ECONOMIC IMPACTS CHAPTER 6

6.1 INTRODUCTION

The regulatory alternatives under consideration would subject commercial fishermen operating in fisheries covered by the ALWTRP to a number of new requirements. These include:

- *Minimum trawl-length standards*, which would apply to the lobster, blue crab, and other trap/pot (OTP) fisheries in the plan's Northeast waters;
- New *gear configuration requirements,* which would apply to trap/pot fisheries in the plan's Southeast waters;
- *Seasonal closure* of designated areas in the Northeast to trap/pot gear; and
- New *gear marking* requirements, which would apply to regulated fisheries in all waters that are subject to the ALWTRP, as well as some areas that are exempt from other ALWTRP requirements.

Complying with these requirements is likely to impose additional costs on commercial fishermen and, in some instances, to have an adverse impact on their revenues. If these impacts are large, it is possible that some fishermen may switch their effort to other fisheries or cease fishing entirely.

The following discussion describes the methods used to estimate the costs that commercial fishermen would incur in complying with potential modifications to the ALWTRP and presents the results of this analysis. These cost estimates represent the direct impact of new regulations on the commercial fishing industry. They also provide a foundation for subsequent evaluation of the regulations' potential effect on commercial fishing activity, and of the implications of such effects for communities that depend on the commercial fishing industry (see Chapter 7). The discussion is organized as follows:

- Section 6.2 describes the data sources and methodology employed to estimate compliance costs associated with minimum trawl-length and other gear configuration requirements;

- Section 6.3 describes the data sources and methodology employed to characterize the economic impact of the seasonal closure of certain areas to trap/pot gear;

- Section 6.4 describes the methods used to estimate the compliance costs associated with gear marking requirements;

- Section 6.5 presents the resulting estimates of compliance costs for each regulatory alternative; and

- Section 6.6 describes the distribution of estimated costs by fishery.

The analysis examines the costs of each regulatory alternative in a social welfare framework, focusing on potential changes in producer and consumer surplus. In the context of this analysis, producer surplus is the difference between the revenues that fishermen receive for their catch and the economic costs incurred in harvesting it. Similarly, consumer surplus is the difference between the maximum amount that consumers would be willing to pay for the catch and the price they actually pay. Any reduction in consumer or producer surplus represents a loss of economic welfare, and thus, a cost to society.

The analysis measures the cost of complying with new regulatory requirements relative to Alternative 1, the no action alternative; it does not address the cost of complying with ALWTRP requirements already in place. This is not to imply that implementation of the ALWTRP's current requirements is costless. Commercial fishermen clearly incur costs to meet current standards. The economic analysis, however, is designed to measure costs on an incremental basis – i.e., to measure the *change* in costs associated with a *change* in regulatory requirements. If no change in regulatory requirements is imposed – as would be the case under Alternative 1 – the costs of complying with the ALWTRP would remain unchanged. Thus, the incremental cost of the no action alternative is zero.

Much of the analysis described in this chapter builds on the foundation provided by NMFS' Vertical Line Model. As discussed earlier in this EIS, the model integrates information on fishing activity, gear configurations, and whale movements to provide indicators of the potential for entanglements to occur at various locations and at different points in time. The costs that the management measures under consideration might impose depend on the fishery (or fisheries) in which a vessel participates; the seasons and locations in which a vessel operates; the regulations to which it is already subject; and the current configuration of the vessel's gear. The Vertical Line Model specifies operating assumptions for groups of vessels that hold these key features in common, providing an important starting point for assessing economic impacts. The role of the model in the analysis of economic impacts is described in detail below; readers interested in additional information on the model's structure or the data, assumptions, and methods it employs should consult the model's formal documentation, which is available for review on the ALWTRP website (http://www.nero.noaa.gov/Protected/whaletrp/index.html).

6.2 ANALYTIC APPROACH: 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 fall into several categories:

- **Gear Conversion**: 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.

- **Catch Impacts**: Catch rates may decline for vessels that are required to convert from shorter sets to longer trawls, reducing the revenues of affected operations.

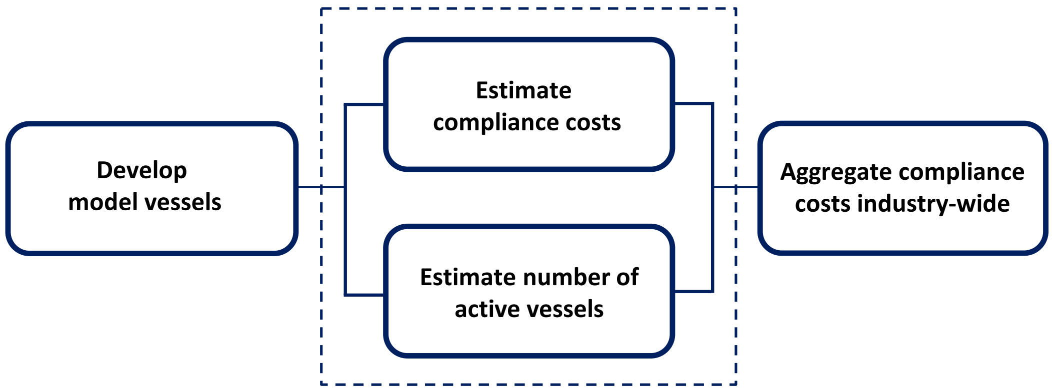
- **Other Impacts**: Some vessels that shift to longer trawls may experience changes in the rate at which gear is lost. In addition, some fishermen may need to modify their vessels or add crew to handle longer trawls.

Given the broad scope of the ALWTRP, a vessel-by-vessel analysis of the costs of complying with these requirements is infeasible. Instead, the analysis is based upon the model vessels defined in the Vertical Line Model. Each model vessel represents a group of vessels that fish in the same area, share other operating characteristics, and would face similar requirements under a given regulatory alternative. As Exhibit 6-1 illustrates, the analysis estimates regulatory compliance costs for each model vessel. This cost estimate is then applied to the population of active vessels that the model represents, and aggregated across this population to estimate regulatory compliance costs for all vessels in a given category.[1] The sum of costs across all vessel categories provides an estimate of regulatory compliance costs for the commercial fishing industry as a whole.

[1] The population of active vessels that a model vessel represents is based in part on vessel trip reports that indicate the location of fishing activity. Some vessels report activity in multiple areas in a given month. To avoid double-counting in such cases, the analysis assigns the vessel's activity to each area in proportion to the distribution of trips it reports. For example, if over the course of a month a vessel reports seven trips to Area A and three trips to Area B, the analysis will assign 0.7 active vessels to Area A and 0.3 active vessels to Area B. Thus, all estimates of the number of vessels active in a given area are reported on a full-time equivalent basis; the number of vessels that fish a portion of their gear in the area each month may be higher. The documentation for the Vertical Line Model provides additional information on this issue.

Exhibit 6-1

ECONOMIC IMPACT ASSESSMENT METHODOLOGY



6.2.1 Development of Model Vessels

The first step in analyzing the impacts of trawling requirements is to define the relevant suite of model vessels, i.e., groups of vessels that operate in a similar fashion and thus are likely to face similar compliance costs. The regulations currently imposed under the ALWTRP vary by fishery, location, and time of year. Potential modifications to the ALWTRP, as embodied in the regulatory alternatives under consideration, would follow a similar approach. Thus, compliance costs are likely to vary depending upon the fishery in which a vessel participates, the location in which it operates, and the seasons in which it is active. The model vessels employed in the cost analysis are designed to capture these differences.

In addition, the model vessels are designed to take into account differences in compliance costs that would result from the nature, configuration, and quantity of gear that vessels employ. For example, some lobster vessels fishing in a given region may configure their traps/pots in pairs, while others may already use longer trawls; since this difference could have a significant impact on the costs of complying with trawling requirements, it is important that the cost analysis differentiate between such vessels. Similarly, the configuration of gear and operating characteristics of vessels participating in other trap/pot fisheries could vary significantly depending upon the species they target. For example, vessels that target black sea bass and those that target conch employ different configurations of gear, and thus are likely to face different compliance costs. Again, it is important to differentiate between such vessels in the cost analysis.

Analysis of the economic impact of the trawling requirements requires comparing the baseline configuration of gear assigned to model vessels in the Vertical Line Model with the new configuration of gear that would be required under each regulatory alternative. This procedure allows assessment of compliance costs for the full suite of possible outcomes. For instance, for the set of lobster vessels fishing in non-exempt state waters in Maine Lobster Zone B, the Vertical Line Model identifies 36 possible gear configuration options, as defined by a matrix that specifies both the number of traps fished (four categories) and the number of traps per trawl (nine categories). The model relies on survey data to characterize the baseline distribution of gear configurations within this matrix. The cost analysis then identifies the gear configurations that would be prohibited under each regulatory alternative; vessels that currently fish sets shorter than the required minimum would need to reconfigure their gear. The *difference* between the baseline configuration and the new configuration of gear that each regulatory alternative would require (which varies by area and alternative) drives the analysis of gear conversion costs; thus, estimates of compliance costs for vessels that are subject to identical requirements will vary depending upon the configuration of gear they currently employ. As described below, the cost analysis takes into account a broad range of "before and after" gear configuration options.

6.2.2 Gear Conversion Costs

When vessels convert from shorter sets to longer trawls, one impact is the direct cost of converting gear to the new configuration. These costs include two major elements:

- **Equipment Costs**: Fishing traps in a new configuration may require the use of new equipment. For instance, the use of longer trawls is likely to require additional groundline. These costs may be offset, at least in part, by a reduction in the use of other types of equipment, such as a reduction in the use of vertical line, buoys, etc.

- **Labor Costs**: The costs of converting gear include the implicit value of the time that fishermen spend reconfiguring their equipment.

Exhibit 6-2 illustrates the methodology employed to estimate these costs. As shown, for each regulatory provision applicable to a group of vessels, the analysis identifies new gear conversion requirements (i.e., modifications that are not already specified under existing rules), estimates the material and labor required to bring all gear into compliance, and calculates the resulting cost. For each provision, 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 equipment costs that might result from efforts to comply with new ALWTRP regulations. The discussion below further describes how these costs are estimated.

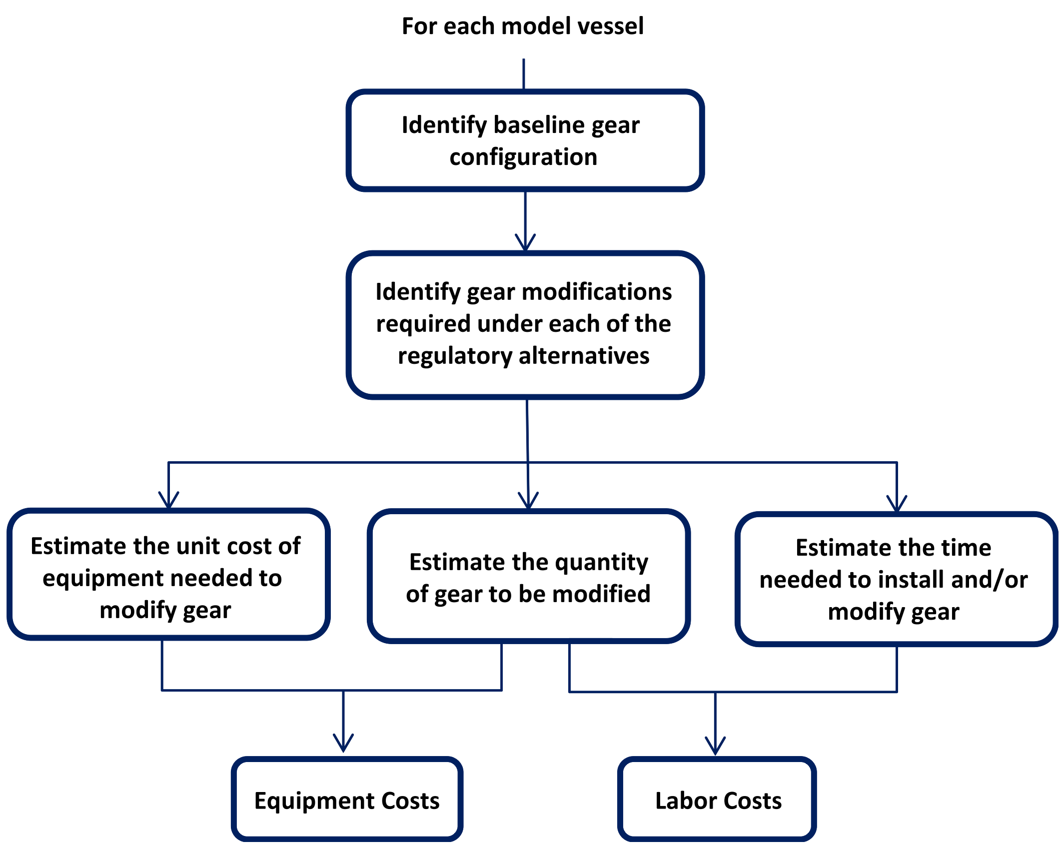
6.2.2.1 Equipment Costs

Vessels that switch to longer trawls as a result of new ALWTRP requirements will incur costs for new equipment, but may also realize savings on components of gear that the new configuration would use less extensively or eliminate entirely. For example, under Alternative 2, the use of singles or doubles in the regulated state waters portion of Maine Lobster Zone B would be prohibited; trap/pot vessels that currently fish singles or doubles would need to switch to trawls of no fewer than three traps in order to comply with the alternative's requirements. The analysis assumes that the affected vessels would switch to the minimum set length the new requirements would permit – in this case, triples. For vessels that previously fished doubles, this implies an increase in the quantity of groundline and a decrease in the quantity of vertical line employed. It also implies a decrease in the number of buoys and other gear elements (e.g., weak links) associated with each set. To capture this dynamic, the gear cost analysis compares "before" and "after" gear configurations for each category of affected vessels, identifying the impact of each regulatory alternative on the gear that vessels in that category would employ.

The equipment cost that vessels would incur is also a function of the total number of traps that must be reconfigured. For each model vessel, the cost model itemizes changes in the quantity of all gear elements based on the maximum number of traps fished at any point during the year. In this way, the estimate of gear conversion costs for each model vessel reflects the cost of reconfiguring all of its gear, not just the subset of traps it may fish in a particular month.

Exhibit 6-2

METHODOLOGY USED TO CALCULATE GEAR CONVERSION COSTS



Gear specifications for each model vessel are customized to the relevant fishing area. The specification of baseline gear use is consistent with typical practices and existing regulatory requirements, while the specification of gear use under each regulatory alternative is based on an assessment of the changes needed to comply with the new requirements. The factors considered in each case include:

- set configuration (i.e., the number of traps and number of endlines per trawl);
- the depth at which gear is typically set, combined with a vertical line slack factor (to define vertical line length);
- vertical line diameter;
- vertical line composition (i.e., the percent of vertical line that is sinking line);
- buoy system features (buoy size, number, and type);
- the number of anchors (if any) per set;
- the length and diameter of any anchor lines;
- the distance between traps on a trawl (to define groundline length); and
- groundline diameter.[2]

Appendix 6-A details how these parameters vary by fishing area. As explained in the appendix, many of these parameters are based on information provided in McCarron and Tetreault (2012). Additional specifications draw on data provided by state fisheries managers to support development of the Vertical Line Model.

To evaluate the net change in equipment costs associated with fishing longer trawls, the analysis incorporates unit cost information gathered from marine supply retailers. The unit cost estimates represent the average of prices quoted by two major marine supply retailers in the northeast, Friendship Trap and New England Marine and Industrial. This price information was gathered via searches of on-line catalogs as well as personal communication with company representatives. Supplementary information from other retailers provides prices for miscellaneous gear elements.

Fishermen would incur the change in equipment costs when new requirements go into effect, and on an ongoing basis thereafter. To appropriately reflect the opportunity costs associated with such investments, the analysis presents these costs on an annualized basis. The cost model develops the annual cost of the "before" and "after" gear configurations based on standard discounting procedures, employing estimates of the useful life of each gear element. These estimates were developed with guidance from NMFS gear specialists. The calculation of annualized costs is based on a real annual discount rate of seven percent, consistent with current Office of Management and Budget guidelines. All costs are reported in 2011 dollars.

[2] The analysis assumes that groundline employed in non-exempt waters is sinking line, consistent with the ALWTRP's current requirements.

Appendix 6-A summarizes the unit prices and useful life estimates compiled for all gear elements.

6.2.2.2 Labor for Gear Conversion and Associated Costs

In addition to equipment costs, converting trap/pot gear to longer trawls would require an investment of fishermen's time. The following discussion summarizes the assumptions the analysis employs to estimate the amount of time fishermen are likely to spend reconfiguring their gear, as well as the method used to estimate the implicit value of their time.

Labor for Gear Conversion

Numerous factors may influence the amount of time a fisherman is likely to spend on gear conversion, including:

- The individual's skill and experience;
- The complexity of the reconfiguration required;
- Whether gear is reconfigured on shore or at sea;
- For reconfiguration at sea, the distance between sets;
- The availability of a sternman to assist with the work; and
- The method (knots, splicing, etc.) used to string traps together into trawls.

In the absence of data to support characterization of all of these factors, the labor cost analysis applies a simplified method. Following the recommendation of NMFS gear specialists, the analysis assumes 15 minutes of labor for each trap that must be converted to a new configuration, based on the assumption that the reconfiguration will be performed at sea.[3] To determine the number of traps that must be converted, the analysis first calculates, for each model vessel, the number of sets that the new configuration will accommodate. Using the model vessel's baseline gear configuration as a starting point, it then calculates the number of traps that must be added to each set to reach the target set length. For example, assume as a starting point a model vessel that under baseline conditions fishes 400 sets of doubles (a total of 800 traps), but under a given regulatory alternative would be required to fish trawls of at least five traps. In this case:

- The regulatory alternative will accommodate 160 sets of 5-trap trawls (800/5 = 160);
- The analysis takes as a starting point 160 sets of doubles (320 traps);

[3] Personal communication with NMFS gear specialists, September 24, 2012.

- The remaining 480 traps must be added to these sets to create five-trap trawls;
- At 15 minutes per trap, the analysis estimates that 120 labor-hours would be required to reconfigure the 480 traps (480 traps times 0.25 hours per trap).

While this approach is highly simplified, it is intended to encompass the suite of considerations noted above. In addition, because it is based upon an estimate of the time required to reconfigure gear at sea, it is designed to be more conservative (i.e., to yield a higher cost estimate) than would be the case if the analysis assumed that the reconfiguration of gear occurred on shore.

Labor Cost

The cost model assigns an implicit value to fishermen's time based on labor rates in professions they would pursue if not involved in fishing. Economists refer to this concept as the "opportunity cost" of time. To identify alternative professions, the analysis relies on responses provided to a survey administered by the Gulf of Maine Research Institute in 2005 (GMRI, 2006). The GMRI survey asked a sample of 1,158 randomly selected lobstermen a variety of questions regarding education, vessel characteristics, fishing effort, and other aspects of their work. Compiled and published in 2006, the survey findings guide a number of assumptions in the cost and socioeconomic analysis presented in this EIS.

When asked about alternative professions, the GMRI survey respondents most commonly indicated that they would be involved in carpentry, other trades, vessel maintenance, merchant marine activity, or another aspect of commercial fishing (i.e., harvesting other species, boat maintenance). Exhibit 6-3 summarizes the responses.

The cost analysis uses the distribution of responses to develop a weighted average wage rate that reflects the opportunity cost of a fisherman's time. First, the analysis normalizes the survey responses, eliminating the indeterminate or non-relevant responses ("other", "don't know" and "retire"). The analysis then matches the alternative occupations with Bureau of Labor Statistics (BLS) occupational categories, developing a simple average wage rate for each occupation (or group of occupations) based on the May 2011 mean hourly wage rate reported by BLS. For instance, the survey response "carpentry/trades/mechanic" is assigned an average wage rate based on the rates that BLS reports for "Carpenters" and for "Automotive Service Technicians and Mechanics". Finally, the analysis weights the wage rates by the distribution of survey responses to estimate an average opportunity cost of $22.48 per hour.

Exhibit 6-3

CALCULATION OF THE IMPLICIT VALUE OF A TRAP/POT FISHERMAN'S TIME

Alternative Occupation	Percent of Respondents That Identified Alternative[1]	Normalized Distribution of Responses	Average Wage Rate	BLS Occupational Categories Incorporated into Average Wage Rate
Carpentry/Trades/Mechanic	28%	41%	$19.93	Carpenters; Automotive Service Technicians and Mechanics
Other Commercial Fishing/Merchant Marine/Boat Building and Maintenance	26%	38%	$21.37	Fishers and Related Fishing Workers; Motorboat Mechanics; Sailors and Marine Oilers; Captains, Mates, and Pilots of Water Vessels
Other Business	8%	12%	$33.05	Business and Financial Operations Occupations
Truck Driver/Equipment Operator	3%	4%	$20.57	Heavy and Tractor-Trailer Truck Drivers; Operating Engineers and Other Construction Equipment Operators
Education	2%	3%	$24.46	Education, Training, and Library Occupations
Police/Firefighter/EMT/Military	1%	1%	$22.12	Police and Sheriff's Patrol Officers; Firefighters; Emergency Medical Technicians and Paramedics
Engineering	1%	1%	$40.17	Mechanical Engineers
Other	10%	N.A.	**Weighted Average: $22.48**	
Retire	2%	N.A.		
Don't Know	16%	N.A.		

Notes:

1. Because the survey permitted multiple responses, these figures do not sum to 100 percent.

Sources: GMRI, 2006; BLS Occupational Employment Statistics.

The analysis uses this wage rate to characterize the opportunity cost for lobstermen and fishermen who spend time reconfiguring their gear under the proposed requirements.[4] For purposes of expressing compliance costs on an annualized basis, the analysis assumes that labor costs would be incurred when the regulations take effect, and amortizes them over a period of five years. This period reflects the approximate length of the ALWTRP's regulatory review cycle.

6.2.2.3 Caveats and Uncertainties

The discussion above highlights several key assumptions in the analysis of gear conversion costs. Chief among these are (1) the specific baseline configurations and gear elements used in each fishing area; (2) the cost and useful life of various gear elements; (3) the amount of labor needed to convert short sets to longer trawls; and (4) the implicit value of fishermen's time. There are uncertainties associated with each of these assumptions, but the overall direction of any potential bias in the resulting estimates of gear conversion costs is unclear.

It is noteworthy that the analysis of gear conversion costs results in net cost savings for some groups of vessels. This occurs when trawling implies lower expenditures on key gear elements. For instance, vessels fishing in the Federal waters of Lobster Management Area (LMA) 1 are likely to employ relatively sophisticated and expensive buoy systems. If trawling reduces the number of sets fished and the number of buoys used, the result is reflected as a net cost savings, even after accounting for investments of time needed to reconfigure gear. While the analysis incorporates these impacts, it also recognizes the potential for other costs – in particular, adverse impacts on catch rates – to offset any savings implied by estimates of changes in gear costs. The following section discusses these impacts in greater detail.

6.2.3 Catch Impacts Associated with Trawling Requirements

The analysis of compliance costs associated with trawling requirements recognizes the potential for impacts on landings under certain conditions. Fishermen use singles and other short sets for a variety of reasons. In some cases, short sets may allow fishermen to target especially productive bottom structure where longer trawls may be inefficient or difficult to haul (e.g., because of fouling on bottom structure). This advantage may be most prevalent in rocky habitats, including those around islands. Second, short sets can be distributed more widely than trawled traps. Wide distribution may aid in the search for the target species. Likewise, wide distribution may reduce competition between traps, increasing the catch per unit of effort.

Data to support a quantitative analysis of trawling effects on catch are extremely limited. Because multiple factors influence catch rates (gear configuration, gear density, the abundance of the target species, bottom structure, soak time, individual skill, etc.), it is difficult to isolate the effect of trawl configuration on catch. The Maine Department of Marine Resources (DMR)

[4] The approach the analysis employs to value the opportunity cost of time treats the time required to comply with new ALWTRP requirements as time that would otherwise be invested in productive activity, rather than leisure. This approach provides a conservative (i.e., higher) estimate of the cost of complying with new regulations.

developed and implemented a project designed, in part, to assess the impacts of longer trawls on catch in the lobster fishery (DMR, 2012). Participants hauled roughly 2,300 sets of gear in control configurations (singles and doubles) and 835 sets of gear in trawls ranging from triples to tens. The research found no statistically significant reduction in catch per trap when comparing the control configurations to the experimental configurations.

Despite this finding, industry experts believe it is possible, and in some instances likely, that changes in gear configuration could have an adverse impact on catch. Experts from the Massachusetts Division of Marine Fisheries, for example, have called attention to the potential for catch impacts in the inshore lobster fishery around Cape Cod, where single traps are routinely fished.[5] Research has demonstrated that the optimal spacing of lobster traps depends upon the abundance of lobster in an area; the greater the density of lobster, the greater the density of traps that can be fished without an adverse impact on catch per trap (Schreiber, 2010). The use of singles in the Cape region is partly attributable to this dynamic. The density of lobsters in these waters is lower than it is off the Maine coast; under these conditions, traps that are placed relatively close together – as would be the case when fishing trawls – are more likely to compete with one another in attracting lobsters. As a result, traps fished in trawls around the Cape might be less productive than traps fished as singles.[6]

Lacking any systematic data linking gear configuration and catch rate, the analysis applies a simplified approach to characterize potential impacts. To recognize the potential for catch impacts to be greater when gear configurations change markedly, it first classifies affected vessels into two categories:

- **Category A** – Those subject to relatively large increases in trawl length, defined as an increase of a factor of two or more in the number of traps in each set; and

- **Category B –** Those subject to smaller increases in the number of traps in each set.

The analysis then incorporates two scenarios designed to provide a reasonable estimate of the range of potential catch impacts:

- **Lower Bound** – In the lower bound scenario, the analysis assumes that vessels in Category A experience a five percent reduction in annual catch. The catch of vessels in Category B is assumed to be unaffected.

- **Upper Bound –** In the upper bound scenario, the analysis assumes that all vessels in Category A experience a 10 percent reduction in annual catch, while those in Category B experience a five percent reduction.

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[5] Personal communication with Massachusetts DMF, November 7, 2012.

[6] Personal communication with Massachusetts DMF, November 7, 2012. DMF also noted that several ports on the Outer Cape have sandbars that can only be cleared when the tide is high. Fishermen access and haul their traps in a relatively narrow window of time each day. While trawl fishermen tend to haul more gear to make up for lower catch rates, this may not be an option for those whose ability to exit and return to port is limited by the tides.

The impact of a reduction in catch on a vessel's annual landings is calculated as follows:

Baseline Catch per Trap (pounds/trap) x *Traps Fished (traps/year)* x *Catch Reduction (%)*

Similarly, the reduction in annual landings is converted to a loss in annual revenue using the following equation:

Reduction in Catch (pounds/year) x *Ex-Vessel Price ($/pound)*

Exhibit 6-4 summarizes the source and value of key parameters applied in the analysis. For example, in Maine Lobster Management Zones A through G, the estimated annual catch per trap (33.5 pounds) is an average of two figures: (1) the annual catch per trap reported for the Gulf of Maine in the Atlantic States Marine Fisheries Commission's most recent Lobster Stock Assessment (2009); and (2) the average annual catch per trap reported by LMA 1 lobstermen in the GMRI survey (2006). At an ex-vessel price of $3.21 per pound – the average price reported for landings in Maine from 2009 through 2011 – this translates to annual revenues of $107.57 per trap. Thus, a five to ten percent reduction in catch implies a reduction in annual revenues of $5.38 to $10.76 per trap.

It is vital to note that the assumptions applied in estimating potential catch impacts are generalized, and the magnitude of such impacts is highly uncertain. A given vessel may experience catch changes greater or less than the impacts assumed in the analysis. These impacts may diminish over time, as fishermen adapt to new gear configurations and learn to fish longer trawls more efficiently. Nonetheless, it is important to recognize that changes in gear configurations could have an overall impact on catch rates. The analysis does so, applying a range of assumptions to illustrate the potential magnitude of this effect.

6.2.4 Other Potential Impacts Associated with Gear Configuration Requirements

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;
- 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); and
- Savings that may result under Alternative 6 (Preferred) as a result of establishing a quarter-mile buffer around select islands on the Maine coast; trawling requirements would not apply in these buffer areas.

Exhibit 6-4

PARAMETERS FOR ASSESSING LANDINGS REDUCTION AND ASSOCIATED REVENUE IMPACTS FOR VESSELS CONVERTING TO LONGER TRAWLS

Fishery	Waters	Annual Catch per Trap (pounds)	Basis for Catch per Trap Estimate	Ex-Vessel Price	Price Basis	Gross Revenue per Trap	5% Revenue Reduction per Trap	10% Revenue Reduction per Trap
Lobster	Maine State and Federal Waters (Zones A-G)	33.5	GMRI survey catch per trap for LMA 1; Lobster Stock Assessment (LSA) catch per trap for Gulf of Maine	$3.21	Average ME price, 2009 to 2011	$107.57	$5.38	$10.76
	New Hampshire State Waters	33.5	GMRI survey catch per trap for LMA 1; LSA catch per trap for Gulf of Maine	$4.16	Average NH price, 2009 to 2011	$139.30	$6.96	$13.93
	Massachusetts SRA 1	30.2	2011 Catch Report data	$3.93	Average MA price, 2009 to 2011	$118.56	$5.93	$11.86
	Massachusetts SRA 2	30.6	2011 Catch Report data	$3.93	Average MA price, 2009 to 2011	$120.23	$6.01	$12.02
	Massachusetts SRA 3	27.4	2011 Catch Report data	$3.93	Average MA price, 2009 to 2011	$107.71	$5.39	$10.77
	Massachusetts SRA 4	34.3	2011 Catch Report data	$3.93	Average MA price, 2009 to 2011	$134.94	$6.75	$13.49
	Massachusetts SRA 5	24.9	2011 Catch Report data	$3.93	Average MA price, 2009 to 2011	$97.76	$4.89	$9.78
	Massachusetts SRA 6	29.6	2011 Catch Report data	$3.93	Average MA price, 2009 to 2011	$116.18	$5.81	$11.62
	Massachusetts SRA 7	32.1	2011 Catch Report data	$3.93	Average MA price, 2009 to 2011	$126.18	$6.31	$12.62
	Massachusetts SRA 8	32.8	2011 Catch Report data	$3.93	Average MA price, 2009 to 2011	$128.90	$6.45	$12.89
	Massachusetts SRA 9	36.6	2011 Catch Report data	$3.93	Average MA price, 2009 to 2011	$143.82	$7.19	$14.38
	Massachusetts S. Cape (SRAs 10-13)	16.2	2011 Catch Report data; average for the 3 SRAs	$3.93	Average MA price, 2009 to 2011	$63.78	$3.19	$6.38
	Massachusetts SRA 14	21.7	2011 Catch Report data	$3.93	Average MA price, 2009 to 2011	$85.23	$4.26	$8.52
	Rhode Island State Waters	24.5	GMRI catch per trap for LMA 2; LSA catch per trap for Southern New England	$4.35	Average RI price, 2009 to 2011	$106.80	$5.34	$10.68
	LMA 1 Other	33.5	GMRI survey catch per trap for LMA 1; LSA catch per trap for Gulf of Maine	$3.32	Weighted average price for ME, NH, and MA, 2009 to 2011	$111.40	$5.57	$11.14

Exhibit 6-4

PARAMETERS FOR ASSESSING LANDINGS REDUCTION AND ASSOCIATED REVENUE IMPACTS FOR VESSELS CONVERTING TO LONGER TRAWLS

Fishery	Waters	Annual Catch per Trap (pounds)	Basis for Catch per Trap Estimate	Ex-Vessel Price	Price Basis	Gross Revenue per Trap	5% Revenue Reduction per Trap	10% Revenue Reduction per Trap
	LMA OC Other	59.3	Average of SRAs 9 and 18 based on DMF Catch Report data	$3.93	Average MA price, 2009 to 2011	$233.29	$11.66	$23.33
	LMA 2 Other	24.5	GMRI survey catch per trap for LMA 2; LSA catch per trap for Southern New England	$4.01	Weighted average price for MA and RI, 2009 to 2011	$98.43	$4.92	$9.84
	LMA 3	94.6	GMRI catch per trap for LMA 3; LSA catch per trap for Georges Bank	$3.36	Overall average price (all Atlantic states), 2009 to 2011	$317.90	$15.89	$31.79
OTP	Massachusetts SRA 10-13	326.4	Weighted mix of catch per trap for 3 MA species, using weights from VL Model	$3.19	Weighted mix of price for 3 MA species, using weights from VL Model	$1,113.36[1]	$55.67	$111.34
	Massachusetts SRA 14	106.9	Weighted mix of catch per trap for 3 MA species, using weights from VL Model	$3.19	Weighted mix of price per trap for 3 MA species, using weights from VL Model	$340.23[1]	$17.01	$34.02
	RI State Waters	121	Average catch per trap for scup in MA Catch Report data	$0.66	Average RI price, 2009 to 2011	$79.86	$3.99	$7.99
	All Other Northeast OTP	N.A.	N.A.	N.A.	N.A.	N.A.	$9,955[2]	$19,910[2]

Notes:

1. Figure represents the weighted average of gross revenue per trap for each of three MA species (conch, scup, and black sea bass).
2. For OTP vessels outside of MA and RI state waters, the analysis incorporates a revenue reduction that is five or ten percent of average annual gross revenue for OTP vessels (approximately $199,100), as reported in NMFS' 2011 Dealer database.

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. The subsections below address each of these costs in greater detail.

6.2.4.1 Gear Loss Costs

Some gear configuration requirements affecting fixed-gear fisheries have the potential to affect rates of gear loss. Substantial changes in equipment losses can have important cost implications, and should therefore be examined carefully.

The impact of minimum trawl length requirements on gear loss in trap/pot fisheries is difficult to predict with confidence. The uncertainty is largely attributable to the array of underlying factors responsible for gear loss. On the one hand, longer trawls may increase the likelihood that groundline will foul on bottom structure, increasing the potential for line to part while hauling traps. Longer trawls may also increase the potential for gear conflicts, particularly situations in which one fisherman's gear is laid across another's. In these cases, one party may inadvertently sever another's lines, making it impossible to retrieve all or some of the gear. A longer trawl also increases the consequences of such incidents; i.e., the more gear on a single trawl, the more gear is lost when that trawl is rendered irretrievable.

In other ways, trawling requirements may reduce the potential for gear loss. The fundamental objective of longer trawls is to limit the number of vertical lines in the water column and reduce encounters with large whales; such encounters are one possible source of gear loss. Likewise, a decrease in the number of vertical lines may reduce the frequency with which gear is entangled in ship propellers or certain types of fishing gear. Furthermore, in areas where trawling requirements necessitate addition of a second endline (e.g., for a vessel going from triples to ten-trap trawls), the second endline may make it easier to locate and retrieve gear when one endline is lost. Longer trawls are also heavier and may be less likely to be swept away during extreme storm or tidal events.

Available data assessing how trawling requirements could affect gear loss are inconclusive. The Maine DMR trawling project (discussed above) asked participants to record whether they lost gear while hauling. An analysis of the raw data provided by DMR shows that of the roughly 3,100 sets of gear, 28 were lost. Of the lost sets, all but six were trawls of three traps or longer. While this outcome suggests a potential increase in gear loss when trawls are required, nine of the lost sets were seven- and 10-trap trawls fished with a single endline (an intentional feature of the project design). This gear configuration is unlikely in normal practice and would not be required by any of the alternatives that NMFS is considering. Furthermore, the participants fished the trawls on an experimental basis; for example, they may have intentionally placed some trawls on bottom structure unsuited to the experimental configuration. Overall, the sample of gear loss incidents in the project is too small to draw reliable conclusions about how trawling influences gear loss.

In 2010 and 2011, the Massachusetts DMF completed a comprehensive study of gear loss and "ghost" fishing (i.e., impacts from lost or derelict gear). Roughly 520 Massachusetts lobstermen responded to the survey (about 59 percent of all the lobstermen permitted in the Commonwealth); the responses were distributed across LMAs 1, 2, 3, and the Outer Cape in approximate proportion to lobstering activity. Respondents characterized the extent of their gear loss in different seasons and discussed the perceived causes of gear loss. Exhibit 6-5 summarizes key information gathered in the survey. The findings demonstrate that gear loss is common and represents a significant cost for many lobstermen.

Exhibit 6-5

SUMMARY OF FINDINGS FROM MASSACHUSETTS DMF GEAR LOSS AND GHOST GEAR SURVEY

LMA	Average Number of Traps Lost per Vessel	Primary Causes of Gear Loss	Average Value of Gear Lost per Vessel
1	10 to 23	Storm events and vessel traffic	$640 to $1,570
Outer Cape	14 to 34	Storm events and vessel traffic	$1,410 to $2,950
2	8 to 21	Vessel traffic and bottom hang ups	$570 to $1,500
3	19 to 46	Gear conflicts, line wear, storm events	$3,860 to $7,140
Source: Massachusetts DMF, 2011			

The survey also included questions about typical gear configurations, allowing DMF to examine how gear loss varies with trawl length. Exhibit 6-6 summarizes the findings. The minimum gear loss rates reported for each configuration show slightly higher losses associated with singles. The maximum rates more strongly suggest that gear loss is greater when fishing singles and doubles than when trawls of three or more traps are used. Overall, these data indicate that rather than exacerbating gear loss, trawling requirements may reduce the amount of gear lost and thereby yield an economic benefit to affected fishermen.

Exhibit 6-6

INFLUENCE OF CONFIGURATION ON GEAR LOSS: MASSACHUSETTS DMF GEAR LOSS AND GHOST GEAR SURVEY

Configuration	Trap Loss Rate	
	Minimum	Maximum
Singles	2.7%	21.4%
Doubles	1.6%	19.3%
Trawls (three or more traps)	2.1%	8.7%
Source: Massachusetts DMF, 2011		

Overall, the effect of trawling on gear loss is unclear. While data from the Maine trawling project suggest some potential for increased gear loss during fishermen's transition to trawls, the more extensive data from the Massachusetts ghost gear survey suggest that trawls are less subject to gear loss in steady-state conditions. Gear loss is likely a function of numerous variables that extend well beyond the trawl configuration, including bottom structure, shipping traffic, gear density, gear conflicts, tides, currents, and weather events. The net effect of trawling in the context of all these variables is difficult to characterize or quantify. Hence, the cost estimates discussed in this chapter do not explicitly incorporate the impact of gear loss changes.

6.2.4.2 Addition of Crew

Fishermen operating alone could potentially have difficulty handling the longer trawls required under some of the regulatory alternatives. The physical demands of hauling trawls may be challenging for fishermen who haul by hand rather than with a mechanized hauler. Even with a hauler, older fishermen may find it difficult to manage longer trawls. Addition of a sternman or other crew is one possible response for affected vessels. However, fishing alone is relatively uncommon on most vessels in ALWTRP-regulated waters. In addition, the cost of adding crew is prohibitive for most vessel operators. The subsections below present data suggesting that the addition of crew is unlikely as a response to the trawling requirements.

Crew on Affected Vessels

Numerous lobstermen and OTP fishermen choose to fish alone, primarily for economic reasons. To the extent that the desired quantity of gear can be hauled safely and efficiently without a sternman, vessel operators are likely to avoid the cost of additional crew (see below). The GMRI socioeconomic survey (2006) asked respondents (lobstermen landing more than 1,000 pounds) about their typical crew size (including the captain). A significant share of lobstermen fish alone, ranging from 19 percent in Maine Zone C to 66 percent in the LMA 2 portion of Massachusetts waters. It is important to note, however, that the GMRI data do not distinguish between inshore vessels and vessels fishing further offshore, an important predictor of crew size. In particular, it is important to consider crew size in exempt versus non-exempt waters.

In Maine, where many affected vessels operate, data suggest that a large share of lobstermen fishing alone operate in waters that would be exempt from the trawling requirements. While comprehensive data on crew size are not available, Maine DMR data on lobster licenses indicate the maximum crew per vessel. Permits coded LCO (for operators over 70 years of age) or LC 1 allow only the operator to fish; LC 2 and LC 3 permits allow for one and two sternmen, respectively.[7] A variety of other licenses are issued to students, minors, and other groups.

The permit classification data were linked to data from DMR's Annual Logs Survey, a 2010 survey of Maine lobstermen.[8] The supplemented data allow a more detailed analysis of the geographic area fished by vessels with only the captain on board. Exhibit 6-7 demonstrates that while about 16 percent of vessels in exempt waters hold permits restricting crew to the vessel operator, only about seven percent of vessels in non-exempt state waters are similarly restricted. Likewise, the vast majority of vessels fishing in Federal waters hold licenses that allow for one or more sternmen. Overall, these data suggest that a small percentage of Maine vessels in ALWTRP-regulated waters fish without a sternman. Furthermore, the data indicate that a very small percentage of these vessels are operated by older captains who might have particular difficulty managing trawls.

[7] Note that the permit types designate the maximum crew allowed, not actual crew; e.g., an operator with an LC 2 license could fish without a sternman. Therefore, the analysis may understate the actual number of vessels with no crew.

[8] The Vertical Line Model bases its characterization of gear use by Maine lobster vessels in large part on information obtained from the Annual Logs Survey. Issued in 2010 to all Maine lobstermen, the survey requested information on gear configurations and the location of fishing effort, specifying one or more of 21 areas. Approximately 2,100 lobstermen responded to the survey.

Exhibit 6-7 MAINE LOBSTER LICENSES AS AN INDICATOR OF CREW SIZE			
	Licensed for Vessel Operator Only (No Crew)		
Waters	**Operator-Only (LC 1)**	**Over-70 Operator (LCO)**	**All Other Licenses**
Exempt (State) Waters	13.3%	2.7%	84.1%
Non-Exempt State Waters	6.2%	0.7%	93.1%
Federal Waters	3.4%	0.4%	96.2%
Source: Analysis of Maine Annual Logs Survey data and permit data (2010).			

Massachusetts DMF also provided data allowing an assessment of crew size. As part of supplemental reporting for permit renewal, DMF asks vessel operators to report the size crew the vessel typically carries. Linking these data to 2009 Catch Report data enables a comprehensive analysis of crew size. Exhibit 6-8 summarizes the distribution of crew size for all lobster and other trap/pot vessels in all months and waters. As shown, about 30 percent of all vessel operators report that they fish alone. This practice is especially predominant in inshore areas. Unlike Maine, however, most of these inshore areas are subject to ALWTRP requirements (i.e., the geographic extent of exempt waters is extremely limited). Nonetheless, the majority of potentially affected vessels already fish with a crew.

Exhibit 6-8 DISTRIBUTION OF VESSELS BY CREW SIZE: ACTIVE LOBSTER AND OTP VESSELS IN MASSACHUSETTS			
Operator Only	**One Crew Member**	**Two or More Crew Members**	**Not Reporting**
30.3%	44.7%	13.5%	11.4%
Source: Analysis of Massachusetts DMF Permit and Catch Report data (2009).			

Sternman Costs

Vessel operators choose to work with crew primarily for economic reasons. For instance, a sternman may be cost-effective when lobster abundance is high, harvests are large, and fishing effort is high. Sternmen may also be hired for non-economic reasons, such as safety in offshore waters and for apprenticing purposes.

Sternmen are typically paid a percentage of the vessel's gross (or sometimes net) revenue. Exhibit 6-9 summarizes data from GMRI's 2005 survey of lobstermen in the Gulf of Maine.[9] As the exhibit indicates, payments to sternmen represent a substantial operating cost. A single sternman may be paid roughly 20 percent of gross revenue. On offshore vessels that typically operate with multiple crew members, sternmen may be paid a third of gross revenues.

[9] Figures are adjusted to 2011 dollars using the Gross Domestic Product Implicit Price Deflator index provided in the Economic Report of the President, 2012.

Exhibit 6-9 TYPICAL STERNMAN COSTS		
Area	**Average Payments to Sternmen ($2011)**	**Payment as a Percent of Gross Revenue**
LMA 1	$25,188	21%
LMA 2	$21,269	17%
LMA 3 (Offshore)	$155,568	32%
Source: GMRI (2006) as summarized in Thunberg (2007).		

Conclusions

The information presented above demonstrates that the addition of a sternman is a major economic decision for a vessel operator, and is dependent upon many factors. If an operator fishes alone, trawling requirements are not likely to alter that preference. Moreover, the available data suggest that vessel operators who work without a sternman are not necessarily limited to fishing singles. For example, of the Massachusetts lobster and OTP vessel operators who work alone, over two-thirds already fish trawls of three or more traps.[10] Anecdotal discussions with fisheries managers also indicate that trawls are routinely fished by vessel operators working alone.[11]

Nonetheless, the physical demands of hauling trawls may prove to be a challenge to some lone operators. In Maine, these vessels may have the option of relocating to exempt waters. Beyond this option, it is possible that the trawling requirements may force some fishermen to fundamentally reconsider their operations, including crew choices. For instance, an operator fishing alone may choose to hire a sternman, fish more traps, and possibly move to a new location. NMFS does not believe such changes will be widespread, and the analysis does not reflect the cost of such major operational shifts.

6.2.4.3 Vessel Modification

For a variety of reasons, operators of smaller vessels may find it difficult to fish trawls. Some small vessels, for example, may lack the deck space to accommodate trawls. Experts with Maine DMR, however, note that in some cases, operators of smaller vessels have made it feasible to use trawls by affixing plywood sheeting to the stern or the rail of their vessels, thus extending the available deck space.[12] The operators of small vessels affected by the proposed trawling requirements may choose to make similar modifications.

Estimating the number of vessels that would need this type of modification would require data on vessel size and other features that are not readily available; thus, the estimate of

[10] Based on analysis of MA DMF permit and 2009 Catch Report data.

[11] Personal communications with Maine DMR (August 30, 2012) and Massachusetts DMF (November 7, 2012).

[12] Personal communication with Maine DMR, August 30, 2012.

compliance costs does not specifically incorporate vessel modification costs. All else equal, the exclusion of these costs biases the estimate downward. In aggregate, however, these costs are likely to be relatively low; thus, the magnitude of any bias is likely to be minor.

6.2.4.4 Requirements for Southeast Trap/Pot Fisheries

As described in Chapter 3, Alternatives 2 through 6 (Preferred) include a set of special requirements for trap/pot gear in the Southeast region, which would affect the blue crab and OTP fisheries operating in ALWTRP-regulated waters off the coasts of South Carolina, Georgia, and Florida. In waters off South Carolina and Georgia, the alternatives would require affected vessels to fish singles; use weak links with a breaking strength no greater than 600 pounds; use vertical line with a breaking strength no greater than 2,200 pounds; and use vertical line that is free of weights and knots. The requirements for waters off Florida are similar, but specify 200-pound weak links and the use of sink rope with a breaking strength no greater than 1,500-pounds over the entire length of each vertical line. In addition, the alternatives would require trap/pot gear set in Federal waters in the Southeast to be returned to shore at the conclusion of each trip, effectively prohibiting overnight sets of this gear. All vessels operating in regulated waters would also be required to adhere to ALWTRP gear-marking conventions.

Research suggests that current practices are largely consistent with the gear configuration requirements outlined above; therefore, the cost of complying with them is unlikely to be significant.[13] NMFS' Southeast Regional Office (SERO) has verified that most affected vessels currently use singles; this observation is consistent with research performed in developing the Vertical Line Model. In addition, SERO inspections suggest that fishermen are already using weak links of the recommended breaking strength. The consistency of current practices with the remaining gear configuration requirements is slightly less certain, but for the reasons noted below, significant compliance costs are unlikely:

- SERO indicates that most fishermen already use rope with the proposed breaking strength.

- In addition, SERO indicates that the use of sinking material across the entire length of each vertical line is already required for traps/pots set in South Carolina state waters and is standard practice off the coast of Georgia. SERO is less certain whether the use of sinking material across the entire length of vertical line is standard practice in the waters off Florida.

- The requirement for vertical line to be free of knots, weights, and splices raises greater uncertainty, but the available data suggest that current practice is largely consistent with this requirement. NOAA Enforcement inspections in Florida found a small number of crabbers (two or three) with non-continuous line. In addition to finding limited use of non-

[13] Personal communication with Jessica Powell of NMFS/Southeast Regional Office and Richard Chesler of NOAA Enforcement, September 17, 2012.

> continuous line, NOAA Enforcement notes that Florida crabbers fish in shallow water (30 to 40 feet), so the need for splicing is fairly minimal.

A simple worst-case illustration suggests that complying with the requirement to use continuous sinking line of the proper breaking strength would impose relatively modest costs on vessels in the southeast blue crab and OTP fisheries, even if these requirements necessitated replacement of all of a vessel's vertical line. If a vessel fishes 200 traps in 40 feet of water, it would require approximately 8,000 feet of vertical line. At a price of approximately $0.053 per foot, this quantity of line would cost approximately $424.[14] Amortized over the useful life of the line, these costs would have little influence on the profit of any single vessel. Moreover, operators of these vessels could choose to avoid the cost by relocating their effort to exempt waters.

The prohibition on overnight sets in the Southeast region's Federal waters would likely affect a subset of vessels in the blue crab fishery, but the data available on activity in these waters suggest that the impact would be limited. The majority of blue crab effort in the Southeast occurs in exempt waters landward of the COLREGS line; therefore, the number of vessels that would be affected by a change in requirements for Federal waters would be small. Southeast Logbook data show no crabbing activity in Federal waters; however, a number of Georgia and South Carolina fishermen who commented on the DEIS at public hearings indicated that they occasionally set gear in Federal waters.[15] State fisheries experts confirm this, noting that this activity tends to peak from December through March, when blue crabs typically migrate to deeper water in search of more desirable salinity and temperature conditions.[16] A one-time survey performed by the Georgia Department of Natural Resources (DNR) indicates that approximately 25 fishermen harvested blue crab in ocean waters in the winter months of 2009 (George, 2010). These fishermen collectively placed about 400 to 500 traps in Federal waters; the same fishermen fished roughly three times as many pots in state waters. Based on this survey, DNR estimates that roughly 12 to 25 fishermen might fish a portion of their traps in Federal waters at some point during the year. South Carolina data show even fewer vessels operating in Federal waters; in 2010, only one vessel fished in South Carolina's ocean waters, suggesting that activity in Federal waters was negligible that year.

The prohibition on overnight sets would likely eliminate fishing for blue crab in Federal waters, since returning gear to port each night is impractical. In years when the crabs' migration falls short of Federal waters, this would have little or no impact on landings. In others, however, the prohibition on overnight sets in Federal waters would force fishermen to restrict their effort to state waters, and would likely lead to a reduction in landings. Characterizing the landings loss is difficult given the lack of location-specific data and the annual variation in fishing conditions. A rough, upper-bound estimate for the Georgia fishery is possible using the limited data

[14] This figure is based on the list price for a 1,000-foot spool of Osprey #8 sinking crab pot rope, as specified by a supplier in North Carolina (mikekellerltd.com).

[15] State fisheries experts indicate that blue crab fishermen typically report the estuary in which they set most of their gear as the location of their activity. This may explain the absence of Logbook data on crabbing activity in Federal waters.

[16] Personal communication with Clay George and Doug Haymans, Georgia Department of Natural Resources, December 19, 2013.

available. In 2009 (the year of the DNR survey), about 65 crabbers fished during the winter months (December through March). The DNR survey estimates that a maximum of 25 of these fishermen (38 percent) fished in Federal waters. The survey also suggests that these fishermen fished about one-quarter of their traps in Federal waters; this is equivalent to approximately 9.5 percent of all gear fished during the winter period. NMFS dealer data indicate that Georgia crabbers landed about $896,000 in blue crab during the winter of 2009. Pro-rating this figure suggests that gear set in Federal waters accounted for approximately $85,000 in gross revenue during 2009. It is unlikely, however, that all of this revenue would be lost. Some might be recovered by relocating gear to state waters during the winter months, and some might be recovered at other times of the year, as the crabs return inshore. Overall, the prohibition on overnight sets could prevent a small subset of crabbers from maximizing their harvests in certain years, but it is unlikely to create substantial economic losses in the fishery.

Given these considerations, the quantitative economic impact estimates presented in this chapter do not include gear conversion or other costs related to potential new requirements in the Southeast. The only costs for Southeast blue crab and OTP vessels that are incorporated into these estimates are those associated with new gear marking provisions, which under Alternatives 2 through 6 (Preferred) would apply to all fisheries that are subject to ALWTRP requirements (see discussion below).

6.2.4.5 Exemption for New Hampshire State Waters

As previously noted, Alternatives 3, 5, 6 (Draft), and 6 (Preferred) would exempt trap/pot gear in New Hampshire state waters from minimum trawl length requirements. Alternatives 3, 5, and 6 (Draft) also would exempt gear in these waters from all other provisions of the ALWTRP except for gear marking requirements. While the economic analysis takes the exemption from minimum trawl length requirements into account in estimating the costs of complying with Alternatives 3, 5, 6 (Draft), and 6 (Preferred), it does not attempt to estimate potential cost savings associated with exempting gear in New Hampshire waters from the ALWTRP's existing gear requirements (e.g., the requirement to use sinking groundline). It is likely that an exemption from these requirements would reduce operating costs for vessels fishing in New Hampshire waters. To the extent that this is the case, the analysis of gear conversion costs will overstate the costs of complying with Alternatives 3, 5, and 6 (Draft).

6.2.4.6 Buffer Areas for Maine Islands

Alternative 6 (Preferred) would establish quarter-mile buffer areas around three Maine islands: Matinicus Island, Ragged Island (located adjacent to Matinicus), and Monhegan Island. Vessels fishing in these areas would not be subject to minimum trawl length requirements. The rationale for the buffers, described further in Chapter 3, focuses on the likely absence of whales in close proximity to these islands and bottom conditions that favor the use of single traps.

Relative to the other action alternatives, the designation of a quarter-mile buffer zone around Matinicus, Ragged, and Monhegan Islands would reduce compliance costs for vessels fishing singles in these waters. The effect is difficult to quantify, since the available data on the location of trap/pot activity is insufficiently precise to characterize the concentration of gear within these areas. Those familiar with the islands, however, note that the quantity of gear likely to be set within the buffer areas is small. Experts at the Island Institute, a non-profit organization devoted to protecting Maine's remote island and coastal communities, indicate that only five to 10 lobstermen work the waters around Monhegan.[17] Likewise, only about 10 to 15 lobstermen fish the waters surrounding Matinicus and Ragged Islands. Those fishing closest to the islands (many of whom are nearing retirement or are young entrants learning the trade) tend to use smaller vessels and fewer traps, further limiting the quantity of gear affected.[18] Thus, while the establishment of buffer areas would likely reduce compliance costs for a small number of vessels, this measure is unlikely to have a substantial impact on compliance costs for the lobster fishery as a whole and is not taken into account in estimating the cost of complying with Alternative 6 (Preferred).

6.3 ANALYTIC APPROACH: SEASONAL CLOSURES

As described in detail in Chapter 3, Alternatives 3 through 6 (Preferred) include provisions that would close certain areas to trap/pot gear during specified periods. Analysis of available data on vessel activity indicates that the practical impact of these provisions would be limited to the lobster fishery, since vessels in other trap/pot fisheries do not appear to be active in the areas of interest when a closure would be in effect. How a lobster vessel is likely to respond to a given closure depends on the features of the closure as well as the unique economic incentives facing the vessel operator. In general, vessel operators will likely choose one of two responses:

- **Relocate –** It may be possible for vessel operators to fish for lobster in other areas during the closure period. The potential for relocation depends on many factors, including regulatory restrictions on access to alternative areas, the distance to those grounds, the productivity of the grounds, and the potential for competition with others to limit access to a new area.

- **Suspend Fishing –** If alternative fishing grounds are not readily available, vessel operators may suspend fishing while their regular grounds are closed and resume fishing in the area when the closure ends.

These responses have different implications for economic welfare, and affected fishermen may respond differently, depending upon individual circumstances. The discussion that follows examines this issue, beginning with a brief review of the literature on the effect of area closures on commercial fisheries. It then describes the general approach the analysis employs to analyze the costs associated with closures. Finally, it examines each of the proposed closures individually, describing how affected vessels are likely to respond.

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[17] Personal communication with Nick Battista, Marine Programs Director, Island Institute, November 25, 2013.

[18] The waters around Monhegan Island are governed by a conservation agreement established by the Maine Department of Marine Resources and the Maine Legislature. The agreement limits fishing to 250 days from October to June and allows a maximum of 400 traps per vessel. Personal communication with Erin Summers, Maine Department of Marine Resources, January 13, 2014.

6.3.1 Review of the Literature on Closure Impacts

To inform the analysis of closure impacts, NMFS conducted a brief review of methods that other studies have employed to evaluate similar actions. Exhibit 6-10 summarizes the results of this review. The research identified no studies that employed methods directly applicable to analysis of the closures under consideration. In particular, none of the recent studies address the fisheries and areas that would be subject to seasonal closures under Alternatives 3 through 6 (Preferred). In addition, several of the studies apply quantitative methodologies requiring detailed, vessel-specific information on fishing location, landings, and other parameters. This type of information is not available for the vast majority of vessels that the closures under consideration would affect.

Despite these limitations, the literature identifies several concepts that help inform analysis of the economic impacts of a closure:

- First, most of the studies focus on two fundamental responses to closures: suspending fishing or relocating fishing effort. The analysis presented here examines both potential responses.

- Second, the studies emphasize the high degree of uncertainty regarding the potential impact of a closure. To reflect this uncertainty, the analysis applies methods that yield a range of estimated economic impacts.

- Finally, at least one study found a tendency for affected vessels to relocate to the perimeter of the closed area. As discussed below, we apply a similar assumption as a default when available data do not allow a more detailed analysis of relocation options.

Exhibit 6-10

LITERATURE ON FISHERY CLOSURE IMPACTS

Author	Year	Fishery	Approaches and/or Major Findings
NMFS	2006	Sea Scallop Dredge Fishery (Mid-Atlantic)	Study assumed that 100 percent of affected vessels would cease fishing during the May through November scallop closure in the Mid-Atlantic.
Power and Abeare	2009	Various	Study applied an Ideal Free Distribution model to assess closure effects. This technique uses optimization methods to predict where vessels will relocate. The approach assumes that vessels will move to locations that offer the greatest catch or profitability.
Murawski, et al.	2008	Groundfish (New England)	Study examined redistribution of effort in response to 1994 groundfish closure in New England. It found evidence of effort intensification within five kilometers of the closed area.
Goni, et al.	2006	Spiny Lobster (Mediterranean)	Study found that vessels initially congregated around the closed area but later relocated to avoid traffic and congestion.
Rijnsdorp, et al.	2001	Dutch Beam Trawl	Study demonstrates the potential for temporal shifts in effort following a closure. Dutch trawlers quickly returned to a cod fishing area after a seasonal closure and fished the area intensively for approximately two weeks thereafter.

6.3.2 Costs of Suspending Fishing

Fishermen may respond to closures by suspending fishing during the closure period. The forgone revenue associated with inactivity would be the primary cost for fishermen who choose to sit out closures. The sections below describe the general methodological approach used to estimate costs for trap/pot vessels that suspend fishing activity.

6.3.2.1 Catch per Trap

The analysis of the cost of suspending fishing is based on estimates of revenue per trap, which are then used to estimate forgone revenue based on the number of traps fished on affected vessels. The estimates of revenue impacts are tailored to the area and season each closure would affect. In each case, the analysis incorporates catch-per-trap estimates based on the best available data. For the Jeffreys Ledge (Alternative 4 & 5) and Jordan Basin (Alternative 4 & 5) closures, the analysis relies upon data from GMRI's 2005 survey of lobster fishermen. Respondents fishing in LMAs 1, 2, and 3 reported their average landings and traps fished during each quarter of the year; Exhibit 6-11 summarizes the survey findings and the resulting estimates of catch per trap. To estimate catch per trap during the closure period, the analysis weights the relevant quarterly catch-per-trap figures to conform to the period of each closure and the relevant LMA. For example, the analysis of the Jeffreys Ledge closure is based on the catch-per-trap data for LMA 1, applying weights of 1.0 to the fourth quarter catch-per-trap figure (October through December) and 0.33 to the first quarter figure (January).

Exhibit 6-11

CATCH PER TRAP ESTIMATES BASED ON GMRI SURVEY

LMA	Number of Survey Respondents	Quarter	Traps per Vessel	Pounds Landed	Catch per Trap (Pounds)
1	N=918	1	443	859	1.9
		2	481	2,909	6.0
		3	557	11,071	19.9
		4	550	10,678	19.4
		Annual	557	25,517	45.8
2	N=205	1	367	784	2.1
		2	394	1,937	4.9
		3	450	4,846	10.8
		4	448	2,539	5.7
		Annual	450	10,106	22.5
3	N=33	1	1,041	5,618	5.4
		2	1,030	12,066	11.7
		3	1,055	25,970	24.6
		4	1,035	29,497	28.5
		Annual	1,055	73,151	69.3

For the closure of the Cape Cod Bay Restricted Area (Alternative 3), Massachusetts Restricted Area #1 (Alternatives 4 & 5), and Massachusetts Restricted Area #2 (Alternative 6 Draft and 6 Preferred), the analysis incorporates catch per trap estimates based on Massachusetts DMF's Catch Report data. Using 2011 data, DMF compiled information for each statistical reporting area (SRA) on landings and traps fished in each month. These data enable estimation of catch per trap figures that are tailored to the specific geographic areas and months affected by each closure. Specifically, the catch-per-trap estimate for each closure is a weighted average of the seasonal catch per trap in the affected SRAs. The weights represent the percent of all the gear affected by the closure that is associated with the given SRA. For instance, if gear from SRA 6 represents 10 percent of all the gear displaced by the closure in February, a weight of 0.1 is applied to the February SRA 6 catch per trap figure. The weights are developed using NMFS' Vertical Line Model. Exhibit 6-12 presents the final catch per trap figures estimated for each of the Cape Cod closures.

Exhibit 6-12

CATCH PER TRAP ESTIMATES FOR CAPE COD CLOSURES

Area	Months	Regulatory Alternatives	Affected SRAs	Catch per Trap During Closure Period (Pounds)
CCB Restricted Area	Feb - Apr	3	6, 7, 8, 19	2.77
Massachusetts Restricted Area #1	Jan - Apr	4 & 5	5, 6, 7, 8, 9, 10, 18, 19	6.08
Massachusetts Restricted Area #2	Jan - Apr	6 Draft and 6 Preferred	5, 6, 7, 8, 9, 18, 19	6.08
Source: Analysis of Massachusetts DMF Catch Report data (2011).				

6.3.2.2 Revenue per Trap

Catch per trap is combined with ex-vessel price data to estimate gross revenue per trap. At the time this analysis was developed, the NMFS Dealer data provided ex-vessel prices through 2011. To characterize typical market conditions, the analysis incorporates price data for the three most recent years available (2009 to 2011).[19] To align prices with the area-and season-specific catch-per-trap data, the analysis uses ex-vessel price data from the states and months relevant to each closure.

Gross revenue per trap is the product of the catch per trap and the applicable ex-vessel price for each closure. A final adjustment is needed to convert gross revenue per trap to net revenue per trap. Fishermen who suspend fishing during closures will forgo revenue but will save the operating costs associated with the effort (while continuing to pay fixed costs such as boat payments). Operating costs are the costs that vary with fishing effort, and primarily include bait, fuel, and payments to sternmen (when relevant). The GMRI survey (as summarized in Thunberg, 2007) characterized operating costs as a percent of gross revenue for each of the three major LMAs, as shown in Exhibit 6-13. Operating costs as a percent of gross revenue range

[19] All price information is adjusted to 2011 dollars using the Gross Domestic Product Implicit Price Deflator index provided in the Economic Report of the President, 2012.

from a total of 23 percent (LMA 2, no sternman aboard) to a high of 56 percent (LMA 3, sternmen aboard).[20]

Exhibit 6-13 OPERATING COSTS AS A PERCENT OF GROSS REVENUE					
	LMA 1		LMA 2		LMA 3
Cost Element	No Sternman	Sternman	No Sternman	Sternman	Sternman
Sternman Pay	N.A.	21%	N.A.	17%	32%
Fuel and Bait	26%	23%	23%	21%	24%
Total	26%	44%	23%	38%	56%
Source: Thunberg, 2007					

The analysis applies these figures to the estimates of gross revenue per trap to calculate revenue per trap net of operating cost savings. Lacking definitive data on crew size, the analysis applies the mid-point of the "with sternman" and "without sternman" figures to estimate revenue per trap net of operating cost savings.[21]

Exhibit 6-14 summarizes the parameters used to estimate lost revenue per trap for each closure. As discussed further below, the analysis includes a closure-specific estimate of the number of traps fished per vessel. Thus, the impact of the closure on the net revenue of each affected vessel is the product of the number of traps the vessel would ordinarily fish in the closed area and the estimate of forgone revenue per trap, net of operating cost savings.

6.3.2.3 Transition Costs

In addition to costs incurred within the closure period, vessels suspending fishing will likely incur transition costs preceding and following the closure. Specifically, vessels will need to remove gear from the closed area in advance of the closure start date in order to ensure that no gear remains in the restricted area when the closure begins. Likewise, at the end of the closure period, vessels returning gear to the restricted area will reset it incrementally until all traps are in place.

Based on discussion with NMFS gear experts, the analysis assumes that most lobster vessels can haul/remove 60 traps per trip and set 80 traps per trip.[22] For instance, if a vessel

[20] Note that these figures are consistent with those reported in earlier studies. In 1995, a University of Rhode Island study estimated operating costs of 34 percent, 32 percent, and 71 percent, respectively, for the northern inshore, southern inshore, and offshore segments of the lobster fishery. In 1989, Liebzeit and Allen found percentages ranging from 30 to 56 percent, depending upon the state (Massachusetts and Rhode Island) and vessel size.

[21] Most vessels in regulated waters fish with a sternman aboard; therefore, the estimates of lost revenue per trap may slightly overstate the loss most vessels would incur.

[22] The analysis assumes that any large offshore vessels affected by a closure would be capable of pulling or resetting 120 traps per trip.

fishes 300 traps, it can remove these traps over the course of five days. As more traps are removed, the loss in net revenues increases. Similarly, net revenue losses diminish as traps are reset. The magnitude of transition costs for each particular closure is a function of the total number of traps that affected vessels fish, as well as the unique net revenue per trap figures that apply to the closure.

6.3.2.4 Caveats

Ex-vessel prices for lobster are a key factor in estimating the losses associated with suspending fishing. The estimates of net revenue per trap employed in this analysis are based on 2009 to 2011 price data, the most recent data available at the time the analysis was developed. Prices during 2012 trended lower; ex-vessel prices during the summer of 2012 were reported in some areas of Maine to have gone as low as $1.50 per pound. Most observers consider this decline to have been anomalous, partly the product of the early arrival of shedder (soft-shell) lobsters ahead of tourist season (Associated Press, 2012). Nonetheless, a downward trend in prices is possible. All else equal, continuation of that trend would lead the analysis to overstate future losses in net revenue.

It is also important to note that the analysis of the revenue losses associated with suspending fishing assumes that fishermen lose all the catch they would ordinarily harvest during the closure period. The loss in landings may actually be less, depending on lobster movements and behavior. Specifically, some of the lobsters not caught during the closure may simply be harvested once the closed area is reopened (i.e., catch rates may be higher than normal following the closure). To the extent that this occurs, the analysis may overstate the economic losses associated with suspending fishing.

Exhibit 6-14

DERIVATION OF LOST REVENUE PER TRAP FOR THE ASSESSMENT OF CLOSURE-RELATED ECONOMIC LOSSES

Area	Closure Period	Catch Per Trap During Closure (Pounds)	Basis For Catch Per Trap	Ex-Vessel Price	Basis For Ex-Vessel Price	Gross Revenue Per Trap During Closure	Operating Cost as a % of Gross Revenue	Basis for Operating Cost	Lost Revenue per Trap (Gross Net of Operating Cost)
CCB Restricted Area (Alternative 3)	Feb 1 – Apr 30	2.77	Weighted average of SRAs 6, 7, 8 and 19 using DMF Catch Report data	$4.85	Average MA ex-vessel price, Feb through Apr (2009 to 2011)	$13.44	35.0%	Midpoint (with and without sternman) of LMA 1 vessels as estimated in Thunberg (2007)	$8.74
Jeffreys Ledge (Alternatives 4 & 5)	Oct 1 – Jan 31	20.1	Weighted average of GMRI quarters 4 and 1 for LMA 1	$3.33	Average ME, NH, and MA ex-vessel price, Oct through Jan (2009 to 2011)	$66.71	35.0%	Midpoint (with and without sternman) of LMA 1 vessels as estimated in Thunberg (2007)	$43.36
Jordan Basin - LMA 3 waters (Alternatives 4 & 5)	Nov 1 – Jan 31	20.8	Weighted average of GMRI quarters 4 and 1 for LMA 3	$3.37	Average ME ex-vessel price, Nov through Jan (2009 to 2011)	$70.02	56.0%	LMA 3 vessels as estimated in Thunberg (2007)	$30.81
Jordan Basin - LMA 1 waters (Alternatives 4 & 5)	Nov 1 – Jan 31	13.6	Weighted average of GMRI quarters 4 and 1 for LMA 1	$3.37	Average ME ex-vessel price, Nov through Jan (2009 to 2011)	$45.75	35.0%	Midpoint (with and without sternman) of LMA 1 vessels as estimated in Thunberg (2007)	$29.74
Massachusetts Restricted Area #1 (Alternatives 4 & 5)	Jan 1 – Apr 30	6.08	Weighted average of SRAs 5, 6, 7, 8, 9, 10, 18 and 19 using DMF Catch Report data	$4.72	Average MA ex-vessel price, Jan through Apr (2009 to 2011)	$28.72	32.8%	Midpoint (with and without sternman) of LMA 1 and 2 vessels as estimated in Thunberg (2007)	$19.31
Massachusetts Restricted Area #2 (Alternative 6 Draft & 6 Preferred)	Jan 1 – Apr 30	6.08	Weighted average of SRAs 5, 6, 7, 8, 9, 18 and 19 using DMF Catch Report data	$4.72	Average MA ex-vessel price, Jan through Apr (2009 to 2011)	$28.72	32.8%	Midpoint (with and without sternman) of LMA 1 and 2 vessels as estimated in Thunberg (2007)	$19.31

6.3.3 Relocation Costs

The distance that a vessel must travel to reach alternative fishing grounds during a closure is likely to differ from the distance it would ordinarily travel to reach fishing grounds within the closed area. This implies a potential change in two major operating costs: fuel and time. The general approach to evaluating these changes is discussed below, focusing on parameters that remain constant regardless of the closure in question. Later sections discuss key parameters unique to each closure.

6.3.3.1 Fuel Costs

One potential impact of relocating effort during a closure is a change in operating costs associated with fuel consumption. This is a function of the change in distance that a vessel operator must steam in order to tend his or her gear, the number of trips taken during the period in question, the vessel's fuel efficiency, and the price of fuel.

The impact of each closure on the distance that vessel operators must steam to tend their gear is determined on a case-by-case basis, taking into consideration the ports from which affected vessels are known or are likely to operate, the distance from these ports to the area affected by the closure, and the distance from these ports to alternative areas. Additional information on the areas to which the analysis assumes vessels would relocate is provided in the detailed discussion of the analysis of each closure. In all cases, however, the method assumes that relocation to the substitute fishing area is temporary, and that the affected vessels will return to their preferred fishing grounds when the closure has ended.

Once the alternative fishing location is identified, the total change in distance traveled depends on the number of fishing trips made during the closure period. The GMRI survey asked fishermen how many trips they took per week during each quarter of the year, dividing the responses by LMA. The analysis uses the survey data to estimate the number of affected trips, tailoring the estimate to correspond with the location and timing of each closure.

Any change in fuel costs also depends on the fuel-efficiency of the affected vessels, which is a function of engine size (horsepower). Information on the engines with which affected vessels are equipped is not available; however, it is possible to estimate the horsepower of affected vessels based on the general correlation between horsepower and vessel length. The analysis employs an equation characterizing this relationship, using it, in combination with an estimate of the average length of affected vessels, to estimate the horsepower of vessels that may relocate their effort while a closure is in effect.

Consistent with data from a recent study by the Maine Maritime Academy (MMA, 2011), the analysis assumes that marine engines burn 0.053 gallons of diesel fuel per hour for each unit of horsepower delivered. The analysis uses this figure to estimate total fuel use per hour for all affected vessels. Based on input from NMFS gear specialists, the analysis also assumes that vessels steam at an average speed of 14 knots. This figure, in combination with data on distances, provides a basis for estimating the change in steaming time to and from alternative fishing grounds. The analysis then multiplies this figure by the estimate of diesel use per hour to obtain an estimate of the change in fuel use per trip.

Multiplying fuel use per trip by the number of trips and price of diesel fuel yields the change in fuel costs. The analysis is based on a retail diesel price of $3.93 per gallon, the mean of the weekly prices recorded for New England from October 2010 through October 2012 (EIA, 2012). In calculating the change in costs attributable to each regulatory alternative, the analysis uses the pre-tax price of diesel fuel; state and Federal fuel taxes are excluded from the analysis, since these taxes represent a transfer payment rather than a true social cost. The pre-tax fuel price employed in the analysis of each closure varies with the region affected. For instance, in the case of the closures affecting vessels in the Cape Cod region, the price employed is the Massachusetts pre-tax price.

Exhibit 6-15

SUMMARY OF FUEL USE PARAMETERS USED IN CLOSURE COST ASSESSMENT

Parameter	Value/Estimation Method	Source
Horsepower (Lobster Vessels)	HP = -16.3566 + 9.71*(Vessel Length in Feet)	NMFS Permit Data (2011)
Fuel Consumption at Cruising Speed	0.053 gallons/hour/HP	Maine Maritime Academy, 2011
Typical Cruising Speed (Lobster Vessels)	14 knots	NMFS Gear Specialists
Retail Price for Diesel Fuel	$3.93 per gallon	Energy Information Administration, 2012
State and Federal Fuel Taxes: Maine	57.1 cents per gallon	American Petroleum Institute, 2012
State and Federal Fuel Taxes: Massachusetts	47.9 cents per gallon	American Petroleum Institute, 2012
Pre-Tax Diesel Price: Maine	$3.36 per gallon	Derived from above
Pre-Tax Diesel Price: Massachusetts	$3.45 per gallon	Derived from above

6.3.3.2 Time Costs

Steaming to alternate fishing grounds is also likely to alter the time that an affected vessel's captain and crew spend on the water. This change is a function of the change in travel distance and vessel speed (see above). Combining this information with information on the number of trips taken during the closure period yields an estimate of the overall change in time at sea. The analysis values this time as follows:

- The captain's time is valued using the opportunity cost ($22.48 per hour) estimated for the gear conversion analysis discussed above. This figure is a weighted average of wage rates in a variety of alternative occupations identified in the GMRI survey.

- The analysis also incorporates the opportunity cost of sternmen's time. Each hour of this time is valued at $14.53, the mean hourly wage for

Fishers and Related Fishing Workers (BLS, May 2011).[23] The number of sternmen per vessel is estimated based on closure-specific data, as discussed below.

The opportunity cost of labor is an appropriate cost component in a welfare economic framework; however, neither the captain nor sternmen are paid on an hourly basis. Instead, they typically are paid a portion of either the gross or net revenue for each trip. Fishermen's actual take-home pay will vary only to the extent that catch varies. As such, labor costs are an implicit cost rather than an out-of-pocket expense for the vessel operator.

6.3.3.3 Transition Costs

In addition to costs incurred within the closure period, vessels that relocate their effort will likely incur additional costs preceding and following the closure, both in moving their traps to a new location and returning them to their original location when the closure ends. The relocation of gear is likely to take place incrementally, with a portion of the affected traps moved each trip until all traps are relocated.

The fuel and time costs associated with moving gear to and from alternate fishing grounds are a function of several factors:

- Vessel size (and deck space), which determines the number of traps that can be moved in a single trip;
- The total number of traps that must be moved; and
- The additional distance traveled in order to relocate gear each trip.

The total number of traps affected and the quantity of gear that can be transported each trip determines the number of trips that must be made in order to relocate the gear displaced by the closure. Based on discussions with NMFS gear experts, the analysis assumes that most trap/pot vessels can transfer 40 traps per trip; for larger offshore vessels, the analysis assumes relocation of 120 traps per trip. Multiplying the number of trips required by the extra distance traveled each trip allows estimation of the added fuel and time costs, applying the same parameters discussed above.

6.3.3.4 Catch Impacts

It is also possible that relocating vessels will experience a reduction in catch relative to their preferred fishing location inside the closed area. Catch reductions could result because of crowding and heightened competition in the areas to which fishermen relocate; because fishermen are less familiar with the bottom structure or other determinants of catch in the new

[23] No reliable information exists on alternative occupations for sternmen, and the value of the captain's time likely overstates the opportunity cost for sternmen. Hence, the analysis incorporates the average wage rate in the fishing sector.

area; or simply because the alternative fishing grounds available are less productive than those inside the closed area.

The data required to develop a rigorous estimate of potential catch impacts are not available. Such an estimate would require a well-defined characterization of catch rates in the closed area and similar knowledge of conditions (e.g., lobster density) in a specific alternative fishing area. In practice, the potential impact is likely to vary significantly from individual to individual, depending upon the fisherman's expertise and ability to adapt to a new area. As a result, any catch reduction estimated for vessels that relocate their effort is subject to significant uncertainty.

Lacking more specific data, the analysis assumes that vessels which choose to relocate would experience a 20 percent reduction in catch during the closure period. The revenue loss per vessel is estimated by multiplying the gross revenue per trap figures (summarized earlier in Exhibit 6-14) by the number of traps fished per vessel.

6.3.3.5 Caveats

In addition to the assumptions noted above, the analysis of relocation costs is based on a number of other assumptions that are subject to considerable uncertainty. These include:

- The assumption that fishermen would reconfigure their gear, as necessary, to meet the minimum trawl length requirement in any area to which they relocate, but would incur no gear conversion costs beyond those associated with meeting these requirements;

- The assumption that fishermen who relocate their effort would continue to fish the same number of traps they used in the closed area.

- The assumption that fishermen will continue to make the same number of fishing trips while using the alternate location.

The net effect of these assumptions on the cost estimates is unclear. The methodological discussion for each of the individual closures highlights additional uncertainties associated with the selection of specific relocation sites for affected vessels.

6.3.4 Analysis of Specific Closure Scenarios

Vessel operators are likely to respond to the closure of a particular area in the way they believe would have the least adverse impact on their income, subject to financial, regulatory, and other constraints on the options available to them. Their responses will depend not only on the nature of their fishing operations (e.g., fishery, vessel type, quantity of affected gear) but also on the features of the closure itself (area and time period). The variety of possible outcomes and the large number of potentially affected fishermen precludes a vessel-by-vessel analysis of likely responses.

As noted above, this analysis examines two general response scenarios to evaluate the potential impact of closures: relocation or suspension of fishing effort. Within that framework, however, the analysis of economic impacts seeks to recognize key variables that may differ from case to case, such as the number of vessels a particular closure would affect, the scale of the fishing operations affected, regional differences in the prices that affected vessels may receive for their catch, and the availability of alternative fishing sites. The sections below discuss each closure individually, focusing on unique aspects of the approach to analyzing their potential impacts.

6.3.4.1 Jordan Basin Restricted Area

The closure of the Jordan Basin Restricted Area to trap/pot gear from November through January is an element of Alternatives 4 and 5. As shown in Exhibit 6-16, the closure would extend over a 725 square-mile area in the northern portion of LMA 3, immediately adjacent to Maine Lobster Zones C and D. A small portion of Zone C, which is located in LMA 1, is also included in the closure area.

The Vertical Line Model estimates that on average five vessels fish in the Jordan Basin Restricted Area during the period the area would be closed: one in LMA 3 and four in LMA 1.[24] The distinction between LMA 3 and LMA 1 waters has important implications in estimating closure costs, since vessels that operate in LMA 3 are typically larger, fish a larger number of traps, and harvest more lobster per trap during the closure period than vessels in LMA 1. Exhibit 6-17 summarizes the parameters employed to estimate costs for each category of vessel.

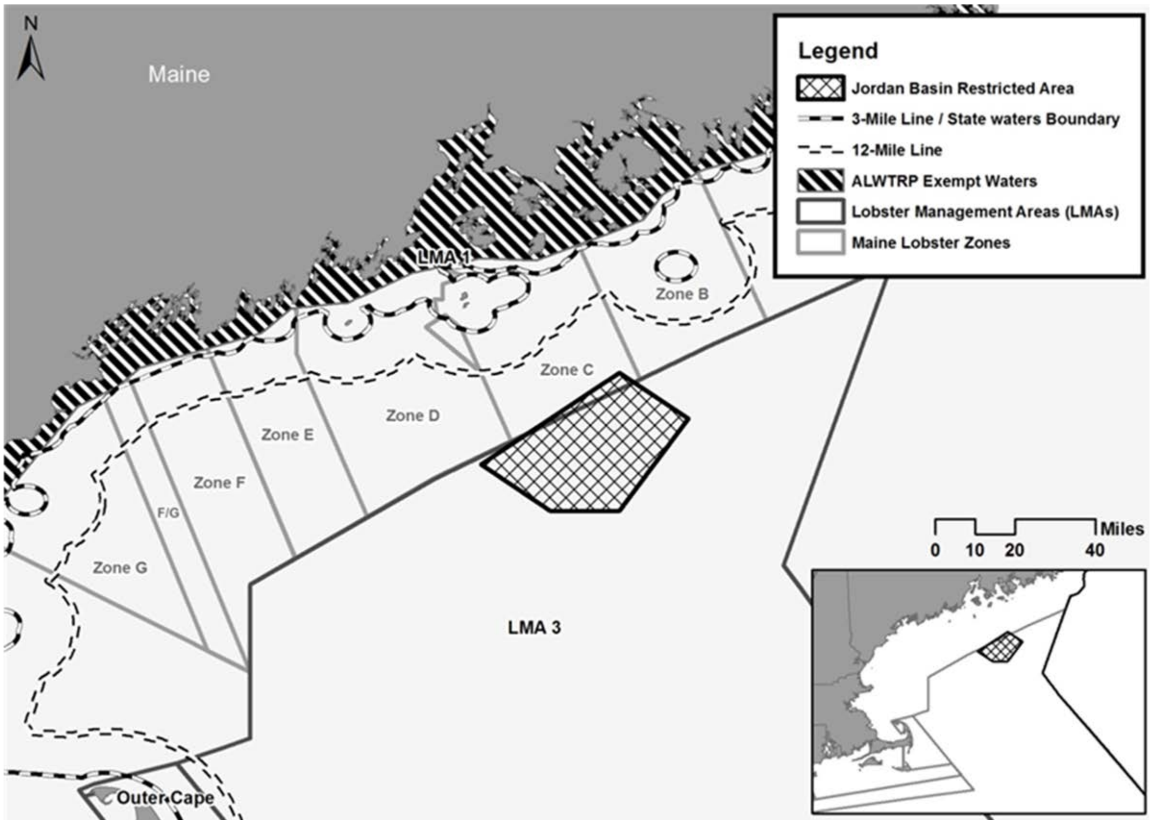
Detailed information on lobster vessels active in the Jordan Basin area is generally not available, making it difficult to predict how vessels potentially affected by a closure would respond.[25] In the absence of better information, the analysis takes a bounding approach to assessing the decision to relocate or suspend fishing. In the upper bound, the analysis assumes that all affected vessels would suspend fishing during the closure and forgo the revenue (net of operating cost savings) on the lobster they would have otherwise landed. This is a highly conservative assumption, since vessels operating in these waters would likely be capable of reaching alternate fishing grounds. The incentive for these vessels to relocate their traps rather than suspend operations from November through January is also likely to be strong, since prices during this period tend to be higher than in the summer or early fall.

[24] The number of vessels that fish a portion of their gear in the Jordan Basin area may exceed this estimate. For purposes of analysis, however, the estimate of affected vessels is presented on a full-time equivalent basis. For additional information on the characterization of vessel activity, see the documentation for the Vertical Line Model.

[25] Unlike other commercial fishing permits, Federal lobster permits currently impose no trip report requirements. Information on the location of trips taken by vessels that hold Federal lobster permits is limited to those that also hold permits for fisheries that require trip reports. The Vertical Line Model assumes that the activity of vessels that do not file trip reports is evenly distributed across the LMA for which the permits were issued. The estimate of activity in the Jordan Basin area – particularly in LMA 1 – is based primarily on this approach. For additional information, see the documentation for the Vertical Line Model.

Exhibit 6-16

JORDAN BASIN RESTRICTED AREA



As an alternative to suspending operations, the lower bound of the analysis assumes that the vessels affected by the Jordan Basin closure would relocate their effort to new grounds. Specifically, the offshore vessel would relocate its effort to LMA 3 waters immediately outside the closed area. Likewise, the LMA 1 vessels would relocate their effort to waters north and east of the closed area, in Maine Lobster Zone C. The analysis estimates the additional time and fuel costs these vessels would incur each year to transfer their gear to these alternative locations, as well as the costs they would incur to return the gear to the restricted area when the closure period ends. The additional distance traveled each trip in moving gear between the restricted and unrestricted areas is estimated as the average distance from the centroid of the closed area to the surrounding waters; this distance is developed separately for LMA 3 and LMA 1 vessels. Absent information on the home ports of the affected vessels, the analysis assumes that the relocation of gear has no material effect on steaming time to and from port; i.e., no additional fuel or time costs are incurred when fishing in the new locations.

Exhibit 6-17

SUMMARY OF PARAMETERS AFFECTING CLOSURE COSTS: JORDAN BASIN

Area	Parameter	Value	Basis
LMA 3	Closure Period	November - January	See Chapter 3
	Number of Affected Lobster Vessels (Full-Time Equivalent)	1	Vertical Line Model
	Percent of Vessels Relocating	Lower: 100% Upper: 0%	Bounding assumption
	Avg. Vessel Length (feet)	54	NMFS Permit data
	Avg. Vessel Horsepower	508	Estimated based on vessel length
	New Location(s)	LMA 3 waters surrounding closed area	GIS analysis
	Avg. Change in Roundtrip (miles)	0	N.A.
	Trips per Week	2.2	Weighted average for LMA 3 vessels in QI and QIV; GMRI, 2006
	Crew per Vessel (excluding captain)	2	GMRI, 2006
	Traps per Vessel	1,200	NMFS gear team; Vertical Line Model
	Traps Transferred per Trip	120	NMFS gear team
	Trips Required to Relocate Gear	20	(Traps/#Transferred per Trip)*2
	Distance Traveled to Relocate Gear (miles/trip)	18.1	GIS analysis
	Percent of Vessels Suspending Fishing	Lower: 0% Upper: 100%	Bounding assumption
	Revenue Lost per Trap, Net of Operating Cost Savings, when Vessels Suspend Fishing	$30.81	Analysis of NMFS Dealer data; average catch per trap for LMA 3 vessels in GMRI survey; operating costs based on Thunberg (2007)
	Net Revenue Lost per Trap when Fishing Alternate Areas	$14.00	Assumes 20 percent reduction in baseline revenue per trap; revenue per trap determined by analysis of GMRI survey data and NMFS Dealer data

Exhibit 6-17
(continued)

SUMMARY OF PARAMETERS AFFECTING CLOSURE COSTS: JORDAN BASIN

Area	Parameter	Value	Basis
LMA 1	Closure Period	November - January	See Chapter 3
	Number of Affected Lobster Vessels (Full-Time Equivalent)	4	Vertical Line Model
	Percent of Vessels Relocating	Lower: 100% Upper: 0%	Bounding assumption
	Avg. Vessel Length (feet)	39	Maine DMR Annual Logs Survey and Permit data
	Avg. Vessel Horsepower	362	Estimated based on vessel length
	New Location(s)	LMA 1 waters surrounding closed area	GIS analysis
	Avg. Change in Roundtrip (miles)	0	N.A.
	Trips per Week	3.16	Weighted average for LMA 1 vessels in QI and QIV; GMRI, 2006
	Crew per Vessel (excluding captain)	1.5	GMRI, 2006 and Maine DMR Annual Logs Survey and Permit data
	Traps per Vessel	484	Maine DMR Annual Logs Survey
	Traps Transferred per Trip	40	NMFS gear team
	Trips Required to Relocate Gear	24	(Traps/#Transferred per Trip)*2
	Distance Traveled to Relocate Gear (miles/trip)	8.6	GIS analysis
	Percent of Vessels Suspending Fishing	Lower: 0% Upper: 100%	Bounding assumption
	Revenue Lost per Trap, Net of Operating Cost Savings, when Vessels Suspend Fishing	$29.74	Analysis of NMFS Dealer data; average catch per trap for LMA 1 vessels in GMRI survey; operating costs based on Thunberg (2007)
	Net Revenue Lost per Trap when Fishing Alternate Areas	$9.15	Assumes 20 percent reduction in baseline revenue per trap; revenue per trap determined by analysis of GMRI survey data and NMFS Dealer data

For purposes of calculating the impact of relocating gear on fishermen's time, the LMA 3 vessel is assumed to carry a captain and two sternmen. The average number of trips made each week (2.2) is based on data provided by LMA 3 respondents to the GMRI lobster survey; the figure is a weighted average of the frequency of trips reported for the fourth and first quarters of the year (GMRI, 2006).[26] For LMA 1 vessels, the same sources and approach are used to calculate trips per week (see Exhibit 6-17). Average crew (1.5) is based on crew data from the GMRI lobster survey as well as Maine permit data, which suggest that about half of the vessels in Zone C Federal waters fish with one sternman, while most others fish with two.

6.3.4.2 Cape Cod Restricted Areas

The regulatory alternatives under consideration incorporate several closures affecting waters around Cape Cod:

- **Alternative 3 –** the closure of the Cape Cod Bay Restricted Area from February through April;
- **Alternatives 4 & 5 –** the closure of Massachusetts Restricted Area #1 from January through April; and
- **Alternatives 6 Draft & 6 Preferred –** the closure of Massachusetts Restricted Area #2 from January through April.

Exhibit 6-18 shows the boundaries of these areas, while Exhibit 6-19 summarizes key features of the closures. The general approach used to assess the impact on affected vessels is the same for all the Cape closures; therefore, this section discusses the closures as a group.

As with other closures, the analysis of the impact of the Cape Cod closures first considers the costs that affected vessels would incur if they chose to suspend fishing for the duration of the closure. This approach provides an upper-bound estimate of potential impacts, since it assumes that fishermen would forgo all revenue (net of operating cost savings) for the catch normally harvested during the closure period.

For a lower-bound estimate of closure impacts, the analysis assumes that at least a portion of the affected vessels would relocate their effort while the closure is in effect. Massachusetts DMF Catch Report data from 2009 provide the foundation for this analysis. The data provide information on approximately 80 percent of commercial fishing vessels that landed their catch in Massachusetts in 2009.[27] Vessel operators reported a variety of information, including the statistical reporting areas (SRAs) and months in which they fished. The analysis employs this information to help predict likely relocation responses for affected vessels.

[26] The GMRI survey included only 33 respondents fishing in LMA 3. This small sample size may affect the reliability of the parameters used to characterize impacts on offshore lobster vessels, although the direction of the bias is unclear.

[27] The data exclude 20 percent of active vessels that participated in a trip-level pilot reporting program in 2009.

Different methods are applied for vessels holding only a state permit versus those that hold a Federal permit. These methods are discussed further below.

Exhibit 6-18

CAPE COD CLOSURES

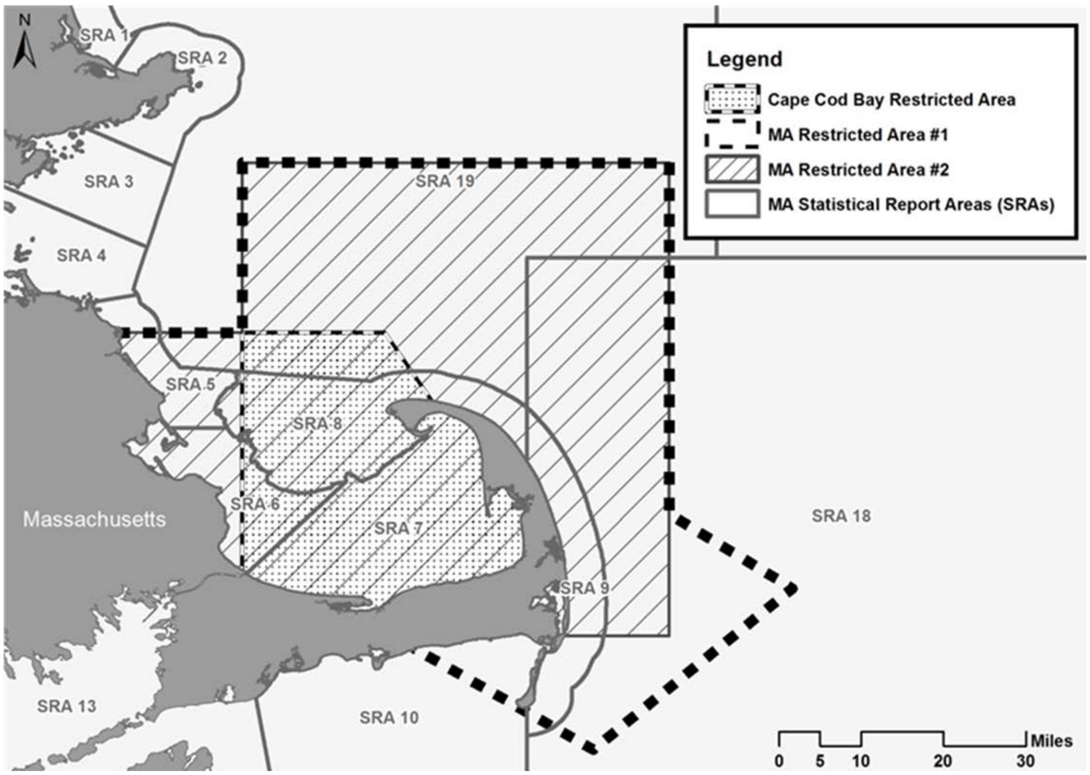


Exhibit 6-19 FEATURES OF CAPE COD CLOSURES			
Feature	**CCB Restricted Area**	**Massachusetts Restricted Area #1**	**Massachusetts Restricted Area #2**
Regulatory Alternative	3	4 & 5	6 Draft and 6 Preferred
Closure Period	February - April	January - April	January - April
Size (square miles)	644	2,464	2,161
Statistical Reporting Areas (MA SRAs with Over 25% of Waters Inside Closed Area)	6, 7, 8, 19	5, 6, 7, 8, 9, 10, 18, 19	5, 6, 7, 8, 9, 18, 19

Relocation of Vessels Holding Only a State Permit

Vessels holding only a state permit are authorized to fish exclusively in Massachusetts SRAs 1 through 14 (the inshore SRAs). Many of these vessels are relatively small, and their ability to relocate their effort within state waters – particularly in the winter and early spring –

may be constrained by safety considerations and practical limits on their range. To assess the potential for affected vessels to relocate, the analysis examines the distribution of their current effort, as reflected in the 2009 Catch Report data. If a vessel reports fishing in one or more SRAs that would remain open (in whole or in part) while a restricted area is closed, the analysis assumes that it would be possible for that vessel to relocate all of its effort outside the restricted area while the closure is in effect. Conversely, if the data show that, during the period of interest, a vessel fishes solely in SRAs that fall wholly within a restricted area, the analysis assumes that it would not be feasible for that vessel to relocate. SRA 7, for example, is fully contained within the Cape Cod Bay Restricted Area; the analysis assumes that all vessels that report fishing exclusively in this area from February through April would be forced to suspend fishing while the Cape Cod Bay Restricted Area is closed. Likewise, in the case of Massachusetts Restricted Areas #1 and #2, the analysis assumes that vessels that fish solely in SRAs 6, 7, and/or 8 from January through April would be forced to suspend fishing while these areas are closed. Exhibit 6-20 shows the resulting estimates of the percentage of affected vessels that would suspend fishing in response to each closure, as well as the percentage the analysis assumes could relocate.

Exhibit 6-20

PERCENT OF AFFECTED VESSELS IN STATE WATERS THAT ARE ASSUMED TO RELOCATE THEIR EFFORT DURING CAPE COD CLOSURES

Response	CCB Restricted Area	Massachusetts Restricted Area #1	Massachusetts Restricted Area #2
Suspend Fishing	17.1%	46.6%	47.4%
Relocate	82.9%	53.4%	52.6%

The analysis also relies on the 2009 Catch Report data to identify the SRAs to which vessels deemed able to relocate are likely to move their gear. The approach assumes that vessels will relocate their gear to new areas in proportion to their current distribution of gear, adjusting that distribution to take into account the share of each SRA that would remain open while a particular closure is in effect. This assessment involves the following steps:

- First, the analysis draws on the Catch Report data to develop a matrix illustrating the distribution of activity by SRA for vessels whose effort would be partially displaced by the closure. This distribution focuses solely on vessel activity during the months the closure would be in effect.

- The analysis adjusts this distribution to take into account the impact of the closure on the proportion of each SRA that remains open to fishing. For example, under Alternative 3, the closure of the Cape Cod Bay Restricted Area from February through April would leave 42 percent of SRA 6 open to fishing. Thus, the analysis adjusts the baseline distribution of vessel activity in SRA 6 by multiplying the baseline value by a factor of 0.42. Values for SRAs that would be entirely closed throughout the closure period are set to zero.

- The analysis then converts the resulting set of values to a frequency distribution by dividing the value for each SRA by the sum of the values across all SRAs. The results indicate the relative distribution of activity for affected vessels outside the restricted area, providing the basis for redistributing the effort the closure would displace.

Exhibit 6-21 shows the results of this process for each of the Cape Cod closures. The exhibit indicates that the majority of the effort displaced by the closure of the Cape Cod Bay Restricted Area would likely relocate to SRA 6. In contrast, the majority of the effort displaced by the closure of Massachusetts Restricted Area #1 or #2 would likely relocate to SRAs 4 and 5.

Exhibit 6-21

REDISTRIBUTION OF EFFORT FOR STATE PERMITTED VESSELS AFFECTED BY CAPE COD CLOSURES

SRA	CCB Restricted Area	Massachusetts Restricted Area #1	Massachusetts Restricted Area #2
4	5.4%	43.8%	41.8%
5	26.3%	51.4%	51.2%
6	59.2%	0.0%	0.0%
7	0.0%	0.0%	0.0%
8	7.7%	0.0%	0.0%
9	1.4%	2.2%	6.9%
10	0.0%	2.6%	0.0%

Once the locations for the redistribution of gear are established, the analysis uses GIS techniques to estimate impacts on trip distances and resulting changes in fuel and time costs. The closure cost assessment first requires information on the incremental distance that vessels will travel when moving traps to a new location. This extra distance is estimated by determining the distance from the centroid of the closed portion of each SRA to the centroid of the open portion of each SRA to which gear is assumed to be moved. The frequency distributions discussed above are then used to calculate the weighted average distance that affected vessels would be required to travel in order to relocate their gear.

The impact of each closure on the distance that displaced vessel operators must steam to tend their gear is determined as follows:

- First, the analysis calculates the weighted average distance from each relocating vessel's homeport to the closed portion of the SRA that the vessel vacates.

- Next, the analysis calculates the weighted average distance from each vessel's homeport to the centroid of the open portion of the SRA(s) to which it is assumed to relocate its displaced effort.

- Finally, the difference between these values serves as the estimate of the incremental distance traveled for each round trip.

It is important to note that this methodology yields small or even negative incremental travel distances for some vessels. This issue is explored further below.

Relocation of Vessels that Hold a Federal Permit

The Cape Cod closures would affect relatively small portions of Massachusetts SRAs 18 and 19, which lie in Federal waters. The Massachusetts Catch Report data are unlikely to reflect all activity in these waters; in particular, the data will not capture the activity of vessels that do not land their catch in Massachusetts. The available Federal data are also incomplete, since vessels that hold only a Federal lobster permit are not subject to Vessel Trip Report (VTR) requirements. In the absence of more complete data on activity in SRAs 18 and 19, the analysis employs a simplified approach to characterize the potential relocation of effort by vessels that hold a Federal permit. Specifically, the analysis assumes that these vessels will relocate their gear to the perimeter of the closed area, while remaining within the SRA originally fished. The distance that vessels travel when relocating their gear before and after the closure is the average of the distance from the centroid of the closed portion of each SRA to the perimeter of the closed area. The incremental change in the distance that vessel operators must travel to tend their gear is calculated using the method described above for vessels that hold only a state permit; in this case, however, the analysis is based on the homeports of the vessels that hold a Federal permit and are known to fish in SRAs 18 or 19.

Summary of Cape Cod Closure Parameters

Exhibit 6-22 summarizes the final set of parameters used to estimate costs associated with each of the Cape Cod closures. The travel distances developed via the methods discussed above warrant discussion. In all cases, the impact of relocation on the distance that vessel operators must travel to tend their gear is either small or negative. A reduction in travel distances reflects the possibility that some vessel operators may respond to a closure by relocating their gear closer to their homeport. While somewhat counterintuitive, this outcome is possible when considering the logical set of alternatives open to affected vessels.

Exhibit 6-22

SUMMARY OF PARAMETERS AFFECTING CLOSURE COSTS: CAPE COD CLOSURES

Vessel Category	Parameter	CCB Restricted Area	Massachusetts Restricted Area #1	Massachusetts Restricted Area #2	Basis
Vessels Holding Only a State Permit	Closure Period	February – April	January – April	January – April	See Chapter 3
	Number of Affected Lobster Vessels (Full-Time Equivalent)	9	32	32	Vertical Line Model
	Percent of Vessels Relocating	Lower: 82.9% Upper: 0%	Lower: 53.4% Upper: 0%	Lower: 52.6% Upper: 0%	Bounding assumption, based in part on analysis of DMF Catch Report data (2009)
	Avg. Vessel Length (feet)	33	34	34	Analysis of DMF Catch Report data appended with vessel permit data (2009)
	Avg. Vessel Horsepower	304	314	314	Estimated based on vessel size; relationship developed from NMFS Permit data
	New Location(s)	Proportional to baseline gear distribution outside closed area			GIS analysis using DMF Catch Report data
	Avg. Change in Roundtrip (miles)	-11.6	-8.0	-3.2	GIS analysis
	Trips per Week	2.3	2.18	2.18	GMRI Survey (2006); average for closure period
	Crew per Vessel (excluding captain)	1	1	1	Analysis of DMF Catch Report data appended with vessel permit data (2009)
	Traps per Vessel	243	252	253	Analysis of DMF Catch Report data (2009)
	Traps Transferred per Trip	40	40	40	NMFS gear team
	Trips Required to Relocate Gear	12	13	13	(Traps/#Transferred per Trip)*2
	Distance Traveled to Relocate Gear (miles/trip)	21.2	38.2	35.2	GIS analysis
	Percent of Vessels Suspending Fishing	Lower: 17.1% Upper: 100%	Lower: 46.6% Upper: 100%	Lower: 47.4% Upper: 100%	Bounding assumption, based in part on analysis of DMF Catch Report data (2009)
	Revenue Lost per Trap, Net of Operating Cost Savings, when Vessels Suspend Fishing	$8.74	$19.31	$19.31	Prices based on analysis of NMFS Dealer data; average catch per trap based on data analysis provided by MA DMF
	Net Revenue Lost per Trap when Fishing Alternate Areas	$2.69	$5.74	$5.74	Assumes 20 percent reduction in baseline revenue per trap; revenue per trap determined by analysis of MA DMF data on catch per trap and NMFS Dealer data
Vessels with a Federal Permit	Closure Period	February – April	January – April	January – April	See Chapter 3
	Number of Affected Lobster Vessels (Full-Time Equivalent)	7	78	77	Vertical Line Model
	Percent of Vessels Relocating	Lower: 100% Upper: 0%	Lower: 100% Upper: 0%	Lower: 100% Upper: 0%	Bounding assumption

Exhibit 6-22

SUMMARY OF PARAMETERS AFFECTING CLOSURE COSTS: CAPE COD CLOSURES

Vessel Category	Parameter	CCB Restricted Area	Massachusetts Restricted Area #1	Massachusetts Restricted Area #2	Basis
	Avg. Vessel Length (feet)	39	40	40	Analysis of DMF Catch Report data appended with vessel permit data (2009)
	Avg. Vessel Horsepower	362	372	372	Estimated based on vessel size; relationship developed from NMFS Permit data
	New Location(s)	Perimeter of closed area, remaining in same SRA			GIS analysis
	Avg. Change in Roundtrip (miles)	0.8	0.6	0.4	GIS analysis
	Trips per Week	2.3	2.18	2.18	GMRI Survey (2006); average for closure months
	Crew per Vessel (excluding captain)	1	1	1	Analysis of DMF Catch Report data appended with vessel permit data (2009)
	Traps per Vessel	446	428	428	Analysis of DMF Catch Report data (2009)
	Traps Transferred per Trip	40	40	40	NMFS gear team
	Trips Required to Relocate Gear	22	21	21	(Traps/#Transferred per Trip)*2
	Distance Traveled to Relocate Gear (miles/trip)	6.6	21.3	21.2	GIS Analysis
	Percent of Vessels Suspending Fishing	Lower: 0% Upper: 100%	Lower: 0% Upper: 100%	Lower: 0% Upper: 100%	Bounding assumption
	Revenue Lost per Trap, Net of Operating Cost Savings, when Vessels Suspend Fishing	$8.74	$19.31	$19.31	Prices based on analysis of NMFS Dealer data; Average catch per trap based on data analysis provided by MA DMF
	Net Revenue Lost per Trap when Fishing Alternate Areas	$2.69	$5.74	$5.74	Assumes 20 percent reduction in baseline revenue per trap; revenue per trap determined by analysis of MA DMF data on catch per trap and NMFS Dealer data

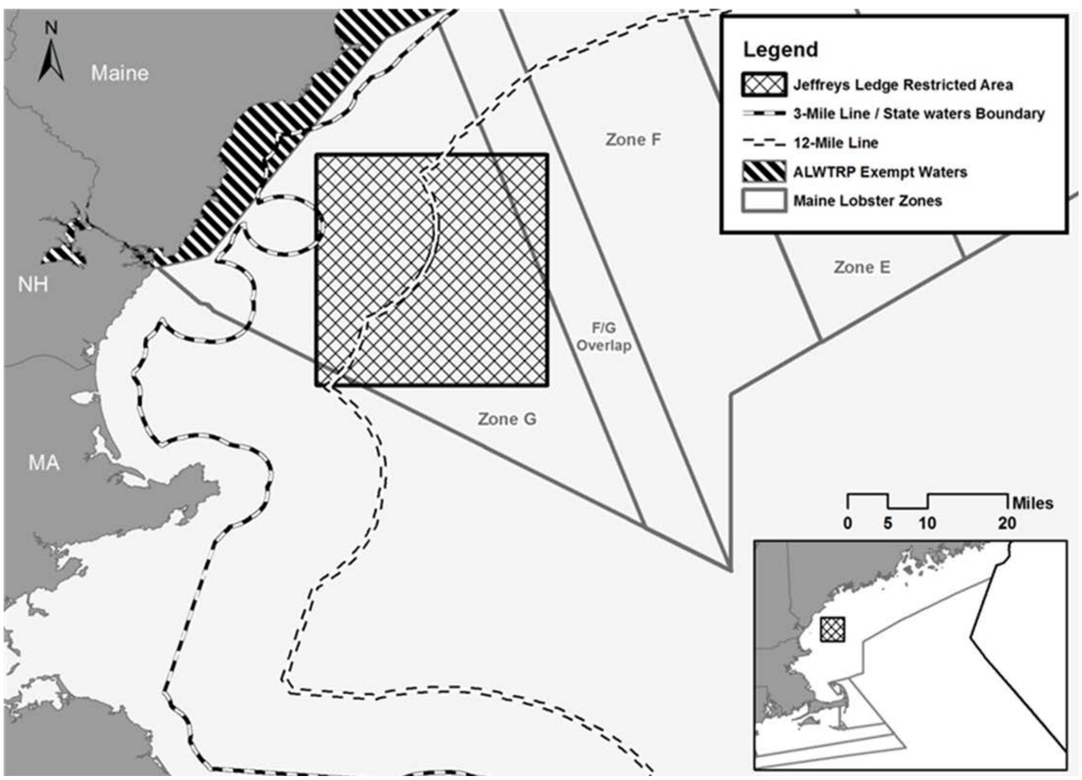
6.3.4.3 Jeffreys Ledge Restricted Area

The closure of the Jeffreys Ledge Restricted Area to trap/pot gear from October through January is an element of Alternatives 4 and 5. As shown in Exhibit 6-23, the closure would extend over a 607 square-mile area off the coast of southern Maine and New Hampshire. Most of the affected area lies in the Federal portion of Maine Lobster Zone G, which is located in LMA 1.

The timing and location of the Jeffreys Ledge closure suggest a potential for significant economic impacts. The fall season is a productive one for New England's lobster fishery, particularly in southern Maine, where weather conditions at that time of year are milder than in down east coastal areas. Available data for LMA 1 indicate that lobster vessels catch an average of over 19 pounds of lobster per trap during the fourth quarter of the year, making this period nearly as productive as the third-quarter summer season.

Exhibit 6-23

JEFFREYS LEDGE RESTRICTED AREA



As a monthly average from October through January, the analysis estimates that on a full-time equivalent basis, approximately 69 lobster vessels are active in the Jeffreys Ledge Restricted Area. This estimate, however, is based on relatively incomplete data. Many vessels that hold LMA 1 lobster permits are not required to file vessel trip reports. As a result, comprehensive information on lobster vessel activity within the area is unavailable. Some insight, however, can be obtained by reviewing the available VTR data; Maine's Annual Logs Survey, in combination with state permit data from the Maine Department of Marine Resources; and Massachusetts Catch Report data, combined with state permit information from the Massachusetts Division of Marine Fisheries. These sources suggest the following:

- The vessels that would be affected by the closure originate primarily from Maine. Relatively few potentially affected vessels – perhaps no more than one to three – appear to be from Massachusetts. In addition, the VTR data suggest that some New Hampshire vessels may be affected – between two to four, depending on the month.

- The Maine lobster vessels originate in several homeports along the southern Maine coast from Portland to the New Hampshire border, with Kennebunkport, Ogunquit, and Kittery accounting for the largest share of vessels. The New Hampshire vessels originate from or near Portsmouth Harbor.

- Based on Maine permit data, lobster vessels active in the closure area vary in size, ranging from approximately 25 to 45 feet in length, and averaging about 36 feet.

Given the heterogeneous nature of the affected vessels, predicting the likely response to the closure of Jeffreys Ledge is difficult. In the absence of better information, the analysis takes a bounding approach to assessing the decision to relocate or suspend fishing. In the upper bound, the analysis assumes that all affected vessels would suspend fishing during the closure and forgo the revenue (net of operating cost savings) on the lobster they would have otherwise landed. This is a highly conservative assumption, since vessels operating in the area are likely to be capable of reaching alternate fishing grounds. The incentive for these vessels to relocate their traps rather than suspend operations from October through January is also likely to be high, since the lobster catch during this period is an important source of revenue.

As an alternative, the lower bound of the analysis assumes that the vessels affected by the Jeffreys Ledge closure would relocate their effort to the unaffected portion of Federal waters in Maine Lobster Zone G. The analysis estimates the additional time and fuel costs these vessels would incur each year to transfer their gear to these waters, as well as the costs they would incur to return the gear to the restricted area when the closure period ends. It also analyzes the impact of relocation on the distance vessel operators must travel to tend their gear while the restricted area is closed, and the resulting impact on time and fuel costs. Estimates of the impact of the closure on the distances that affected vessels must travel are calculated as follows:

- The average distance that vessels must travel in moving gear between the restricted and unrestricted areas is the distance from the centroid of the closed portion of Zone G (Federal) to the centroid of the unrestricted portion of Zone G (Federal).

- The impact of relocating on the distance that vessel operators must travel to tend their gear is the difference between (1) the average distance from relevant ports in Maine and New Hampshire to the centroid of the closed portion of Zone G (Federal) and (2) the average distance from these same ports to the centroid of the unrestricted portion of Zone G (Federal). This analysis includes all major fishing ports from Portland, Maine south to Portsmouth, New Hampshire.

The average number of trips taken per week (3.3) is based on GMRI survey data for lobstermen in LMA 1 during the months the closure would be in effect (GMRI, 2006). Exhibit 6-24 summarizes these and other relevant parameters used in estimating the costs associated with the Jeffreys closure.

Exhibit 6-24

SUMMARY OF PARAMETERS AFFECTING CLOSURE COSTS: JEFFREYS LEDGE

Parameter	Value	Basis
Closure Period	October - January	See Chapter 3
Number of Affected Lobster Vessels	69	Vertical Line Model
Percent of Vessels Relocating	Lower: 100% Upper: 0%	Bounding assumption
Avg. Vessel Length (feet)	36	Maine DMR Annual Logs Survey and Permit data
Avg. Vessel Horsepower	333	Estimated based on vessel size; relationship developed from NMFS Permit data
New Location(s)	Zone G Federal waters remaining open	GIS analysis
Avg. Change in Roundtrip (miles)	9.4	GIS analysis
Trips per Week	3.3	Average for LMA 1 vessels in closure months; GMRI, 2006
Crew per Vessel (excluding captain)	1	GMRI, 2006
Traps per Vessel	375	Maine DMR Annual Logs Survey and Permit data; vessels in Maine Zone G, Federal waters
Traps Transferred per Trip	40	NMFS gear team
Trips Required to Relocate Gear	19	(Traps/#Transferred per Trip)*2
Distance Traveled to Relocate Gear (miles/trip)	22.1	GIS Analysis
Percent of Vessels Suspending Fishing	Lower: 0% Upper: 100%	Bounding assumption
Revenue Lost per Trap, Net of Operating Cost Savings, when Vessels Suspend Fishing	$43.36	Average catch per trap for LMA 1 vessels in GMRI survey; prices based on analysis of NMFS Dealer data
Net Revenue Lost per Trap when Fishing Alternate Areas	$13.34	Assumes 20 percent reduction in baseline revenue per trap; revenue per trap determined by analysis of GMRI survey data and NMFS Dealer data

6.3.4.4 Summary

Exhibit 6-25 summarizes key aspects of each of the potential closures, including their temporal and geographic scope; estimates of the number of vessels and traps they would displace; and estimates of the landings and revenues currently attributable to activity in these areas during the months the closures would be in effect.

Exhibit 6-25

OVERVIEW OF POTENTIAL CLOSURES

Area	Period	Size (sq. mi.)	Estimate of Activity Affected			
			Vessels	Traps	Landings (pounds)	Gross Revenues
CCB Restricted Area	Feb 1 – Apr 30	644	16	5,309	15,579	$71,353
Jeffreys Ledge	Oct 1 – Jan 31	607	69	25,875	543,211	$1,726,121
Jordan Basin	Nov 1 – Jan 31	725	5	3,136	56,023	$172,596
Massachusetts Restricted Area #1	Jan 1 – Apr 30	2,464	110	41,448	264,063	$1,190,387
Massachusetts Restricted Area #2	Jan 1 – Apr 30	2,161	109	41,052	261,532	$1,179,013

6.4 ANALYTIC APPROACH: GEAR MARKING REQUIREMENTS

With the exception of Alternative 1, each of the regulatory alternatives under consideration specifies revised gear marking requirements. As explained in greater detail in Chapter 3, the proposed gear marking scheme calls for three 12-inch marks per vertical line, adhering to a regional color-coding system. The requirements would apply to all fisheries subject to the ALWTRP, including the lobster, OTP, blue crab, and gillnet fisheries. Under Alternatives 2, 3, 4, 5, and 6 (Draft), the 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 analysis relies on the Vertical Line Model to estimate the number of vertical lines it would be necessary to mark under Alternatives 2 through 6 (Preferred). In each case, the estimate of gear marking demands is consistent with the new trawling requirements the alternative specifies. Aggregate gear marking costs are based on numbers of active vessels estimated in the Vertical Line Model.

The estimate of gear marking costs considers both the cost of material/equipment and labor costs. To model these costs, the analysis assumes that lines would be marked using gear marking whips that would be woven into the line. Whips are currently available at a cost of $0.06 each; thus, given the need to mark in three locations, the equipment cost for gear marking is estimated at $0.18 for each vertical line. NMFS gear experts estimate that each whip would take roughly five minutes to install. At an implicit value of $22.48 for an hour of a labor (see above), this translates to a labor cost of $1.87 per mark, or $5.62 for each vertical line. The resulting total cost – $5.80 per vertical line – is amortized over the useful life of the line to develop an annualized estimate of gear marking costs.[28]

6.5 ESTIMATED COMPLIANCE COSTS BY ALTERNATIVE

As noted in the introduction to this chapter, the economic analysis is designed to measure regulatory compliance costs on an incremental basis – i.e., to measure the *change* in costs associated with a *change* in regulatory requirements. If no change in regulatory requirements is imposed – as would be the case under Alternative 1 – the economic burden attributable to the ALWTRP would be unaffected. Thus, Alternative 1 would impose no additional costs on the regulated community.

The analysis of the remaining alternatives measures their economic impact relative to the status quo – i.e., relative to the no action alternative. The impact of these alternatives can be characterized in several ways, including the number of vessels that would need to take action in order to comply with new requirements. As shown in Exhibit 6-26, the gear marking provisions of Alternatives 2 through 6 (Preferred) would affect the largest number of fishing operations. This figure varies little across the alternatives, except in the case of Alternative 6 (Preferred); that alternative removes the requirement that Maine vessels in ALWTRP-exempt waters mark gear. As a result, the number of affected vessels is reduced from approximately 6,100 to 4,000.

The gear configuration provisions of these alternatives also affect a large number of vessels, primarily lobster vessels that would need to reconfigure their gear in order to meet trawling requirements. Under Alternatives 2 and 4, the analysis estimates that approximately 1,800 vessels would be required to reconfigure their gear; this figure falls to approximately 1,400 under Alternatives 3, 5, 6 (Draft), and 6 (Preferred). In contrast, the provisions for fishing area closures specified under Alternatives 3 through 6 (Preferred) are estimated to affect no more than 200 vessels. The impact on these vessels, however, could be significant.

[28] Under Alternatives 2 through 6 (Draft), the marking requirements for gear fished in exempt portions of Maine state waters would differ from the requirements for gear fished in non-exempt areas. Similarly, under Alternatives 3, 5, and 6 (Draft and Preferred), the marking requirements for gear fished in New Hampshire state waters would differ from the requirements for gear fished in non-exempt areas. Fishermen who move gear between exempt and non-exempt waters over the course of a year would be required to comply with the applicable gear marking provisions for each area, either by maintaining separate sets of vertical line or by re-marking their line before it is moved. The estimate of gear marking costs does not take this issue into account. To the extent that these circumstances arise, the analysis may understate the costs associated with the introduction of new gear marking requirements.

Exhibit 6-26

NUMBER OF VESSELS AFFECTED BY NEW REQUIREMENTS UNDER EACH REGULATORY ALTERNATIVE

Regulatory Alternative	Gear Configuration	Closures	Gear Marking	Total
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

Note: A single vessel may be affected by multiple new requirements; hence, the totals presented here are not the simple sum of the gear configuration, closure, and gear marking categories.

Exhibit 6-27 summarizes the estimate of annual compliance costs for each of the alternatives. Several findings are noteworthy:

- Of the action alternatives, estimated costs are lowest for Alternative 3. This alternative incorporates less stringent trawling requirements than specified under Alternative 2 and includes only the CCB Restricted Area closure, which affects relatively few vessels and poses limited costs.

- Alternative 4 is likely to pose the greatest costs. It includes three closures, all of which cover large areas. The estimated impact of the closures specified under this alternative ranges from $1.3 million to $2.1 million per year.

- The cost of complying with Alternative 5 is likely to be 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.

- In general, compliance with gear configuration requirements imposes the greatest costs, with estimates ranging as high as $4.4 million per year. The costs attributable to the seasonal closure of restricted areas also contribute significantly to the estimate of total compliance costs under Alternatives 4, 5, 6 (Draft), and 6 (Preferred). Gear marking requirements add approximately $1 million annually to the estimated cost of complying with most of the action alternatives.

- Gear marking costs are significantly lower under Alternative 6 (Preferred) because it does 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 the 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 the other action alternatives.

Exhibit 6-27

ESTIMATED ANNUAL COMPLIANCE COSTS BY ALTERNATIVE (2011 dollars)

Regulatory Alternative	Gear Configuration		Closures		Gear Marking	Total	
	Lower	Upper	Lower	Upper		Lower	Upper
Alternative 1 (No Action)	$0	$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.

Exhibit 6-27 indicates that variation in the estimate of compliance costs across alternatives also depends on the provisions each alternative incorporates for the seasonal closure of restricted areas. These impacts are greatest under Alternatives 4 and 5, which include the seasonal closure of three areas: Jeffreys Ledge, Jordan Basin, and Massachusetts Restricted Area #1. As shown in Exhibit 6-28, the Jeffreys Ledge closure poses the greatest potential impact, with estimated costs ranging from $0.7 million to $1.2 million per year. The costs attributable to the closure of Massachusetts Restricted Area #1 are estimated at $0.6 million to $0.8 million per year, while those attributable to the closure of Jordan Basin are estimated at $43,000 to $103,000 annually. The estimate of costs attributable to the closure of Massachusetts Restricted Area #2, as specified under Alternatives 6 (Draft) and 6 (Preferred), ranges from $0.6 million to $0.8 million; these figures are comparable to the estimates developed for the closure of Massachusetts Restricted Area #1. In contrast, the estimated impact of closing the CCB Restricted Area on a seasonal basis is relatively modest, adding less than $50,000 per year to the estimated cost of complying with Alternative 3.

Exhibit 6-28 ANNUAL COSTS BY CLOSURE (2011 dollars)			
	Annual Cost		
Closure	Lower Bound Scenario	Upper Bound Scenario	Regulatory Alternative
CCB Restricted Area	$21,000	$49,000	3
Jeffreys Ledge	$743,000	$1,172,000	4,5
Jordan Basin	$43,000	$103,000	4,5
Massachusetts Restricted Area #1	$553,000	$839,000	4,5
Massachusetts Restricted Area #2	$557,000	$831,000	6 (Draft), 6 (Preferred)

The analysis includes several assumptions concerning the impact of new requirements on the catch of target species, which could have implications for market prices. The impact of greatest concern is likely to be the effect on the lobster fishery. As explained, the analysis assumes that lobster vessels converting to longer trawls may realize a decrease in landings and gross revenue. In addition, vessels affected by closures may experience a reduction in catch as a result of suspending fishing or relocating to less productive fishing grounds. Despite these potential effects, the aggregate impact on lobster landings is likely to be minor. The greatest impact is likely to occur under Alternative 4, where the analysis estimates a potential reduction in lobster landings of approximately 2.1 million pounds per year. This is equivalent to approximately 1.7 percent of lobster landings in 2011. A landings reduction of this size is well within the range of annual variation in lobster catch and is unlikely to have significant implications for the market price of lobster.

6.6 ESTIMATED COMPLIANCE COSTS BY FISHERY

Of the fisheries subject to the requirements of the ALWTRP, the lobster fishery would bear the largest share of impacts from the regulatory alternatives under consideration. As Exhibit 6-29 shows, the lobster fishery accounts for the greatest number of vessels that would be required to reconfigure their gear to comply with trawling requirements. This is true across all action alternatives. In addition, the analysis indicates that the lobster fishery alone would be affected by the seasonal closure of fishing grounds. In contrast, all vessels fishing gear that is subject to the requirements of the ALWTRP would be affected by the gear marking provisions incorporated under Alternatives 2 through 6 (Draft); this includes gear fished in Maine and New Hampshire waters that otherwise would be exempt from ALWTRP requirements. Alternative 6 (Preferred) is the exception in that it would not require gear fished in Maine's exempt waters to be marked.

Exhibit 6-30 summarizes the estimate of annual compliance costs by fishery and regulatory alternative. 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 under Alternatives 2 through 6 (Preferred). OTP vessels would also incur a significant share of costs under these alternatives, primarily because of the proposed minimum trawl-length requirements.[29] The impact of the action alternatives on other fisheries is likely to be minor, reflecting the costs associated with meeting new gear marking requirements.

Exhibit 6-29

NUMBER OF VESSELS AFFECTED BY NEW REQUIREMENTS, BY FISHERY

Regulatory Provisions	Regulatory Alternative	Fishery				Total
		Lobster Trap/Pot	Other Trap/Pot	Blue Crab	Gillnet	
Gear Configuration	Alternative 1 (No Action)	0	0	0	0	0
	Alternative 2	1,679	139	0	0	1,817
	Alternative 3	1,256	136	0	0	1,392
	Alternative 4	1,695	139	0	0	1,834
	Alternative 5	1,263	136	0	0	1,400
	Alternative 6 (Draft)	1,228	136	0	0	1,364
	Alternative 6 (Preferred)	1,221	136	0	0	1,357
Closures	Alternative 1 (No Action)	0	0	0	0	0
	Alternative 2	0	0	0	0	0
	Alternative 3	16	0	0	0	16
	Alternative 4	184	0	0	0	184
	Alternative 5	184	0	0	0	184
	Alternative 6 (Draft)	109	0	0	0	109
	Alternative 6 (Preferred)	109	0	0	0	109
Gear Marking	Alternative 1 (No Action)	0	0	0	0	0
	Alternative 2	5,300	282	48	499	6,129
	Alternative 3	5,300	282	48	499	6,129
	Alternative 4	5,300	282	48	499	6,129
	Alternative 5	5,300	282	48	499	6,129
	Alternative 6 (Draft)	5,300	282	48	499	6,129
	Alternative 6 (Preferred)	3,186	274	48	498	4,006
All	Alternative 1 (No Action)	0	0	0	0	0
	Alternative 2	5,300	282	48	499	6,129
	Alternative 3	5,300	282	48	499	6,129
	Alternative 4	5,300	282	48	499	6,129
	Alternative 5	5,300	282	48	499	6,129
	Alternative 6 (Draft)	5,300	282	48	499	6,129
	Alternative 6 (Preferred)	3,186	274	48	498	4,006

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

[29] Due to insufficient data on vessel activity, the analysis of compliance costs under Alternatives 2 through 6 (Preferred) excludes potential impacts on trap/pot vessels operating in the Northern Inshore shrimp fishery. The Vessel Trip Report data incorporated in the Vertical Line Model identify only two such vessels; this suggests that much of the activity of trap/pot vessels in this fishery is accounted for by vessels that are not subject to Federal reporting requirements, presumably because they do not hold a Federal permit and fish only in state waters. Much of this activity is likely to occur in portions of Maine state waters that are currently exempt from ALWTRP requirements. Under Alternatives 2 through 6 (Draft), vessels operating in these waters would only be subject to ALWTRP gear marking provisions; they would be exempt even from these requirements under Alternative 6 (Preferred). Given these considerations, it is unlikely that exclusion of the Northern Inshore shrimp fishery from the analysis will lead it to substantially understate the costs of complying with Alternatives 2 through 6 (Preferred).

Exhibit 6-30

DISTRIBUTION OF ESTIMATED ANNUAL COMPLIANCE COSTS BY FISHERY (2011 dollars)

	Fishery						Total	
	Lobster Trap/Pot		Other Trap/Pot					
Regulatory Alternative	**Lower**	**Upper**	**Lower**	**Upper**	**Blue Crab**	**Gillnet**	**Lower**	**Upper**
Alternative 1 (No Action)	$0	$0	$0	$0	$0	$0	$0	$0
Alternative 2	$1,814,000	$4,546,000	$430,000	$849,000	$7,000	$5,000	$2,255,000	$5,407,000
Alternative 3	$1,645,000	$3,600,000	$414,000	$833,000	$7,000	$5,000	$2,070,000	$4,445,000
Alternative 4	$3,121,000	$6,550,000	$430,000	$849,000	$7,000	$5,000	$3,562,000	$7,411,000
Alternative 5	$2,954,000	$5,551,000	$414,000	$833,000	$7,000	$5,000	$3,379,000	$6,396,000
Alternative 6 (Draft)	$2,192,000	$4,361,000	$416,000	$836,000	$7,000	$5,000	$2,620,000	$5,208,000
Alternative 6 (Preferred)	$1,482,000	$3,637,000	$416,000	$835,000	$7,000	$5,000	$1,910,000	$4,484,000

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

6.7 REFERENCES

American Petroleum Institute, "Notes to State Motor Fuel Excise and Other Taxes," accessed online at: http://www.api.org/oil-and-natural-gas-overview/industry-economics/fuel-taxes.aspx.

Associated Press, "With Lobster Catch Dropping Off, Prices Inch Up," by Clarke Canfield, September 4, 2012.

Atlantic States Marine Fisheries Commission, *American Lobster Stock Assessment Report for Peer Review*, March 2009.

Bureau of Labor Statistics, Occupational Employment Statistics, accessed online at http://www.bls.gov/oes/, September 2012.

Energy Information Administration, *Short-Term Energy Outlook*, 2012, accessed online at http://www.eia.gov/forecasts/steo/.

Energy Information Administration, "Weekly New England No. 2 Diesel Retail Prices (Dollars per Gallon)," data series accessed online at http://www.eia.gov/petroleum/gasdiesel/.

George, Clay, "Commercial Trap and Pot Fishing Effort in Georgia Ocean Waters: A Report to the Atlantic Large Whale Take Reduction Team," March 1, 2010.

Goni, Raquel, Antoni Quetglas, Olga Renones, "Spillover of spiny lobsters *Palinurus elephas* from a marine reserve to an adjoining fishery," *Marine Ecology*, Vol. 308, 2006.

Gulf of Maine Research Institute, *Lobster Socioeconomic Impact Survey*, prepared by Market Decisions, prepared for Laura Taylor Singer and Daniel S. Holland, November 16, 2006.

Liebzeit, A. and D. Allen, "Investment Decision-making in the American Lobster Fishery: A Comparison Between Limited Entry and Open Access Regimes," 1989.

Maine Department of Marine Resources, *Gear Trawling Project: How Long is Too Long for a Trawl?* A collaboration between the Department of Maine Resources, the Gulf of Maine Lobster Foundation, and the lobster industry, February 2012.

Maine Maritime Academy, "Lobster Boat Efficiency Project," CEI Fuel Efficiency Workshop, Vinalhaven, Maine, December 6, 2011.

Massachusetts Division of Marine Fisheries, *Comparative Economic Survey and Analysis of Northeast Fishery Sector 10 (South Shore, Massachusetts)*, prepared by Dr. David Pierce, Brant McAfee, and Story Reed, November 2011.

Massachusetts Division of Marine Fisheries, *Impact of Ghost Fishing to the American Lobster Fishery*, 2011.

McCarron, Patrice and Heather Tetreault, *Lobster Pot Gear Configurations in the Gulf of Maine*, 2012.

Murawski, Stephen A., Susan E. Wigley, Michael J. Fogarty, Paul J. Rago, Michael Mountain, "Effort distribution and catch patterns adjacent to temperate MPAs," *ICES Journal of Marine Sciences*, Vol. 62, Issue 6, April 2005.

National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Regional Office, *Final Environmental Assessment and Regulatory Impact Review, Regulatory Flexibility Act, Analysis of Sea Turtle Conservation Measures for the Mid-Atlantic Sea Scallop Dredge Fishery*, April 2006.

Powers, Joseph E., Shane M. Abeare, "Fishing effort redistribution in response to area closures," *Fisheries Research*, Vol. 99, Issue 3, August 2009.

Rijnsdorp, A.D., G.J. Piet, J.J. Poos, "Effort allocation of the Dutch beam trawl fleet in response to a temporarily closed area in the North Sea," International Council for Exploration of the Sea, 2001.

Schreiber, Laurie, "Lobster Catch-to-Trap Ratio Studied," *Fisherman's Voice*, Vol. 15, No. 4, April 2010.

Thunberg, Eric M., *Demographic and Economic Trends in the Northeastern United States Lobster (Homarus americanus) Fishery, 1970-2005,* National Oceanic and Atmospheric Administration, Northeast Fisheries Science Center Reference Document 07-17, October 2007.

U.S. Council of Economic Advisors, *Economic Report of the President*, 2012.

University of Rhode Island, Department of Environmental and Natural Resource Economics, SIMLOB: The Resource and Harvest Sector Components of the North American Lobster (Homarus Americanus) Market Model: Final Report, 1995.

Appendix 6-A

GEAR CONVERSION COST METHODOLOGY

This appendix describes the methods used to estimate the equipment cost associated with configuring gear to comply with minimum trawl length proposals included under Regulatory Alternatives 2 through 6 (Preferred). The costs that vessels incur are a function of baseline gear configurations and the specific configuration required under the trawling proposal. NMFS' Vertical Line Model assigns baseline configurations to model vessels (i.e., total number of traps fished, number of traps per trawl, and number of vertical lines per trawl) that vary by fishery and location. These model vessels serve as the starting point for assessing how annual gear costs would change. The model allows the analysis to determine the extent to which vessels in a particular area are fishing sets shorter than the required length, providing an estimate of both the number of vessels that would need to convert gear as well as the current configuration used by those vessels. More detail on the Vertical Line Model can be found in the model's formal documentation, which is available for review on the ALWTRP website (http://www.nero.noaa.gov/Protected/whaletrp/index.html).

Exhibit 6A-1 summarizes the procedure used to estimate the incremental costs associated with converting to longer trawls. For each set of vessels, the method uses unit cost information and useful life information to estimate the annual costs of employing the baseline configuration of gear and the new configuration. The difference between these two annual costs represents the incremental cost of complying with the trawling requirement under consideration. The calculation of annualized costs is based on a seven percent annual discount rate, consistent with current guidance from the Office of Management and Budget (1992).

The estimation of gear conversion costs requires information on certain gear characteristics that are not specified in the Vertical Line Model. Exhibit 6A-2 summarizes these parameters.[30] As shown, the typical configuration of gear employed in trap/pot fisheries varies by region; this variation affects the cost of complying with the proposed trawling requirements. For example, Maine Zone A is characterized by strong tidal currents; to counter the potential effect of these currents, lobster vessels fishing in the area frequently use weights or anchors to keep their gear in place. Similarly, vessels in state waters commonly fish at shallower depths than do vessels in Federal waters, and therefore require less line to connect trawls to surface buoys. While highly generalized, the assumptions summarized in the exhibit allow a more detailed estimate of the potential change in annual gear costs associated with the trawling requirements.

[30] Most of the information in this table is adapted from a recent study developed by the Maine Lobstermen's Association (McCarron and Tetreault, 2012); some supplementary information comes from other sources.

Exhibit 6A-1

METHODOLOGY FOR CALCULATING COSTS OF GEAR RECONFIGURATION

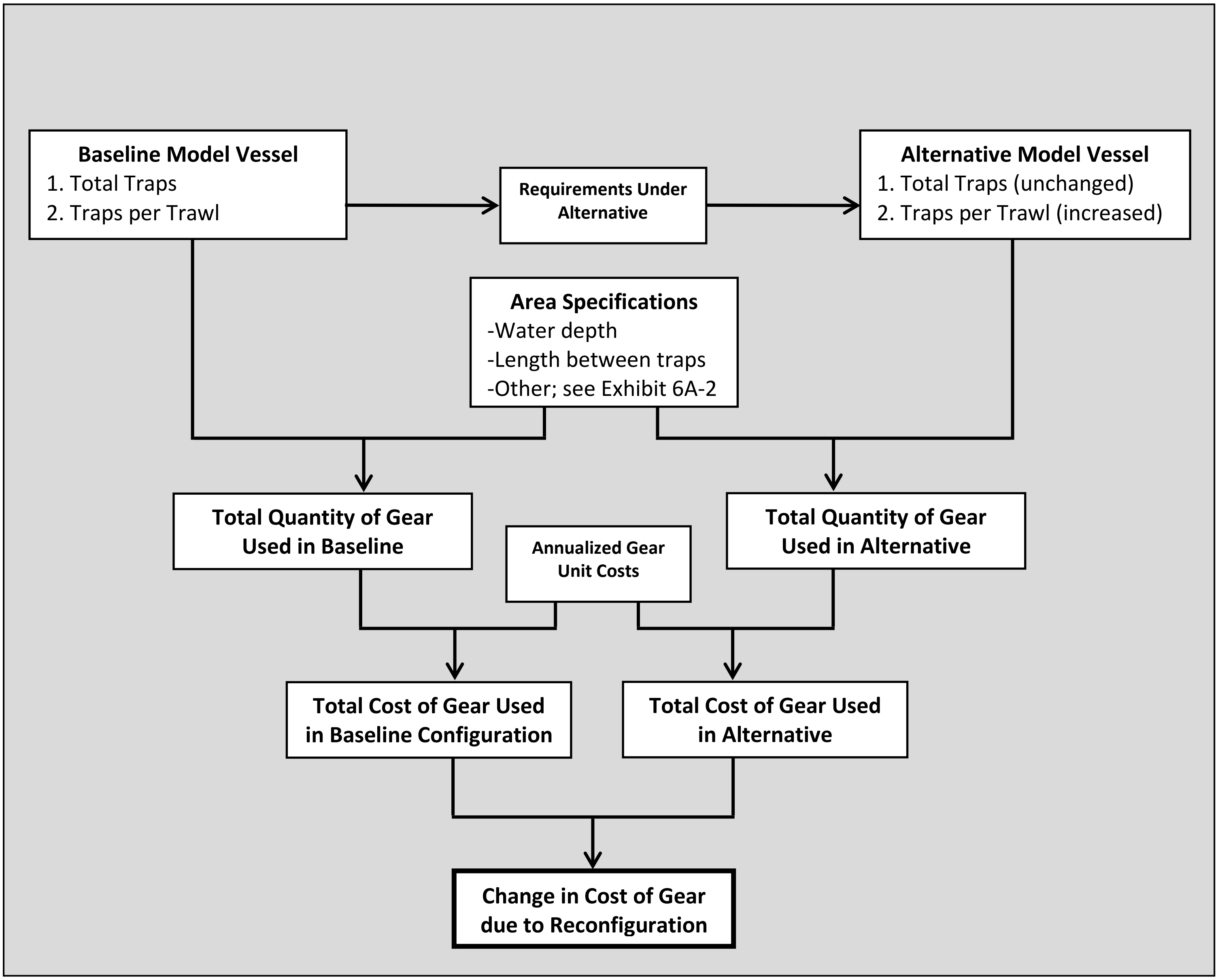


Exhibit 6A-2

GEAR SPECIFICATIONS FOR MAJOR AREAS AFFECTED BY TRAWLING PROPOSALS

State	Zone	Waters	Average Depth (ft.)[1]	% of VL that is Sink Line	VL Slack Factor[2]	VL Diam.	Distance Between Traps (ft.)	Gangion Length (ft.)	Ground -line Diam.	First Buoy	Second Buoy	Length of Line to 2nd Buoy (ft.)	Anchor	Length of Anchor Line (ft.)
ME	A	State	98	33%	1.5	3/8"	60	6	3/8"	5x11	5x11	60	40 lbs.	20
ME	A	Nearshore	452	25%	1.5	3/8"	60	6	3/8"	60" Polyball	5x11	60	40 lbs.	20
ME	B	State	114	33%	1.25	3/8"	90	6	3/8"	5x11	Toggle	60	N/A	N/A
ME	B	Nearshore	457	25%	1.25	3/8"	90	6	3/8"	6x14	5x11	60	N/A	N/A
ME	C	State	104	33%	1.3	3/8"	48	6	3/8"	5x11	N/A	N/A	N/A	N/A
ME	C	Nearshore	433	25%	2	3/8"	90	6	3/8"	7x14	5x11	60	N/A	N/A
ME	D	State	97	33%	1.2	7/16"	45	6	7/16"	5x11	N/A	N/A	N/A	N/A
ME	D	Nearshore	425	25%	1.25	7/16"	75	6	7/16"	9x16	5x11	60	N/A	N/A
ME	E	State	101	33%	1.15	7/16"	45	6	7/16"	5x11	N/A	N/A	N/A	N/A
ME	E	Nearshore	478	25%	1.15	7/16"	90	6	7/16"	9x16	N/A	N/A	N/A	N/A
ME	F	State	59	33%	1.15	7/16"	63	6	7/16"	5x11 (double)[3]	N/A	N/A	N/A	N/A
ME	F	Nearshore	515	25%	1.5	7/16"	90	6	7/16"	5x11	5x11	60	N/A	N/A
ME	G	State	96	33%	1.5	3/8"	90	6	3/8"	7x14	N/A	N/A	N/A	N/A
ME	G	Nearshore	416	25%	1.68	3/8"	72	6	3/8"	9x16	9x16	60	N/A	N/A
NH	N/A	State	70	33%	1.2	3/8"	60	6	3/8"	5x11	N/A	N/A	N/A	N/A
MA	N/A	State	59	33%	1.1	3/8"	96	6	3/8"	5x11 (double)	5x11	60	N/A	N/A
MA	N/A	Nearshore	209	25%	1.1	3/8"	96	6	3/8"	9x16	5x11	60	N/A	N/A
RI[4]	N/A	State	54	33%	1.1	3/8"	103	6	3/8"	5x11	N/A	N/A	N/A	N/A
RI	N/A	Nearshore	120	25%	1.1	3/8"	103	6	3/8"	9x16	5x11	60	N/A	N/A

[1] Average depth data were collected from the NOAA National Environmental Satellite, Data, and Information Service.
[2] Slack factor represents the ratio of vertical line length to average water depth (e.g., 100 ft. depth * 1.5 slack factor = 150 ft. vertical line). Vertical line consists of a portion of sinking rope and a portion of floating rope.
[3] A double 5x11 is two 5x11 buoys that are attached to the same stick. Correspondingly, the price is twice that of a single 5x11 buoy.
[4] Data for Rhode Island vessels were not available. The figures applied are extrapolated from Massachusetts.

Sources: McCarron and Tetreault, 2012.

In addition to the model vessel configurations and area specifications described in Exhibit 6A-2, several additional assumptions affect the analysis of gear reconfiguration costs:

- A gangion is a length of sinking rope attaching a trap to the main groundline. The analysis assumes one gangion per trap when the trawl has two endlines. When a trawl has one endline, the analysis assumes one gangion for all but the last trap.

- Every surface buoy is attached to the line by a weak link of appropriate breaking strength, consistent with current ALWTRP requirements.

- Anchor line, if used, is assumed to be the same type and diameter as the vertical line float rope.

- Rope connecting multiple buoys is the same type and diameter as the vertical line sink rope.

- When anchors are used, there is one anchor per endline.

Lacking more detailed information, gear characteristics (e.g., rope diameter, slack factor, etc.) for other trap pot (OTP) fisheries are assumed to be equivalent to those specified for lobster operations in each area. An important exception applies in the case of the conch component of the OTP fishery. Massachusetts DMF officials suggest that trawling conch pots can be problematic because the pots may spill their contents when hauled.[31] Although low-cost retrofit options for the traps may exist, little information is available on the nature and cost of these options. Therefore, the analysis assumes that conch vessels switching from singles to trawls will need to purchase all new traps compatible with trawling. This assumption may lead to an overstatement of compliance costs for this fishery.

Exhibit 6A-3 summarizes the unit cost information applied in the analysis. When available, price information for individual gear elements was gathered from on-line catalogs; when information was unavailable or unclear on-line, retailers were contacted by phone. Major suppliers of price data included Friendship Trap and New England Marine and Industrial. In cases where multiple suppliers provided differing prices for a gear element, an average is applied. NMFS gear specialists reviewed the pricing information and provided estimates of the expected useful life for each gear component.[32]

[31] Personal communication with Massachusetts DMF, November 7, 2012.

[32] Note that the exhibit includes unit cost information only for components of gear that the analysis suggests might change as a result of the introduction of new regulatory requirements. The analysis does not require cost estimates for other elements of gear, such as lobster traps, that the new regulations would be unlikely to affect.

Exhibit 6A-3

UNIT PRICES AND USEFUL LIFE ESTIMATES FOR GEAR ELEMENTS

Gear Description	Purchase Price	Unit	Average Useful Life (years)	Annualized Purchase Price
Line				
3/8" floating rope	$0.07	per foot	9	$0.009726
3/8" sink rope	$0.11	per foot	6	$0.021176
7/16" floating rope	$0.08	per foot	9	$0.011963
7/16" sink rope	$0.18	per foot	6	$0.035548
Traps				
Conch trap (singles)	$29.30	per trap	10	$3.898748
Conch trap (trawls)	$32.50	per trap	10	$4.324550
Buoys and Floats				
Toggle	$1.99	per toggle	10	$0.264130
Polyball 60"	$44.35	per buoy	10	$5.900683
Bullet Buoy 5x11	$5.40	per buoy	10	$0.718541
Bullet Buoy 5x11 (double)	$10.80	per double	10	$1.437081
Bullet Buoy 6x14	$7.80	per buoy	10	$1.037227
Bullet Buoy 7x14	$12.11	per buoy	10	$1.610729
Bullet Buoy 9x16	$15.64	per buoy	10	$2.081107
Anchors				
40 lb. Danforth anchor	$155.60	per anchor	30	$11.718920
Links and Rings				
600 lb. light-weight plastic weak link	$0.97	per weak link	5	$0.221097
1,500 lb. offshore weak link	$5.65	per link	5	$1.287834
Other				
12" gear marking whip	$0.06	per whip	N/A[1]	$0.055000

[1] The useful life of a marking whip is assumed to be the same as that of the line into which it is incorporated.

Sources: NMFS gear specialists; Friendship Trap and New England Marine and Industrial (on-line catalogs and personal communication).