

**SUMMARY AND INTEGRATION OF
IMPACT ANALYSIS FINDINGS****CHAPTER 8**

This chapter summarizes and integrates the findings of the biological, economic, and social impact analyses presented in the three preceding chapters, assessing the relative merits of the regulatory alternatives considered in this Environmental Impact Statement (EIS). In all cases the analysis measures these impacts relative to Alternative 1, the no action alternative. Alternative 1 would make no change in the requirements of the Atlantic Large Whale Take Reduction Plan (ALWTRP), preserving the regulatory status quo. Thus, it would have no economic impact and no effect on social conditions in fishing communities. It also would have no impact on the rate at which North Atlantic right whales, North Atlantic humpback whales, or fin whales are seriously injured or killed as the result of incidental entanglement in commercial fishing gear. As Chapter 2 discusses in detail, the available data indicate that additional action is needed to reduce the risk of entanglement and achieve the degree of protection mandated for these species under the Endangered Species Act (ESA) and Marine Mammal Protection Act (MMPA). Accordingly, NMFS is considering modifications to the ALWTRP designed to meet the requirements of the ESA and MMPA. These modifications include:

- *Minimum trawl-length standards*, which would apply to the lobster, blue crab, and other trap/pot (OTP) fisheries in the ALWTRP's Northeast waters;
- *New gear configuration requirements*, which would apply to trap/pot fisheries in the ALWTRP's Southeast waters;
- *Seasonal closure* of designated areas in the Northeast to trap/pot gear;
- *Changes in the designation of waters that would be exempt from ALWTRP requirements* off the coast of New Hampshire; and
- *New gear marking requirements*, which would apply to regulated fisheries in all waters that are subject to the ALWTRP and, under most of the alternatives, to gear fished in Maine and New Hampshire waters that would be exempt from other ALWTRP requirements.

NMFS has specified several action alternatives – Alternatives 2 through 6 (Preferred) – that include different combinations of these measures. NMFS' assessment of the biological, economic, and social impacts of these alternatives is summarized below.

8.1 BIOLOGICAL IMPACTS

8.1.1 Impacts on Whales

All of the action alternatives include provisions that would revise the gear marking requirements specified under the ALWTRP. Under Alternatives 2, 3, 4, 5, and 6 (Draft), the new requirements would apply to gear set in all non-exempt waters, as well as exempt waters in Maine and New Hampshire. Under Alternative 6 (Preferred), gear set in Maine waters landward of the ALWTRP exemption line would remain exempt from gear marking requirements. The new gear-marking provisions would have no immediate impact on entanglement risks. In the long run, however, they may help the National Marine Fisheries Service (NMFS) target and improve its efforts to protect large whales. It is often difficult to connect the gear in which a whale is entangled with a particular fishery, because entangled whales frequently carry only a portion of the gear they have encountered and disentanglement efforts sometimes recover only some of the remaining gear. The gear marking requirements under consideration would help to generate information on the nature of the gear involved in an entanglement. In addition, these provisions in some cases would allow NMFS to identify the owner of the gear, which would enable the agency to gather additional information on where, when, and how the gear was set. By increasing understanding of the nature of large whale entanglements, gear marking measures would allow NMFS, over time, to improve the effectiveness of the ALWTRP. Under Alternative 1, the no action alternative, no additional improvements to the effectiveness of the ALWTRP would occur.

The other regulatory provisions under consideration are likely to have a more immediate and direct effect on the entanglement issue. For example, Alternatives 2 through 6 (Preferred) incorporate various provisions restricting the number of trap/pot buoy lines that fishermen in the Northeast region can employ. Analysis using the Vertical Line Model indicates that the trawling requirements (in combination with other provisions) would reduce the number of vertical lines in ALWTRP-regulated waters by approximately 30 to 35 percent, depending on the alternative. By reducing the number of vertical lines in the water column, these provisions would help to reduce the frequency of entanglements. Under Alternative 1, the no action alternative, the number of vertical lines in the water column would not change, leaving the whales exposed to the current level of entanglement risk.

Alternatives 2 through 6 (Preferred) would also introduce additional gear restrictions for vessels fishing in and around calving grounds in the Southeast. These restrictions affect weak link breaking strength, vertical line strength, vertical line composition, and trawling (i.e., mandatory use of singles). While current practices largely adhere to the proposed restrictions, some incremental conservation benefit may be realized. In addition, these provisions would create safeguards against changes in fishing practices that might increase entanglement risks. Under Alternative 1, the no action alternative, no additional safeguards would be put in place.

Beyond the provisions described above, Alternatives 3 through 6 (Preferred) would also close designated areas in the Northeast to trap/pot gear during months in which whales are most likely to be present (see Exhibit 8-1). Closure of these areas is likely to lead to further reductions in the risk of entanglement compared to Alternative 1, the no action alternative.

| Exhibit 8-1 | | | |
|-------------------------------------------|-------------------------------|-----------------------|----------------------------|
| SUMMARY OF AREA CLOSURE PROVISIONS | | | |
| Closure | Regulatory Alternative | Closure Period | Size (square miles) |
| Cape Cod Bay Restricted Area | 3 | February - April | 644 |
| Jordan Basin | 4 & 5 | November - January | 725 |
| Jeffreys Ledge | 4 & 5 | October - January | 607 |
| Massachusetts Restricted Area #1 | 4 & 5 | January - April | 2,464 |
| Massachusetts Restricted Area #2 | 6 (Draft) & 6 (Preferred) | January - April | 2,161 |

Alternatives 3, 5, and 6 (Draft) also include a provision that would expand the areas that are exempt from ALWTRP gear modification requirements to include all New Hampshire state waters. Under Alternative 6 (Preferred), gear in New Hampshire state waters would remain subject to current gear modification requirements (e.g., the requirement to use sinking groundline), but would be exempt from minimum trawl-length regulations. Whales are unlikely to be found in these waters, as suggested both by NMFS' review of the data and its current understanding of whale behavior. NMFS believes that exempting this area from minimum trawl-length regulations would be unlikely to have a significant adverse impact on endangered or protected whales compared to Alternative 1, the no action alternative.

8.1.2 Other Biological Impacts

In addition to impacts on large whale species, changes to ALWTRP regulations may affect other aspects of the marine environment, including other protected species, essential fish habitat, and directed catch and bycatch in affected fisheries. Analysis of these issues suggests no significant differences among Alternatives 2 through 6 (Preferred) with respect to impacts on essential fish habitat, directed catch, or bycatch; in each case, the impacts are generally expected to be minor.

Gear restrictions are likely to benefit other protected species prone to entanglement. Specifically, NMFS believes that the trawling requirements could help reduce entanglement risks for sea turtles, whales, dolphins, porpoises, and seals. Likewise, weak link requirements in the Southeast may benefit blue, sei, and sperm whales. The impact of Alternatives 2 through 6 (Preferred) with respect to these benefits is likely to be similar compared to Alternative 1, the no action alternative. The closure of designated areas in the Northeast to trap/pot gear could provide ancillary benefits to sea turtles, sei whales, harbor porpoises, seals, and some pelagic delphinids that may be present when the closures are in effect. Compared to Alternative 1, the no action alternative, these benefits are likely to be greatest under Alternatives 4 and 5, which propose the closure of three different areas for various periods over several months, and lower under Alternatives 3, 6 (Draft), and 6 (Preferred), which propose the closure of less extensive areas for three or four months (see Exhibit 8-1).

Adding all New Hampshire state waters to the area designated as exempt from ALWTRP requirements, as provided for under Alternatives 3, 5, and 6 (Draft), would relieve vessels fishing in these waters from the need to comply with current ALWTRP requirements, including universal gear modification requirements, weak link requirements, and the requirement to use

sinking groundline. These changes could have an adverse effect on other protected species, such as sea turtles.

8.1.3 Comparison of Biological Impacts across Alternatives

The biological impacts analysis presented in Chapter 5 relies primarily on NMFS' Vertical Line Model to examine how the regulatory alternatives might reduce the possibility of interactions between whales and fishing gear. As discussed in that chapter, the model integrates information on fishing activity, gear configurations, and whale sightings to provide indicators of the potential for entanglements to occur at various locations and at different points in time. The fundamental measure of entanglement potential is co-occurrence. The co-occurrence value estimated in the model is an index figure, integrated across the spatial grid, indicating the degree to which whales and the vertical line employed in gillnet or trap/pot fisheries coincide in the waters subject to the ALWTRP. Biological impacts are characterized with respect to the percentage reduction in the overall co-occurrence indicator each alternative would achieve.

Exhibit 8-2 summarizes the estimated change in co-occurrence under each action alternative relative to the no-action alternative (Alternative 1). Separate results are provided for Northeast waters and for ALWTRP waters coastwide. Alternative 2, which includes trawling requirements but no closures, is estimated to yield a reduction in co-occurrence of approximately 36 percent. Alternatives 3 through 6 (Preferred) add incrementally to this reduction through closure of high-risk areas at various times of year. The estimated impact of these closures is greater when affected vessels are assumed to suspend fishing rather than relocate to alternative fishing grounds. The greatest reduction in co-occurrence is achieved under Alternative 5, which includes modified trawling requirements as well as three closures (Jeffreys Ledge, Massachusetts Restricted Area #1, and Jordan Basin). Under this alternative, the estimated reduction in co-occurrence ranges from approximately 40 to 42 percent. Under Alternative 6 (Preferred), the estimated reduction in co-occurrence is approximately 38 percent in Northeast waters and 37 to 38 percent coastwide.

| Exhibit 8-2 | | |
|------------------------------------------|-------------------------------------------------|------------------|
| ANNUAL CHANGE IN CO-OCCURRENCE | | |
| Alternative | Percent Reduction in Co-Occurrence Score | |
| | Northeast Waters | Coastwide |
| Alternative 1 (No Action) | 0.0% | 0.0% |
| Alternative 2 | -36.1% | -35.8% |
| Alternative 3 (100% Suspend) | -37.7% | -37.4% |
| Alternative 3 (Relocation) | -37.4% | -37.2% |
| Alternative 4 (100% Suspend) | -40.8% | -40.5% |
| Alternative 4 (Relocation) | -39.0% | -38.7% |
| Alternative 5 (100% Suspend) | -42.0% | -41.7% |
| Alternative 5 (Relocation) | -40.0% | -39.7% |
| Alternative 6 – Draft (100% Suspend) | -38.2% | -38.0% |
| Alternative 6 – Draft (Relocation) | -37.7% | -37.4% |
| Alternative 6 – Preferred (100% Suspend) | -38.2% | -37.9% |
| Alternative 6 – Preferred (Relocation) | -37.7% | -37.4% |

8.2 ECONOMIC IMPACTS

The economic impact analysis developed for this EIS provides detailed estimates of the compliance costs associated with potential changes to the ALWTRP. The analysis estimates compliance costs for model vessels and extrapolates from these findings to estimate the overall cost to the commercial fishing industry of complying with the regulatory changes under consideration. As noted above, the analysis measures the cost of complying with new requirements relative to Alternative 1, the no action alternative – i.e., a baseline scenario that assumes no change in existing ALWTRP requirements. Thus, all estimates of compliance costs are incremental to those already incurred in complying with the ALWTRP. All costs are presented on an annualized basis and reported in 2011 dollars. The calculation of annualized costs is based on a real annual discount rate of seven percent.

The discussion that follows begins by summarizing the methods used to estimate the cost of complying with each of the regulatory alternatives that NMFS is considering. It then presents the resulting cost estimates.

8.2.1 Compliance Cost Estimation Methods

8.2.1.1 Gear Configuration Requirements

A major component of Alternatives 2 through 6 (Preferred) is a minimum trawl-length requirement – i.e., prohibiting trawls of less than a specified number of traps or pots – for trap/pot fisheries in Northeast waters. The exact nature of this requirement varies by alternative and location. The costs that fishermen are likely to incur in complying with such requirements are primarily composed of *gear conversion* costs and *catch impacts*.

Vessels fishing shorter configurations (e.g., singles, doubles) would need to reconfigure their gear to comply with trawling requirements. These changes may require expenditures on new equipment as well as investments of fishermen's time. Analysis of the economic impact of the trawling requirements entails comparing the baseline configuration of gear assigned to model vessels in NMFS' Vertical Line Model with the minimum trawl length that would be required under each regulatory alternative. The analysis identifies instances in which the reconfiguration of gear would be required, estimates the material and labor necessary to bring all gear into compliance, and calculates the resulting cost. Equipment costs are a function of the quantity of gear to be converted and the unit cost of the materials needed to satisfy the trawling requirement. Labor costs are a function of the time required to implement a specific modification, the quantity of gear to be converted, and the implicit labor rate. All costs are calculated on an incremental basis, taking into account any savings in material or labor costs that might result from efforts to comply with new ALWTRP regulations.

In addition to the direct cost of gear conversion, catch rates may decline for vessels that are required to convert from shorter sets to longer trawls, reducing the revenues of affected operations. To estimate impacts in the lower bound, the analysis assumes that vessels implementing a major increase in trawl length (an increase of a factor of two or more in the number of traps in each set) would experience a five percent reduction in their annual catch. In

the upper bound, the analysis assumes that these vessels would experience a ten percent reduction in catch, while all other vessels would experience a five percent reduction. The resulting impact on each vessel's annual revenues is based on prevailing ex-vessel prices for lobster or other trap/pot species.

The analysis does not attempt to quantify several other impacts potentially associated with changes in ALWTRP gear configuration requirements. These include:

- Costs associated with increased gear loss;
- The potential need for a larger crew to handle longer trawls;
- Vessel modification costs;
- Costs for various gear requirements proposed for trap fisheries in the southeast Atlantic; and
- Savings that may result under Alternatives 3, 5, and 6 (Draft) as a result of exempting gear in New Hampshire state waters from existing gear modification requirements (e.g., the requirement to use sinking groundline).
- Savings that may result under Alternative 6 (Preferred) as a result of establishing quarter-mile buffer zones around Matinicus, Ragged, and Monhegan Islands, within which trap/pot gear would not be subject to minimum trawl-length requirements.

The analysis addresses these impacts qualitatively, either because data to develop reasonable estimates are lacking or because available information suggests the impacts will be relatively small.

8.2.1.2 Seasonal Closure Requirements

The analysis of the costs associated with the seasonal closure of designated areas begins by using the Vertical Line Model to estimate the number and type of vessels ordinarily active in each area during the proposed closure period. The remainder of the analysis is organized around two scenarios. In the upper bound, the analysis assumes that these vessels would remove all affected gear from the water for the duration of the closure. In this scenario, economic losses are estimated as the net loss in vessel revenue (i.e., the loss in gross revenue adjusted to take into account estimated savings in operating costs). In the lower bound, the analysis uses available data to identify alternative fishing grounds and the likely subset of vessels that would relocate their gear to alternative areas. In this scenario, estimates of economic losses are based on estimated changes in fuel use, time on the water, and catch per trap.

8.2.1.3 Gear Marking Requirements

Alternatives 2 through 6 (Preferred) specify revised gear marking requirements for all vessels that are subject to the ALWTRP, including those in the lobster, OTP, blue crab, and gillnet fisheries. The requirements apply to gear set in all non-exempt waters. Under Alternatives 2 through 6 (Draft), the new requirements would also apply to gear set in exempt areas of Maine and New Hampshire state waters. In contrast, under Alternative 6 (Preferred), gear set in Maine waters landward of the ALWTRP exemption line would remain exempt from gear marking requirements. For each alternative, the analysis of gear marking costs is based on the Vertical Line Model's estimates of the number of affected vessels and the number of vertical lines fished by those vessels (taking proposed trawling requirements into account). To model these costs, the analysis assumes that lines would be marked using gear marking whips woven into the line, each of which takes roughly five minutes to install. Annualized time and material costs are estimated for each model vessel, then extrapolated to the broader population of affected vessels.

8.2.2 Economic Impact Results

Exhibit 8-3 summarizes the estimated number of affected vessels and industry compliance costs for each of the regulatory alternatives, breaking the results down by major regulatory component. Several findings are noteworthy:

- In general, compliance with gear configuration requirements imposes the greatest costs, with estimates ranging from \$1.0 million to \$4.4 million per year. The costs attributable to the seasonal closure of restricted areas also contribute substantially to the estimate of total compliance costs under Alternatives 4, 5, 6 (Draft), and 6 (Preferred), with estimated annual impacts ranging from \$560,000 to \$2.1 million. Gear marking requirements add approximately \$1.0 million annually to the estimated cost of complying with Alternatives 2 through 6 (Draft), and approximately \$340,000 annually to the estimated cost of complying with Alternative 6 (Preferred).
- Estimated compliance costs for Alternative 2 range from \$2.3 million to \$5.4 million per year, comparable to the estimates given for Alternative 6 (Draft) but lower than those for Alternatives 4 and 5 and higher than those for Alternative 3 and Alternative 6 (Preferred). Most of the estimated compliance costs under Alternative 2 are attributable to the alternative's gear conversion requirements, which are comparable to those specified under Alternative 4 but slightly more stringent than those specified under Alternatives 3, 5, 6 (Draft), and 6 (Preferred). This alternative would not require the seasonal closure of any area, and thus would impose no costs related to a closure.

- The estimated cost of complying with Alternative 3 – \$2.1 million to \$4.4 million per year – is lower than that of complying with Alternatives 2, 4, 5, and 6 (Draft), and comparable to that of complying with Alternative 6 (Preferred). This alternative incorporates less stringent trawling requirements than specified under Alternative 2 and includes only the CCB Restricted Area closure, which would affect relatively few vessels and pose limited costs.
- Alternative 4 is likely to pose the greatest costs – an estimated \$3.6 million to \$7.4 million per year – stemming both from its relatively stringent gear conversion requirements and provisions for the seasonal closure of three large areas. The estimated impact of the closures specified under this alternative ranges from \$1.3 million to \$2.1 million per year.
- The estimated cost of complying with Alternative 5 – \$3.4 million to \$6.4 million per year – is similar to but somewhat less than that of complying with Alternative 4. The difference is attributable to a difference in trawling requirements, which are slightly less stringent under Alternative 5.
- Total estimated compliance costs for Alternative 6 (Draft) are similar to those for Alternative 2, though the range of estimated costs is somewhat narrower. The total estimated impact – \$2.6 million to \$5.2 million per year – includes approximately \$560,000 to \$830,000 in costs attributable to the seasonal closure of Massachusetts Restricted Area #2.
- The estimated cost of complying with Alternative 6 (Preferred) is \$1.9 million to \$4.5 million per year. The costs attributable to gear conversion requirements and the seasonal closure of Massachusetts Restricted Area #2 under this alternative are similar to those estimated for Alternative 6 (Draft); however, gear marking costs are substantially lower under Alternative 6 (Preferred) because it would not require gear in Maine waters landward of the ALWTRP exemption line to be marked. In the lower bound scenario, this leads the estimate of total compliance costs for Alternative 6 (Preferred) to be lower than the corresponding figures for all other action alternatives. In the upper bound scenario, the overall estimate for Alternative 6 (Preferred) is slightly higher than that for Alternative 3, but lower than the estimates for Alternatives 2, 4, 5, and 6 (Draft).

Exhibit 8-3

ESTIMATE OF AFFECTED VESSELS AND ANNUAL COMPLIANCE COSTS BY ALTERNATIVE
(2011 dollars)

| | Alternative | Gear Conversion | | Closures | | Gear Marking | Total | |
|---------------------------|---------------------------|---------------------------|-------------|-------------|-------------|--------------|-------------|-------------|
| | | Lower | Upper | Lower | Upper | | Lower | Upper |
| Affected Vessels | Alternative 1 (No Action) | 0 | | 0 | | 0 | 0 | |
| | Alternative 2 | 1,817 | | 0 | | 6,129 | 6,129 | |
| | Alternative 3 | 1,392 | | 16 | | 6,129 | 6,129 | |
| | Alternative 4 | 1,834 | | 184 | | 6,122 | 6,122 | |
| | Alternative 5 | 1,400 | | 184 | | 6,122 | 6,122 | |
| | Alternative 6 (Draft) | 1,364 | | 109 | | 6,129 | 6,129 | |
| | Alternative 6 (Preferred) | 1,357 | | 109 | | 4,006 | 4,006 | |
| | Compliance Costs | Alternative 1 (No Action) | \$0 | \$0 | \$0 | \$0 | \$0 | \$0 |
| Alternative 2 | | \$1,241,000 | \$4,392,000 | \$0 | \$0 | \$1,014,000 | \$2,255,000 | \$5,407,000 |
| Alternative 3 | | \$1,003,000 | \$3,349,000 | \$21,000 | \$49,000 | \$1,047,000 | \$2,070,000 | \$4,445,000 |
| Alternative 4 | | \$1,213,000 | \$4,288,000 | \$1,340,000 | \$2,113,000 | \$1,010,000 | \$3,562,000 | \$7,411,000 |
| Alternative 5 | | \$996,000 | \$3,240,000 | \$1,340,000 | \$2,113,000 | \$1,043,000 | \$3,379,000 | \$6,396,000 |
| Alternative 6 (Draft) | | \$1,009,000 | \$3,323,000 | \$557,000 | \$831,000 | \$1,054,000 | \$2,620,000 | \$5,208,000 |
| Alternative 6 (Preferred) | | \$1,015,000 | \$3,316,000 | \$557,000 | \$831,000 | \$338,000 | \$1,910,000 | \$4,484,000 |

Note: Values may not sum to the totals shown due to rounding.

Depending on the alternative and scenario (upper versus lower bound) in question, the analysis indicates that the lobster fishery would incur roughly 80 percent to 90 percent of estimated costs. OTP vessels in the Northeast would also incur a substantial share of costs, primarily because of the proposed minimum trawl-length requirements. The impact of the action alternatives on other fisheries is likely to be minor, reflecting only the costs associated with meeting new gear marking requirements.

Research suggests that current practices are largely consistent with the gear configuration requirements proposed for Southeast trap/pot fisheries. Therefore, the cost of complying with them is unlikely to be significant, and these costs are not analyzed in detail.

8.3 SOCIAL IMPACTS OF ALTERNATIVES

The analysis of social impacts considers how compliance with the regulatory alternatives could affect the socioeconomic viability of fishing and fishermen's quality of life. The method and results described here are presented in greater detail in Chapter 7.

8.3.1 Potentially Affected Communities

The social impact analysis first uses county-level data on affected fishing vessels to identify the communities at greatest risk of experiencing adverse social impacts stemming from the ALWTRP modifications under consideration. The analysis uses additional county-level socioeconomic data to characterize key features of the at-risk communities, examining economic, demographic, and social features that may influence the impact of the regulations on the region.

Communities in mid-coast and Downeast Maine are the most vulnerable to adverse social impacts as a result of changes to the ALWTRP. Washington, Hancock, and Knox counties in particular are highly exposed to the effects of regulation due to the importance of the lobster fishery to these communities. The value of ALWTRP-affected landings in these communities is significant, and the greatest of all affected communities. Additionally, the total number of affected vessels in these three counties is greater than in any other county in the affected region. These communities are also highly sensitive to the proposed regulations, as evidenced by their significant social, cultural, and economic dependence upon fishing. The high unemployment and poverty rates in these counties suggest that they may have a relatively low capacity to adapt to economic impacts induced by new ALWTRP regulations.

More than 50 percent of ex-vessel revenues in Maine's other coastal counties is attributable to landings made with ALWTRP gear. In some instances, however, such as Waldo County, the overall value of these landings is relatively low. In others, such as Lincoln, Sagadahoc, Cumberland, and York, the value of potentially affected landings is substantial, but the economy as a whole is more diversified. As a result, these counties are somewhat less sensitive to adverse impacts that may stem from changes in ALWTRP regulations. The same is true of New Hampshire's Rockingham County, where economic diversification and lower unemployment suggest a stronger capacity to respond to change.

In Massachusetts and Rhode Island, the situation is more varied. In general, the value of landings made with ALWTRP gear in the counties of these states is lower than that reported for counties in Maine and New Hampshire, both on an absolute and a relative basis. In addition, the economies of the counties in Massachusetts and Rhode Island tend to be more diversified and less dependent on the commercial fishing sector. Nonetheless, ALWTRP gear accounts for ex-vessel revenues of more than \$15 million per year in Essex (MA), Barnstable (MA), and Bristol (MA) counties, suggesting that exposure to adverse impacts in these counties may be substantial. Dependence on commercial fishing is moderate in Essex and Bristol counties, but is high in Barnstable County. With an unemployment rate that exceeds 10 percent, Barnstable County may be particularly vulnerable to adverse impacts stemming from the introduction of new ALWTRP regulations.

8.3.2 Comparison of Vessel Compliance Costs to Ex-Vessel Revenues

To identify potentially hard-hit sectors of the commercial fishing industry, the analysis compares estimates of average vessel compliance costs to estimates of average gross revenue per vessel. There is no clearly-defined threshold at which annualized costs represent a large enough percent of annual revenues that a vessel operator would cease fishing or would otherwise suffer social and economic hardship. For purposes of discussion, however, the analysis highlights two impact categories:

- **Heavily-Affected Vessels** – Segments of a fishery for which the estimated upper bound compliance costs exceed 15 percent of annual revenues.
- **At-Risk Vessels** – Segments of a fishery for which estimated compliance costs range between 5 and 15 percent of annual revenues.

The number of vessels identified as heavily affected ranges from zero under Alternatives 2 and 3 to 163 under Alternatives 4 and 5 (see Exhibit 8-4). For the latter two alternatives, the vessels in the heavily affected category are lobster vessels that would be displaced either by the closure of Jeffreys Ledge or the closure of Massachusetts Restricted Area #1. In contrast, under Alternatives 6 (Draft) and 6 (Preferred), the analysis identifies 90 vessels as heavily affected; this group consists of lobster vessels that would be displaced by the closure of Massachusetts Restricted Area #2.

8.3.3 Other Socioeconomic Impacts

As Exhibit 8-4 indicates, Alternatives 2 through 6 (Preferred) could generate additional socioeconomic impacts beyond the direct effect of compliance costs on vessel operations. For example:

- To the extent that compliance reduces lobster landings, the dealer and processing sectors of the economy could be affected. The estimated reduction in landings of lobster is greatest under Alternative 4 (2.1 million pounds per year) and smallest under Alternative 3 (1.0 million pounds per year). Even in the case of Alternative 4, however, the estimated effect on

landings is less than two percent of total landings in 2011. Because the reduction is substantially less than the annual fluctuation in total landings in recent years, adverse impacts on the dealer and processing sectors under any of the alternatives are unlikely to be substantial.

- Competition for fishing grounds may increase if changes to the ALWTRP include the seasonal closure of certain fishing grounds. Most notably, fishermen who would otherwise fish in the closed area may relocate their effort to new grounds, increasing competition in those areas. Competition for fishing grounds may also increase to the extent that fishermen relocate from their traditional fishing grounds to exempted waters or waters that are subject to more moderate regulation.
- Increased congestion in certain areas may increase the incidence of gear conflicts. Gear conflicts may also arise because of ALWTRP regulations that require fishermen in some cases to use trawls with a single endline, which prevents other fishermen from visually determining the direction in which a trawl or string is set.
- Minimum trawl-length requirements implemented under the ALWTRP may pose safety issues for fishermen. Some industry representatives have suggested that hauling or setting trawls from a small vessel can be dangerous due to the increased quantity of groundline lying on and deploying from a crowded deck, increasing the risk of a crew member becoming entangled and possibly pulled overboard. Furthermore, sources suggest that hauling gear with sinking groundline may pose a danger when fishermen attempt to free fouled line from a snag on bottom structure – an occurrence that could become more common with the introduction of minimum trawl-length requirements.
- Some small vessels may find it infeasible to comply with minimum trawl-length requirements due to limitations on deck space and related issues. To the extent that smaller vessels have difficulty competing, trends toward consolidation and increased corporate ownership of fishing vessels may be reinforced.

Exhibit 8-4

SUMMARY OF SOCIOECONOMIC IMPACTS BY ALTERNATIVE

| Parameter | Alternative 1 (No Action) | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5 | Alternative 6 (Draft) | Alternative 6 (Preferred) |
|-------------------------------------------------------------------------------------------|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| Number of Heavily Affected Vessels (Upper Bound Scenario) | 0 | 0 | 0 | 163 | 163 | 90 | 90 |
| Total Employment on Heavily Affected Vessels (Upper Bound Scenario) | NA | NA | NA | 330 | 330 | 179 | 179 |
| Anticipated Reduction in Lobster Landings (Upper Bound Scenario) | 0 | 1,283,000 lbs. | 997,000 lbs. | 2,112,000 lbs. | 1,807,000 lbs. | 1,235,000 lbs. | 1,231,000 lbs. |
| Impacts on Dealers | No change | Minor short-term supply disruptions possible | Minor short-term and seasonal supply disruptions possible | Minor short-term and seasonal supply disruptions possible | Minor short-term and seasonal supply disruptions possible | Minor short-term and seasonal supply disruptions possible | Minor short-term and seasonal supply disruptions possible |
| Impacts on Processors | No change | Minor short-term supply disruptions possible | Minor short-term and seasonal supply disruptions possible | Minor short-term and seasonal supply disruptions possible | Minor short-term and seasonal supply disruptions possible | Minor short-term and seasonal supply disruptions possible | Minor short-term and seasonal supply disruptions possible |
| Other Potential Negative Social Impacts | No change | Minor | Some potential for increased congestion and gear conflict | Greater potential for increased congestion and gear conflict | Greater potential for increased congestion and gear conflict | Moderate potential for increased congestion and gear conflict | Moderate potential for increased congestion and gear conflict |
| Positive Social Impacts (Reduction in Baseline Co-occurrence Score, Upper Bound Scenario) | No change (0.0 percent change in baseline co-occurrence score) | Public welfare benefits of increased whale protection (36.1 percent reduction in baseline co-occurrence score) | Public welfare benefits of increased whale protection (37.7 percent reduction in baseline co-occurrence score) | Public welfare benefits of increased whale protection (40.8 percent reduction in baseline co-occurrence score) | Public welfare benefits of increased whale protection (42.0 percent reduction in baseline co-occurrence score) | Public welfare benefits of increased whale protection (38.2 percent reduction in baseline co-occurrence score) | Public welfare benefits of increased whale protection (38.2 percent reduction in baseline co-occurrence score) |

Because new gear configuration requirements under Alternatives 2 through 6 (Preferred) would affect roughly the same number of vessels, the impacts related to such requirements under each of these alternatives is likely to be similar. The potential for increased crowding, competition and gear conflicts, however, is greatest under Alternatives 4 and 5, which include the most extensive seasonal area closures.

The public welfare benefits associated with increased whale protection are likely to be similar across all action alternatives. As noted, the analysis measures the change in whale protection offered by a given alternative as a change in the co-occurrence of whales and vertical lines. By this measure, Alternative 5 offers the greatest protection to whales, with a reduction in co-occurrence (upper bound scenario) of 42 percent. Alternative 2 offers the least benefit, with a reduction in co-occurrence (upper bound scenario) of 36 percent. These biological benefits have socioeconomic implications for the general public. Increasing whale populations would have a positive impact on the consumer surplus derived from whale watching (a use benefit) and may increase producer surplus for operators of whale watch vessels. Likewise, whale conservation may enhance intrinsic values that society holds for healthy, flourishing whale populations.

8.4 INTEGRATION OF RESULTS

The inability to quantify and value the benefits of potential changes to the ALWTRP prohibits the use of benefit-cost analysis to identify the regulatory alternative that would be likely to provide the greatest net benefit. Instead, Exhibit 8-5 summarizes the estimated cost of complying with each regulatory alternative, coupled with the estimated impact of each alternative on the Vertical Line Model's co-occurrence indicator. It also presents estimates of the cost-effectiveness of each alternative in reducing co-occurrence, both in the aggregate and for its major components (i.e., gear marking, gear reconfiguration, and seasonal area closures). Because the alternatives vary with respect to the reduction in co-occurrence they achieve, it is not possible to identify a superior option based on cost-effectiveness alone. Nonetheless, the cost-effectiveness figures provide a useful means of comparing the relative impacts of the regulatory provisions that each alternative incorporates. The exhibit reveals several noteworthy findings:

- The minimum trawl-length requirements yield the greatest reduction in co-occurrence for the associated compliance cost. In contrast, closures are less cost-effective, as evidenced by their greater cost per unit reduction in co-occurrence.
- Alternative 3 is cost-effective relative to most of the other alternatives (\$56,000 to \$119,000 per unit of co-occurrence reduction). This is in part because the costs attributed to the seasonal closure of the Cape Cod Bay Restricted Area are relatively low. In addition, this alternative includes modifications to the gear reconfiguration requirements specified in Alternative 2 that are estimated to have a greater impact on co-occurrence at a lower total cost.

- The cost-effectiveness estimates for the remaining closures – Jeffreys Ledge, Jordan Basin, Massachusetts Restricted Area #1, and Massachusetts Restricted Area #2 – range from \$194,000 to \$573,000 per unit of co-occurrence reduction.
- Overall, the least cost-effective alternative is Alternative 4. It includes the same gear reconfiguration requirements specified under Alternative 2, plus three closures with relatively high costs per unit of co-occurrence reduction. Alternative 5 appears to be superior to Alternative 4, achieving a greater estimated impact on co-occurrence at a lower total cost.
- Alternative 6 (Preferred) is the most cost-effective of the alternatives (\$51,000 to \$118,000 per unit of co-occurrence reduction). It eliminates gear marking requirements for vessels in Maine exempt waters, lowering costs without affecting the estimated co-occurrence reductions. Like Alternative 6 (Draft), it includes only one closure (Massachusetts Restricted Area #2), further improving overall cost-effectiveness relative to alternatives that include more extensive closures.

Exhibit 8-6 further illustrates these findings, using cost-effectiveness curves to compare the impacts of Alternative 6 (Preferred) to those of Alternative 4, the least cost-effective of the alternatives analyzed. The exhibit displays co-occurrence reduction on the horizontal axis and compliance costs on the vertical axis for both the upper and lower bound scenarios for each alternative. The segments of each curve show the marginal impacts of the two alternatives' major regulatory provisions. As the exhibit shows, gear-marking costs under Alternative 6 (Preferred) are estimated to be approximately one-third of those under Alternative 4, reflecting the exemption from gear-marking requirements the preferred alternative provides for gear in Maine's exempt waters. This shifts the cost-effectiveness curves for Alternative 6 (Preferred) downward from those for Alternative 4, as reflected in the lower y-intercept. The marginal impacts of the two alternatives' gear reconfiguration provisions are similar, although these impacts are estimated to be slightly more effective and less costly under Alternative 6 (Preferred). In contrast, the provisions for seasonal area closures under Alternative 4 are more extensive than those under Alternative 6 (Preferred), yielding a greater reduction in co-occurrence scores. The benefits associated with these closures, however, come at a relatively high cost, as reflected in the steeper slope of each segment of the cost-effectiveness curves that represents these impacts.

NMFS has considered the benefit and cost information presented above and believes that Alternative 6 (Preferred) offers the best option for achieving compliance with MMPA and ESA requirements. By excluding vessels in Maine exempt waters from gear marking requirements, Alternative 6 (Preferred) reduces compliance costs with no direct or immediate effect on the estimated reduction in co-occurrence. In addition, Alternative 6 (Preferred) provides most of the benefits that would be achieved under more stringent alternatives, sacrificing only the relatively costly additional reduction in co-occurrence that would be achieved by the closure of Jeffreys Ledge, Jordan Basin, and Massachusetts Restricted Area #1. Based on these considerations, NMFS has identified Alternative 6 (Preferred) as its proposed approach to achieving the goals of the ALWTRP.

| Exhibit 8-5 | | | | | | | |
|------------------------------------|----------------------|----------------------|-----------------------|------------------------------------------|----------------------|-----------------------|------------------------------------------|
| COST-EFFECTIVENESS OF ALTERNATIVES | | | | | | | |
| Alternative | Regulatory Component | Lower Bound Scenario | | | Upper Bound Scenario | | |
| | | Cost | Co-Occurrence Benefit | Cost per Unit of Co-Occurrence Reduction | Cost | Co-Occurrence Benefit | Cost per Unit of Co-Occurrence Reduction |
| 1 | NA | \$0 | 0.0% | NA | \$0 | 0.0% | NA |
| 2 | Gear Marking | \$1,014,000 | 0.0% | | \$1,014,000 | 0.0% | |
| | Gear Reconfiguration | \$1,241,000 | 35.8% | \$34,625 | \$4,392,000 | 35.8% | \$122,540 |
| | Total | \$2,255,000 | 35.8% | \$62,916 | \$5,407,000 | 35.8% | \$150,859 |
| 3 | Gear Marking | \$1,047,000 | 0.0% | | \$1,047,000 | 0.0% | |
| | Gear Reconfiguration | \$1,003,000 | 37.0% | \$27,096 | \$3,349,000 | 37.0% | \$90,474 |
| | CCB CH | \$21,000 | 0.2% | \$137,538 | \$49,156 | 0.4% | \$124,059 |
| | Total | \$2,070,000 | 37.2% | \$55,692 | \$4,445,000 | 37.4% | \$118,811 |
| 4 | Gear Marking | \$1,010,000 | 0.0% | | \$1,010,000 | 0.0% | |
| | Gear Reconfiguration | \$1,213,000 | 35.8% | \$33,844 | \$4,288,000 | 35.8% | \$119,638 |
| | Jordan | \$43,000 | 0.2% | \$194,464 | \$103,000 | 0.5% | \$226,983 |
| | MRA #1 | \$553,000 | 1.3% | \$435,448 | \$839,000 | 1.8% | \$470,735 |
| | Jeffreys | \$743,000 | 1.4% | \$547,456 | \$1,172,000 | 2.5% | \$475,733 |
| | Total | \$3,562,000 | 38.7% | \$92,066 | \$7,411,000 | 40.5% | \$182,802 |
| 5 | Gear Marking | \$1,043,000 | 0.0% | | \$1,043,000 | 0.0% | |
| | Gear Reconfiguration | \$996,000 | 37.0% | \$26,907 | \$3,240,000 | 37.0% | \$87,529 |
| | Jordan | \$43,000 | 0.2% | \$274,178 | \$103,000 | 0.3% | \$296,740 |
| | MRA #1 | \$553,000 | 1.3% | \$435,404 | \$839,000 | 1.8% | \$470,701 |
| | Jeffreys | \$743,000 | 1.3% | \$573,414 | \$1,172,000 | 2.5% | \$464,491 |
| | Total | \$3,379,000 | 39.7% | \$85,030 | \$6,396,000 | 41.7% | \$153,495 |
| 6 (Draft) | Gear Marking | \$1,054,000 | 0.0% | | \$338,000 | 0.0% | |
| | Gear Reconfiguration | \$1,009,000 | 36.2% | \$27,879 | \$3,316,000 | 36.2% | \$91,622 |
| | MRA #2 | \$557,000 | 1.2% | \$447,644 | \$831,000 | 1.8% | \$471,979 |
| | Total | \$2,620,000 | 37.4% | \$69,985 | \$5,208,000 | 38.0% | \$137,222 |
| 6 (Pre-ferred) | Gear Marking | \$338,000 | 0.0% | | \$338,000 | 0.0% | |
| | Gear Reconfiguration | \$1,015,000 | 36.2% | \$28,057 | \$3,316,000 | 36.2% | \$91,661 |
| | MRA #2 | \$557,000 | 1.2% | \$447,644 | \$831,000 | 1.8% | \$471,979 |
| | Total | \$1,910,000 | 37.4% | \$51,041 | \$4,484,000 | 37.9% | \$118,195 |

Notes:

- By improving understanding of the nature of entanglements, gear marking requirements could in the long-term have a beneficial impact on the cost-effectiveness of regulations specified under the ALWTRP; however, they would have no direct or immediate impact on the co-occurrence indicator.
- Values may not sum to the totals shown due to rounding.

Exhibit 8-6

**COST-EFFECTIVENESS CURVES FOR ALTERNATIVES 4 AND 6 (PREFERRED):
LOWER AND UPPER BOUND COMPLIANCE SCENARIOS**

