicated they would not reduce speed through a DMA; instead, they would chose to travel to alternate sighting grounds, or target another whale species, which would reduce the economic impacts. Regular speed whale watching vessels over 65 ft (19.8 m) would still be able to travel to or transit through DMAs, but would need to reduce their speed when transiting through a DMA. Therefore, regular speed vessels are affected by the delays from speed restrictions. If whales were located in a DMA, it is likely that a whale watching vessel would already be traveling at a slow speed to allow the

[33] Calculated at $13,320 daily operating costs excluding fuel times 15 days for 5 vessels.

passengers to look and take pictures, thus reducing the estimated delay. If a DMA were located in an area where the vessel would have to transit in order to reach a particular destination, and the captain did not want to slow down, he could route around the area or seek other potential whale watching areas that day to reduce the effects of a time delay.

The number effective days of DMA restrictions in the Northeast (excluding Cape Cod Bay) is estimated to be 68 days per year (Table 4-1), thus the economic impact, as described here, is based on a single DMA implementation, may actually be four or more times higher in a year with multiple DMAs. The estimated effective days of DMA restrictions in Cape Cod Bay is estimated to be 105 days, which could increase the economic impact six fold. However, each DMA would not necessarily affect all whale watching operators, so even if there were multiple DMAs in the Northeast in one year, it is unlikely that they would result in the higher impacts mentioned in this paragraph.

4.4.6.3 Alternative 3 – Speed Restrictions in Designated Areas

If implemented, the speed restrictions in Alternative 3 would have direct, long-term, adverse effects on whale watching vessels 65 feet and over along the US East Coast. Under Alternative 3, the year-round speed restrictions in the Northeast region and Cape Cod Bay (Section 2.2.3) would render the high-speed whale watching vessels unprofitable and they may be sold or diverted into other service.[34] As this would not be a recurring economic cost, any loss associated with the sale of the vessel is not included in this economic assessment. It is also assumed 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 will discourage 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 (46.3) from the Northeast region coastline and in Cape Cod Bay. It is assumed that at 12 knots, the 13 regular-speed vessels would incur a 30-minute delay each way for two round-trips daily during a 90-day summer whale-watching period. The estimated economic impact is $1.6 million for a speed restriction of 12 knots, $2.8 million at 10 knots, and $0.9 million at 14 knots (Data Chart 4-42).

Speed restrictions proposed in the mid-Atlantic from October 1 to April 30 extend out 25 nm (46.3 km), which would also include the majority of the right whale migratory corridor. In the Southeast, speed restrictions from December 1 through March 31 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 greater 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 assumed any economic impact on the whale watching industry in these regions could be avoided or would be a negligible.

[34] This analysis also applies to Alternative 5.

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	468,000	260,000	156,000
Alternative 3	2,808,000	1,560,000	936,000
Alternative 6	468,000	260,000	156,000
Total			
Alternative 2	867,600	659,600	555,600
Alternative 3	2,808,000	1,560,000	936,000
Alternative 6	867,600	659,600	555,600

Source: Prepared by Nathan Associates from data on operator websites and selected interviews.

4.4.6.4 Alternative 4 – Recommended Shipping Routes

The use of recommended shipping lanes proposed in Alternative 4 would not affect whale watching operations. The shipping lanes into Cape Cod Bay, Brunswick, Fernandina, and Jacksonville port areas are primarily utilized 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 Measures

Alternative 5 would have direct, long-term, adverse effects on whale watching vessels 65 feet and over operating in the waters off the East Coast. The economic impacts of Alternative 5 are the same as Alternative 3 ($2.8 at 10 knots, $1.6 at 12 knots, and $0.9 at 14 knots), described above (Section 4.4.6.3).

4.4.6.6 Alternative 6 (Preferred) – Right Whale Ship Strike Reduction Strategy

Alternative 6 would have direct, long-term, adverse impacts on whale watching vessels 65 feet and greater. 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 proposed speed restrictions for an extended Off Race Point are proposed for March through April would not affect the whale watching season. Accordingly, the economic impact of Alterative 6 is assumed the same as Alternative 2 due to the implementation of DMAs (Section 4.4.6.2). When the impacts to both regular and high-speed vessels are added, they amount to $0.9 million at 10 knots, $0.7 million at 12 knots, and $0.6 million at 14 knots (Data Chart 4-41).

The number of whale watching operators in the MAUS and SEUS regions is minimal and the impact of the strategy on the whale watching industry in these areas is likely to be negligible.

4.4.7 Impacts on Charter Vessel Operations

During the stakeholder meetings, representatives of the charter fishing industry raised concerns regarding the negative effects the speed restrictions may have on the 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 fishing areas in less than 3 hours (Section 3.4.6). Under Alternative 6, a speed restriction of 12 knots for 30 nm (56 km) would add about 90 minutes to the roundtrip steaming time, and could severely affect client demand.

As described above an increase of 1.5 hours roundtrip steaming time would reduce the competitiveness of the larger headboats (more than 65 ft [19.8 m] LOA) particularly for the half-day and full-day charters. It is expected that vessels of less than 65 feet LOA would increase their share of those market segments. For extended full-day charters, headboats of LOA in excess of 65 feet would incur additional costs associated with the 1.5-hour increase in roundtrip steaming 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 on the East Coast. There are no operational measures contained in Alternative 1 that would affect charter boat operations.

4.4.7.2 Alternative 2 – Dynamic Management Areas

Under Alternative 2, DMAs would not affect the operation of the majority of charter vessels, which are under 65 feet, but would affect larger vessels during the periods that DMAs are being implemented. Those vessels 65 feet and greater could either route around a DMA or reduce speed through a DMA, thereby choosing the option that would be the most time and cost efficient but still incurring some time penalty.

4.4.7.3 Alternative 3 – Speed Restrictions in Designated Areas

Under Alternative 3, a speed restriction of 12 knots over 25 nm (46.3 km) would have minor, direct, long-term, adverse economic impacts on charter vessels of $600,000 a year. This impact increases to $1.1 million at a 10-knot speed restriction and decreases to $200,000 at 14 knots. As described in Section 4.4.7, the impacts only apply to headboats in excess of 65 feet that have full-day charters.

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 Measures

The impacts under Alternative 5 ($1.1 million at 10 knots, $600,000 at 12 knots, and $200,000 at 14 knots) are the same as for Alternative 3 (Section 4.4.7.3).

4.4.7.6 Alternative 6 (Preferred) – Right Whale Ship Strike Reduction Strategy

Charter vessels equal to or larger than 65 ft (19.8 m) would be affected by implementation of Alternative 6. It is estimated that the annual economic impact of a speed restriction of 12 knots for these vessels over 30 nm (56 km) would be approximately $720,000.[35] At a 10-knot speed restriction, the estimated impact is $1.2 million. At 14 knots, there is a $240,000 impact.

4.4.7.7 Summary of the Direct and Indirect Economic Impacts on all Maritime Sectors

This section summarizes the findings regarding the economic impacts of the alternatives on US East Coast maritime activity in 2004. This includes the shipping industry and port areas, commercial fishing vessels, cruise vessels, passenger ferries, whale watching vessels, and charter vessels (Sections 4.4.1–4.4.7). Data Chart 4-43 presents the direct and indirect economic impacts by alternative and speed restriction for 2003 and 2004.

- **Alternative 5** has the largest estimated economic impact in terms of direct economic impact, indirect economic impact, and total economic impact. In 2004, the estimated total economic impact of Alternative 5 at a speed restriction of 12 knots is $163 million annually. The operational measure of speed restrictions year-round under Alternative 5 (and Alternative 3) will 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 substantial total economic impact for Alternative 5. The brunt of the direct economic impact is borne by the commercial shipping industry with a combined direct economic impact of $66 million. This represents 87 percent of the total direct economic impact for a speed restriction of 12 knots. The total annual economic impact with a speed restriction of 10 knots is estimated at $272 million and with a speed restriction of 14 knots at $94 million.
- **Alternative 3** has the second largest annual economic impact of $151 million with a speed restriction of 12 knots. The direct economic impact is estimated at $71 million while the indirect economic impact is estimated at $80 million. The total annual economic impact with a speed restriction of 10 knots is estimated at $249 million and with a speed restriction of 14 knots at $83 million.
- **Alternative 6** (Preferred) has the third largest total economic impact of $62 million with a speed restriction of 12 knots. This is comprised of $44 million in direct economic impact and $18 million in indirect economic impact. The total economic impact with a speed restriction of 10 knots is $116 million and with a speed restriction of 14 knots, the total economic impact is $35 million.
- **Alternative 2** ranks fourth in terms of the largest total economic impact with an annual impact of $16 million for a speed restriction of 12 knots. This alternative did not have any estimated indirect economic impact as vessel calls were assumed not to be diverted to Canadian ports. The total annual economic impact with a speed restriction of 10 knots is estimated at $23 million and with a speed restriction of 14 knots at $10 million.
- **Alternative 4** has the lowest total economic impact at $1 million annually for 10, 12, and 14 knots. This alternative consists only of use of recommended routes and port areas that may incur negative secondary economic impacts were offset by port areas with gains.

[35] This calculation assumes 40 headboat vessels with 60 roundtrips per year and an hourly steaming operating cost of $200.

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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	15,401.6	9,840.3	5,925.9	80,969.3	50,457.7	29,362.5	1,026.3	1,026.3	1,026.3	83,527.8	52,423.5	30,820.0	45,764.0	28,700.5	17,112.4
Cumulative effect of multi-port strings	-	-	-	6,775.7	5,646.4	4,743.0	-	-	-	6,775.7	5,646.4	4,743.0	5,313.2	4427.7	3,719.3
Re-routing of southbound coastwise shipping	-	-	-	3,700.0	3,700.0	3,700.0	-	-	-	3,700.0	3,700.0	3,700.0	2,500.0	2,500.0	2,500.0
Commercial fishing vessels	-	-	-	862.0	-	-	-	-	-	862.0	-	-	1,034.4	-	-
Charter fishing vessels	-	-	-	1,100.0	600.0	200.0	-	-	-	1,100.0	600.0	200.0	1,200.0	720.0	240.0
Passenger ferries	5,128.0	4,145.7	3,161.3	6,514.0	5,530.7	4,154.0	-	-	-	6,514.0	5,530.7	4,154.0	5,593.2	4,572.4	3,570.3
Whale watching vessels	867.6	659.6	555.6	2,808.0	1,560.0	936.0	-	-	-	2,808.0	1,560.0	936.0	867.6	659.6	555.6
Subtotal direct economic impact	21,397.2	14,645.6	9,642.8	102,729.0	67,494.8	43,095.5	1,026.3	1,026.3	1,026.3	105,287.5	69,460.6	44,553.0	62,272.4	41,580.2	27,697.6
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	21,397.2	14,645.6	9,642.8	244,337.0	148,983.8	81,898.5	1,026.3	1,026.3	1,026.3	267,823.5	161,237.8	93,464.2	111,872.9	59,783.7	33,000.3
2004															
Direct economic impact															
Shipping industry vessels	16,989.3	10,815.9	6,509.1	86,822.9	53,895.7	31,237.0	1,145.2	1,145.2	1,145.2	89,745.6	56,114.6	32,889.4	49,406.8	30,863.9	18,355.3
Cumulative effect of multi-port strings	-	-	-	7,227.8	6,023.2	5,059.5	-	-	-	7,227.8	6,023.2	5,059.5	5,805.5	4,837.9	4,063.8
Re-routing of southbound coastwise shipping	-	-	-	3,800.0	3,800.0	3,800.0	-	-	-	3,800.0	3,800.0	3,800.0	2,500.0	2,500.0	2,500.0
Commercial fishing vessels	-	-	-	862.0	-	-	-	-	-	862.0	-	-	1,034.4	-	-
Charter fishing vessels	-	-	-	1,100.0	600.0	200.0	-	-	-	1,100.0	600.0	200.0	1,200.0	720.0	240.0
Passenger ferries	5,128.0	4,145.7	3,161.3	6,514.0	5,530.7	4,154.0	-	-	-	6,514.0	5,530.7	4,154.0	5,593.2	4,572.4	3,570.3
Whale watching vessels	867.6	659.6	555.6	2,808.0	1,560.0	936.0	-	-	-	2,808.0	1,560.0	936.0	867.6	659.6	555.6
Subtotal direct economic impact	22,984.9	15,621.2	10,226.0	109,134.7	71,409.6	45,386.5	1,145.2	1,145.2	1,145.2	112,057.5	73,628.5	47,038.9	66,407.5	44,153.8	29,285.0
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	22,984.9	15,621.2	10,226.0	248,540.7	151,012.6	82,637.5	1,145.2	1,145.2	1,145.2	271,639.5	162,936.9	93,995.3	116,102.5	62,433.8	34,640.0

Source: Prepared by Nathan Associates as described in text.

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4.4.8 Impacts on Environmental Justice

The proposed operational measures evaluated in this EIS 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, 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 have a minority population greater than the United States or representing more than 50 percent of the area's total population (New York City, Hampton, Georgetown, Charleston, Baltimore, and Savannah); four (Eastport, Morehead City, Wilmington, and Brunswick)[36] 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.

Comparison of economic impacts among the 26 affected port areas is not easily done because of the wide differences in size and economic activities between the areas. 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 3-3. 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.

4.4.8.1 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.

4.4.8.2 Alternative 2 – Dynamic Management Areas

Table 4-3 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.

[36] The cities of Georgetown, Charleston and Savannah occur in both categories, and are not counted twice.

Table 4-3
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	3.22	Boston, MA	0.0042
Port Canaveral, FL	0.34	New Bedford, MA	0.0038
Searsport, ME	0.050	New Haven, CT	0.0033
Fernandina, FL	0.045	*All Areas*	*0.0033*
Salem, MA	0.038	**Wilmington, NC**	**0.0028**
Eastport, ME	**0.030**	**Morehead City, NC**	**0.0020**
Bridgeport, CT	0.018	**Hampton Roads, VA**	**0.0018**
Portland, ME	0.017	Providence, RI	0.0014
Savannah, GA	**0.011**	**Charleston, SC**	**0.0014**
New London, CT	0.010	**New York, NY[2]**	**0.0012**
Jacksonville, FL	0.0092	Philadelphia, PA	0.0010
Portsmouth, NH	0.0056	**Baltimore, MD**	**0.0010**
Brunswick, GA	**0.0047**	Long Island, NY[2]	N/A[2]
Georgetown, SC	**0.0046**		

Note 1: Direct impacts on shipping industry as a percentage of total 2004 merchandise value for each port. Impacts calculated for the 12-knot speed restriction level were used.
Note 2: For the purposes of this analysis, New York and Long Island are factored together.

As demonstrated, 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 area 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 $34,700) as well as in relative terms (impacts on Eastport, the most heavily affected of all ten environmental justice areas, would still represent only three hundredths of a 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.

4.4.8.3 Alternative 3 – Speed Restrictions in Designated Areas

Table 4-4 shows how each port area would be affected under Alternative 3 using the same method as previously defined.

As applied in Alternative 2, Alternative 3 also maintains that four out of ten environmental justice areas would experience relatively heavier impacts than all the areas taken together. However, like 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 4-4
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	37.3	Providence, RI	0.025
Bridgeport, CT	0.27	**Wilmington, NC**	**0.022**
Searsport, ME	0.25	Boston, MA	0.021
Salem, MA	0.19	*All Areas*	*0.017*
Eastport, ME	**0.15**	**Savannah, GA**	**0.016**
New London, CT	0.13	Philadelphia, PA	0.016
Portland, ME	0.087	**Baltimore, MD**	**0.015**
New Haven, CT	0.063	**Morehead City, NC**	**0.014**
New Bedford, MA	0.056	**New York, NY[2]**	**0.014**
Port Canaveral, FL	0.046	**Charleston, SC**	**0.009**
Fernandina, FL	0.043	Jacksonville, FL	0.009
Georgetown, SC	**0.042**	**Brunswick, GA**	**0.005**
Portsmouth, NH	0.028	Long Island, NY[2]	N/A[2]
Hampton Roads, VA	**0.027**		

Note 1: Direct impacts on shipping industry as a percentage of total 2004 merchandise value for each port. Impacts calculated for the 12-knot speed restriction level were used.
Note 2: For the purposes of this analysis, New York and Long Island are factored together.

4.4.8.4 Alternative 4 – Recommended Shipping Routes

Table 4-5 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 (in descending order) with the ten areas that are environmental justice communities shown in boldface.

Table 4-5
Relative Intensity of Economic Impacts by Port Area – Alternative 4

Port Area	Economic Impact Index[1]	Port Area	Economic Impact Index[1]
Salem, MA	0.031	Providence, RI	0
Fernandina, FL	0.014	**Wilmington, NC**	**0**
Jacksonville, FL	0.005	**Eastport, ME**	**0**
Boston, MA	0.0035	Cape Cod, MA	0
Brunswick, GA	**0.001**	**Savannah, GA**	**0**
All Areas	*0.0003*	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**		

Note 1: Direct impacts on shipping industry as a percentage of total 2004 merchandise value for each port. Impacts calculated for the 12-knot speed restriction level were used.
Note 2: For the purposes of this analysis, New York and Long Island are factored together.

Under this alternative, Brunswick is the only environmental justice community that would incur economic impacts. However, these impacts would be very minor ($60,700 per year or one thousandth of a 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.

4.4.8.5 Alternative 5 – Combination of Measures

Table 4-6 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 4-6
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	37.8	Boston, MA	0.026
Bridgeport, CT	0.27	Providence, RI	0.025
Searsport, ME	0.26	**Wilmington, NC**	**0.022**
Salem, MA	0.23	*All Areas*	*0.017*
Eastport, ME	**0.16**	**Savannah, GA**	**0.016**
New London, CT	0.13	Jacksonville, FL	0.016
Port Canaveral, FL	0.11	Philadelphia, PA	0.016
Portland, ME	0.09	**Baltimore, MD**	**0.015**
Fernandina, FL	0.081	**Morehead City, NC**	**0.014**
New Haven, CT	0.063	**New York, NY[2]**	**0.013**
New Bedford, MA	0.056	**Charleston, SC**	**0.009**
Georgetown, SC	**0.042**	**Brunswick, GA**	**0.007**
Portsmouth, NH	0.03	Long Island, NY[2]	N/A[2]
Hampton Roads, VA	**0.027**		

Note 1: Direct impacts on shipping industry as a percentage of total 2004 merchandise value for each port. Impacts calculated for the 12-knot speed restriction level were used.
Note 2: For the purposes of this analysis, New York and Long Island are factored together.

4.4.8.6 Alternative 6 (Preferred) – Right Whale Ship Strike Reduction Strategy

Table 4-7 shows how each port area would be affected under Alternative 6.

Table 4-7
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	7.25	**Savannah, GA**	**0.013**
Bridgeport, CT	0.14	**Hampton Roads, VA**	**0.013**
Fernandina, FL	0.11	**Morehead City, NC**	**0.012**
Port Canaveral, FL	0.069	Providence, RI	0.010
New London, CT	0.054	*All Areas*	*0.0095*
Eastport, ME	**0.04**	**Brunswick, GA**	**0.0085**
Searsport, ME	0.039	Philadelphia, PA	0.008
New Bedford, MA	0.035	**Charleston, SC**	**0.0075**
Georgetown, SC	**0.033**	Portsmouth, NH	0.007
New Haven, CT	0.029	**Baltimore, MD**	**0.007**
Salem, MA	0.025	**New York, NY[2]**	**0.007**
Portland, ME	0.021	Boston, MA	0.006
Jacksonville, FL	0.020	Long Island, NY[2]	N/A[2]
Wilmington, NC	**0.017**		

Note 1: Direct impacts on shipping industry as a percentage of total 2004 merchandise value for each port. Impacts calculated for the 12-knot speed restriction level were used.
Note 2: For the purposes of this analysis, New York and Long Island are factored together.

Under Alternative 6, six of the ten environmental justice areas would experience impacts heavier than those on the 26 areas taken together. However, in all cases, these impacts would be very small (for example, impacts in Eastport, the most affected of the ten environmental justice areas, would represent four hundredths of a 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.

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 ships to recommended routes. Furthermore, the USCG is conducting the PARS to analyze any existing "navigational hazards" in the proposed shipping lanes. Any cultural resource located on the ocean surface would be considered a hazard to navigation, hence the lanes would not be designated in an area with potential hazards.

Consultation with the Advisory Council on Historic Preservation, a NOAA Marine Archeologist, and NOAA General Council, resulted in a consensus that the proposed operational measures in the alternatives have no potential to affect any cultural resources or historic properties.[37]

[37] 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 Regulatory Impacts

The proposed action and alternatives will comply with EO 12898 (Section 1.7.1). A Regulatory Impact Review/Regulatory Impact Analysis is provided in Chapter 5, in compliance with EO 12866 (Section 1.7.2). The Initial Regulatory Flexibility Analysis is located in Appendix F, 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 4.4.8. 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 (Section 1.8.1). 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 Right Whale Recovery Plan, which is required by the ESA, states that downlisting the species from endangered to threatened as a short-term goal. Under Alternative 1, ship strikes would continue and the right whale population would not be expected to increase, therefore this intermediate goal would not 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 2–6, which contain one or more operational measures 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.

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 (Section 1.8.2). The existing measures contained in this alternative have not been effectively reducing 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 2–6, which 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. NMFS would be consistent with the objectives of the MMPA to protect the 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 (Section 3.2.1).

4.6.3 Ports and Waterways Safety Act

4.6.3.1 No Action Alternative

Under the No Action Alternative, the USCG would not conduct the PARS and no routing measures would be implemented. 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 will make recommendations on NOAA's proposed shipping lanes through the PARS study. Shipping lanes are proposed in Alternatives 4, 5, and 6. Throughout the PARS, the USCG will fulfill its mandate to protect the marine environment under the Ports and Waterways Safety Act of 1972. These designated lanes 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 the NMFS strategy.

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 not be any subsequent effects that could have a significant economic impact on small entities. Therefore, analysis under the RFA would be unnecessary.

4.6.4.2 Action Alternatives

The operational measures contained in the alternatives require NMFS to prepare an initial regulatory flexibility analysis (IRFA) to determine whether the operational measures would have a significant economic impact on a substantial number of small entities. The IRFA will utilize 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 employees or less. The SBA defines a small business in the commercial fishing sector as a firm with gross revenues up to $3.5 million. All potentially affected sectors will be assessed in the IRFA. Based on these standards and industry data on firm size, the number of small entities in the affected industries will be identified and the impacts will be quantified. The IRFA is provided in Appendix F.

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 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]); however, 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 30 nm (56 km) offshore. The MAUS SMAs are proposed 30 nm (56 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 policy's 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 Strategy. These states include 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 will be submitted to the states along with the proposed rule, and a copy of this document, for review and concurrence by the responsible state agencies under Section 307 of the Coastal Zone Management Act (CZMA).

4.6.6 Effect Analysis on Other Resources

4.6.6.1 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 operational measures of the Strategy, 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 other Federal agency's policies, vessels or operations. NMFS has had numerous meetings with the Navy and has accepted written comments from them on the ANPR and the NOI to prepare a DEIS. The National Ocean Service's National Marine Sanctuary Program has two sanctuaries within the scope of the Strategy: Stellwagen Bank and Gray's Reef. A coordination letter will be sent to these sanctuaries along with copy of the DEIS to ensure consistency with their policies. The state coastal zone management programs were provided with consistency determination letters under the CZMA (Section 4.6.5). Should the states identify any conflicts between the proposed action and state policies, NMFS will develop mitigation measures to mediate any issues. States that have environmental clearinghouses will also be sent a coordination letter along with the DEIS to ensure consistency with other environmental protection divisions within the agency.

4.6.6.2 Public Health and Safety

NMFS may 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., inclement weather at sea). The proposed action and alternatives would have a negligible effect on public health. If anything, the reduced vessel emissions at sea because of reduced speeds would have a positive impact on public health. Local and regional weather patterns would predict the transport and dispersion of any marine emissions, therefore it is difficult to predict the location of these positive effects on air quality and public health. In addition, 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.

The PARS considers safety and navigational hazards with respect to the recommended routes, therefore, routes would not be established in locations that posed a threat to mariner safety. Whereas some have argued that speed restrictions will increase navigational and human safety, a number of industry and federal sources indicate that the speeds being considered would not, a priori, endanger vessels or mariners. However, NMFS may consider exceptions for navigational safety in inclement weather conditions.

4.6.6.3 Energy Requirements and Conservation Potential

It has been estimated that 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 4-8 shows that a profile of the world fleet, main engine power and the percent of energy demand by vessel type. The cargo fleet accounts for the large majority of fuel consumption (69 percent), while the noncargo fleet uses 20 percent and the military accounts for 14 percent. This review includes estimates for the world fleet as such data is readily available and a 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.

Table 4-8
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%

[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.

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[38] 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.** Obviously, traveling into the wind or in rough seas will increase fuel requirements.

[38] Fleet refers to the world's merchant fleet, using ship registry data from Lloyd's Maritime Information System, 2002.

- **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 3 percent applying a silicone-base coating to its cruise ships (Cruise Industry News Winter 2005-2006).
- **Speed.** For any given vessel, speed is probably the singular 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 6 percent reduction in speed (from 9 to 8.5 knots) can result in a fuel savings of approximately 11 percent for fishing vessels (FAO, 1999).

Provided that there are many variables determining fuel consumption, the information above states the speed is the most important factor influencing fuel consumption, which is the only variable the operational measures 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, are likely end up using more fuel with the increase in distance traveled. However, the recommended routes should not be too far off 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.

4.6.6.4 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.

4.6.6.5 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 3.4.8 and 4.5.

4.6.6.6 Relationships Between Local Short-term Use of Man's Environment and the Maintenance and Enhancement of Long-term Productivity

The proposed action would not make 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.

4.6.6.7 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 the operational measures and integrating the speed restrictions and recommended routes into their voyage planning on a seasonal basis. The regulations would not change after the initial implementation; therefore 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 monitor compliance, therefore, the amount of additional man-hours required for this particular action would be minimal.

4.6.6.8 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 shipping lanes. 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 and would only occur when the speed restrictions are in place 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 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 EISs. 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, “Existing Conditions.” 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

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 ability to absorb 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 within our 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 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 Artic 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 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)[39] examined recent shifts of marine communities in response to rising water temperatures, concluding that most cetaceans will experience roughly poleward shifts in prey distributions. 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. 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.[40] 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 severe existing problems, like the North Atlantic right whale, these changes could be significant obstacles to species survival (NMFS, 2005a).

EPA (2005b) reports that action is occurring "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 coordinating the world's most extensive research effort on climate change. US 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).

4.7.1.2 Ocean Noise Levels

Whales, dolphins, and other marine mammals primarily rely on their hearing to locate food, detect predators, find mates, and keep herds together. Large whales communicate primarily using low-frequency sounds (typically below 1000 Hertz) that travel long distances through water (NRDC, 1999 *in* NMFS, 2005a). The growing amount of noise within this range from ships, supertankers, underwater explosions, and other sources represents an additional potential threat to large whales. Noise pollution may disrupt and inhibit feeding and reproduction; displace whales from traditional calving grounds, feeding grounds, or migratory routes; or, in the worst case, cause direct auditory damage and death. Noise pollution sources include ship and boat propeller noise; drilling, blasting, and dredging; acoustic deterrent devices used by fish farms and fishing vessels; sonar and airguns used in seismic exploration; and the use of low- and mid-frequency sonar in military operations. In recent years, this new source of stress has garnered

[39] 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.

[40] 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 a certain minima (Kenney *et al*., 2001).

increased attention from both the scientific community and the general public. The impact of acoustic pollution, however, has been difficult to ascertain, and its effect on marine mammals is one of the least understood subjects within marine mammal science (NMFS, 2005a).

Although acute mortality from noise pollution is established, much less is known about the impact of chronic noise pollution on cetacean health. Potential impacts from long-distance undersea noise vary from no effect 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 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, 10 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 being conducted 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 30 to 50 meters behind the ship. Seismic surveys introduce low frequency sound (< 250 Hz) into the ocean. These devices are used to obtain information on the seafloor, the structure of sediments, and ocean currents and circulation patterns.

The 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 habitation, masking or hearing impairment, and other physical effects. To minimize or avoid adverse effects of seismic operations on marine resources, monitoring and mitigation 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 Vessel Noise

Shipping has been a constant source of anthropogenic noise in the ocean since the inception of waterborne commerce and transportation, and will only continue to increase with the steady increase in commercial shipping. From 1985 to 1999, world seaborne trade increased 50 percent to approximately 5 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 fills the frequency band below 500 Hz and produces sounds of 190 decibels or more. Midsized ships such as tugboats and ferries produce quieter sounds, around 150 to 170 decibels in the same frequency range (Jasney *et al*., 2005).

Noise from Military Activities

Although direct, unequivocal evidence has been hard to obtain, there is growing evidence 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 SEUS right whale 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; however, no conclusive link was established (NMFS, 2005a). The Navy currently has mitigation measures in place to prevent similar events from reoccurring (Appendix A).

Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar

Controversy has surrounded the Navy's potential use of SURTASS LFA sonar, which is a long-range, low frequency (between 100 and 500 Hertz) sonar system that has both active and passive components. The sonar's detection capability does not rely on noise generated by the target, but rather on the use of active sounds or pulses originating from the system. SURTASS LFA sonar provides the Navy with a reliable system for long-range detection of quieter, harder-to-detect, newer-generation submarines. Its low frequency sound travels in seawater more effectively and for greater distances than the higher frequency sound used by most other active sonar systems (Department of the Navy [DoN], 2001 *in* NMFS, 2005a).

The Navy funded a study of the effect of low-frequency sonar to evaluate the impact of the SURTASS LFA system on endangered species. The study assessed the effects on four species of baleen whales (blue, fin, gray, and humpback whales) known to be sensitive to low-frequency sounds.[41] The findings were that when exposed to sound pressure levels ranging from 120 to 150 decibels, the marine mammals exhibited only minor, short-term behavioral responses. Given the uncertainty of the science in this area, however, a number of measures were included in the final NMFS rule on the military use of SURTASS LFA, including use restrictions in coastal zones and a monitoring and detection plan (NMFS, 2005a).

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 coast of southeastern North Carolina. The impacts of this project are described in the *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

[41] The study was limited to these four species of baleen whales because (1) baleen whales are considered to have the best hearing in the low frequency band of all marine mammals, (2) these species have protected status under the law, and (3) there is prior evidence that these species react to low frequency sounds.

acoustic transducer[42] devices), which would be used for antisubmarine warfare training. The transducer nodes would transmit and receive 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 sonar in the mid-frequency range.

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 whales if the preferred alternative were selected. However, this finding has been challenged by scientists, government agencies and nongovernmental 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 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 mentioned in this section in addition to other natural and anthropogenic threats to right whales might result in long-term adverse impacts on right whale health. 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 acoustic expert panels to develop 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.
- Hosting a national educational lecture series on marine mammal acoustic communication and the potential impacts of natural and manmade sources underwater.

[42] A transducer is an instrument that converts one form of energy to another.

- 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.
- 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 Sections 3.3.2, "Water Quality," research suggests that water 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 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 noncetacean marine mammals is sufficient to warrant concern about similar impacts on cetacean species.

As the human population along the East Coast continues to expand in coming decades, 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 impairing 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.

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" (i.e., 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 intense period of early 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, 1987) (NMFS, 2005a).

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 another 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, or entanglements may result in long-term effects, such as starvation in cases where lines are wrapped around the mouth. 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 resulting from entanglements was 1.2 in 2003. As this number exceeds the PBR levels for right whales, NMFS took action to reduce mortality from entanglements.

The Atlantic Large Whale Take Reduction Team (ALWTRT) is one of several take reduction teams established by NMFS in the 1996 to help develop plans to mitigate the risk to marine mammals posed by fishing gear along the Atlantic coast. TRTs were established as advisory teams under the MMPA. The ALWTRT is composed of fishermen, scientists, conservationists, and state and federal officials.

The MMPA requires Take Reduction Plans for strategic marine mammals stocks that interact with Category I or II fisheries. 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 large whale TRT 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 whales, humpbacks, 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 (Section 1.8.2) to further reduce entanglements. NMFS is considering various alternatives to meet this objective and thus is preparing an EIS on the proposed amendments to the ALWTRP (Section 1.9.2).

The ALWTRP and proposed amendments would have a beneficial cumulative effect on the right whale population. Reducing both the primary causes of human-induced mortality, entanglement, and ship strikes, will have significant beneficial effects on the population. These two conservation 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, thus, 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 9 million participants a year in 87 countries, generating revenue of one billion US dollars (Hoyt, 2001). Whale watching tends to concentrate in habitat areas critical to whales, such as feeding areas. 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 articles reviewed the impact of whale watching on many types of whale behavior, such as time feeding, time diving, tale 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 the exception of a 1986 study by W.A. Watkins.

Watkins (1986 *in* Amaral and Carson, 2005) 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 prior to 1976, the advent of whale watching in the area, and after 1976, to document any changes in whale behavior. He found that; minkes changed from frequent positive interest in vessels to generally uninterested reactions; finbacks changed from mostly negative to uninterested reactions; humpbacks dramatically changed from mixed responses that were often negative to often strongly positive reactions; but right whales continued their responses 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 *in* Amaral and Carlson, 2005).

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 in order 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). As more research is undertaken on the long-term impacts of whale watching on whale behavior and biology, the cumulative effects will become clearer. Meanwhile, many regions and countries have developed whale-watching guidelines to reduce the pressure on whales and avoid negative effects based on existing science; Carlson (2003) compiled whale watching guidelines and regulations around the world for the International Fund for Animal Welfare.

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 in a different context 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 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 frequent coastal waters 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 in the form of waterfront property, marinas, and other recreational facilities presents an real threat to the habitat of this coastal species. Coastal development in the future will increasingly add vessel traffic to coastal waters and will potentially interfere with marine species and their habitat.

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 Right Whale Recovery Plan, 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 and impacts 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 then take steps to minimize identified adverse effects from coastal development (NMFS, 2005b).

Cape Wind Project

Cape Wind Associates is proposing an offshore wind energy project that consists of the installation and operation of 130 Wind Turbine Generators (WTGs) on Horshoe Shoal in Nantucket Sound. The wind-generated energy produced by the WTGs will be transmitted via a submarine transmission cable system to the electric service platform, which will transform and transmit the electric power to the shore via alternating current submarine cable circuits (USACE, 2004a). The USACE published a DEIS on this project in November 2004, and a marine biological assessment in May 2004, assessing the impacts of the project on threatened and endangered marine species. The Wind Park is expected to be operational in 2009.

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 result in acoustic harassment. 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 in other feeding grounds such as Stellwagen Bank, Jeffrey’s Ledge, Browns and Bacaro Banks, and in the Great South Channel (Kenney and Winn, 1986 *in* USACE, 2004a). Only seven instances of right whales have been documented in Nantucket Sound since the early 1900s. Whales are more common offshore to the east of Nantucket Island than in the Sound (USACE, 2004a). Given the rare occurrence of right whales in the Nantucket Sound, the probability of cumulative, adverse effects on right whales is low.

4.7.2.5 Nonregulatory Measures of NOAA’s Right Whale Ship Strike Reduction Strategy

The other four nonregulatory measures of the Strategy 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, and (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 Strategy will increase the level of right whale protective measures. The grant programs will continue to research new technologies and other right whale biology and habitat parameters in order to identify new and expanded ship strike mitigation measures. The MSRS will continue to log vessel traffic information and compliance data. The northeastern and southeastern right whale recovery plan implementation teams will continue to educate mariners about the threat of ship strikes, and when the Strategy is implemented, the teams may help disseminate information on the operational measures of the Strategy. Current outreach and education efforts, including updating navigational charts, brochures, placards and other publications to educate mariners about the vulnerability of right whales to ship strikes will further the objectives of the Strategy while a new program is being developed under element 2.

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 intends to develop and implement 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 be taken the reduce the threat. This program is underway. NMFS has developed 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 to inbound ships. Key groups such as the implementation teams and others are assisting in reviewing, prioritizing, and performing the tasks.

The third element, conducting ESA Section 7 consultations (Section 1.8.3), would establish separate agency-specific ship strike mitigation measures to cover the vessels owned or operated by, or under contract to, Federal agencies, that are exempt from the operational measures of the Strategy. This element ensures that the mitigation measures undertaken by the nonsovereign vessels are not [negated] by the Federal agency's exemption. These vessels are exempted because 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 analyze and mitigate impacts of vessel activities authorized, funded or carried out by Federal agencies. NMFS will review actions (including those subject to the conditions of existing Biological Opinions [Appendix A]) involving vessel operations of federal agencies (e.g. 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.

The forth element, developing a Right Whale Conservation Agreement with the government of Canada, would aim to extend mitigation measures into Canadian right whale habitat, therefore strengthening the overall effectiveness of the Strategy to the population. As North Atlantic right whales are transnational in distribution, NOAA intends, with the appropriate federal agency or agencies, to initiate the 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 in their protection of right whales. Although 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.

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 mention in Section 4.7.1.2. Some of these programs occur offshore, away from right whale habitat and other activities overlap spatially with right whales. In addition to these activities, the Navy has a suite of regularly occurring activities within the Boston Complex in the Gulf of Maine. The Navy has initiated information consultation under Section 7 of the ESA on these activities, and the Navy has implemented interim mitigation 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.

Sinking Exercises (SINKEX)

The Navy proposes to conduct Sinking Exercises (SINKEX) in the western North Atlantic Ocean, specifically 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 6000 feet (1828.8 m). The SINKEX location follows the EEZ contours, and is generally greater than 200 nm (370 km) offshore (DoN, 2005b).

Right whales are a coastal species and very few sightings occur beyond the continental shelf. The Navy's Biological Assessment assessed the seasonal occurrence of right whales in the proposed site and found a possible occurrence in the spring and fall, unknown in the winter, and 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 sighting 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' NERO and SERO have determined that the SINKEX was not likely to adversely affect listed species. The Navy is also planning to undergo Section 7 consultation for this SINKEX program. Until the consultation is completed it has yet to be determined whether NMFS concurs with the Navy's findings in this BA.

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 greater 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 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 or 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 with 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 determines 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. Until the consultation is 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 Vessels and Deepwater Ports

Section 4.7.3.1 describes the three existing (including two applications to expand existing terminals), one approved, and seven new proposed (at the time of publication of the DEIS) LNG terminals on the East Coast. While all the proposed facilities would increase vessel traffic on the East Coast, if approved, only two of these proposals are for offshore deepwater ports that would be located in right whale habitat. Five 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 nine 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, 2006).

The two offshore proposals addressed in detail in this section that would have potential impacts on right whales are the Northeast Gateway and Neptune Deepwater Ports. Both applications for a Deepwater Port license were determined to be complete in 2005 and thus both projects have commenced the NEPA process. The USCG and MARAD are also expected to initiate Section 7 consultations under the ESA with NMFS (Section 1.8.3). This section addresses the cumulative impacts of constructing 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 would be located approximately 22 miles northeast of Boston, Massachusetts, in a water depth of approximately 260 ft (79.2 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 mile pipeline that would connect to the existing Algoquin 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, 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 are preparing an EIS to assess the impacts of the facility on the environment, and the Biological Opinion resulting from the Section 7 consultation will determine if the action is likely to jeopardize the continued existence of any endangered or threatened species and or adversely modify or destroy critical habitat. Further, NOAA specifically requested that the EIS considers the potential impacts of the construction and operation of the terminal on endangered species, including right whales, in their scoping comments on the NOI to prepare an EIS for the Neptune LNG Deepwater Port. However, at this time there is no information available on the potential impacts of this vessel traffic and construction on right whales.

Northeast Gateway

The Northeast Gateway LNG terminal would be located offshore in Massachusetts Bay, approximately 13 miles south-southeast of the city of Gloucester, Massachusetts, in federal waters approximately 270 to 290 feet in depth. The natural gas would be delivered to shore by building a new 16.4 mile pipeline from the proposed deepwater port to the existing Algoquin HubLine™ pipeline (Northeast Gateway Energy Bridge, LLC, 2005). As with the Neptune project, the construction and operation of this terminal would increase vessel traffic. 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 on 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 are preparing an EIS to assess the impacts of the facility on the environment, and the Biological Opinion resulting from the Section 7 consultation will determine if the action is likely to jeopardize the continued existence of any endangered or threatened species and or adversely modify or destroy critical habitat. 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. The proposed port location is just due north of the existing TSS, and if the NOAA – proposed northern rotation of the TSS is approved by the IMO, then portions of the safety zones and navigation areas around the Northeast port would occur within the TSS. This would reduce the potential for interaction with baleen whales from 69 to 33 percent.

Northeast Gateway did include some mitigation measures in the 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 wile 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 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. Also, noise during construction and the entanglement potential by fishing gear displaced by LNG sites pose additional threats to right whales. These topics are expected to be analyzed in the EIS and Section 7 consultations.

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 within the safety zone 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. There are four proposed LNG sites (two offshore and two inshore) in the northeast that are in the process of applying for Deepwater Port licenses, one inshore site approved by FERC, and one existing. If approved by MARAD/USCG, the Northeast Gateway proposal would be located approximately ten miles offshore of Gloucester, Massachusetts. The Suez-Neptune proposal would be located approximately 22 miles northeast of Boston. In northern Maine, an inshore Quoddy Bay terminal at Pleasant Point and a Downeast terminal in Robbinston have been identified by project sponsors. Weaver’s Cove in the Taunton River, near Fall River, Massachusetts has been approved. Due to recent changes in plans, Weaver’s Cove proposed changing the number of anticipated ship deliveries from 50-70 to 120 a year by smaller vessels that would fit through the opening of the Brightman Street Bridge (FERC, 2006). The existing LNG site is in Everette, 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. Several new terminals have been proposed to the Federal Energy Regulatory Commission (FERC), including a proposal for Long Island Sound, NY, by Broadwater Energy, the Delaware River in NJ, by Crown Landing LNG, and Sparrows Point in Baltimore, by AES Corp.

In the Southeast, there is one existing terminal on Elba Island, in Chatham County, Georgia, 5 miles downstream from Savannah, Georgia. 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 1600 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 (Penberty, 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 potential for cumulative effects 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. The proposed LNG terminals would increase vessel traffic around the site and/or port if it is an inshore terminal. 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 becomes available.

4.7.3.2 United States Coast Guard Restrictions

The Coast Guard has one of the lead roles of providing homeland security in US harbors, ports and along the coastlines. Commercial, tanker, passenger, and merchant vessels have all been subject to increased security measures enforced by the USCG. The Coast Guard is the primary law enforcement agency of the US. As part of their missions for both national security and law enforcement, the Coast Guard may board vessels at any given time. The agency is authorized to board to vessels subject to the jurisdiction of the US, anytime upon the high seas and upon waters over which the US has jurisdiction, 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 extreme 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 (mouth of Chesapeake Bay) at least 8 hours prior to dusk or 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 hit tidal windows to call at the port. LNG vessels are affecting the schedule of port traffic into Savannah as well. Port traffic is restricted 1 hour before LNG vessels enter the harbor and up to 2 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 in upcoming years to the point where there could be over 100 vessel calls as early as 2008, resulting in additional delays (Penberthy, November 15, 2005).

LNG vessels may have additional delays if DMAs are implemented in or around the approaches to these ports; however, 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 or 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 which may have economic impacts on similar groups of stakeholders that are affected by the operational measures of the Strategy. If these actions are implemented in the future, then 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 [629 m] by 0.54 nm [1,00m] 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 feet (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 the Nantucket Sound in the long term (USACE, 2004b).

Economic Effects of ALWTRP on the Fishing Industry

As mentioned 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 information is an excerpt from the DEIS for amending the ALWTRP.

Table 4-9 summarizes estimated industry compliance costs for each of the regulatory alternatives, breaking the results down by fishing sector (lobster, other trap/pot, and gillnet). As shown, the incremental costs imposed on the fishing industry would equal approximately $14.2 million per year under Alternatives 2, 3 (Preferred), 4, and 6 (Preferred). The impact of the new standards on lobster vessels would account for over 90 percent of these costs.

Aside from Alternative 1 (No Action), the only regulatory alternative that differs significantly from the others with respect to estimated economic impacts is Alternative 5. The analysis suggests that this alternative would impose incremental regulatory costs of approximately $1.0 million annually. The costs are lower because Alternative 5 would not impose as broad a set of gear modification requirements, but would instead modify the SAM zone and focus primarily upon the regulation of vessels fishing in that zone (NMFS, 2005a).

The cumulative effects analysis chapter of this DEIS 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 for additional cumulative effects on the fishing industry.

Table 4-9
Estimated Increase in Annual ALWTRP Compliance Costs

Economic Impact	Regulatory Alternative	Lobster Trap/Pot Vessels	Other Trap/Pot Vessels	Gillnet Vessels	Total
Average Increase in Annual Compliance Costs For Vessels Affected by Changes in ALWTRP Regulations	Alternative 1 (No Action)	$0	$0	$0	N.A.
	Alternative 2	$3,484	$1,055	$917	N.A.
	Alternative 3 (Preferred)	$3,483	$1,060	$925	N.A.
	Alternative 4	$3,484	$1,055	$923	N.A.
	Alternative 5	$210	$184	$163	N.A.
	Alternative 6 (Preferred)	$3,482	$947	$925	N.A.
Number of Vessels Affected by Changes in ALWTRP Regulations	Alternative 1 (No Action)	$0	$0	$0	$0
	Alternative 2	$3,686	$418	$1,044	$5,148
	Alternative 3 (Preferred)	$3,684	$413	$1,024	$5,121
	Alternative 4	$3,686	$418	$1,035	$5,139
	Alternative 5	$3,684	$416	$1,024	$5,124
	Alternative 6 (Preferred)	$3,684	$416	$1,024	$5,124
Total Increase in Annual Compliance Costs for Vessels Affected by Changes in ALWTRP Regulations	Alternative 1 (No Action)	$0	$0	$0	$0
	Alternative 2	$12,844,000	$440,900	$957,300	$14,242,200
	Alternative 3 (Preferred)	$12,830,500	$438,100	$946,700	$14,215,300
	Alternative 4	$12,844,000	$440,900	$955,600	$14,240,500
	Alternative 5	$773,800	$76,500	$168,000	$1,018,400
	Alternative 6 (Preferred)	$12,826,700	$394,000	$947,300	$14,168,100

Note: Totals may not sum due to rounding.

The proposed operational measures contained in the Strategy would have no impact on the fishing industry at a 12-knot speed restriction; however, 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. Although only fishing vessels 65 feet and greater are affected by the Strategy, therefore only a small subset would be affected by both sets of regulations. If a 10-knot speed restriction is implemented for the operational measures, 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 a Category 3 marine diesel engine. The current Tier one standards implemented in these regulations will apply until the EPA adopts a second Tier of standards in a future rulemaking, which will be completed by April 27, 2007. The Tier two 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 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. These standards would result in significant reductions of nitrogen oxides (NOx) and particulate matter (PM), and would 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 is also affected by the operational measures of the Strategy – the Water Transportation, freight and passenger. As the more stringent standards will be adopted in 2007, information is not currently available on the economic impacts of this reasonably foreseeable action. Therefore, it is difficult to evaluate the cumulative economic impacts on the commercial shipping industry.

Anti-Fouling System Regulations

The IMO adopted the International Convention on the Control of Harmful Anti-fouling Systems on Ships on the 5th of October 2001, and it has not yet entered into force. Anti-fouling paints are used to coat the bottoms of ships to prevent marine organisms, including algae and mollusks (barnacles) from attaching themselves to the hull, which slows down the ship and increases fuel consumption. The paint kills these organisms, and also leaches into the water, harming other marine organisms and affecting the environment. One type of anti-fouling paint contains the organotin tributylin (TBT), has been proven extremely harmful to the environment, and 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 takes it a step further and prohibits the use of any harmful organotins in anti-fouling paints used on ships and will establish a mechanism to prevent the potential use of other harmful substances in anti-fouling systems by 1 January 2008. 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 their water quality standards or regulations. Therefore, TBT is regulated at the state level. This action 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 is in compliance 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 on the 13th of February 2004, and it has not yet entered into force. The USCG is drafting regulations to develop ballast water discharge standards, which would require vessels to have treatment systems to treat ballast water with before discharge. This action has potential economic impacts on the shipping industry, although data will not be available until the regulatory analysis is complete.

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 (the second leading cause of mortality), as well as 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 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 textual comparison of the impacts for each alternative by the resource area. A summary of this comparison is also provided in table format in Table 4-10.

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 operational measure aimed at reducing ship strikes – DMAs, speed restrictions, and recommended shipping routes, respectively. These alternatives offer more protection to right whales than alternative one, and less than alternatives 5 and 6, which propose more than one operational measure. Alternative 2 does not specifically benefit other marine species, whereas alternatives 3 and 4 provide minor benefits.

Alternative 6 provides a higher level of protection to right whales and other marine species. This alternative includes multiple ship strike reduction measures, including DMAs, speed restrictions in the NEUS and SEUS management areas and critical habitat, speed restrictions in the MAUS in SMAs, and instead of proposing recommended routes only, (as in Alternative 4) these routes would also have speed restrictions. Alternative 5 provides the highest level of protection to right whales and other marine species as it combines the measures from alternatives 1 – 4, and accounts for all available ship strike reduction measures, an ATBA, shifting the Boston TSS, expanded areas with speed restrictions, and year round speed restrictions in the NEUS, verses seasonal, as proposed in Alternative 6.

Alternative 1 would have no effects on the physical environment. None of the alternatives affect bathymetry and substrate as all proposed actions occur on the ocean surface. Alternatives 2, 3 (in all areas), and 4 and 5 (in the NEUS) would have negligible impacts on water quality, whereas Alternative 4 and 6 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 (22.2 to 46.3 km), where water quality regulations are less stringent. Alternative 5 has 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 has no overall effect on air quality, Alternative 2, 5, and 6 only have minor, positive impacts on air quality due to reduced emissions, and Alternatives 3 has 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 has slightly more of a positive effect on ocean noise levels due to larger scale speed restrictions that reduce vessel noise.

Alternative 1 would not affect port areas and commercial shipping vessel operations. Refer to Section 4.4 for a further breakdown of the direct and indirect impacts. All numbers listed in this paragraph refer to the most recent estimates in 2004 at a speed restriction of 10, 12, and 14 knots, respectively. Alternative 4 had the smallest economic impact in 2004 at $1.1 million for all speeds. Alternative 2 follows with $17.0 million, $10.8 million, and $6.5 million. Alternative 6 falls in the middle at $107.4 million, $56.4 million, and $30.2 million. Alternative 3 has the second highest impact at $237 million, $143.3 million, and $77.3 million. Alternative 5 has the highest economic impact at $260.4 million, $155.2 million, and $88.7 million.

Table 4-10
Summary Matrix of Impacts

Impact Area	Alternative 1: No Action	Alternative 2: Dynamic Management Areas	Alternative 3: Speed Restrictions in Designated Areas	Alternative 4: Recommended Shipping Routes	Alternative 5: Combination of Alternatives 1-4	Alternative 6: NOAA's Ship Strike Reduction Strategy
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 by 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 increase as the speed limit decreases, i.e., major benefits at 10 knots to minor benefits at 14 knots.	There would be major, direct, long-term, positive effects on right whale population recovery in all three regions from implementing the operational measures contained in Alternative 6. Generally, the level of positive effects increase 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** There would be indirect, long-term, negative effects on sea turtles from implementing the No Action Alternative. None of the alternatives are expected to affect seabirds or protected anadromous and marine fish, 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 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 a minor, indirect, long-term positive effect on other marine mammals if their range overlaps with the recommended shipping routes, the ATBA, or TSS. **Sea Turtles** There would be a minor, indirect, long-term, positive effect on sea turtles that occur within the shipping lanes, ATBA, or TSS.	**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 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, long-term, positive effects on other marine mammals from 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 be indirect, long-term, positive effects on sea turtles from 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** There would potentially be minor, direct, short-term, positive effects on	**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** There would potentially be direct, short- and long-term, positive impacts	**Bathymetry and Substrate** There would be no effects on bathymetry and substrate from implementing recommended shipping routes. **Water Quality** There would be negligible 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 shipping lanes. While vessel emissions may be concentrated in	**Bathymetry and Substrate** There would be no effects on bathymetry and substrate as a result of combining alternatives 1-4. **Water Quality** There would have 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 5 would have minor, direct, long-term, positive effects on air quality.	**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, long-term, positive effects on air quality as a result of speed restrictions in SMAs, DMAs, critical habitat, and shipping

Table 4-10
Summary Matrix of Impacts

Impact Area	Alternative 1: No Action	Alternative 2: Dynamic Management Areas	Alternative 3: Speed Restrictions in Designated Areas	Alternative 4: Recommended Shipping Routes	Alternative 5: Combination of Alternatives 1-4	Alternative 6: NOAA's Ship Strike Reduction Strategy
		ocean noise levels from implementing DMAs. Noise would be temporarily reduced if the vessel reduces speed through the DMA.	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.	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.	**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.	lanes. **Ocean Noise** There would potentially be a minor, direct, long-term, 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.	**10 knots** The total **direct** economic impact of Alternative 2 in 2004 was $17.0 million. **12 knots** There would be a **direct** adverse economic impact on port areas and vessel operations, estimated around $10.8 million in 2004. The speed restrictions through a DMA or routing around a DMA results in additional time spent at sea, which translates to higher costs. **14 knots** The total **direct** economic impact of Alternative 2 in 2004 was $6.5 million. There are no **additional direct** or **indirect** costs estimated under Alternative 2.	**10 knots** The **direct** economic impact of Alternative 3 in 2004 was $86.8 million. **Additional direct** costs were estimated at $11.0 million. **Indirect** costs were estimated at $139.4 million. **Total:** $237 million. **12 knots** There would be a **direct** adverse economic impact on port areas and vessel operations in the amount of $53.9 million in 2004. Speed restrictions throughout the East Coast affect vessel arrival times affect vessel costs. **Additional direct** costs under Alternative 3 were estimated at $9.8 million in 2004. **Indirect** costs under Alternative 3 were estimated around $79.6 million in 2004. **Total:** $143.3 million **14 knots** The **direct** economic impact of Alternative 3 in 2004 was $31.2. **Additional** direct costs were $8.8 million. **Indirect** costs were $37.3 million. **Total:** $77.3 million.	**10 knots** The total **direct** economic impact of Alternative 4 in 2004 was $1.1 million. **12 knots** There would be a **direct** economic impact on port areas and vessel operations in the amount of $1.1 million in 2004. Vessels traveling in the recommended shipping routes would deviate from their original route, which adds extra mileage to a voyage. **14 knots** The total **direct** economic impact of Alternative 4 in 2004 was $1.1 million. There are no **additional direct** or **indirect** costs estimated under Alternative 4.	**10 knots** The **direct** economic impact of Alternative 5 in 2004 was $89.7 million The **additional direct** costs were estimated at $11.0 million. **Indirect costs** were estimated at $159.6. **Total:** $260.4 million **12 knots** There would be a **direct** economic impact on port areas and vessel operations from implementing Alternatives 5. This impact was estimated at $56.1 million in 2004. **Additional direct** costs under Alternative 5 were estimated at $9.8 million in 2004. **Indirect** costs under Alternative 5 were estimated around $89.3 million in 2004. **Total:** $155.2 million **14 knots** The **direct** economic impact of Alternative 5 in 2004 was $32.9 million. The **additional direct** costs were estimated at $8.8 million. **Indirect** costs were estimated at $47.0 million. **Total:** $88.7	**10 knots** The **direct** economic impact of Alternative 6 in 2004 was $49.4. The **additional direct** costs were estimated at $8.3 million. The **indirect** costs were estimated at $49.7 million. **Total:** $107.4 **12 knots** There would be a **direct** economic impact on port areas and vessel operations as a result of implementing Alternative 6. The impact was estimated at $30.9 million in 2004. **Additional direct** costs under Alternative 6 were estimated at $7.3 million in 2004. **Indirect** costs under Alternative 6 were estimated around $18.3 in 2004. **Total:** $56.4 million **14 knots** The **direct** economic impact of Alternative 6 in 2004 was $18.4 million. The **additional direct** costs were estimated at $6.6 million. **Indirect** costs were estimated at $5.3 million. **Total:** $30.2 million
Commercial Fishing Vessels	There would be no impacts on commercial fishing vessels under the No Action Alternative.	There would be negligible impacts on commercial fishing vessels under Alternative 2 at a 10, 12, or 14-knot speed restriction.	There would be no adverse effects on commercial fishing vessels at 12- and 14-knot speed restrictions under Alternative 3. However, the economic impact at 10 knots is estimated at $0.9 million.	There would be negligible impacts on commercial fishing vessels under Alternative 4 at all three speed restrictions.	There would be no adverse effects on commercial fishing vessels at a speed restriction of 12 or 14 knots. However, the economic impact at 10 knots is estimated at $0.9 million.	There would be no adverse effects on commercial fishing vessels at a speed restriction of 12 or 14 knots. However, the economic impact at 10 knots is estimated at $1.0 million.
Ferry Vessels	There would be no impacts on ferry vessels under the No Action Alternative.	There would be a direct, long-term, adverse impact on ferry vessels under Alternative 2. In 2004, the impacts were estimated at $5.1 million at 10 knots, $4.1 million at 12 knots, and $3.2 million at 14 knots.	There would be a direct, long-term, adverse impact on ferry vessels under Alternative 3. In 2004, the impacts were estimated around $6.5 million at 10 knots, $5.5 million at 12 knots, and $4.1 at 14 knots.	There would be no impacts on ferry vessels under Alternative 4.	There would be a direct, long-term, adverse impact on ferry vessels under Alternative 5. In 2004, the impacts were estimated around $6.5 million at 10 knots, $5.5 million at 12 knots, and $4.1 at 14 knots.	There would be a direct, long-term, adverse impact on ferry vessels under Alternative 6. In 2004, the impacts were estimated around $5.6 million at 10 knots, $4.6 million at 12 knots, and $3.6 million at 14 knots.

Table 4-10
Summary Matrix of Impacts

Impact Area	Alternative 1: No Action	Alternative 2: Dynamic Management Areas	Alternative 3: Speed Restrictions in Designated Areas	Alternative 4: Recommended Shipping Routes	Alternative 5: Combination of Alternatives 1-4	Alternative 6: NOAA's Ship Strike Reduction Strategy
Whale Watching Vessels	There would be no impacts on whale watching vessel operations under the No Action Alternative.	There would be minor, direct, long-term, adverse effects on whale watching vessels under Alternative 2. In 2004, the impacts were estimated at $0.9 million at 10 knots, $0.7 million at 12 knots, and $0.5 million at 14 knots.	There would be direct, long-term, adverse effects on whale watching vessels under Alternative 3. In 2004 the impacts were estimated at $2.8 million at 10 knots, $1.6 million at 12 knots, and $0.9 million at 14 knots.	There would be no effects on whale watching vessel operations under Alternative 4.	There would be direct, long-term, adverse effects on whale watching vessels under Alternative 5. In 2004, the impacts were estimated at $2.8 million at 10 knots, $1.6 million at 12 knots, and $0.9 million at 14 knots.	There would be direct, long-term, adverse effects on whale watching vessels under Alternative 6. In 2004, the impacts were estimated at $0.9 million at 10 knots, $0.7 million at 12 knots, and $0.5 million at 14 knots.
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 under Alternative 2.	There would be minor, direct, long-term, adverse economic impacts on charter vessels, estimated at $1.1 million at 10 knots, $600,000 at 12 knots, and $200,000 at 14 knots in 2004.	There would be no impacts on charter vessel operations under Alternative 2.	There would be minor, direct, long-term, adverse economic impacts on charter vessels, estimated at $1.1 million at 10 knots, $600,000 at 12 knots, and $200,000 at 14 knots in 2004.	There would be minor, direct, long-term, adverse economic impacts on charter vessels, estimated at $1.2 million at 10 knots, $720,000 at 12 knots, and $240,000 at 14 knots in 2004.
Environmental Justice	There would be no impacts on environmental justice communities.	Under Alternative 2, no low-income or minority populations would be disproportionately affected. Alternative 2 does not raise environmental justice concerns under EO 12898.	Under Alternative 3, no low-income or minority populations would be disproportionately affected. Alternative 3 does not raise environmental justice concerns under EO 12898.	Under Alternative 4, no low-income or minority populations would be disproportionately affected. Alternative 4 does not raise environmental justice concerns under EO 12898.	Under Alternative 5, 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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Alternative 1 would not affect commercial fishing vessels. At a speed restriction of 12 or 14 knots, there would not be any economic effects on commercial fishing vessels for any of the alternatives. If, however, the speed restriction were 10 knots, alternatives 3, 5, and 6 would have minor, adverse economic effects on this industry. Alternatives 3 and 5 would cost the industry $0.9 million, and Alternative 6 would cost $1.0 million at a 10-knot speed restriction.

Alternatives 1 and 4 would not affect ferry vessels. The impacts in this paragraph are the most recent 2004 estimates, at a speed restriction of 10, 12, and 14 knots, respectively. Alternative 2 has the smallest economic impact on ferries, $5.1 million, $4.1 million, and $3.2 million. Alternative 6 follows with $5.6 million, $4.6 million, and $3.6 million. Alternatives 3 and 5 have the highest economic impact, $6.5 million, $5.5 million, and $4.1 million each.

Alternatives 1 and 4 would not affect whale watching vessels. Alternatives 2 and 6 have the smallest economic impact on whale watching vessels, $0.9 million at 10 knots, $0.7 million at 12 knots, and $0.6 million at 14 knots in 2004. Alternatives 3 and 5 have a higher economic impact at $2.8 million at 10 knots, $1.6 million at 12 knots, and $0.9 million at 14 knots.

Alternatives 1, 2, and 4 would not affect Charter vessels. Alternatives 3 and 5 would have the smallest economic impact on charter vessels, $1.1 million at 10 knots, $0.6 million at a 12 knots, and $0.2 million at 14 knots. Alternative 6 has a slightly larger economic impact at $1.2 million at 10 knots, $0.7 million at 12 knots, and $0.2 million at 14 knots. These numbers are 2004 estimates.

None of the alternatives have disproportionate effects on environmental justice communities. None of the alternatives have an effect on cultural resources.

4.9 Mitigation Measures

Mitigation measures are not addressed separately in this EIS 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 as a result of 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. The success of the operational measures is vital 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.

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