UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
PROGRAM PLANNING AND INTEGRATION
Silver Spring, Maryland 20910

JUN 30 2010

To All Interested Government Agencies and Public Groups:

Under the National Environmental Policy Act, an environmental review has been performed on the following action.

TITLE: 2010-2012 Atlantic Herring Environmental Assessment (EA)

LOCATION: Atlantic Exclusive Economic Zone

SUMMARY: This action implements 2010-2012 specification and management measures for Atlantic herring. The action also makes minor corrections to existing regulations. These specifications and management measures promote the utilization and conservation of the Atlantic herring resource

RESPONSIBLE
OFFICIAL: Patricia A. Kurkul
Regional Administrator
National Marine Fisheries Service, National Oceanic and Atmospheric Administration (NOAA)
55 Great Republic Drive, Gloucester, MA 01930
(978) 281-9315

The environmental review process led us to conclude that this action will not have a significant impact on the environment. Therefore, an environmental impact statement was not prepared. A copy of the finding of no significant impact (FONSI), including the environmental assessment, is enclosed for your information.

Although NOAA is not soliciting comments on this completed EA/FONSI we will consider any comments submitted that would assist us in preparing future NEPA documents. Please submit any written comments to the Responsible Official named above.

Sincerely,

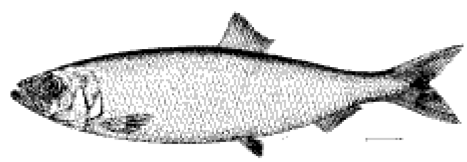
Paul N. Doremus, Ph. D.
NOAA NEPA Coordinator

Enclosure

Proposed Atlantic Herring Specifications

for the 2010-2012 Fishing Years
(January 1, 2010 – December 31, 2012)

including the
Environmental Assessment (EA),
Regulatory Impact Review (RIR), and
Initial Regulatory Flexibility Analysis (IRFA)



Prepared by the
New England Fishery Management Council

in consultation with
Atlantic States Marine Fisheries Commission
National Marine Fisheries Service
Mid-Atlantic Fishery Management Council

Date Submitted (FINAL): February 16, 2010

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EXECUTIVE SUMMARY

This document contains the New England Fishery Management Council's recommended specifications for the 2010-2012 Atlantic herring fishery as required by the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and the Herring Fishery Management Plan (FMP) approved by the National Marine Fisheries Service (NMFS) on October 27, 1999. The proposed specifications are consistent with the provisions contained in the Magnuson-Stevens Act and the Atlantic Herring FMP. This document also contains information and supporting analyses required under other applicable law, namely the National Environmental Policy Act (NEPA), Regulatory Flexibility Act (RFA), and Executive Order 12866.

The specifications for the Atlantic herring fishery are for annual amounts (for the 2010-2012 fishing years) of:

- Allowable Biological Catch (ABC),
- A stock-wide U.S. Optimum Yield (OY),
- Domestic Annual Harvest (DAH),
- Domestic Annual Processing (DAP),
- Total Joint Venture Processing (JVPt),
- Internal Waters Processing (IWP),
- U.S. At-Sea Processing (USAP),
- Border Transfer (BT, U.S.-caught herring transferred to Canadian vessels for export),
- Total Allowable Level of Foreign Fishing (TALFF),
- Reserve, and
- Total Allowable Catch (TAC) levels for each of four herring management areas. Set-asides for research and fixed gear fisheries in Area 1A are also specified as necessary.

Amounts for an F_{MSY}-based overfishing limit are also specified; the OFL levels will be implemented as part of Amendment 4 to the Atlantic Herring FMP during the upcoming fishing year.

The 2010-2012 Atlantic herring fishery specifications have been developed in accordance with the provisions and new requirements of the Magnuson-Stevens Fishery Conservation and Management Act, including the requirement to establish a process for and specifications for ACLs and AMs for Atlantic herring by 2011. Amendment 4 to the Herring FMP is currently under development and includes the provisions for the ACL/AM process. The 2011-2012 specifications are consistent with the process proposed in Amendment 4 for specifying ACLs and AMs through the fishery specification process. Amendment 4 is scheduled to be finalized by the Council in early 2010 and implemented prior to the start of the 2011 fishing year. The proposed 2010-2012 fishery specifications are based on the process/provisions currently included in the Herring FMP but provide the necessary elements for a transition to the new ACL/AM process that will be implemented in Amendment 4. With the implementation of Amendment 4, the most notable changes in the 2010-2012 herring fishery specifications include the specification for OFL (based on F_{MSY}) and re-specification of the current ABC (*allowable* *biological catch*) to the MSA-defined ABC (*acceptable biological catch*) that accounts for scientific uncertainty. The Atlantic herring fishery is and will continue to be managed by hard TACs. A stock-wide ACL (OY) will be established that accounts for both scientific uncertainty (through the specification of ABC) and management uncertainty (through the specification of OY and a buffer between ABC and OY).

The Herring FMP mandates that the total allowable catch (TAC) be distributed to four herring management areas on an annual basis. The Council uses the best information available to estimate the proportion of each spawning component of the Atlantic herring stock complex in each area/season and distributes the TACs such that the risk of overfishing an individual spawning component is minimized. The purpose of this action is to establish specifications for the Atlantic herring fishery during the 2010-2012 fishing years. Additionally, the proposed specifications are intended to facilitate the transition to the ACL/AM framework mandated by the MSA and implemented through Amendment 4 to the Atlantic Herring FMP in 2011.

Proposed 2010-2012 Specifications

Proposed Atlantic Herring Fishery Specifications for the 2010-2012 Fishing Years

SPECIFICATION	2010-2012 ALLOCATION (MT)
F_{MSY}-Based Fishing Level	145,000 – 2010 134,000 – 2011 127,000 - 2012
ABC	106,000
U.S. OY	91,200
DAH	91,200
DAP	87,200
JVPt	0
JVP	0
IWP	0
USAP	0
BT	4,000
TALFF	0
RESERVE	0
TAC Area 1A*	26,546
TAC Area 1B	4,362
TAC Area 2	22,146
TAC Area 3	38,146
Research Set-Aside	None
Fixed Gear Set-Aside (1A)	295

**Specifications include possible allocation of 3,000 additional mt of herring to Area 1A in November and December of each year, depending on landings in the Canadian New Brunswick weir fishery (see below).*

The proposed specifications include a provision to allocate an additional 3,000 mt of herring to Area 1A in November for the remainder of the fishing year, based on the level of catch in the New Brunswick (NB) weir fishery. The Council is proposing to deduct 14,800 mt from the ABC to account for potential catch of Atlantic herring in the NB weir fishery. NMFS will monitor NB weir fishery landings, which are made available by Canada's Department of Fisheries and Oceans (DFO) on a close to real-time basis (within 2 weeks). If, by considering landings through October 15 of each year, NMFS determines that less than 9,000 mt has been taken in the NB weir fishery, NMFS will allocate an additional 3,000 mt to Area 1A to be made available to the directed herring fishery during November and through the remainder of the fishing year (until it is harvested). This specification provides additional opportunity for fishing in Area 1A if catch in the NB weir fishery is substantially less than the deducted amount (14,800 mt), while still minimizing the likelihood that ABC would be exceeded.

The 2010-2012 herring fishery specifications are intended to facilitate the transition to an ACL/AM framework mandated by the reauthorized MSA. The provisions to change the fishery specifications and the specifications process are being incorporated into Amendment 4 to the Herring FMP, which is scheduled for implementation at the start of the 2011 fishing year. The proposed specifications, therefore, while consistent with the process and provisions currently outlined in the Herring FMP, include some changes to provide for consistency with the new MSA requirements and changes that will occur through the implementation of Amendment 4 in 2011.

Impact Assessment

To characterize the potential impacts of the proposed specifications on the Atlantic herring resource, the Herring PDT ran short-term (three year) projections of fishing mortality and total stock biomass based on the F_{MSY}-based catch level and the various catch levels under the proposed action, other alternatives considered for ABC, as well as the no action alternative (Table 61). All scenarios among the OFL and ABC alternatives including the proposed action would result in a decline in biomass between 2009 and 2012. A 7.4% decline in median biomass from 2009-2012 is estimated based on projections at the proposed ABC level for 2010-2012. By contrast, no action ABC results in a 35% decrease in biomass, while ABC Alternative 1 (non-preferred) results in an 11% decline and ABC Alternative 2 (non-preferred) results in a 2% decline. The associated changes in fishing mortality are substantial for the no action ABC where F increases from 0.16 to 0.58 over the course of three years. Fishing mortality for the proposed ABC value increases slightly to 0.19. F projected under ABC Alternative 1 (non-preferred) increases in 2010 to 0.27 but returns to the 2009 level in the next two years. ABC Alternative 2 (non-preferred) shows little or no change in F. In each of these scenarios, above average recruitment would mitigate the decrease in biomass while below average recruitment would result in a greater decline.

The risk assessment in Section 6.1.1.2 of this document provides a basis for comparing alternatives and TAC options based on expected removals and relative exploitation of the inshore stock component. While there is no separate assessment of the inshore component (and therefore no biological reference points or overfishing thresholds), it is important to consider removals of the inshore stock relative to other options as well as historical removals and the no action alternative (status quo) because this is the smaller of the stock components and is the target of more fishing pressure than the offshore component. Although the herring resource is not overfished and fishing mortality is currently well below the threshold level, reductions in catch of the inshore component appear to necessary to further ensure that overfishing does not occur on this stock. This is why the Council is proposing reductions in the TACs for 2010-2012, particularly in the areas where the inshore component is taken.

When compared to the no action alternative (2009 specifications), the results of the risk assessment (Section 6.1.1.2.2) indicate that the proposed action should greatly reduce relative exploitation of the inshore stock component. Median relative exploitation ratios for the no action alternative are 0.59 in 2010, 0.64 in 2011, and 0.71 in 2012; median relative exploitation ratios for the proposed action are 0.42 in 2010, 0.45 in 2011, and 0.50 in 2012. Fishing mortality on the inshore component under the proposed TACs is therefore expected to be considerably lower than the status quo.

Summary of Biological Impacts (Including Protected Species and Habitat): The biological analyses provided in this document suggest that the impacts of the proposed action on the Atlantic herring resource will not be significant. While the biomass is projected to decline under the proposed action, the herring resource is not expected to decline substantially or into an overfished condition, and overfishing is not projected to occur. The impacts of the proposed action on herring are more positive than the impacts of the status quo or some of the other alternatives/options the Council considered during the development of the 2010-2012 specifications. The impacts of the TACs are evaluated through a risk assessment; risk is considered based on the likelihood of producing an exploitation rate on an individual stock component that may be higher than that associated with the overfishing threshold for the entire stock complex. Overall, the proposed TACs are associated with less risk than the no action alternative.

The impacts of the proposed action on protected resources are expected to be minimal. This includes impacts on the amount of forage available to protected species. The risk of the impacts of the proposed action are low compared to the other alternatives spatially and temporally, and the rate of fishing is not expected to increase, so interactions with the herring fishery may be low, limiting the potential effects to protected species.

This document considers the effects of the proposed action on habitat and essential fish habitat (EFH). After reviewing all the available information, the conclusion was reached that if the quality of EFH is reduced as a result of this contact, the impacts are minimal and/or temporary and, pursuant to MSA, do not need to be minimized, i.e., that there was no need to take specific action at that time to minimize the adverse effects of the herring fishery on benthic EFH. This conclusion also applied to pelagic EFH for Atlantic herring larvae, juveniles, and adults, and to pelagic EFH for any other federally-managed species in the region. The various species and life stages that might be affected are listed in the Affected Environment, Physical Environment and EFH section of this document.

Summary of Economic/Social Impacts: The economic impacts that result from the alternatives proposed in the 2010-2012 herring specifications fall into these general categories: 1) loss of revenue when expected landings based on OY fall below 2008 landings levels, 2) changes in harvest costs for alternatives that result in fishing activity taking place further from shore, 3) impacts to the lobster fleet for alternatives that restrict landings from Area 1A in the summer, 4) impacts to the mackerel fishery, and 5) impacts to herring processors. These impacts are discussed in more detail in the *Economic Impacts* section of this document (Section 6.4.1).

The Proposed Action will not reduce the stock-wide TAC below 2008 landings levels in any of the three year time span covered by this action. So, in terms of the ability of the fleet to land the same quantity of herring as in the recent pass, the Proposed Action would not negatively impact the fishery. All other options under Alternative 2 would reduce the stock-wide TAC to 75,200 metric tons. Since the management areas close when 95% of the TAC is reached, landings would be capped at 71,440 metric tons which is 9,360 metric tons less than 2008 landings. At the average 2008 price of $260 per metric ton, the value of the difference is approximately 2.4 million dollars.

The Proposed Action reduces the Area 1A TAC by 41% from 45,000 metric tons to 26,546 metric tons. Other options that were considered during the specifications process reduce the Area 1A TAC by less than 10%, while others reduce it by as much as 90%. Options with large Area 1A reductions are generally associated with TACs in Areas 2 and 3 that are higher than historical Area 2 and 3 landings. However, harvesting fish from these areas when the Area 1A TAC is reached may not always be ideal. If Area 1A closes in the summer, fish will not be in Area 2 that time of year. As far as Area 3, it is uncertain whether fish will aggregate in such a way that normal fishing operations can occur. Also, Area 3 is a large area offshore area and so finding fish may be problematic. In addition, some smaller/coastal vessels are not able to safely fish offshore.

Increases in the amount of offshore fishing will increase operating costs. Since search time is likely to increase, the length of the trip will increase which means fuel and other expenses will increase. The length of the trip will also increase since the fishing grounds are further from shore. The degree to which fishing cost will change is difficult to predict so an overall estimate of increased cost is not provided. However, observer data shows that for midwater trawl vessels each additional day at sea increased costs by $2,800 on average.

Impacts to the lobster fishery are expected for options, including the Proposed Action, that substantially reduce the Area 1A TAC. Herring is used for bait in the lobster fishery and nearly 50,000 metric tons of herring is used as bait per year. A 2006 survey by Market Decisions (as reported in Thunberg, 2007) showed that bait costs were 14% to 15% of gross landed value for full-time lobster fishermen in Lobster Conservation Management Area 1 (coastal Maine, New Hampshire, and the North and South Shore regions of Massachusetts). In Lobster Conservation Management Area 2 (coastal Rhode Island and coastal Massachusetts South of Cape Cod), bait costs were 11% to 12% of gross. Shortages in supply, particularly in the summer months could cause price spikes thereby cutting into profit margins. If price increases are high enough, lobster fishermen will seek bait alternatives which may be inferior. Businesses that supply bait may also be impacted since much of the infrastructure is based on delivering salted herring in barrels. Changing to other sources may be costly in the short run.

Options that restrict the Area 2 TAC below historical landings from Area 2 of about 20,000 to 22,000 metric tons have the potential to impact the mackerel fishery. Mackerel fishing takes place in the winter and early spring months in herring management Area 2. In the winter, herring migrate to Area 2. The co-occurrence of both these fisheries in Area 2 during the winter results in herring being caught as bycatch in the mackerel fishery. Many of the same vessels participate in both fisheries. Some mackerel vessels, however, do not have limited access herring permits and are limited to 2,000 pounds of herring per trip. The Area 2 TAC under the Proposed Action is 22,146 metric tons so impacts to the mackerel fishery are not expected to be large.

Since reductions in overall landings are not expected from the Proposed Action, herring processors should not be impacted except in the event that seasonal shortages disrupt the flow of production and/or market opportunities are lost. For options that reduce landings, there would be revenue losses to herring processors and impacts on processing plant employees. The cannery in Maine is particularly vulnerable to options that significantly reduce the Area 1A TAC since the cannery has traditionally been dependant on that area in the summer. Reductions in available herring, highly variable landings, and increased cost of herring will make it difficult for the cannery to continue to produce canned herring at a profit and keep employees working.

This specifications plan involves deep reductions in the overall TAC for the Atlantic Herring Fishery. These reductions are likely to correspond with short term negative impacts to the lobster/bait industries, herring freezer plants and other direct consumers of the herring resource. Over the long term, sustaining the herring resource may also have benefits – particularly for those who benefit indirectly from the existence of a large and healthy herring stock (whale watching businesses, tuna fishermen and other fishermen who pursue stocks that rely on herring for forage). Given the severity of the potential cuts, the impact assessment in this document focuses primarily on the possible short term (within three years) impacts related to this package.

The proposed alternative for the 2010-2012 specifications package will substantially reduce the quantities of herring that may be landed from what has traditionally been the most productive area, that is, Area 1A. Furthermore, given that stock-wide TACs will be reduced, losses from 1A cannot be fully mitigated by fishing in alternative areas. Clearly, the most immediate and apparent impacts of the reductions are economic, that is, the effect on individual and business income. In the assessment provided in this document, however, the socio-cultural implications of income reduction as well as other impacts are considered. Among the social factors of interest are: quality of life, community dynamics and/or stability, governance, access to resources, distribution of resources among user groups (equity and justice concerns), and the role of fishing in American culture and tradition.

In view of the analysis presented in this document, the EIS for Amendment 1 to the Atlantic Herring FMP, and the EA/RIR/IRFA for the 2007-2009 Atlantic herring fishery specifications, establishment of the herring fishery specifications for the 2010-2012 fishing years will not have a significant effect on the human environment, with specific reference to the criteria contained in Section 6.02 of NOAA Administrative Order NAO 216-6, Environmental Review Procedures for Implementing the National Environmental Policy Act, May 20, 1999. Accordingly, the preparation of a Supplemental Environmental Impact Statement for the action proposed in this document is not necessary. Supporting information and analyses are provided in this document.

LIST OF ACRONYMS

ABC	Allowable Biological Catch
ACL	Annual Catch Limit
ACOE	Army Core of Engineers
AHE	Affected Human Environment
AM	Accountability Measure
APA	American Pelagic Association
ASMFC	Atlantic States Marine Fisheries Commission or Commission
B	Biomass
BT	Border Transfer
CAA	Catch at Age
CEQ	Council on Environmental Quality
CHOIR	Coalition for the Atlantic Herring Fishery's Orderly, Informed, and Responsible Long-Term Development
CZMA	Coastal Zone Management Act
DAH	Domestic Annual Harvest
DAP	Domestic Annual Processing
DEA	Data Envelopment Analysis
DMF	Division of Marine Fisheries
DMR	Department of Marine Resources
DSEIS	Draft Supplemental Environmental Impact Statement
DWF	Distant-Water Fleets
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
E.O.	Executive Order
ESA	Endangered Species Act of 1973
F	Fishing Mortality Rate
FEIS	Final Environmental Impact Statement
FMP	Fishery Management Plan
FSEIS	Final Supplemental Environmental Impact Statement
FY	Fishing Year
GB	Georges Bank
GEA	Gear Effects Evaluation
GIFA	Governing International Fisheries Agreement
GMRI	Gulf of Maine Research Institute

GOM	Gulf of Maine
GRT	Gross Registered Tons
HAPC	Habitat Area of Particular Concern
HCA	Habitat Closed Area
HPTRP	Harbor Porpoise Take Reduction Plan
ICNAF	International Commission for the Northwest Atlantic Fisheries
IRFA	Initial Regulatory Flexibility Analysis
IOY	Initial Optimal Yield
IVR	Interactive Voice Response
IWC	International Whaling Commission
IWP	Internal Waters Processing
JVP	Joint Venture Processing
LWTRP	Large Whale Take Reduction Plan
M	Natural Mortality Rate
MA DMF	Massachusetts Division of Marine Fisheries
MAFMC	Mid-Atlantic Fishery Management Council
ME DMR	Maine Department of Marine Resources
MMPA	Marine Mammal Protection Act
MRFSS	Marine Recreational Fisheries Statistical Survey
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSRA	Magnuson-Stevens Reauthorization Act
MSY	Maximum Sustainable Yield
mt	Metric Tons
NAO	North Atlantic Oscillation
NB	New Brunswick
NEFMC	New England Fishery Management Council
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NS	National Standard
NT	Net Tonnage
NSGs	National Standard Guidelines
OCS	Outer Continental Shelf
OFL	Overfishing Limit
OLE	Office of Law Enforcement
OY	Optimum Yield

PBR	Potential Biological Removal
PDT	Plan Development Team
PS/FG	Purse Seine/Fixed Gear
PRA	Paperwork Reduction Act
RFA	Regulatory Flexibility Act
RFFA	Reasonably Foreseeable Future Action
RIR	Regulatory Impact Review
SARC	Stock Assessment Review Committee
SAV	Submerged Aquatic Vegetation
SAW	Stock Assessment Workshop
SSB	Spawning Stock Biomass
SSC	Scientific and Statistical Committee
SFA	Sustainable Fisheries Act
TAC	Total Allowable Catch
TALFF	Total Allowable Level of Foreign Fishing
TC	Technical Committee
TRAC	Transboundary Resource Assessment Committee
TRT	Take Reduction Team
USAP	U.S. At-Sea Processing
USFWS	US Fish and Wildlife Service
VEC	Valued Ecosystem Component
VMS	Vessel Monitoring System
VPA	Virtual Population Analysis
VTR	Vessel Trip Report

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1.0 INTRODUCTION

This document contains the New England Fishery Management Council's recommended specifications for the 2010-2012 Atlantic herring fishery as required by the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and the Herring Fishery Management Plan (FMP) approved by the National Marine Fisheries Service (NMFS) on October 27, 1999. The proposed specifications are consistent with the provisions contained in the Magnuson-Stevens Act and the Atlantic Herring FMP. This document also contains information and supporting analyses required under other applicable law, namely the National Environmental Policy Act (NEPA), Regulatory Flexibility Act (RFA), and Executive Order 12866.

The specifications for the Atlantic herring fishery are for annual amounts (for the 2010-2012 fishing years) of:

- Allowable Biological Catch (ABC),
- A stock-wide Annual Catch Limit (ACL) which also equates to a U.S. Optimum Yield (OY),
- Domestic Annual Harvest (DAH),
- Domestic Annual Processing (DAP),
- Total Joint Venture Processing (JVPt),
- Internal Waters Processing (IWP),
- U.S. At-Sea Processing (USAP),
- Border Transfer (BT, U.S.-caught herring transferred to Canadian vessels for export),
- Total Allowable Level of Foreign Fishing (TALFF),
- Reserve, and
- Total Allowable Catch (TAC) levels for each of four herring management areas (Figure 1). Set-asides for research and fixed gear fisheries in Area 1A are also specified as necessary.

Amounts for an F_{MSY}-based overfishing limit are also specified; the OFL levels will be implemented as part of Amendment 4 to the Atlantic Herring FMP during the upcoming fishing year (see following *Background* section for more information).

1.1 BACKGROUND

1.1.1 Formulas for Specifications

The 2010-2012 specifications will be based on the current formulas for specifications in the Atlantic Herring FMP. However, because this specifications package will cover the fishing years during which the Council and NMFS will transition into the ACL/AM framework established in Amendment 4 (see below for more information), related discussion and clarification is provided in this document where possible to facilitate this transition.

According to the Herring FMP, OY should be less than or equal to allowable biological catch (ABC) minus the expected Canadian catch (C) from the stock complex. The FMP stated that the estimate of the Canadian catch deducted from ABC will be no more than 20,000 mt for the New Brunswick weir fishery and no more than 10,000 mt for the Georges Bank Canadian harvest:

$OY \leq ABC-C$ (C not to exceed 30,000 mt according to the Herring FMP, but Amendment 1 provides flexibility)

Domestic annual harvest (DAH) is established based on the expected catch from U.S. fishing vessels during the upcoming fishing year. The Herring FMP specifies that OY is equal to DAH plus a reserve.

OY = DAH + Reserve

The FMP provides a list of factors to consider when determining the amount of OY, if any, to be assigned to a reserve. There was no reserve for the 2005/2006 fishing years, and there has been no discussion to date of assigning any portion of the OY for the upcoming fishing years to a reserve.

The Herring FMP also specifies that domestic annual harvest (DAH) will be composed of domestic annual processing (DAP), the total amount allocated to processing by foreign ships (JVPt), and the amount of herring that can be taken in U.S. waters and transferred to Canadian herring carriers for transshipment to Canada (BT).

DAH = DAP + JVPt + BT

JVPt consists of joint venture processing operations in both federal waters (JVPs) and state waters (internal waters processing, or IWP).

JVPt = JVPs + IWP

- The Herring FMP specifies that because JVP is derived from DAH, DAH should be determined first before establishing an allocation for JVP.
- Allocations for TALFF (foreign fishing) should be considered if OY is greater than DAH. The Council should therefore consider setting OY at a level that represents a realistic estimate of the amount of herring that can be harvested by the domestic fleet. Given past and recent landings in the fishery (relatively consistent for 15 years), it will be very difficult for

the Council to justify specifications greatly in excess of recent fishery performance based solely on the industry's intent to expand further.

- Consideration of both the capacity in the herring industry (vessels and processors) as well as fishery performance in recent years (landings) is important when specifying OY, DAH, DAP, JVP, and TALFF.

The Herring FMP authorizes the allocation of a portion of DAP for at-sea processing by domestic processing vessels that exceed the current size limits (U.S. at-sea processing, USAP). When determining the USAP allocation, the Council should consider the availability of other processing capacity, development of the fishery, status of the resource, and opportunities for vessels to enter the herring fishery.

1.1.2 Amendment 4 to the Atlantic Herring FMP

The MSA was reauthorized in January 2007 and includes several new provisions:

Section 302 (g) of the MSA states: *(Each Council shall) establish, maintain, and appoint the members of a scientific and statistical committee to assist it in the development, collection, evaluation, and peer review of such statistical, biological, economic, social, and other scientific information as is relevant to such Council's development and amendment of any fishery management plan…*

Each scientific and statistical committee shall provide its Council ongoing scientific advice for fishery management decisions, including recommendations for acceptable biological catch, preventing overfishing, maximum sustainable yield, and achieving rebuilding targets…

Section 302 (h)(6) of the MSA states: *(Each Council shall) develop annual catch limits for each of its managed fisheries that may not exceed the fishing level recommendations of its Scientific and Statistical Committee or the peer review process established.*

Section 303 (a)(15) of the MSA states: *(Any FMP shall) establish a mechanism for specifying annual catch limits in the plan (including a multiyear plan), implementing regulations, or annual specifications, at a level such that overfishing does not occur in the fishery, including measures to ensure accountability.*

NMFS has provided input on what these new requirements may entail through Agency guidance on how Councils can comply with National Standard 1 and the new MSA requirements. The Proposed Rule for the revised National Standard guidelines was published by NMFS on June 9, 2008, and the comment period on the Proposed Rule extended through September 22, 2008. Following a review of public comments, NMFS published a Final Rule with guidelines on complying with the MSA and the National Standards, including the implementation of ACLs and AMs to meet National Standard 1 (preventing overfishing) on January 16, 2009.

In general, the guidelines include details about how FMPs must prevent overfishing while achieving optimum yield (OY) on a continuing basis. There are general definitions of several new and existing terms. The Final Rule also describes what is required in an FMP related to National Standard 1 – prevent overfishing. The Council's Scientific and Statistical Committee

(SSC) is required to recommend a level of acceptable biological catch, from which the Council is required to establish annual catch limits for the fishery. There is guidance on what is a "fishery" and which stocks are and are not required to have ACLs and AMs. There are also detailed descriptions of exceptions to these requirements, guidance for international fisheries, and various requirements for describing data collection and estimation methods.

The Atlantic Herring FMP is required to be in compliance with the new provisions of the MSA by 2011 because the Atlantic herring fishery is not subject to overfishing at this time. The process-related elements of the MSA requirements are being implemented through Amendment 4 to the Herring FMP and are expected to become effective for the 2011 fishing year.

The Atlantic herring fishery has been managed using hard TACs since the 2000 fishing year. The TACs are developed through the fishery specification process and are based on an *Allowable Biological Catch* (ABC) that is based on MSY and has been reduced to OY based on biological, economic, ecological, and other considerations. The Herring FMP has already laid the foundation for complying with the ACL and AM requirements of the MSA, although additional accountability measures are proposed in Amendment 4.

The 2010-2012 Atlantic herring fishery specifications have been developed in accordance with the provisions and new requirements of the Magnuson-Stevens Fishery Conservation and Management Act, including the requirement to establish a process for and specifications for ACLs and AMs for Atlantic herring by 2011. Amendment 4 to the Herring FMP is currently under development and includes the provisions for the ACL/AM process. The 2011-2012 specifications are consistent with the process proposed in Amendment 4 for specifying ACLs and AMs through the fishery specification process. Amendment 4 is scheduled to be finalized by the Council in early 2010 and implemented prior to the start of the 2011 fishing year. The proposed 2010-2012 fishery specifications are based on the process/provisions currently included in the Herring FMP but provide the necessary elements for a transition to the new ACL/AM process that will be implemented in Amendment 4.

1.1.3 New Formulas for Specifications Related to Amendment 4 Provisions

New formulas related to the specification of the overfishing limit, acceptable biological catch, and the annual catch limits, as mandated by the MSA, are described below and will be effective upon the implementation of Amendment 4. OFL levels are specified in this document as well, though, because they are F_{MSY}–based fishing levels and form the basis of the ABC and OY specifications.

According to guidance from NMFS, FMPs should set ACLs based on recommendations from the Council's Scientific and Statistical Committee (SSC) for all managed fisheries. The "overfishing limit" (OFL) identified in the MSA essentially corresponds to a maximum sustainable yield (MSY) value for the fishery. NMFS recommends that acceptable biological catch (ABC) and an annual catch limit (ACL) be established as well. The ABC should be set lower than the OFL to account for scientific uncertainty as necessary:

OFL>=ABC>=ACL

OFL – Scientific Uncertainty = ABC (Determined by SSC)

ABC – Management Uncertainty (Canadian catch, state waters catch, discards – determined by Council) = Stock-wide ACL = OY

With the implementation of Amendment 4, the most notable changes in the 2010-2012 herring fishery specifications include the specification for OFL (based on F_{MSY}) and re-specification of the current ABC (*allowable biological catch*) to the MSA-defined ABC (*acceptable biological catch*) that accounts for scientific uncertainty. The Atlantic herring fishery is and will continue to be managed by hard TACs. A stock-wide OY will be established that accounts for both scientific uncertainty (through the specification of ABC) and management uncertainty (through the specification of OY and a buffer between ABC and OY) (see Table 1).

Table 1 Relationship Between Proposed 2010-2012 Specifications and Measures Proposed in Amendment 4

PROPOSED 2010-2012 SPECIFICATIONS	PROPOSED AMENDMENT 4 SPECIFICATIONS
Allowable Biological Catch (ABC)	Overfishing Limit (OFL)
	Acceptable Biological Catch (ABC)
U.S. Optimum Yield (OY)	OY/Stock-wide ACL
Domestic Annual Harvesting (DAH)	Domestic Annual Harvesting (DAH)
Domestic Annual Processing (DAP)	Domestic Annual Processing (DAP)
Total Joint Venture Processing (JVPt)	Total Joint Venture Processing (JVPt)*
Joint Venture Processing (JVP)	Joint Venture Processing (JVP)*
Internal Waters Processing (IWP)	Internal Waters Processing (IWP)*
U.S. At-Sea Processing (USAP)	U.S. At-Sea Processing (USAP)*
Border Transfer (BT)	Border Transfer (BT)
Total Allowable Level of Foreign Fishing (TALFF)	Total Allowable Level of Foreign Fishing (TALFF)*
RESERVE	RESERVE*
TAC Area 1A	Sub-ACL Area 1A
TAC Area 1B	Sub-ACL Area 1B
TAC Area 2	Sub-ACL Area 2
TAC Area 3	Sub-ACL Area 3
Research Set-Aside	Research Set-Aside
Fixed Gear Set-Aside in 1A	Fixed Gear Set-Aside in 1A

**Specifications that are starred may be eliminated in Amendment 4 (see below).*

1.1.4 Modifications to Specifications Under Consideration in Amendment 4

The Council is considering an option in Amendment 4, which would retain the general provisions for establishing specifications for the Atlantic herring fishery but would eliminate the need to annually specify JVP, IWP, TALFF, and a TAC reserve. While TALFF would not have to be considered by the Council during the specifications process if this option is selected, countries interested in foreign fishing for herring may still request TALFF allocations from NMFS, and these requests would be addressed as they arise.

Note: Because Amendment 4 has not yet been implemented, the Council proposes to retain all existing specifications for the 2010-2012 fishing years and set JVP, IMP, TALFF, and the TAC reserve at zero for these three years, in anticipation of approving the option in Amendment 4 to eliminate these specifications in future years.

1.2 PURPOSE AND NEED

The Atlantic Herring FMP requires that the NMFS Regional Administrator, after consultation with the Council, determine the specifications for the herring fishery on an annual basis. Amendment 1 to the Herring FMP established a process whereby the Council can set specifications for up to three fishing years. Amendment 4 to the Herring FMP, currently under development, is modifying the specifications process to ensure consistency with the MSA as reauthorized in 2007 (see Section 1.1.1). The Herring FMP requires the Council and the Regional Administrator to review the best available information regarding the status of the resource and fishery and develop appropriate fishery specifications. The FMP also provides the Regional Administrator the authority to adjust the specifications in mid-season as necessary.

The Herring FMP mandates that the total allowable catch (TAC) be distributed to the management areas shown in Figure 1 on an annual basis. The Council uses the best information available to estimate the proportion of each spawning component of the Atlantic herring stock complex in each area/season and distributes the TACs such that the risk of overfishing an individual spawning component is minimized. The purpose of this action is to establish specifications for the Atlantic herring fishery during the 2010-2012 fishing years. Additionally, the proposed specifications are intended to facilitate the transition to the ACL/AM framework mandated by the MSA and implemented through Amendment 4 to the Atlantic Herring FMP in 2011.

The Atlantic herring fishery specifications are intended to meet the goal and many of the objectives of the Atlantic Herring FMP, as modified in Amendment 1, specifically:

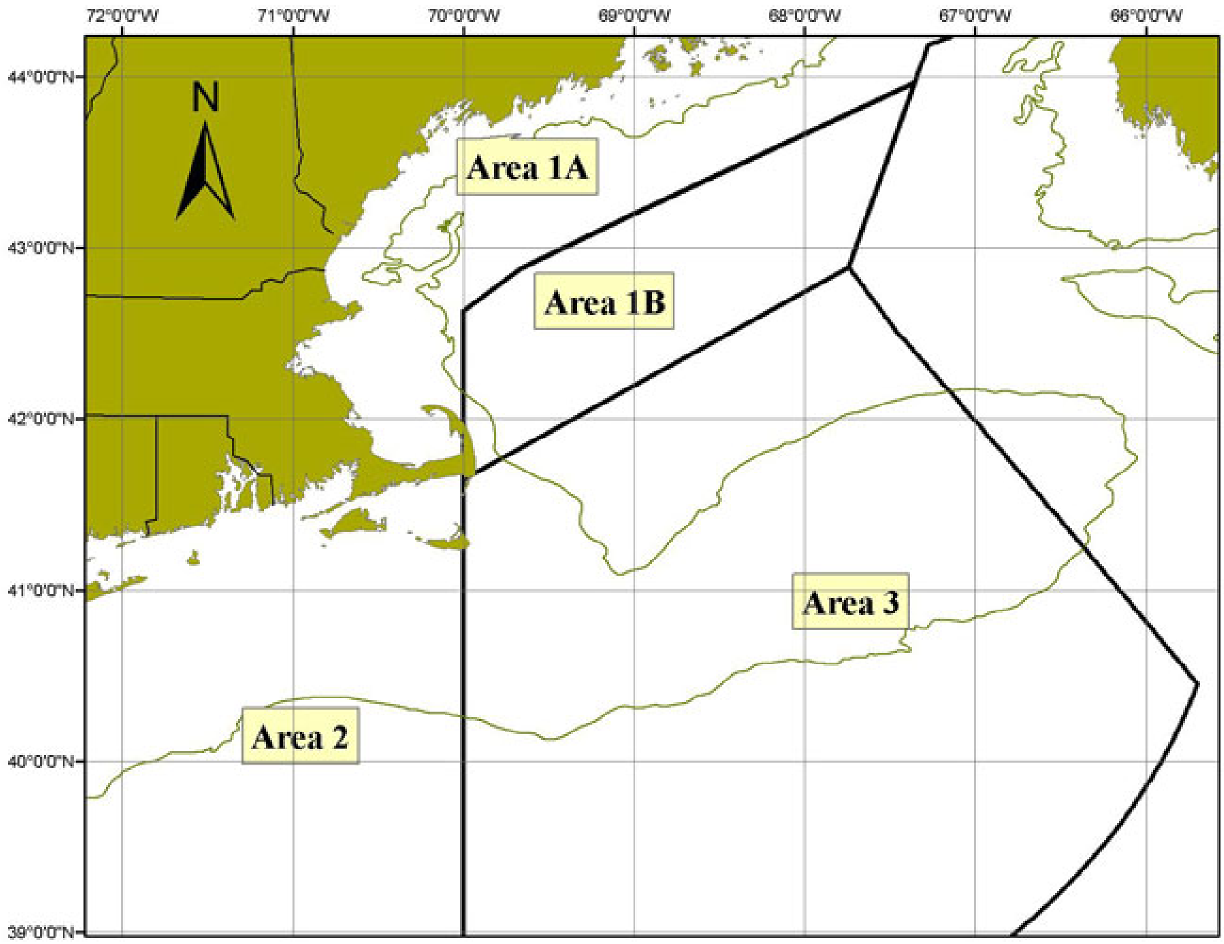
Goal

- Manage the Atlantic herring fishery at long-term sustainable levels consistent with the National Standards of the Magnuson-Stevens Fishery Conservation and Management Act

Objectives

- Harvest the Atlantic herring resource consistent with the definition of overfishing contained in the Herring FMP and prevent overfishing
- Prevent the overfishing of discrete spawning components of Atlantic herring
- Avoid patterns of fishing mortality by age which adversely affect the age structure of the stock
- Provide for long-term, efficient, and full utilization of the optimum yield from the herring fishery while minimizing waste from discards in the fishery. Optimum yield is the amount of fish that will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, taking into account the protection of marine ecosystems, including maintenance of a biomass that supports the ocean ecosystem, predator consumption of herring, and biologically sustainable human harvest. This includes recognition of the importance of Atlantic herring as one of many forage species of fish, marine mammals, and birds in the Northeast Region.
- Minimize, to the extent practicable, the race to fish for Atlantic herring in all management areas
- Provide, to the extent practicable, controlled opportunities for fishermen and vessels in other mid-Atlantic and New England fisheries
- Promote and support research, including cooperative research, to improve the collection of information in order to better understand herring population dynamics, biology and ecology, and to improve assessment procedures
- Promote compatible US and Canadian management of the shared stocks of herring
- Continue to implement management measures in close coordination with other Federal and State FMPs and the ASMFC management plan for Atlantic herring, and promote real-time management of the fishery

Figure 1 Atlantic Herring Management Areas



2.0 PROPOSED ACTION

This section provides the New England Fishery Management Council's final recommendations to NMFS regarding the Atlantic herring fishery specifications for the 2010-2012 fishing years. Supporting information and the Council's rationale for the proposed specifications are provided/discussed in Section 5.0 of this document (p. 119). Other alternatives/options for the 2010-2012 specifications that the Council considered (but is not recommending) are described in Section 3.0 of this document.

The proposed Atlantic herring fishery specifications for the 2010-2012 fishing years are presented in Table 2 below.

Table 2 Proposed Atlantic Herring Fishery Specifications for the 2010-2012 Fishing Years

SPECIFICATION	2010-2012 ALLOCATION (MT)
F_{MSY}-Based Fishing Level (will become OFL in Amendment 4)	145,000 – 2010 134,000 – 2011 127,000 - 2012
ABC	106,000
U.S. OY	91,200
DAH	91,200
DAP	87,200
JVPt	0
JVP	0
IWP	0
USAP	0
BT	4,000
TALFF	0
RESERVE	0
TAC Area 1A*	26,546
TAC Area 1B	4,362
TAC Area 2	22,146
TAC Area 3	38,146
Research Set-Aside	None
Fixed Gear Set-Aside (1A)	295

**Specifications include possible allocation of 3,000 additional mt of herring to Area 1A in November and December of each year, depending on landings in the Canadian New Brunswick weir fishery (see below).*

The proposed specifications for 2010-2012 include a provision to allocate an additional 3,000 mt of herring to Area 1A in November and December based on the level of catch in the New Brunswick (NB) weir fishery. The Council is recommending a deduction of 14,800 mt from the ABC to account for potential catch of Atlantic herring in the NB weir fishery. NMFS will monitor NB weir fishery landings, which are made available by Canada's Department of Fisheries and Oceans (DFO) on a close to real-time basis (within 2 weeks). If, by considering landings through October 15 of each year, NMFS determines that less than 9,000 mt has been taken in the NB weir fishery, NMFS will allocate an additional 3,000 mt to Area 1A to be made available to the directed herring fishery during the months of November and December. This specification provides additional opportunity for fishing in Area 1A if catch in the NB weir fishery is substantially less than the deducted amount (14,800 mt), while still minimizing the likelihood that ABC would be exceeded.

The 2010-2012 herring fishery specifications are intended to facilitate the transition to an ACL/AM framework mandated by the reauthorized MSA. The provisions to change the fishery specifications and the specifications process are being incorporated into Amendment 4 to the Herring FMP, which is scheduled for implementation at the start of the 2011 fishing year. The proposed specifications, therefore, while consistent with the process and provisions currently outlined in the Herring FMP, include some changes to provide for consistency with the new MSA requirements and changes that will occur through the implementation of Amendment 4 in 2011.

3.0 OTHER ALTERNATIVES/OPTIONS CONSIDERED BY THE COUNCIL FOR THE 2010-2012 ATLANTIC HERRING SPECIFICATIONS (NON-PREFERRED)

The other alternatives considered by the Council during the development of the 2010-2012 herring fishery specifications are described in the following subsections. These are non-preferred alternatives/options and are not recommended by the Council for implementation.

3.1 NO ACTION ALTERNATIVE (STATUS QUO)

The no action alternative would maintain the 2009 Atlantic herring fishery specifications for the 2010-2012 fishing years.

Atlantic herring fishery specifications for the 2007-2009 fishing years were based on the 2006 TRAC assessment results and include a specification of allowable biological catch equivalent to the 2006 MSY value of 194,000 mt (Table 3). Optimum yield for the fishery is set at 145,000 mt, and the buffer between MSY and OY accounts for Canadian catch (20,000 mt), the retrospective pattern in the 2006 stock assessment, other sources of assessment/scientific uncertainty, and the important role of herring in the Northwest Atlantic ecosystem.

Table 3 Summary of the No Action Alternative (2009 Specifications Maintained for 2010-2012)

	2007	2008/2009
Allowable Biological Catch (ABC)	194,000	194,000
U.S. Optimum Yield	145,000	145,000
Domestic Annual Harvesting (DAH)	145,000	145,000
Domestic Annual Processing (DAP)	141,000	141,000
Joint Venture Processing Total (JVPt)	0	0
JVP	0	0
Internal Waters Processing (IWP)	0	0
U.S. At-Sea Processing (USAP)	20,000 (Areas 2 and 3 only)	20,000 (Areas 2 and 3 only)
Border Transfer (BT)	4,000	4,000
Total Allowable Level of Foreign Fishing (TALFF)	0	0
RESERVE	0	0
TAC Area 1A	50,000 (5,000 Jan-May)	45,000 (43,650 fishery; 5,000 Jan-May)
TAC Area 1B	10,000	10,000 (9,700 fishery)
TAC Area 2	30,000	30,000 (29,100 fishery)
TAC Area 3	55,000	60,000 (58,200 fishery)
Research Set-Aside (RSA)	N/A	Area 1A RSA 1,350 Area 1B RSA 300 Area 2 RSA 900 Area 3 RSA 1,800

Area 2 and 3 RSA was not utilized and was re-allocated to the management area TACs for the remainder of the fishing year.

3.2 OTHER ALTERNATIVES CONSIDERED FOR ABC (NON-PREFERRED)

During the development of the 2010-2012 herring fishery specifications, the Council considered several alternatives for specifying ABC and sought advice/recommendations from the SSC. ABC for the 2010-2012 fishing years was originally recommended by the Scientific and Statistical Committee to be 90,000 mt (Alternative 2, Table 4). Because the herring resource is not overfished and the MSA-mandated ACL provisions do not need to be established until 2011, the Herring Committee developed a second alternative for ABC that would set ABC at the F_{MSY}-based catch level (145,000 mt) for 2010 and at the SSC-recommended level for 2011 and 2012 (Alternative 1, Table 4).

Table 4 F_{MSY}-Based Catch Levels and Non-Preferred Alternatives for ABC for the 2010-2012 Fishing Years

YEAR	F_{MSY} Catch (mt)*	ABC Alternative 1 (mt)	ABC Alternative 2 (mt)
2010	145,000	145,000	90,000
2011	134,000	90,000	90,000
2012	127,000	90,000	90,000

**F_{MSY}* Catch will become the Overfishing Limit (OFL) upon implementation of Amendment 4. Allowable biological catch (ABC) will become the acceptable biological catch (ABC) values upon implementation of Amendment 4.*

At its September meeting, the Council reviewed the initial SSC recommendation to specify ABC at 90,000 mt for 2010-2012 (see Appendix I for September SSC Report and more detailed information). NEFMC members approved a motion to request that "the SSC revisit the size of the 40% buffer between OFL and ABC to consider whether application of recent years retrospective difference of about 17% is sufficient to account for scientific uncertainty caused by retrospective patterns." (The motion carried on a show of hands (8/7/1). In November 2009, the SSC therefore revisited its ABC recommendations and replaced the September 2009 recommendations with new recommendations that:

- ABC for the Gulf of Maine / Georges Bank Atlantic herring complex in 2010 to 2012 should be limited to recent catch.
- A new benchmark assessment should be scheduled as soon as possible.

The November 2009 SSC recommendations (summarized in the bullets above) form the basis for the Council's rationale for the proposed action (ABC specification of 106,000 mt for 2010-2012). Information related to the 2009 TRAC Assessment, SSC discussions, and the non-preferred alternatives for ABC is provided in **Appendix I** to this document (*2009 TRAC Status Report and Related ABC Documents*). Information related to the proposed specification of ABC (106,000 mt), including the November 2009 SSC recommendations and the Council's rationale, is provided in Section 5.2 of this document.

3.3 OTHER OPTIONS CONSIDERED FOR OY (NON-PREFERRED)

The Council recommends that a deduction of 14,800 mt be taken from ABC during each year from 2010-2012 to account for potential catch in the NB weir fishery (specified in Amendment 4 as management uncertainty). This deduction provides a buffer to ensure that ABC will not be exceeded, and once the deduction is taken, the resulting available catch will equate to Optimum Yield for the U.S. herring fishery (specified in Amendment 4 as a stock-side annual catch limit).

Based on the non-preferred ABC alternatives considered during the development of the specifications, non-preferred OY options included a specification of U.S. OY at 130,200 mt in 2010 and 75,200 mt in 2011 and 2012 under Alternative 1, and 75,200 mt in all three years under Alternative 2 (Table 5).

Table 5 Other Options Considered for Specifying Optimum Yield for the 2010-2012 Fishing Years (Non-Preferred)

YEAR	ABC Alt 1 (mt)	Canadian Catch (Management Uncertainty) (mt)	U.S. OY Alt 1 (mt)	ABC Alt 2 (mt)	Canadian Catch (Management Uncertainty) (mt)	U.S. OY Alt 2 (mt)
2010	145,000	14,800	**130,200**	90,000	14,800	**75,200**
2011	90,000	14,800	**75,200**	90,000	14,800	**75,200**
2012	90,000	14,800	**75,200**	90,000	14,800	**75,200**

OY will also become the stock-wide ACL upon implementation of Amendment 4.

3.4 OTHER OPTIONS CONSIDERED FOR MANAGEMENT AREA TACS (NON-PREFERRED)

The other options that were considered by the Council for specifying TACs in each of four herring management areas (identified as sub-ACLs in Amendment 4) are summarized in Table 6 and described below. A figure depicting the Atlantic herring management areas is provided on p. 8 of this document (Figure 1). Table 7 summarizes the proposed monthly/seasonal allocation of quota in Area 1A under Options 4-6 (Options 1-3 did not include changes to the allocation of 1A quota).

The Proposed Action (described in Section 2.0 of this document) is a slightly modified version of Option 2A (non-preferred) that incorporates a different value for ABC and OY and maintains the same TACs for all three fishing years.

Notes:

- In all of the options, regarding the allocations for the 2011 and 2012 fishing years –total stock biomass is projected to decrease (from the assessment projections), and the OFL decreases. Because the average Canadian catch from 1995-2008 is utilized in the risk assessment, the fraction of inshore removals taken in the Canadian fishery increases in 2011 and 2012. Therefore, the percentage allocations to the management areas are adjusted in 2011 and 2012 while trying to maintain the intent of the option. In most cases, some of the allowable catch must be shifted to Area 3.
- The Council currently has the ability to adjust the seasonal allocation of quota in Area 1A. Regulations specified in CFR 648.201(f) state that the TAC for Management Area 1A is divided into two seasonal periods. The first season extends from January 1 through May 31, and the second season extends from June 1 through December 31. Seasonal TACs for Area 1A, including the specification of the seasonal periods, shall be set through the annual specification process.

Option 1 (Historical): This option was developed based on the distribution of herring catch in the four management areas for the last ten years, 1999-2008. The percentages of herring landings by management area were calculated for each of the ten years and averaged across the time period to determine the distribution of the sub-ACL under this option. The initial distribution (2010) allocates 58.4% of the ACL to Area 1A, 5% to Area 1B, 18.5% to Area 2, and 18.1% to Area 3. No changes are proposed to the distribution of the quota in Area 1A under this option.

Option 2 (2001): This option was developed based on the distribution of herring TACs in the 2001 fishing year, the year after the implementation of the Atlantic Herring FMP. The percentages of herring landings by management area in 2001 were calculated and applied to the stock-wide ACLs in each of the two alternatives to determine the sub-ACLs. Because there was a TAC reserve for Area 2 in 2001, this option was divided into two options, one that includes the Area 2 reserve and one that eliminates the Area 2 reserve. No changes are proposed to the distribution of the quota in Area 1A under this option.

Option 2: This option includes the 80,000 mt TAC reserve in Area 2 that was specified during the 2001 fishing year. The total OY in 2001 was 250,000 mt, and 130,000 mt was allocated to Area 2, including the reserve. The initial distribution of the sub-ACLs under this option (2010) allocates about 24% of the ACL to Area 1A, 4% to Area 1B, 52% to Area 2, and 20% to Area 3.

Option 2A: This option eliminates the 80,000 mt TAC reserve in Area 2 and reduces the 2001 OY to 170,000 mt to calculate the percent distribution of the TACs. The initial distribution of the sub-ACLs under this option (2010) allocates about 35.3% of the ACL to Area 1A, 5.9% to Area 1B, and 29.4% to both Areas 2 and 3.

**An error was made in the calculation of the TACs under this option, and the sum of the area TACs therefore do not total OY. This was considered by the Committee and Council when selecting the final recommendations for the 2010-2012 specifications.*

Option 3 (2009): This option was developed based on the distribution of herring TACs in the 2009 fishing year. The percentages of herring landings by management area in 2009 were calculated and applied to the stock-wide ACLs in each of the two alternatives to determine the sub-ACLs. The initial distribution of the sub-ACLs under this option (2010) allocates about 31% of the ACL to Area 1A, 6.9% to Area 1B, 20.7% to Area 2, and 41.4% to Area 3. No changes are proposed to the distribution of the quota in Area 1A under this option.

Option 4 (Max 1A): This option was developed by the Herring PDT based on direction from the Herring Committee to develop an option that maximizes the catch from Area 1A that the risk assessment indicates is likely to achieve a relative exploitation rate for the inshore component in the range of 0.24-0.28 (0.24 represents the F_{MSY} exploitation rate for the stock complex). To achieve the desired exploitation rate, monthly/seasonal restrictions are applied to the fishery in Area 1A (Table 7). Because of the significance of the seasonal restrictions, the Herring PDT developed two options to maximize catch in Area 1A that allow fishing during different months.

Option 4A: The initial distribution of the sub-ACLs under this option (2010) allocates about 15.2% of the ACL to Area 1A, 6.6% to Area 1B, 6% to Area 2, and 72.2% to Area 3. Fishing in Area 1A is allowed only during July, August, and September under this option, with 33% of the sub-ACL for Area 1A available during each of those months.

Option 4B: The initial distribution of the sub-ACLs under this option (2010) allocates about 25.2% of the ACL to Area 1A, 6.6% to Area 1B, 6% to Area 2, and 62.2% to Area

3. Fishing in Area 1A is allowed only during May, June, and July under this option, with 33% of the sub-ACL for Area 1A available during each of those months.

Option 5 (Max 2): This option was developed by the Herring PDT based on direction from the Herring Committee to develop an option that maximizes the catch from Area 2 that the risk assessment indicates is likely to achieve a relative exploitation rate for the inshore component in the range of 0.24-0.28 (0.24 represents the F_{MSY} exploitation rate for the stock complex). To achieve the desired exploitation rate, monthly/seasonal restrictions are applied to the fishery in Area 1A (Table 7). The initial distribution of the sub-ACLs under this option (2010) allocates about 8.6% of the ACL to Area 1A, 6.7% to Area 1B, 40% to Area 2, and 44.7% to Area 3. Fishing in Area 1A is allowed only during July, August, and September under this option, with 40% of the sub-ACL for Area 1A available during July and 30% available during both August and September.

Option 6 (Balanced): This option was developed by the Herring PDT based on direction from the Herring Committee to develop an option that reduces the quota in a relatively balanced manner across all management areas such that the risk assessment indicates the option will likely achieve a relative exploitation rate for the inshore component in the range of 0.24-0.28 (0.24 represents the F_{MSY} exploitation rate for the stock complex). To achieve the desired exploitation rate, monthly/seasonal restrictions are applied to the fishery in Area 1A (Table 7). The initial distribution of the sub-ACLs under this option (2010) allocates about 13.6% of the ACL to both Areas 1A and 2, 6.8% to Area 1B, and 66% to Area 3. Fishing in Area 1A is allowed only during July, August, and September under this option, with 33% of the sub-ACL for Area 1A available during each of those months.

Table 6 2010-2012 TAC Options Considered by the Council (Non-Preferred)

		ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVES 1 and 2	
		2010	2010	2011	2012
OFL		**145,000**	**145,000**	**134,000**	**127,000**
ABC		**145,000**	**90,000**	**90,000**	**90,000**
Mgmt Uncertainty		**14,800**	**14,800**	**14,800**	**14,800**
Stockwide ACL/OY		**130,200**	**75,200**	**75,200**	**75,200**
Option 1 (historical)	**1A**	76,000	43,900	40,313	37,135
	1B	6,500	3,700	3,398	3,130
	2	24,100	13,900	12,764	11,758
	3	23,600	13,700	18,725	23,177
Option 2 (2001 with reserve)	**1A**	31,200	18,000	16,529	15,226
	1B	5,200	3,000	2,755	2,538
	2	67,700	39,100	35,906	33,075
	3	26,100	15,100	20,010	24,361
Option 2A (2001 without reserve)	**1A**	45,400	26,000	23,876	21993
	1B	7,600	4,300	3,949	3,637
	2	37,800	21,700	19,927	18,356
	3	37,800	21,700	19,927	18,356
Option 3 (2009)	**1A**	40,400	23,300	21,396	19,709
	1B	9,000	5,200	4,775	4,399
	2	27,000	15,600	14,325	13,196
	3	53,800	31,100	34,703	37,896
Option 4A (Max 1A)	**1A**	19,771	11,419	10,486	9,659
	1B	8,593	4,963	4,558	4,198
	2	7,812	4,512	4,143	3,817
	3	94,024	54,306	56,013	57,526
Option 4B (Max 1A)	**1A**	32,778	18,931	16,000	13,000
	1B	8,593	4,963	4,500	3,500
	2	7,812	4,512	4,000	4,000
	3	81,017	46,794	50,700	54,700
Option 5 (Max 2)	**1A**	11,197	6,467	5,000	4,000
	1B	8,723	5,038	4,500	4,000
	2	52,080	30,080	26,000	24,000
	3	58,200	33,615	39,700	43,200
Option 6 (Balanced)	**1A**	17,690	10,217	8,500	7,000
	1B	8,854	5,114	4,500	3,500
	2	17,707	10,227	8,500	7,000
	3	85,949	49,642	53,700	57,700

Table 7 2010-2012 Monthly Catch Proportions Considered by the Council (Non-Preferred Options)

	OPTION 1 (Historical)	OPTION 2 (2001)	OPTION 3 (2009)	OPTION 4A (Max 1A)	OPTION 4B (Max 1A)	OPTION 5 (Max 2)	OPTION 6 (Balanced)
	AREA 1A	AREA 1A	AREA 1A	AREA 1A	AREA 1A	AREA 1A	AREA 1A
JAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FEB	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MARCH	0.00	0.00	0.00	0.00	0.00	0.00	0.00
APRIL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAY	0.00	0.00	0.00	0.00	0.33	0.00	0.00
JUNE	0.09	0.09	0.09	0.00	0.33	0.00	0.00
JULY	0.23	0.23	0.23	0.33	0.33	0.40	0.33
AUGUST	0.28	0.28	0.28	0.33	0.00	0.30	0.33
SEPT	0.02	0.02	0.02	0.33	0.00	0.30	0.33
OCT	0.19	0.19	0.19	0.00	0.00	0.00	0.00
NOV	0.19	0.19	0.19	0.00	0.00	0.00	0.00
DEC	0.00	0.00	0.00	0.00	0.00	0.00	0.00

**Note: Options 1-3 (shaded) indicate the catch proportions used in the Herring PDT's risk assessment, which are based on the best available information about 2009 proportion of monthly catches. The catch proportions in Options 1 – 3 are not proposed to be implemented as regulations. The catch proportions in Options 4- 6 would, however, be implemented if any of those options were selected (i.e., Options 4 – 6 include a seasonal allocation of the 1A quota).*

4.0 AFFECTED ENVIRONMENT – UPDATED STOCK AND FISHERY INFORMATION

Guidance from the NMFS Regional Office suggests that the Affected Environment component of any Environmental Assessment should contain enough information for the reader and reviewer to understand how decisions were made and conclusions were drawn in the impact analyses. This section therefore provides updated stock and fishery information for the Atlantic herring resource and fishery and was utilized to support the recommendations made by the Council for the 2010-2012 herring specifications.

The following description of the affected environment is incorporated by reference from the Atlantic Herring FMP (March 1999), the Final Environmental Impact Statement (FEIS) for Minimizing Impacts of the Atlantic Herring Fishery on Essential Fish Habitat (NMFS, January 2005), and the Final EIS for Amendment 1 to the Herring FMP (May 3, 2006). Relevant information is presented below in summary form and is updated through the 2008 and 2009 fishing years wherever possible. All of the above documents, as well as the Environmental Assessment for the Essential Fish Habitat (EFH) components of the Herring FMP (October 1998), should be referenced for more complete information about the environment affected by the Atlantic herring fishery.

The Valued Ecosystem Components (VECs) affected by the Proposed Action include the Atlantic Herring Resource (herring and non-target/bycatch) Habitat and Essential Fish Habitat (EFH), protected resources, and the Atlantic Herring Fishery.

4.1 ATLANTIC HERRING RESOURCE

4.1.1 Atlantic Herring (Target Species)

Life History:
Atlantic herring occur from North Carolina to the Canadian Maritime provinces and from inshore to offshore waters to the edge of the continental shelf. They can also be found in every major estuary from the Chesapeake Bay to the Gulf of Maine. They are most abundant north of Cape Cod (Kelly and Moring 1986) with the largest and oldest fish found in the southern most portion of the range (Munro 2002). Adult herring undertake extensive migrations to areas where they feed, spawn, and overwinter. Spawning occurs in the summer and fall, starting earlier along the eastern Maine coast and southwest Nova Scotia (August – September) than in the southwestern Gulf of Maine (early to mid-October in the Jeffreys Ledge area) and as late as November – December on Georges Bank (Reid et al.1999). In U.S. waters, Atlantic herring reach a maximum length of about 39 cm (15.6 inches) and an age of about 15-18 years (Anthony 1972).

Population Management and Status: New England Fishery Management Council's manages herring under the Atlantic Herring Fishery Management Plan. The stock complex is not overfished at this time, and overfishing is not occurring. A complete description of the Atlantic herring resource can be found in Section 7.1 of the FSEIS for Amendment 1 to the Herring FMP. The following subsections update trawl survey data through 2008 if possible (also provided in Amendment 4) and summarize results of the recently-completed updated stock assessment (TRAC 2009) for Atlantic herring.

4.1.1.1 Updated Trawl Surveys

Research trawl surveys are conducted region-wide by the National Marine Fisheries Service (NMFS) and in inshore areas by the Massachusetts Division of Marine Fisheries (MA DMF) as well as the Maine Department of Marine Resources (ME DMR). Available sources of information have been updated through 2008 when possible and are presented in the subsections below.

4.1.1.2 NMFS Trawl Survey – All Strata

Table 8 summarizes data (mean weight per tow in kilograms and mean number per tow) from the NMFS spring and autumn bottom trawl surveys from 1990 – 2008. Table 9 summarizes data from the NMFS winter bottom trawl survey from 1992 – 2007 (the winter survey ended in 2007, so no additional information is available).

The NEFSC trawl survey samples the range of the Atlantic herring resource in the U.S. Exclusive Economic Zone (EEZ). The 2007 fall survey numbers were slightly lower, but not substantially different from those seen in 2005 and 2006. The 2007 spring survey numbers dropped from 2006 levels but also are similar to those in 2005. The 2008 spring survey numbers were slightly higher than 2007, and the 2008 autumn survey numbers were almost identical to those observed in 2007. Overall, no trend is apparent in any of the surveys in recent years, although the long-term trend over the survey time series has been upwards.

Table 8 NMFS Trawl Survey – Herring Catch Per Tow (Mean Number and Weight in kg), 1990-2008

YEAR	SPRING SURVEY		AUTUMN SURVEY	
	number/tow	kg/tow	number/tow	kg/tow
1990	8.98	0.92	13.98	1.64
1991	25.40	2.29	20.75	2.95
1992	39.30	2.76	56.61	9.25
1993	68.52	7.68	16.81	2.51
1994	35.40	3.88	13.71	2.15
1995	27.57	3.14	125.75	13.12
1996	58.58	3.81	37.65	4.64
1997	64.66	4.08	37.06	4.87
1998	50.62	4.73	20.63	2.84
1999	84.52	9.45	13.52	1.84
2000	32.02	2.80	20.65	3.18
2001	33.72	3.22	25.33	3.69
2002	40.92	2.63	77.99	10.74
2003	19.71	1.87	94.76	6.23
2004	48.00	2.22	40.70	5.04
2005	19.87	1.49	25.70	3.37
2006	27.72	2.89	28.16	3.48
2007	17.34	1.72	22.97	3.17
2008	19.18	2.02	22.83	3.07

Table 9 NMFS Winter Trawl Survey – Herring Catch Per Tow (Mean Number and Weight in kg), 1992-2007

YEAR	WINTER Number/Tow	WINTER KG/Tow
1992	35.42	3.19
1993	49.77	6.56
1994	4.39	0.51
1995	17.60	2.60
1996	112.25	6.86
1997	54.53	8.47
1998	57.29	6.05
1999	56.01	6.77
2000	66.20	3.54
2001	77.09	7.56
2002	74.66	9.45
2003	42.78	4.49
2004	34.26	2.16
2005	98.06	9.08
2006	50.87	4.80
2007	55.26	6.37

4.1.1.3 Trawl Survey Data – Inshore Only

A selected subset of NMFS and MA DMF trawl survey strata were chosen to represent trends in the inshore herring component during 1963-2004. NMFS strata 26-27,38-40 and Mass DMF strata 25-29 (Cape Cod Bay) and 31-36 (Mass. Bay North) were used during spring and autumn (Figure 2, Figure 3).

Figure 2 NMFS Trawl Survey Strata

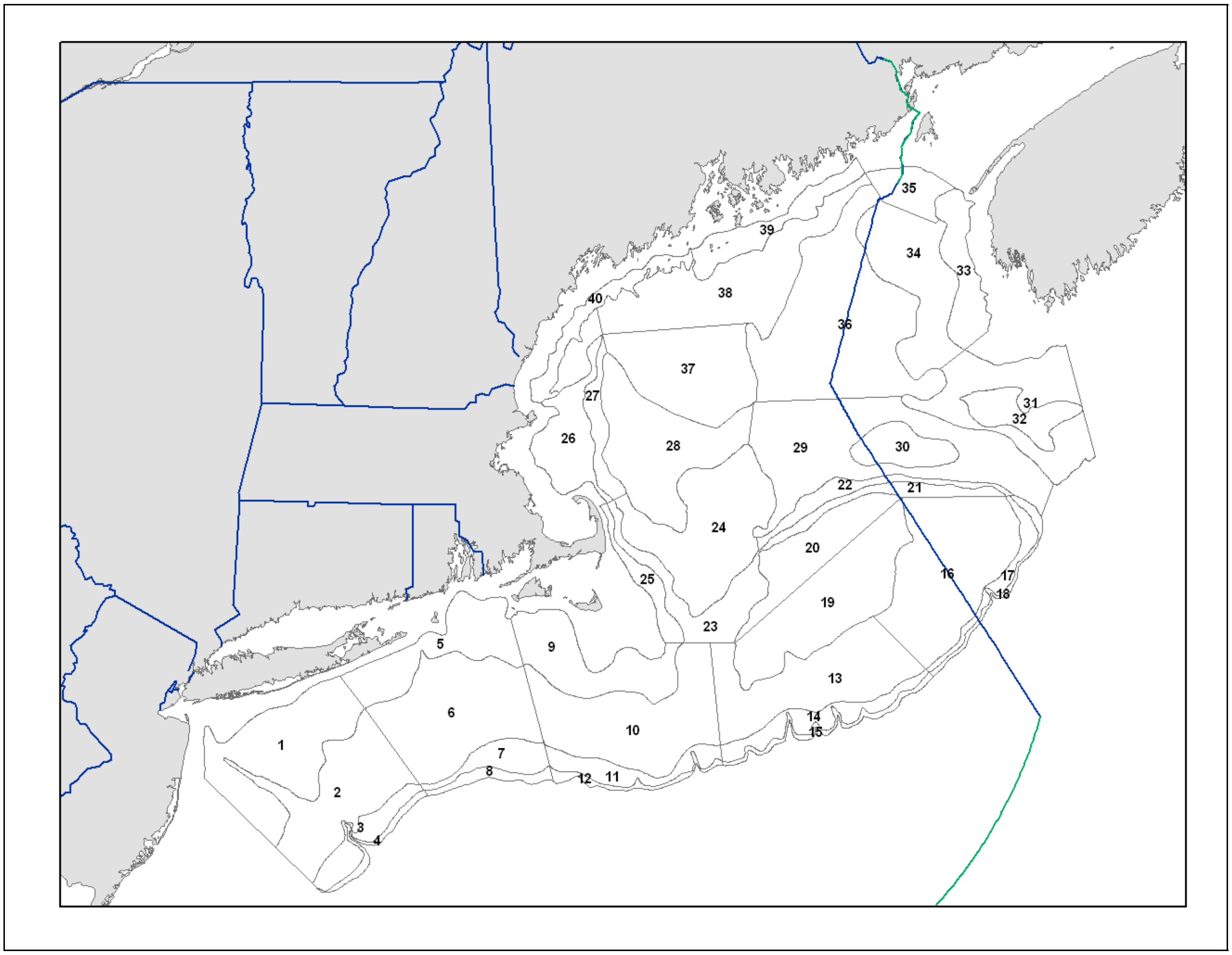
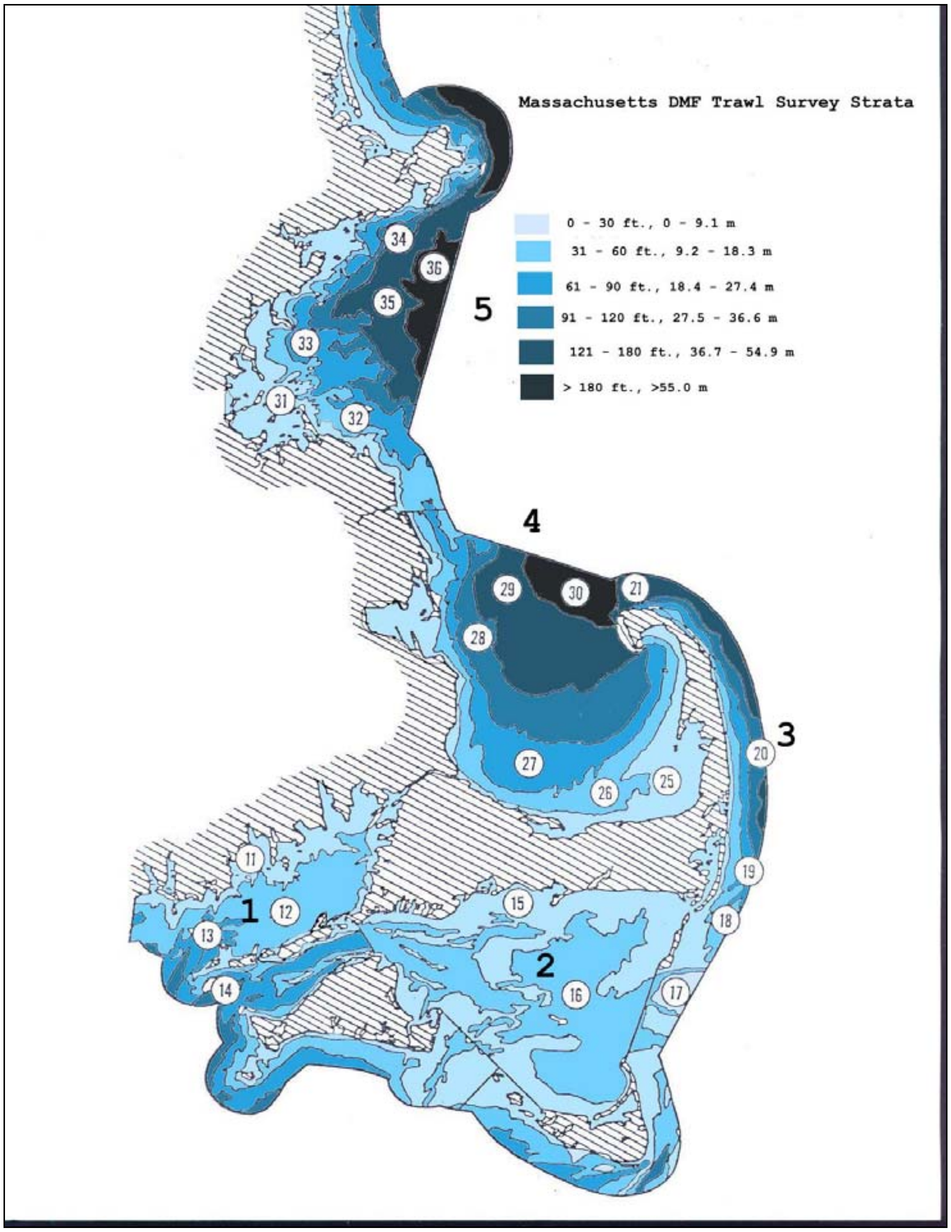


Figure 3 MA DMF Inshore Trawl Survey Strata



In addition, since Fall 2000, Maine DMR, in conjunction with the Gulf of Maine Research Institute and the State of New Hampshire, have been conducting an inshore bottom trawl survey. While this survey targets principal groundfish species from the NH/MA boarder to Canada, it has regularly sampled herring.

The data collected from these trawl surveys are utilized to evaluate trends in the abundance of Atlantic herring and are summarized in the following subsections.

4.1.1.3.1 NMFS Trawl Survey – Inshore Only

To examine trends in the inshore Gulf of Maine separately, NMFS survey strata 26, 27, and 38-40 were isolated because they include the majority of the area from this survey that represents the inshore Gulf of Maine. The NMFS fall survey and the spring survey were relatively flat, averaging very few fish per tow during the late 1960s through the early 1980s (Figure 4 – Figure 7). In the late 1980s, the indices increased significantly, and although variable, have remained relatively high.

The number of fish per tow from the survey in the inshore Gulf of Maine increased to a record high in the 2004 spring survey. A similar peak was observed in the fall survey in the previous year. Another relatively significant increase in numbers and weight per tow occurred during the fall of 2006, but this was not observed in the spring survey; the following 2007 spring survey increased slightly from very low levels, and 2008 levels are slightly lower than those observed in 2007. Throughout the more recent time series, the surveys in the inshore Gulf of Maine have been quite variable, and no trend is apparent. Overall, survey tows in the inshore GOM since 2004 are not as high in number or weight as those observed during the late 1990s and early 2000s. It should be noted that while the fall survey might be construed to represent mostly the Gulf of Maine spawning component, the same cannot be said for the Spring inshore survey.

Figure 4 Herring Catch/Tow (Number) Indices from the NMFS Autumn Bottom Trawl Survey Strata 26-27,38-40 (Inshore GOM Area), 1963-2008

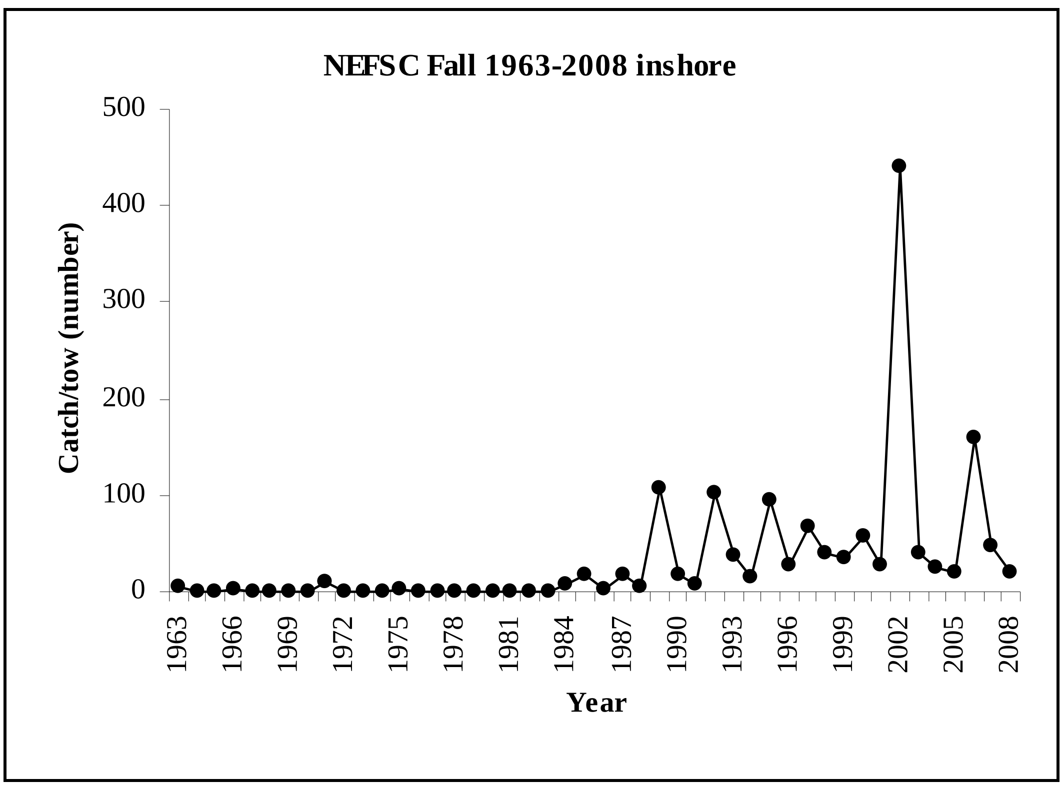


Figure 5 Herring Catch/Tow (Kilograms) Indices from the NMFS Autumn Bottom Trawl Survey Strata 26-27,38-40 (Inshore GOM Area), 1963-2008

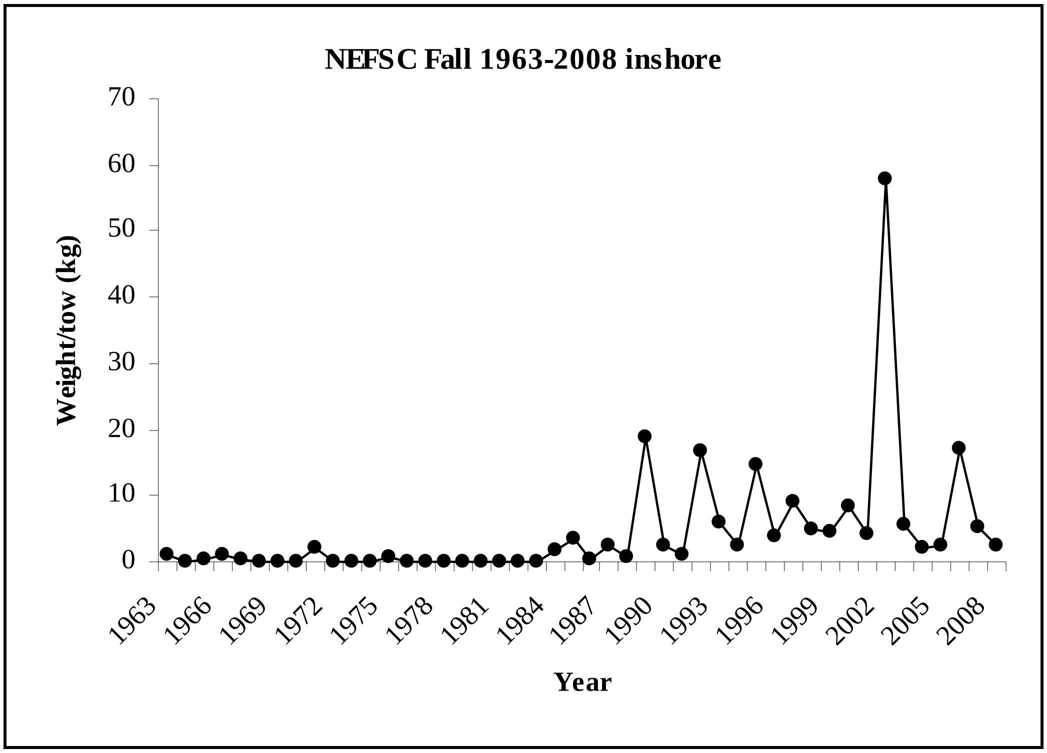


Figure 6 Herring Catch/Tow (Number) Indices from the NMFS Spring Bottom Trawl Survey Strata 26-27,38-40 (Inshore GOM Area), 1968-2008

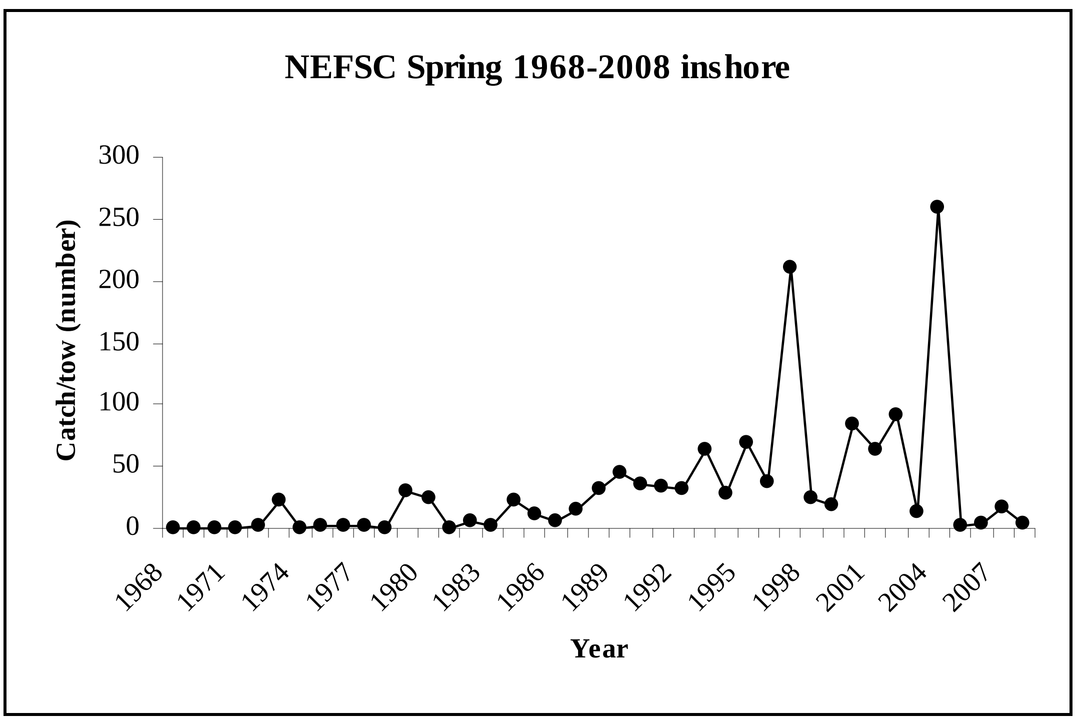
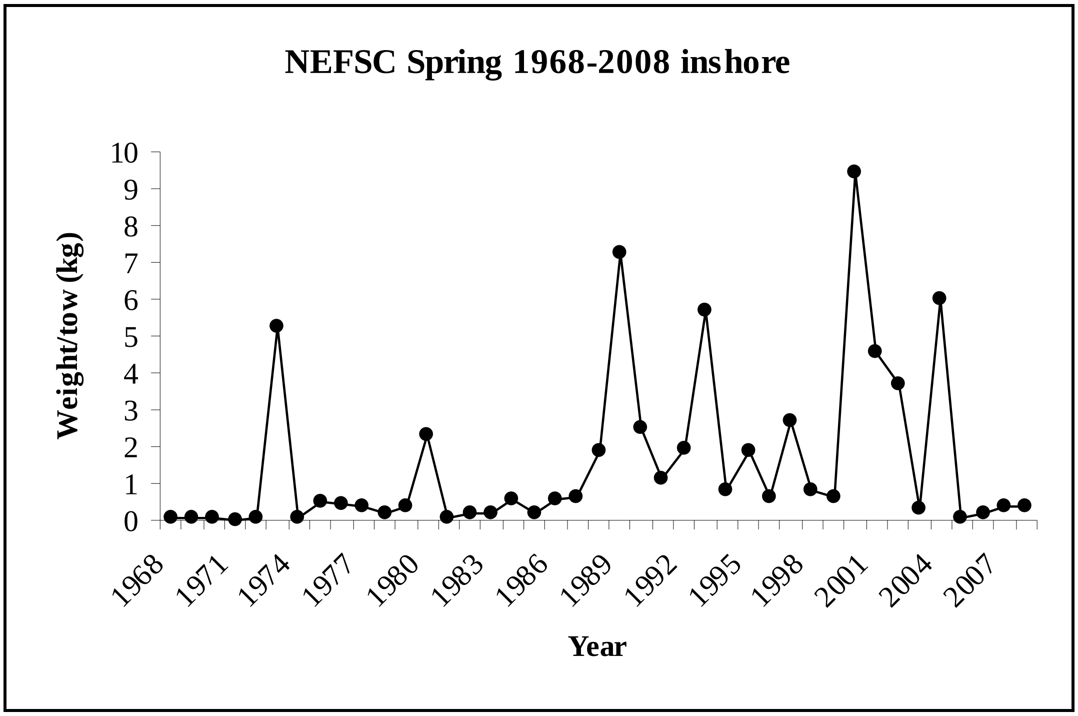


Figure 7 Herring Catch/Tow (Kilograms) Indices from the NMFS Spring Bottom Trawl Survey Strata 26-27,38-40 (Inshore GOM Area), 1968-2008

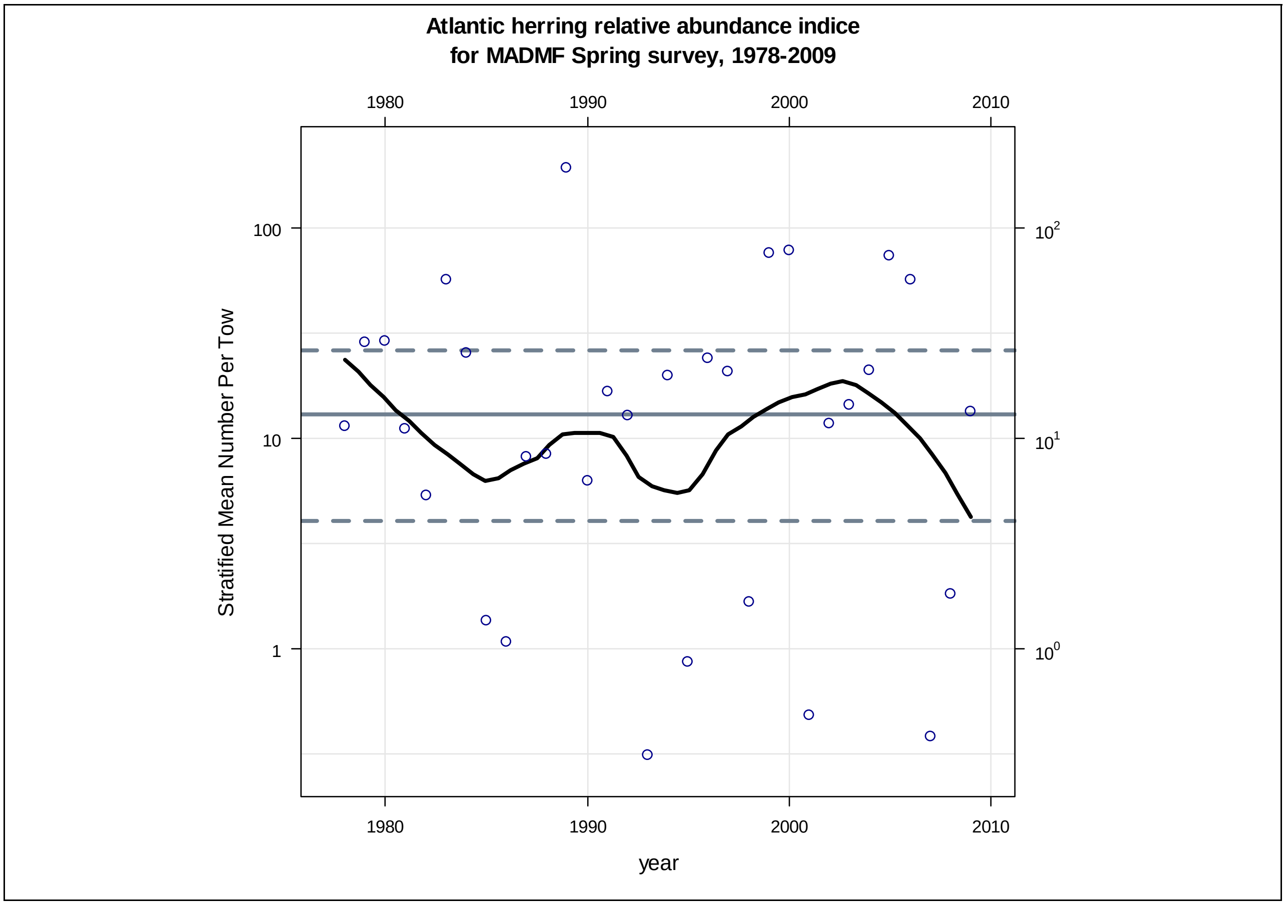


4.1.1.3.2 MA DMF Inshore Trawl Survey

The MA DMF research bottom trawl surveys (Strata 25-36) for spring and fall through 2008 were examined for trends in the inshore herring component. In general, the MA DMF inshore survey is dominated by young herring and does not track adult herring abundance. These indices, however, may be more useful as a measure of recruitment to the inshore component of the resource.

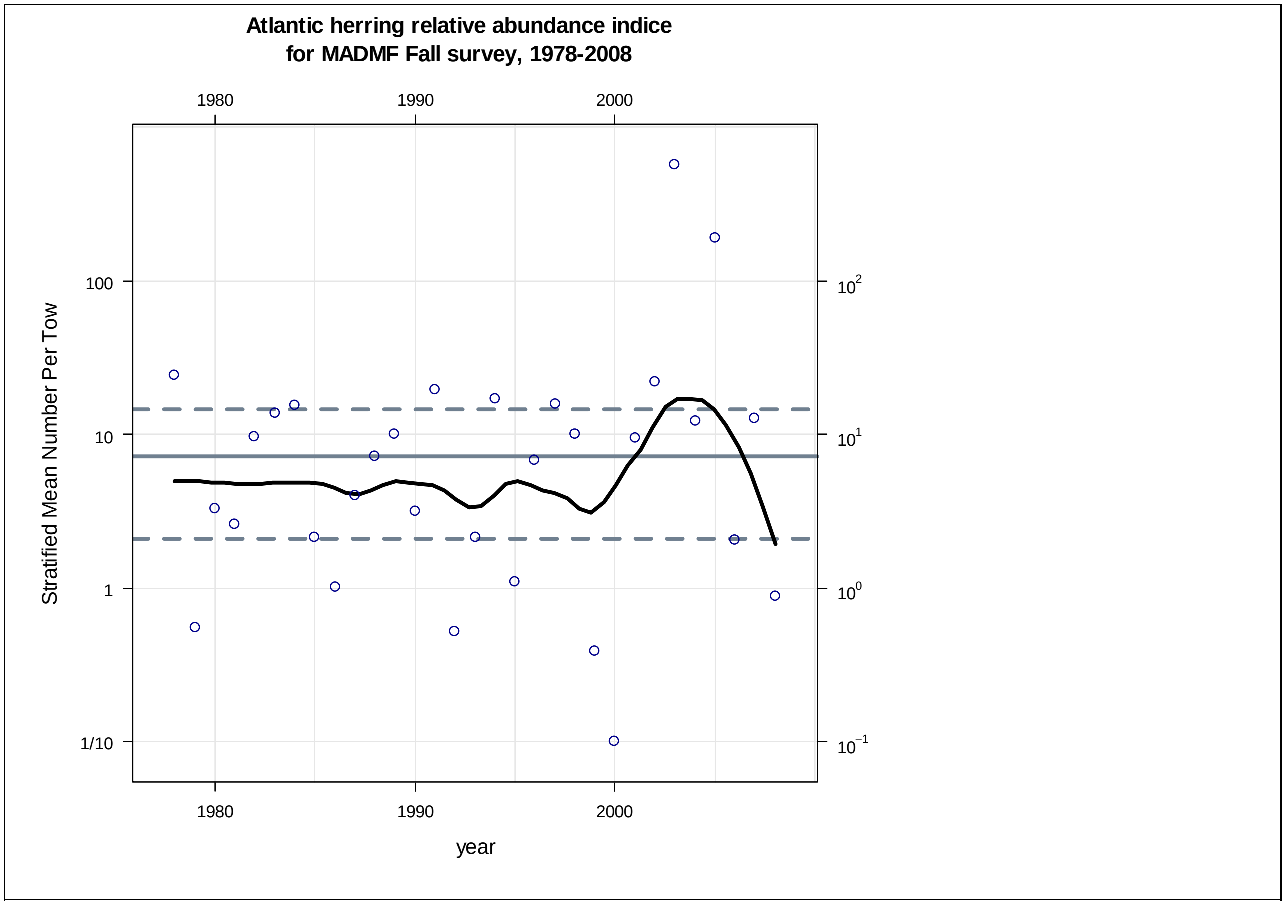
Both the fall and spring survey time series are highly variable, as may be expected for a pelagic species and both indices are dominated by young herring. Both survey indices have generally declined since 2005. The spring survey fluctuates without trend, although 2007 and 2006 were well below the 25th quantile (Figure 8) and the fall survey may (Figure 8, Figure 9). Note that the large increase in the fall 2003 index was heavily influenced by two very large tows in Region 4 (Cape Cod Bay). The relative abundance index was low in 2007 and 2008, with both years below the 25th quantile of the time series. The index ticked up to approximately the median in 2009.

Figure 8 MADMF Spring Survey Mean Number per tow for Strata 25-36



Solid black line is loess fit with span=0.5. Solid gray line is time series median and dashed lines delimit inter-quartile range. Note Y scale axis is semi-log scale.

Figure 9 MA DMF Fall Survey Mean Number per tow for Strata 25-36



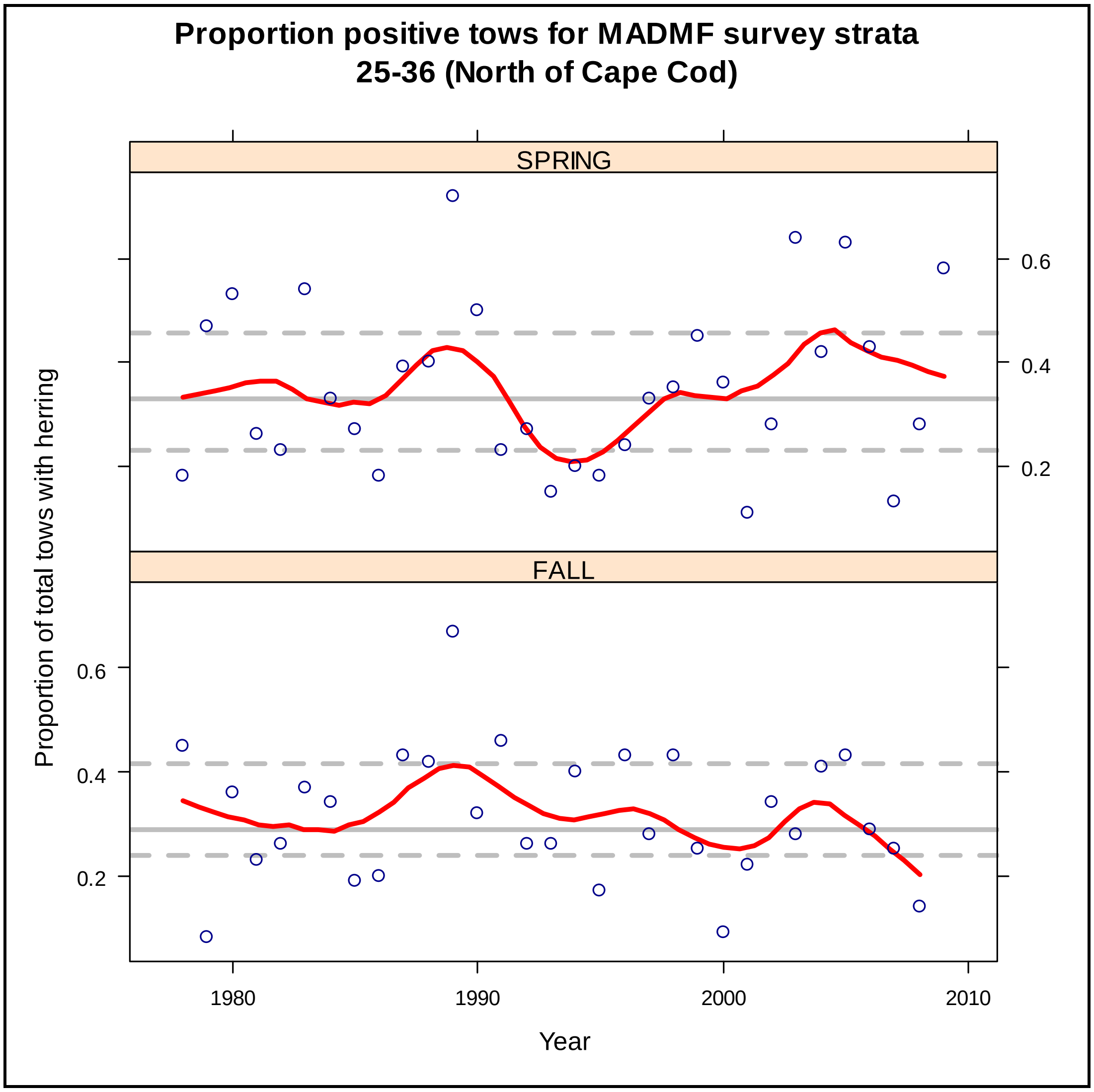
Solid black line is loess fit with span=0.3. Solid gray line is time series median and dashed lines delimit inter-quartile range. Note Y scale axis is semi-log scale.

The encounter rate for herring in the MA DMF inshore bottom trawl survey, as measured by the ratio of tows with herring to total tows, is shown in Figure 10. Both the spring and fall time series are highly variable and have fluctuated without trend for most of the time series. Most recent encounter rates in the spring time series appear stable with lower index in 2007 and 2008, and a high index in 2009. The fall survey is showing a decline from 2006 through 2008. The encounter rate index may track abundance of recruit fish, but is less sensitive to the influence of large tows. However, because herring is a schooling pelagic fish, the encounter rate index may be tracking the number of schools rather than abundance.

Both the relative abundance indices and the encounter rate indices are highly variable, and the high variation makes interpretation difficult. Perhaps the best use for these indices would be to watch for short runs that occur on either side of the inter-quartile range. Runs below the 25^{th} quantile may indicate trend of poor recruitment.

The time series of length frequency distributions for spring and fall surveys are shown in Figure 11 – Figure 14. These figures indicate the high year to year variation and indicate that the MADMF indices are dominated by juveniles.

Figure 10 Number of MA DMF Spring (1978-2009) and Fall (1978-2008) Survey Tows that Encountered Herring, as a Proportion of Total Tows for strata 25-36



Solid red line is loess fit with span=0.3 and degree=1. Solid gray line is time series median. Dashed gray lines indicate 25th and 75th quantiles of the time series

Figure 11 Stratified Mean Number per tow at Length for MA DMF Spring Survey, 1978-2009

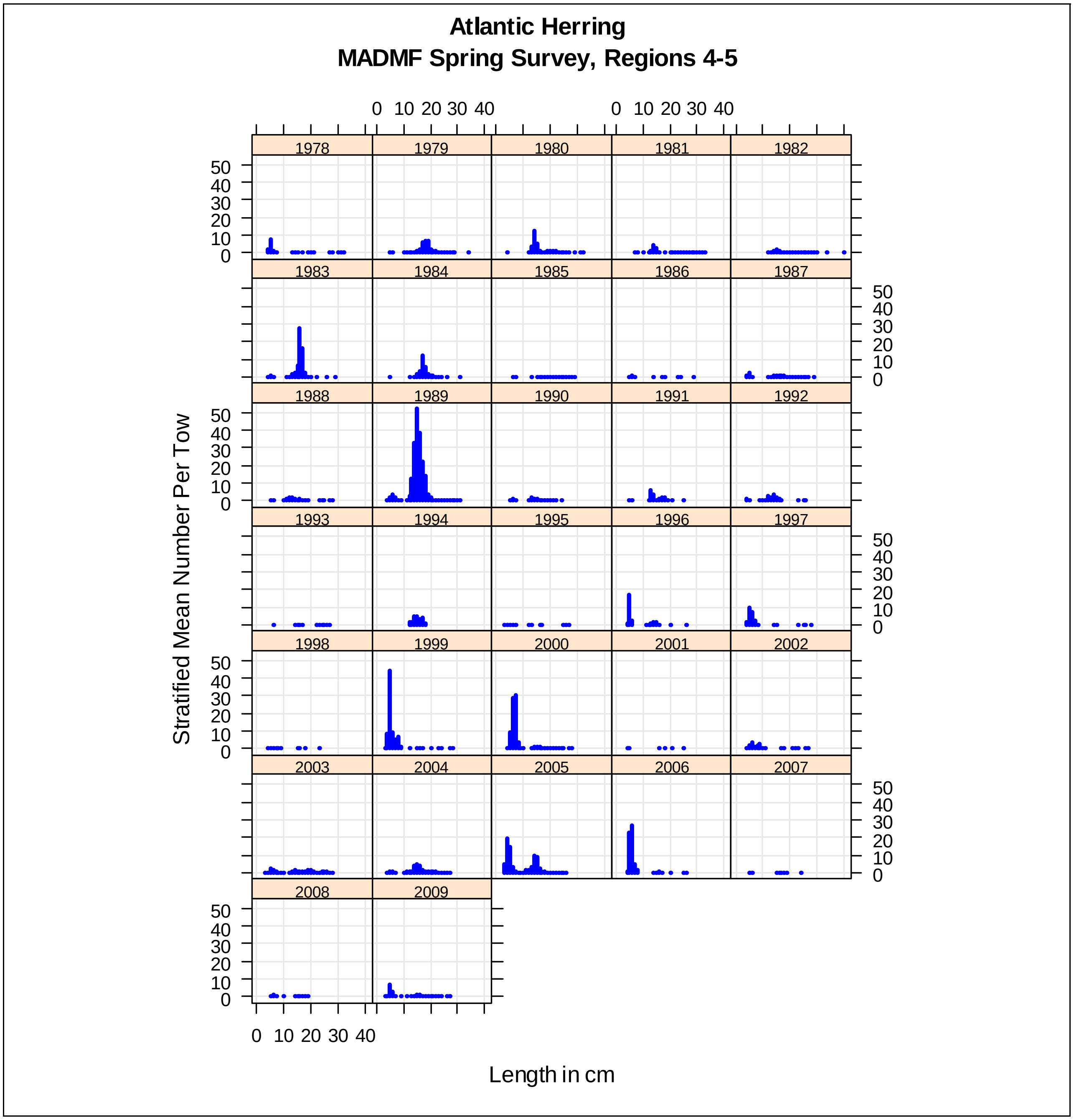


Figure 12 Proportion of Total Mean Number per tow at Length for MA DMF Spring Survey (strata 25-36) for 1978-2008

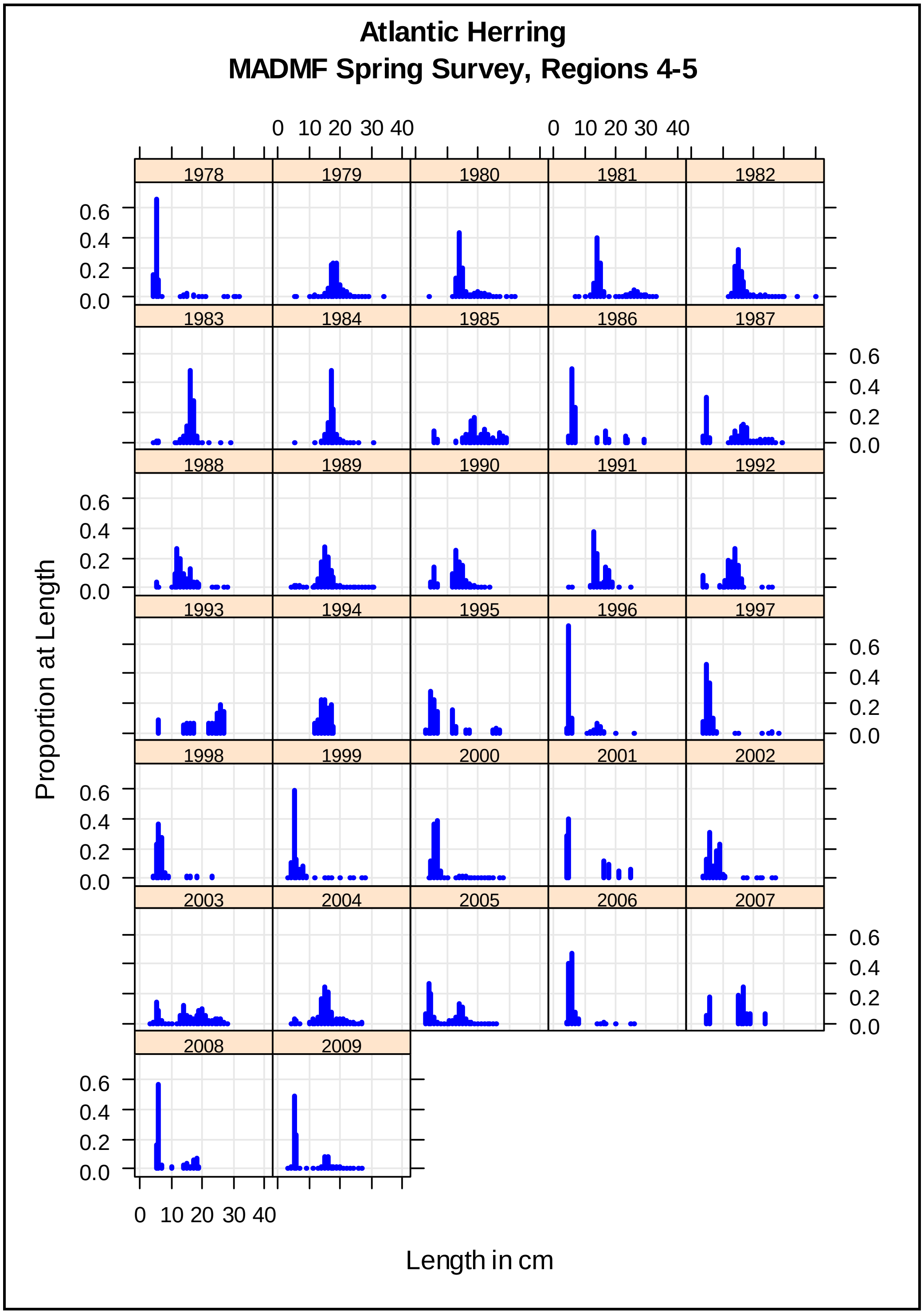


Figure 13 Stratified Mean Number per tow at Length for MA DMF Fall Survey, 1978-2008

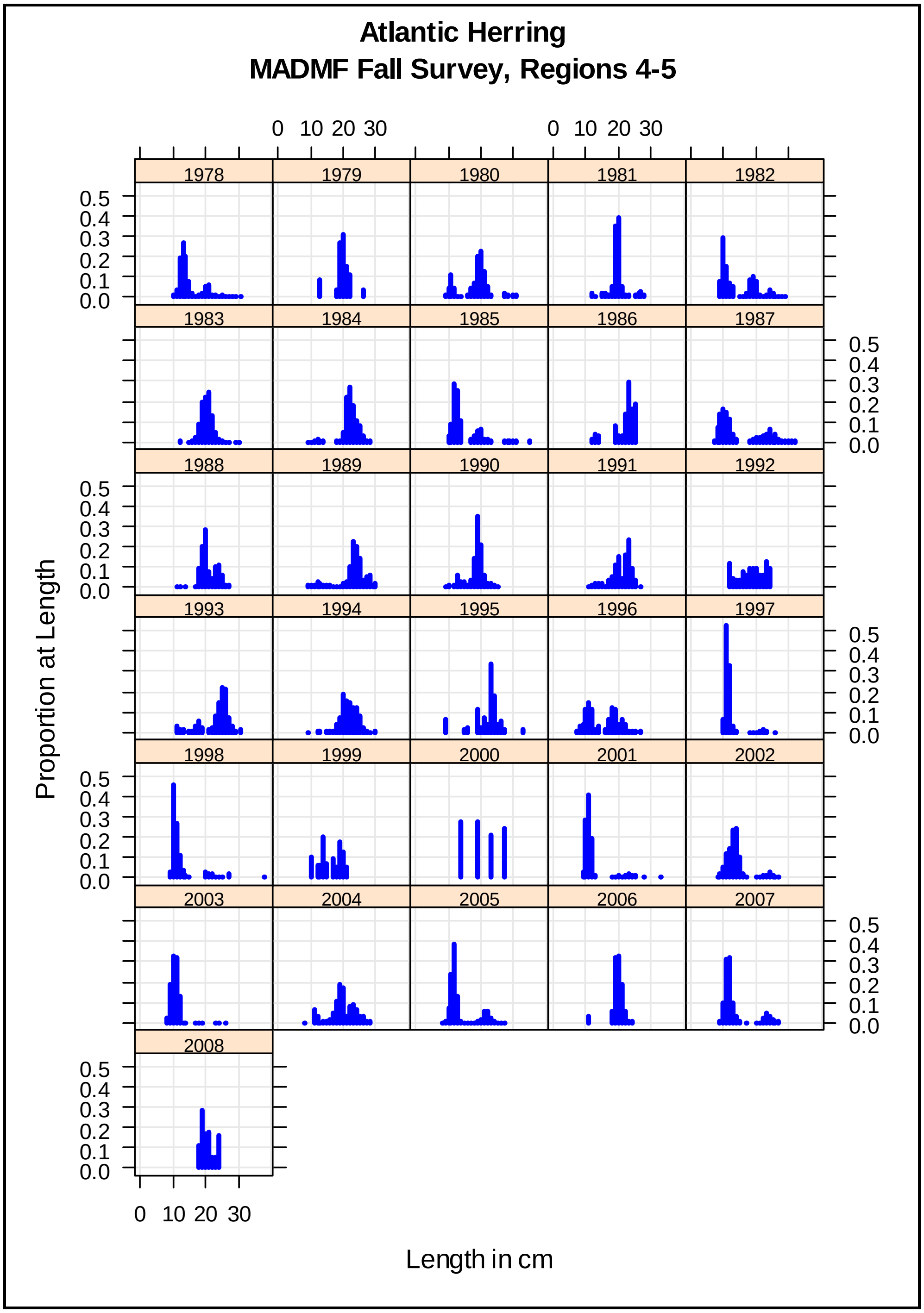
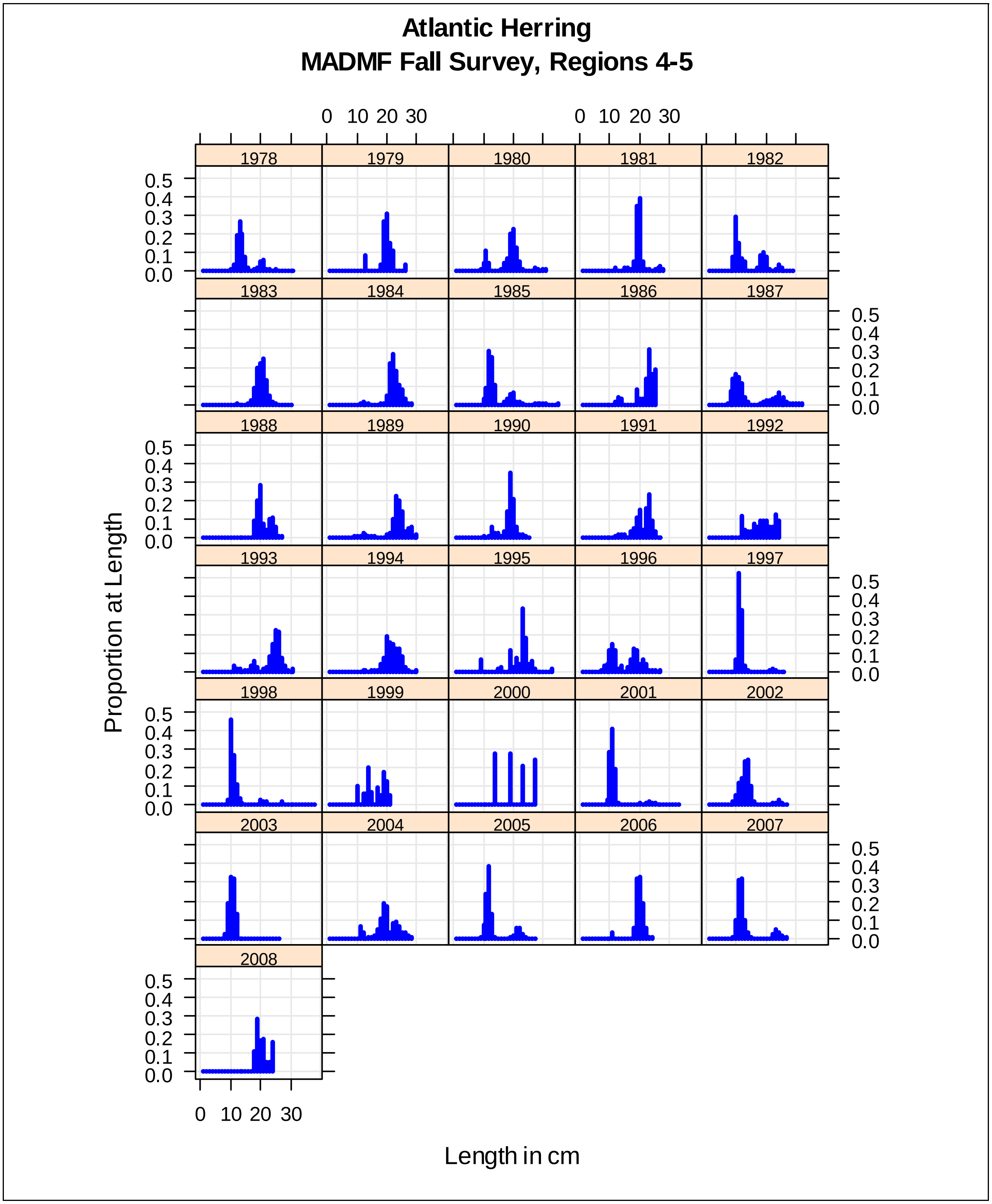


Figure 14 Proportion of Total Mean Number per tow at Length for MA DMF Autumn Survey (strata 25-36), 1978-2008



4.1.1.3.3 ME DMR Inshore Trawl Survey

Since Fall 2000, Maine DMR, in conjunction with the Gulf of Maine Research Institute and the State of New Hampshire, have been conducting an inshore bottom trawl survey. While this survey targets principal groundfish species from the NH/MA boarder to Canada, it regularly samples herring in many of its strata. Results from the fall and spring survey (Figure 15 and Figure 16) have been variable over the time series, and no trend is apparent.

This is a ME/NH coast-wide bottom trawl survey, the results of which should not be viewed as an index of spawning stock biomass (SSB) for the inshore component of the herring resource. In fact, most of the fish sampled by this survey are age 1 fish. Similar to the MA DMF survey, this bottom trawl survey may provide an indication of pre-recruitment year class strength.

Figure 15 ME DMR Fall Inshore Bottom Trawl Survey Catch (# Fish) Per Tow

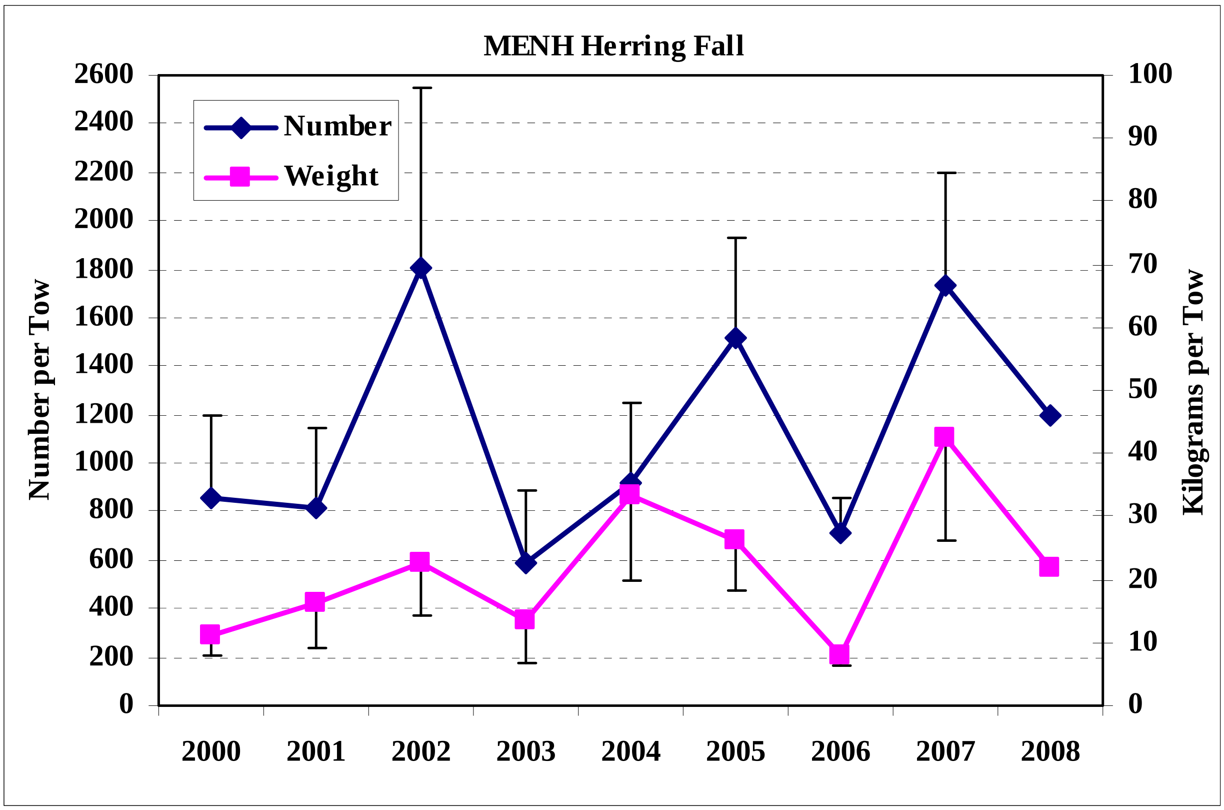
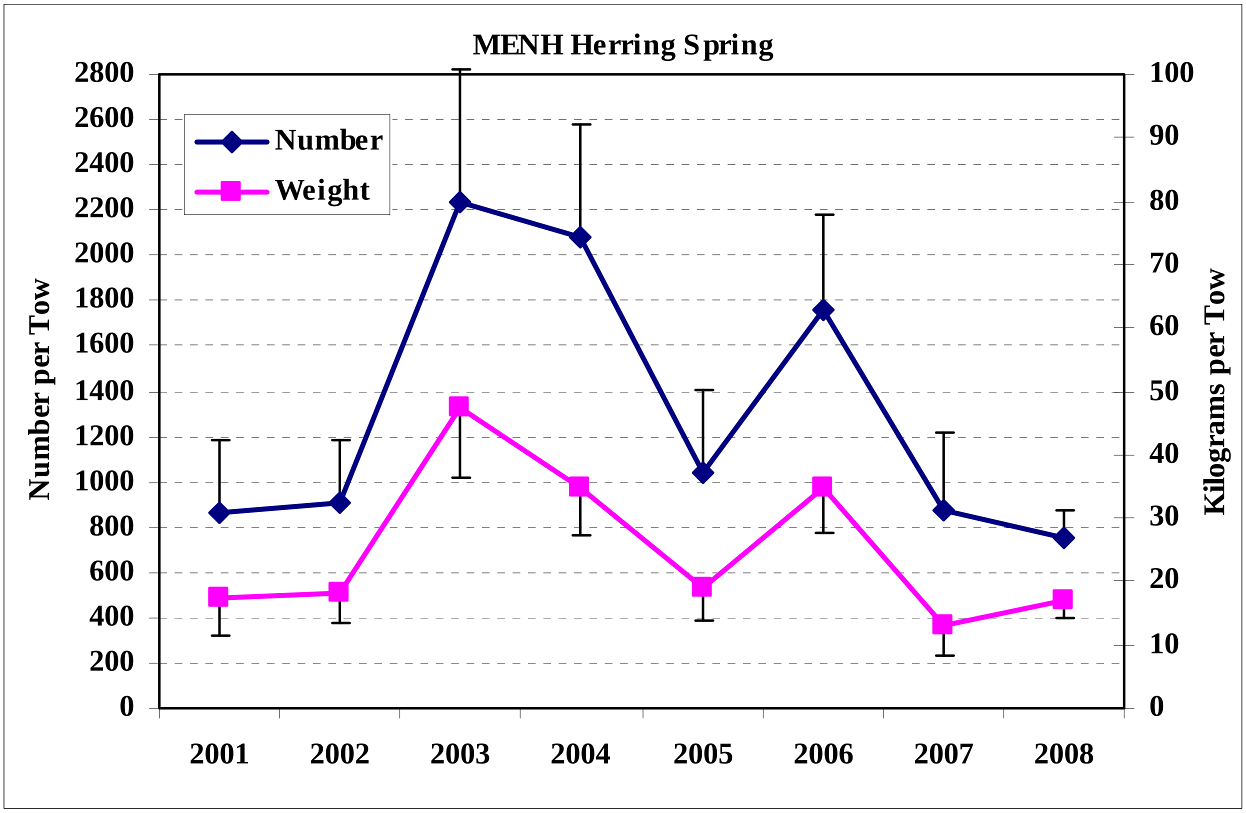


Figure 16 ME DMR Spring Inshore Bottom Trawl Survey Catch (# Fish) Per Tow



4.1.1.4 TRAC Stock Assessment – Summary of Stock Status

Since 1998, the Transboundary Resources Assessment Committee (TRAC) has reviewed stock assessments and projections necessary to support management activities for shared resources across the USA Canada boundary in the Gulf of Maine-Georges Bank region. These assessments are necessary to advise decision makers on the status of these resources and likely consequences of policy choices. The most recent TRAC benchmark assessment of the Atlantic herring complex occurred in June 2009 in St. Andrew's New Brunswick. This assessment served as an update; Atlantic herring for the Gulf of Maine/Georges Bank area were last assessed in a benchmark assessment in May 2006 (O'Boyle and Overholtz 2006). At the 2006 assessment meeting, it was agreed that the Age Structured Assessment Program (ASAP) Base model showed the least retrospective pattern and was the preferred approach amongst all the model formulations. The purpose of the 2009 update assessment meeting was to update both independent and dependent data, and use it in the established benchmark formulation to determine the current status of the Atlantic herring resource. The updated assessment model also prompted revision of the biological reference points to reflect the new results.

The TRAC update assessment results estimate that Atlantic herring biomass was 651,700 mt at the beginning of 2008, which is slightly below B_{MSY} (670,600 mt). Estimated fishing mortality in 2008 was 0.14, which is below F_{MSY} (0.27). The stock complex is not overfished at this time, and overfishing is not occurring. **The 2009 TRAC Status Report from this assessment is provided in Appendix I to this document and should be referenced for more information about the status of the Atlantic herring resource complex**.

The following information summarizes the results of the 2009 TRAC Assessment and the current status of the Atlantic herring complex:

- Combined Canada and USA herring landings increased from 106,000 mt in 2005 to 116,000 mt in 2006, then declined to 90,000 mt in 2008.
- Stock biomass (2+, January 1) increased steadily from about 111,600 mt in 1982 to almost 830,000 mt in 1997, fluctuated without trend since then, and was estimated to be 652,000 mt at the beginning of 2008. This is below B_{MSY} (670,600 mt).
- Recruitment at Age 2 from the 2004 and 2006 year classes appear weaker than the long-term (1967-2005) average of 2.3 billion fish. The 2005 year class abundance estimate is above average abundance at 3.3 billion fish.
- Fishing mortality (Age 2+) declined to 0.14 in 1993 and has remained stable at about 0.16 from 2002 onwards. Estimated fishing mortality in 2008 was 0.14. This is below F_{MSY} (0.27).
- The Atlantic herring 2006 TRAC recommended that a strategy be adopted to maintain a low to neutral risk of exceeding the fishing mortality limit reference point, and that when stock conditions are poor, fishing mortality rates should be further reduced to promote rebuilding. A Fox surplus production model estimated F_{MSY} = 0.27, MSY = 178,374 mt, and B_{MSY} = 670,600 mt.

Retrospective analyses were used to detect any patterns to overestimate - or underestimate – fishing mortality, biomass and recruitment relative to the terminal year estimates. A significant retrospective pattern was detected in this assessment in overestimating SSB relative to the current estimate (averaging + 42%/year, and ranging between 14-56%) and this is a concern (Figure 17). The pattern has persisted for several years and is expected to continue in the future.

Figure 17 Retrospective Pattern Associated with SSB in TRAC 2009 Atlantic Herring Update Assessment

TRAC Assessment - Outlook

An outlook is provided from the TRAC Assessment in terms of the consequences on SSB and for yield in 2009, 2010, and 2011 of maintaining the current (2008) fishing mortality rate (F=0.14, see Table 10 below). Although uncertainty in stock size and recruitment generates uncertainty in forecast results, a formal risk analysis was not undertaken due to the significant retrospective pattern in SSB and the difficulty and uncertainty in selecting the final model formulation. Nevertheless, the forecasts are considered useful for general management guidance.

The projections assumed that recruitment of the 2009-2011 year classes was equal to the recent 10-year average (2.0 billion fish at Age 2). A fishing mortality of F=0.14 in 2009 generates a landings of 82,403 mt and an SSB in 2009 of 460,343 mt, a decline of about 11%. Continuing to fish at F=0.14 in both 2010 and 2011 produces annual landings of 81,154 mt and 82,625 mt, respectively, and results in a slight decline in SSB in 2011 to 444,532 mt.

Table 10 2009 TRAC Assessment – General Outlook for 2009-2011 at Current F (0.14)

	2+ Biomass	SSB	Landings	F
2009	694.3	460.3	82.4	0.14
2010	683.8	440.0	81.2	0.14
2011	692.2	444.5	82.6	0.14

4.1.2 Non-target and Bycatch Species

"Non-target species" refers to the other species which permitted herring vessels land while fishing for herring. These other fish species may be caught by the same gear while fishing for herring, and sold assuming the vessel has proper authorization or permit(s). As defined in the MSA, "bycatch" refers to "fish which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic discards and regulatory discards." For the purposes of this EA, the discussion of non-target species and bycatch refers primarily to mackerel, dogfish, and herring based the catch and discard data by weight on observed herring trips from 2007-2009 (Tables 35-46). These species predominate bycatch (i.e., herring and dogfish) or are the primary alternate species that are landed by herring vessels (i.e., mackerel). Mackerel is commonly landed when caught. Spiny dogfish, which tend to be relatively abundant in catches, may be landed but are often the predominant component of the discarded bycatch. Herring, though the target species, may be discarded for various reasons discussed below.

Spiny Dogfish

Dogfish are sometimes kept and landed as a non-target species, however, the majority of dogfish are discarded as bycatch. On 133 observed herring trips taken between 2007-2009, 15-20% of the pounds discarded were dogfish.

Life History: The spiny dogfish, *Squalus acanthias*, is distributed in the western North Atlantic from Labrador to Florida and are considered to be a unit stock off the coast of New England. In summer, dogfish migrate northward to the Gulf of Maine-Georges Bank region and into Canadian waters and return southward in autumn and winter. Spiny dogfish tend to school by size and, when mature, by sex. The species bears live young, with a gestation period of about 18 to 22 months, and produce between 2 to 15 pups with an average of 6. Size at maturity for females is around 80 cm, but can vary from 78 cm to 85 cm depending on the abundance of females.

Population Management and Status: The fishery is managed under an FMP developed jointly by the NEFMC and Mid-Atlantic Fishery Management Council (MAFMC) for Federal waters and a plan developed concurrently by the Atlantic States Marine Fisheries Commission (ASMFC) for state waters. Spawning stock biomass of spiny dogfish declined rapidly in response to a directed fishery during the 1990's. Management measures, initially implemented in 2001, have been effective in reducing landings and reducing fishing mortality. Overfishing is not presently considered to be occurring. Conclusions regarding the overfished and overfishing status of spiny dogfish are strongly dependent on the NEFSC spring survey results in 2006. Future surveys will be closely monitored to determine if the 2006 results signal a true increase in abundance (http://www.nefsc.noaa.gov/sos/spsyn/op/dogfish/).

Mackerel

As a non-target species in the herring fishery, mackerel were noted to be caught along with herring and landed. On 133 observed herring trips taken between 2007 and 2009, mackerel represented 15-20% of the lbs kept (versus discarded). Most of the catch is herring; mackerel represents the second most retained species.

Life History: Atlantic mackerel is a pelagic, schooling species distributed between Labrador (Parsons 1970) and North Carolina (Anderson 1976a). A southern group begins its spring migration from waters off North Carolina and Virginia in March- April, and moves northward, reaching New Jersey and Long Island usually by April-May, where spawning occurs. Both groups make extensive northerly (spring) and southerly (autumn) migrations to and from spawning and summer feeding grounds. Both groups overwinter between Nova Scotia and Cape Hatteras (USDC 1984a).

The southern group spawns from mid-April to June in the Mid-Atlantic Bight and the Gulf of Maine and the northern group spawns in the southern Gulf of St. Lawrence from the end of May to mid-August (Morse 1978). Most spawn in the shoreward half of continental shelf waters, although some spawning extends to the shelf edge and beyond. Average size at maturity is about 10.5-11" FL (Grosslein and Azarovitz 1982) and maximum age observed is 17 years (Pentilla and Anderson 1976).

Population Management and Status: The MAFMC manages the Atlantic mackerel along with squid and butterfish (MSB) fisheries with the MSB Fishery Management Plan (FMP). The mackerel stock is not overfished and overfishing is not occurring. A December 2009 TRAC will re-assess the status.

Atlantic Herring

The life history and status of Atlantic herring was described in (Section 4.1.1) and more thoroughly in the EIS for Amendment 1 to the FMP. As a bycatch species, the industry indicates herring is discarded due to mechanical issues associated with gear, poor species composition of a tow, test tows, or poor herring quality (feedy). Species composition is an issue when too many dogfish are in the net which are impossible to pump out. On 133 observed herring trips taken between 2007 and 2009, 45-50% of the pounds discarded were herring. Further discussion of herring discards appears at 5.3.3 and discusses herring discards as a portion of overall catch for the entire herring fishery.

4.1.3 Herring Overfishing Definition – Stock Status

The 2009 TRAC update assessment results estimate that Atlantic herring biomass was 651,700 mt at the beginning of 2008, which is below B_{MSY} (670,600 mt). Estimated fishing mortality in 2008 was 0.14, which is below F_{MSY} (0.27).

The Atlantic herring stock complex is above ½ B_{MSY} and fishing mortality is below F_{MSY}, so the stock is not overfished and overfishing is not occurring. The current overfishing definition (Atlantic Herring FMP, 1999) for Atlantic herring is provided below.

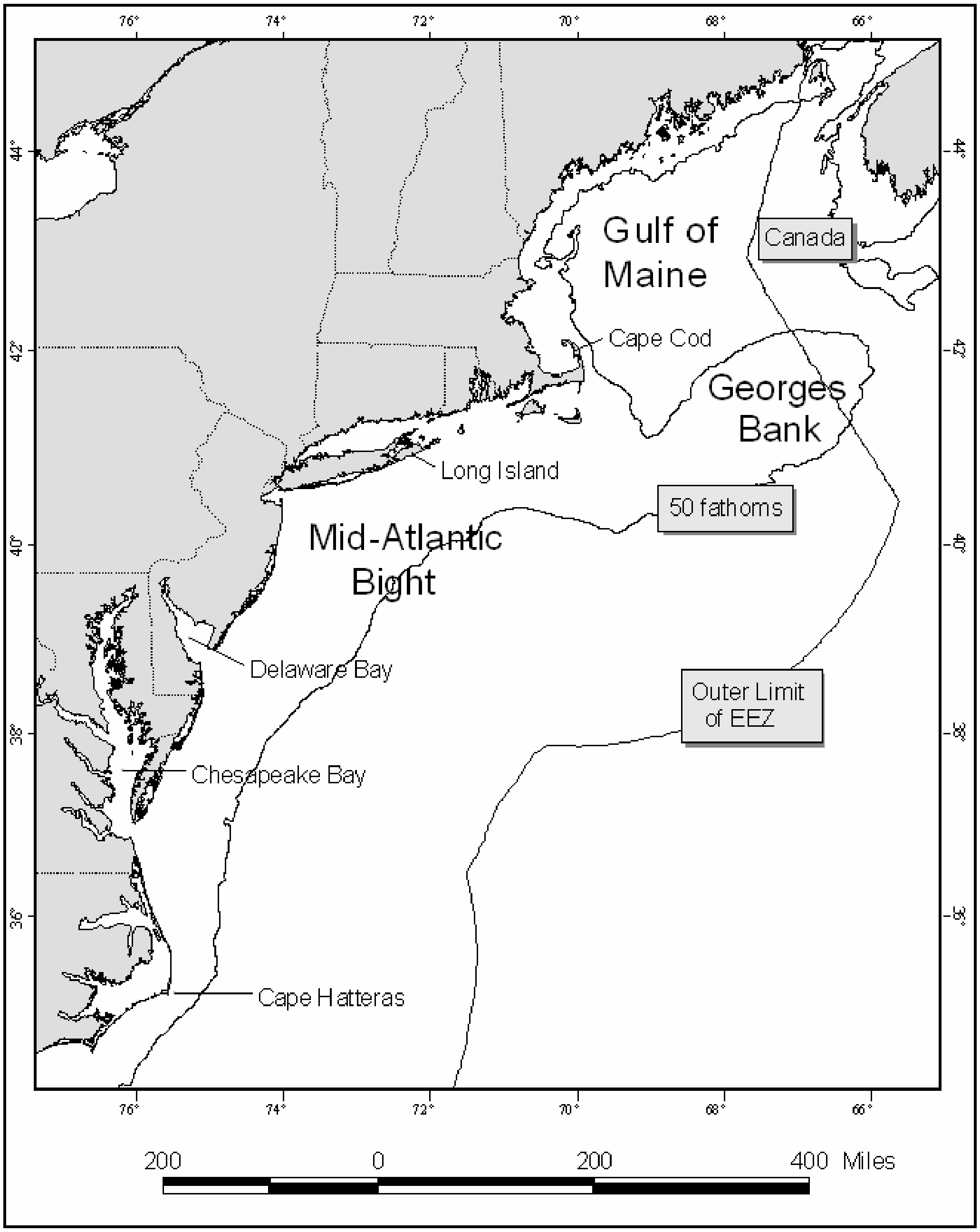
> *If stock biomass is equal or greater than B_{MSY} , overfishing occurs when fishing mortality exceeds F_{MSY}. If stock biomass is below B_{MSY} , overfishing occurs when fishing mortality exceeds the level that has a 50 percent probability to rebuild stock biomass to B_{MSY} in 5 years ($F_{Threshold}$). The stock is in an overfished condition when stock biomass is below ½ B_{MSY} and overfishing occurs when fishing mortality exceeds $F_{Threshold}$. These reference points are thresholds and form the basis for the control rule.*
>
> *The control rule also specifies risk-averse fishing mortality targets, accounting for the uncertainty in the estimate of F_{MSY}. If stock biomass is equal to or greater than $1/2B_{MSY}$, the target fishing mortality will be the lower level of the 80 percent confidence interval about F_{MSY}. When biomass is below B_{MSY} , the target fishing mortality will be reduced consistent with the five-year rebuilding schedule used to determine $F_{Threshold}$.*

4.2 HABITAT AND EFH

4.2.1 Physical and Biological Environment

The Northeast U.S. Shelf Ecosystem includes the area from the Gulf of Maine south to Cape Hatteras, extending from the coast seaward to the edge of the continental shelf, including the slope sea offshore to the Gulf Stream to a depth of 2,000 m (Figure 18**,** Sherman et al. 1996). Four distinct sub-regions are identified: the Gulf of Maine, Georges Bank, the Mid-Atlantic Bight, and the continental slope. The physical and biological features of these regions are described below. Much of this information was extracted from Stevenson et al. (2004), and the reader is referred to this document and sources referenced therein for additional information. These sources included, among others: Abernathy 1989; Backus 1987; Beardsley et al. 1996; Brooks 1996; Cook 1988; Mountain 1994; Reid and Steimle 1988; Schmitz et al. 1987; Sherman et al. 1996; Stumpf and Biggs 1988; Townsend 1992; and Wiebe et al. 1987.

Figure 18 Northeast U.S Shelf Ecosystem



4.2.1.1 Gulf of Maine

The Gulf of Maine is an enclosed, glacially-derived, coastal sea, bounded on the east by Browns Bank, on the north by the Nova Scotian (Scotian) Shelf, on the west by the New England states, and on the south by Cape Cod and Georges Bank. The Gulf of Maine is characterized by a system of deep basins, moraines and rocky protrusions with limited access to the open ocean. This geomorphology influences complex oceanographic processes that result in a rich biological community.

Geology

The Gulf of Maine is topographically unlike any other part of the continental border along the U.S. Atlantic coast. The Gulf of Maine's geologic features, when coupled with the vertical variation in water properties, result in a great diversity of habitat types. It contains twenty-one distinct basins separated by ridges, banks, and swells. The three largest basins are Wilkinson, Georges, and Jordan. Depths in the basins exceed 250 m, with a maximum depth of 350 m in Georges Basin, just north of Georges Bank. The Northeast Channel between Georges Bank and Browns Bank leads into Georges Basin, and is one of the primary avenues for exchange of water between the Gulf of Maine and the North Atlantic Ocean.

High points within the Gulf include irregular ridges, such as Cashes Ledge, which peaks at 9 m below the surface, as well as lower flat-topped banks and gentle swells. Some of these rises are remnants of the sedimentary shelf that was left after most of it was removed by the glaciers. Others are glacial moraines and a few, like Cashes Ledge, are outcroppings of bedrock. Very fine sediment particles created and eroded by the glaciers have collected in thick deposits over much of the Gulf of Maine, particularly in its deep basins. These mud deposits blanket and obscure the irregularities of the underlying bedrock, forming topographically smooth terrains. Some shallower basins are covered with mud as well, including some in coastal waters. In the rises between the basins, other materials are usually at the surface. Unsorted glacial till covers some morainal areas, as on Sewell Ridge to the north of Georges Basin and on Truxton Swell to the south of Jordan Basin. Sand predominates on some high areas and gravel, sometimes with boulders, predominates on others.

Coastal sediments exhibit a high degree of small-scale variability. Bedrock is the predominant substrate along the western edge of the Gulf of Maine, north of Cape Cod in a narrow band out to a depth of about 60 m. Rocky areas become less common with increasing depth, but some rock outcrops poke through the mud covering the deeper sea floor. Mud is the second most common substrate on the inner continental shelf. Mud predominates in coastal valleys and basins that often abruptly border rocky substrates. Many of these basins extend without interruption into deeper water. Gravel, often mixed with shell, is common adjacent to bedrock outcrops and in fractures in the rock. Large expanses of gravel are not common, but do occur near reworked glacial moraines and in areas where the seabed has been scoured by bottom currents. Gravel is most abundant at depths of 20-40 m, except in eastern Maine where a gravel-covered plain exists to depths of at least 100 m. Bottom currents are stronger in eastern Maine where the mean tidal range exceeds 5 m. Sandy areas are relatively rare along the inner shelf of the western Gulf of Maine, but are more common south of Casco Bay, especially offshore of sandy beaches.

Physical Oceanography

An intense seasonal cycle of winter cooling and turnover, springtime freshwater runoff, and summer warming influences oceanographic and biologic processes in the GOM. The Gulf has a general counterclockwise non-tidal surface current that flows around its coastal margin. It is primarily driven by fresh, cold Scotian Shelf water that enters over the Scotian Shelf and through the Northeast Channel, and freshwater river runoff, which is particularly important in the spring. Dense, relatively warm, and saline slope water entering through the bottom of the Northeast Channel from the continental slope also influences gyre formation. Counterclockwise gyres generally form in Jordan, Wilkinson, and Georges Basins and the Northeast Channel as well.

These surface gyres are more pronounced in spring and summer; with winter, they weaken, and are more wind-influenced.

Stratification of surface waters during spring and summer seals off a mid-depth layer of water that preserves winter salinity and temperatures. This cold layer of water is called Maine Intermediate Water, and is located between more saline Maine Bottom Water and the warmer, stratified Maine Surface Water. The stratified surface layer is most pronounced in the deep portions of the western Gulf of Maine. Tidal mixing of shallow areas prevents thermal stratification and results in thermal fronts between the stratified areas and cooler mixed areas. Typically, mixed areas include Georges Bank, the southwest Scotian Shelf, eastern Maine coastal waters, and the narrow coastal band surrounding the remainder of the Gulf.

The Northeast Channel provides an exit for cold Maine Intermediate Water and outgoing surface water while it allows warmer more saline slope water to move in along the bottom and spill into the deeper basins. The influx of water occurs in pulses, and appears to be seasonal, with lower flow in late winter and a maximum in early summer. Gulf of Maine circulation and water properties can vary significantly from year to year. Notable episodic events include shelf-slope interactions such as the entrainment of shelf water by Gulf Stream rings, and strong winds that can create currents as high as 1.1 $m \cdot s^{-1}$ over Georges Bank. Warm core Gulf Stream rings can also influence upwelling and nutrient exchange on the Scotian shelf, and affect the water masses entering the Gulf of Maine. Annual and seasonal inflow variations also affect water circulation.

Internal waves are episodic and can greatly affect the biological properties of certain habitats. Internal waves can shift water layers vertically, so that habitats normally surrounded by cold MIW are temporarily bathed in warm, organic rich surface water. On Cashes Ledge, it is thought that deeper nutrient rich water is driven into the photic zone, providing for increased productivity. Localized areas of upwelling interaction occur in numerous places throughout the Gulf.

Biological Oceanography

Based on 303 benthic grab samples collected in the Gulf of Maine during 1956-1965, Theroux and Wigley (1998) reported that, in terms of numbers, the most common groups of benthic invertebrates in the GOM were annelid worms (35%), bivalve mollusks (33%), and amphipod crustaceans (14%). Biomass was dominated by bivalves (24%), sea cucumbers (22%), sand dollars (18%), annelids (12%), and sea anemones (9%). Watling (1988) considered predominant taxa, substrate types, and seawater properties when separating benthic invertebrate samples into seven bottom assemblages (Table 11).

Table 11 Gulf of Maine Benthic Assemblages as Identified by Watling (1988)

Assemblage	Community Description
1	Comprises all sandy offshore banks, most prominently Jeffreys Ledge, Fippennies Ledge, and Platts Bank; depth on top of banks about 70 m; substrate usually coarse sand with some gravel; fauna characteristically sand dwellers with an abundant interstitial component.
2	Comprises the rocky offshore ledges, such as Cashes Ledge, Sigsbee Ridge and Three Dory Ridge; substrate either rock ridge outcrop or very large boulders, often with a covering of very fine sediment; fauna predominantly sponges, tunicates, bryozoans, hydroids, and other hard bottom dwellers; overlying water usually cold Gulf of Maine Intermediate Water.
3	Probably extends all along the coast of the Gulf of Maine in water depths less than 60 m; bottom waters warm in summer and cold in winter; fauna rich and diverse, primarily polychaetes and crustaceans, probably consists of several (sub-) assemblages due to heterogeneity of substrate and water conditions near shore and at mouths of bays.
4	Extends over the soft bottom at depths of 60 - 140 m, well within the cold Gulf of Maine Intermediate Water; bottom sediments primarily fine muds; fauna dominated by polychaetes, shrimp, and cerianthid anemones.
5	A mixed assemblage comprising elements from the cold water fauna as well as a few deeper water species with broader temperature tolerances; overlying water often a mixture of Intermediate Water and Bottom Water, but generally colder than 7°C most of the year; fauna sparse, diversity low, dominated by a few polychaetes, with brittle stars, sea pens, shrimp, and cerianthids also present.
6	Comprises the fauna of the deep basins; bottom sediments generally very fine muds, but may have a gravel component in the offshore morainal regions; overlying water usually 7 - 8°C, with little variation; fauna shows some bathyal affinities but densities are not high, dominated by brittle stars and sea pens, and sporadically by a tube-making amphipod.
7	The true upper slope fauna that extends into the Northeast Channel; water temperatures are always above 8°C and salinities are at least 35 ppt; sediments may be either fine muds or a mixture of mud and gravel.

Various studies have classified demersal fish assemblages for the Gulf of Maine and Georges Bank, including Gabriel (1992), Mahon et al. (1998), and Overholtz and Tyler (1985). Gabriel (1992) found that the most persistent feature over time in assemblage structure from Nova Scotia to Cape Hatteras was the boundary separating assemblages between the GOM and Georges Bank, which occurred at approximately the 100 m isobath on northern Georges Bank. The Overholtz and Tyler (1985) classification is given below (Table 12).

Table 12 Demersal Fish Assemblages of Georges Bank and the Gulf of Maine

Assemblage	Species
Slope and Canyon	offshore hake, blackbelly rosefish, Gulf stream flounder, fourspot flounder, goosefish, silver hake, white hake, red hake
Intermediate	silver hake, red hake, goosefish, Atlantic cod, haddock, ocean pout, yellowtail flounder, winter skate, little skate, sea raven, longhorn sculpin
Shallow	Atlantic cod, haddock, pollock, silver hake, white hake, red hake, goosefish, ocean pout, yellowtail flounder, windowpane, winter flounder, winter skate, little skate, longhorn sculpin, summer flounder, sea raven, sand lance
Gulf of Maine-Deep	white hake, American plaice, witch flounder, thorny skate, silver hake, Atlantic cod, haddock, cusk, Atlantic wolffish
Northeast Peak	Atlantic cod, haddock, Pollock, ocean pout, winter flounder, white hake, thorny skate, longhorn sculpin

4.2.1.2 Georges Bank

Georges Bank is a shallow (3 - 150 m depth), elongate (161 km wide by 322 km long) extension of the continental shelf that was formed by the Wisconsinian glacial episode. It is characterized by a steep slope on its northern edge and a broad, flat, gently sloping southern flank. The Great South Channel lies to the west.

Geology and Physical Oceanography

Glacial retreat during the late Pleistocene deposited the bottom sediments currently observed on the eastern section of Georges Bank, and the sediments have been continuously reworked and redistributed by the action of rising sea level, and by tidal, storm and other currents. It is anticipated that erosion and reworking of sediments will reduce the amount of sand available to the sand sheets, and cause an overall coarsening of the bottom sediments (Valentine et al. 1993).

Bottom topography on eastern Georges Bank is characterized by linear ridges in the western shoal areas; a relatively smooth, gently dipping sea floor on the deeper, easternmost part; a highly energetic peak in the north with sand ridges up to 30 m high and extensive gravel pavement; and steeper and smoother topography incised by submarine canyons on the southeastern margin. The central region of the Bank is shallow, and the bottom is characterized by shoals and troughs, with sand dunes superimposed upon them. The two most prominent elevations on the ridge and trough area are Cultivator and Georges Shoals. This shoal and trough area is a region of strong currents, with average flood and ebb tidal currents greater than 4 km/h, and as high as 7 km/h. The dunes migrate at variable rates, and the ridges may move.

The Great South Channel separates the main part of Georges Bank from Nantucket Shoals. Nantucket Shoals is similar in nature to the central region of the Bank. Currents are strongest where water depth is shallower than 50 m. Tidal and storm currents range from moderate to strong, depending upon location and storm activity. Sediments in this region include gravel pavement and mounds, some scattered boulders, sand with storm-generated ripples, and scattered shell and mussel beds.

Oceanographic frontal systems separate water masses of the GOM and Georges Bank from oceanic waters south of the Bank. These water masses differ in temperature, salinity, nutrient concentration, and planktonic communities, which influence productivity and may influence fish abundance and distribution. Currents on Georges Bank include a weak, persistent clockwise gyre around the Bank, a strong semidiurnal tidal flow predominantly northwest and southeast, and very strong, intermittent storm induced currents, which all can occur simultaneously. Tidal currents over the shallow top of Georges Bank can be very strong, and keep the waters over the Bank well mixed vertically. This results in a tidal front that separates the cool waters of the well-mixed shallows of the central Bank from the warmer, seasonally stratified shelf waters on the seaward and shoreward sides of the Bank. The clockwise gyre is instrumental in distribution of plankton, including fish eggs and larvae.

Biological Oceanography

The strong, erosive currents affect the character of the biological community. Amphipod crustaceans (49%) and annelid worms (28%) numerically dominated the contents of 211 samples collected on Georges Bank during 1956-1965 (Theroux and Wigley 1998). Biomass was dominated by sand dollars (50%) and bivalves (33%). Theroux and Grosslein (1987) utilized the same database to identify four macrobenthic invertebrate assemblages. They noted that the boundaries between assemblages were not well defined because there is considerable intergrading between adjacent assemblages. These assemblages are associated with sedimentary provinces as defined by Valentine and Lough (1991) and Valentine (1993) (Table 13).

The Western Basin assemblage is found in the upper Great South Channel region at the northwestern corner of the Bank, in comparatively deepwater (150 - 200 m) with relatively slow currents and fine bottom sediments of silt, clay and muddy sand. Fauna are comprised mainly of small burrowing detritivores and deposit feeders, and carnivorous scavengers. Valentine and Lough (1991) did not identify a comparable assemblage; however, this assemblage is geographically located adjacent to Assemblage 5 as described by Watling (1998) (Table 11). The Northeast Peak assemblage is found along the Northern Edge and Northeast Peak, which varies in depth and current strength and includes coarse sediments, consisting mainly of gravel and coarse sand with interspersed boulders, cobbles, and pebbles. Fauna tend to be sessile (coelenterates, brachiopods, barnacles, and tubiferous annelids) or free-living (brittle stars, crustaceans, and polychaetes), with a characteristic absence of burrowing forms. The Central Georges Bank assemblage occupies the greatest area, including the central and northern portions of the Bank in depths less than 100 m. Medium-grained shifting sands predominate in this dynamic area of strong currents. Organisms tend to be small to moderately large with burrowing or motile habits. The Southern Georges Bank assemblage is found on the southern and southwestern flanks at depths from 80 - 200 m, where fine-grained sands and moderate currents predominate. Many southern species exist here at the northern limits of their range.

Along with high levels of primary productivity, Georges Bank has been historically characterized by high levels of fish production. Several studies have attempted to identify demersal fish assemblages over large spatial scales. Overholtz and Tyler (1985) found five depth related groundfish assemblages for Georges Bank and the GOM that were persistent temporally and spatially. Depth and salinity were identified as major physical influences explaining assemblage structure. Gabriel (1992) identified six assemblages, which are compared with the results of Overholtz and Tyler (1985) in Table 13. Mahon et al. (1998) found similar results.

Table 13 Sedimentary Provinces and Associated Benthic Landscapes of Georges Bank

Sedimentary Province	Depth (m)	Description	Benthic Assemblage
Northern Edge / Northeast Peak (1)	40 - 200	Dominated by gravel with portions of sand, common boulder areas, and tightly packed pebbles. Representative epifauna (bryozoa, hydrozoa, anemones, and calcareous worm tubes) are abundant in areas of boulders. Strong tidal and storm currents.	Northeast Peak
Northern Slope and Northeast Channel (2)	200 - 240	Variable sediment type (gravel, gravel-sand, and sand) scattered bedforms. This is a transition zone between the northern edge and southern slope. Strong tidal and storm currents.	Northeast Peak
North /Central Shelf (3)	60 - 120	Highly variable sediment type (ranging from gravel to sand) with rippled sand, large bedforms, and patchy gravel lag deposits. Minimal epifauna on gravel due to sand movement. Representative epifauna in sand areas includes amphipods, sand dollars, and burrowing anemones.	Central Georges
Central and Southwestern Shelf - shoal ridges (4)	10 - 80	Dominated by sand (fine and medium grain) with large sand ridges, dunes, waves, and ripples. Small bedforms in southern part. Minimal epifauna on gravel due to sand movement. Representative epifauna in sand areas includes amphipods, sand dollars, and burrowing anemones.	Central Georges
Central and Southwestern Shelf - shoal troughs (5)	40 - 60	Gravel (including gravel lag) and gravel-sand between large sand ridges. Patchy large bedforms. Strong currents. (Few samples – submersible observation noted presence of gravel lag, rippled gravel-sand, and large bedforms.) Minimal epifauna on gravel due to sand movement. Representative epifauna in sand areas includes amphipods, sand dollars, and burrowing anemones.	Central Georges
Southeastern Shelf (6)	80 - 200	Rippled gravel-sand (medium and fine grained sand) with patchy large bedforms and gravel lag. Weaker currents; ripples are formed by intermittent storm currents. Representative epifauna includes sponges attached to shell fragments and amphipods.	Southern Georges
Southeastern Slope (7)	400 - 2000	Dominated by silt and clay with portions of sand (medium and fine) with rippled sand on shallow slope and smooth silt-sand deeper.	none

Sediment provinces as defined by Valentine et al. (1993) and Valentine and Lough (1991), with additional comments by Valentine (pers. comm.) and benthic assemblages assigned by Theroux and Grosslein (1987).

4.2.1.3 Mid-Atlantic Bight

The Mid-Atlantic Bight includes the shelf and slope waters from Georges Bank south to Cape Hatteras, and east to the Gulf Stream (Figure 18). Like the rest of the continental shelf, the topography of the Mid-Atlantic Bight was shaped largely by sea level fluctuations caused by past ice ages. The shelf's basic morphology and sediments derive from the retreat of the last ice sheet, and the subsequent rise in sea level. Since that time, currents and waves have modified this basic structure.

Geology and Physical Oceanography

Shelf and slope waters of the Mid-Atlantic Bight have a slow southwestward flow that is occasionally interrupted by warm core rings or meanders from the Gulf Stream. On average, shelf water moves parallel to bathymetry isobars at speeds of 5 - 10 cm/s at the surface and 2 cm/s or less at the bottom. Storm events can cause much more energetic variations in flow. Tidal currents on the inner shelf have a higher flow rate of 20 cm/s that increases to 100 cm/s near inlets.

Slope water tends to be warmer than shelf water because of its proximity to the Gulf Stream, and tends to be more saline. The abrupt gradient where these two water masses meet is called the shelf-slope front. This front is usually located at the edge of the shelf and touches bottom at about 75 - 100 m depth of water, and then slopes up to the east toward the surface. It reaches surface waters approximately 25 - 55 km further offshore. The position of the front is highly variable, and can be influenced by many physical factors. Vertical structure of temperature and salinity within the front can develop complex patterns because of the interleaving of shelf and slope waters; e.g., cold shelf waters can protrude offshore, or warmer slope water can intrude up onto the shelf.

The seasonal effects of warming and cooling increase in shallower, nearshore waters. Stratification of the water column occurs over the shelf and the top layer of slope water during the spring-summer and is usually established by early June. Fall mixing results in homogenous shelf and upper slope waters by October in most years. A permanent thermocline exists in slope waters from 200 - 600 m deep. Temperatures decrease at the rate of about 0.02ºC per meter and remain relatively constant except for occasional incursions of Gulf stream eddies or meanders. Below 600 m, temperature declines, and usually averages about 2.2ºC at 4000 m. A warm, mixed layer approximately 40 m thick resides above the permanent thermocline.

The “cold pool” is an annual phenomenon particularly important to the Mid-Atlantic Bight. It stretches from the Gulf of Maine along the outer edge of Georges Bank and then southwest to Cape Hatteras. It becomes identifiable with the onset of thermal stratification in the spring and lasts into early fall until normal seasonal mixing occurs. It usually exists along the bottom between the 40 and 100 m isobaths and extends up into the water column for about 35 m, to the bottom of the seasonal thermocline. The cold pool usually represents about 30% of the volume of shelf water. Minimum temperatures for the cold pool occur in early spring and summer, and range from 1.1 - 4.7ºC.

The shelf slopes gently from shore out to between 100 and 200 km offshore where it transforms to the slope (100 - 200 m water depth) at the shelf break. In both the Mid-Atlantic and on Georges Bank, numerous canyons incise the slope, and some cut up onto the shelf itself (see the “Continental Slope” section, below). The primary morphological features of the shelf include shelf valleys and channels, shoal massifs, scarps, and sand ridges and swales. Most of these structures are relic except for some sand ridges and smaller sand-formed features. Shelf valleys and slope canyons were formed by rivers of glacier outwash that deposited sediments on the outer shelf edge as they entered the ocean. Most valleys cut about 10 m into the shelf, with the exception of the Hudson Shelf Valley that is about 35 m deep. The valleys were partially filled as the glacier melted and retreated across the shelf. The glacier also left behind a lengthy scarp near the shelf break from Chesapeake Bay north to the eastern end of Long Island. Shoal retreat massifs were produced by extensive deposition at a cape or estuary mouth. Massifs were also formed as estuaries retreated across the shelf.

The sediment type covering most of the shelf in the Mid-Atlantic Bight is sand, with some relatively small, localized areas of sand-shell and sand-gravel. On the slope, silty sand, silt, and clay predominate. Some sand ridges are more modern in origin than the shelf's glaciated morphology. Their formation is not well understood; however, they appear to develop from the sediments that erode from the shore face. They maintain their shape, so it is assumed that they are in equilibrium with modern current and storm regimes. They are usually grouped, with heights of about 10 m, lengths of 10 – 50 km and spacing of 2 km. Ridges are usually oriented at a slight angle towards shore, running in length from northeast to southwest. The seaward face usually has the steepest slope. Sand ridges are often covered with smaller similar forms such as sand waves, megaripples, and ripples. Swales occur between sand ridges. Since ridges are higher than the adjacent swales, they are exposed to more energy from water currents, and experience more sediment mobility than swales. Ridges tend to contain less fine sand, silt and clay while relatively sheltered swales contain more of the finer particles. Swales have greater benthic macrofaunal density, species richness and biomass, due in part to the increased abundance of detrital food and the physically less rigorous conditions.

Sand waves are usually found in patches of 5 – 10 with heights of about 2 m, lengths of 50 – 100 m and 1 - 2 km between patches. Sand waves are primarily found on the inner shelf, and often observed on sides of sand ridges. They may remain intact over several seasons. Megaripples occur on sand waves or separately on the inner or central shelf. During the winter storm season, they may cover as much as 15% of the inner shelf. They tend to form in large patches and usually have lengths of 3 - 5 m with heights of 0.5 - 1 m. Megaripples tend to survive for less than a season. They can form during a storm and reshape the upper 50-100 cm of the sediments within a few hours. Ripples are also found everywhere on the shelf, and appear or disappear within hours or days, depending upon storms and currents. Ripples usually have lengths of about 1-150 cm and heights of a few centimeters.

Sediments are uniformly distributed over the shelf in this region. A sheet of sand and gravel varying in thickness from 0-10 m covers most of the shelf. The mean bottom flow from the constant southwesterly current is not fast enough to move sand, so sediment transport must be episodic. Net sediment movement is in the same southwesterly direction as the current. The sands are mostly medium to coarse grains, with finer sand in the Hudson Shelf Valley and on the outer shelf. Mud is rare over most of the shelf, but is common in the Hudson Shelf Valley. Occasionally relic estuarine mud deposits are re-exposed in the swales between sand ridges. Fine sediment content increases rapidly at the shelf break, which is sometimes called the "mud line," and sediments are 70 - 100% fines on the slope.

The mud patch (considered sometimes to be part of the Southern New England region) is located just southwest of Nantucket Shoals and southeast of Long Island and Rhode Island. Tidal currents in this area slow significantly, which allows silts and clays to settle out of the water column. The mud is mixed with sand, and is occasionally re-suspended by large storms. This habitat is an anomaly of the outer continental shelf.

Artificial reefs are another significant Mid-Atlantic habitat, formed much more recently on the geologic time scale than other regional habitat types. These localized areas of hard structure have been formed by shipwrecks, lost cargos, disposed solid materials, shoreline jetties and groins, submerged pipelines, cables, and other materials (Steimle and Zetlin 2000). While some of materials have been deposited specifically for use as fish habitat, most have an alternative primary purpose; however, they have all become an integral part of the coastal and shelf ecosystem. It is expected that the increase in these materials has had an impact on living marine resources and fisheries, but these effects are not well known. In general, reefs are important for attachment sites, shelter, and food for many species, and fish predators such as tunas may be attracted by prey aggregations, or may be behaviorally attracted to the reef structure. Steimle and Zetlin (2000) used NOAA hydrographic surveys to plot rocks, wrecks, obstructions, and artificial reefs, which together were considered by the authors to be a fairly complete list of nonbiogenic reef habitat in the Mid-Atlantic estuarine and coastal areas. They also described representative epibenthic/epibiotic, motile epibenthic, and fish species associated these habitats.

Biological Oceanography

Wigley and Theroux (1981) reported on the faunal composition of 563 bottom grab samples collected in the Mid-Atlantic Bight during 1956-1965. Amphipod crustaceans and bivalve mollusks accounted for most of the individuals (41% and 22%, respectively), whereas mollusks dominated the biomass (70%). Three broad faunal zones related to water depth and sediment type were identified by Pratt (1973). The “sand fauna” zone was defined for sandy sediments (1% or less silt) that are at least occasionally disturbed by waves, from shore out to 50 m. The “silty sand fauna” zone occurred immediately offshore from the sand fauna zone, in stable sands containing a small amount of silt and organic material. Silts and clays become predominant at the shelf break and line the Hudson Shelf Valley, and support the “silt-clay fauna”.

Building on Pratt’s work, the Mid-Atlantic shelf was further divided by Boesch (1979) into seven bathymetric/morphologic subdivisions based on faunal assemblages (Table 14). Sediments in the region studied (Hudson Shelf Valley south to Chesapeake Bay) were dominated by sand with little finer materials. Ridges and swales are important morphological features in this area. Sediments are coarser on the ridges, and the swales have greater benthic macrofaunal density, species richness, and biomass. Faunal species composition differed between these features, and Boesch (1979) incorporated this variation in his subdivisions. Much overlap of species distributions was found between depth zones, so the faunal assemblages represented more of a continuum than distinct zones.

Demersal fish assemblages were described at a broad geographic scale for the continental shelf and slope from Cape Chidley, Labrador to Cape Hatteras, North Carolina (Mahon et al. 1998) and from Nova Scotia to Cape Hatteras (Gabriel 1992). Factors influencing species distribution included latitude and depth. Results of these studies were similar to an earlier study confined to the Mid-Atlantic Bight continental shelf (Colvocoresses and Musick 1984). In this study, there were clear variations in species abundances, yet they demonstrated consistent patterns of community composition and distribution among demersal fishes of the Mid-Atlantic shelf. This is especially true for five strongly recurring species associations that varied slightly by season (Table 14). The boundaries between fish assemblages generally followed isotherms and isobaths. The assemblages were largely similar between the spring and fall collections, with the most notable change being a northward and shoreward shift in the temperate group in the spring.

Table 14 Mid-Atlantic Habitat Types as described by Pratt (1973) and Boesch (1979) with Characteristic Macrofauna as identified in Boesch (1979)

Description	**Depth (m)**	**Geology**	**Characteristic Benthic Macrofauna**
Inner shelf	0 - 30	coarse sands with finer sands off MD and VA (sand zone)	Polychaetes: *Polygordius, Goniadella, Spiophanes*
Central shelf	30 - 50	(sand zone)	Polychaetes: *Spiophanes, Goniadella,*Amphipod: *Pseudunciola*
Central and inner shelf swales	0 - 50	occurs in swales between sand ridges (sand zone)	*Polychaetes: Spiophanes, Lumbrineris, Polygordius*
Outer shelf	50 - 100	(silty sand zone)	Amphipods: *Ampelisca vadorum, Erichthonius* Polychaetes: *Spiophanes*
Outer shelf swales	50 - 100	occurs in swales between sand ridges (silty sand zone)	Amphipods: *Ampelisca agassizi, Unciola, Erichthonius*
Shelf break	100 - 200	(silt-clay zone)	not given
Continental slope	> 200	(none)	not given

Table 15 Major Recurrent Demersal Finfish Assemblages of the Mid-Atlantic Bight During Spring and Fall as determined by Colvocoresses and Musick (1984)

Season	*Species Assemblage*				
	Boreal	***Warm temperate***	***Inner shelf***	***Outer shelf***	***Slope***
Spring	Atlantic cod, little skate, sea raven, goosefish, winter flounder, longhorn sculpin, ocean pout, silver hake, red hake, white hake, spiny dogfish	black sea bass, summer flounder, butterfish, scup, spotted hake, northern searobin	windowpane	fourspot flounder	shortnose greeneye, offshore hake, blackbelly rosefish, white hake
Fall	white hake, silver hake, red hake, goosefish, longhorn sculpin, winter flounder, yellowtail flounder, witch flounder, little skate, spiny dogfish	black sea bass, summer flounder, butterfish, scup, spotted hake, northern searobin, smooth dogfish	windowpane	fourspot flounder , fawn cusk eel, gulf stream flounder	shortnose greeneye offshore hake, blackbelly rosefish, white hake, witch flounder

4.2.2 Essential Fish Habitat

Councils are required to designated Essential Fish Habitat (EFH) for all life stages of each managed species. The Atlantic herring EFH description is provided below.

4.2.2.1 Atlantic Herring EFH

Essential Fish Habitat (EFH) for Atlantic herring is described in NEFMC (1998a) as those areas of the coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated in Figure 19 through Figure 22 and in Table 16 and meet the following conditions:

Eggs: Bottom habitats with a substrate of gravel, sand, cobble and shell fragments, but also on aquatic macrophytes, in the Gulf of Maine and Georges Bank as depicted in Figure 19. Eggs adhere to the bottom, forming extensive egg beds which may be many layers deep. Generally, the following conditions exist where Atlantic herring eggs are found: water temperatures below 15° C, depths from 20 - 80 meters, and a salinity range from 32 - 33‰. Herring eggs are most often found in areas of well-mixed water, with tidal currents between 1.5 and 3.0 knots. Atlantic herring eggs are most often observed during the months from July through November.

Larvae: Pelagic waters in the Gulf of Maine, Georges Bank, and southern New England that comprise 90% of the observed range of Atlantic herring larvae as depicted in Figure 20. Generally, the following conditions exist where Atlantic herring larvae are found: sea surface temperatures below 16° C, water depths from 50 - 90 meters, and salinities around 32‰. Atlantic herring larvae are observed between August and April, with peaks from September through November.

Juveniles: Pelagic waters and bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras as depicted in Figure 21. Generally, the following conditions exist where Atlantic herring juveniles are found: water temperatures below 10° C, water depths from 15 - 135 meters, and a salinity range from 26 - 32‰.

Adults: Pelagic waters and bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras as depicted in Figure 22. Generally, the following conditions exist where Atlantic herring adults are found: water temperatures below 10° C, water depths from 20 - 130 meters, and salinities above 28‰.

Spawning Adults: Bottom habitats with a substrate of gravel, sand, cobble and shell fragments, but also on aquatic macrophytes, in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Delaware Bay as depicted in Figure 22. Generally, the following conditions exist where spawning Atlantic herring adults are found: water temperatures below 15° C, depths from 20 - 80 meters, and a salinity range from 32 - 33‰. Herring eggs are spawned in areas of well-mixed water, with tidal currents between 1.5 and 3.0 knots. Atlantic herring are most often observed spawning during the months from July through November.

All of the above EFH descriptions include those bays and estuaries listed in Table 16, according to life history stage. The Council acknowledges potential seasonal and spatial variability of the conditions generally associated with this species.

Table 16 EFH Designation of Estuaries and Embayments for Atlantic Herring

Estuaries and Embayments	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Passamaquoddy Bay		m,s	m,s	m,s	
Englishman/Machias Bay	s	m,s	m,s	m,s	s
Narraguagus Bay		m,s	m,s	m,s	
Blue Hill Bay		m,s	m,s	m,s	
Penobscot Bay		m,s	m,s	m,s	
Muscongus Bay		m,s	m,s	m,s	
Damariscotta River		m,s	m,s	m,s	
Sheepscot River		m,s	m,s	m,s	
Kennebec / Androscoggin Rivers		m,s	m,s	m,s	
Casco Bay	s	m,s	m,s	s	
Saco Bay		m,s	m,s	s	
Wells Harbor		m,s	m,s	s	
Great Bay		m,s	m,s	s	
Merrimack River		M	m		
Massachusetts Bay		s	s	s	
Boston Harbor		s	m,s	m,s	
Cape Cod Bay	s	s	m,s	m,s	
Waquoit Bay					
Buzzards Bay			m,s	m,s	
Narragansett Bay		s	m,s	m,s	
Long Island Sound			m,s	m,s	
Connecticut River					
Gardiners Bay			s	s	
Great South Bay			s	s	
Hudson River / Raritan Bay		m,s	m,s	m,s	
Barnegat Bay			m,s	m,s	
Delaware Bay			m,s	s	
Chincoteague Bay					
Chesapeake Bay				s	

S ≡ The EFH designation for this species includes the seawater salinity zone of this bay or estuary (salinity > 25.0‰).
M ≡ The EFH designation for this species includes the mixing water / brackish salinity zone of this bay or estuary (0.5 < salinity < 25.0‰).
F ≡ The EFH designation for this species includes the tidal freshwater salinity zone of this bay or estuary (0.0 < salinity < 0.5‰).
These EFH designations of estuaries and embayments are based on the NOAA Estuarine Living Marine Resources (ELMR) program (Jury *et al.* 1994; Stone *et al.* 1994).

Figure 19 EFH Designation for Atlantic Herring Eggs

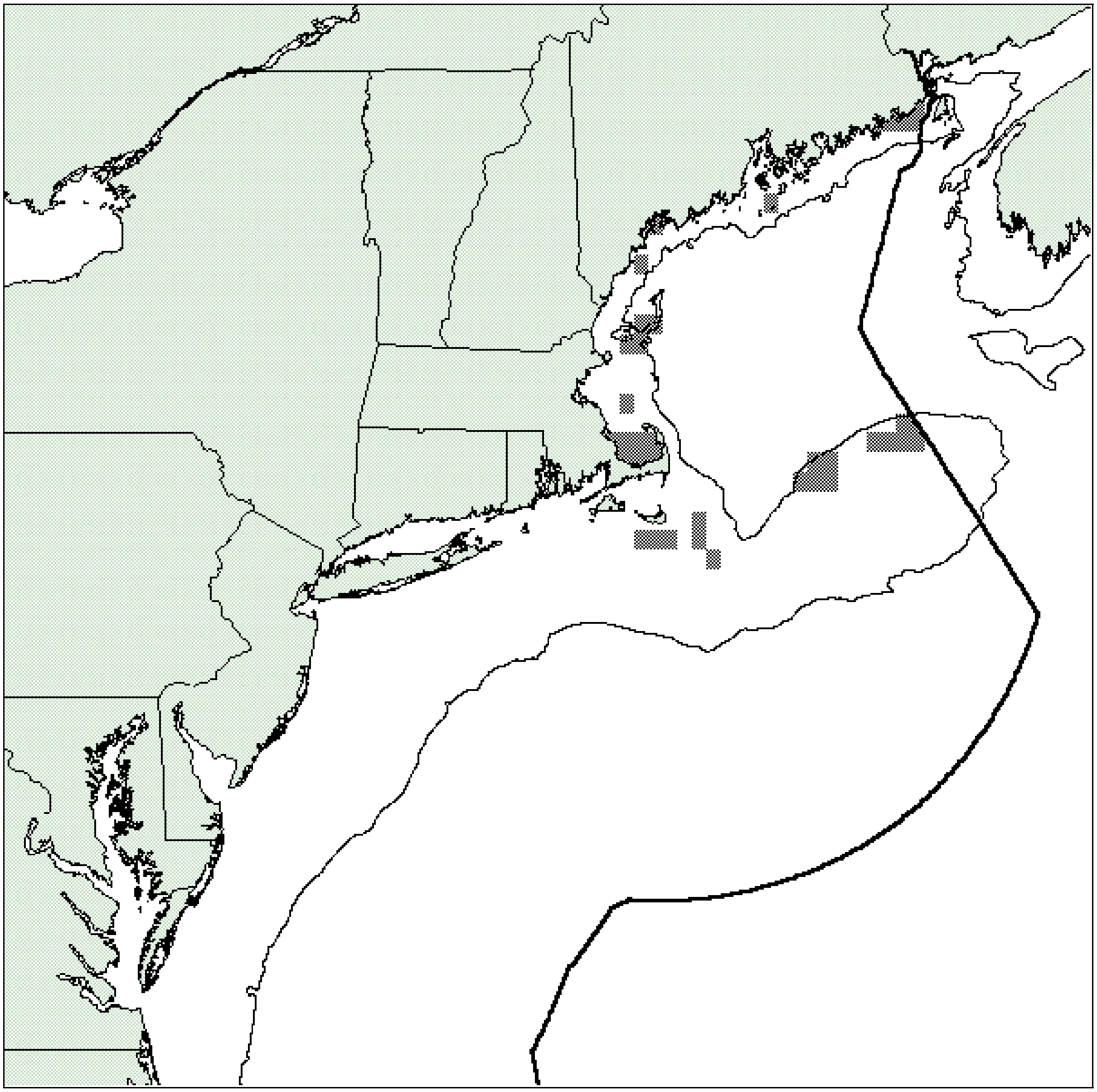


Figure 20 EFH Designation for Atlantic Herring Larvae

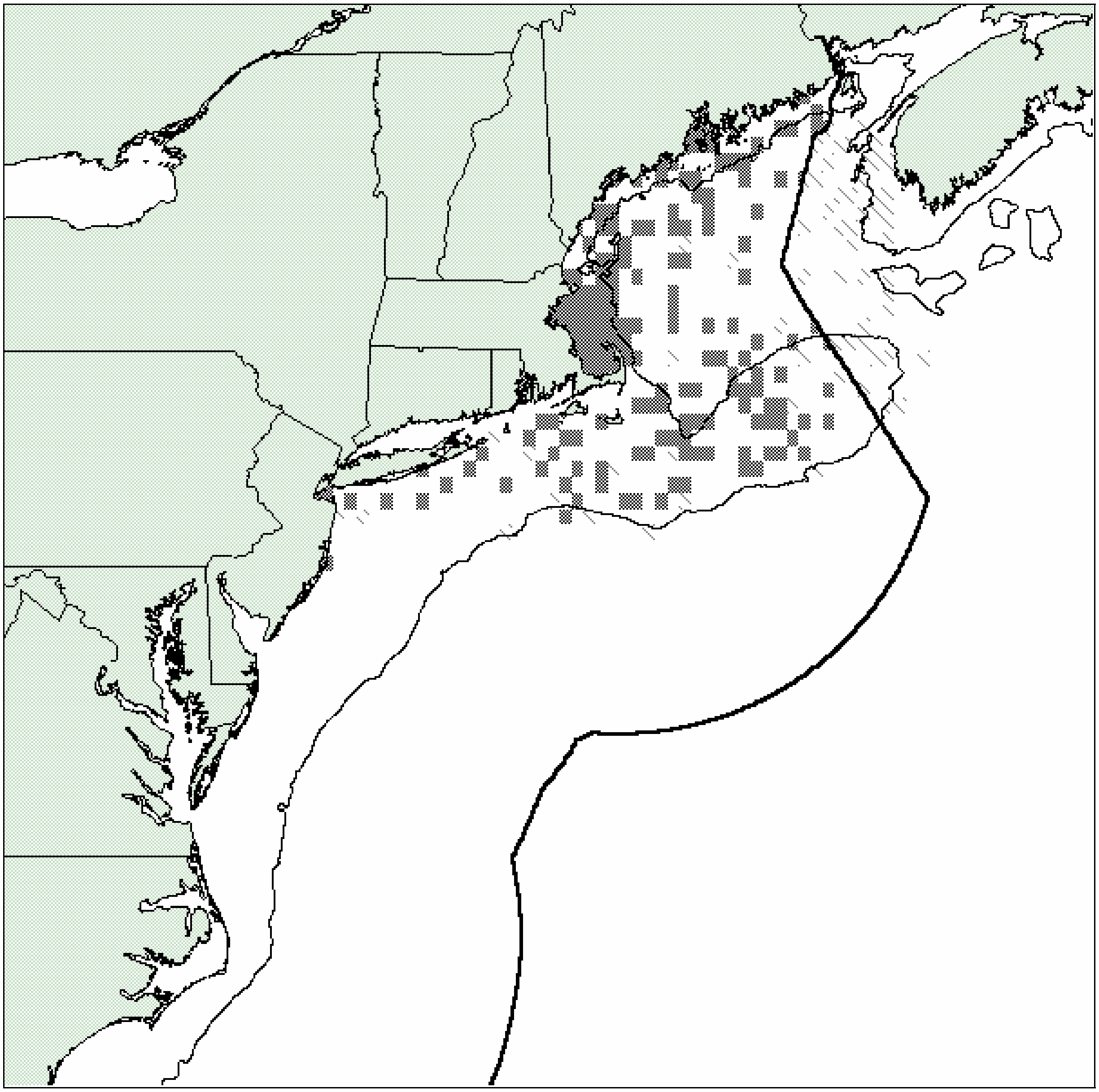


Figure 21 EFH Designation for Juvenile Atlantic Herring

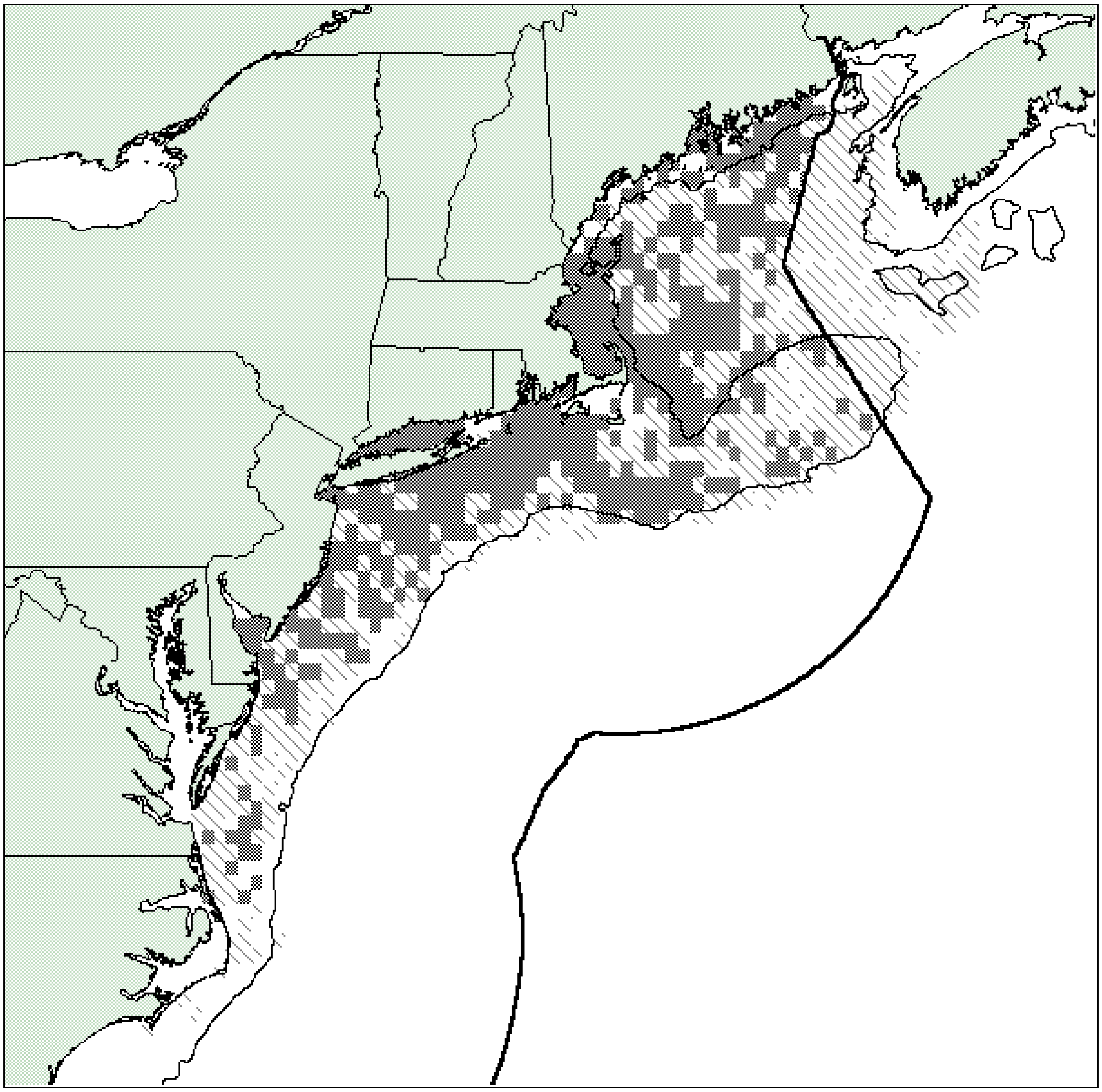
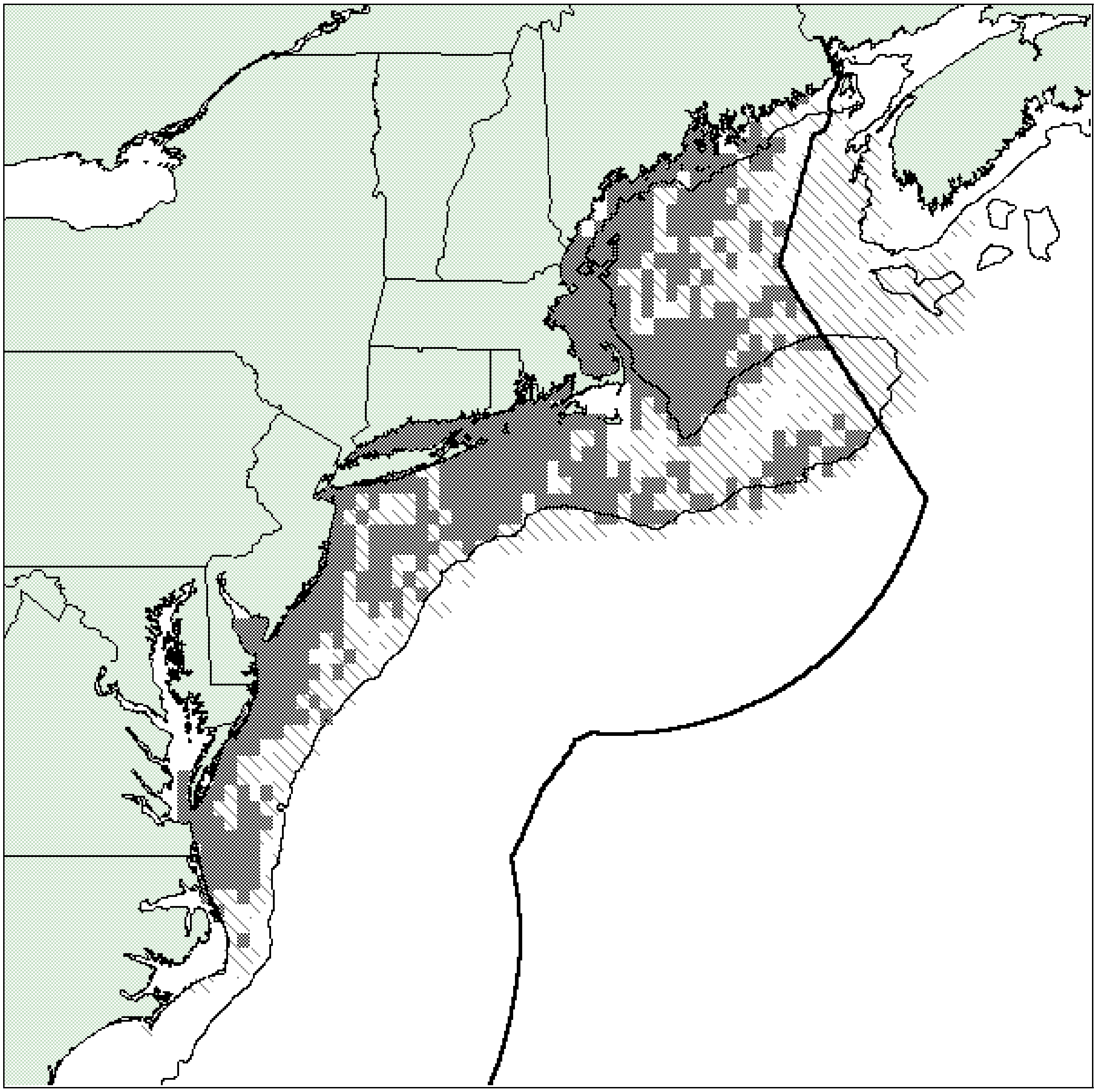


Figure 22 EFH Designation for Adult Atlantic Herring



4.2.2.2 EFH for Other Species

The Atlantic herring fishery is prosecuted in four areas defined as 1A, 1B, 2, and 3 (Figure 23). These areas, which could potentially be affected by the proposed action, have been identified as EFH various species listed in Table 17. Many of these EFH designations were developed in NEFMC Essential Fish Habitat Omnibus Amendment 1 (1998). For additional information, the reader is referred to the Omnibus Amendment and the other FMP documents listed in Table 18. In addition, EFH descriptions and maps for all Northeast region species can be accessed at http://www.nero.noaa.gov/hcd/webintro.html. Two FMP amendments in development will update current EFH designations. Amendment 16 to the Northeast Multispecies FMP will add Atlantic wolffish to the management unit and includes an EFH designation for the species.

Designations for all other species managed by NEFMC are being reviewed and updated in Essential Fish Habitat Omnibus Amendment 2.

Figure 23 Geographic Extent of the Atlantic Herring Fishery

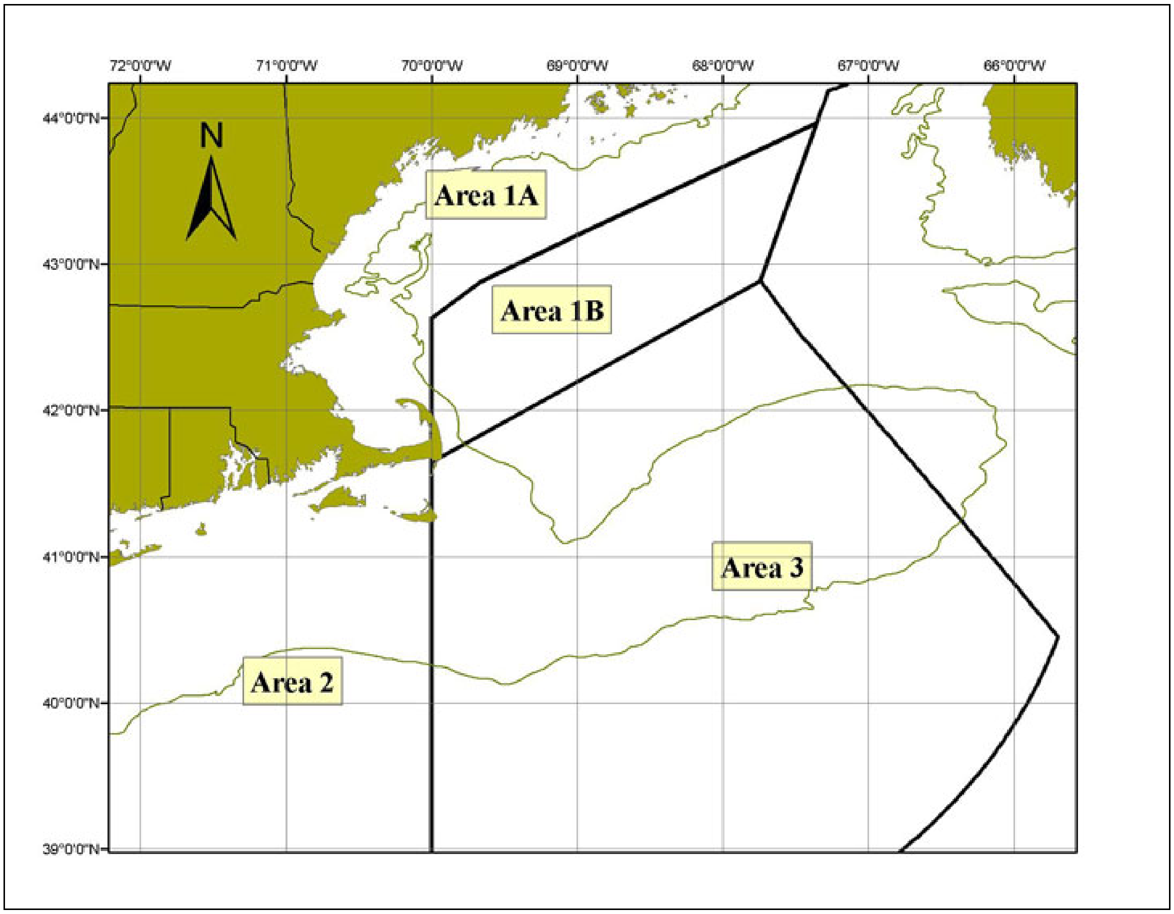


Table 17 – Demersal Species/Lifestages for which Designated EFH Overlaps with the Atlantic Herring Fishery, Listed Alphabetically by Common Name

Species	***Life Stage***	***Geographic Area of EFH***	***Depth***	***Seasonal Occurrence***	***EFH Description***
American plaice	juvenile	GOME and estuaries from Passamaquoddy Bay to Saco Bay, ME and from Mass. Bay to Cape Cod Bay, MA	45 - 150		Bottom habitats with fine grained sediments or a substrate of sand or gravel
American plaice	adult	GOME and estuaries from Passamaquoddy Bay to Saco Bay, ME and from Mass. Bay to Cape Cod Bay, MA	45 - 175		Bottom habitats with fine grained sediments or a substrate of sand or gravel
Atlantic cod	juvenile	GOME, GB, eastern portion of continental shelf off southern NE and following estuaries: Passamaquoddy Bay to Saco Bay; Mass. Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	25 - 75		Bottom habitats with a substrate of cobble or gravel
Atlantic cod	adult	GOME, GB, eastern portion of continental shelf off southern NE and following estuaries: Passamaquoddy Bay to Saco Bay; Mass. Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	10 - 150		Bottom habitats with a substrate of rocks, pebbles, or gravel
Atlantic halibut	juvenile	GOME, GB	20 - 60		Bottom habitats with a substrate of sand, gravel, or clay
Atlantic halibut	adult	GOME, GB	100 - 700		Bottom habitats with a substrate of sand, gravel, or clay
Atlantic salmon	juvenile	Rivers from CT to Maine: Connecticut, Pawcatuck, Merrimack, Cocheco, Saco, Androscoggin, Presumpscot, Kennebec, Sheepscot, Ducktrap, Union, Penobscot, Narraguagus, Machias, East Machias, Pleasant, St. Croix, Denny's, Passagassawaukeag, Aroostook, Lamprey, Boyden, Orland Rivers, and the Turk, Hobart and Patten Streams; and the following estuaries for juveniles and adults: Passamaquoddy Bay to Muscongus Bay; Casco Bay to Wells Harbor; Mass. Bay, Long Island Sound, Gardiners Bay to Great South Bay. All aquatic habitats in the watersheds of the above listed rivers, including all tributaries to the extent that they are currently or were historically accessible for salmon migration.	10 – 61		Bottom habitats of shallow gravel/cobble riffles interspersed with deeper riffles and pools in rivers and estuaries, water velocities between 30 - 92 cm/s
Atlantic sea scallop	juvenile	GOME, GB, southern NE and middle Atlantic south to Virginia-North Carolina border and following estuaries: Passamaquoddy Bay to Sheepscot R.; Casco Bay, Great Bay, Mass Bay, and Cape Cod Bay	18 - 110		Bottom habitats with a substrate of cobble, shells, and silt
Atlantic sea scallop	adult	GOME, GB, southern NE and middle Atlantic south to Virginia-North Carolina border and following estuaries: Passamaquoddy Bay to Sheepscot R.; Casco Bay, Great Bay, Mass Bay, and Cape Cod Bay	18 - 110		Bottom habitats with a substrate of cobble, shells, coarse/gravelly sand, and sand
Atlantic surfclam	juvenile	Eastern edge of GB and the GOME throughout Atlantic EEZ	0 - 60, low density beyond 38		Throughout substrate to a depth of 3 ft within federal waters, burrow in medium to coarse sand and gravel substrates, also found in silty to fine sand, but not in mud

Species	*Life Stage*	*Geographic Area of EFH*	*Depth*	*Seasonal Occurrence*	*EFH Description*
Atlantic surfclam	adult	Eastern edge of GB and the GOME throughout Atlantic EEZ	0 - 60, low density beyond 38	Spawn summer to fall	Throughout substrate to a depth of 3 ft within federal waters
Barndoor skate	juvenile	Eastern GOME, GB, Southern NE, Mid-Atlantic Bight to Hudson Canyon	l0 - 750, mosty < 150		Bottom habitats with mud, gravel, and sand substrates
Barndoor skate	adult	Eastern GOME, GB, Southern NE, Mid-Atlantic Bight to Hudson Canyon	l0 - 750, mosty < 150		Bottom habitats with mud, gravel, and sand substrates
Black sea bass	juvenile	Demersal waters over continental shelf from GOME to Cape Hatteras, NC, also includes estuaries from Buzzards Bay to Long Island Sound; Gardiners Bay, Barnegat Bay to Chesapeake Bay; Tangier/ Pocomoke Sound, and James River	1 – 38	Found in coastal areas (April to December, peak June to November) between VA and MA, but winter offshore from NJ and south; estuaries in summer and spring	Rough bottom, shellfish and eelgrass beds, manmade structures in sandy-shelly areas, offshore clam beds, and shell patches may be used during wintering
Black sea bass	adult	Demersal waters over continental shelf from GOME to Cape Hatteras, NC, also includes estuaries: Buzzards Bay, Narragansett Bay, Gardiners Bay, Great South Bay, Barnegat Bay to Chesapeake Bay; Tangier/ Pocomoke Sound, and James River	20 - 50	Wintering adults (November to April) offshore, south of NY to NC; inshore, estuaries from May to October	Structured habitats (natural and manmade), sand and shell substrates preferred
Clearnose skate	juvenile	GOME, along shelf to Cape Hatteras, NC; includes the estuaries from Hudson River/Raritan Bay south to the Chesapeake Bay mainstem	0 – 500, mostly < 111		Bottom habitats with substrate of soft bottom along continental shelf and rocky or gravelly bottom
Clearnose skate	adult	GOME, along shelf to Cape Hatteras, NC; includes the estuaries from Hudson River/Raritan Bay south to the Chesapeake Bay mainstem	0 – 500, mostly < 111		Bottom habitats with substrate of soft bottom along continental shelf and rocky or gravelly bottom
Golden crab	juvenile	Chesapeake Bay to the south through the Florida Straight (and into the Gulf of Mexico)	290 - 570		Continental slope in flat areas of foraminifera ooze, on distinct mounds of dead coral, ripple habitat, dunes, black pebble habitat, low outcrop, and soft bioturbated habitat
Golden crab	adult	Chesapeake Bay to the south through the Florida Straight (and into the Gulf of Mexico)	290 - 570		Continental slope in flat areas of foraminifera ooze, on distinct mounds of dead coral, ripple habitat, dunes, black pebble habitat, low outcrop, and soft bioturbated habitat
Haddock	juvenile	GB, GOME, middle Atlantic south to Delaware Bay	35 - 100		Bottom habitats with a substrate of pebble and gravel
Haddock	adult	GB and eastern side of Nantucket Shoals, throughout GOME, *additional area of Nantucket Shoals, and Great South	40 - 150		Bottom habitats with a substrate of broken ground, pebbles,

Species	*Life Stage*	*Geographic Area of EFH*	*Depth*	*Seasonal Occurrence*	*EFH Description*
		Channel			smooth hard sand, and smooth areas between rocky patches
Little skate	juvenile	GB through Mid-Atlantic Bight to Cape Hatteras, NC; includes the estuaries from Buzzards Bay south to the Chesapeake Bay mainstem	0 - 137, mostly 73 - 91		Bottom habitats with sandy or gravelly substrate or mud
Little skate	adult	GB through Mid-Atlantic Bight to Cape Hatteras, NC; includes the estuaries from Buzzards Bay south to the Chesapeake Bay mainstem	0 - 137, mostly 73 - 91		Bottom habitats with sandy or gravelly substrate or mud
Monkfish	juvenile	Outer continental shelf in the middle Atlantic, mid-shelf off southern NE, all areas of GOME	25 - 200		Bottom habitats with substrates of a sandshell mix, algae covered rocks, hard sand, pebbly gravel, or mud
Monkfish	adult	Outer continental shelf in the middle Atlantic, mid-shelf off southern NE, outer perimeter of GB, all areas of GOME	25 - 200		Bottom habitats withsubstrates of a sandshell mix, algae covered rocks, hard sand, pebbly gravel, or mud
Ocean pout	juvenile	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Saco Bay; Mass. Bay, and Cape Cod Bay	< 50	Late fall to spring	Bottom habitats in close proximity to hard bottom nesting areas
Ocean pout	adult	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Saco Bay; Mass. Bay, Boston Harbor, and Cape Cod Bay	< 80		Bottom habitats, often smooth bottom near rocks or algae
Ocean quahog	juvenile	Eastern edge of GB and GOME throughout the Atlantic EEZ	8 - 245		Throughout substrate to a depth of 3 ft within federal waters, occurs progressively further offshore between Cape Cod and Cape Hatteras
Ocean quahog	adult	Eastern edge of GB and GOME throughout the Atlantic EEZ	8 - 245	Spawn May to December with several peaks	Throughout substrate to a depth of 3 ft within federal waters, occurs progressively further offshore between Cape Cod and Cape Hatteras
Offshore hake	juvenile	Outer continental shelf of GB and southern NE south to Cape Hatteras, NC	170 - 350		Bottom habitats
Offshore hake	adult	Outer continental shelf of GB and southern NE south to Cape Hatteras, NC	150 - 380		Bottom habitats
Pollock	juvenile	GOME, GB, and the following estuaries: Passamaquoddy Bay to Saco Bay; Great Bay to Waquoit Bay; Long Island Sound, Great South Bay	0 – 250		Bottom habitats with aquatic vegetation or a substrate of sand, mud, or rocks
Pollock	adult	GOME, GB, southern NE, and middle Atlantic south to New Jersey and the following estuaries: Passamaquoddy Bay, Damariscotta R., Mass Bay, Cape Cod Bay, Long Island Sound	15 – 365		Hard bottom habitats including artificial reefs
Red crab	juvenile	Southern flank of GB and south the Cape Hatteras, NC	700 - 1800		Bottom habitats of continental slope with a substrate of silts, clays, and all silt-clay-sand composites
Red crab	adult	Southern flank of GB and south the Cape Hatteras, NC	200 - 1300		Bottom habitats of continental slope with

Species	***Life Stage***	***Geographic Area of EFH***	***Depth***	***Seasonal Occurrence***	***EFH Description***
					a substrate of silts, clays, and all silt-clay-sand composites
Red drum	juvenile	Along the Atlantic coast from Virginia through the Florida Keys	< 50	Found throughout Chesapeake Bay from September to November	Utilize shallow backwaters of estuaries as nursery areas and remain until they move to deeper water portions of the estuary associated with river mouths, oyster bars, and front beaches
Red drum	adult	Along the Atlantic coast from Virginia through the Florida Keys	< 50	Found in Chesapeake in spring and fall and also along eastern shore of VA	Concentrate around inlets, shoals, and capes along the Atlantic coast; shallow bay bottoms or oyster reef substrate preferred, also nearshore artificial reefs
Red hake	juvenile	GOME, GB, continental shelf off southern NE, and middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Saco Bay; Great Bay, Mass. Bay to Cape Cod Bay; Buzzards Bay to Conn. R.; Hudson R./ Raritan Bay, and Chesapeake Bay	< 100		Bottom habitats with substrate of shell fragments, including areas with an abundance of live scallops
Red hake	adult	GOME, GB, continental shelf off southern NE, and middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Saco Bay; Great Bay, Mass. Bay to Cape Cod Bay; Buzzards Bay to Conn. R.; Hudson R./ Raritan Bay, Delaware Bay, and Chesapeake Bay	10 - 130		Bottom habitats in depressions with a substrate of sand and mud
Redfish	juvenile	GOME, southern edge of GB	25 - 400		Bottom habitats with a substrate of silt, mud, or hard bottom
Redfish	adult	GOME, southern edge of GB	50 - 350		Bottom habitats with a substrate of silt, mud, or hard bottom
Rosette skate	juvenile	Nantucket shoals and southern edge of GB to Cape Hatteras, NC	33 - 530, mostly 74 - 274		Bottom habitats with soft substrate, including sand/mud bottoms, mud with echinoid and ophiuroid fragments, and shell and pteropod ooze
Rosette skate	adult	Nantucket shoals and southern edge of GB to Cape Hatteras, NC	33 - 530, mostly 74 - 274		Bottom habitats with soft substrate, including sand/mud bottoms, mud with echinoid and ophiuroid fragments, and shell and pteropod ooze
Scup	juvenile	Continental shelf from GOME to Cape Hatteras, NC includes the following estuaries: Mass. Bay, Cape Cod Bay to Long Island Sound; Gardiners Bay to Delaware Inland Bays; and Chesapeake Bay	(0 - 38)	Spring and summer in estuaries and bays	Demersal waters north of Cape Hatteras and inshore on various sands, mud, mussel, and eelgrass bed type substrates
Scup	adult	Continental shelf from GOME to Cape Hatteras, NC includes the following estuaries: Cape Cod Bay to Long Island Sound; Gardiners Bay to Hudson R./ Raritan Bay; Delaware Bay and Inland	(2 -185)	Wintering adults (November to April) are usually offshore, south of NY to NC	Demersal waters north of Cape Hatteras and inshore estuaries (various substrate types)

Species	*Life Stage*	*Geographic Area of EFH*	*Depth*	*Seasonal Occurrence*	*EFH Description*
		Bays; and Chesapeake Bay			
Silver hake	juvenile	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Casco Bay, Mass. Bay to Cape Cod Bay	20 – 270		Bottom habitats of all substrate types
Silver hake	adult	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Casco Bay, Mass. Bay to Cape Cod Bay	30 – 325		Bottom habitats of all substrate types
Smooth skate	juvenile	Offshore banks of GOME	31 – 874, mostly 110 - 457		Bottom habitats with a substrate of soft mud (silt and clay), sand, broken shells, gravel and pebbles
Smooth skate	adult	Offshore banks of GOME	31 – 874, mostly 110 - 457		Bottom habitats with a substrate of soft mud (silt and clay), sand, broken shells, gravel and pebbles
Spanish mackerel, cobia, and king mackerel	juvenile	South Atlantic and Mid-Atlantic Bights			Sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island oceanside waters from surf zone to shelf break, but from the Gulf Stream shoreward
Spanish mackerel, cobia, and king mackerel	adult	South Atlantic and Mid-Atlantic Bights			Sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island oceanside waters from surf zone to shelf break, but from the Gulf Stream shoreward
Spiny dogfish	juvenile	GOME through Cape Hatteras, NC across the continental shelf; continental shelf waters south of Cape Hatteras, NC through Florida; also includes estuaries from Passamaquoddy Bay to Saco Bay; Mass. Bay and Cape Cod Bay	10 - 390		Continental shelf waters and estuaries
Spiny dogfish	adult	GOME through Cape Hatteras, NC across the continental shelf; continental shelf waters south of Cape Hatteras, NC through Florida; also includes estuaries from Passamaquoddy Bay to Saco Bay; Mass. Bay and Cape Cod Bay	10 - 450		Continental shelf waters and estuaries
Summer flounder	juvenile	Over continental shelf from GOME to Cape Hatteras, NC; south of Cape Hatteras to Florida; also includesestuaries from Waquoit Bay to James R.; Albemarle Sound to Indian R.	0.5 – 5 in estuary		Demersal waters, on muddy substrate but prefer mostly sand; found in the lower estuaries in flats, channels, salt marsh creeks, and eelgrass beds
Summer flounder	adult	Over continental shelf from GOME to Cape Hatteras, NC; south of Cape Hatteras to Florida; also includes estuaries from Buzzards Bay, Narragansett Bay, Conn. R. to James R.; Albemarle Sound to Broad R.; St. Johns R., and Indian R.	0 - 25	Shallow coastal and estuarine waters during warmer months, move offshore on outer continental shelf at depths of 150 m in colder months	Demersal waters and estuaries

Species	Life Stage	Geographic Area of EFH	Depth	Seasonal Occurrence	EFH Description
Thorny skate	adult	GOME and GB	18 - 2000, mostly 111 - 366		Bottom habitats with a substrate of sand, gravel, broken shell, pebbles, and soft mud
Tilefish	juvenile	US/Canadian boundary to VA/NC boundary (shelf break, submarine canyon walls, and flanks: GB to Cape Hatteras)	76 - 365	All year, may leave GB in winter	Rough bottom, small burrows, and sheltered areas; substrate rocky, stiff clay, human debris
Tilefish	adult	US/Canadian boundary to VA/NC boundary (shelf break, submarine canyon walls, and flanks: GB to Cape Hatteras)	76 - 365	All year, may leave GB in winter	Rough bottom, small burrows, and sheltered areas; substrate rocky, stiff clay, human debris
White hake	adult	GOME, southern edge of GB, southern NE to middle Atlantic and the following estuaries: Passamaquoddy Bay to Great Bay; Mass. Bay to Cape Cod Bay	5 - 325		Bottom habitats with substrate of mud or fine grained sand
White hake	juvenile	GOME, southern edge of GB, southern NE to middle Atlantic and the following estuaries: Passamaquoddy Bay to Great Bay; Mass. Bay to Cape Cod Bay	5 - 225	May to September	Pelagic stage - pelagic waters; demersal stage - bottom habitat with seagrass beds or substrate of mud or fine grained sand
Windowpane flounder	juvenile	GOME, GB, southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Great Bay; Mass. Bay to Chesapeake Bay	1 - 100		Bottom habitats with substrate of mud or fine grained sand
Windowpane flounder	adult	GOME, GB, southern NE, middle Atlantic south to Virginia - NC border and the following estuaries: Passamaquoddy Bay to Great Bay; Mass. Bay to Chesapeake Bay	1 - 75		Bottom habitats with substrate of mud or fine grained sand
Winter flounder	juvenile	GB, inshore areas of GOME, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Chincoteague Bay	0.1 – 10 (1 - 50, age 1+)		Bottom habitats with a substrate of mud or fine grained sand
Winter flounder	adult	GB, inshore areas of GOME, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Chincoteague Bay	1 - 100		Bottom habitats including estuaries with substrates of mud, sand, grave
Winter skate	juvenile	Cape Cod Bay, GB, southern NE shelf through Mid-Atlantic Bight to North Carolina; includes the estuaries from Buzzards Bay south to the Chesapeake Bay mainstem	0 - 37, mostly < 111		Bottom habitats with substrate of sand and gravel or mud
Winter skate	adult	Cape Cod Bay, GB southern NE shelf through Mid-Atlantic Bight to North Carolina; includes the estuaries from Buzzards Bay south to the Chesapeake Bay mainstem	0 - 371, mostly < 111		Bottom habitats with substrate of sand and gravel or mud
Witch flounder	juvenile	GOME, outer continental shelf from GB south to Cape Hatteras	50 - 450 to 1500		Bottom habitats with fine grained substrate
Witch flounder	adult	GOME, outer continental shelf from GB south to Chesapeake Bay	25 - 300		Bottom habitats with fine grained substrate
Yellowtail flounder	juvenile	GB, GOME, southern NE continental shelf south to Delaware Bay and the following estuaries: Sheepscot R., Casco Bay, Mass. Bay to Cape Cod Bay	20 - 50		Bottom habitats with substrate of sand or sand and mud
Yellowtail flounder	adult	GB, GOME, southern NE continental shelf south to Delaware Bay and the following estuaries: Sheepscot R., Casco Bay, Mass. Bay to Cape Cod Bay	20 - 50		Bottom habitats with substrate of sand or sand and mud

Table 18 Listing of Sources for Original EFH Designation Information

Species	*Management authority*	*Plan managed under*	*EFH designation action*
American plaice	NEFMC	NE Multispecies	EFH Omnibus/NE Multispecies A11
Atlantic cod	NEFMC	NE Multispecies	EFH Omnibus/NE Multispecies A11
Atlantic halibut	NEFMC	NE Multispecies	EFH Omnibus/NE Multispecies A11
Atlantic herring	NEFMC	Atlantic Herring	EFH Omnibus/Atlantic Herring FMP
Atlantic salmon	NEFMC	Atlantic salmon	EFH Omnibus/Atlantic Salmon FMP
Atlantic sea scallop	NEFMC	Atlantic Sea Scallop	EFH Omnibus/Atlantic Sea Scallop
Atlantic surfclam	MAFMC	Atlantic Surfclam Ocean Quahog	Atlantic Surfclam Ocean Quahog A
Barndoor skate	NEFMC	NE Skate Complex	Original NE Skate Complex FMP
Black sea bass	MAFMC	Summer Flounder, Scup, and Black Sea Bass	Summer Flounder, Scup, and Black
Clearnose skate	NEFMC	NE Skate Complex	Original NE Skate Complex FMP
Golden crab	SAFMC	Golden Crab	Golden Crab FMP A1
Haddock	NEFMC	NE Multispecies	EFH Omnibus/NE Multispecies A11
Little skate	NEFMC	NE Skate Complex	Original NE Skate Complex FMP
Monkfish	NEFMC, MAFMC	Monkfish	EFH Omnibus/Monkfish A1
Ocean pout	NEFMC	NE Multispecies	EFH Omnibus/NE Multispecies A11
Ocean quahog	MAFMC	Atlantic Surfclam Ocean Quahog	Atlantic Surfclam Ocean Quahog A
Offshore hake	NEFMC	NE Multispecies	NE Multispecies A12
Pollock	NEFMC	NE Multispecies	EFH Omnibus/NE Multispecies A11
Red crab	NEFMC	Red Crab	Original Red Crab FMP
Red drum	ASMFC/SAFMC	ASMFC Red Drum FMP	SAFMC Habitat Plan
Red hake	NEFMC	NE Multispecies	NE Multispecies A12
Redfish	NEFMC	NE Multispecies	EFH Omnibus/NE Multispecies A11
Rosette skate	NEFMC	NE Skate Complex	Original NE Skate Complex FMP
Scup	MAFMC	Summer Flounder, Scup, and Black Sea Bass	Summer Flounder, Scup, and Black
Silver hake	NEFMC	NE Multispecies	NE Multispecies A12
Smooth skate	NEFMC	NE Skate Complex	Original NE Skate Complex FMP
Spanish mackerel, cobia, and king mackerel	SAFMC/GMFMC	Coastal Migratory Pelagics	Coastal Migratory Pelagics FMP A1
Spiny dogfish	MAFMC/NEFMC	Spiny Dogfish	Original Spiny Dogfish FMP
Summer flounder	MAFMC	Summer Flounder, Scup, and Black Sea Bass	Summer Flounder, Scup, and Black
Thorny skate	NEFMC	NE Skate Complex	Original NE Skate Complex FMP
Tilefish	MAFMC	Tilefish	Tilefish FMP
White hake	NEFMC	NE Multispecies	EFH Omnibus/NE Multispecies A11
Windowpane flounder	NEFMC	NE Multispecies	EFH Omnibus/NE Multispecies A11
Winter flounder	NEFMC	NE Multispecies	EFH Omnibus/NE Multispecies A11
Winter skate	NEFMC	NE Skate Complex	Original NE Skate Complex FMP
Witch flounder	NEFMC	NE Multispecies	EFH Omnibus/NE Multispecies A11
Yellowtail flounder	NEFMC	NE Multispecies	EFH Omnibus/NE Multispecies A11

4.3 PROTECTED RESOURCES (MARINE MAMMALS AND PROTECTED SPECIES)

There are numerous species that inhabit the environment within the Atlantic Herring FMP management unit, and that therefore potentially occur in the operations area of the herring industry, that are afforded protection under the Endangered Species Act of 1973 (ESA; i.e., for those designated as threatened or endangered) and/or the Marine Mammal Protection Act of

1972 (MMPA), and are under NMFS' jurisdiction. Fifteen species are classified as endangered or threatened under the ESA, while the remainders are protected by the provisions of the MMPA.

4.3.1 Species Present in the Area

The following list of species, protected either by the ESA, the MMPA, or both, may be found in the environment that would be utilized by the herring fishery. The Council has also identified two right whale critical habitat designations in the Northeast.

Cetaceans	
North Atlantic right whale (*Eubalaena glacialis*)	Endangered
Humpback whale (*Megaptera novaeangliae*)	Endangered
Fin whale (*Balaenoptera physalus*)	Endangered
Sei whale (*Balaenoptera borealis*)	Endangered
Blue whale (*Balaenoptera musculus*)	Endangered
Sperm whale (*Physeter macrocephalus*)	Endangered
Minke whale (*Balaenoptera acutorostrata*)	Protected
Pilot whale (*Globicephala spp.*)	Protected
Risso's dolphin (*Grampus griseus*)	Protected
White-sided dolphin (*Lagenorhynchus acutus*)	Protected
Common dolphin (*Delphinus delphis*)	Protected
Spotted and striped dolphins (*Stenella spp.*)	Protected
Bottlenose dolphin – Offshore Stock (*Tursiops truncatus*)	Protected
White-beaked dolphin (*Lagenorhynchus albirostris*)	Protected
Harbor Porpoise (*Phocoena phocoena*)	Protected
Sea Turtles	
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered
Green sea turtle (*Chelonia mydas*)	Endangered
Loggerhead sea turtle (*Caretta caretta*)	Threatened
Fish	
Shortnose sturgeon (*Acipenser brevirostrum*)	Endangered
Atlantic salmon (*Salmo salar*)	Endangered
Pinnipeds	
Harbor seal (*Phoca vitulina*)	Protected
Gray seal (*Halichoerus grypus*)	Protected
Harp seal (*Pagophilus groenlandicus*)	Protected
Hooded seal (*Cystophora cristata*)	Protected
Northern Right Whale Critical Habitat Designations	
Cape Cod Bay	

Great South Channel

Two additional species of pinnipeds: Ringed seal (*Phoca hispida*) and the Bearded seal (*Erignathus barbatus*) are listed as candidate species under the ESA. The Northeastern U.S. is at the southern tip of the habitat range for both of these species. These species are rarely sighted off the northeastern U.S. Although a few stranding records have been recorded in the Northeast Region, sightings are rare in the Northeast Atlantic.

4.3.2 Species Potentially Affected

It is expected that the sea turtle, cetacean, and pinniped species discussed below have the potential to be affected by the operation of the herring fishery. Background information on the range-wide status of sea turtle and marine mammal species that occur in the area and are known or suspected of interacting with fishing gear (demersal gear including trawls, gillnets, and longline types) can be found in a number of published documents. These include sea turtle status reviews and biological reports (NMFS and USFWS 1995; Marine Turtle Expert Working Group (TEWG) 1998, 2000; NMFS and USFWS 2007a, 2007b; Leatherback TEWG 2007), recovery plans for ESA-listed cetaceans and sea turtles (NMFS 1991, 2005; NMFS and USFWS 1991a, 1991b; NMFS and USFWS 1992), the marine mammal stock assessment reports (e.g., Waring et al. 2006; 2007; 2009), and other publications (e.g., Clapham et al. 1999, Perry et al. 1999, Best et al. 2001, Perrin et al. 2002).

Additional ESA background information on the range-wide status of these species and a description of critical habitat can be found in a number of published documents including recent sea turtle (NMFS and USFWS 1995, USFWS 1997, TEWG 2000, NMFS SEFSC 2001, NMFS and USFWS 2007a), loggerhead recovery team report (NMFS and USFWS 2008), status reviews and stock assessments, Recovery Plans for the humpback whale (NMFS 1991a), right whale (NMFS 1991b, 2005), right whale EIS (August 2007), fin and sei whale (NMFS 1998b), and the marine mammal stock assessment report (Waring et al. 2008) and other publications (*e.g.*, Perry *et al.* 1999; Clapham *et al.* 1999; IWC 2001 *a*). A recovery plan for fin and sei whales is also available and may be found at the following web site http://www.NOAAFisheries.noaa.gov/prot_res/PR3/recovery.html (NOAA Fisheries unpublished).

4.3.2.1 Sea Turtles

Loggerhead, leatherback, Kemp's ridley, and green sea turtles occur seasonally in southern New England and Mid-Atlantic continental shelf waters north of Cape Hatteras, North Carolina. In general, turtles move up the coast from southern wintering areas as water temperatures warm in the spring (James et al. 2005, Morreale and Standora 2005, Braun-McNeill and Epperly 2004, Morreale and Standora 1998, Musick and Limpus 1997, Shoop and Kenney 1992, Keinath et al. 1987). The trend is reversed in the fall as water temperatures cool. By December, turtles have passed Cape Hatteras, returning to more southern waters for the winter (James et al. 2005, Morreale and Standora 2005, Braun-McNeill and Epperly 2004, Morreale and Standora 1998, Musick and Limpus 1997, Shoop and Kenney 1992, Keinath et al. 1987). Hard-shelled species are typically observed as far north as Cape Cod whereas the more cold-tolerant leatherbacks are observed in more northern Gulf of Maine waters in the summer and fall (Shoop and Kenney 1992, STSSN database http://www.sefsc.noaa.gov/seaturtleSTSSN.jsp).

In general, sea turtles are a long-lived species and reach sexual maturity relatively late (NMFS SEFSC 2001; NMFS and USFWS 2007a, 2007b, 2007c, 2007d). Sea turtles are injured and killed by numerous human activities (NRC 1990; NMFS and USFWS 2007a, 2007b, 2007c, 2007d). Nest count data are a valuable source of information for each turtle species since the number of nests laid reflects the reproductive output of the nesting group each year. A decline in the annual nest counts has been measured or suggested for four of five western Atlantic loggerhead nesting groups through 2004 (NMFS and USFWS 2007a), however, data collected since 2004 suggests nest counts have stabilized or increased (TEWG 2009). Nest counts for Kemp's ridley sea turtles as well as leatherback and green sea turtles in the Atlantic demonstrate increased nesting by these species (NMFS and USFWS 2007b, 2007c, 2007d).

4.3.2.2 Large Cetaceans

The most recent Marine Mammal Stock Assessment Report (SAR) (Waring et al. 2009) reviewed the current population trend for each of these cetacean species within U.S. EEZ waters, as well as providing information on the estimated annual human-caused mortality and serious injury, and a description of the commercial fisheries that interact with each stock in the U.S. Atlantic. Information from the SAR is summarized below.

The western North Atlantic baleen whale species (North Atlantic right, humpback, fin, sei, and minke) follow a general annual pattern of migration from high latitude summer foraging grounds, including the Gulf and Maine and Georges Bank, to low latitude winter calving grounds (Perry et al. 1999, Kenney 2002). However, this is an oversimplification of species movements, and the complete winter distribution of most species is unclear (Perry et al. 1999, Waring et al. 2009). Studies of some of the large baleen whales (right, humpback, and fin) have demonstrated the presence of each species in higher latitude waters even in the winter (Swingle et al. 1993, Wiley et al. 1995, Perry et al. 1999, Brown et al. 2002, Patrician et al. 2009). Blue whales are most often sighted on the east coast of Canada, particularly in the Gulf of St. Lawrence, and occurs only infrequently within the U.S. EEZ (Waring et al. 2002).

In comparison to the baleen whales, sperm whale distribution occurs more on the continental shelf edge, over the continental slope, and into mid-ocean regions (Waring et al. 2006). However, sperm whales distribution in U.S. EEZ waters also occurs in a distinct seasonal cycle (Waring et al. 2006). Typically, sperm whale distribution is concentrated east-northeast of Cape Hatteras in winter and shifts northward in spring when whales are found throughout the Mid-Atlantic Bight (Waring et al. 2006). Distribution extends further northward to areas north of Georges Bank and the Northeast Channel region in summer and then south of New England in fall, back to the Mid-Atlantic Bight (Waring et al. 1999).

For North Atlantic right whales, the available information suggests that the population is increasing at a rate of 1.8 percent per year during 1990-2003, and the total number of North Atlantic right whales is estimated to be at least 323 animals in 2003 (Waring et al. 2009). The minimum rate of annual human-caused mortality and serious injury to right whales averaged 3.8

per year during 2002 to 2006 (Waring et al. 2009). Of these, 1.4 per year resulted from fishery interactions. Recent mortalities included six female right whales, including three that were pregnant at the time of death (Waring et al. 2009).

The North Atlantic population of humpback whales is estimated to be 11,570, although the estimate is considered to be negatively biased (Waring et al. 2009). The best estimate for the Gulf of Maine stock of humpback whales is 847 whales (Waring et al. 2009). The population trend was considered positive for the Gulf of Maine population, but there are insufficient data to estimate the trend for the larger North Atlantic population. Based on data available for selected areas and time periods, the minimum population estimates for other western north Atlantic whale stocks are 2,269 fin whales, 207 sei whales, 4,804 sperm whales, and 3,312 minke whales (Waring et al. 2009). No recent estimates are available for blue whale abundance. Insufficient data exist to determine trends for any other large whale species.

The ALWTRP was recently revised with publication of a new final rule (72 FR 57104, October 5, 2007) that is intended to continue to address entanglement of large whales (right, humpback, fin, and minke) in fixed commercial fishing gear (i.e., pot, trap, and gillnet fisheries) and to reduce the risk of death and serious injury from entanglements that do occur.

4.3.2.3 Small Cetaceans

Numerous small cetacean species (dolphins; pygmy and dwarf sperm whales; pilot and beaked, whales; and the harbor porpoise) occur within the area from Cape Hatteras through the Gulf of Maine. Seasonal abundance and distribution of each species in the Mid-Atlantic, Georges Bank, and/or Gulf of Maine waters varies with respect to life history characteristics. Some species primarily occupy continental shelf waters (e.g., white sided dolphins, harbor porpoise), while others are found primarily in continental shelf edge and slope waters (e.g., Risso’s dolphin), and still others occupy all three habitats (e.g., common dolphin, spotted dolphins, striped dolphins). Information on the western North Atlantic stocks of each species is summarized in Waring et al. (2009).

4.3.2.4 Pinnipeds

Of the four species of seals expected to occur in the area, harbor seals have the most extensive distribution with sightings occurring as far south as 30° N (Katona et al. 1993, Waring et al. 2009). Gray seals are the second most common seal species in U.S. EEZ waters, occurring primarily in New England (Katona et al. 1993; Waring et al. 2009). Pupping for both species occurs in both U.S. and Canadian waters of the western north Atlantic with the majority of harbor seal pupping likely occurring in U.S. waters and the majority of gray seal pupping in Canadian waters, although there are at least three gray seal pupping colonies in U.S. waters as well. Harp and hooded seals are less commonly observed in U.S. EEZ waters. Both species form aggregations for pupping and breeding off eastern Canada in the late winter/early spring, and then travel to more northern latitudes for molting and summer feeding (Waring et al. 2006). Both species have a seasonal presence in U.S. waters from Maine to New Jersey, based on sightings, stranding, and fishery bycatch (Waring et al. 2009).

4.3.3 Species Not Likely to be Affected

The Gulf of Maine (GOM) Distinct Population Segment (DPS) of anadromous Atlantic salmon was initially listed by the USFWS and NMFS (collectively, the Services) as an endangered species on November 17, 2000 (65 FR 69459). A subsequent listing as an endangered species by the Services on June 19, 2009 (74 FR 29344) included an expanded range for the GOM DPS of Atlantic salmon.

Presently, the GOM DPS includes all anadromous Atlantic salmon whose freshwater range occurs in the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River. Included are all associated conservation hatchery populations used to supplement these natural populations; currently, such conservation hatchery populations are maintained at Green Lake National Fish Hatchery (GLNFH) and Craig Brook National Fish Hatchery (CBNFH). Coincident with the June 19, 2009 endangered listing, NMFS designated critical habitat for the GOM DPS of Atlantic salmon (74 FR 29300; June 19, 2009). The critical habitat designation for the GOM DPS includes 45 specific areas occupied by Atlantic salmon at the time of listing that include approximately 19,571 km of perennial river, stream, and estuary habitat and 799 square km of lake habitat within the range of the GOM DPS and in which are found those physical and biological features essential to the conservation of the species. The entire occupied range of the GOM DPS in which critical habitat is designated is within the State of Maine.

The action being considered in the EA is not likely to adversely affect shortnose sturgeon, the Gulf of Maine distinct population segment (DPS) of Atlantic salmon, hawksbill sea turtles, blue whales, or sperm whales, all of which are listed as endangered species under the ESA. Shortnose sturgeon and salmon belonging to the Gulf of Maine Distinct Population Segment (DPS) occur within the general geographical areas fished by the herring fishery, but they are unlikely to occur in the area where the fleet operates given their numbers and distribution. Therefore, none of these species are likely to be affected by the new measures. The following discussion provides the rationale for these determinations. Although there are additional species that may occur in the operations area that are not known to interact with the specific gear types that would be used by the herring fishery, impacts to these species are still considered due to their range and similarity of behaviors to species that have been adversely affected.

Shortnose sturgeon are benthic fish that mainly occupy the deep channel sections of large rivers. Shortnose sturgeon can be found in rivers along the western Atlantic coast from St. Johns River, Florida (although the species is possibly extirpated from this system), to the Saint John River in New Brunswick, Canada. The species is anadromous in the southern portion of its range (i.e., south of Chesapeake Bay), while some northern populations are amphidromous (NMFS 1998). Since the herring fishery would not operate in or near the rivers where concentrations of shortnose sturgeon are most likely found, it is highly unlikely that the herring fishery would affect shortnose sturgeon.

The wild populations of Atlantic salmon found in rivers and streams from the lower Kennebec River north to the U.S. - Canada border are listed as endangered under the ESA. These populations include those in the Dennys, East Machias, Machias, Pleasant, Narraguagus, Ducktrap, and Sheepscot Rivers and Cove Brook. Juvenile salmon in New England rivers typically migrate to sea in May after a 2- to 3-year period of development in freshwater streams, and remain at sea for two winters before returning to their U.S. natal rivers to spawn. Results from a 2001 post-smolt trawl survey in Penobscot Bay and the nearshore waters of the Gulf of Maine indicate that Atlantic salmon post-smolts are prevalent in the upper water column throughout this area in mid- to late May. Therefore, commercial fisheries deploying small-mesh active gear (pelagic trawls and purse seines within 10 m of the surface) in nearshore waters of the Gulf of Maine may have the potential to incidentally take smolts. Little information has been generated regarding salmon take by the herring fishery since Amendment 1 passed, thus, this species is not considered further in this EA.

The hawksbill turtle is uncommon in the waters of the continental U.S. Hawksbills prefer coral reefs, such as those found in the Caribbean and Central America. Hawksbills feed primarily on a wide variety of sponges but also consume bryozoans, coelenterates, and mollusks. The Culebra Archipelago of Puerto Rico contains especially important foraging habitat for hawksbills. Nesting areas in the western North Atlantic include Puerto Rico and the Virgin Islands. There are accounts of hawksbills in south Florida and individuals have been sighted along the east coast as far north as Massachusetts; however, east coast sightings north of Florida are rare (NMFS 2009a). Since operation of the herring fleet would not occur in waters that are typically used by hawksbill sea turtles, it is highly unlikely that its operations would affect this turtle species.

Blue whales do not regularly occur in waters of the U.S. EEZ (Waring et al. 2009). In the North Atlantic, blue whales are most frequently sighted in the St. Lawrence from April to January (Sears 2002). No blue whales were observed during the Cetacean and Turtle Assessment Program (CeTAP) surveys of the mid- and north Atlantic areas of the outer continental shelf (CeTAP 1982). Calving for the species occurs in low latitude waters outside of the area where the herring fleet operates. Blue whales feed on euphausiids (krill) that are too small to be captured in fishing gear. Given that the species is unlikely to occur in areas where the herring fishery operates, and given that the operation of the fleet would not affect the availability of blue whale prey or areas where calving and nursing of young occurs, the Proposed Action would not be likely to adversely affect blue whales.

Unlike blue whales, sperm whales do regularly occur in waters of the EEZ. However, the distribution of the sperm whales in the EEZ occurs on the continental shelf edge, over the continental slope, and into mid-ocean regions (Waring et al. 2006). In contrast, the herring fishery operates in continental shelf waters. The average depth of sperm whale sightings observed during the CeTAP surveys was 1792 m (CeTAP 1982). Female sperm whales and young males almost always inhabit open ocean, deep water habitat with bottom depths greater than 1000 m and at latitudes less than 40° N (Whitehead 2002). Sperm whales feed on large squid and fish that inhabit the deeper ocean regions (Perrin et al. 2002). Given that sperm whales are unlikely to occur in areas (based on water depth) where the herring fishery operates, and given that the operation of the fleet would not affect the availability of sperm whale prey or areas where calving and nursing of young occurs, the Proposed Action would not be likely to adversely affect sperm whales.

Although large whales and marine turtles may be potentially affected through interactions with fishing gear, it is likely that the herring fishery would not have any adverse effects on the availability of prey for most of these species. Right whales and sei whales feed on copepods (Horwood 2002, Kenney 2002). The herring fishery would not affect the availability of copepods for foraging right and sei whales because copepods are very small organisms that would pass through herring fishing gear rather than being captured in it. Humpback whales and fin whales, however, feed on krill as well as small schooling fish (e.g., sand lance, herring, mackerel) (Aguilar 2002, Clapham 2002). The TRAC Status Report of 2006 suggests that although predator consumption estimates have increased since the mid-1980's, the productive potential of the herring stock complex has improved in recent years. The proposed management measures may provide a benefit to the protected resources by providing a greater quantity of food available. Moreover, none of the turtle species are known to feed upon groundfish.

4.3.4 Interactions Between Gear and Protected Resources

Commercial fisheries are categorized by NMFS based on a two-tiered, stock-specific fishery classification system that addresses both the total impact of all fisheries on each marine mammal stock as well as the impact of individual fisheries on each stock. The system is based on the numbers of animals per year that incur incidental mortality or serious injury due to commercial fishing operations relative to a stock's Potential Biological Removal (PBR) level (the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population). Tier 1 takes into account the cumulative mortality and serious injury to marine mammals caused by commercial fisheries while Tier 2 considers marine mammal mortality caused by the individual fisheries; Tier 2 classifications are used in this EA to indicate how each type of gear proposed for use in the Proposed Action may affect marine mammals (NMFS 2009b). Table 19 identifies the classifications used in the List of Fisheries (LOF) proposed for FY 2010 (50 CFR 229), which are broken down into Tier 2 Categories I, II, and III).

Table 19 Description of the Tier 2 Fishery Classification Categories

Category	Category Description
Tier 2, Category I	A commercial fishery that has frequent incidental mortality and serious injury of marine mammals. This classification indicates that a commercial fishery is, by itself, responsible for the annual removal of 50 percent or more of any stock's potential biological removal (PBR) level.
Tier 2, Category II	A commercial fishery that has occasional incidental mortality and serious injury of marine mammals. This classification indicates that a commercial fishery is one that, collectively with other fisheries, is responsible for the annual removal of more than 10 percent of any marine mammal stock's PBR level and that is by itself responsible for the annual removal of between 1 percent and 50 percent, exclusive of any stock's PBR.
Tier 2, Category III	A commercial fishery that has a remote likelihood of, or no known incidental mortality and serious injury of marine mammals. This classification indicates that a commercial fishery is one that collectively with other fisheries is responsible for the annual removal of: Less than 50 percent of any marine mammal stock's PBR level, or More than 1 percent of any marine mammal stock's PBR level, yet that fishery by itself is responsible for the annual removal of 1 percent or less of that stock's PBR level. In the absence of reliable information indicating the frequency of incidental mortality and serous injury of marine mammals by a commercial fishery, the Assistant Administrator would determine whether the incidental serious injury or mortality is "remote" by evaluating other factors such as fishing techniques, gear used, methods used to deter marine mammals, target species, seasons and areas fished, qualitative data from logbooks or fisher reports, stranding data, and the species and distribution of marine mammals in the area or at the discretion of the Assistant Administrator.

Interactions between gear and a given species occur when fishing gear overlaps both spatially and trophically with the species' niche. Spatial interactions are more "passive" and involve unintentional interactions with fishing gear. Trophic interactions are more "active" and occur when protected species attempt to consume prey caught in fishing gear and become entangled in the process. Spatial and trophic interactions can occur with various types of fishing gear used by the herring fishery through the year.

Although interactions between deployed gear and protected species would vary, all the species identified in the following table have the potential to be affected by the operation of the herring fishery. The herring fishery is prosecuted by midwater trawl gear (single), paired midwater trawls, purse seines, stop seines and weirs. A full description of the gear used in the fishery is provided in the Amendment 1 FSEIS. Only the first three are considered to be primary gears in the Atlantic herring fishery. Weirs and stop seines are responsible for a only a small fraction of herring landings (see Amendment 1 FSEIS), operate exclusively within State waters and are not regulated by the Federal FMP, and therefore will not be discussed further in this document relative to protected species. It should be noted, however, that both gear types have accounted for interactions with protected species, notably right, humpback and minke whales, and harbor porpoise, as well as harbor and gray seals. Animals, particularly pinnipeds, may be released alive.

Table 20 Marine Mammal Impacts Based on Herring Gear and Herring Fishing Areas (Based on Proposed 2010 List of Fisheries)

Fishery		Estimated Number of Vessels/Persons	Marine Mammal Species and Stocks Incidentally Killed or Injured
Category	Type		
Tier 2, Category II	Northeast midwater trawl (including pair trawl)	17	Harbor Seal, Western North Atlantic Long-finned pilot whale, Western North Atlantic Short-finned pilot whale, Western North Atlantic White-sided dolphin, Western North Atlantic
Tier 2, Category II	Mid-Atlantic midwater trawl (including pair trawl)	620	Bottlenosed dolphin WNA offshore Common dolphin, WNA Long-finned pilot whale, WNA Risso's dolphin, WNA Short-finned pilot whale, WNA White-sided dolphin, WNA
Tier 2, Category III	Gulf of Maine Atlantic herring purse seine	30	Harbor seal, Western North Atlantic Gray seal, Western North Atlantic
Tier 2, Category III	Gulf of Maine herring and Atlantic mackerel stop seine/weir	50	Gray seal, Northwest North Atlantic Harbor porpoise, Gulf of Maine/Bay of Fundy Harbor seal, Western North Atlantic Minke whale, Canadian East Coast White-sided dolphin, Western North Atlantic

Due to the remote likelihood of interactions denoted by the *List of Fisheries* designations for the purse seine fishery and stop seines and weirs, discussion of these fisheries will only be where necessary. This discussion, as well as that in Amendment 1, will instead focus on the proposed measures and associated midwater trawl activities.

Given the target species of this fishery and because herring is a primary prey species for seals, porpoises and some whales, levels of protected species interactions with the fishery are likely for the midwater and pair trawl. The NOAA Fisheries Northeast Fisheries Science Center incidental take reports are published on the Northeast Fisheries Science Center website - http://www.nefsc.noaa.gov/femad/fishsamp/fsb/ A number of takes have occurred in the past four years by the midwater trawl fishery, as indicated in Table 21.

Table 21 Number of Incidental Takes Recorded by Fisheries Observers

Protected Species Encountered	2009 (Through July)	2008	2007	2006	Total
Grey Seal	1	2			3
Harbor Seal	1	1			2
Fin/Sei Whale		1			1
Humpback Whale		1			1
Pilot Whale		6			6
White-sided Dolphin		3	2	3	8
Seal Unk.			1		1

Although the incidents are isolated to observed herring trips, the table indicates that pilot whales and white-sided dolphin are the most likely to be taken in the herring midwater trawl fishery. According to Waring *et al.* (2005), pilot whales are distributed along the continental shelf in winter and off the northeast coast in early spring. White-sided dolphins are also distributed offshore on the continental shelf, but seasonally move into the Bay of Fundy and Gulf of Maine. Interactions between each of these species and the herring fishery are most likely to occur in Areas 1B, 2 and 3, given their offshore distribution. Short-finned pilot whales may also interact with the fishery, but the possibility is more remote since the fishery occurs from Cape Hatteras north to the Gulf of Maine and the boundary between the two pilot whale species is the New Jersey/Cape Hatteras area. The humpback whale is a species that has not been recorded as interacting with the herring fishery significantly before.

Harbor porpoise and both gray and harbor seals are distributed inshore during the period of highest activity in the herring fishery, from May through October. Interactions are most likely to occur in Area 1A, although porpoise are also found in the Bay of Fundy and less frequently on the northern edge of Georges Bank. Although all three of these species have had documented interactions with the herring purse seine/fixed gear fishery, the animals, if observed, are often released alive.

4.3.5 Actions to Minimize Interactions with Protected Species

Many of the factors that serve to mitigate the impacts of the herring fishery on protected species are currently being implemented in the Northeast Region under the Atlantic Trawl Gear Take Reduction Strategy (ATGTRS). While neither the Atlantic Large Whale Take Reduction Plan (ALWTRP) nor the Harbor Porpoise Take Reduction Plan (HPTRP) contain any components that would serve to mitigate the impact of the herring fishery on protected species, they do benefit the protected species with which the herring fishery interacts. In addition, the Herring FMP has undergone repeated consultations pursuant to Section 7 of the Endangered Species Act (ESA), with the most recent Biological Opinion prepared by NOAA Fisheries in 1999. The conclusion in that Opinion states that the herring fishery is not likely to jeopardize the continued existence of threatened or endangered species or critical habitat. The Biological Opinion includes an Incidental Take Statement that provides the fishery with an exemption to the take prohibitions established in Section 9 of the ESA.

4.3.5.1 Atlantic Trawl Gear Take Reduction Team/Atlantic Trawl Gear Take Reduction Strategy

The first meeting of the Atlantic Trawl Gear Take Reduction Team (ATGTRT) was held in September 2006. The ATGTRT was convened by NMFS as part of a settlement agreement between the Center for Biological Diversity and NOAA Fisheries Service to address the incidental mortality and serious injury of long-finned pilot whales, short-finned pilot whales, common dolphins, and white-sided dolphins in several trawl gear fisheries operating in the Atlantic Ocean. Incidental takes of pilot whales, common dolphins and white-sided dolphins have occurred in fisheries operating under the Atlantic Mackerel, Squid, and Butterfish FMP, as well as in midwater and bottom trawl fisheries in the Northeast and Mid-Atlantic regions.

In December of 2008 a Atlantic Trawl Gear Take Reduction Strategy (ATGTRS) was finalized. The ultimate goal of a Take Reduction Plan (TRP) was to reduce the incidental serious injury and mortality of marine mammals from commercial fishing operations to insignificant levels approaching a zero serious injury and mortality rate. At the time of the ATGTRS, however, none of these marine mammal stocks under consideration by the ATGTRT were classified as a strategic stock nor did they interact with a Category I fishery. The ATGTRT therefore felt that efforts should be made to identify and conduct research necessary to identify measures to reduce serious injury and mortality of marine mammals in Atlantic trawl fisheries and, ultimately, to achieve the MMPA's Zero Mortality Rate Goal.

To that end the ATGTRT developed two plans; an Education and Outreach Plan and a Research Plan, as a part of the ATGTRS. The Education and Outreach Plan identifies activities that promote the exchange of information necessary to reduce the bycatch of marine mammals in Atlantic trawl fisheries. The Research Plan identifies information and research needs necessary to improve our understanding of the factors resulting in the bycatch in Atlantic trawl fisheries.

4.3.5.2 Harbor Porpoise Take Reduction Plan

NMFS published the rule implementing the Harbor Porpoise Take Reduction Plan on December 1, 1998. The HPTRP includes measures for gillnet gear modifications and area closures, based on area, time of year, and mesh size. In general, the Gulf of Maine component of the HPTRP includes time and area closures, some of which are complete closures to gillnet gear only; others are closures to gillnet fishing unless pingers (acoustic deterrent devices) are used in the prescribed manner. An action proposed on July 21st, 2009 (74 *Federal Register* 36058**)** would also incorporate the concept of ''consequence'' closure areas in Southern New England. The Mid-Atlantic component includes time and area closures in which gillnet fishing is prohibited regardless of the gear specifications.

4.3.5.3 Atlantic Large Whale Take Reduction Plan

The ALWTRP contains a series of regulatory measures designed to reduce the likelihood of fixed fishing gear (gillnets, pots, and traps) entanglements of right, humpback, fin, and minke whales in the North Atlantic. The main tools of the plan include a combination of broad gear modifications and time/area closures (which are being supplemented by progressive gear research), expanded disentanglement efforts (which include an Atlantic Large Whale Disentanglement Network which includes governmental and non-governmental agencies in addition to fishermen), extensive outreach efforts in key areas, whale research, and an expanded right whale surveillance program to supplement the Mandatory Ship Reporting System.

4.4 ATLANTIC HERRING FISHERY

A complete description of the Atlantic herring fishery – vessels, processors, and communities – is provided in Amendment 1 to the Herring FMP. The following subsections update general fishery information through the 2008 fishing year and is consistent with information provided in previous SAFE Reports. The Amendment 1 FSEIS should be referenced for additional information.

4.4.1 Herring IVR Landings

The main reason for utilizing the interactive voice response (IVR) system in the Atlantic herring fishery is to monitor the Total Allowable Catch (TAC) limits set for the four Federal management areas. As part of the herring FMP, each management area is annually assigned a TAC (in metric tons). Although harvesters are required to also report catches with vessel trip report (VTR) forms, near real-time data is obtained through the IVR system allowing the TACs to be monitored. As of the 2008 fishing year, the 3% research set-aside established in Amendment 1 requires that when the catch in a management area is projected to reach 92% of its specified TAC, the Regional Administrator closes the area to all directed herring fishing. The 2008 fishing year was the eighth year of mandatory IVR reporting for the Atlantic herring fleet.

Table 22 Total Allowable Catches (TACs) for 2008 Fishing Year

Management Area	TAC (mt)	92% of TAC (mt)
Area 1A (Jan 1st – May 31st)	5,000	N/A
Area 1A (June 1st – Dec 31st)	40,000	N/A
Area 1A TOTAL	45,000	41,400
Area 1B	10,000	9,200
Area 2	30,000	27,600
Area 3	60,000	55,200

Note: Research set-asides were only utilized in Area 1A and 1B during 2008, so the 3% set-aside was made available to the fishery. The same has occurred in 2009.

Table 23 Total IVR Landings of Atlantic Herring, 2000-2008

Year	Total IVR Landings (MT)
2000	107,387
2001	121,569
2002	91,831
2003	100,544
2004	93,722
2005	96,895
2006	99,185
2007	78,172
2008	80,800

Table 24 provides IVR catches for the 2008 fishing year. Overall, the IVR reports totaled 80,800 mt of herring across all management areas, which represents about 56% of the OY for the U.S. fishery (145,000 mt) . Consistent with previous years, the majority of the landings were taken from Area 1 (1A and 1B). Part of the reduction in total landings since 2006 is attributable to a 15,000 mt decrease in the TAC for Area 1A. Overall, the timing of the fishery appears to have been consistent with previous years (Figure 24). However, fishing effort in Area 1A was distributed over the year in a more step-wise fashion due to adjustments to the days out provisions that are intended to slow the pace of the fishery (Figure 25). In 2008, the Area 1A fishery closed on November 14, 2008.

Table 24 IVR Herring Catch for 2008 Fishing Year

Management Area	IVR Catch (mt)	% of TAC
Area 1A (Jan 1st – May 31st)	0	N/A
Area 1A (June 1st – Dec 31st)	41,640	N/A
Area 1A TOTAL	41,640	92.5%
Area 1B	8,104	81%
Area 2	19,256	64.2%
Area 3	11,800	19.7%
Total	**80,800**	**55.7%**

Figure 24 Cumulative Total Catch of Atlantic Herring in All Management Areas by Week, 2004-2008 (IVRs)

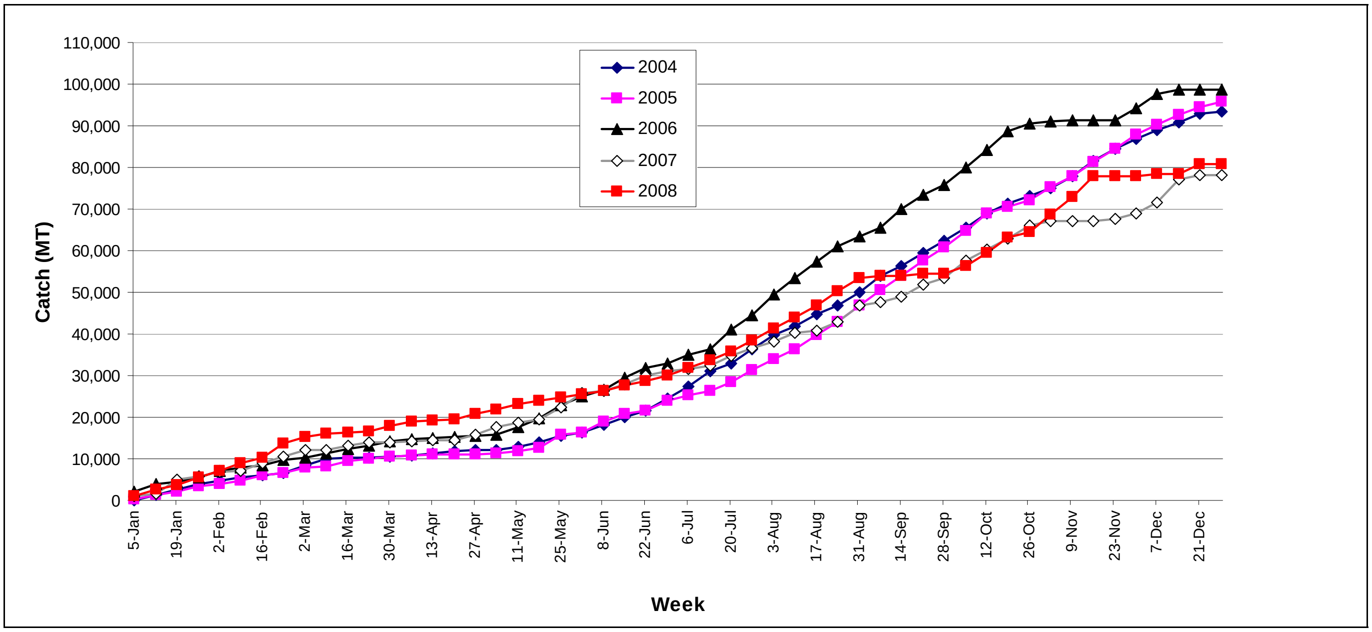


Figure 25 Cumulative Total Catch of Atlantic Herring in Area 1A by Week, 2004-2008 (IVRs)

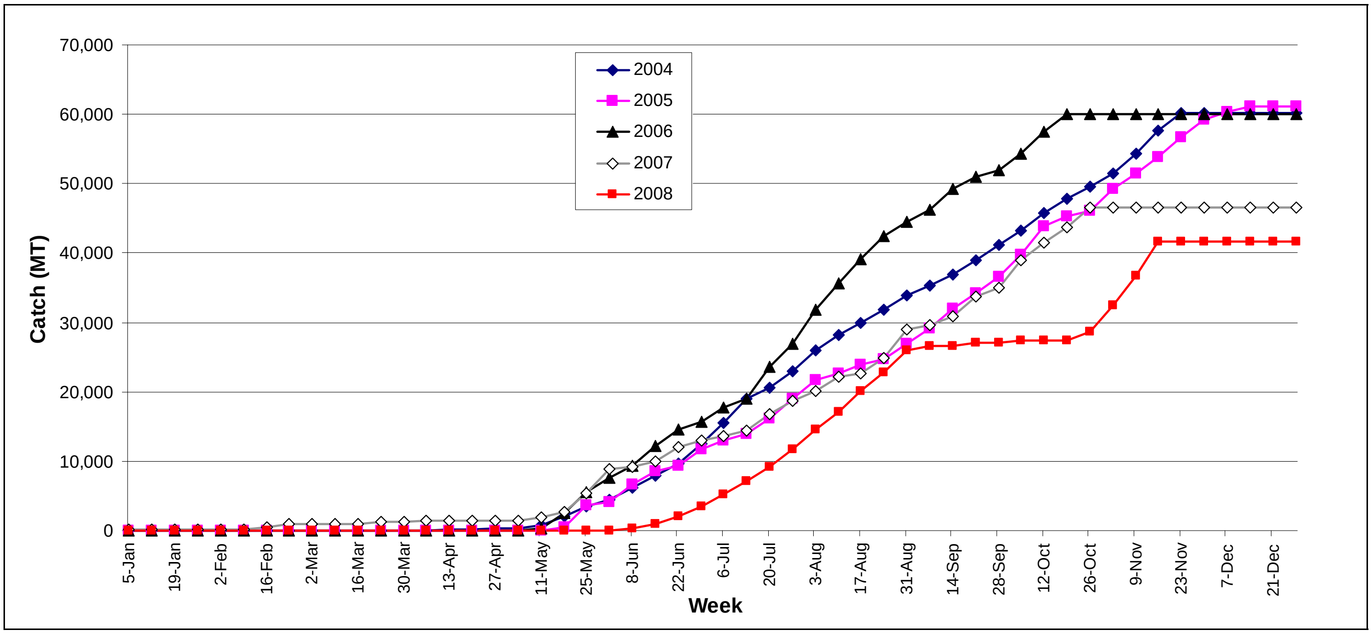


Table 25 shows the differences in IVR-reported herring catch by management area from 2007 to 2008. The decrease in Area 1A catch corresponds with the additional 5,000 mt decrease in the 1A TAC from 50,000 mt in 2007 to 45,000 mt in 2008. Catch from Area 1B increased to compensate, in part, for the catch reduction in Area 1A. The Area 2 fishery increased substantially. Landings from Area 3 increased as well but remain far lower than the 60,000 mt TAC for that area. Overall, landings increased from 2007 to 2008 by 2,628 metric tons (+3.4%) but remain considerably lower than years prior to 2007 and well below the total available OY for the U.S. Atlantic herring fishery.

Table 25 Differences in IVR Herring Catch by Management Area, 2007-2008

Management Area	2007 Catch (mt)	2008 Catch (mt)	Difference (mt)
1A	46,870	41,640	**-5,230**
1B	6,859	8,104	**+1,245**
2	14,687	19,256	**+4,569**
3	9,756	11,800	**+2,044**
Total	**78,172**	**80,800**	**+2,628**

Table 26 provides 2009 IVR-reported Atlantic herring catch through September 24, 2009. The Atlantic herring fishery is monitored using data provided by federally-permitted fishing vessels weekly through the IVR system and supplemented by NMFS using other data sources where IVR data are not available. For quota monitoring purposes, IVR data are compared to federal and state dealer data each week and, dealer reports are used to supplement the IVR when necessary. These supplements include data from non-federally permitted inshore fisheries when provided by state agencies or from other sources.

Table 26 2009 IVR Herring Catch Through September 24, 2009

Management Area	IVR Reports Without Supplements			Supplemented with Dealer Data	
	Cumulative Catch (mt)	Quota (mt)	Percent of Quota (%)	Cumulative Catch (mt)	Percent of Quota (%)
1A	22,160	43,150	51%	22,224[1]	52%[1]
1B	1,602	9,700	17%	1,604	17%
2	25,620	30,000	85%	26,643	89%
3	11,622	60,000	19%	11,815	20%
Total	61,004	142,850	43%	62,286	44%

[1] *Includes current ME state-only vessel herring landings.*

4.4.2 Landings from State Waters

Atlantic Herring are regulated by the Atlantic States Marine Fisheries Commission's (Commission) Atlantic Herring Section (Section) in state waters from Maine through New Jersey. The Section developed and adopted Amendment 2 to the Interstate FMP for Atlantic Herring as a complimentary document to the Council's Amendment 1. The Section's adoption of Amendment 2 and the Council's adoption of Amendment 1 were vital steps towards the creation of a complementary and comprehensive herring management program between state and federal waters. 2007 was the first full year under both amendments. The Commission adopted Addendum I to Amendment 2 in March 2009.

Management in state and federal waters is largely identical. State and federal plans delineate four management areas, each of which are assigned a maximum total allowable catch (TAC). The Commission and Council have worked cooperatively to establish identical TACs for each area since these areas were created. TACs are set based on maximum sustainable yield (MSY) derived from optimum yield (OY), allowing fishermen to harvest a sustainable amount of herring while accounting for herring's role as a forage species. Three percent of the TAC for each area may be set aside for research.

There are a few differences between state and federal management. The Council implemented a midwater trawl ban from June 1 – September 30 beginning in 2007 while no such regulation exists in state waters. The Commission has implemented month long spawning closures in the Gulf of Maine and 'days out' effort controls. Vessels may not land herring on any day designated as a 'day out' of the fishery and may only land once per 24 hour period. At the beginning of each fishing year, Section members from states adjacent to a management area will meet to review the TAC and catch projections, and set days out accordingly. Addendum I to the Commission's Amendment 2 gives the Section the option to divide the Area 1A TAC into quota periods.

The Commission is currently developing two draft addenda. Draft Addendum II will propose changes to the Commissions specification setting process including options that are consistent with reauthorized Magnuson Stevens Act and Draft Addendum III will propose days out exemption for small mesh bottom trawl vessels.

Landings by non-federally permitted vessels comprise a small amount of overall landings and made up only 243 metric tons (Table 27) in 2008 accounting for 2.9% percent of total U.S. landings (83,600 mt) in 2008.

Table 27 2008 Atlantic Herring Landings by Non-Federally-Permitted Vessels

State	Live Pounds	Metric Tons
CT*		
DE*		
MD*		
ME	392,999	178.26
NJ*		
NY	107,295	48.67
VA	5,258	2.38
Total	**536,036**	**243.14**

Provided by ACCSP for non-federally-permitted vessels.
**Indicates data are confidential.*

4.4.3 Herring Fishery – Economic Factors

One of the major features of Amendment 1 was the establishment of a limited access program in the herring fishery. There are four permit categories: 1) limited access permit for all management areas (Category A); 2) limited access permit for access to Areas 2 and 3 only (Category B); 3) limited access incidental catch permit for 25 mt per trip (Category C); and 4) an open access incidental catch permit for 3 mt per trip (Category D).

With the implementation of the limited access permit program in Amendment 1, the following numbers of vessels applied for and received permits in 2008:

- Category A – 41 vessels;
- Category B – 4 vessels;
- Category C – 50 vessels; and
- Category D – 2,275 vessels.

As of April, 2009, the following information is available about vessel permitting:

Table 28 Amendment 1 Limited Access Permits Issued as of April 2009

2009 Permits Issued (LA = limited access)			
Category A (LA All Areas)	Category B (LA Areas 2/3)	Category C (LA Incidental)	Category D (Open Access)
41	4	54	2,272

Not all of the vessels that received Amendment 1 herring permits were active during the 2008 fishing year. Table 29 classifies all ***active*** vessels – those that reported landing herring by principal gear (based on the gear which earned the most revenue for the vessel in a given year) and permit category (in 2005 and 2006, there were two open access permit categories based on intended level of herring catch). The majority of the vessels that had Category 1 permits in 2005 and 2006 qualified for either the all-areas limited access permit or the limited access Areas 2 and

3 only permit. The majority of Category 2 permits in 2005 and 2006 obtained either the limited access incidental catch permit or open access permit. However, there were a few vessels in which these patterns were reversed. The vessels in the "no permit" category did not obtain any kind of permit for herring after the implementation of Amendment 1 and do not have significant landings.

Table 30 shows the 2008 landings by gear used, management area, and permit category. Nearly 98% of the total 2008 landings are landed by vessels with an all-areas limited access permit. Approximately 28% of the total landings in 2008 were from limited access purse seine vessels landing herring from Area 1A. Approximately 18% were from limited access pair trawl vessels landing herring from Area 1A. As far as catch by gear type, nearly 60% of the landings were by pair trawl vessels; a third of which is from Area 1A. Purse seine vessel landed 32% of the total with nearly 90% of the purse seine catch coming form Area 1A.

Table 31 summarizes the number of trips and days absent by management area and permit category for the 2008 fishing year.

Table 32 and Table 33 summarize the number of trips and the amount of Atlantic herring landings, respectively, by fishing port and permit category, for the 2008 fishing year. The majority of the limited access directed fishery for Atlantic herring (Category A permits) operates from ports in Maine and Massachusetts, with another smaller component operating out of Cape May, New Jersey and RI/CT.

2008 Atlantic Herring Revenues

Based on dealer weighout reports, herring revenues by permit category during the 2008 fishing year were:

- Category A - $19.9 million;
- Category B – cannot report, less than three vessels;
- Category C - $19,500;
- Category D - $86,700.

Note: all vessels are considered small businesses according to the Small Business Administration's definition of having less than $4 million in gross revenues.

As compared to 2007, the total value of landings were significantly lower in 2008 for Category C and D vessels. Category C value of landings were $485,000 in 2007 and $207,000 for Category D vessels. Conversely, Category A landings rose to $19.9 million from $15.7 million.

Table 29 Number of Vessels by Principal Gear and Permit Category (VTR Data, 2005-2008)

		2005 Permit Category					
		Category 1		Category 2		No Permit	Total
2005	PURSE SEINE	4					**4**
	MIDWATER TRAWL	5		6			**11**
	PAIR TRAWL	12					**12**
	BOTTOM TRAWL	7		45		6	**58**
	SEINE/WEIR					1	**1**
	OTHER			42		16	**58**
	TOTAL	28		93		23	**144**
		2006 Permit Category					
		Category 1		**Category 2**		**No Permit**	**Total**
2006	PURSE SEINE	4		2			**6**
	MIDWATER TRAWL	6		5			**11**
	PAIR TRAWL	14		1			**15**
	BOTTOM TRAWL	9		50		9	**68**
	SEINE/WEIR					1	**1**
	OTHER			37		20	**57**
	TOTAL	33		95		30	**158**
		2007 Permit Category					
		All Areas	**Areas 2/3**	**LA Inc. Catch**	**Open Access**	**No Permit**	**Total**
2007	PURSE SEINE	6			5		**11**
	MIDWATER TRAWL	4			3		**7**
	PAIR TRAWL	13			1		**14**
	BOTTOM TRAWL	5	2	11	56	14	**88**
	SEINE/WEIR				36	14	**50**
	TOTAL	28	2	11	101	28	**170**
		2008 Permit Category					
		All Areas	**Areas 2/3**	**LA Inc. Catch**	**Open Access**	**No Permit**	**Total**
2008	PURSE SEINE	4			1	4	**9**
	MIDWATER TRAWL	3			3		**3**
	PAIR TRAWL	16			1		**17**
	BOTTOM TRAWL	3	1	12	46	6	**68**
	SEINE/WEIR				4		**4**
	OTHER				25	13	**38**
	TOTAL	26	1	12	72	28	**139**

Table 30 2008 Herring Landings (mt) by Gear and Amendment 1 Permit Category (VTR Data)

	Management Area	Amendment 1 Permit Category					
		All Areas	Areas 2/3	LA Inc. Catch	Open Access	No Permit	Total
PURSE SEINE	1A	23,389			347	302	24,038
	1B	2,637			14		2,651
	3X	90					90
	Unknown	93				55	147
MIDWATER TRAWL	1A	1,137					1,137
	1B	797					797
	2X	558					558
	3X	1,531					1,531
PAIR TRAWL	1A	14,987					14,987
	1B	4,104					4,104
	2X	19,471				63	19,534
	3X	11,520					11,520
	Unknown	50					50
BOTTOM TRAWL	1A	93		58	72	1	223
	2X	1,309	c	20	23	22	c
	3X			1	2		3
OTHER	1A				3	1	4
	1B						
	2X				3		3

Table 31 Number of Trips and Days Absent by 2008 Permit Category

GEAR TYPE	AREA		2008 PERMIT CATEGORY					2008 TOTAL
			A	B	C	D	#N/A	
PURSE SEINE	**1A**	Number of trips	193			7	15	215
		Total days absent	460			14	24	498
		Average trip length	2.4			2.0	1.6	2.3
	1B	Number of trips	20			1		21
		Total days absent	49			1		50
		Average trip length	2.5			1.0		2.4
	3X	Number of trips	1					1
		Total days absent	3					3
		Average trip length	3.0					3.0
	(blank)	Number of trips	1				8	9
		Total days absent	3				9	12
		Average trip length	3.0				1.1	1.3
	Total	**Number of trips**	215			8	23	246
		Total days absent	515			15	33	563
		Average trip length	2.4			1.9	1.4	2.3
MIDWATER TRAWL	**1A**	Number of trips	4					4
		Total days absent	17					17
		Average trip length	4.3					4.3
	1B	Number of trips	7					7
		Total days absent	21					21
		Average trip length	3.0					3.0
	2X	Number of trips	12					12
		Total days absent	56					56
		Average trip length	4.7					4.7
	3X	Number of trips	9					9
		Total days absent	40					40
		Average trip length	4.4					4.4
	Total	**Number of trips**	32					32
		Total days absent	134					134
		Average trip length	4.2					4.2

Table 31 Number of Trips and Days Absent by 2008 Permit Category

GEAR TYPE	AREA		2008 PERMIT CATEGORY					2008 TOTAL
			A	B	C	D	#N/A	
PAIR TRAWL	**1A**	Number of trips	67					67
		Total days absent	226					226
		Average trip length	3.4					3.4
	1B	Number of trips	22					22
		Total days absent	59					59
		Average trip length	2.7					2.7
	2X	Number of trips	131				1	132
		Total days absent	560				8	568
		Average trip length	4.3				8.0	4.3
	3X	Number of trips	54					54
		Total days absent	241					241
		Average trip length	4.5					4.5
	Total	**Number of trips**	274				1	275
		Total days absent	1086				8	1094
		Average trip length	4.0				8.0	4.0
BOTTOM TRAWL	**1A**	Number of trips	1		117	228	14	360
		Total days absent	2		119	232	14	367
		Average trip length	2.0		1.0	1.0	1.0	1.0
	2X	Number of trips	37	31	51	149	22	290
		Total days absent	146	33	91	215	23	508
		Average trip length	3.9	1.1	1.8	1.4	1.0	1.8
	3X	Number of trips			3	2		5
		Total days absent			11	12		23
		Average trip length			3.7	6.0		4.6
	Total	**Number of trips**	38	31	171	379	36	655
		Total days absent	148	33	221	459	37	898
		Average trip length	3.9	1.1	1.3	1.2	1.0	1.4

Table 31 Number of Trips and Days Absent by 2008 Permit Category

GEAR TYPE	AREA		2008 PERMIT CATEGORY					2008 TOTAL
			A	B	C	D	#N/A	
OTHER	**1A**	Number of trips				33	52	85
		Total days absent				33	52	85
		Average trip length				1.0	1.0	1.0
	2X	Number of trips				107	4	111
		Total days absent				111	4	115
		Average trip length				1.0	1.0	1.0
	(blank)	Number of trips					5	5
		Total days absent					6	6
		Average trip length					1.2	1.2
	Total	**Number of trips**				140	61	201
		Total days absent				144	62	206
		Average trip length				1.0	1.0	1.0

Table 32 2008 Trips by Port and Permit Category

NUMBER OF TRIPS		2008 PERMIT CATEGORY			
STATE	**PORT**	**A**	**B**	**C**	**D**
	Fall River	5			
	Gloucester	120		3	39
	New Bedford	107			
	Other MA			2	41
MA Total		232		5	80
	Port Clyde	25			10
	Portland	80			1
	Stonington	56			
	Rockland	103			
	Vinalhaven	18			
	Other ME	2			101
ME Total		284			112
	Portsmouth			6	18
	Seabrook			102	60
	Other NH	2		7	
NH Total		2		115	78
	Belford				30
	Cape May	30		1	
	Long Beach				17
	Point Pleasant				76
	Other NJ				34
NJ Total		30		1	157
NY Total				30	95
RI/CT Total		43	31	20	6

Table 33 2008 Atlantic Herring Landings by Port and Permit Category

MT HERRING LANDED		2008 PERMIT CATEGORY			
STATE	PORT	A	B	C	D
	Fall River	344			
	Gloucester	26,756		1	8
	New Bedford	18,426			
	Other MA			1	19
MA Total		45,527		1	26
	Port Clyde	1,837			361
	Portland	9,109			0
	Stonington	6,297			
	Rockland	13,142			
	Vinalhaven	1,275			
	Other ME	0	0	0	18
ME Total		31,660			379
NH Total		353		57	31
NJ Total		2,835			6
NY Total				4	8
RI/CT Total		1,336	1,027	16	14

4.4.4 Updated Observer Data

The following data summary tables have been provided by the NEFSC Observer Program based on observer data from 2007-2009 (2009 through April).

Key for All Tables in this Section

- Years represent calendar years January 1 – December 31
- Data are reported for all observed trips with 2,000 pounds or more of Atlantic Herring and/or Unk Herring
- 2009 data are reported through April 2009
- Permit Categories reflect Amendment 1 – A/B Limited Access All Areas, C Limited Access Incidental Catch, D Open Access Incidental Catch
- OTF = Otter Trawl Finfish (Bottom Trawl)
- OTM = Otter Trawl Midwater
- PTM = Pair Trawl Midwater
- PUR = Purse Seine
- Observed pair trawl operations have been counted as one trip
- Quarter 1 = January-March
- Quarter 2 = April – June
- Quarter 3 = July – September
- Quarter 4 = October – December

Table 34 summarizes coverage rates from the NEFSC Observer Program for the 2007-2009 calendar years (also the herring fishing years), with 2009 levels summarized through April 30, 2009. 2008 and 2009 to date have seen relatively high levels of coverage across all sectors of the fishery (Area 1A is closed until June, so the data for 2009 do not yet reflect purse seine activity). Summary coverage rates based on the number of trips observed as a percentage of the number of trips taken are 4.3% in 2007, 14.6% in 2008, and 13.3% in 2009 YTD. Of all Atlantic herring landed during the 2008 fishing year (regardless of trip type), the Observer Program covered 20% (16,561 mt observed of 83,275 mt landed). In 2007, 7% of the total herring landings in the fishery were observed (5,156 mt observed of 78,701 mt landed). Through April 2009, the Observer Program has covered 24% of the herring landings (6,215 mt of 26,373 mt landed).

Table 34 Observer Program Coverage Rates for Trips Landing Greater than 2,000 pounds of Herring, 2007-2009 YTD

Year	Gear Type	Total Trips	Total Days	Total Herring Landed	Obs Trips	Obs Days	Obs Herring Kept	% trips obs	% days obs	% herring obs
2007	OTF	357	633	10,354,058	12	15	411,751	3%	2%	4%
2007	OTM	137	457	17,489,210	10	40	1,918,285	7%	9%	11%
2007	PTM	240	860	74,401,385	14	58	6,910,185	6%	7%	9%
2007	PUR	345	733	70,082,994	10	23	2,122,267	3%	3%	3%
2008	OTF	90	241	4,603,190	4	4	70,409	4%	2%	2%
2008	OTM	28	103	8,816,600	15	58	3,081,669	54%	56%	35%
2008	PTM	269	1042	110,452,566	44	170	27,293,511	16%	16%	25%
2008	PUR	230	542	58,942,542	27	64	6,941,134	12%	12%	12%
2009*	OTF	100	245	6,949,390	7	11	451,112	7%	4%	6%
2009*	OTM	22	123	3,048,675	7	32	650,071	32%	26%	21%
2009*	PTM	164	660	47,986,029	24	91	12,822,033	15%	14%	27%

**through April 2009*
Pair trawl operations counted as 1 trip and weight is total for the operation
Herring is Atl Herring or Unk Herring
Day defined as (date land - date sail) + 1
Landings data from Vessel Trip Reports

Table 35 summarizes the catch and discard of all species observed on 18 trips by Category A and B herring permit holders using bottom trawls and catching 2,000 pounds or more of Atlantic herring from January 2007-April 2009. Spiny dogfish represented the majority of bycatch on these trips, followed by Atlantic herring, fishing debris, and alewife. Some of the bycatch species observed on these trips suggest that these vessels were fishing close to the ocean bottom (flounder, skates, sculpin, for example). A more detailed analysis of observer and other bycatch data will be provided in the EIS for Amendment 5 to the Atlantic Herring FMP.

Table 35 Catch and Discards of All Species on 18 Observed Bottom Trawl Trips, 2007-2009, Permit Categories A & B

Species	Lbs Disc	Lbs Kept	Total Lbs	Total Catch Rate (per 1000 lbs Atl Herring Kept)	Discard Rate (per 1000 lbs Atl Herring Kept)
ALEWIFE	416.1	9,916.5	10,332.6	24.85	1.00
COD, ATLANTIC	202.5		202.5	0.49	0.49
CRAB, SPIDER, NK	4.2		4.2	0.01	0.01
DEBRIS, FISHING GEAR	440.0		440.0	1.06	1.06
DOGFISH, SPINY	42,184.0	87.0	42,271.0	101.65	101.44
FISH, NK		70.0	70.0	0.17	
FLOUNDER, WINDOWPANE	4.1		4.1	0.01	0.01
FLOUNDER, WINTER	62.9		62.9	0.15	0.15
HAKE, RED (LING)	2.1		2.1	0.01	0.01
HAKE, SILVER (WHITING)		7,546.5	7,546.5	18.15	
HERRING, ATLANTIC	2,584.4	415,842.0	418,426.4	1006.21	6.21
HERRING, BLUEBACK	1.3	3,659.0	3,660.3	8.80	0.00
HERRING, NK		84,612.0	84,612.0	203.47	
LAMPREY, NK	0.1		0.1	0.00	0.00
LOBSTER, AMERICAN	2.0		2.0	0.00	0.00
MACKEREL, ATLANTIC	282.3	38,935.0	39,217.3	94.31	0.68
MENHADEN, ATLANTIC	2.4	119.0	121.4	0.29	0.01
OCEAN POUT	14.5		14.5	0.03	0.03
POLLOCK	5.0		5.0	0.01	0.01
RAVEN, SEA	6.4		6.4	0.02	0.02
SCULPIN, LONGHORN	200.4		200.4	0.48	0.48
SCUP	1.0		1.0	0.00	0.00
SHAD, AMERICAN	0.1	1,522.0	1,522.1	3.66	0.00
SHAD, HICKORY	0.2	2.0	2.2	0.01	0.00
SKATE, LITTLE	308.0		308.0	0.74	0.74
SKATE, NK	5.1		5.1	0.01	0.01
SKATE, WINTER (BIG)	527.0		527.0	1.27	1.27
SPOT	0.1		0.1	0.00	0.00
SQUID, ATL LONG-FIN	1.7	51.0	52.7	0.13	0.00
SQUID, SHORT-FIN	43.0	851.0	894.0	2.15	0.10
TAUTOG (BLACKFISH)	1.2		1.2	0.00	0.00
GRAND TOTAL	**47,302.1**	**563,213.0**	**610,515.1**	**1468.14**	**113.75**

Table 36 summarizes the catch and discard of all species observed on 6 trips by Category C and D Herring permit holders using bottom trawls and catching 2,000 pounds or more of Atlantic herring from January 2007-April 2009. Bycatch by these vessels appears to be more diverse than the Category A and B bottom trawl vessels, and the catch of small mesh multispecies like red hake and whiting suggest that these vessels were likely fishing in the exempted small mesh fisheries for a mix of small mesh multispecies and herring. A more detailed analysis of observer and other bycatch data will be provided in the EIS for Amendment 5 to the Atlantic Herring FMP.

Table 36 Catch and Discards of All Species on 6 Observed Bottom Trawl Trips, 2007-2009, Permit Categories C & D

Species	Lbs Disc	Lbs Kept	Total Lbs	Total Catch Rate (per 1000 lbs Atl Herring Kept)	Discard Rate (per 1000 lbs Atl Herring Kept)
ALEWIFE	53.0	4,158.0	4,211.0	58.27	0.73
COD, ATLANTIC	84.9		84.9	1.17	1.17
DEBRIS, FISHING GEAR	60.0		60.0	0.83	0.83
DOGFISH, SPINY	2,763.5	3,017.0	5,780.5	79.98	38.24
FLOUNDER, AMERICAN PLAICE	227.8		227.8	3.15	3.15
FLOUNDER, FOURSPOT	2.0		2.0	0.03	0.03
FLOUNDER, WITCH (GREY SOLE)	19.0		19.0	0.26	0.26
FLOUNDER, YELLOWTAIL	49.0		49.0	0.68	0.68
HADDOCK	37.0		37.0	0.51	0.51
HAKE, RED (LING)	1,033.0	3,898.5	4,931.5	68.24	14.29
HAKE, SILVER (WHITING)	422.0	9,393.5	9,815.5	135.82	5.84
HAKE, WHITE	17.0		17.0	0.24	0.24
HERRING, ATLANTIC		72,271.0	72,271.0	1000.00	
HERRING, BLUEBACK		2,048.0	2,048.0	28.34	
HERRING, NK	28,000.0		28,000.0	387.43	387.43
LOBSTER, AMERICAN	66.5	6.0	72.5	1.00	0.92
LUMPFISH	57.0		57.0	0.79	0.79
OCEAN POUT	3.0		3.0	0.04	0.04
POLLOCK	2.0		2.0	0.03	0.03
RAVEN, SEA	77.0		77.0	1.07	1.07
REDFISH, NK (OCEAN PERCH)	6.0		6.0	0.08	0.08
SCULPIN, LONGHORN	24.8		24.8	0.34	0.34
SKATE, THORNY	2.0		2.0	0.03	0.03
SPONGE, NK	8.0		8.0	0.11	0.11
SQUID, ATL LONG-FIN		94.0	94.0	1.30	
SQUID, SHORT-FIN		17.0	17.0	0.24	
WRYMOUTH	6.0		6.0	0.08	0.08
GRAND TOTAL	**33,020.5**	**94,903.0**	**127,923.5**	**1770.05**	**456.90**

Table 37 summarizes the catch and discard of all species observed on 13 midwater trawl trips catching 2,000 pounds or more of Atlantic herring during Quarter 1 (January – March) from 2007-2009. These vessels were likely fishing for herring in Area 2. Some of the trips may have been targeting mackerel in this area during this time. A more detailed analysis of observer and other bycatch data will be provided in the EIS for Amendment 5 to the Atlantic Herring FMP.

Table 37 Catch and Discards of All Species on 13 Observed Midwater Trawl Trips, 2007-2009, Quarter 1, Permit Category A

Species	Lbs Disc	Lbs Kept	Total Lbs	Total Catch Rate (per 1000 lbs Atl Herring Kept)	Discard Rate (per 1000 lbs Atl Herring Kept)
ALEWIFE	170.4	69,787.0	69,957.4	48.13	0.12
BASS, STRIPED	280.0		280.0	0.19	0.19
BUTTERFISH		1,231.0	1,231.0	0.85	
DEBRIS, FISHING GEAR	180.0		180.0	0.12	0.12
DEBRIS, METAL	50.0		50.0	0.03	0.03
DOGFISH, NK	2,500.0		2,500.0	1.72	1.72
DOGFISH, SPINY	38,253.0		38,253.0	26.32	26.32
FISH, NK	225,000.0		225,000.0	154.79	154.79
FLOUNDER, NK	29.0		29.0	0.02	0.02
HAKE, SILVER (WHITING)		92.0	92.0	0.06	
HERRING, ATLANTIC	33,881.0	1,453,622.0	1,487,503.0	1023.31	23.31
HERRING, BLUEBACK	615.0	57,231.0	57,846.0	39.79	0.42
HERRING, NK		103,452.0	103,452.0	71.17	
LAMPREY, NK	4.6		4.6	0.00	0.00
LUMPFISH	10.0		10.0	0.01	0.01
MACKEREL, ATLANTIC	2,224.0	3,247,030.0	3,249,254.0	2235.28	1.53
MENHADEN, ATLANTIC		556.0	556.0	0.38	
SCULPIN, LONGHORN	3.0		3.0	0.00	0.00
SHAD, AMERICAN	49.1	1,543.0	1,592.1	1.10	0.03
SHRIMP, NK		5.0	5.0	0.00	
SQUID, ATL LONG-FIN	22.0		22.0	0.02	0.02
SQUID, SHORT-FIN		234.0	234.0	0.16	
GRAND TOTAL	**303,271.1**	**4,934,783.0**	**5,238,054.1**	**3603.45**	**208.63**

Table 38 summarizes the catch and discard of all species observed on 7 midwater trawl trips catching 2,000 pounds or more of Atlantic herring during Quarter 2 (April – June) from 2007-April 2009. Atlantic herring and spiny dogfish represented the majority of bycatch for midwater trawl vessels in Quarter 2 during this time. A more detailed analysis of observer and other bycatch data will be provided in the EIS for Amendment 5 to the Atlantic Herring FMP.

Table 38 Catch and Discards of All Species on 7 Observed Midwater Trawl Trips, 2007-2009, Quarter 2, Permit Category A

Species	Lbs Disc	Lbs Kept	Total Lbs	Total Catch Rate (per 1000 lbs Atl Herring Kept)	Discard Rate (per 1000 lbs Atl Herring Kept)
ALEWIFE	21.0	134.0	155.0	0.09	0.01
BUTTERFISH	1.0	740.0	741.0	0.45	0.00
DOGFISH, SPINY	1,209.0		1,209.0	0.73	0.73
EEL, SAND LANCE, NK		6.0	6.0	0.00	
FLOUNDER, FOURSPOT		98.0	98.0	0.06	
FLOUNDER, NK		18.0	18.0	0.01	
HADDOCK	5.0	5,693.0	5,698.0	3.46	0.00
HAKE, NK	7.0	432.0	439.0	0.27	0.00
HAKE, SILVER (WHITING)	45.0	2,921.0	2,966.0	1.80	0.03
HERRING, ATLANTIC	31,005.5	1,648,087.0	1,679,092.5	1018.81	18.81
HERRING, BLUEBACK	7.0		7.0	0.00	0.00
LUMPFISH	26.0		26.0	0.02	0.02
MACKEREL, ATLANTIC		1,097,003.0	1,097,003.0	665.62	
POLLOCK	21.0		21.0	0.01	0.01
REDFISH, NK (OCEAN PERCH)	36.0		36.0	0.02	0.02
SCULPIN, LONGHORN		9.0	9.0	0.01	
SEA ROBIN, NORTHERN	2.0	18.0	20.0	0.01	0.00
SEAWEED, NK	150.0		150.0	0.09	0.09
SHAD, AMERICAN		33.0	33.0	0.02	
SKATE, LITTLE	2.0		2.0	0.00	0.00
SKATE, WINTER (BIG)	13.0		13.0	0.01	0.01
SQUID, ATL LONG-FIN		298.0	298.0	0.18	
GRAND TOTAL	**32,550.5**	**2,755,490.0**	**2,788,040.5**	**1691.68**	**19.75**

Table 39 summarizes the catch and discard of all species observed on 10 midwater trawl trips catching 2,000 pounds or more of Atlantic herring during Quarter 4 (October – December) in 2007 and 2008. Spiny dogfish, Atlantic herring, and small mesh multispecies represented the majority of bycatch during this time. A more detailed analysis of observer and other bycatch data will be provided in the EIS for Amendment 5 to the Atlantic Herring FMP.

Table 39 Catch and Discards of All Species on 10 Observed Midwater Trawl Trips, 2007-2009, Quarter 4, Permit Category A

Species	Lbs Disc	Lbs Kept	Total Lbs	Total Catch Rate (per 1000 lbs Atl Herring Kept)	Discard Rate (per 1000 lbs Atl Herring Kept)
ALEWIFE	0.5	50,935.0	50,935.5	22.20	0.00
BUTTERFISH	0.1	324.0	324.1	0.14	0.00
COD, ATLANTIC	16.0		16.0	0.01	0.01
DOGFISH, SPINY	10,099.5		10,099.5	4.40	4.40
FLOUNDER, YELLOWTAIL		35.0	35.0	0.02	
HADDOCK		1,871.0	1,871.0	0.82	
HAKE, RED (LING)	318.5	203.0	521.5	0.23	0.14
HAKE, SILVER (WHITING)	117.0	1,491.0	1,608.0	0.70	0.05
HAKE, WHITE	0.1	71.0	71.1	0.03	0.00
HERRING, ATLANTIC	250.6	2,294,510.0	2,294,760.6	1000.11	0.11
HERRING, BLUEBACK		11,419.0	11,419.0	4.98	
HERRING, NK	0.1	952.0	952.1	0.41	0.00
JELLYFISH, NK	0.5		0.5	0.00	0.00
LUMPFISH	5.0		5.0	0.00	0.00
MACKEREL, ATLANTIC		8,312.0	8,312.0	3.62	
MONKFISH (ANGLER, GOOSEFISH)	7.2		7.2	0.00	0.00
POLLOCK	10.0		10.0	0.00	0.00
SCULPIN, LONGHORN	1.5	97.0	98.5	0.04	0.00
SHAD, AMERICAN		2,494.0	2,494.0	1.09	
SHAD, HICKORY		280.0	280.0	0.12	
SKATE, LITTLE	0.1		0.1	0.00	0.00
SQUID, SHORT-FIN	175.0	378.0	553.0	0.24	0.08
GRAND TOTAL	**11,001.7**	**2,373,372.0**	**2,384,373.7**	**1039.16**	**4.79**

Table 40 summarizes the catch and discard of all species observed on 41 pair trawl trips catching 2,000 pounds or more of Atlantic herring during Quarter 1 (January – March) from 2007-2009. Pair trawl vessels fished almost exclusively in Area 2 (southern New England) during Quarter 1 and caught a significant amount of herring and Atlantic mackerel. Spiny dogfish, Atlantic herring, and Atlantic mackerel accounted for the majority of bycatch observed on these trips. A more detailed analysis of observer and other bycatch data will be provided in the EIS for Amendment 5 to the Atlantic Herring FMP.

Table 40 Catch and Discards of All Species on 41 Observed Pair Trawl Trips, 2007-2009, Quarter 1, Permit Category A

Species	Lbs Disc	Lbs Kept	Total Lbs	Total Catch Rate (per 1000 lbs Atl Herring Kept)	Discard Rate (per 1000 lbs Atl Herring Kept)
ALEWIFE	213.1	52,548.0	52,761.1	3.45	0.01
BASS, STRIPED	541.0		541.0	0.04	0.04
BUTTERFISH	14.0	275.0	289.0	0.02	0.00
COD, ATLANTIC	43.0		43.0	0.00	0.00
DEBRIS, FISHING GEAR	1,230.0		1,230.0	0.08	0.08
DEBRIS, METAL	200.0		200.0	0.01	0.01
DEBRIS, NK	500.0		500.0	0.03	0.03
DEBRIS, WOOD	5.0		5.0	0.00	0.00
DOGFISH, SPINY	43,148.3	2,566.0	45,714.3	2.99	2.82
FISH, NK	8,985.0	768,647.0	777,632.0	50.90	0.59
HADDOCK	346.0	12.0	358.0	0.02	0.02
HAKE, SILVER (WHITING)	160.4	1,131.0	1,291.4	0.08	0.01
HERRING, ATLANTIC	76,252.4	15,277,771.0	15,354,023.4	1004.99	4.99
HERRING, BLUEBACK	102.9	115,438.0	115,540.9	7.56	0.01
HERRING, NK	3.0	145,455.0	145,458.0	9.52	0.00
MACKEREL, ATLANTIC	74,859.5	6,828,307.0	6,903,166.5	451.84	4.90
MENHADEN, ATLANTIC	307.0	699.0	1,006.0	0.07	0.02
MONKFISH (ANGLER, GOOSEFISH)		11.0	11.0	0.00	
SCUP	691.0		691.0	0.05	0.05
SEA BASS, BLACK	129.0	1,404.0	1,533.0	0.10	0.01
SHAD, AMERICAN	18.3	8,519.0	8,537.3	0.56	0.00
SHRIMP, NK	64.0		64.0	0.00	0.00
SKATE, WINTER (BIG)	6.0		6.0	0.00	0.00
SQUID, ATL LONG-FIN	15.0	744.0	759.0	0.05	0.00
SQUID, SHORT-FIN	14.1	213.0	227.1	0.01	0.00
WHITING, BLACK (HAKE, OFFSHORE)	1.0		1.0	0.00	0.00
GRAND TOTAL	**207,849.0**	**23,203,740.0**	**23,411,589.0**	**1532.40**	**13.60**

Table 41 summarizes the catch and discard of all species observed on 16 pair trawl trips catching 2,000 pounds or more of Atlantic herring during Quarter 2 (April – June) from 2007-April 2009. Atlantic herring and spiny dogfish accounted for the majority of bycatch observed on these trips. A more detailed analysis of observer and other bycatch data will be provided in the EIS for Amendment 5 to the Atlantic Herring FMP.

Table 41 Catch and Discards of All Species on 16 Observed Pair Trawl Trips, 2007-2009, Quarter 2, Permit Category A

Species	Lbs Disc	Lbs Kept	Total Lbs	Total Catch Rate (per 1000 lbs Atl Herring Kept)	Discard Rate (per 1000 lbs Atl Herring Kept)
ALEWIFE	1.1	3,076.0	3,077.1	0.31	0.00
BUTTERFISH	0.1	474.0	474.1	0.05	0.00
COD, ATLANTIC		8.0	8.0	0.00	
CUNNER (YELLOW PERCH)		4,864.0	4,864.0	0.50	
DOGFISH, SPINY	11,714.0	7,852.0	19,566.0	2.00	1.20
EEL, SAND LANCE, NK	350.0		350.0	0.04	0.04
FISH, NK	300.0		300.0	0.03	0.03
HADDOCK	100.0	10,721.5	10,821.5	1.11	0.01
HAKE, SILVER (WHITING)		1,218.0	1,218.0	0.12	
HERRING, ATLANTIC	20,401.2	9,780,083.0	9,800,484.2	1002.09	2.09
HERRING, NK		260,000.0	260,000.0	26.58	
MACKEREL, ATLANTIC	2.5	1,827,011.0	1,827,013.5	186.81	0.00
SEA BASS, BLACK		7.0	7.0	0.00	
SEA ROBIN, NORTHERN	10.0		10.0	0.00	0.00
SKATE, WINTER (BIG)	3.0		3.0	0.00	0.00
GRAND TOTAL	**32,881.9**	**11,895,314.5**	**11,928,196.4**	**1219.64**	**3.36**

Table 42 summarizes the catch and discard of all species observed on 4 pair trawl trips catching 2,000 pounds or more of Atlantic herring during Quarter 3 (July – September) in 2007 and 2008 (2009 data for Quarter 3 are not yet available). Whiting, redfish, and Atlantic herring accounted for the majority of bycatch observed on these four trips. A more detailed analysis of observer and other bycatch data will be provided in the EIS for Amendment 5 to the Atlantic Herring FMP.

Table 42 Catch and Discards of All Species on 4 Observed Pair Trawl Trips, 2007-2009, Quarter 3, Permit Category A

Species	Lbs Disc	Lbs Kept	Total Lbs	Total Catch Rate (per 1000 lbs Atl Herring Kept)	Discard Rate (per 1000 lbs Atl Herring Kept)
COD, ATLANTIC	3.4		3.4	0.00	0.00
HADDOCK	677.0	380.0	1,057.0	0.59	0.38
HAKE, RED/WHITE MIX		1,204.0	1,204.0	0.68	
HAKE, SILVER (WHITING)	61,380.0	5,208.0	66,588.0	37.36	34.44
HERRING, ATLANTIC	28,460.0	1,782,320.0	1,810,780.0	1015.97	15.97
HERRING, NK	200.0		200.0	0.11	0.11
REDFISH, NK (OCEAN PERCH)	9,328.2	528.0	9,856.2	5.53	5.23
SQUID, NK		144.0	144.0	0.08	
SQUID, SHORT-FIN	410.0	593.0	1,003.0	0.56	0.23
GRAND TOTAL	**100,458.6**	**1,790,377.0**	**1,890,835.6**	**1060.88**	**56.36**

Table 43 summarizes the catch and discard of all species observed on 21 pair trawl trips catching 2,000 pounds or more of Atlantic herring during Quarter 4 (October – December) in 2007 and 2008. A more detailed analysis of observer and other bycatch data will be provided in the EIS for Amendment 5 to the Atlantic Herring FMP.

Table 43 Catch and Discards of All Species on 21 Observed Pair Trawl Trips, 2007-2009, Quarter 4, Permit Category A

Species	Lbs Disc	Lbs Kept	Total Lbs	Total Catch Rate (per 1000 lbs Atl Herring Kept)	Discard Rate (per 1000 lbs Atl Herring Kept)
ALEWIFE		26,810.0	26,810.0	1.36	
BUTTERFISH		180.0	180.0	0.01	
COD, ATLANTIC		50.0	50.0	0.00	
DOGFISH, SPINY	17,812.3		17,812.3	0.90	0.90
EEL, NK	3.0		3.0	0.00	0.00
FISH, NK	24,000.0		24,000.0	1.21	1.21
HADDOCK	25,356.0	3,471.5	28,827.5	1.46	1.28
HAKE, SILVER (WHITING)	2.0	378.8	380.8	0.02	0.00
HERRING, ATLANTIC	1,530.7	19,780,100.0	19,781,630.7	1000.08	0.08
HERRING, BLUEBACK		17,381.0	17,381.0	0.88	
LOBSTER, AMERICAN		10.0	10.0	0.00	
LUMPFISH	11.0		11.0	0.00	0.00
MACKEREL, ATLANTIC	0.8	677,594.9	677,595.7	34.26	0.00
POLLOCK		7.0	7.0	0.00	
REDFISH, NK (OCEAN PERCH)		212.5	212.5	0.01	
SHAD, AMERICAN	221.0	1,552.0	1,773.0	0.09	0.01
SHAD, HICKORY	1,128.0	132.0	1,260.0	0.06	0.06
SQUID, SHORT-FIN	1,141.2	1,723.0	2,864.2	0.14	0.06
GRAND TOTAL	**71,206.0**	**20,509,602.7**	**20,580,808.7**	**1040.48**	**3.60**

Table 44 summarizes the catch and discard of all species observed on 9 purse seine trips catching 2,000 pounds or more of Atlantic herring during Quarter 2 (April – June) from 2007-April 2009. A more detailed analysis of observer and other bycatch data will be provided in the EIS for Amendment 5 to the Atlantic Herring FMP.

Table 44 Catch and Discards of All Species on 9 Observed Purse Seine Trips, 2007-2009, Quarter 2, Permit Category A

Species	Lbs Disc	Lbs Kept	Total Lbs	Total Catch Rate (per 1000 lbs Atl Herring Kept)	Discard Rate (per 1000 lbs Atl Herring Kept)
DOGFISH, SPINY	99.4	1,598.0	1,697.4	1.30	0.08
HERRING, ATLANTIC	586.0	1,308,041.0	1,308,627.0	1000.45	0.45
LUMPFISH	3.8		3.8	0.00	0.00
MACKEREL, ATLANTIC	34.0	365.0	399.0	0.31	0.03
GRAND TOTAL	**723.2**	**1,310,004.0**	**1,310,727.2**	**1002.05**	**0.55**

Table 45 summarizes the catch and discard of all species observed on 22 purse seine trips catching 2,000 pounds or more of Atlantic herring during Quarter 3 (July – September) for 2007 and 2008. A more detailed analysis of observer and other bycatch data will be provided in the EIS for Amendment 5 to the Atlantic Herring FMP.

Table 45 Catch and Discards of All Species on 22 Observed Purse Seine Trips, 2007-2009, Quarter 3, Permit Category A

Species	Lbs Disc	Lbs Kept	Total Lbs	Total Catch Rate (per 1000 lbs Atl Herring Kept)	Discard Rate (per 1000 lbs Atl Herring Kept)
DOGFISH, SPINY	8,783.0	11,249.0	20,032.0	3.00	1.31
HAKE, SILVER (WHITING)	20.0	4,241.0	4,261.0	0.64	0.00
HERRING, ATLANTIC	287,028.0	6,680,430.0	6,967,458.0	1042.97	42.97
HERRING, BLUEBACK		358.0	358.0	0.05	
MACKEREL, ATLANTIC		88.0	88.0	0.01	
SEAWEED, NK		101.0	101.0	0.02	
SQUID, ATL LONG-FIN		272.0	272.0	0.04	
SQUID, NK		15.0	15.0	0.00	
SQUID, SHORT-FIN	50.0	758.0	808.0	0.12	0.01
GRAND TOTAL	**295,881.0**	**6,697,512.0**	**6,993,393.0**	**1046.85**	**44.29**

Table 46 summarizes the catch and discard of all species observed on 3 purse seine trips catching 2,000 pounds or more of Atlantic herring during Quarter 4 (October – December) for 2007 and 2008. A more detailed analysis of observer and other bycatch data will be provided in the EIS for Amendment 5 to the Atlantic Herring FMP.

Table 46 Catch and Discards of All Species on 3 Observed Purse Seine Trips, 2007-2009, Quarter 4, Permit Category A

Species	Lbs Disc	Lbs Kept	Total Lbs	Total Catch Rate (per 1000 lbs Atl Herring Kept)	Discard Rate (per 1000 lbs Atl Herring Kept)
HERRING, ATLANTIC	700.0	479,930.0	480,630.0	1001.46	1.46
SQUID, SHORT-FIN		70.0	70.0	0.15	
GRAND TOTAL	**700.0**	**480,000.0**	**480,700.0**	**1001.60**	**1.46**

4.4.5 Haddock Incidental Catch

The management measures in Framework 43 to the Northeast Multispecies FMP established a catch cap for haddock in the Atlantic herring fishery, based on the following provisions:

- Vessels issued an All Areas or Areas 2 and 3 Limited Access herring permit may possess and land haddock and other regulated species smaller than the minimum sizes established by the NE multispecies regulations. Such vessels may not use a multispecies Day at Sea (DAS) or sell any NE multispecies for human consumption.
- Vessels issued an All Areas or Areas 2 and 3 Limited Access herring permit are prohibited from discarding haddock that has been brought on the deck or pumped into the hold.
- Vessels issued an All Areas or Areas 2 and 3 Limited Access herring permit may possess and land up to 100 lb, combined, of other regulated NE multispecies on all trips that do not use a multispecies DAS. Such fish may not be sold for human consumption.
- Vessels issued an All Areas or Areas 2 and 3 Limited Access herring permit must notify NMFS of their intent to land at least 6 hours prior to landing.
- An incidental haddock catch allowance is specified for the herring fishery. When the catch allowance has been attained, all vessels issued a herring permit or fishing in the Federal portion of the GOM/GB Herring Exemption Area are prohibited from fishing for, possessing, or landing herring in excess of 2,000 lb per trip in or from the GOM/GB Herring Exemption Area, unless all herring possessed and landed by the vessel were caught outside the GOM/GB Herring Exemption Area and the vessel complies with the gear stowage provisions while transiting the Exemption Area.
- When the incidental haddock catch allowance has been attained, the haddock possession limit is reduced to 0 lb for all vessels issued a herring permit, including those issued an All Areas or Areas 2 and 3 Limited Access herring permit.

- Herring dealers and processors that sort herring as part of their operations are required to separate out, report, retain and make available for inspection all haddock offloaded from vessels that have an All Areas or Areas 2 and 3 Limited Access herring permit. This requirement applies to vessels issued an at-sea processing permit. Such haddock may not be sold and must be retained for 12 hours. At-sea processing vessels must retain such haddock for 12 hours following landing.

The haddock catch cap is established in conjunction with the other NE multispecies TACs, which are specified for a fishing year that covers the period May 1 – April 30. The cap for the period May 1, 2008 – April 30, 2009 was 541,925 lb. Reported haddock catch through May 22, 2009 was 37,126 lb.

The cap for the period May 1, 2009 - April 30, 2010 is 316,218 lb. At this time, 12,215 lb has been documented towards the 2009-2010 catch cap.

4.4.6 Canadian Herring Fisheries

Catch of the Gulf of Maine/Georges Bank ***Atlantic herring*** stock complex in Canadian waters consists primarily of fish caught in the New Brunswick (NB) weir fishery. Currently, the Herring FMP assumes that 20,000 mt of fish from the inshore component of the Atlantic herring resource will be taken annually in the NB weir fishery. This assumed catch is subtracted from the available yield from the inshore component of the resource before TACs are determined for management areas in the U.S. EEZ. While the NB weir catch has been quite variable over time, the 20,000 mt assumption has been determined in previous years to be appropriate. The language in Amendment 1 provides flexibility to reconsider this assumption and adjust according to trends in the fishery in future years as part of the fishery specification process.

Table 47 summarizes landings of herring from all Canadian fisheries from 1963-2008. The column labeled "Non-Stock 4Xs N.B. Weir & Shutoff" generally represents catch from the NB weir fishery. For the most part, shutoffs are not located in the same area as weirs, and landings from shutoffs are thought to be from the 4WX stock component. Combined weir and shutoff landings were almost 31,000 mt in 2007, a significant increase from 12,863 mt in 2006. The catch from this fishery in 2007 was the highest observed since the late 1980s and early 1990s. However, catch is clearly quite variable and dropped again to just under 6,500 mt in 2008. The NB weir fishery landings are presented separately in Table 48 and totaled about 30,145 mt in 2007 and 6,041 mt in 2008.

Table 48 lists herring landings by month for weirs located in New Brunswick from 1978 to 2008. 2007 NB weir landings of 30,145 mt were the highest on record since 1992 and 1993. 2008 NB weir landings were the lowest of the time series. The most recent five-year average of NB weir landings (2004 – 2008) is 16,217 mt, and the most recent ten-year average (1999-2008) is 15,739 mt. Extremely low landings during the 2008 fishing year decreased these moving averages, especially the ten-year average. The average landings for the entire time series is 21,829 mt. Landings from the NB weir fishery have always been somewhat variable; the fishery is dependent on many factors including weather, fish migration patterns, and environmental conditions. NB weir landings should be monitored closely over the next several years to see if a trend emerges.

Table 49 provides information on the number of active weirs and the average catch per weir from the Canadian fisheries from 1978 to 2008. The columns labeled "NB" represent the New Brunswick weir fishery that catches fish from the Atlantic herring stock complex (the Nova Scotian weir fishery primarily catches herring from a different stock). Over time, the number of active weirs in the fishery has decreased considerably, although 2007 saw the highest number since 2001. The number of active weirs declined in 2008, as did catch per unit effort (CPUE). With such low landings, CPUE in 2008 was the second-lowest of the entire time series.

Table 47 Historical Series of Nominal and Adjusted Annual Landings (t) by Major Gear Components and Seasons of the 4WX Herring Fishery, 1963-2008

Year^	4W Winter Purse Seine	4Xs Fall&Winter Purse Seine	4Xqr Summer Purse Seine	4X Summer Gillnet	4Xr Nova Scotia Weir	4WX Stock Nominal Landings	4WX Stock Adjusted Landings*	4WX Stock TAC	Non-Stock 4Xs N.B. Weir & Shutoff	4VWX Coastal Nova Scotia	Offshore Scotian Shelf Banks	Total 4VWX Adjusted Landings
1963		6,871	15,093	2,955	5,345	30,264	30,264		29,366		3,000	62,630
1964		15991	24,894	4,053	12,458	57,396	57,396		29,432		2,000	88,828
1965		15,755	54,527	4,091	12,021	86,394	86,394		33,346		6,000	125,740
1966		25,645	112,457	4,413	7,711	150,226	150,226		35,805		2,000	188,031
1967		20,888	117,382	5,398	12,475	156,143	156,741		30,032		1,000	187,773
1968		42,223	133,267	5,884	12,571	193,945	196,362		33,145		18,000	247,507
1969	25,112	13,202	84,525	3,474	10,744	137,057	150,462		26,539		121,000	298,001
1970	27,107	14,749	74,849	5,019	11,706	133,430	190,382		15,840		87,000	293,222
1971	52,535	4,868	35,071	4,607	8,081	105,162	129,101		12,660		28,000	169,761
1972	25,656	32,174	61,158	3,789	6,766	129,543	153,449		32,699		21,000	207,148
1973	8,348	27,322	36,618	5,205	12,492	89,985	122,687		19,935		14,000	156,622
1974	27,044	10,563	76,859	4,285	6,436	125,187	149,670		20,602			170,272
1975	27,030	1,152	79,605	4,995	7,404	120,186	143,897		30,819			174,716
1976	37,196	746	58,395	8,322	5,959	110,618	115,178		29,206			144,384
1977	23,251	1,236	68,538	18,523	5,213	116,761	117,171	109,000	23,487			140,658
1978	17,274	6,519	57,973	6,059	8,057	95,882	114,000	110,000	38,842			152,842
1979	14,073	3,839	25,265	4,363	9,307	56,847	77,500	99,000	37,828			115,328
1980	8,958	1,443	44,986	19,804	2,383	77,574	107,000	65,000	13,525			120,525
1981	18,588	1,368	53,799	11,985	1,966	87,706	137,000	100,000	19,080			156,080
1982	12,275	103	64,344	6,799	1,212	84,733	105,800	80,200	25,963			131,763
1983	8,226	2,157	63,379	8,762	918	83,442	117,400	82,000	11,383			128,783
1984	6,336	5,683	58,354	4,490	2,684	77,547	135,900	80,000	8,698			144,598
1985	8,751	5,419	87,167	5,584	4,062	110,983	165,000	125,000	27,863			192,863
1986	8,414	3,365	56,139	3,533	1,958	73,409	100,000	97,600	27,883			127,883
1987	8,780	5,139	77,706	2,289	6,786	100,700	147,100	126,500	27,320			174,420
1988	8,503	7,876	98,371	695	7,518	124,653	199,600	151,200	33,421			233,021
1989	6,169	5,896	68,089	95	3,308	83,557	97,500	151,200	44,112			141,612
1990	8,316	10,705	77,545	243	4,049	102,627	172,900	151,200	38,778			211,678
1991	17,878	2,024	73,619	538	1,498	97,010	130,800	151,200	24,576			155,376
1992	14,310	1,298	80,807	395	2,227	100,227	136,000	125,000	31,967			167,967
1993	10,731	2,376	81,478	556	2,662	98,464	105,089	151,200	31,573			136,662
1994	9,872	3,174	64,509	339	2,045	80,099	80,099	151,200	22,241			102,340
1995	3,191	7,235	48,481	302	3,049	62,499	62,499	80,000	18,248			80,747
1996	2,049	3,305	42,708	6,340	3,476	58,068	58,068	57,000	15,913	1,450	11,745	87,176
1997	1,759	2,926	40,357	6,816	4,019	56,117	56,117	57,000	20,552	2,340	20,261	99,270
1998	1,405	1,494	67,433	2,231	4,464	77,027	77,027	90,000	20,091	4,120	5,591	106,829
1999	1,235	4,764	64,432	1,660	5,461	77,552	77,552	105,000	18,644	5,618	12,646	114,460
2000	1,012	4,738	78,010	823	701	85,284	85,284	100,000	16,829	4,283	2,182	108,578
2001	0	4,001	62,004	1,857	3,708	71,570	71,570	78,000	20,209	6,006	12,503	110,288
2002	367	5,257	69,894	393	1,143	77,054	77,054	78,000	11,874	10,375	7,039	106,342
2003	0	8,860	79,140	439	921	89,360	89,360	93,000	9,003	9,162	998	108,523
2004	0	5,659	69,015	225	3,130	78,029	78,029	83,000	20,686	6,924	4,165	109,804
2005	0	2,601	43,487	566	2,245	48,899	48,899	50,000	13,055	6,311	5,263	73,528
2006	0	930	45,002	719	2,508	49,159	49,159	50,000	12,863	6,566	9,809	78,397
2007	0	1,847	46,045	1,334	1,130	50,356	50,356	50,000	30,944	5,240	5,385	91,925
2008	0	2,000	50,022	15	2,524	54,561	54,561	55,000	6,447	3,704	918	65,631

^Annual landings by purse seiners are defined for the period from October 15 of the preceding year to October 14 of the current year.

*Adjusted totals includes misreporting adjustments for 1978-84 (Mace 1985) and for 1985-93 (Stephenson 1993, Stephenson et al 1994)

All landings by other gear types are for the calendar year.

Table 48 Revised Monthly Weir Landings (t) for Weirs Located in New Brunswick, 1978 to 2008

PROVINCE	YEAR	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year Total
N.B.	1978	3				512	802	5,499	10,275	10,877	4,972	528	132	33,599
	1979	535	96			25	1,120	7,321	9,846	4,939	5,985	2,638	74	32,579
	1980					36	119	1,755	5,572	2,352	1,016	216		11,066
	1981					70	199	4,431	3,911	2,044	2,435	1,686	192	14,968
	1982		17			132	30	2,871	7,311	7,681	3,204	849	87	22,181
	1983					65	29	299	2,474	5,382	3,945	375		12,568
	1984					6	3	230	2,344	2,581	3,045	145		8,353
	1985					22	89	4,217	8,450	6,910	4,814	2,078	138	26,718
	1986	43				17		2,480	10,114	5,997	6,233	2,564	67	27,516
	1987	39	21	6	12	10	168	2,575	10,893	6,711	5,362	703	122	26,621
	1988		12	1	90	657	287	5,993	11,975	8,375	8,457	2,343	43	38,235
	1989		24		95	37	385	8,315	15,093	10,156	7,258	2,158		43,520
	1990					93	20	4,915	14,664	12,207	7,741	168		39,808
	1991					57	180	4,649	10,319	6,392	2,028	93		23,717
	1992				15	50	774	5,477	10,989	9,597	4,395	684		31,981
	1993					14	168	5,561	14,085	8,614	2,406	470	10	31,328
	1994				18		55	4,529	10,592	3,805	1,589	30		20,618
	1995					15	244	4,517	8,590	3,956	896	10		18,228
	1996					19	676	4,819	7,767	1,917	518	65		15,781
	1997				8	153	1,017	6,506	7,396	5,316				20,396
	1998					560	713	3,832	8,295	5,604	525			19,529
	1999					690	805	5,155	9,895	2,469	48			19,063
	2000					10	7	2,105	7,533	4,940	1,713	69		16,376
	2001					35	478	3,931	8,627	5,514	1,479			20,064
	2002					84	20	1,099	6,446	2,878	1,260	20		11,807
	2003					257	250	1,423	3,554	3,166	344	10		9,003
	2004					21	336	2,694	8,354	8,298	913	3		20,620
	2005						213	802	7,145	3,729	740	11		12,639
	2006					8	43	1,112	3,731	3,832	2,328	125	462	11,641
	2007	182		20	30	84	633	3,241	11,363	7,637	6,567	314	73	30,145
	2008						81	1,502	2,479	1,507	389	49	32	6,041
NB Average Catch (t)		160	34	9	38	134	331	3,673	8,390	5,657	3,087	682	119	21,829

Table 49 Overall Effort from New Brunswick and Nova Scotia Weirs for Catch (t), Number of Active Weirs and Catch per Weir (t), 1978 – 2008

	Annual Catch (t)			No. Active Weirs			Catch per weir (t)		
Year	NB	NS	Total Catch	NB	NS	Total No.	NB	NS	Average
1978	33,599	7,858	41,458	208	31	239	162	253	173
1979	32,579	6,339	38,918	210	27	237	155	235	164
1980	11,066	2,383	13,449	120	29	149	92	82	90
1981	14,968	1,824	16,793	147	28	175	102	65	96
1982	22,181	1,130	23,311	159	19	178	140	59	131
1983	12,568	896	13,464	143	23	166	88	39	81
1984	8,353	2,702	11,056	116	13	129	72	208	86
1985	26,718	4,055	30,774	156	14	170	171	290	181
1986	27,516	1,957	29,473	105	18	123	262	109	240
1987	26,621	6,776	33,397	123	21	144	216	323	232
1988	38,235	7,480	45,715	191	21	212	200	356	216
1989	43,520	3,296	46,817	171	20	191	255	165	245
1990	39,808	4,132	43,940	154	22	176	258	188	250
1991	23,717	1,498	25,216	143	20	163	166	75	155
1992	31,981	2,224	34,206	151	12	163	212	185	210
1993	31,328	2,662	33,990	145	10	155	216	266	219
1994	20,618	2,045	22,662	129	11	140	160	186	162
1995	18,228	3,049	21,277	106	10	116	172	305	183
1996	15,781	3,476	19,257	101	12	113	156	290	170
1997	20,396	4,019	24,415	102	15	117	200	268	209
1998	19,529	4,048	23,577	108	15	123	181	270	192
1999	19,063	4,537	23,600	100	14	114	191	324	207
2000	16,376	683	17,058	77	3	80	213	228	213
2001	20,064	3,708	23,772	101	14	115	199	265	207
2002	11,807	1,143	12,950	83	9	92	142	127	141
2003	9,003	921	9,924	78	8	86	115	115	115
2004	20,620	3,130	23,750	84	8	92	245	391	258
2005	12,639	2,245	14,884	76	10	86	166	225	173
2006	11,641	2,491	14,132	89	6	95	131	415	149
2007	30,145	1,130	31,275	97	8	105	311	141	298
2008	6,041	2,524	8,565	76	8	84	79	315	102
Average	21,829	3,108	24,938	124	15	140	175	218	179

Correlation Between Recruitment and NB Weir Fishery Catch

To examine the relationship between year class strength (measured as modeled recruitment to age 2) and catch in the NB weir fishery, a correlation analysis was performed by the Herring PDT. Correlation analysis should show whether or not the relationship between catch and year class strength is strong enough to draw conclusions and make predictions about future catch in the NB weir fishery. Correlation analysis was performed on Age 2 at entry into the fishery, lagged Age 3 or age at spawning, and Age 1 (lagged forward).

The Pearson product-moment correlation coefficients are presented in Table 50 and show a highly significant relationship between modeled coast wide recruitment to Age 2 or age at first entry to the fishery, and lagged NB weir catches at Age 3. A significant relationship exists between NB weir catch at age 2 and modeled recruitment from 1985, but not when only more recent years are examined. However, no relationship exists between modeled recruitment and catches at Age 1. While it is appropriate to have high correlation given that NB weir catches are used in the ASAP model (2+) and Age 3, it is surprising that catch of Age 1 and catch in more recent years of Age 2 are not good indicators of year class strength as measured by recruitment. However, during the 2009 TRAC, it was noted that including the NB weir catches and starting the model at Age 1 did not improve the model over the current formulation. As such, variability in stock size between Ages 1 and 2, and even between ages 2 and 3, maybe highly variable and these ages are probably to fully selected by the fishery.

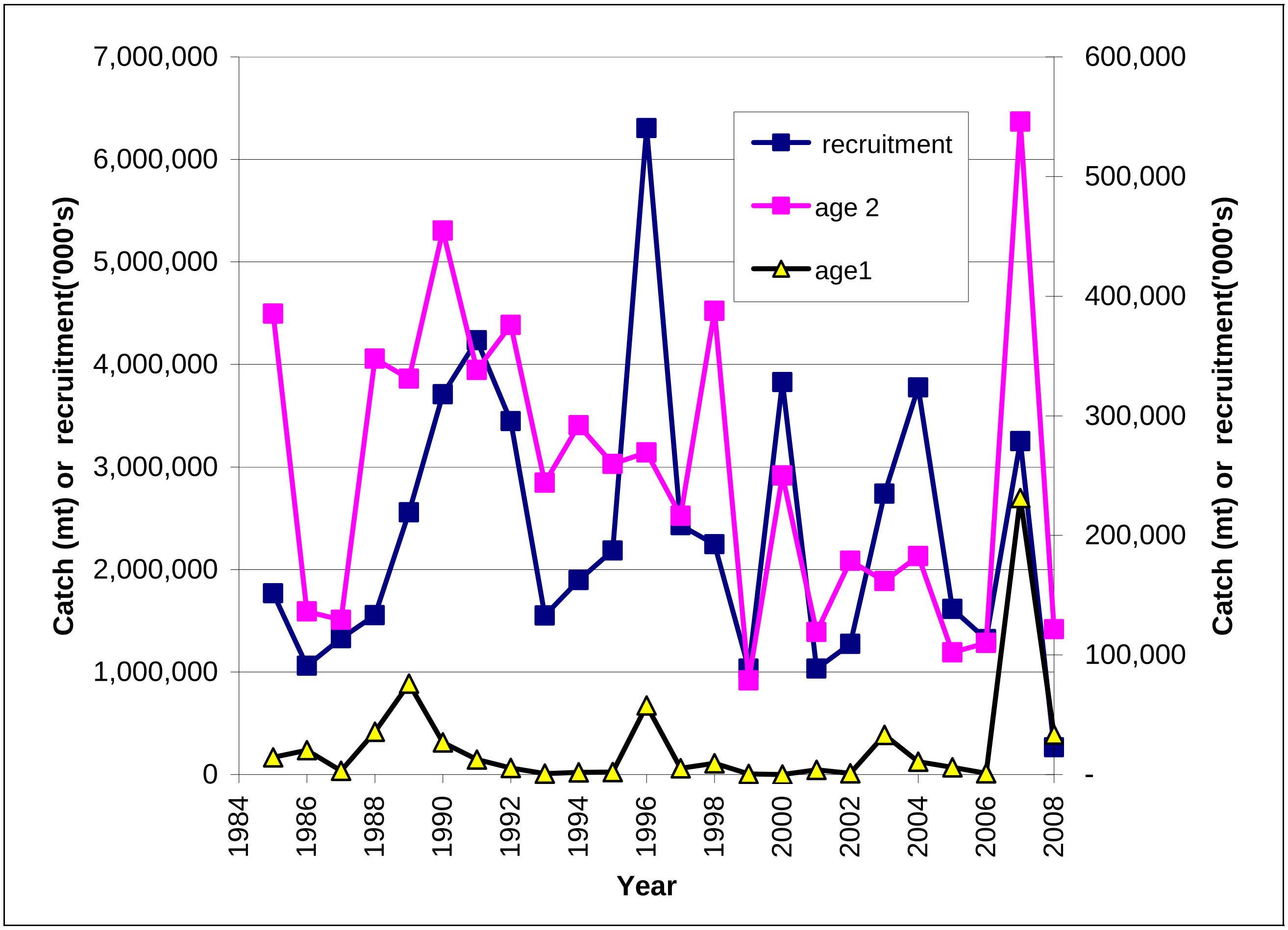
After examining this analysis, the Herring PDT indicated that correlations built on shorter numbers of years (for example since 1999) might not be true representations. They also suggested a moderate relationship between catch at Age 2 in the NB weir and recruitment as modeled in the last assessment (Figure 26). They urged caution, as catch at Age 2 in the NB weirs is already used in the current assessment and as such, looking for a relationship might be circular logic. The PDT also felt that catch at Age 1 in the NB showed no relationship, so complex-wide year class strength from the catch in Age 1's or Age 2's in the NB weir fishery cannot be predicted with accuracy. Given that, the PDT indicated that catch in the NB weir is only reflective of good recruitment in some years.

Table 50 Person Product Moment Correlation Coefficients Comparing Catch at Age (numbers) in the NB Weir Fishery and Modeled Recruitment to Age 2

Start year	1	2	3
1999	0.32	0.58	0.77**
1994	0.31	0.45	0.74*
1985	0.26	0.51*	0.59*

* P< 0.05
** P< 0.01

Figure 26 Catch at Age (1 and 2) and Modeled Recruitment in the Current Assessment



4.4.7 Communities of Interest

Amendment 1 to the Herring FMP selected *Communities of Interest* because they meet at least one (and more than one in most cases) of the following five criteria:

1. Atlantic herring landings of at least 10,000,000 pounds (4,536 mt) in each of five years from 1994-2002, or anticipated landings above this level based on interviews and documented fishery-related developments.
2. Infrastructure dependent in part or whole on Atlantic herring.
3. Dependence on herring as lobster and/or tuna bait.
4. Geographic isolation in combination with some level of dependence on the Atlantic herring fishery.
5. Utilization of Atlantic herring for value-added production.

Since Amendment 1, the community list has changed slightly. A summary of the profiles of these communities, including important demographic and social information, are provided below. Appendix XI to the Amendment 1 EIS should be referenced for further information. Amendment 5 to the Atlantic Herring FMP is currently under development and will update this information.

1. Portland, Maine

Portland is the largest city in Maine and has the highest population (64,257 according to the 2000 Census) in New England north of Boston. Portland's waterfront provides most of the community's fishing industry infrastructure (e.g., Portland Fish Exchange) along side other industries including recreation, tourism, light industry, transportation, cargo, and marine-related research. According to the Department of Labor in Maine, the major employers of Portland include L.L. Bean, public facilities (i.e., medical facilities, schools, post office) and private industry (i.e., phone, food, and newspaper companies, and Wal Mart). Portland's landings come primarily from the large mesh groundfish species and from lobster. Herring brings in about 5% of the dollar value of federal landings in Portland which put it second in herring landings in 2004 and also ranked second cumulatively from 1995-2004.

2. Rockland, Maine

According to Census 2000 data, Rockland City has a total population of 7,609. Other than fishing, and boat building/repair, other stabilizing businesses include furniture and playground equipment manufacturing, biotechnology industries, wholesale distribution, marine-related businesses, seaweed processing, metal fabricating, and food related industries. The major employers of Rockland include medical centers, banks, food distributors, schools, and government facilities. Other private industries include MBNA Marketing Systems Inc, Samorock LLC, Fisher engineering, and Maritime Energy. According to the landings data collected on federally managed species, Rockland's commercial fishery is primarily based on the herring and lobster fisheries, collectively bringing in about 75% of the dollar value of federal landings at its ports. Rockland ranks third in herring landings in 2004 and third cumulatively from 1995-2004.

3. Stonington/Deer Isle, Maine

According to the Census 2000 data, the city has a population of 1,152 and home to the Commercial Fisheries News, the widely-read monthly fishing industry newspaper for the Atlantic coast. Stonington is one of the few Maine fishing communities that has secured waterfront access for commercial fishing because of stable property values as compared to other coastal cities which have risen. Stonington is home to Greenhead Lobster LLC, Stonington Lobster Cooperative, Carter's Seafood, Ingrid Bengis Seafood, Morning Star Seafood and Oceanville seafood. According to Census 2000 data, self-employed workers (e.g., fishermen) account for 39.0% of all jobs, agriculture/forestry/fishing/hunting 22.9%, retail 15.2%, educational health and social services 10.8 %, and arts/entertainment/food services 10.3%. Stonington is involved in the Atlantic herring fishery primarily through its dependence on herring for lobster bait and ranked sixth cumulatively for herring landings from 1995-2004.

4. Vinalhaven, Maine

The island town of Vinalhaven, Maine, located in Knox County, is home to 1,235 according to 2000 census data. Vinalhaven is intimately involved with the Atlantic herring fishery because of its dependence on lobster bait, though it ranked ninth in herring landings in 2004 and tenth cumulatively from 1995 - 2004. Many of the year-round residents of Vinalhaven are participants in the lobster fishery, and several lobster bait dealers, including floating stations and a co-op, are located in Vinalhaven. The 2000 Census found that nearly 64% of Vinalhaven residents identified themselves as either self-employed (which may include fishermen) or as participants in the agriculture, forestry, fishing and hunting industries. Vinalhaven has several packaging and wholesale companies, including Vinalhaven Lobster Co., Vinalhaven Fishermen's Co-op, Inland Seafood and Alfred Osgood, that ship lobster to Portland and other mainland locations for processing and distribution. Bait dealers on Vinalhaven pay a higher price for bait than dealers on the mainland, as there is limited bait storage capacity on the island and insufficient space on the ferry that transports goods and people from the mainland to make regular bait transshipments during the height of the lobster season.

5. Lubec/Eastport, Maine

Lubec/Eastport has a total population of 1,640 according to 2000 U.S. Census data. Lubec/Eastport has a diversity of employment, including medical centers, schools, an apparel company, and an Atlantic salmon aquaculture facility. Eastport also has the only Nori seaweed processing plant in the United States. Census data indicate that arts, entertainment, recreation, accommodation and food services (30.3%), manufacturing (16.7%) and retail trade (10.3%) were the primary industries. Fewer Eastport residents identified themselves as self employed (10%) or employees of the agriculture, forestry, fishing and hunting industry (9.8%). Residents of Eastport never solely depended on one commercial fishery for their economy, but some may have depended on catches of several species. As of 1998 most of the commercial fishery in Eastport is based on Scallops, urchin, clams, and sea cucumbers. Although Lubec/Eastport is involved in the Atlantic herring fishery through its dependence on lobster bait, no herring landings were reported in Lubec/Eastport in 2004.

6. Prospect Harbor, Maine

Prospect Harbor is part of the Town of Gouldsboro, Maine which has a total population of 1,941 according to the 2000 U.S. Census. According to Census 2000 data, jobs with agriculture, forestry, fishing and hunting accounted for 13.1% of all jobs. Self employed workers, a category where fishermen might be found, accounts for 25.2% of the labor force. Prospect Harbor/Gouldsboro is an important community involved in the Atlantic herring fishery, and ranked eight in herring ladings in 2004 and ninth in cumulatively from 1995 - 2004. The last remaining sardine cannery, Stinton/Bumblebee, is located in Prospect Harbor and typically trucks in herring from other ports like Rockland and Portland. The cannery, which is scheduled to close sometime in 2010, had as many as 150 employees in 2003. Other important fisheries related businesses include the Young Brothers Company, which builds nationally marketed lobster vessels, and the Corea Lobster Co-Op, which sells wholesale lobsters, fuel and marine supplies. The Fishermen's Voice, also located in Gouldsboro, is a monthly newspaper that covers issues pertinent to the fishing industry in Maine.

7. Bath, Maine

Bath, which had a total population of 9,266 according to 2000 Census data, does not have a current or historical economic bind to the harvest sector. Jobs with agriculture, forestry, fishing and hunting accounted 1.4% of all jobs, and self-employed workers, a category where fishermen might be found, accounted for 8.7% of the labor force. Other sectors, including educational, health and social services (22.3%), manufacturing (19.8%) and retail trade (13.2%), were more significant employers. The major employers of Bath include Bath Iron Works (BIW), which is the largest employer in all of Maine, Brunswick Naval Air Station, L.L. Bean, and Bowdoin College (200 years old). Until very recently, Bath was home to one of Stinson/Bumblebee Seafood's two sardine processing plants. The company's remaining sardine cannery Prospect Harbor, in Gouldsboro, Maine; it is scheduled to close sometime in 2010. Bath ranked 16th in herring landings in 2004 and eighth cumulatively from 1995-2004. It is unclear at this time what Bath's involvement in and dependence on the herring fishery will be in the future.

8. Sebasco Estates, Maine

Sebasco Estates is a small village within the town of Phippsburg, which has a total population of 2,106 according to 2000 U.S. Census Data. Jobs with agriculture, forestry, fishing and hunting accounted for 7.5% of all jobs, and Self employed workers, a category where fishermen might be found, accounts for 17.2% of the labor force. Manufacturing (18.2%), educational, health and social services (18.1%), retail trade (13.5%), and entertainment, recreation, accommodation and food services (8.8%) were also major employment categories. Sebasco Estates/Phippsburg is involved in the Atlantic herring fishery primarily due to its dependence on herring for lobster bait. Several lobster bait dealers, large and small, are located in this area.

9. NH Seacoast – Newington, Portsmouth, Hampton/Seabrook

Newington ranked fifth in herring landings in 2004 and 12th cumulatively from 1995-2004, with herring landings increasing in more recent years. Newington is primarily dependent on the herring fishery because of the bait it provides for lobster fishing in Great Bay estuary. Other commercial fisheries in the Great Bay estuary include herring, baitfishing for alewives, mummichogs (*Fundulus sp.*) and tomcod using gillnets, seines and minnow traps; trapping for eels, and angling and dipnetting for smelt. Newington has several large and small herring bait dealers, and freezer facilities to store lobster bait. The Little Bay Lobster Company and the Shafmaster Fleet Services both harvest and delivers lobster nationally and internationally. The Newington fishing industry also competes with other water dependant industries, including a tallow, steel scrap and wood chip export industries. Newington, NH has a population of 775 according to 2000 Census data. None of the labor forced identified as having jobs in agriculture, forestry, fishing and hunting accounted, but 12.5% of the labor force identified as being self-employed. Major employers in the city include Fox Run Mall (retail**)** and Neslab (light manufacturing lab equipment), each with 600 employees.

Portsmouth is somewhat involved in the herring fishery through its dependence on herring for lobster and tuna bait. The port is centrally-located with good transportation infrastructure and provides other fishing related services. Portsmouth ranked 13th in herring landings in 2004 and 11th cumulatively from 1995-2004. Portsmouth has a total population of 20,784 according to 2000 U.S. Census data. Less than 1% of the labor force identified as being employed in griculture, forestry, fishing and hunting, and 9.1% of the labor force identified as being self employed. Other important local industries for employment include educational, health and social services (18.8%), retail trade (15.2%), professional, scientific, management, administrative, and waste management services (13.2%), manufacturing (12.5%), and entertainment, recreation, accommodation and food services (9.0%).

Hampton and Seabrook are somewhat involved in the herring fishery through their dependence on herring for lobster and tuna bait. Only 2 mt of herring were reported to have been landed in Hampton in 2004. Seabrook ranked 17th in herring landings in 2004. According to the Census 2000 data, the Hampton has a population of 14,937 and Seabrook has a population of 7,934. Less than 1% of the Hampton labor force identified as having jobs in agriculture, forestry, fishing and hunting; 9.1% of the labor force identified themselves as self employed. Major employers in the city include Foss Manufacturing Co. of New Hampshire (auto, marine carpet**)** with 190 employees, and Complex Inc. (Disposable medical devices) with 105 employees. In Seabrook, jobs with agriculture, forestry, fishing and hunting also only accounted for less than 1% of the labor force; 7.4% of the labor force identified as self employed.

10. Gloucester, Massachusetts

According to 2000 Census data, Gloucester has a total population of 30,273. Gloucester's commercial fishing industry had the 13th highest landings in pounds and the nation's ninth highest landings value in 2002. In 2002 Gloucester had the highest landings value of lobster in Massachusetts, with over $10 million of combined state and federal landings recorded from federally permitted vessels. Several lobster bait dealers and a pumping station for offloading herring are located in Gloucester. In addition, Cape Seafoods, one of the largest processors of herring for frozen export, is located at the State Pier and owns several dedicated pelagic fishing vessels. Gloucester was the top-ranked port for herring landings in 2004 and cumulatively from 1995-2004. Gloucester lobster fishermen depend on the harvested herring as bait for their traps and tuna fishermen use herring as bait for their lines.

Manufacturing (16.7%), retail trade (10.8%), educational, health and social services (20.2%) and entertainment, recreation, accommodation and food services (9.2%) were Gloucester's primary industries in 2000. ajor employers that provide over 100 jobs in Gloucester include the following: Varian Semi Conductor Equipment Associates (950), Battenfeld Gloucester Engineering (400), Shaw's Supermarkets (350), Addison Gilbert Hospital (325), NutraMax Products (220), and Seacoast Nursing and Retirement (160).

Nearly 3% of the Gloucester workforce identified themselves as being employed in agriculture, forestry, fishing and hunting; another 8.6% of the labor force identified as self employed. Gloucester Seafood Display Auction, opened in 1997, is the largest open seafood display auction in North America as of 2000. Cape Pond Ice, which was started in 1848, is the only ice business remaining in Gloucester, and provides other ice services, such as vegetable transport and ice sculptures to offset the declining business from the fishing industry. B&N Gear is the only bottom trawl gear seller in town. Gorton's, which has only been packaging imported fish since the mid-1990s, employs approximately 500 people.

11. New Bedford, Massachusetts

According to Census 2000 data, New Bedford has a total population of 93,768. In 2000 and 2001, New Bedford was the highest value port in the U.S., generating $150.5 million in dockside revenue. New Bedford contains approximately 44 fish wholesale companies, 75 seafood processors and some 200 shore side industries. Maritime International, which has one of the largest U.S. Department of Agriculture-approved cold treatment centers on the East Coast, is also located in New Bedford. New Bedford ranked fourth in herring landings in 2004 and seventh cumulatively from 1995-2004. Herring landings in New Bedford increased significantly in recent years with the establishment of the NORPEL plant, which is one of the largest processors of herring for frozen export. NORPEL also owns several dedicated pelagic fishing vessels. Despite the high value of the New Bedford port, 2000 census data found that jobs with agriculture, forestry, fishing and hunting accounted for only 1.1% of all jobs, and that Self employed workers accounted for just 3.9% of the labor force.

New Bedford struggles with a highly contaminated harbor, which is the result of years of municipal discharge of untreated combined sewage, industrial waste, and storm water from combined sewer overflows. New Bedford Harbor was listed by the U.S. Environmental Protection Agency (EPA) as a Superfund site in 1982 is because of the high concentrations of Polychlorinated biphenyls (PCBs) and other metals and organic compounds in the sediment; a cleanup is underway. Significant levels of these pollutants have also accumulated in the water, fish, lobsters, and shellfish in the Harbor and adjacent areas. Closures of fishing areas in the harbor have caused economic losses in the millions for the quahog landings, and closure of the lobster fishery has resulted in an estimated loss of $250,000 per year.

12. Southern Rhode Island – Point Judith, Newport, North Kingstown

Point Judith is marginally involved in the Atlantic herring fishery. Landings of herring in Point Judith were much higher in the early 1990s, possibly due to increased participation in the Atlantic mackerel fishery. Several lobster bait dealers are located in Point Judith, and some herring is trucked to Maine from Point Judith for processing. Point Judith ranked 10th in herring landings in 2004 and fourth cumulatively from 1995-2004. Besides an active fishing port Point Judith supports a thriving tourism industry that includes restaurants, shops, whale watching, recreational fishing, and a ferry to Block Island. It also has a number of fish processing companies that do business locally, nationally, and internationally. Point Judith's largest fish processors are the Town Dock Company and the Point Judith Fishermen's Company – a subsidiary of M. Slavin & Sons based in NY. Seven smaller processors are also located in the

Point Judith area: American Mussel Processors, Inc., Deep Sea Fish of RI, Ocean State Lobster Co., MC Fresh Inc., Narragansett Bay Lobster Co., Inc., South Pier Fish Company, and Sea Fresh America. Census data are not available for Point Judith itself, but are available for the county subdivision "Narragansett Pier CDP" which includes Point Judith; Narragansett Pier CDP has a total population of 3,671 according to 2000 Census data. Jobs with agriculture, forestry, fishing and hunting accounted 1.6% of all jobs, and self employed workers accounted for 8.6% of the labor force. Educational, health and social services (30.9%) was the other major source of labor for Narragansett Pier CDP.

Newport is marginally involved in the Atlantic herring fishery, and ranked 15th in herring landings in 2004 and 17th cumulatively from 1995-2004. Newport has a total population of 26,475 according to 2000 Census data. Less than 1% of the labor force identified as having jobs in agriculture, forestry, fishing and hunting. Self employed workers accounted for 8.3% of the labor force. Aquidneck Lobster Co., Dry Dock Seafood, International Marine Industries Inc., Long Wharf Seafood, Neptune Trading Group Ltd., Parascandolo and Sons Inc., and Omega Sea are wholesalers and retailers of seafood in Newport. Other primary employment industries include educational, health and social services (19.9%), arts, entertainment, recreation, accommodation and food services (18.6%), professional, scientific, management, administrative, and waste management services (12.3%), retail trade (10.9%), and manufacturing (7.2%).

North Kingstown is involved in the Atlantic herring fishery primarily through its involvement in the bait fishery. Several lobster bait dealers and freezer facilities are located in North Kingstown, and some herring is trucked to Maine from North Kingstown for processing. North Kingstown ranked 12th in herring landings in 2004 and fifth cumulatively from 1995-2004. North Kingston's Sea Freeze, Ltd. is the largest producer of sea-frozen fish on the U.S. east coast. It supplies sea-frozen and land-frozen fish to domestic and international markets including bait products to long-line fleets. Sea Freeze owns two freezer trawlers that provide *Illex* and *Loligo* squid, mackerel and herring the Sea Freeze facilities. Although herring is among the least financially valuable species that Sea Freeze harvests and processes, it is nevertheless important to the business due to its year round availability. In 2000, the plant employs approximately 60 people, but exists largely independent of the surrounding community. North Kingston has a population of 26,326 according to 2000 census data. Jobs in agriculture, forestry, fishing and hunting employed less than 1% of the labor force. Self employed workers also accounted for less than 1% of the labor force. Educational health and social services (26.3 %), retail trade (13.2%), manufacturing (12.7%), and professional, scientific, management, administrative services (8.3%) were more significant industries.

13. Cape May, New Jersey

Cape May is involved in the Atlantic herring and other pelagic fisheries. A pumping station for offloading herring and Lund's Fisheries, a processor of herring and mackerel, are located in Cape May. Lunds' also owns a number of dedicated pelagic fishing vessels, and is a member of the Garden State Seafood Association. There are also two other exporters of seafood in Cape May: the Atlantic Cape Fisheries Inc., which exports marine fish and shellfish, oysters, scallops, clams and squids; and the Axelsson and Johnson Fish Company Inc., which exports shad, marine fish, conch, American lobster, lobster tails, scallops and whole squid. Only 8 mt of herring were reported to have been landed in Cape May in 2004. According to the Census 2000 data, Cape May has a total population of 4,034; 0.4% of the labor force was employed in agriculture, forestry, fishing and hunting, and 15% of the labor force identified as self-employed. Arts, entertainment, recreation, accommodation and food services (21.1%), and finance, insurance, real estate and rental and leasing (10.6%), retail trade (16.4%), and educational, health and social services (13.6 %) were more significant industries for the Cape May labor force.

Supporting Industries

Infrastructure and the opportunity to capitalize on available markets for herring are important elements of the fishery. Infrastructure in this fishery, whether it be shoreside or at-sea, is tailored to serving the small pelagic fisheries (herring and mackerel, primarily) and therefore wholly dependent on them. Very few elements of the infrastructure are engaged in other fisheries like multispecies, monkfish, or scallops. Investments in infrastructure for the Atlantic herring fishery reflect a long-term commitment to this fishery.

Only a few ports are capable of accommodating large herring vessels and their large volumes of fish. A transportation network is essential to distribute herring rapidly to processing and other facilities. Trucking and transportation services are therefore a critical element of the infrastructure for this fishery.

Sardine canneries rely on herring for 100% of their operations. Whole frozen processing facilities rely on a combination of herring and mackerel for 100% of their operations. Joint venture (JV) and internal waters processing (IWP) operations at-sea remain important considerations in the Atlantic herring fishery, although interest in these operations has diminished as additional shoreside processing facilities have developed in recent years.

Dependence on herring as lobster and/or tuna bait.

Atlantic herring is important for the lobster and tuna fisheries, as well as other primarily recreational fisheries (striped bass, for example). Maine relies heavily on herring to supply bait to the significant lobster fishery in the region. The supply of bait could result in multiplier effects throughout the numerous coastal communities that depend largely on herring bait (mostly in Maine).

Mackerel Fishery

Mackerel fishing takes place in the winter and early spring months in herring management Area 2. In the winter, herring migrate to Area 2. The co-occurrence of both these fisheries in Area 2 during the winter results in herring being caught as bycatch in the mackerel fishery. Many of the same vessels participate in both fisheries. Some mackerel vessels, however, do not have limited access herring permits and are limited to 6,600 pounds of herring per trip.

The majority of Category A mackerel vessels (limited access herring permits for all management areas) are homeported in Massachusetts, New Jersey, and Rhode Island. The majority of Category D mackerel vessels (open access herring permit for 3 mt) are homeported in New Jersey, New York, and Rhode Island. It is likely that the Category D vessels from NY, NJ, and

RI are some of the vessels for which there may be concern about potential herring bycatch, especially if their activity in the mackerel fishery increases.

5.0 PROPOSED ACTION –SUPPORTING INFORMATION AND RATIONALE

5.1 F_{MSY}-BASED FISHING LEVEL

A fishing level based on MSY or F_{MSY} is identified as the starting point for specifying Optimum Yield and management area TACs when the herring stock complex is not overfished and overfishing is not occurring. The F_{MSY} fishing level is proposed to be set at 145,000 mt in 2010, 134,000 mt in 2011, and 127,000 mt in 2012 and will become the OFL upon the implementation of Amendment 4 to the Herring FMP.

To estimate the 2010 F_{MSY} fishing level, the Herring PDT applied the 2008 catch to the 2008 biomass estimate for the herring complex to estimate the 2009 starting biomass. The PDT then estimated a fishing mortality rate for 2009 based on the 2008 landings plus an additional 7,800 mt to account for the increased catch in Area 2. The projected F for 2009 is 0.16. Applying 0.16 to the estimated biomass in 2009 yields a projected biomass in 2010. F_{MSY} was then be applied to the 2010 biomass projection to derive an overfishing limit (F_{MSY} x B) for 2010. The resulting fishing level for 2010 is 143,845 mt (Table 51).

Table 51 Projected F_{MSY} Fishing Level for 2010

LANDINGS	**(000 mt)**								
YEAR	**AVG**	**STD**							
2009	93.292	12.135							
2010	144.806	19.827	**2009F = 0.16 2010F and 2011F = 0.27**						
2011	132.512	21.913							
PERCENTILES OF LANDINGS			**(000 MT)**						
YEAR	**1%**	**5%**	**10%**	**25%**	**50%**	**75%**	**90%**	**95%**	**99%**
2009	68.5	75.3	78.1	84.5	92.078	101.0	109.9	115.6	124.2
2010	104.7	114.5	119.7	130.0	143.845	158.3	171.4	178.9	193.7
2011	88.7	98.3	104.0	116.0	132.019	147.3	162.2	170.3	183.7

Based on long-term projections, the SSC concluded that biomass is likely to be above B_{MSY} at this time. The SSC supported the PDT recommendations for this fishing level and utilized the long-term projections to derive OFL specifications for 2011 and 2012 as well. The SSC based its OFL calculation on the existing overfishing definition (the maximum fishing mortality threshold is F_{MSY} when stock size is greater than B_{MSY}, and the fishing mortality that allows rebuilding in five years when biomass is less than B_{MSY}). The 2008 estimate of biomass is substantially greater than the biomass expected from long-term stochastic projection at F_{MSY}. Accordingly, the SSC's calculation of OFL is based on F_{MSY} projections (Table 52; additional information and analysis is provided in Appendix I to this document).

Table 52 Percentiles of Projected Landings Distribution for F_{MSY} Fishing Mortality Scenario for Atlantic Herring

		Percentiles of projected landings distribution (Catch in 000's of metric tons)									
	YEAR	1%	5%	10%	25%	50%	75%	90%	95%	99%	F
F_{MSY}	2010	105.477	115.066	120.727	131.296	144.996	160.488	176.931	189.598	221.021	0.27
	2011	89.868	99.955	106.437	118.597	134.493	153.115	175.320	194.622	226.376	0.27
	2012	76.543	88.241	95.355	109.068	126.966	148.563	175.386	193.975	226.817	0.27

50^{th} Percentile represents the proposed F_{MSY} fishing level for 2010-2012.

5.2 ABC

Allowable biological catch (ABC) is proposed to be set at 106,000 mt for 2010-2012. This will become the acceptable biological catch (ABC) with the implementation of Amendment 4 to the Herring FMP in 2011 and 2012. While the description of ABC will change in Amendment 4, the values for 2010-2012 will not change, and the development of the ABC specification is consistent with the approach used in the Herring FMP.

The ABC specification is the F_{MSY} fishing level reduced by a buffer to account for scientific uncertainty, which will ensure that fishing mortality on the stock complex will remain below the threshold level. The ABC is proposed to be defined in Amendment 4 to the Herring FMP as the *maximum catch that is recommended for harvest, consistent with meeting the biological objectives of the management plan.* ABC can equal but never exceed the OFL. ABC should be based on F_{MSY} or its proxy for the stock if overfishing is not occurring and/or the stock is not in a rebuilding program, and should be based on the rebuilding fishing mortality (F_{reb}) rate for the stock if it is in a rebuilding program. The specification of ABC will consider scientific uncertainty and will be recommended to the Council by its Scientific and Statistical Committee. The recommendations from the SSC regarding the specification of ABC are considered to be based on the best available scientific information.

In September 2009, the SSC endorsed the 2009 stock assessment produced by the Transboundary Resources Assessment Committee (TRAC) as a basis for projection, derivation of overfishing limit (OFL) and Acceptable Biological Catch (ABC) but recognized considerable uncertainty in the assessment. Two aspects of the uncertainty in the assessment influence the derivation of OFL and ABC: 1) The assessment has a strong 'retrospective pattern' in which estimates of stock size are sequentially revised downward as new data are added to the assessment; and 2) Maximum sustainable yield reference points estimated from the biomass dynamics model are inconsistent with the age-based, stochastic projection; such that fishing at the current estimate of F_{MSY} is expected to maintain equilibrium biomass that is less than the current estimate of B_{MSY}. Given the magnitude of uncertainty in the herring assessment and reference points, an ABC control rule cannot be derived at this time, and the SSC recommends a new benchmark assessment of herring as soon as possible.

In November 2009, at the request of the Council, the SSC revisited its September 2009 ABC recommendations (Appendix I) and provided the recommendations in the following subsection regarding the specification of ABC for Atlantic herring in 2010-2012.

5.2.1 SSC Recommendations November 2009

The Scientific and Statistical Committee (SSC) was asked to "revisit the size of the 40% buffer between OFL and ABC to consider whether application of recent years' retrospective difference of about 17% is sufficient to account for scientific uncertainty caused by retrospective patterns."

In September 2009, the SSC recommended that:

1. *The Overfishing Limit (OFL) is 145,000 mt in 2010, 134,000 mt in 2011 and 127,000 mt in 2012 based on projections of fishing at the current estimate of F_{MSY}.*
2. *Acceptable Biological Catch (ABC) is 90,000 mt each year for 2010 to 2012.*
3. *Catch recommendations include combined U.S. and Canadian catch of the Gulf of Maine / Georges Bank Atlantic herring complex.*
4. *A new benchmark assessment should be scheduled as soon as possible to address sources of uncertainty, re-estimate MSY reference points and consider including estimates of consumption and spatial structure in the assessment.*

The SSC developed its September 2009 ABC recommendation using two general approaches that produced consistent catch advice. The first approach accounted for the uncertainty in the assessment with a 40% buffer between OFL and ABC. The second approach was based on the observation that recent catches had resulted in stable biomasses above B_{MSY} and fishing mortality below F_{MSY} since the mid 1990s. Based on these, the SSC recommended an ABC of 90,000mt for 2010 to 2012.

The SSC considered the Council request by correspondence and during a conference call on November 12, 2009. The SSC concluded that there is no scientific basis for a 17% buffer, and that a 17% buffer is insufficient to account for scientific uncertainty.

Although there is substantial uncertainty in the stock assessment, the Gulf of Maine-Georges Bank stock complex does not appear to be overfished and overfishing does not appear to be occurring. In the context of several sources of substantial uncertainty (retrospective inconsistency, exploitation of mixed stocks, etc.), it would not be appropriate to allow catches to increase. Accordingly, the SSC recommends that annual catches in 2010 to 2012 should be limited to recent catch. Catches were 90,000 mt in 2008; the average for 2006 to 2008 is 106,000 mt; and the average for 2004 to 2008 is 108,000 mt.

The choice of recent time period to use in the derivation of ABC depends on the Council's implicit tolerance to risk. However, it is important to consider that exploitable biomass is projected to decline during 2010 – 2012 due to the recruitment of poorer than average year-classes. Furthermore, the risk of depleting spawning components and the role of herring in the ecosystem as a forage species needs to be considered. Given the substantial uncertainty in the assessment, the Council should consider a conservative catch limit (e.g., 90,000 mt as recommended by the SSC in September). The SSC notes that it would be appropriate to use the same recent time period to determine both the catch limit as well as the management uncertainty adjustment for Canadian catches.

The catch limit should be considered to be reviewable and revisable pending new information. Ideally, information from a revised stock assessment could be used to revise catch advice within this management cycle (2010 to 2012). The SSC recommends that the next benchmark assessment be scheduled well in advance of the management cycle for 2013 catch advice.

The SSC recommends that:

- **Acceptable Biological Catch for the Gulf of Maine / Georges Bank Atlantic herring complex in 2010 to 2012 should be limited to recent catch.**
- **A new benchmark assessment should be scheduled as soon as possible.**

This recommendation replaces the recommendation of September 2009.

5.2.2 "Recent Catch" and Proposed Specification of ABC for 2010-2012

In November 2009, the SSC recommended that ABC for the Atlantic herring stock complex for 2010-2012 be based on recent catch levels but left the determination of "recent catch" at the discretion of the Council. The SSC discussed three approaches to defining recent catch, which range from just the most recent year's catch (2008) to a five-year average (2004-2008). Catches were 90,000 mt in 2008; the average for 2006 to 2008 is 106,000 mt; and the average for 2004 to 2008 is 108,000 mt. The choice of recent time period to use in the derivation of ABC depends on the Council's implicit tolerance to risk. However, the SSC did note that exploitable biomass is projected to decline during 2010 – 2012 due to the recruitment of poorer than average year-classes. Furthermore, the risk of depleting spawning components and the role of herring in the ecosystem as a forage species should be considered.

The Council considered the SSC advice, as well as other considerations as noted above. Consistent with the SSC advice, the Council considered three options for defining recent catch:

- One-year (most recent, 2008) – 90,000 mt; and
- Three-year (2006 – 2008) average – 106,000 mt; and
- Five-year (2004 – 2008) average – 108,000 mt.

The three-year average catch (2006-2008, 106,000 mt) was selected by the Council to form the basis of the ABC specification for 2010-2012 for several reasons:

- A three-year average is commonly used to reflect "recent" levels of landings, biomass, fishing mortality, trawl survey results, and other factors that are utilized to evaluate trends in a fishery or stock status. The Council's approach is consistent with this approach and appears to be technically-sound. It also falls within the range of approaches suggested by the SSC and is therefore consistent with SSC advice and the best available scientific information.
- A one-year approach was not utilized because 2008 catch was one of the lowest on record for many years and may not adequately or accurately address the true level of "recent" catch. While there may be a variety of reasons that 2008 catch was lower, the specific reasons remain unknown (market conditions, fish availability, lower Area 1A TAC, etc.). Canadian

catch (NB weir fishery) was particularly low in 2008, while 2007 landings were the highest of the time series. Variability in catch from year to year should be considered when defining recent catch, and variability is not addressed through a one-year approach.

- The Council considered other factors identified by the SSC, including recruitment, biomass projections, and the importance of herring as a forage species. The three-year approach was chosen instead of a five-year approach with consideration of these and other factors. The Council's proposed approach for specifying ABC provides for a technically-sound way to address annual variability in catch and fishing effort while remaining consistent with SSC advice and slightly more conservative than the five-year option that was considered.
- The proposed specification of ABC (106,000 mt) provides a 27% buffer from the proposed F_{MSY}-based catch in 2010 (145,000 mt) to account for scientific uncertainty associated with the 2009 TRAC updated herring assessment, particularly the retrospective pattern in the assessment model. This should ensure that the risk of exceeding F_{MSY} for the stock complex is minimized, despite any uncertainties associated with the assessment results. The Council supports the SSC recommendation that a benchmark assessment for Atlantic herring is needed as soon as possible and will revisit this issue with the SSC when such an assessment occurs. Until then, the proposed approach is consistent with SSC advice and based on the best available and most recent information.

5.3 MANAGEMENT UNCERTAINTY AND THE SPECIFICATION OF U.S. OY

An additional element of any buffer established between the F_{MSY}-based catch level and the optimum yield relates to what is defined in Amendment 4 as management uncertainty. Once scientific uncertainty and management uncertainty are deducted, the U.S. optimum yield (OY) specification is determined, and in Amendment 4, this value represents a stock-side annual catch limit (ACL). Amendment 4 states that management uncertainty should be addressed prior to establishing ACLs, and deductions should be made from ABC, if necessary, to account for management uncertainty.

Similarly, the provisions in the Herring FMP currently include a deduction to account for Canadian catch prior to specifying a U.S. OY. Consistent with this approach, and to ensure consistency with Amendment 4 in 2011 and 2012, the Council considered three sources of uncertainty during the development of the 2010-2012 specifications prior to setting OY: Canadian catch, State waters catch, and herring discards. The recommendation for a deduction of 14,800 mt is derived by accounting for Canadian catch exclusively, but each of the three issues considered by the Council is discussed below.

5.3.1 Canadian Catch

Although herring currently is not managed jointly through a Resource Sharing Agreement with Canada, the stock assessment is conducted jointly through the Transboundary Resource Assessment Committee (TRAC), and Canadian landings of the Atlantic herring resource must be factored into decisions about U.S. herring fishery specifications and accounted for as an element of management uncertainty, to further ensure that the ABC for the stock complex is not exceeded. Catch of the Atlantic herring stock complex in Canadian waters consists primarily of fish caught in the New Brunswick (NB) weir fishery. The DFO does not regulate the catch of Atlantic herring in the NB weir fishery through any sort of quota. The NB weir fishery is a historical fishery with catches that have been more variable in recent years, but have totaled more than 30,000 mt of herring in past years. The TRAC Assessment incorporates 2+ Atlantic herring catch from the NB weir fishery, and all of it is assumed to come from the inshore component of the stock complex. Detailed information about catch in the NB weir fishery can be found in Section 4.4.6 of this document (p. 104).

It is also assumed that fish caught in the NB weir fishery are from the inshore component of the Atlantic herring resource that U.S. fishermen catch in the Gulf of Maine (and in Area 2 during the winter). In the past, when determining U.S. fishery specifications and TACs, managers have incorporated a catch of 20,000 mt from the NB weir fishery. However, Amendment 1 to the Herring FMP included provisions to allow for this assumption to be modified by the Herring PDT during the specification process, based on recent patterns and landings in the NB weir fishery.

In the risk assessment analysis that the Herring PDT has developed for assessing and comparing the TAC options, the average 2+ catch from the NB weir fishery from 1995-2008 is utilized. The average NB weir catch during this time period is assumed to come from the inshore component of the stock and is deducted from the ABC as inshore removals in all TAC scenarios that are evaluated in the risk assessment. The Herring PDT chose to apply 2+ catch for consistency with the TRAC assessment, which is based on 2+ biomass only. The mean was chosen because the mean represents the average expected value over the time series. The mean 2+ catch from the NB weir fishery from 1995-2008 was 16,300 mt.

The Herring Committee and Council examined recent trends in catch from the NB weir fishery and determined that for management uncertainty, the Canadian catch deduction would be **14,825 mt.** This represents the average 2+ landings from 1999-2008 when eliminating the highest year of the time series – 2007 – and the lowest year of the time series – 2008. The Council expects that this deduction will adequately account for NB weir catch during the 2010-2012 fishing years. Moreover, 2009 NB weir catch to date is about 3,143 mt (through September 28, 2009).

Note: For the purposes of simplifying the specification of OY and dividing OY into TACs for the four management areas, the deduction for Canadian catch was rounded to 14,800 mt.

5.3.2 State Waters Catch

The vast majority of the Atlantic herring resource is harvested in Federal waters. Catch by Federal permit holders that occurs in State waters is reported and counted against the TACs. Catch by state-only permit holders is monitored by the ASMFC and is not large enough to substantially affect management of the Federal fishery and the ability to remain under the TACs. The majority of Atlantic herring landings from State waters occurs in the State of Maine. During the 2007-2009 specifications process, a review of the ASMFC's State Compliance Reports for 2006 indicates that about 31,000 pounds (14 mt) of Atlantic herring were landed in CT from State waters only permit holders. With the exception of Maine, no other states reported landings of herring from state waters fisheries during 2006. According to ME DMR, 252 mt of Atlantic herring were landed by weirs and stop seines in Maine during the months of June – September 2007, with the majority of landings occurring during June. An additional 25 mt was landed by other gear types in the state of Maine (gillnets, hooks, pound nets) during 2006.

The Council has determined that at this time, closing the directed herring fishery when 95% of a TAC (sub-ACL) has been harvested (or 92% in areas with a research set-aside), establishing a large buffer between OFL and ABC, managing a 500 mt set aside for West of Cutler fixed gear fishermen, and the ASMFC's requirement that fixed gear fishermen must report through IVR (and therefore have catch counted against the TAC) reduces any management uncertainty associated with State waters landings to an insignificant amount. This is consistent with the Herring PDT's recommendations regarding potential deductions for State waters catch. As such, the Council recommends that an additional reduction in ABC to account for uncertainty related to state waters landings appears to be unnecessary when setting TACs for 2010-2012.

The non-federally permitted commercial landings in Area 1A are primarily from Maine fixed gear fishermen and a small number of seiners. Amendment 1 sets aside 500 metric tons of Atlantic Herring until November for fixed gear fishermen West of Cutler. The Commission's Amendment 2 to the Interstate FMP for Atlantic Herring requires fishermen East of Cutler to report *weekly* through the federal IVR system. The State of Maine is currently working to have fixed gear fishermen compliant with the IVR reporting requirement and regulations require fixed gear fishermen to report monthly. Non-federally permitted landings in Maine were only 178 metric tons in 2008 (Table 27). Given the above mentioned factors (set aside, current monthly and future weekly reporting of fixed gear landings, and small amount of fixed gear landings) there is a small chance that landings will go unreported. The landings that are missed are likely to be insignificantly small and unlikely to cause an overage of the TAC for Area 1A.

The only other management area with non-federally permitted commercial landings is Area 2. There were only 65 metric tons of non-federally permitted landings in states adjacent to Area 2 in 2008 (Table 27). Historically, the Area 2 TAC not been harvested other than during the 2009 fishing year. Given a an insignificant amount of non-federally permitted landings compared to a large 5% buffer (1,500 mt in 2009) decreasing the TAC is unnecessary to prevent an overage from non-federally permitted harvest.

5.3.3 Atlantic Herring Discards

The Herring Committee reviewed all available information regarding discards of Atlantic herring in the herring fishery and determined that no additional reduction is necessary to account for uncertainty related to herring discards at this time. Available information suggests that Atlantic herring discards in the herring fishery appear to be very low and largely insignificant relative to the landings in the fishery and the ability to prevent the TACs from being exceeded. Even without an additional deduction to account for discards as part of management uncertainty, it is likely that herring discards would be accounted for within the additional 5% of the TAC that remains available for incidental catch once the directed fishery in a management area closes.

- All three sources of herring discard information considered by the Herring PDT and Committee (observer data, VTR, and IVR) are generally consistent with each other and suggest that discard rates of Atlantic herring in the herring fishery are very low (see additional information below).
- Self-reported discard information through the VTRs are included in the catch-at-age matrix, and therefore the current assessment of Atlantic Herring.
- Any further deductions for discarding to account for management uncertainty would need to reflect concerns that discards of herring may increase above the levels that have been observed in recent years for the fishery, or concerns that discards are not being adequately documented through the current observer program and self-reporting
- The Council agrees that current management measures that allocate 5% of the TACs to account for incidental catch after the directed fishery closes will provide an adequate buffer for any increase in discards or un-documented discards occurring in the fishery at this time.

Discussion/Supporting Information

Atlantic herring discard rates from the most recent data collected through the NEFSC Observer Program were examined by the Herring PDT and the Committee. Table 53 summarizes observed Atlantic herring discards by gear type for 2007-2009 YTD and provides discard/kept ratios by gear type. Overall, observed discards of Atlantic herring in the herring fishery are very small and generally amount to less than 1% of the total Atlantic herring catch. Of all observed trips from 2007-2009, approximately 70% were reported to have no Atlantic herring discards. A complete summary of all species observed to be caught/discarded on these trips can be found in Section 4.4.4 of this document. Summary information is provided below following Table 53.

Table 53 Observed Kept and Discarded Atlantic Herring (Pounds and Rates) by Gear Type on Trips with More than 2,000 Pounds, 2007-2009 YTD

KEPT & DISCARD TOTAL WEIGHT OBSERVED (LBS)			
Pair Trawl (corrected for paired hauls)			
	2007	**2008**	**2009**
Atl Herring (K)	6,910,185.0	27,033,511.0	12,676,578.0
Atl Herring (D)	2,320.3	99,222.2	25,101.8
Midwater Trawl			
	2007	**2008**	**2009**
Atl Herring (K)	1,918,285.0	2,977,265.0	650,071.0
Atl Herring (D)	30,451.0	966.1	33,881.0
Purse Seine			
	2007	**2008**	**2009**
Atl Herring (K)	2,122,267.0	6,431,134.0	N/A
Atl Herring (D)	16,270.0	272,044.0	N/A
Bottom Trawl (Permit Cat A&B)			
	2007	2008	2009
Atl Herring (K)	230,607.0		185,235.0
Atl Herring (D)	2,584.0		0.4
KEPT & DISCARD RATES (LBS PER 1000 LBS KEPT HERRING)			
Pair Trawl (corrected for paired hauls)			
	2007	**2008**	**2009**
Atl Herring (K)	1,000.00	1,000.00	1,000.00
Alt Herring (D)	0.34	3.67	1.98
Midwater Trawl			
	2007	**2008**	**2009**
Atl Herring (K)	1,000.00	1,000.00	1,000.00
Atl Herring (D)	15.87	0.32	52.12
Purse Seine			
	2007	**2008**	**2009**
Atl Herring (K)	1,000.00	1,000.00	N/A
Atl Herring (D)	7.67	42.30	N/A
Bottom Trawl (Permit Cat A&B)			
	2007	**2008**	**2009**
Atl Herring (K)	1,000.00		1,000.00
Atl Herring (D)	11.21		0.00

When considering herring discards in the TAC-setting process, it is appropriate to examine discard rates for the fishery as a whole, since TACs are not set by gear type and the available quota is provided for the entire fishery, consistent with other measures that may restrict or limit fishing with a particular gear type (purse seine/fixed gear only area, for example). Table 54 summarizes Atlantic herring discard rates based on observer data for the fishery from 2007-2009 (all trips with 2,000 pounds or more Atlantic herring, 2009 data are complete through April 2009). Discard rates are presented as discard/kept ratios per 1,000 pounds of herring kept. Herring discard rates for the fishery are very low, especially considering the high-volume nature of the fishery. In 2008, when observer coverage was highest (close to 15% of all trips with 2,000 pounds or more herring), the observed discard rate was about 10 pounds of herring per 1,000 pounds kept, i.e., one percent (1%). Observed herring discard rates in 2007 and 2009 were less than 0.5%.

Table 54 Summary Table – Observed Atlantic Herring Discard Rates, 2007-2009 YTD

	2007	**2008**	**2009 (YTD through April)**
% Coverage (Obs. Trips/Total Trips)	4.3%	14.6%	13.3%
Pounds Herring Discarded	51,625.3	372,232.3	58,983.2
Pounds Herring Kept	11,181,344	36,441,910	13,511,884
D/K ratio (per 1,000 pounds herring kept)	4.62	10.21	4.37

Standardized Bycatch Reporting Methodology (SBRM)

The Omnibus Standardized Bycatch Reporting Methodology (SBRM) Amendment to the Council's FMPs specified that:

"*Once each year, the Science and Research Director will present to the Councils a report on catch and discards occurring in Northeast Region fisheries, as reported to the NEFOP by at-sea fisheries observers. This annual discard report will include: (1) The number of observer sea days scheduled for each fishery, by area and gear type, in each quarter; (2) the percent of total trips observed, by gear type, in each quarter; (3) the distribution of sea sampling trips by gear type and statistical area in each fishery; (4) the observed catch and discards of each species, by gear type and fishery, in each quarter; and (5) the observed catch and discards of each species, by gear type and fishery, in each statistical area*."

The NEFSC produced and presented an Annual Discard Report in February 2009, which included information for a 12-month period from July 2007 through June 2008 based on Observer Program data. As in the SBRM analysis of precision, the observer data were classified into fleets using geographical region, gear type, mesh size, access area, and trip category. Trips were classified into two broad geographical regions – New England and Mid-Atlantic – based upon the port: ports located from Maine to Rhode Island were grouped together to form the New England (NE) region and ports located in states from Connecticut southward comprised the Mid-Atlantic (MA) region. Gear type is based upon Northeast gear codes, and some gear codes were combined into a single category (e.g. midwater paired trawl and midwater single trawl).

The Annual Discard Report is a comprehensive summary of the data collected on observed trips by NEFSC trained at-sea observers. No discard estimation, resulting from an expansion of discard ratios, was performed for this report. Calculating discard to kept ratios using this report would not be appropriate because the data utilized to generate this report includes data from all hauls for which an observer was 'on-watch', including hauls where discard data were not collected due to incidental take sampling and trips with 'limited' sampling protocols.

The data presented in the Annual Discard Report has already been reported in the above section, although summarized differently. The NEFSC is currently working on updates to the tables presented in the Annual Discard Report.

Self-Reported Discard Data (VTRs and IVRs)

Herring harvesters are required to report discards in addition to landed catch through independent methods. The harvester fills out a hard copy report for each catch by trip (VTR) and is required to send in these reports monthly (NMFS Gloucester). Harvesters are also required to report weekly via telephone (IVR; NMFS Gloucester) the amount of herring caught (landed and discarded) from each management area.

VTR data has a lengthy processing period from the time the reports are sent in to when the data is entered into the database. However VTRs do give very specific information on catch; including species, amount caught, specific location, and disposition (catch or discarded) for each species encountered. The VTR system is more precise, allowing it to be used to formulate the Catch at Age matrix. As such, self-reported discard information through the VTRs are included in the Catch at Age matrix, and therefore the current assessment of Atlantic Herring. Further, at the end of the year, VTRs are used to measure performance of the fishery relative to the Area TACs. It should also be noted that the VTRs contain landings and discards for all fishermen who encounter Atlantic Herring, rather than just limited access permit holders.

The IVR system is an automated, phone-based reporting method initially created for quota monitoring dealer reporting. It was later modified to include Atlantic herring catch reports in response to the need for real-time quota monitoring. The main reason for utilizing the IVR system in the Atlantic herring fishery is to monitor the TAC limits set for the four federal management areas. As part of the herring FMP, each management area is annually assigned a TAC (in metric tons). Although harvesters are required to report catches with VTR forms, near real-time data is obtained through the IVR system allowing the TACs to be monitored. When the catch in a management area is projected to reach 95% of its specified TAC, the Regional Administrator enacts a closure for all directed herring fishing. Because this system records both landed catch and discards, both are used in determining the Area closures as a result of TAC achievement by management area. The IVR system only shows landings and discards for those vessels required to report though this system.

Data and comparisons between IVR and VTR landings, catch, and discards are presented in Table 55. Overall, self-reported discards are fairly low but with a moderate variability by year. Discard to Kept ratios form IVR and VTR systems are in fairly close agreement overall, ranging from 0.0 to 0.6% for the VTR and 0.0 to 0.4% for the IVR system. These ratios are similar to those reported by at-sea observers. It appears that the discard to kept ratios have been increasing. How much of that increase is due to an actual increase in discards versus improved reporting is unknown.

Data on self-reported discards by area is also presented in Table 56 and Table 57. Highest self-reported discard rates can be found in Area 2 in the VTR, and Area 2 and 3 in the IVR. It should be noted that VTRs overall show higher discard rates by area and year when compared to the IVR. This is in part due to the fact that the VTRs capture all encounters of Atlantic Herring, while the IVRs only capture discards from those vessels required to report using the system.

Table 55 VTR and IVR Self-Reported Estimates of Atlantic Herring Discards by Year (mt)

VTR	Management Area			
Year	Catch	Discards	landings	D/K
1999	110,800	55	110,745	0.000
2000	108,818	325	108,493	0.003
2001	120,025	551	119,474	0.005
2002	93,183	42	93,141	0.000
2003	102,558	31	102,527	0.000
2004	94,572	486	94,086	0.005
2005	93,497	303	93,194	0.003
2006	104,344	201	104,143	0.002
2007	82,841	56	82,785	0.001
2008	83,752	531	83,221	0.006
Average	98,177	281	97,896	0.003
StDev	11,992	212	11,972	0.002
95% confidence	2,558	45	2,553	0.000
Upper	100,734	326	100,450	0.003
Lower	95,619	235	95,343	0.002

IVR	Management Area			
Year	Catch	Discards	landings	D/K
2000	106,055	210	105,844	0.002
2001	123,216	430	122,785	0.004
2002	91,636	0	91,636	0.000
2003	101,594	4	101,590	0.000
2004	93,401	211	93,190	0.002
2005	96,234	135	96,099	0.001
2006	98,710	13	98,697	0.000
2007	78,103	45	78,058	0.001
2008	81,016	210	80,806	0.003
Average	96,663	140	96,523	0.001
StDev	13,450	143	13,370	0.001
95% confidence	3,024	32	3,006	0.000
Upper	99,687	172	99,529	0.002
Lower	93,639	108	93,517	0.001

Table 56 Atlantic Herring Self-Reported VTR Discards by Year and Management Area (mt)

VTR Discards	Management Area				
Year	1A	1B	2X	3X	Total
1999	11.96	0.17	40.48	2.03	54.63
2000	149.43	0.02	145.39	29.70	324.53
2001	339.35	1.87	186.74	23.26	551.22
2002	40.17	0.00	0.86	1.13	42.16
2003	23.12	0.00	1.94	5.56	30.62
2004	57.53	2.35	356.92	69.30	486.10
2005	87.21	0.00	194.64	20.88	302.73
2006	20.82	0.00	166.95	12.88	200.65
2007	4.86	0.00	47.39	3.65	55.90
2008	6.34	0.00	497.43	27.21	530.98
Total	740.80	4.41	1,638.72	195.60	2,579.53

Catch	Management Area				
Year	1A	1B	2X	3X	Total
1999	77,360	829	25,293	7,070	110,552
2000	60,874	5,699	26,923	15,321	108,818
2001	53,440	7,193	15,496	43,813	119,942
2002	60,142	3,764	11,237	18,040	93,183
2003	59,488	2,678	15,054	23,495	100,715
2004	60,021	4,642	11,570	18,194	94,427
2005	59,161	2,837	14,589	16,672	93,259
2006	60,984	6,755	18,510	16,769	103,019
2007	45,178	6,007	20,178	10,271	81,634
2008	40,390	7,551	22,495	13,144	83,580
Total	577,038	47,955	181,345	182,790	989,128

Landings	Management Area				
Year	1A	1B	2X	3X	Total
1999	77,349	829	25,252	7,068	110,497
2000	60,725	5,699	26,778	15,292	108,493
2001	53,101	7,191	15,309	43,790	119,391
2002	60,101	3,764	11,236	18,039	93,141
2003	59,465	2,678	15,052	23,490	100,684
2004	59,963	4,639	11,213	18,125	93,941
2005	59,074	2,837	14,394	16,652	92,956
2006	60,963	6,755	18,343	16,757	102,818
2007	45,173	6,007	20,131	10,267	81,578
2008	40,384	7,551	21,998	13,117	83,049
Total	576,297	47,950	179,706	182,595	986,549

D/K	Management Area				
Year	1A	1B	2X	3X	Average
1999	0.000	0.000	0.002	0.000	0.001
2000	0.002	0.000	0.005	0.002	0.002
2001	0.006	0.000	0.012	0.001	0.005
2002	0.001	0.000	0.000	0.000	0.000
2003	0.000	0.000	0.000	0.000	0.000
2004	0.001	0.001	0.032	0.004	0.009
2005	0.001	0.000	0.014	0.001	0.004
2006	0.000	0.000	0.009	0.001	0.003
2007	0.000	0.000	0.002	0.000	0.001
2008	0.000	0.000	0.023	0.002	0.006
Average	0.001	0.000	0.010	0.001	0.003

Table 57 Atlantic Herring Self-Reported IVR Discards by Year and Management Area (mt)

IVR Discards	Management Area				
YEAR	1A	1B	2	3	Total
2000	56.73	0.00	42.63	111.11	210.47
2001	340.82	18.14	0.00	71.20	430.17
2002	0.00	0.00	0.09	0.00	0.10
2003	2.08	0.82	0.21	0.46	3.57
2004	28.95	0.00	108.87	73.65	211.47
2005	12.80	1.74	28.12	92.29	134.95
2006	1.26	0.04	11.34	0.00	12.63
2007	0.80	0.00	44.35	0.21	45.36
2008	0.45	0.91	206.02	2.28	209.65
Total	443.97	21.64	536.31	351.21	1,353.13

Catch	Management Area				
Year	1A	1B	2X	3X	Total
2000	62,538	7,185	20,104	16,229	106,055
2001	59,559	8,886	17,160	37,611	123,216
2002	59,068	7,355	10,673	14,540	91,636
2003	61,508	5,271	13,833	20,982	101,594
2004	60,114	9,043	13,099	11,146	93,401
2005	61,104	7,873	14,228	13,029	96,234
2006	59,980	13,008	21,277	4,444	98,710
2007	46,852	6,859	14,763	9,629	78,103
2008	41,856	8,104	19,256	11,800	81,016
Total	512,578	73,584	144,393	139,409	869,964

Landings	Management Area				
Year	1A	1B	2X	3X	Total
2000	62,481	7,185	20,061	16,117	105,844
2001	59,218	8,868	17,160	37,540	122,785
2002	59,068	7,355	10,673	14,540	91,636
2003	61,506	5,270	13,833	20,981	101,590
2004	60,085	9,043	12,990	11,072	93,190
2005	61,091	7,872	14,200	12,936	96,099
2006	59,978	13,008	21,266	4,444	98,697
2007	46,851	6,859	14,719	9,629	78,058
2008	41,856	8,103	19,050	11,797	80,806
Total	512,134	73,562	143,952	139,058	868,706

D/K	Management Area				
Year	1A	1B	2X	3X	Average
2000	0.001	0.000	0.002	0.007	0.002
2001	0.006	0.002	0.000	0.002	0.002
2002	0.000	0.000	0.000	0.000	0.000
2003	0.000	0.000	0.000	0.000	0.000
2004	0.000	0.000	0.008	0.007	0.004
2005	0.000	0.000	0.002	0.007	0.002
2006	0.000	0.000	0.001	0.000	0.000
2007	0.000	0.000	0.003	0.000	0.001
2008	0.000	0.000	0.011	0.000	0.003
Average	0.001	0.000	0.003	0.003	0.002

5.4 SPECIFICATION OF BT, TALFF, JVP, IWP, AND RESERVE

5.4.1 Border Transfer (BT)

Specification of BT has remained at **4,000 mt** since the implementation of the Herring FMP, and there does not appear to be a need to change this for the 2010-2012 fishing years.

Table 58 Utilization of Border Transfer (mt)

YEAR	MT Utilized in BT
1994	2,456
1995	2,117
1996	3,690
1997	1,280
1998	1,093
1999	839
2000	1,546
2001	445
2002	688
2003	1,311
2004	184
2005	169
2006	653
2007	53
2008	0

5.4.2 Total Allowable Level of Foreign Fishing (TALFF)

Specification of TALFF for the 2010-2012 fishing years is proposed to remain at zero.

When some of the available optimum yield for the U.S. fishery has been allocated to TALFF in the past, much of the reason for the allocation was to provide incentives for foreign vessels to engage in joint venture processing (JVP) operations with U.S. vessels. TALFF was allocated to promote the utilization of any JVP operation and ensure that processing vessels participating in JVP operations could obtain fish when U.S. harvesting vessels may not be able to supply them for various reasons. This is no longer the case. The Council determined that both TALFF and JVP should be set at 0 mt for 2005-2009 primarily due to the potential for DAH and DAP to be realized by the domestic fishery, therefore maximizing benefits to the U.S. harvesting and shoreside processing sectors. Allowing any level of foreign fishing in U.S. waters could reduce opportunities for the U.S. harvesting fleet to maximize benefits from the available yield.

Moreover, the Council implemented a limited access program for the Atlantic herring fishery as part of Amendment 1 to the Herring FMP, intended to manage long-term harvesting capacity in the domestic fishery. The analysis to support the implementation of the limited access program demonstrated that sufficient harvesting capacity exists in the U.S. fishery to take more than the available yield, and this holds true especially in the upcoming fishing years with the proposed reductions in ABC and OY. A specification of zero for TALFF is consistent with the limited access program implemented in Amendment 1 as well as the proposed provision in Amendment 4 to the Herring FMP to eliminate the need to specify TALFF on an annual basis for the herring fishery in the future.

There has been no JVP activity for herring in recent years, so TALFF allocations to support these operations may no longer be necessary. Throughout the 1990s and into the 2000s, the domestic herring fishery has evolved and expanded to levels sufficient to better (and perhaps fully) utilize the U.S. OY, both in terms of harvesting and processing. Moreover, U.S. OY is proposed to be reduced from 145,000 mt to 91,200 mt for 2010-2012, which is well within the bounds of potential utilization for the domestic herring fleet.

5.4.3 Joint Venture Processing (JVP) and Internal Waters Processing (IWP)

Specification of JVP and IWP for the 2010-2012 fishing years is proposed to remain at zero.

The Council specified an allocation of 0 mt for joint venture processing during the 2005-2009 fishing years, which includes both internal waters processing (IWP) and joint ventures in the exclusive economic zone (EEZ). The ASMFC specification of 0 mt for IWP for these years was consistent with these recommendations. The Council recommended the 0 mt specification for JVP because assuming that market and fishery conditions are such that the OY for the herring fishery can be fully utilized, the Council believes that processing capacity in the U.S. fishery is adequate to utilize the available yield. This holds true especially in the upcoming fishing years with the proposed reductions in ABC and OY.

In a market-driven fishery like the herring fishery, processing capacity can determine the utilization of the available harvesting capacity. Estimates of potential processing capabilities provided in this document suggest that U.S. shoreside processing capacity would be sufficient to fully utilize the available yield from the fishery depending on market and fishery conditions. Additional processing by foreign operations could increase competition for product and consequently impact U.S. processing facilities. In earlier years, the Council encouraged the development of the domestic processing sector of the herring fishery but authorized JVP operations to better ensure the availability of a market for harvesting vessels. Now that additional processing facilities have developed and some have even expanded in recent years, specifications for the herring fishery should promote opportunities for these facilities and, to the extent possible, protect the economic investment that has been made in the U.S. herring fishery. The Herring FMP specifically states that "the underlying concept is that JV activity is only allowed until adequate U.S. processing capacity is developed."

A specification of zero for JVP and IWP is consistent with the proposed provision in Amendment 4 to the Herring FMP to eliminate the need to specify JVP and IWP on an annual basis for the herring fishery in the future. Moreover, U.S. OY is proposed to be reduced from

145,000 mt to 91,200 mt for 2010-2012, which is well within the bounds of potential utilization for the domestic processing fleet.

5.4.4 Reserve

Specification of a reserve for the 2010-2012 fishing years is proposed to remain at zero.

The Council is proposing in Amendment 4 to the Herring FMP to eliminate the specification of a reserve, and the specification of zero reserve for 2010-2012 is consistent with the measures developed in Amendment 4.

5.5 SPECIFICATION OF DAH AND DAP

The Herring FMP specifies that domestic annual harvest (DAH) will be set less than or equal to OY and will be composed of domestic annual processing (DAP), the total amount allocated to processing by foreign ships (JVPt), and the amount of herring that can be taken in U.S. waters and transferred to Canadian herring carriers for transshipment to Canada (BT).

DAH = DAP + JVPt + BT

5.5.1 Domestic Annual Harvesting (DAH)

For 2010-2012, DAH is proposed to be set equal to OY for the U.S. Atlantic herring fishery.

Discussion

When specifying DAH for the herring fishery, important considerations relate to the actual and potential capacity of the U.S. harvesting fleet. Recent fishery performance (landings) is also an important factor in this fishery, which has consistently under-utilized the total available OY. However, the OY specifications proposed for 2010-2012 could result in a reduction in catch for the U.S. fishery, so justifying DAH at a level that is higher than recent fishery performance does not appear to be necessary. The U.S. herring fishery landed an average **103,580 mt of herring from 1995-2008** (Table 59). The Herring FMP became effective during the 2001 fishing year, and since 2001, total landings in the U.S. fishery have decreased. Reduced TACs in Area 1A for the 2007 and 2008 fishing years drove total landings in the fishery down as well. U.S. herring landings from the most recent five-year period (2004-2008) averaged **91,801 mt**.

Table 59 Total U.S. Atlantic Herring Landings, 1995-2008

YEAR	TOTAL U.S. Herring Landings (MT)
1995	106,185
1996	117,275
1997	123,845
1998	108,428
1999	110,800
2000	108,818
2001	120,025
2002	93,183
2003	102,558
2004	94,572
2005	93,497
2006	104,344
2007	82,841
2008	83,752

Source: Vessel Trip Reports (VTRs), Herring SAFE Reports.

5.5.2 Domestic Annual Processing (DAP)

DAP is proposed to equal DAH minus 4,000 mt for BT during the 2010-2012 fishing years (87,200 mt).

Domestic Annual Processing (DAP) is defined in the Herring FMP as the amount of U.S. harvest that domestic processors will use, combined with the amount of the resource that will be sold as fresh fish (including bait). The Herring FMP specifies that DAP is a subset of DAH and is composed of estimates of production from U.S. shoreside and at-sea processors.

Processing, with respect to the Atlantic herring fishery, is defined in the regulations as *the preparation of Atlantic herring to render it suitable for human consumption, bait, commercial uses, industrial uses, or long-term storage, including but not limited to cooking, canning, roe extraction, smoking, salting, drying, freezing, or rendering into meat or oil.* The definition of processing does not include trucking and/or transporting fish.

In recent years, the domestic processing sector of the herring fishery has utilized more than the proposed DAP specification for 2010-2012 in recent years.

5.6 SPECIFICATION OF U.S. AT-SEA PROCESSING (USAP)

Specification of USAP for the 2010-2012 fishing years is proposed to be set at zero.

The Herring FMP states that "part of DAP may be allocated for at-sea processing by domestic vessels that exceed the vessel size limits (see section 3.6.6 of the Herring FMP). This allocation will be called the 'U.S. at-sea processing' (USAP) allocation. The term 'at-sea processing' refers to processing activities that occur in the Exclusive Economic Zone outside State waters. When determining this specification, the Council will consider the availability of other processing capacity, development of the fishery, status of the resource, and opportunities for vessels to enter the herring fishery."

The Council maintained a USAP specification of 20,000 mt (Areas 2/3 only) for the 2007-2009 fishing years. This served as a cap for USAP activities and is not a specific allocation to this processing sector. At the time of the 2007-2009 specifications, landings from Areas 2 and 3 – where USAP is authorized – were considerably lower than allocated TACs for each of the past several years. USAP could have provided an additional outlet for U.S. harvesters, particularly those who operate vessels that do not have refrigerated saltwater (RSW) systems to maintain catch quality for delivery to shoreside processors. Such vessels could offload product to USAP vessels near the fishing areas, increasing the benefits to the U.S. industry. This is consistent with one of the objectives of the Atlantic Herring FMP, as modified in Amendment 1: provide, to the extent practicable, controlled opportunities for fishermen and vessels in other mid-Atlantic and New England fisheries. Moreover, the specification of 20,000 mt for USAP did not restrict either the operation or the expansion of the shoreside processing facilities during the 2007-2009 fishing years.

When the 2007-2009 fishery specifications were developed, information about a new at-sea processing vessel was brought forward and represented something more substantial than a simple expression of intent to utilize the USAP allocation sometime in the future, as was the case in previous years. The Council supported the notion of providing this opportunity to U.S. harvesting vessels and fishery-related communities without compromising opportunities for domestic shoreside processors during the 2007-2009 fishing years. However, this operation never materialized, and none of the USAP specification was used during the 2007-2009 fishing years. It is similarly proposed that USAP be set at zero for the 2010-2012 fishing years.

5.7 SPECIFICATION OF MANAGEMENT AREA TACS, RELATED PROVISIONS, AND SET-ASIDES

The proposed management area TACs for 2010-2012 represent a considerable reduction from current and recent years (Table 60) The total available TAC (OY) is proposed to be reduced 37% from the 2009 level, and all of the proposed TACs are lower than 2009 levels, some by more than 40%. Given that the Atlantic herring stock complex is not overfished and overfishing is not occurring, the proposed TACs should provide even more assurance that the stock complex will not be overfished in 2010-2012, and that the risk of over-exploiting any of the individual spawning components has been further reduced.

Table 60 Proposed TACs – Comparison with Current/Recent Years

TAC ALLOCATIONS (METRIC TONS)								
	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010-2012 Proposed**	**% Reduction from 2009**
Area 1A	60,000	60,000	60,000	50,000	45,000	45,000	26,546	-41%
Area 1B	10,000	10,000	10,000	10,000	10,000	10,000	4,362	-56.4%
Area 2	50,000 (Reserve 70,000)	30,000	30,000	30,000	30,000	30,000	22,146	-26.2%
Area 3	60,000	50,000	50,000	55,000	60,000	60,000	38,146	-36.4%
TOTAL	250,000	150,000	150,000	145,000	145,000	145,000	91,200	-37.1%

The risk assessment in Section 6.1.1.2 of this document provides a basis for comparing alternatives and TAC options based on expected removals and relative exploitation of the inshore stock component. While there is no separate assessment of the inshore component (and therefore no biological reference points or overfishing thresholds), it is important to consider removals of the inshore stock relative to other options as well as historical removals and the no action alternative (status quo) because this is the smaller of the stock components and is the target of more fishing pressure than the offshore component. Although the herring resource is not overfished and fishing mortality is currently well below the threshold level, reductions in catch of the inshore component appear to necessary to further ensure that overfishing does not occur on this stock. This is why the Council is proposing reductions in the TACs for 2010-2012, particularly in the areas where the inshore component is taken.

- When compared to the no action alternative (2009 specifications), the results of the risk assessment (Section 6.1.1.2.2) indicate that the proposed action should greatly reduce relative exploitation of the inshore stock component. Median relative exploitation ratios for the no action alternative are 0.59 in 2010, 0.64 in 2011, and 0.71 in 2012; median relative exploitation ratios for the proposed action are 0.42 in 2010, 0.45 in 2011, and 0.50 in 2012. Fishing mortality on the inshore component under the proposed TACs is therefore expected to be considerably lower than the status quo.

- The comparison of options in Section 6.1.1.2.3 of this document indicates that the no action alternative is 1.75 times more likely than the proposed action to produce a relative exploitation ratio greater than 0.41, the approximate relative exploitation rate observed historically when the herring stock collapsed.
- Historical removals of the inshore stock component (1999-2008) are evaluated through the risk assessment approach in Appendix II of this document. The historical analysis indicates that, based on actual catch in the fishery, relative exploitation of the inshore stock component peaked at 0.62 in 1999, fluctuated around 0.47 from 2000-2007, and declined to 0.39 in 2008. Risk assessment of the proposed action assumes that all TACs will be fully utilized, so actual exploitation of the stock may be lower than what is predicted if the TACs are not fully utilized in all areas where inshore fish are taken (1A, 1B, and 2). Relative to historical removals, the proposed action should reduce removals and exploitation of the inshore stock component.
- Results from applying the simulation tool to herring catches by management area from 1999 through 2008 suggest that removals from the inshore component have been consistently higher than the exploitation rate associated with current F_{MSY} estimate for the entire stock. Differences in productivity among the individual subcomponents of the stock complex are not known and reference points (and therefore status determination criteria) are only available for the stock complex. Therefore, the relative exploitation ratio should be considered as an approximate target rather than a hard threshold. Overfishing levels for the inshore stock are simply unknown at this time, so the Council is taking a precautionary approach by reducing TACs and removals of the inshore component during 2010-2012.

The inputs for the risk assessment include biomass, fishing mortality, reference points, and projections that result from the 2009 TRAC updated assessment for Atlantic herring. There is considerable uncertainty related to the 2009 assessment (discussed in Section 5.2). Two aspects of the uncertainty appear to significantly influence the assessment results: 1) The assessment has a strong ‘retrospective pattern’ in which estimates of stock size are sequentially revised downward as new data are added to the assessment; and 2) Maximum sustainable yield reference points estimated from the biomass dynamics model are inconsistent with the age-based, stochastic projection; such that fishing at the current estimate of F_{MSY} is expected to maintain equilibrium biomass that is less than the current estimate of B_{MSY}. Therefore, the reference points themselves are uncertain. The ABC specification relates to the F_{MSY} fishing level reduced by a buffer to account for scientific uncertainty and ensure that fishing mortality on the stock complex will remain below the threshold level. The proposed ABC specification accounts for this, and additional reductions from ABC (to OY) and the proposed distribution of the TACs (including reductions in inshore removals) should provide more confidence that neither the stock nor any of its components will become overfished.

The economic and social impacts of the proposed TACs for 2010-2012 are expected to be quite substantial (Section 6.4). The Council determined that the benefits of reducing the risk of overfishing the inshore component outweighed the costs of the proposed action and is therefore recommending this conservative approach to setting TACs for 2010-2012. However, economic and social impacts were evaluated very carefully by the Council during its deliberations, and while more conservative approaches were considered during the development of the specifications, these options were not selected by the Council because of the potential to cause significant impacts on the herring fishery through the loss of revenues and fishing opportunities, and on the lobster fishery through the loss of bait. The Council considered the tradeoffs and determined that the reductions and impacts expected from the proposed action could be justified to assure that the stock components are managed conservatively and sustainably. The uncertainties associated with the stock assessment as well as the inputs to the risk assessment are too great at this time to justify larger reductions and greater economic impacts over the next three years. The proposed action is already conservative relative to the status quo and is expected to result in considerable impacts on the fishery.

ASMFC management measures will continue to provide additional benefits for the inshore stock component during 2010-2012. Landing restrictions on spawn herring are designed to conserve the stock by ensuring recruitment to the stock. Much of the management program is designed to move effort into the offshore areas where the TAC has not been fully harvested and the spawning component is thought to be strong. Atlantic herring schools are especially susceptible to fishing when they aggregate for spawning. While vulnerable, they are also most valuable during spawning because their fat content is at its peak. The economic incentives to harvest spawn herring are countered by conservation concerns for the status of the stock. Fishing on spawning herring not only results in high catch rates, but may also interfere with the spawning behavior of uncaught herring. There is a peak point at which spawn herring is acceptable to the market; spawn herring in the latter stages may not be fit for some markets. The ASMFC amendment defines specific measures designed to reduce the exploitation and disruption of spawning aggregations, while providing a limited opportunity to harvest herring during that time of the year. The benefits of the ASMFC spawning closures have not been factored into the risk assessment but are acknowledged by the Council as additional protection for the inshore stock component.

6.0 ANALYSIS OF ENVIRONMENTAL IMPACTS

6.1 IMPACTS ON ATLANTIC HERRING RESOURCE (BIOLOGICAL IMPACTS)

6.1.1 Atlantic Herring (Target Species)

General Summary: The impacts of the proposed action on the Atlantic herring resource as a target species are discussed below in two sections – (1) the impacts of the F_{MSY}-based catch level and the proposed ABC and (2) the impacts of the proposed management area TACs. The biological analyses provided below suggest that the impacts of the proposed action on the Atlantic herring resource will not be significant. While the biomass is projected to decline under the proposed action, the herring resource is not expected to decline substantially or into an overfished condition, and overfishing is not projected to occur. The impacts of the proposed action on herring are more positive than the impacts of the status quo or some of the other alternatives/options the Council considered during the development of the 2010-2012 specifications. The impacts of the TACs are evaluated through a risk assessment; risk is considered based on the likelihood of producing an exploitation rate on an individual stock component that may be higher than that associated with the overfishing threshold for the entire stock complex. Overall, the proposed TACs are associated with less risk than the no action alternative.

6.1.1.1 Impacts of F_{MSY} Based Fishing Level and ABC – Three-Year Projections

For the purposes of this specifications package, the F_{MSY}-based catch level for the Atlantic herring resource (U.S. and Canada) has been calculated. This specification will be renamed "OFL" with the implementation of Amendment 4 in 2011. To estimate the 2010 F_{MSY}-based catch, the Herring PDT applied the 2008 catch to the 2008 biomass estimate for the herring complex to estimate the 2009 starting biomass. The PDT then estimated a fishing mortality rate for 2009 based on the 2008 landings plus an additional 7,800 mt to account for the increased catch in Area 2. The projected F for 2009 is 0.16. Applying 0.16 to the estimated biomass in 2009 yields a projected biomass in 2010. F_{MSY} can then be applied to the 2010 biomass projection to derive an overfishing level (F_{MSY} x B) for 2010. The resulting F_{MSY}-based catch for 2010 (rounded) is 145,000 mt. Applying F_{MSY} for 2011 and 2012 produces values of 134,000 mt and 127,000 mt respectively (rounded, as recommended by the SSC). Recruitment for the stochastic projections were randomly chosen from empirical values between 1967 and 2008.

To characterize the potential impacts of the proposed specifications on the Atlantic herring resource, the Herring PDT ran short-term (three year) projections of fishing mortality and total stock biomass based on the F_{MSY}-based catch level and the various catch levels under the proposed action, other alternatives for ABC, as well as the no action alternative (Table 61). The no action alternative would maintain the current (2009) specifications, with a max catch equal to 194,000 mt and optimum yield equal to 145,000 mt, the sum of the 2009 management area TACs. The projections assume that the catch is fully utilized.

All scenarios among the OFL and ABC alternatives including the proposed action would result in a decline in biomass between 2009 and 2012. **A 7.4% decline in median biomass from 2009-2012 is estimated based on projections at the proposed ABC level for 2010-2012.** By contrast, no action ABC results in a 35% decrease in biomass, while ABC Alternative 1 (non-preferred) results in an 11% decline and ABC Alternative 2 (non-preferred) results in a 2% decline. The associated changes in fishing mortality are substantial for the no action ABC where F increases from 0.16 to 0.58 over the course of three years. Fishing mortality for the proposed ABC value increases slightly to 0.19. F projected under ABC Alternative 1 (non-preferred) increases in 2010 to 0.27 but returns to the 2009 level in the next two years. ABC Alternative 2 (non-preferred) shows little or no change in F. In each of these scenarios, above average recruitment would mitigate the decrease in biomass while below average recruitment would result in a greater decline.

Table 61 Three-Year Projections Based on 2010-2012 Proposed OFL, ABC, Non-Preferred Alternatives, and No Action Alternative

	Catch ('000 mt)			
	2009	**2010**	**2011**	**2012**
Proposed Action – OFL	92.1	145.0	134.0	127.0
Proposed Action – ABC	92.1	106.0	106.0	106.0
ABC – Alternative 1 (Non-Preferred)	92.1	145.0	90.0	90.0
ABC – Alternative 2 (Non-Preferred)	92.1	90.0	90.0	90.0
No Action -ABC	92.1	194.0	194.0	194.0
No Action-OY	92.1	145.0	145.0	145.0
	Projected Fishing Mortality Rate			
	2009	**2010**	**2011**	**2012**
Proposed Action – OFL	0.16	0.27	0.27	0.27
Proposed Action – ABC	0.16	0.19	0.19	0.19
ABC – Alternative 1	0.16	0.27	0.17	0.17
ABC – Alternative 2	0.16	0.16	0.16	0.15
No Action -ABC	0.16	0.38	0.46	0.58
No Action-OY	0.16	0.27	0.29	0.32
	Projected Biomass (median, '000 mt)			
	2009	**2010**	**2011**	**2012**
Proposed Action – OFL	620.2	598.8	551.8	509.8
Proposed Action – ABC	620.2	599.0	591.0	574.5
ABC – Alternative 1	620.2	599.0	551.6	553.1
ABC – Alternative 2	620.2	599.0	607.3	605.7
No Action -ABC	621.7	601.1	504.8	407.2
No Action-OY	620.2	599.0	551.8	498.9

6.1.1.2 Impacts of the Proposed TACs – Risk Assessment

Three of the objectives of the Atlantic herring fishery management program (see Section 1.2 of this document for all goals and objectives) are to:

- Harvest the Atlantic herring resource consistent with the definition of overfishing contained in the Herring FMP and prevent overfishing;
- Prevent the overfishing of discrete spawning components of Atlantic herring; and
- Avoid patterns of fishing mortality by age which adversely affect the age structure of the stock.

This analysis focuses on the impacts of the proposed TAC distributions on the individual spawning components of the herring stock complex, with particular attention to the inshore (Gulf of Maine) spawning component. The inshore component is considered to be the smaller stock component and is the focus of more fishing effort and recent concerns related to localized depletion (see Amendment 1 for more discussion). Therefore, the inshore component can be characterized, for the purposes of analysis, as the "limiting factor" in terms of allocating herring TACs to management areas such that the risk of overfishing individual stock components can be minimized. Canadian catch in the NB weir fishery also is considered in this analysis, as that catch is assumed to come entirely from the inshore component of the Atlantic herring stock complex.

The risk assessment evaluates relative risk associated with the OY/TAC alternatives/options by simulating removals from the inshore and offshore stock components across all reasonable mixing rate combinations and generating a relative exploitation rate, which can then be compared to the target exploitation rate for the entire stock complex. "Risk" is discussed in this analysis as it relates to the potential for fishing a stock component at a level that may be too high, i.e., higher than the overfishing threshold for the entire stock complex (see following sub-sections for more detailed discussion).

Atlantic sea herring complex is assessed as a combined Gulf of Maine and Nantucket shoals/Georges Bank unit stock. The inshore Gulf of Maine and offshore Georges Bank stock are segregated during spawning season, but mix during feeding and movement during the year. During the 2006 TRAC assessment, three approaches (commercial acoustic survey biomass estimates, NEFSC autumn survey swept biomass ratios, and morphometric) were used to estimate the proportions by spawning component (Table 62). TRAC 2006 concluded that each method was "equally valid and that the overall average be based on the unweighted average of each estimate." The mean of the three estimates is 17.667%.

Table 62 Inshore Component as a Percentage of Total Herring Stock Complex Estimated by Three Methods (TRAC 2006)

Method	Inshore component as percentage of total biomass
Acoustic Survey (biomass)	10%
Morphometrics (numbers)	13%
NEFSC area swept biomass	30%

The Herring PDT applied a risk assessment simulation to historical landings by management area for 1999-2008 to assess removals from the inshore component of the stock (see Appendix II for more information).

6.1.1.2.1 Risk Assessment Methodology and Model Inputs

The Herring PDT's risk analysis uses Monte Carlo simulation to assess the amount of inshore removals, the ratio of inshore removals to inshore biomass, and the size of the inshore biomass given uncertainty in the size of the inshore component and the monthly landings by management area. Model inputs include monthly landings as proportion of total landings by month within each management area. The stock mixing percentages, given as inshore biomass as a percentage of total stock by month and area, are shown in Table 2. The pop mixing rate was randomly drawn from a triangular distribution with the minimum set to 0.10, maximum set to 0.30, and the mode set to 0.13. This gives an average percentage of 0.17667 and a median percentage of 0.13. The summer mixing rate was drawn from a uniform distribution with minimum value set at 0.2 and maximum value set at 0.8. This gives a mean and median summer mixing percentage at 0.5 (Table 63).

Table 63 Mixing Percentages (Inshore Component as Percent of Total) by Month and Area

Month	Area 1A	Area 1B	Area 2	Area 3
January	100%	Pop mixing	Pop mixing	0%
February	100%	Pop mixing	Pop mixing	0%
March	100%	Pop mixing	Pop mixing	0%
April	Summer mix	Pop mixing	0%	0%
May	Summer mix	Pop mixing	0%	0%
June	Summer mix	Pop mixing	0%	0%
July	Summer mix	Pop mixing	0%	0%
August	100%	Pop mixing	Pop mixing	0%
September	100%	Pop mixing	Pop mixing	0%
October	100%	Pop mixing	Pop mixing	0%
November	100%	Pop mixing	Pop mixing	0%
December	100%	Pop mixing	Pop mixing	0%

**Pop mixing is a random draw from the triangular distribution and represents the ratio of inshore biomass to total biomass. The summer mix is a number randomly drawn from a uniform distribution and represents mixing when the components are migrating between areas. Area 3 fish are assumed to be all offshore fish.*

Year-specific total stock biomass (2010-2012) was taken from projections from 2009 terminal year abundance at age from the 2009 TRAC assessment with fishing mortality set at F_{MSY}. These projections were provided to the Council's Scientific and Statistical Committee (SSC) and partially contributed to the setting of the F_{MSY}-based catch (OFL) and ABC. The projected age 2+ January total stock biomass and projected catch are shown in Table 64. The inshore biomass was simulated by applying the population mixing rate value to the total stock biomass.

Table 64 Projected Age 2^+ January 1 Total Stock Biomass and Catch at F_{MSY}

Year	Projected 2+ January 1 biomass (mt)	Projected catch (mt) at F_{MSY}
2010	597,789	144,996
2011	548,950	134,493
2012	505,669	126,996

**Catch at F_{MSY} defines the overfishing level.*

Canadian (NB weir fishery) age 2+ landings are simulated using a random draw from the 1995-2008 time series. This 1995-2008 period represents a recent time when Canadian landings appear to fluctuate without trend. Landings were generally higher in the 1984-1994 period. Summary statistics for the Canadian catch are shown in Table 65.

Table 65 Summary Statistics for Canada's New Brunswick 2^+ catch (mt) from 1995-2008

Minimum	25th quantile	median	mean	75th quantile	maximum
6,068	11,690	17,110	16,330	20,170	30,100

The risk analysis model also uses monthly landings by management area as a proportion of total landings by management area as an input (Table 66). The risk assessment simulates removals from the fishery using assumptions about catches by month in management areas 1A, 1B, and 2 (the areas where inshore fish are taken). Historical (1995-2008) monthly catch proportions were used to simulate catch from Areas 1B and 2. VTR data were queried to derive monthly catches within each year, and the monthly catches were divided by the total VTR catch from that same year. An average for each month across all years from 1995-2008 was then calculated and applied to catches in Areas 1B and 2.

To simulate monthly catch in Area 1A, the risk assessment applies the most recent information (2009) about the distribution of 1A catch based on ASMFC management measures. The 2009 Area 1A TAC was allocated through seasonal quotas with no landings allowed before June 1. After June 1, Area 1A TAC was distributed with 72.8% available from June 1 – September 30 and 27.2% available from October 1 – December 31. The available catch was then allocated to those months based on average monthly proportions from 1995-2008.

Uncertainty is simulated by drawing monthly proportions for each management area from a multinomial distribution. Effective sample size is an input parameter and controls the amount of uncertainty in the monthly proportions. The Herring PDT used year-specific observed landings by management area and set the effective sample size to 10,000 so that the distribution of simulated landings by month and area match the monthly proportions inputs to the simulation.

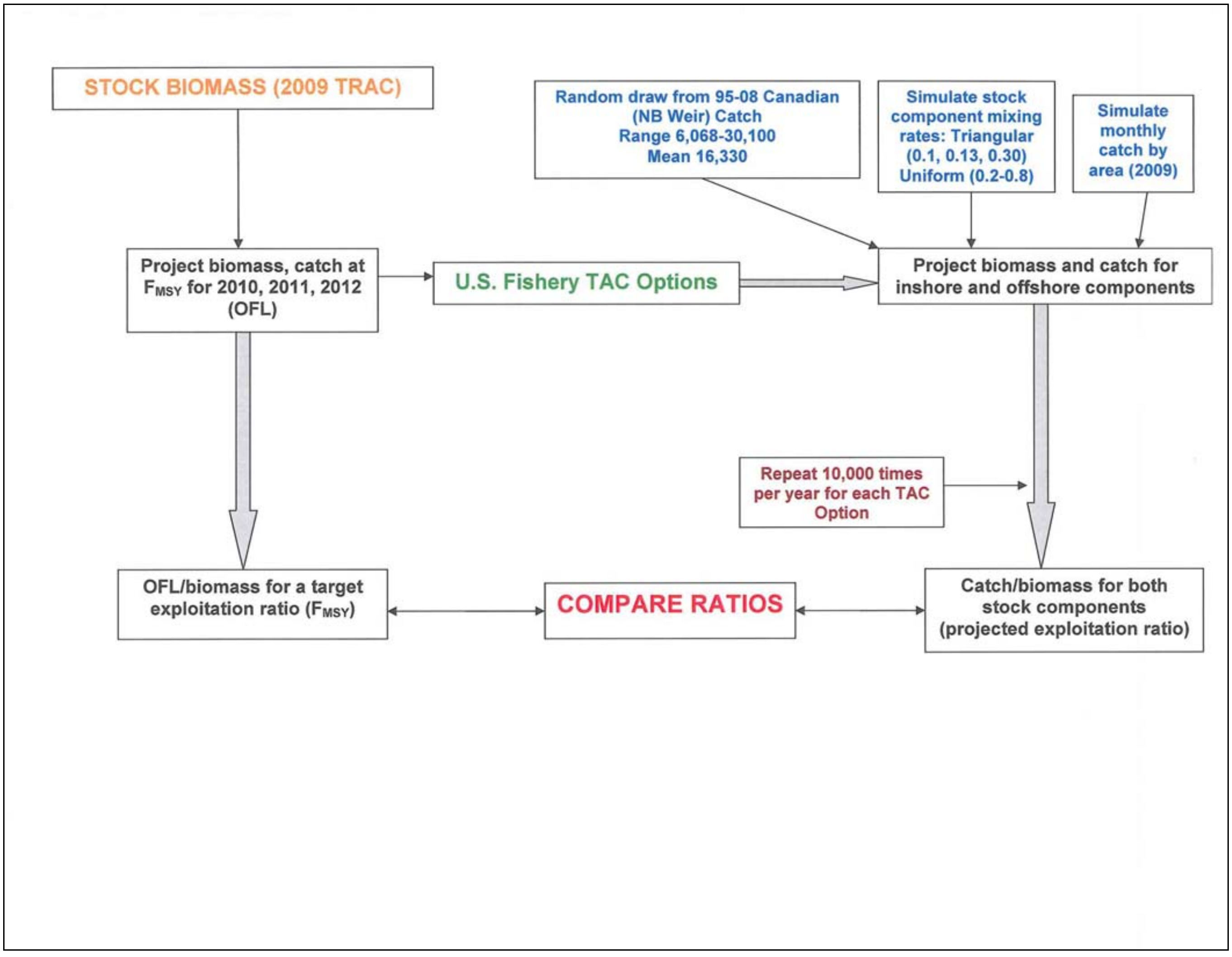
Table 66 Landings as Proportion of Total Landings by Month and Area Used in the Risk Assessment Simulation

Options	Area	Jan	Feb	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
No Action 1, 2, 2A, 3*	Area 1A			None			0.09	0.23	0.28	0.02	0.19	0.19	None
	Area 1B	0.17	0.01	0.01	0.01	0.04	0.04	0.04	0.07	0.06	0.03	0.34	0.18
	Area 2	0.297	0.267	0.293	0.022	0.007	0.001	0.005	0.004	0.012	0.004	0.018	0.07
4A, 4B, 6	Area 1A			None		0.333	0.333	0.333			None		
	Area 1B	0.17	0.01	0.01	0.01	0.04	0.04	0.04	0.07	0.06	0.03	0.34	0.18
	Area 2	0.297	0.267	0.293	0.022	0.007	0.001	0.005	0.004	0.012	0.004	0.018	0.07
5	Area 1A				None			0.4	0.3	0.3		None	
	Area 1B	0.17	0.01	0.01	0.01	0.04	0.04	0.04	0.07	0.06	0.03	0.34	0.18
	Area 2	0.297	0.267	0.293	0.022	0.007	0.001	0.005	0.004	0.012	0.004	0.018	0.07

**Note: Analysis of the Proposed Action applies the same proportion of landings by month and area as the No Action alternative and Options 1, 2, 2A, and 3.*

For each iteration, a single value of the population mixing rate is randomly drawn from the triangular distribution, and a single value of the summer mixing rate is randomly drawn from the uniform distribution. The summer and population mixing rates are independent of each other. These mixing rates were applied to landings taken from month-area combination shown in Table 63 to apportion the landings to the inshore and offshore components of the stock. The population mixing rate is also applied to the age 2^+ January stock biomass to provide an estimate of the inshore biomass. A ratio of inshore landings over total January 1 inshore biomass is calculated. Each year within an option consists of 10,000 iterations (Figure 27).

Figure 27 Flow Chart – Herring PDT Risk Assessment Methodology



Note: The F_{MSY}-based catch is referred to as the "OFL" in the risk assessment analysis and will be specified as the OFL upon the implementation of Amendment 4 in 2011.

The ratio of F_{MSY}-based catch (OFL) to January total biomass was used as a proxy for a target exploitation rate for the inshore component and offshore component because it is based on F_{MSY} for the stock complex. While there is no separate assessment for the inshore and offshore stock components, and therefore no separate reference points, the F_{MSY} reference point for the stock complex is a reasonable basis for comparison to evaluate risk associated with overfishing the stock components. While F_{MSY} may vary to some degree between stock components, the differences are not thought to be extremely significant. To provide some perspective about how the alternatives and options considered in the specifications compare with exploitation rates of other Northwest Atlantic Herring stocks, the Herring PDT examined the available information. Similar to Gavaris (2003), ICES and DFO fishing mortality reference levels are presented in Table 67. Fishing mortality was converted to exploitation rates in the table since exploitation rates are being utilized in the risk assessment (following Ricker, 1975; as a Type 2 fishery with M=0.2 for consistency).

As can be seen in Table 67, exploitation rates set for the majority of herring stocks lie in the 0.15 to 0.25 range. Notable exceptions to this include the Gulf of Riga (0.30) and ages 0-1 for Sub-area IV, Div VIId and Div IIIa (0.10). Given the current F_{MSY} for this complex (F=0.27 or 0.24 exploitation), setting exploitation for the inshore component between 0.24 and 0.28 could be viewed as risk-neutral if the assumed productivity of this subcomponent is higher then most other herring stocks in the NW Atlantic.

Table 67 Summary of Fishing Mortality Reference Points for Northwest Atlantic Herring Stocks

Herring Stock	F Reference Level	Exploitation Rate
U.S.		
GOM/GB	0.27	0.24
ICES		
Norwegian spring spawners	0.15	0.13
Icelandic summer spawners	0.22	0.18
Sub-area IV, Div VIId and Div IIIa (autumn-spawners)	$F_{ages\ 0\text{-}1}$ 0.12	0.10
	$F_{ages\ 2\text{-}6}$ 0.25	0.20
Div VIa (South) and VIIb,c	0.22	0.18
Sub-div 25-29 (including Gulf of Riga) and 32	0.17	0.14
Gulf of Riga	0.40	0.30
Sub-div 30, Bothnian Sea	0.21	0.17
Baltic Sea	0.19	0.16
Baltic South Western	0.25	0.20
DFO		
Gulf of St. Lawrence (Spring)	0.35	0.27
Gulf of St. Lawrence (fall)	0.32	0.25
4WX	not set	0.15*

**A 15% exploitation rate (average) is used to indicate stock health.*

6.1.1.2.2 Results (for Proposed Action and Non-Preferred Alternatives/Options)

The Proposed Action is summarized in Table 68. The non-preferred management alternatives/options and no action alternative are summarized in Table 69.

To present the results of the risk assessment and provide a basis for evaluation, the ratio of F_{MSY}-based catch (OFL) to January total biomass was used as a proxy for a target exploitation rate for the inshore component and offshore component. The F_{MSY}-based catch, ABC, total TAC/U.S. OY, projected January 1 stock biomass, and OFL:January biomass ratio for the proposed action and the non-preferred alternatives/options are shown in Table 70. Note that this ratio does not account for uncertainty in the stock assessment or in the projection. Stock biomass is the median outcome from the projection. Uncertainty in terminal year stock size or retrospective patterns is not accounted for in these simulations.

Although the ratio of F_{MSY}-based catch to January total biomass is used to estimate catch for the subcomponents that is consistent with Stock F_{MSY}, it is *not* a reference point. Productivity may differ between the inshore component and offshore components of the stock, although F_{MSY} values are likely to be within a range of 0.2 to 0.3 common for many herring stocks (see previous discussion and Table 67 for more information).

For each iteration of the simulation, the ratios of inshore catch to inshore biomass and offshore catch to offshore biomass were calculated, and the distribution of these ratios was compared to the F_{MSY} exploitation rate (0.24-0.25). Note that the inshore biomass for each year is function of the total projected biomass from the assessment as well as the mixing rates. For all options, these values differ only by random variation in the mixing rates. Total biomass is projected to decline in 2011 and 2012 (Table 70), and both the inshore and offshore biomass proportionally decline in 2011 and 2012.

Removals from previous years (e.g., 2010) do not impact starting January biomass in subsequent years, which is based on the projected biomass and assumption that F is not exceeded. This assumption is safe when catch to biomass ratios are approximately equal to the target fishing mortality, but the assumption is unreliable when catch to biomass ratios are substantially above F_{MSY} used in the projections.

For purposes of this analysis, a large effective sample size was used in the random draws from the multinomial distribution, so that sampled monthly proportion of landings by area were very close to input values (Table 66). Note that in some options, flexibility exists in terms changing the distribution of the monthly landings in Area 1A without impacting the risk analysis. For example, catches in May, June, and July can be distributed in any proportions within those three months under Options 4A, 4B, and 6 (but not transferred to January-April or August-December). Similarly, catches from August-December can be redistributed through the same period without impacting the analysis. Quotas for Area 1A, therefore, can be assigned to periods – May-July or August-December – rather than on a monthly basis in these options. However, underages in May-July quota can not be shifted to the August-December period without impacting removals on the inshore stock.

Area 1B catch can be re-allocated to any month within Area 1B without impacting the analysis. For Area 2, monthly catches from the January-March and August-December period can be re-allocated anywhere within these two periods without changing the amount of removals from the inshore stock. Area 2 landings from April-July, however, are assigned to the inshore stocks.

Table 68 Landings (mt) by Area, F_{MSY}-Based Catch (OFL), ABC and Projected 2+ January 1 Total Stock Biomass for the Proposed Action

	YEAR	Landings by area (mt)				All Areas Combined		Jan 1 biomass
		Area 1A	Area 1B	Area 2	Area 3	OFL	OY	
PROPOSED ACTION	2010	26,546	4,362	22,146	38,146	144,996	91,200	597,789
	2011	26,546	4,362	22,146	38,146	134,493	91,200	597,789
	2012	26,546	4,362	22,146	38,146	126,996	91,200	548,950

Table 69 Landings (mt) by Area, F_{MSY}-Based Catch (OFL), ABC and Projected 2+ January 1 Total Stock Biomass for Non-Preferred Alternatives/Options

			Landings by area (mt)				All Areas Combined		Biomass
option	alternative	year	Area 1A	Area 1B	Area 2	Area 3	OFL	OY	Jan 1 biomass
option 1	Alt. 1	2010	76,000	6,500	24,100	23,600	144,996	130,200	597,789
	Alt. 2	2010	43,900	3,700	13,900	13,700	144,996	75,200	597,789
	Alt. 1	2011	40,313	3,398	12,764	18,725	134,493	75,200	548,950
	Alt. 1	2012	37,135	3,130	11,758	23,177	126,996	75,200	505,669
option 2	Alt. 1	2010	31,200	5,200	67,700	26,100	144,996	130,200	597,789
	Alt. 2	2010	18,000	3,000	39,100	15,100	144,996	75,200	597,789
	Alt. 1	2011	16,529	2,755	35,906	20,010	134,493	75,200	548,950
	Alt. 1	2012	15,226	2,538	33,075	24,361	126,996	75,200	505,669
option 2A	Alt. 1	2010	45,400	7,600	37,800	37,800	144,996	130,200	597,789
	Alt. 2	2010	26,000	4,300	21,700	21,700	144,996	75,200	597,789
	Alt. 1	2011	23,876	3,949	19,927	19,927	134,493	75,200	548,950
	Alt. 1	2012	21,993	3,637	18,356	18,356	126,996	75,200	505,669
option 3	Alt. 1	2010	40,400	9,000	27,000	53,800	144,996	130,200	597,789
	Alt. 2	2010	23,300	5,200	15,600	31,100	144,996	75,200	597,789
	Alt. 1	2011	21,396	4,775	14,325	34,703	134,493	75,200	548,950
	Alt. 1	2012	19,709	4,399	13,196	37,896	126,996	75,200	505,669
option 4A	Alt. 1	2010	19,771	8,593	7,812	94,024	144,996	130,200	597,789
	Alt. 2	2010	11,419	4,963	4,512	54,306	144,996	75,200	597,789
	Alt. 1	2011	10,486	4,558	4,143	56,013	134,493	75,200	548,950
	Alt. 1	2012	9,659	4,198	3,817	57,526	126,996	75,200	505,669
option 4B	Alt. 1	2010	32,778	8,593	7,812	81,017	144,996	130,200	597,789
	Alt. 2	2010	18,931	4,963	4,512	46,794	144,996	75,200	597,789
	Alt. 1	2011	16,000	4,500	4,000	50,700	134,493	75,200	548,950
	Alt. 1	2012	13,000	3,500	4,000	54,700	126,996	75,200	505,669
option 5	Alt. 1	2010	11,197	8,723	52,080	58,200	144,996	130,200	597,789
	Alt. 2	2010	6,467	5,038	30,080	33,615	144,996	75,200	597,789
	Alt. 1	2011	5,000	4,500	26,000	39,700	134,493	75,200	548,950
	Alt. 1	2012	4,000	4,000	24,000	43,200	126,996	75,200	505,669
Option 6	Alt. 1	2010	17,690	8,854	17,707	85,949	144,996	130,200	597,789
	Alt. 2	2010	10,217	5,114	10,227	49,642	144,996	75,200	597,789
	Alt. 1	2011	8,500	4,500	8,500	53,700	134,493	75,200	548,950
	Alt. 1	2012	7,000	3,500	7,000	57,700	126,996	75,200	505,669
No Action		2010	45,000	10,000	30,000	60,000	144,996	145000	597,789
		2011	45,000	10,000	30,000	60,000	134,493	145000	548,950
		2012	45,000	10,000	30,000	60,000	126,996	145000	505,669

Table 70 F_{MSY}-Based Catch (OFL), ABC, Total TAC/OY, Projected Total Stock Biomass, and Ratio of F_{MSY}-Based Catch to Stock Biomass

Options	Alternative	Year	F_{MSY} Catch (mt)	ABC (mt)	Total TAC/OY (mt)	Biomass (mt)	Target F_{MSY} Catch:Biomass
Proposed Action	**N/A**	**2010**	**144,996**	**106,000**	**91,200**	**597,789**	**0.24**
		2011	**134,493**	**106,000**	**91,200**	**548,950**	**0.25**
		2012	**126,996**	**106,000**	**91,200**	**505,669**	**0.25**
Non-Preferred options*	Alt. 1	2010	144,996	145,000	130,200	597,789	0.24
	Alt. 2	2010	144,996	90,000	75,200	597,789	0.24
	Alt. 1	2011	134,493	90,000	75,200	548,950	0.25
	Alt. 1	2012	126,996	90,000	75,200	505,669	0.25

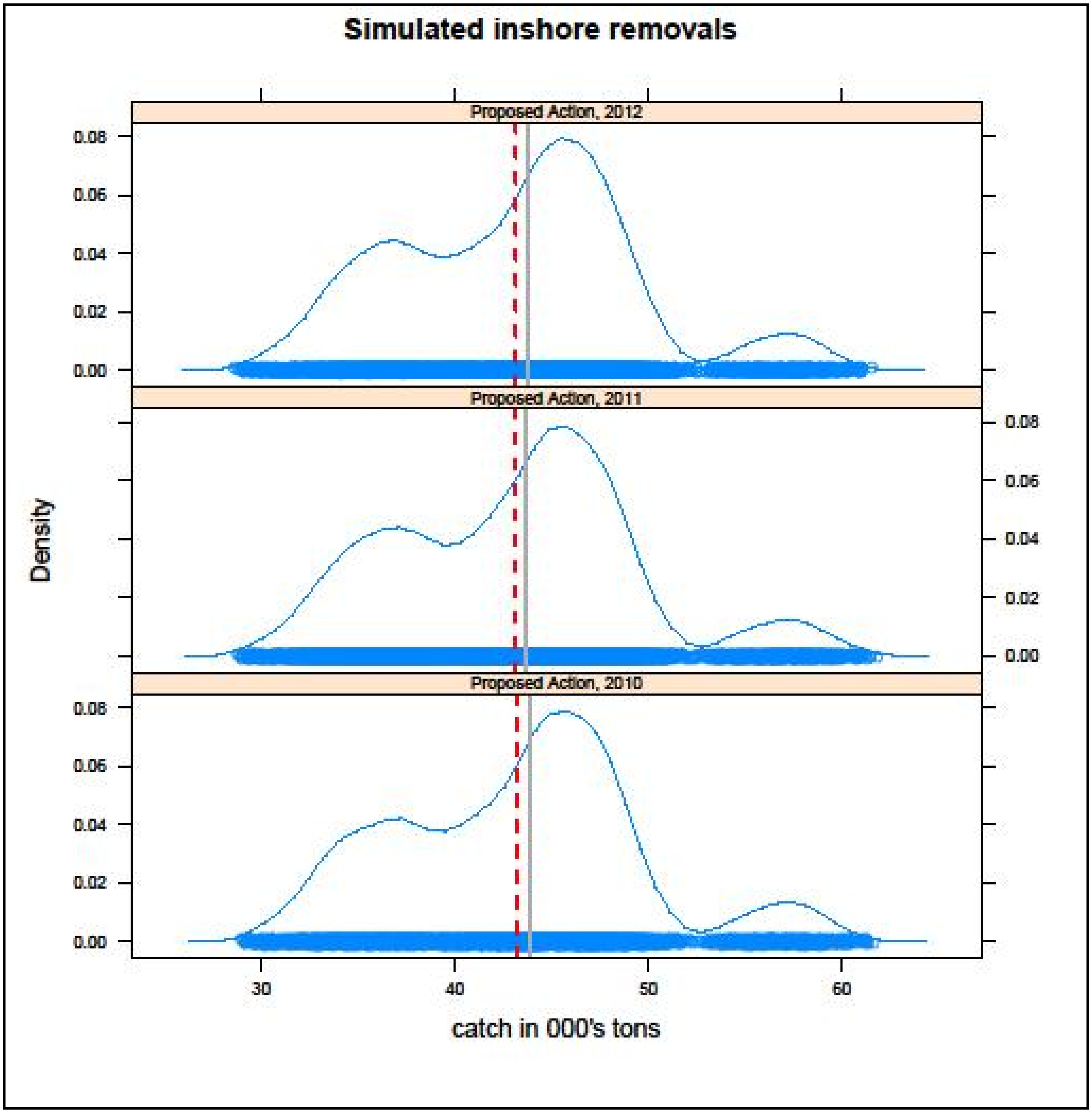
**No Action alternative specifies ABC at 194,000 mt and OY at 145,000 mt.*

Figure 28 – Figure 32 illustrate the results of the risk assessment simulation with respect to:

- Removals of the inshore component (Figure 28);
- Relative exploitation of the inshore component (simulated catch/inshore biomass, Figure 29);
- Biomass of the inshore component (Figure 30);
- Removals of the offshore component (Figure 31); and
- Relative exploitation of the offshore component (simulated catch/offshore biomass, Figure 32).

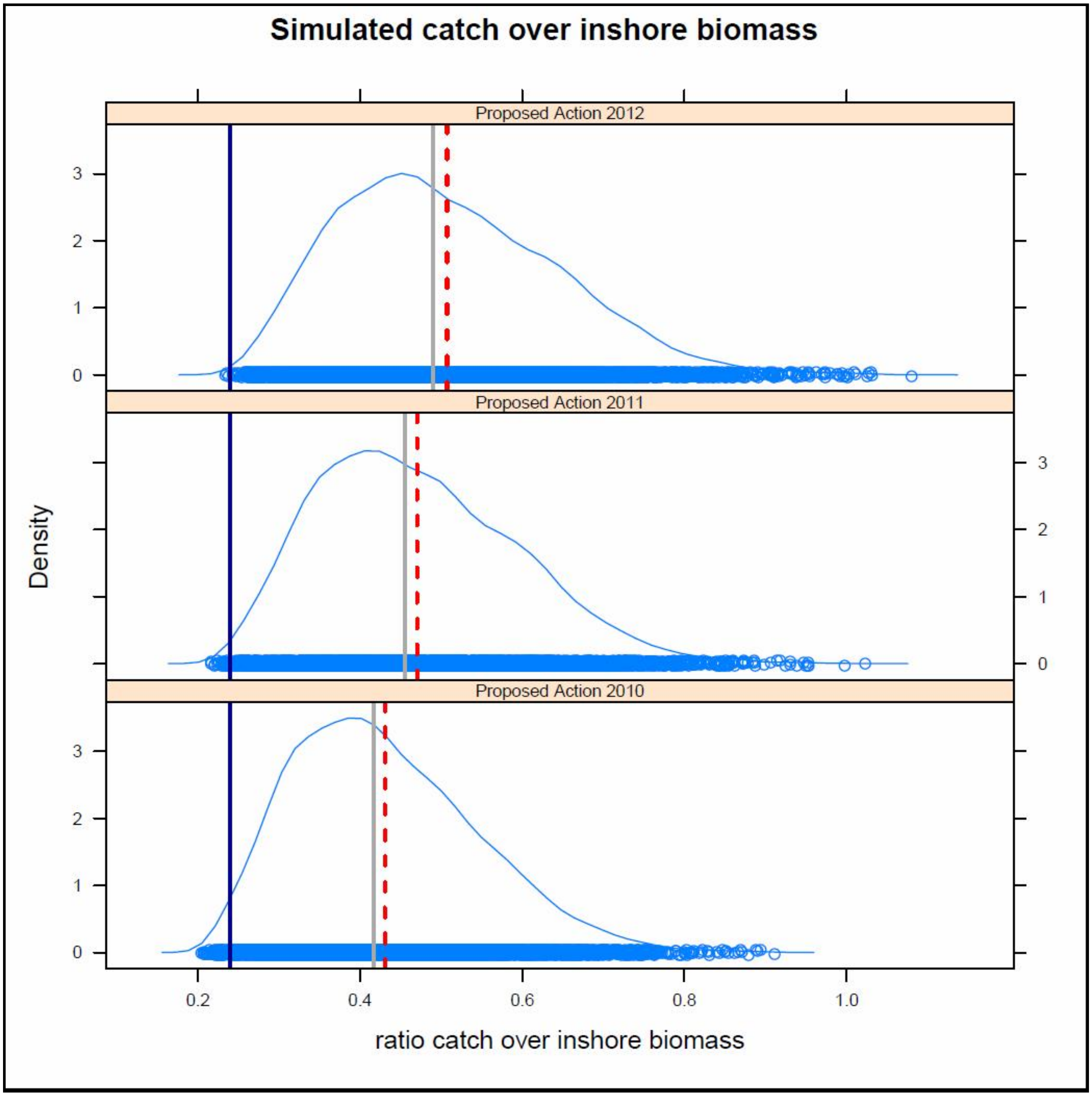
Figure 33 – Figure 41 illustrate the results of the risk assessment simulation with respect to exploitation rates for the inshore stock component under each of the non-preferred options. Complete results for the non-preferred options (all figures) can be found in Appendix III of this document.

Figure 28 Risk Assessment Results for Proposed Action – Simulated Removals of Inshore Component



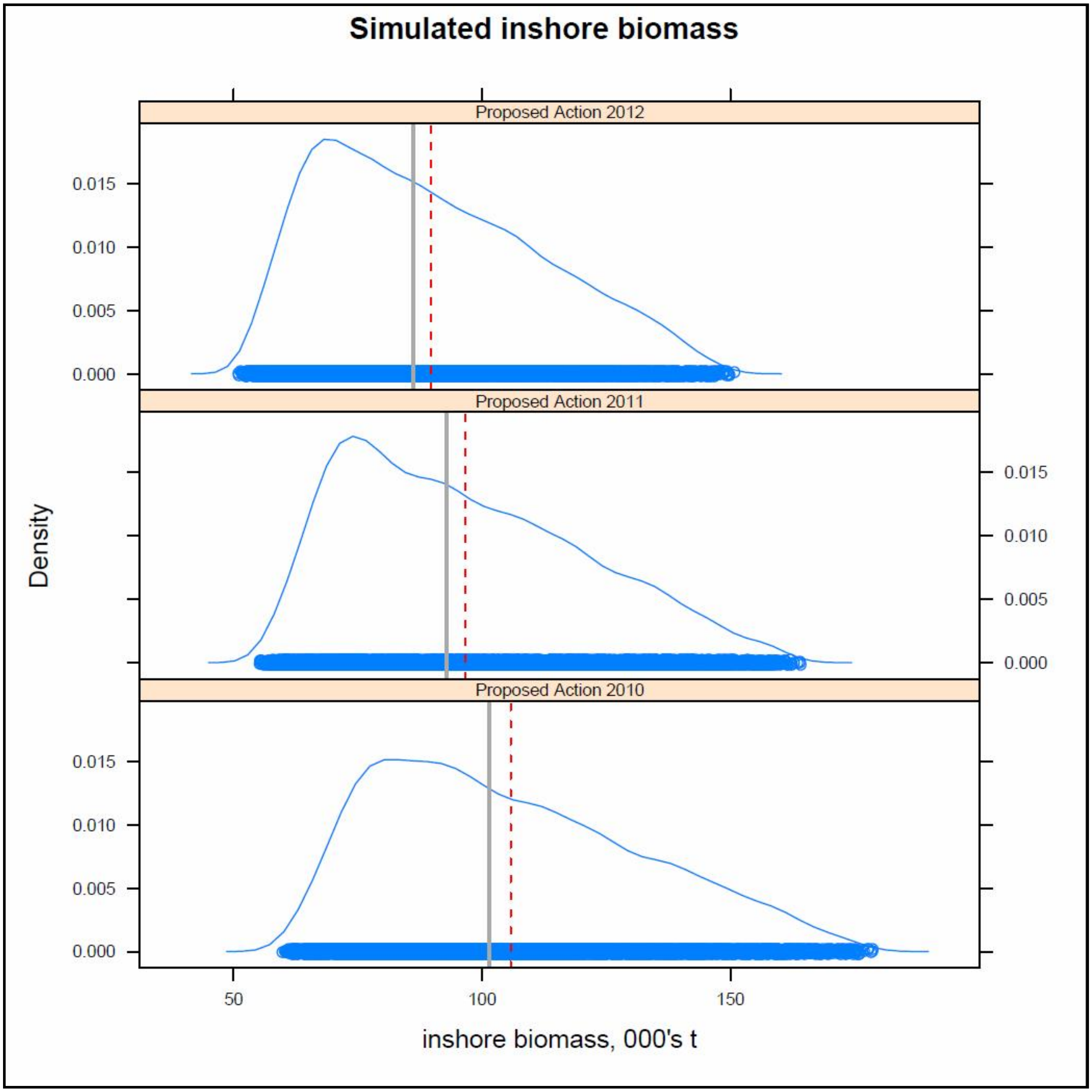
Dashed line is mean removals resulting from the simulation.
Lighter straight line is median removals resulting from the simulation.

Figure 29 Risk Assessment Results for Proposed Action –Simulated Catch/Inshore Biomass (Relative Exploitation)



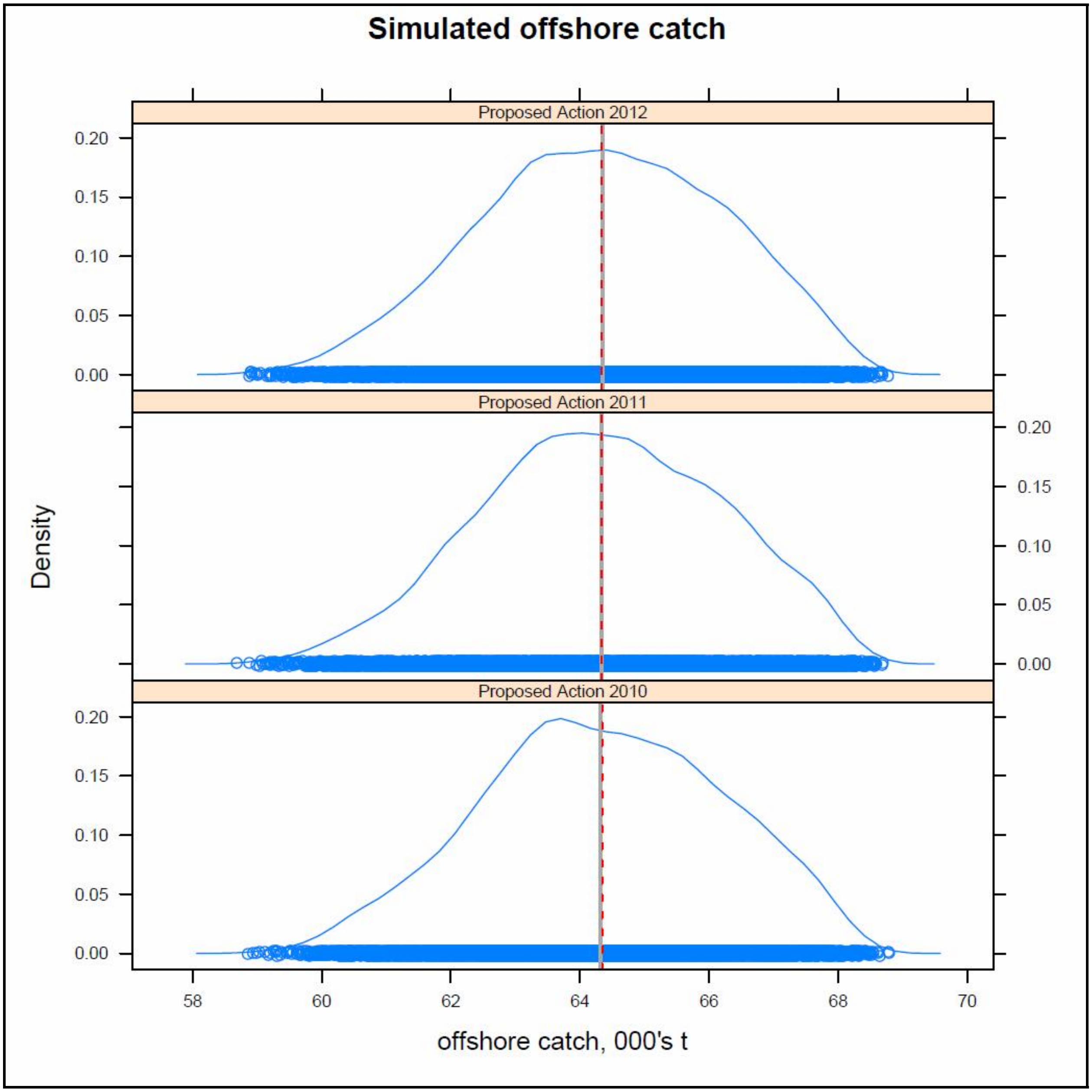
Darker straight line represents exploitation rate of 0.24.
Dashed line is mean exploitation rate resulting from the simulation.
Lighter straight line is the median exploitation rate resulting from the simulation.

Figure 30 Risk Assessment Results for Proposed Action –Simulated Biomass of Inshore Component



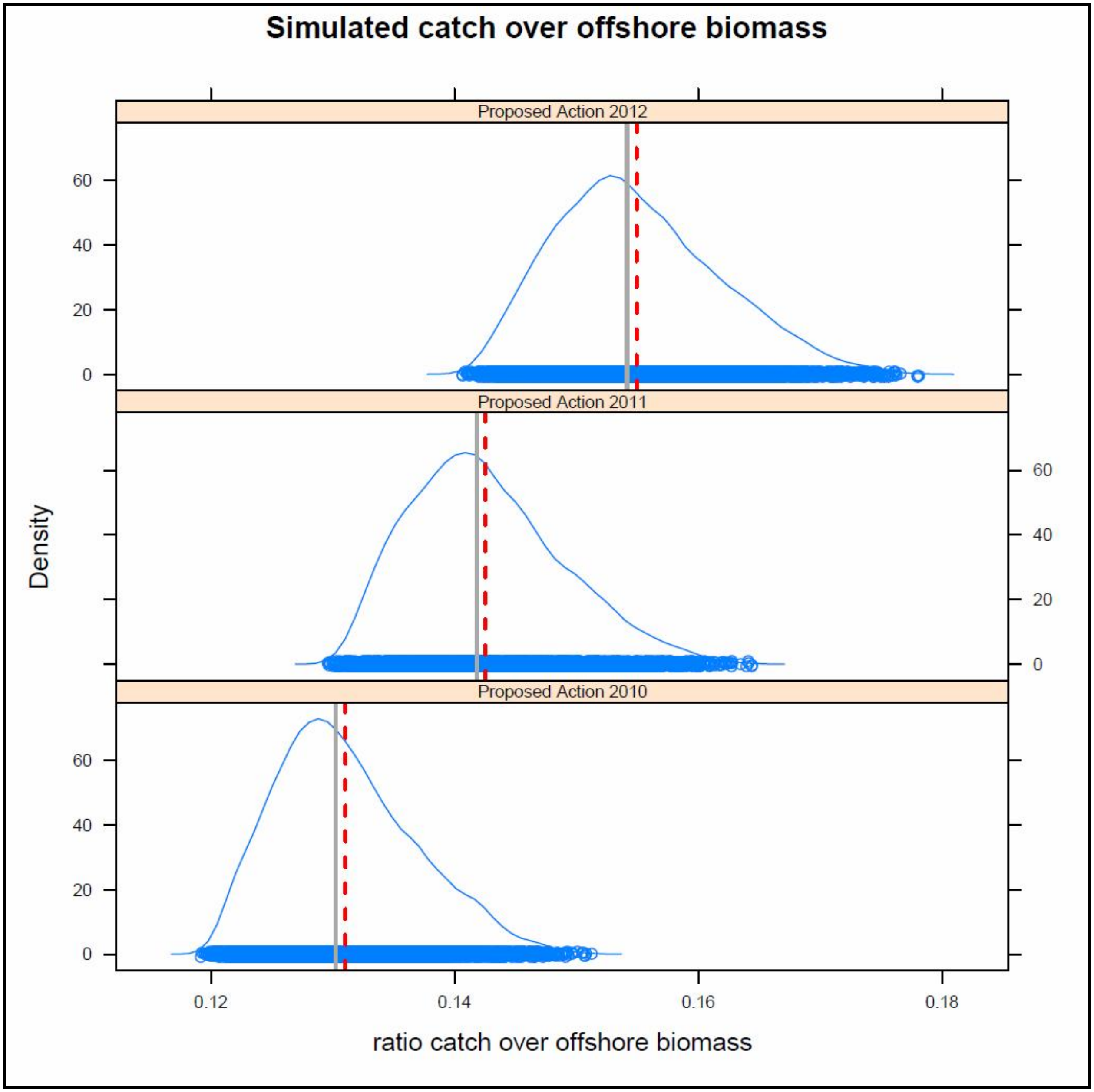
Dashed line is mean biomass resulting from the simulation.
Lighter straight line is median biomass resulting from the simulation.

Figure 31 Risk Assessment Results for Proposed Action –Simulated Removals of Offshore Component



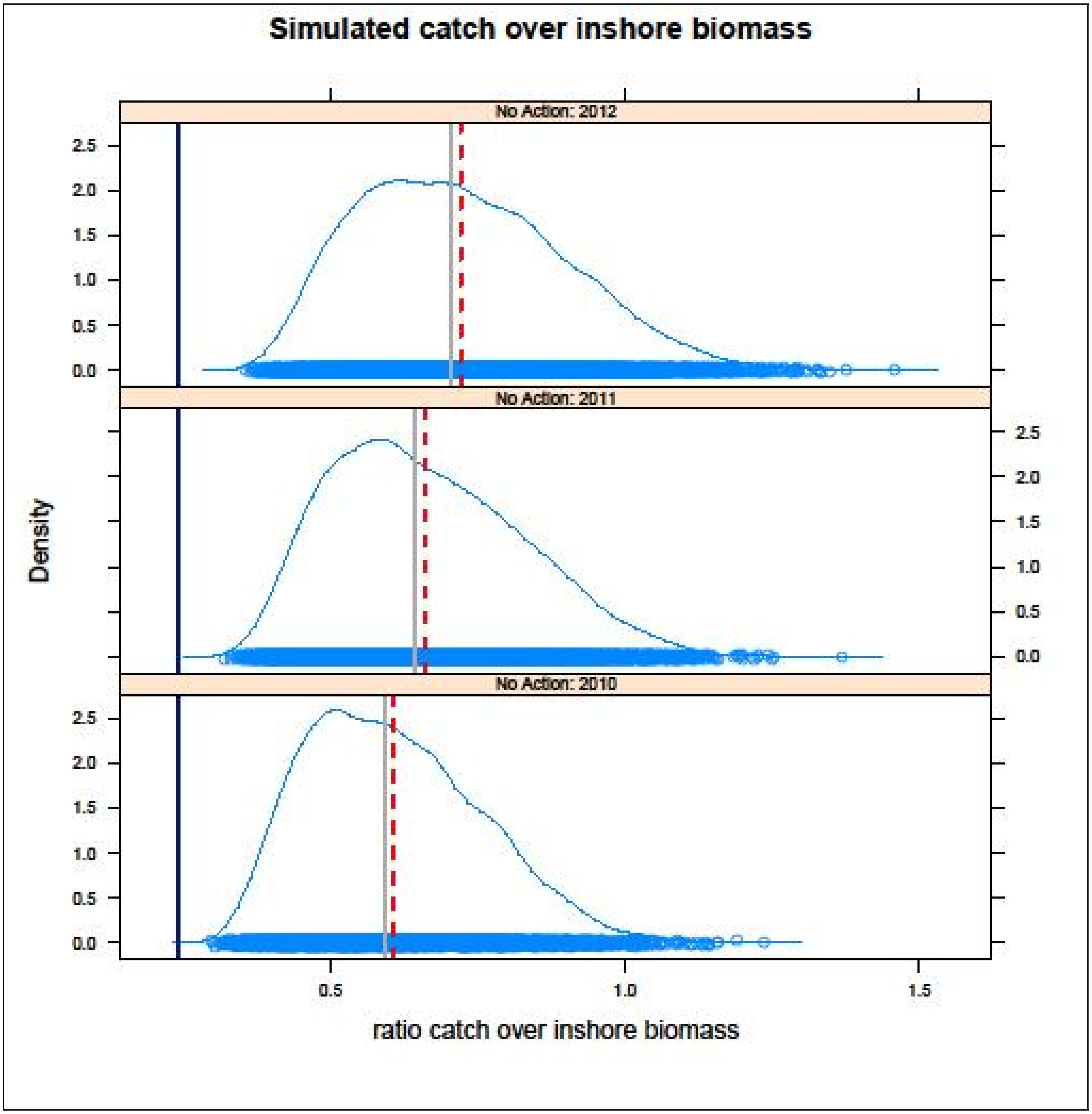
Dashed line is mean removals resulting from the simulation.
Lighter straight line is median removals resulting from the simulation.

Figure 32 Risk Assessment Results for Proposed Action – Simulated Catch/Offshore Biomass (Relative Exploitation)



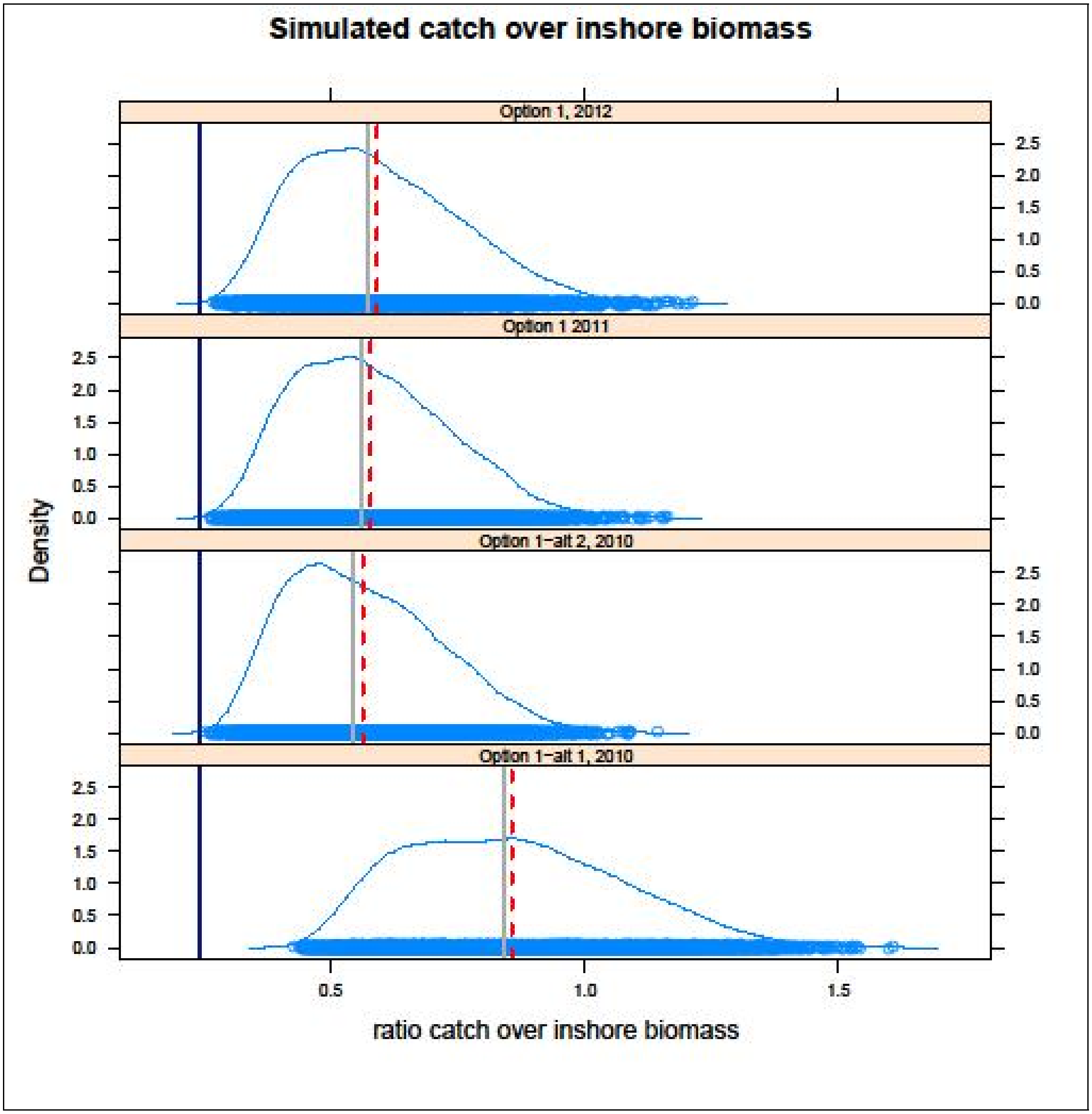
Dashed line is mean exploitation rate resulting from the simulation.
Lighter straight line is the median exploitation rate resulting from the simulation.

Figure 33 Risk Assessment Simulation Results – Catch/Inshore Biomass (Relative Exploitation) Under the No Action Alternative (Non-Preferred)



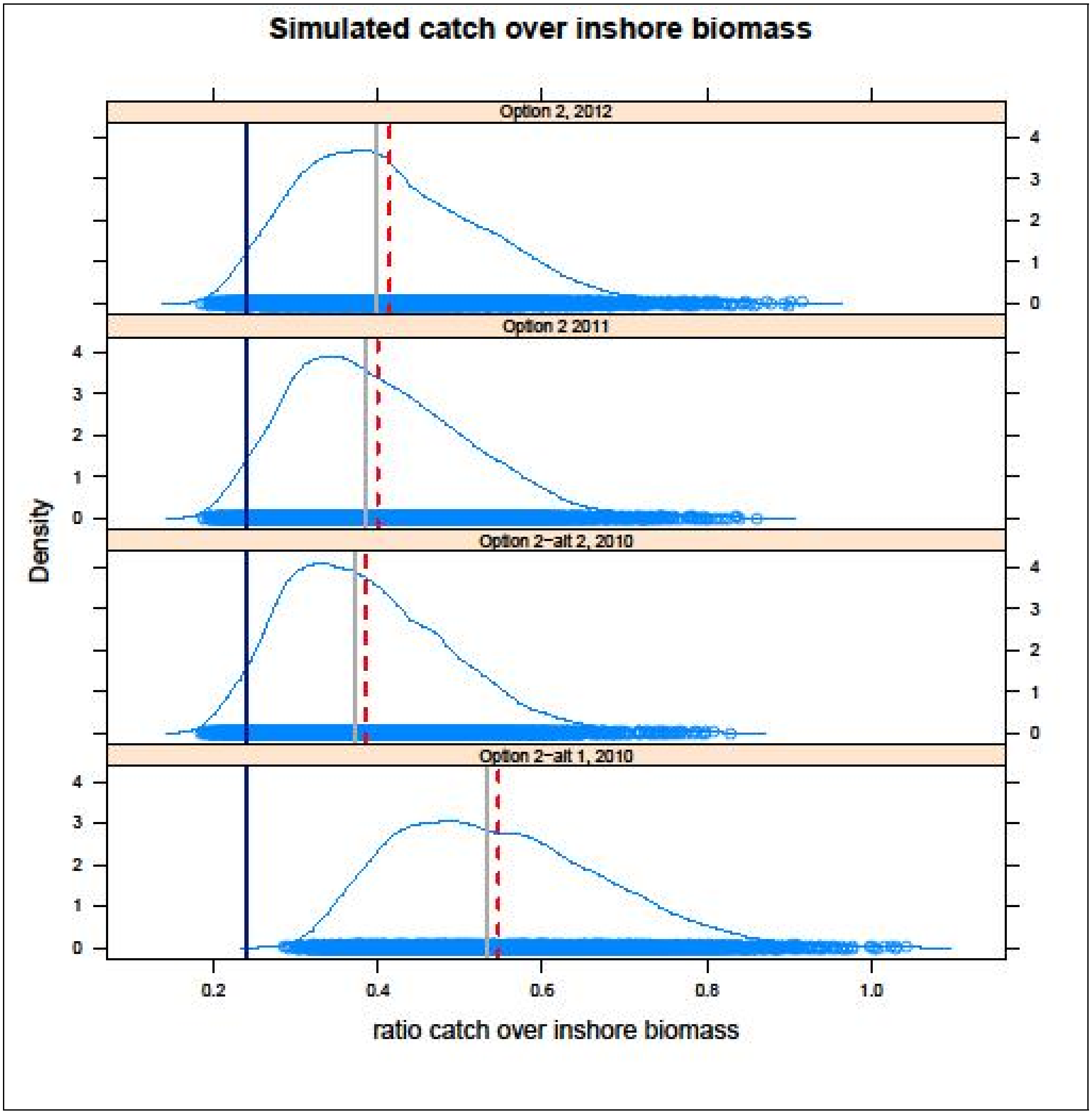
Darker straight line represents exploitation rate of 0.24.
Dashed line is mean exploitation rate resulting from the simulation.
Lighter straight line is the median exploitation rate resulting from the simulation.

Figure 34 Risk Assessment Simulation Results – Catch/Inshore Biomass (Relative Exploitation) Under Option 1 (Non-Preferred)



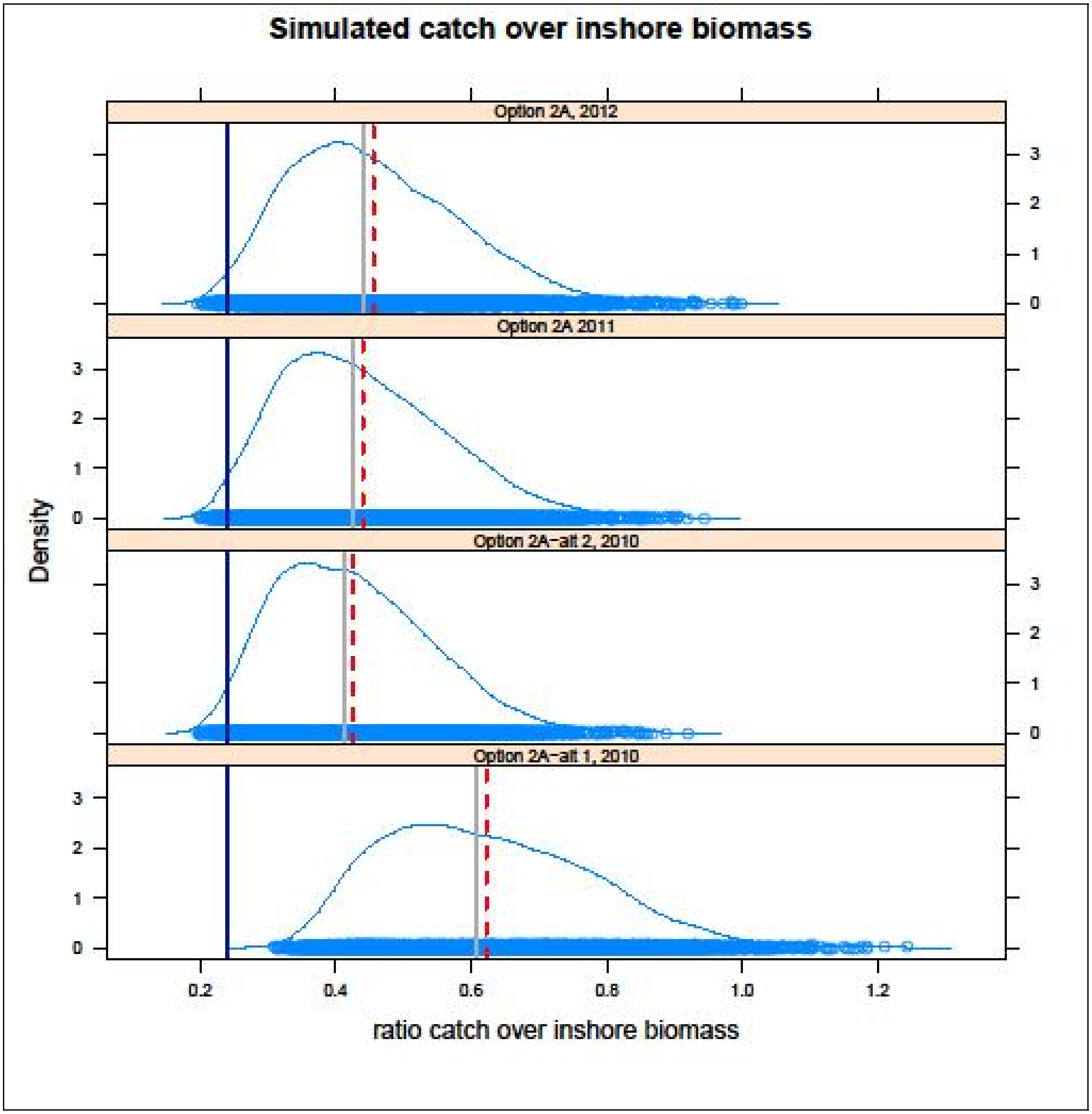
Darker straight line represents exploitation rate of 0.24.
Dashed line is mean exploitation rate resulting from the simulation.
Lighter straight line is the median exploitation rate resulting from the simulation.

Figure 35 Risk Assessment Simulation Results – Catch/Inshore Biomass (Relative Exploitation) Under Option 2 (Non-Preferred)



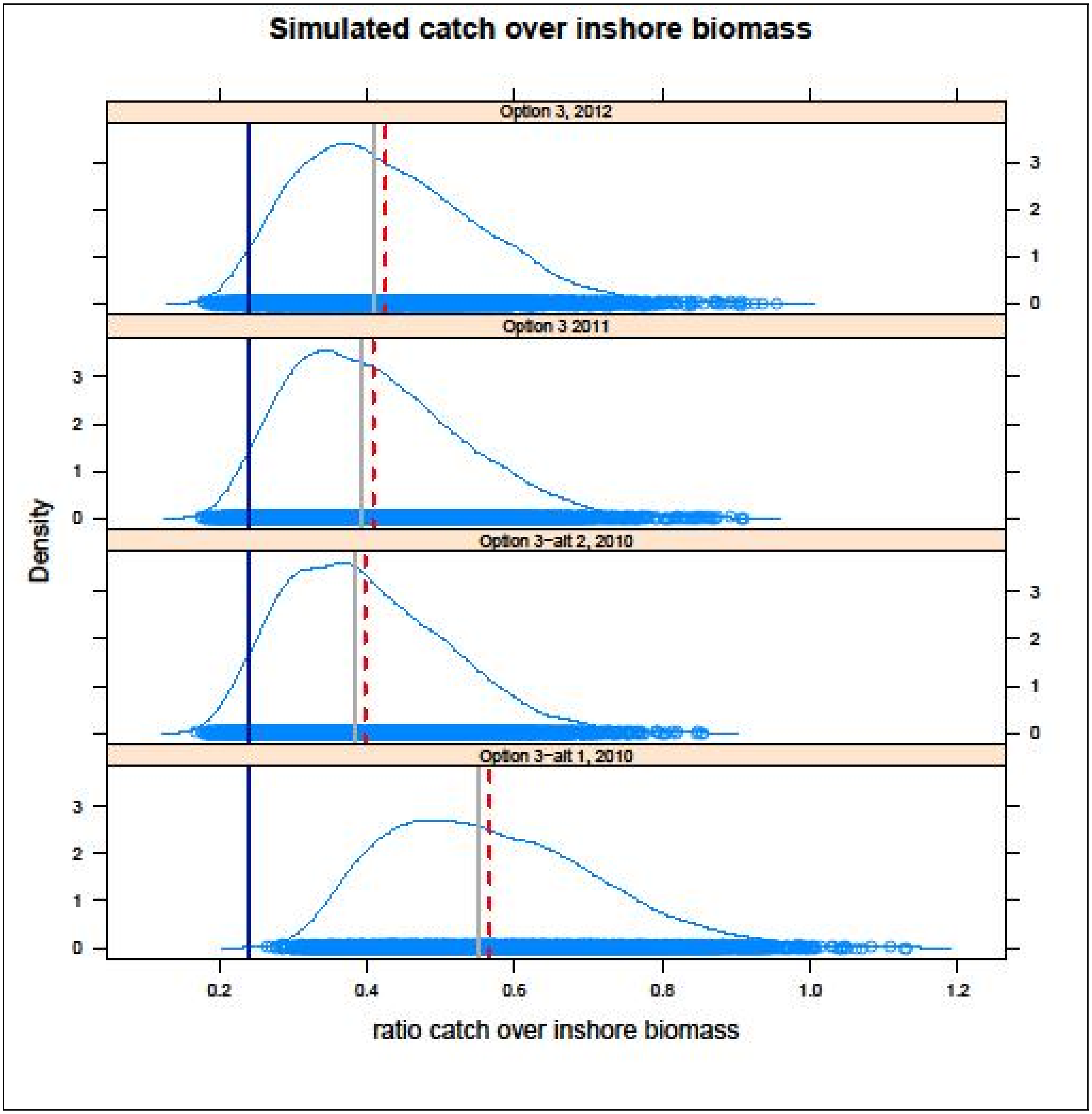
Darker straight line represents exploitation rate of 0.24.
Dashed line is mean exploitation rate resulting from the simulation.
Lighter straight line is the median exploitation rate resulting from the simulation.

Figure 36 Risk Assessment Simulation Results – Catch/Inshore Biomass (Relative Exploitation) Under Option 2A (Non-Preferred)



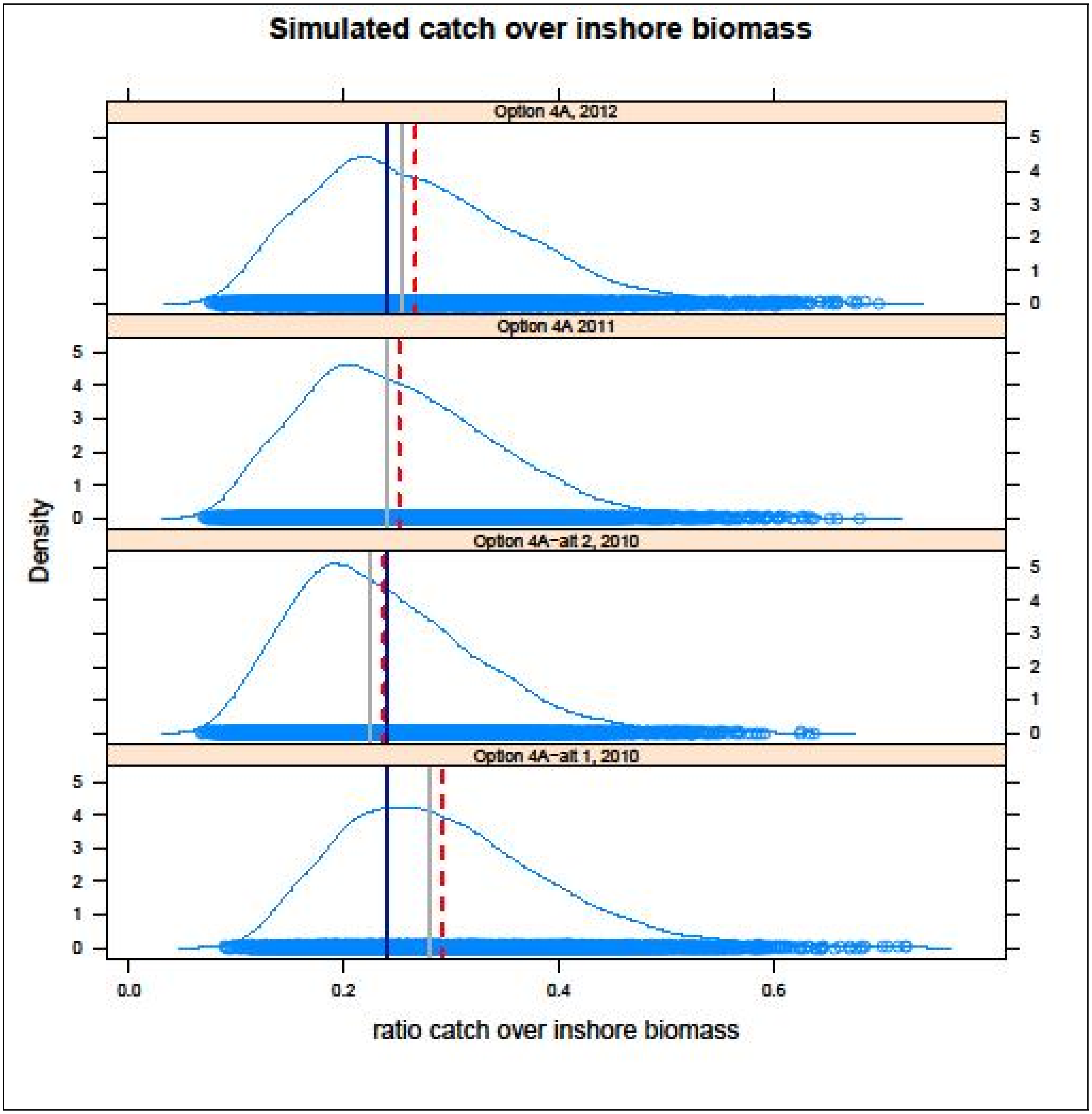
Darker straight line represents exploitation rate of 0.24.
Dashed line is mean exploitation rate resulting from the simulation.
Lighter straight line is the median exploitation rate resulting from the simulation.

Figure 37 Risk Assessment Simulation Results – Catch/Inshore Biomass (Relative Exploitation) Under Option 3 (Non-Preferred)



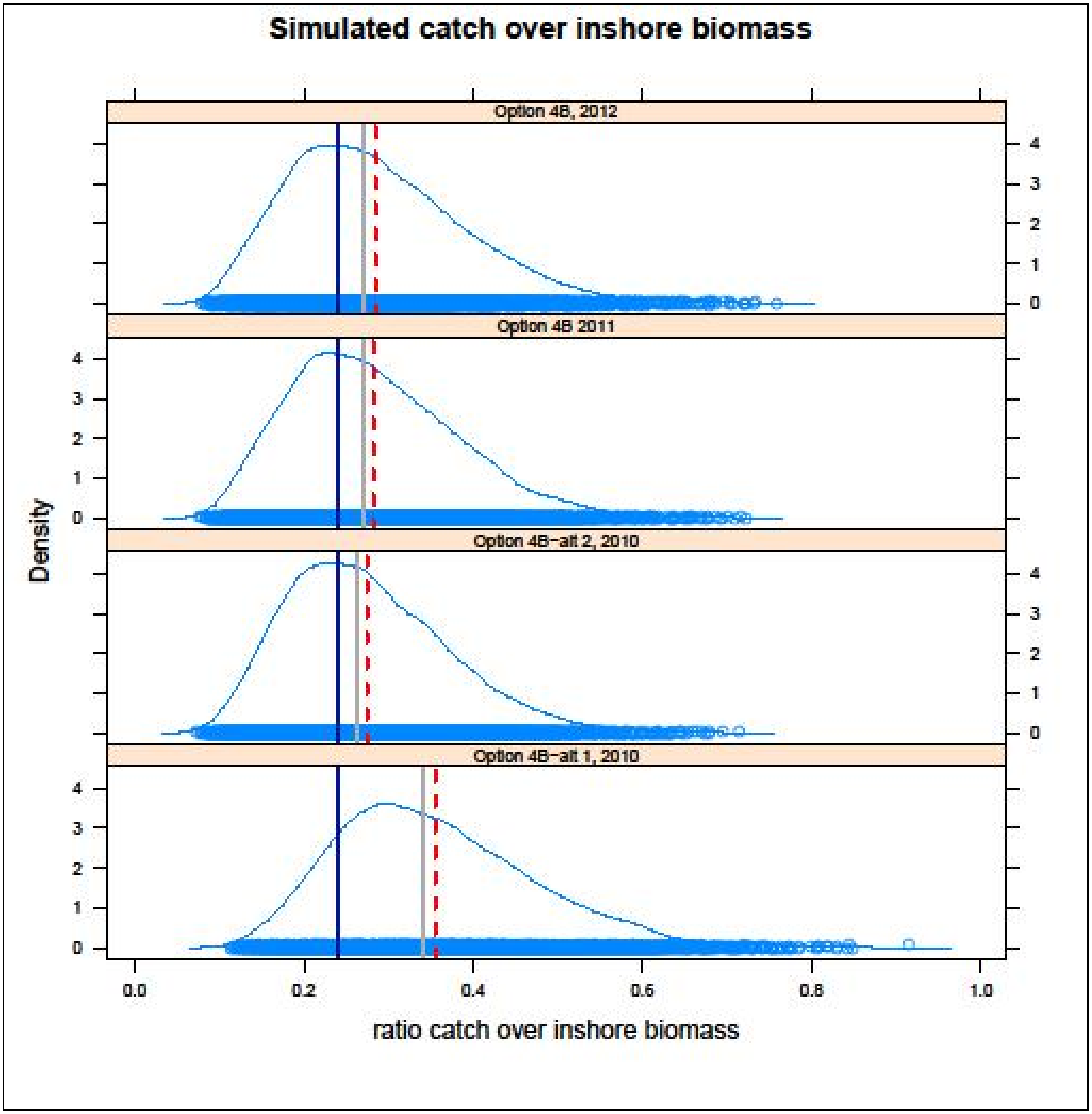
Darker straight line represents exploitation rate of 0.24.
Dashed line is mean exploitation rate resulting from the simulation.
Lighter straight line is the median exploitation rate resulting from the simulation.

Figure 38 Risk Assessment Simulation Results – Catch/Inshore Biomass (Relative Exploitation) Under Option 4A (Non-Preferred)



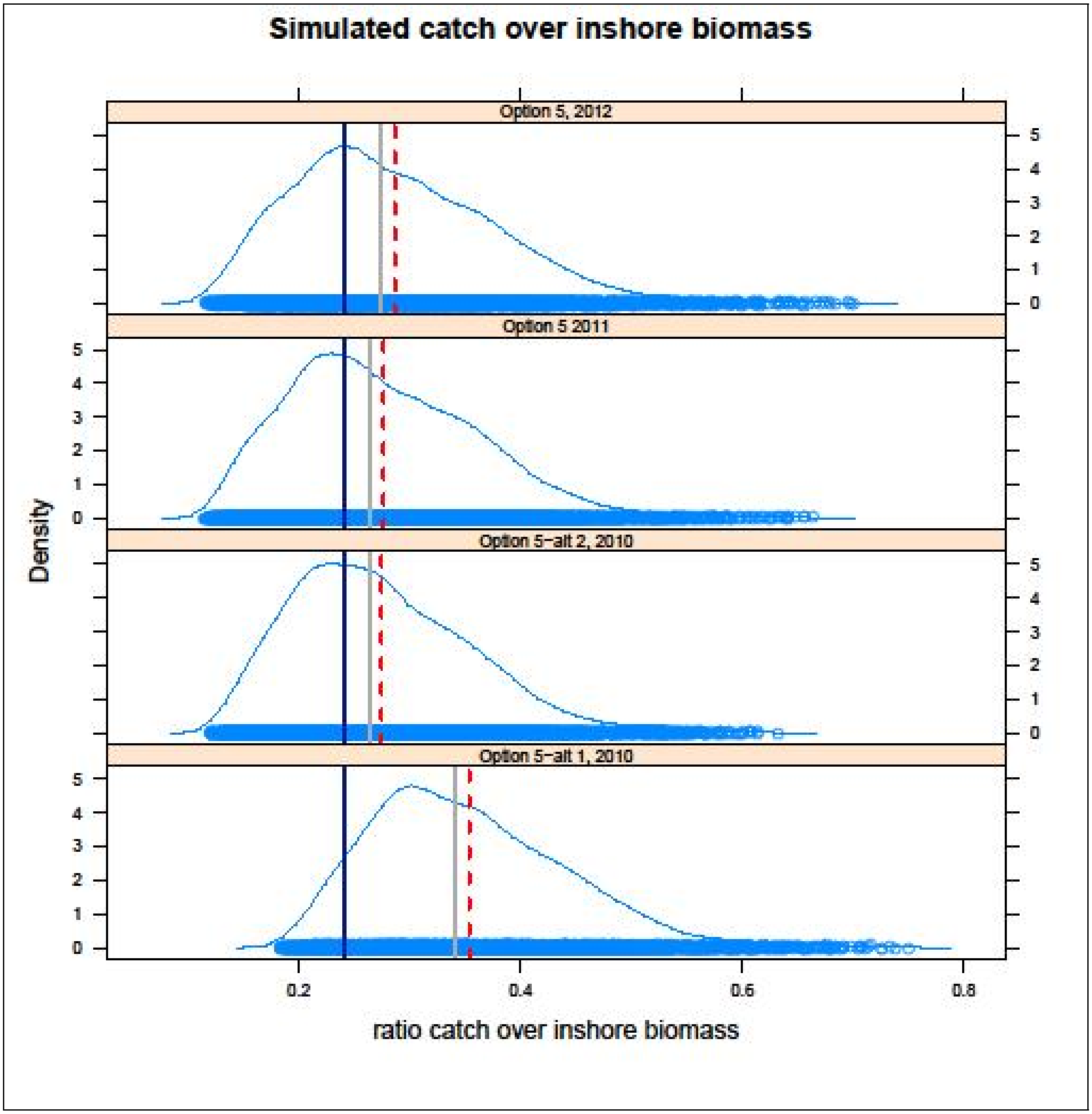
Darker straight line represents exploitation rate of 0.24.
Dashed line is mean exploitation rate resulting from the simulation.
Lighter straight line is the median exploitation rate resulting from the simulation.

Figure 39 Risk Assessment Simulation Results – Catch/Inshore Biomass (Relative Exploitation) <u>Under Option 4B (Non-Preferred)</u>



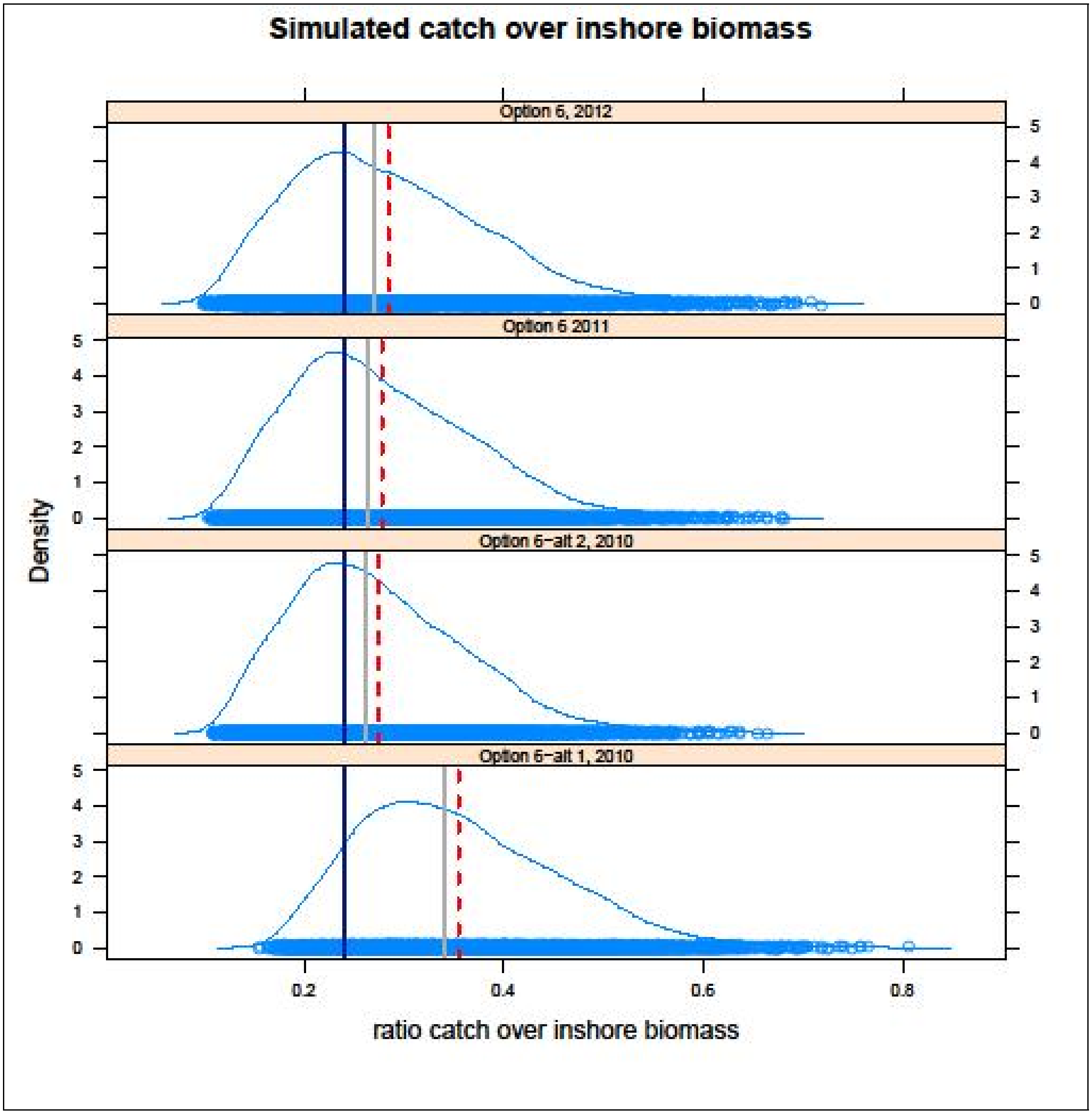
Darker straight line represents exploitation rate of 0.24.
Dashed line is mean exploitation rate resulting from the simulation.
Lighter straight line is the median exploitation rate resulting from the simulation.

Figure 40 Risk Assessment Simulation Results – Catch/Inshore Biomass (Relative Exploitation) <u>Under Option 5 (Non-Preferred)</u>



Darker straight line represents exploitation rate of 0.24.
Dashed line is mean exploitation rate resulting from the simulation.
Lighter straight line is the median exploitation rate resulting from the simulation.

Figure 41 Risk Assessment Simulation Results – Catch/Inshore Biomass (Relative Exploitation) Under Option 6 (Non-Preferred)



Darker straight line represents exploitation rate of 0.24.
Dashed line is mean exploitation rate resulting from the simulation.
Lighter straight line is the median exploitation rate resulting from the simulation.

- Summary statistics for the distribution of various outputs from the risk assessment simulation under the Proposed Action are provided in Table 71.
- Summary statistics of inshore biomass and offshore biomass for Non-Preferred Option 1 are shown in Table 72. Results for the other options are similar and are shown in Appendix III of this document.
- Summary statistics for landings from the inshore component under the non-preferred alternatives/options are shown in Table 73. The ratio of inshore catch to inshore biomass, and size of the offshore biomass, offshore landings, offshore landings to offshore biomass ratios, and density plots of the distributions of inshore biomass, ratio inshore landings/inshore biomass and inshore landings for all of the non-preferred options are provided in Appendix III. Summary statistics for these simulations with respect to the non-preferred options are provided in Table 74, Table 75, and Table 76. These results can be compared to those for the Proposed Action (Table 71).
- The probability of exceeding the "target" ratio is given for the statistics related to simulated inshore catch/biomass (relative exploitation) for all alternatives/options including the proposed action (Table 71). Note that this probability relates to portion of the distribution that is below the target ratio (conditioned on the assumptions within the simulation).

Boxplots of ratios of inshore catch to inshore biomass for the Proposed Action as well as the non-preferred options are shown in Figure 42. In some cases, the ratio of inshore catch to inshore biomass exceeds one, a nonsensical result since catch can not exceed biomass. These are generally arise from combinations of high area-specific ACLs (e.g., Option 1, Alternative 1 in 2010) that are inconsistent with the projected biomass and reasonable values for mixing rates, or from outliers generated by combining odd combinations of randomly-drawn values (such as low inshore biomass, high Canadian Catch, and high mixing rate for the summer mix). Some of these combinations may be unlikely to occur in reality (low inshore biomass may be correlated with low summer mixing rates).

Non-preferred Options 1, 2, 2A, 3, no action, and Alternative 1 for Options for Options 4B, 5 and 6 (all non-preferred) produce relative exploitation rates from the risk assessment that are considerably above the 0.24 ratio, suggesting that resulting fishing mortality rates may be inconsistent with an F_{MSY} strategy (probability of not exceeding 0.25 ranging from 0 to 0.05) for the inshore component. The Proposed Action produces results similar to, but slightly less conservative, than Option 2A, Alternative 2. Both non-preferred alternatives for Option 4A and Alternative 1 for Options 4B, 5 and 6 produce ratios that may be closer to a ratio of 0.24. These options are similar with respect to risk to the inshore component and produce an expected mean ratio of 0.28 or less. Relative to the offshore component, all of the options including the Proposed Action have less than 50% chance of exceeding a 0.24 ratio, and most have the entire distribution below the 0.24 ratio for the offshore stock component.

Table 71 Summary Statistics for the Distribution of Various Outputs from the Risk Assessment Simulation Under the Proposed Action

PROPOSED ACTION

Inshore Catch (mt)

year	Min.	25th	median	mean	75th	max	sd	cv
2010	28,620	38,290	43,920	43,210	47,020	62,110	6,340	14.67
2011	28,850	38,440	43,940	43,240	46,970	62,070	6,272	14.51
2012	28,360	38,210	43,880	43,200	46,970	61,610	6,307	14.60

Ratio Inshore Catch Over Inshore Biomass (mt)

year	Min.	25th	median	mean	75th	max	sd	cv	"target" ratio	P< target
2010	0.20	0.34	0.42	0.43	0.51	0.91	0.12	26.69	0.24	0.02
2011	0.20	0.38	0.45	0.47	0.55	1.02	0.12	26.36	0.25	<0.01
2012	0.23	0.41	0.50	0.51	0.60	1.07	0.14	26.38	0.25	<0.01

Jan 1 Inshore Biomass (mt)

year	Min.	25th	median	mean	75th	max	sd	cv
2010	60,400	83,610	101,300	105,500	124,500	178,700	26429.74	25.1
2011	55,090	77,350	93,130	97,040	114,100	163,400	24351.03	25.1
2012	51,080	70,580	85,250	89,020	104,700	150,700	22237.36	25.0

Offshore Catch (mt)

year	Min.	25th	median	mean	75th	max	sd	cv
2010	58,900	63,030	64,330	64,320	65,710	68,860	1,865.322	2.90
2011	58,950	63,030	64,370	64,350	65,780	68,850	1,868.446	2.90
2012	59,020	63,050	64,370	64,370	65,790	68,910	1,853.779	2.88

Offshore Ratio

year	Min.	25th	median	mean	75th	max	sd	cv	"target" ratio	P<target
2010	0.12	0.13	0.13	0.13	0.13	0.15	0.01	4.36	0.24	1.00
2011	0.13	0.14	0.14	0.14	0.15	0.17	0.01	4.38	0.25	1.00
2012	0.14	0.15	0.15	0.15	0.16	0.18	0.01	4.34	0.25	1.00

Offshore Biomass (mt)

year	Min.	25th	median	mean	75th	max	sd	cv
2010	419,100	473,300	496,500	492,300	514,200	537,400	26,429.74	5.37
2011	385,500	434,900	455,800	451,900	471,600	493,900	24,351.03	5.39
2012	355,000	401,000	420,400	416,700	435,100	454,600	22,237.36	5.34

Table 72 Summary Statistics for the Distribution of Inshore Biomass and Offshore Biomass for Non-Preferred Option 1*

Option*	Alt.	year	Minimum	25th quantile	median	mean	75th quantile	maximum	Standard deviation	CV of the distribution
				Simulated inshore Jan 1 Total Stock Biomass						
option 1	**1**	2010	60,400	84,080	101,600	105,700	124,500	178,700	60,400	24.79
	2	2010	60,390	84,000	101,100	105,700	124,100	177,600	60,390	25.00
	1	2011	55,280	76,850	93,010	96,810	114,200	163,700	55,280	25.02
	1	2012	50,980	71,210	86,050	89,510	105,200	151,300	50,980	24.91
				Simulated offshore Jan 1 Total Stock Biomass						
option 1	**1**	2010	419,100	473,300	496,100	492,100	513,700	537,400	419,100	5.32
	2	2010	420,200	473,600	496,700	492,100	513,800	537,400	420,200	5.37
	1	2011	385,200	434,700	455,900	452,100	472,100	493,700	385,200	5.36
	1	2012	354,400	400,500	419,600	416,200	434,500	454,700	354,400	5.36

**These values represent simulations for Option 1, but results are similar for other options (see Appendix III).*

Table 73 Summary Statistics for Simulated Inshore Removals (mt) by Non-Preferred Alternative/Option

option	Alt.	year	Minimum	25th quantile	median	mean	75th quantile	maximum	Standard deviation	CV of the distribution
option 1	1	2010	66,120	80,500	85,260	85,470	90,620	108,800	7475.45	8.75
	2	2010	40,810	51,500	56,480	56,220	60,300	75,420	6520.73	11.60
	1	2011	37,980	48,100	53,350	52,950	56,930	72,000	6509.99	12.29
	1	2012	35,390	45,230	50,780	50,160	53,990	68,810	6435.10	12.83
option 2	1	2010	37,470	50,110	55,100	55,050	59,420	78,760	7041.66	12.79
	2	2010	23,920	33,750	39,200	38,650	42,420	58,310	6411.27	16.59
	1	2011	22,660	32,000	37,470	36,840	40,500	55,960	6290.82	17.08
	1	2012	21,190	30,170	35,910	35,190	38,860	54,050	6284.04	17.86
option 2A	1	2010	44,910	57,350	62,340	62,210	66,520	85,190	6828.35	10.98
	2	2010	28,210	37,630	43,250	42,540	46,340	61,590	6248.24	14.69
	1	2011	26,340	35,420	41,200	40,480	44,230	59,150	6329.84	15.64
	1	2012	25,040	33,580	39,410	38,610	42,330	56,220	6230.50	16.14
option 3	1	2010	40,180	51,540	56,660	56,420	60,600	77,180	6674.51	11.83
	2	2010	25,620	34,410	40,210	39,410	43,170	57,440	6181.04	15.68
	1	2011	24,190	32,490	38,300	37,580	41,300	54,850	6268.96	16.68
	1	2012	22,500	30,790	36,660	35,840	39,600	53,380	6183.59	17.25
option 4A	1	2010	12,020	24,190	28,880	28,900	33,510	49,820	6947.76	24.04
	2	2010	9,569	18,730	24,390	23,680	27,570	41,310	6397.20	27.02
	1	2011	9,289	18,260	23,850	23,140	26,920	40,870	6292.52	27.19
	1	2012	9,010	17,720	23,500	22,700	26,430	40,010	6298.67	27.75
option 4B	1	2010	14,610	29,810	35,350	35,580	41,530	60,490	8403.04	23.62
	2	2010	11,000	22,600	27,420	27,400	31,900	47,820	6855.70	25.02
	1	2011	10,300	21,120	25,910	25,790	30,030	45,040	6636.82	25.73
	1	2012	9,526	19,210	24,540	24,010	28,000	42,390	6404.90	26.68
option 5	1	2010	20,140	30,960	36,050	35,720	39,580	57,600	6624.19	18.54
	2	2010	14,290	22,270	28,280	27,440	31,130	45,700	6247.07	22.77
	1	2011	12,640	20,290	26,320	25,470	29,120	43,040	6192.81	24.31
	1	2012	11,760	19,170	25,120	24,270	27,880	41,720	6125.23	25.24
option 6	1	2010	21,820	30,750	36,470	35,690	39,380	54,070	6211.26	17.40
	2	2010	15,240	22,300	28,300	27,450	31,160	43,870	6085.31	22.17
	1	2011	13,840	20,630	26,480	25,650	29,410	41,340	6059.72	23.62
	1	2012	12,380	18,990	24,780	23,990	27,720	39,460	5960.46	24.85
No Action		2010	43,790	56,010	61,190	61,000	65,370	83,150	6874.24	11.27
		2011	44,050	56,110	61,120	60,930	65,130	82,950	6740.05	11.06
		2012	44,280	56,080	61,090	60,930	65,130	83,050	6710.75	11.01

Table 74 Summary Statistics for the Distribution of the Ratio of Inshore Catch to Inshore Biomass by Non-Preferred Alternative/Option

Option	Alt.	Year	Minimum	25th quantile	median	mean	75th quantile	maximum	Standard deviation	CV of the distribution	Target ratio	P< target
Option 1	1	2010	0.42	0.69	0.84	0.86	1.00	1.67	0.208	24.31	0.24	0.00
	2	2010	0.25	0.45	0.55	0.56	0.66	1.15	0.146	25.90	0.24	0.00
	1	2011	0.27	0.46	0.56	0.58	0.68	1.20	0.154	26.57	0.25	0.00
	1	2012	0.27	0.47	0.57	0.59	0.70	1.24	0.158	26.58	0.25	0.00
Option 2	1	2010	0.29	0.45	0.53	0.55	0.63	1.06	0.122	22.24	0.24	0.00
	2	2010	0.18	0.31	0.37	0.38	0.45	0.81	0.099	25.73	0.24	0.05
	1	2011	0.18	0.32	0.39	0.40	0.47	0.88	0.106	26.46	0.25	0.04
	1	2012	0.19	0.33	0.40	0.41	0.48	0.89	0.112	27.07	0.25	0.04
Option 2A	1	2010	0.31	0.51	0.61	0.62	0.73	1.23	0.149	24.01	0.24	0.00
	2	2010	0.19	0.34	0.41	0.43	0.50	0.90	0.113	26.46	0.24	0.02
	1	2011	0.20	0.35	0.42	0.44	0.52	0.95	0.118	26.74	0.25	0.02
	1	2012	0.20	0.36	0.44	0.46	0.54	1.00	0.126	27.62	0.25	0.02
Option 3	1	2010	0.28	0.46	0.55	0.57	0.66	1.12	0.140	24.72	0.24	0.00
	2	2010	0.17	0.31	0.38	0.39	0.46	0.86	0.108	27.39	0.24	0.05
	1	2011	0.18	0.32	0.40	0.41	0.49	0.91	0.115	28.01	0.25	0.05
	1	2012	0.18	0.33	0.41	0.42	0.50	0.95	0.120	28.34	0.25	0.05
Option 4A	1	2010	0.09	0.22	0.28	0.29	0.35	0.75	0.096	33.15	0.24	0.35
	2	2010	0.07	0.17	0.22	0.24	0.29	0.64	0.085	36.00	0.24	0.58
	1	2011	0.07	0.19	0.24	0.25	0.31	0.69	0.091	35.98	0.25	0.52
	1	2012	0.07	0.20	0.26	0.27	0.33	0.71	0.100	37.12	0.25	0.48
Option 4B	1	2010	0.11	0.27	0.34	0.36	0.43	0.94	0.117	32.85	0.24	0.16
	2	2010	0.07	0.21	0.26	0.28	0.33	0.72	0.095	34.33	0.24	0.41
	1	2011	0.08	0.21	0.27	0.28	0.34	0.77	0.097	34.55	0.25	0.40
	1	2012	0.08	0.21	0.27	0.28	0.35	0.76	0.103	36.20	0.25	0.43
Option 5	1	2010	0.18	0.29	0.34	0.35	0.41	0.74	0.087	24.69	0.24	0.08
	2	2010	0.12	0.21	0.26	0.27	0.32	0.64	0.081	29.99	0.24	0.41
	1	2011	0.11	0.21	0.26	0.28	0.33	0.66	0.086	31.36	0.25	0.41
	1	2012	0.11	0.22	0.27	0.28	0.34	0.70	0.092	32.19	0.25	0.41
Option 6	1	2010	0.16	0.28	0.34	0.36	0.42	0.77	0.098	27.47	0.24	0.11
	2	2010	0.11	0.21	0.26	0.27	0.33	0.65	0.087	31.59	0.24	0.41
	1	2011	0.10	0.21	0.27	0.28	0.34	0.68	0.093	33.16	0.25	0.41
	1	2012	0.10	0.21	0.27	0.28	0.34	0.71	0.097	34.06	0.25	0.43
No Action		2010	0.30	0.49	0.59	0.61	0.71	1.24	0.147	24.20	0.24	0.00
		2011	0.32	0.54	0.64	0.66	0.77	1.37	0.161	24.27	0.25	0.00
		2012	0.36	0.59	0.71	0.72	0.84	1.46	0.174	24.05	0.25	0.00

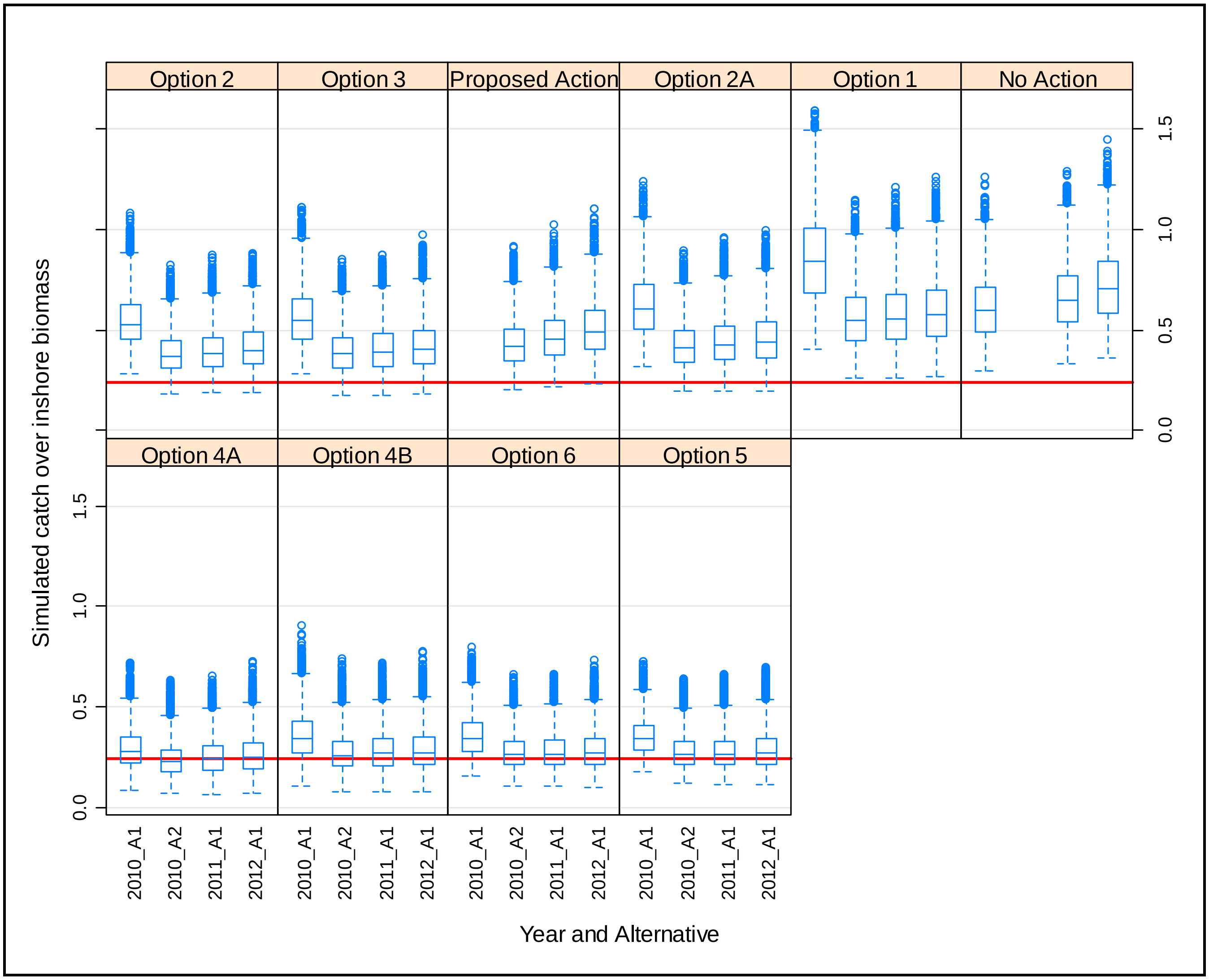
Table 75 Summary Statistics for Simulated Offshore Removals (mt) by Non-Preferred Alternative/Option

Option	Alt.	Year	Minimum	25th quantile	median	mean	75th quantile	maximum	Standard deviation	CV of the distribution
option 1	1	2010	50,660	57,480	61,060	61,110	64,700	70,660	4408.03	7.21
	2	2010	29,260	33,200	35,320	35,310	37,440	40,870	2545.30	7.21
	1	2011	32,990	36,590	38,530	38,540	40,460	43,690	2341.11	6.07
	1	2012	36,280	39,660	41,450	41,430	43,200	46,080	2132.98	5.15
option 2	1	2010	80,260	89,110	91,880	91,540	94,180	99,580	3562.93	3.89
	2	2010	46,540	51,430	53,060	52,870	54,410	57,460	2070.22	3.92
	1	2011	48,780	53,480	54,910	54,720	56,110	59,060	1877.26	3.43
	1	2012	50,840	55,080	56,450	56,310	57,610	60,420	1745.25	3.10
option 2A	1	2010	73,520	80,460	82,710	82,700	85,050	90,200	3175.72	3.84
	2	2010	42,210	46,150	47,430	47,430	48,820	51,750	1820.53	3.84
	1	2011	38,640	42,390	43,560	43,550	44,800	47,550	1654.73	3.80
	1	2012	35,460	38,990	40,110	40,080	41,260	43,780	1545.61	3.86
option 3	1	2010	82,160	88,120	90,090	90,090	92,180	96,390	2723.61	3.02
	2	2010	47,470	50,900	52,020	52,020	53,210	55,700	1563.59	3.01
	1	2011	49,960	52,920	53,950	53,950	55,030	57,360	1425.86	2.64
	1	2012	51,770	54,670	55,610	55,620	56,610	58,780	1324.33	2.38
option 4A	1	2010	109,800	114,600	117,600	117,500	120,500	124,400	3506.13	2.98
	2	2010	63,390	66,090	67,820	67,820	69,540	71,950	2030.25	2.99
	1	2011	64,400	66,860	68,440	68,450	70,040	72,110	1855.70	2.71
	1	2012	65,280	67,540	68,970	68,980	70,420	72,400	1702.36	2.47
option 4B	1	2010	99,520	106,000	110,900	110,900	115,900	121,900	5739.14	5.18
	2	2010	57,420	61,230	64,090	64,100	66,920	70,340	3305.86	5.16
	1	2011	60,110	63,300	65,750	65,740	68,140	71,040	2812.97	4.28
	1	2012	62,680	65,440	67,420	67,400	69,330	71,750	2262.24	3.36
option 5	1	2010	102,600	109,000	111,200	110,900	113,000	116,500	2698.64	2.43
	2	2010	59,260	62,900	64,220	63,990	65,200	67,290	1557.24	2.43
	1	2011	61,910	65,050	66,180	65,980	67,030	68,830	1348.91	2.04
	1	2012	63,490	66,330	67,380	67,200	68,180	69,680	1232.09	1.83
option 6	1	2010	106,100	109,800	110,900	110,900	112,000	114,400	1522.30	1.37
	2	2010	61,370	63,430	64,060	64,040	64,690	66,150	888.93	1.39
	1	2011	63,590	65,360	65,890	65,870	66,420	67,660	742.77	1.13
	1	2012	65,760	67,150	67,570	67,550	67,990	69,020	607.30	0.90
No Action		2010	91,840	98,140	100,300	100,300	102,600	107,500	3000	2.99
		2011	91,640	98,170	100,400	100,300	102,600	107,400	3019	3.01
		2012	91,580	98,160	100,400	100,400	102,700	107,300	3037	3.03

Table 76 Summary Statistics for the Distribution of the Ratio of Offshore Catch to Offshore Biomass by Non-Preferred Alternative/Option

Option	Alt.	Year	Minimum	25th quantile	median	mean	75th quantile	maximum	Standard deviation	CV of the distribution	Target ratio	P< target
Option 1	1	2010	0.10	0.12	0.12	0.12	0.13	0.15	0.0095	7.64	0.24	1.00
	2	2010	0.06	0.07	0.07	0.07	0.08	0.09	0.0056	7.72	0.24	1.00
	1	2011	0.07	0.08	0.09	0.09	0.09	0.10	0.0059	6.89	0.25	1.00
	1	2012	0.09	0.09	0.10	0.10	0.10	0.12	0.0063	6.33	0.25	1.00
Option 2	1	2010	0.175	0.182	0.186	0.186	0.19	0.204	0.0052	2.80	0.24	1.00
	2	2010	0.101	0.105	0.107	0.108	0.11	0.118	0.0030	2.79	0.24	1.00
	1	2011	0.114	0.119	0.121	0.121	0.12	0.134	0.0035	2.91	0.25	1.00
	1	2012	0.126	0.132	0.135	0.136	0.14	0.150	0.0042	3.12	0.25	1.00
Option 2A	1	2010	0.15	0.16	0.17	0.17	0.17	0.19	0.0074	4.39	0.24	1.00
	2	2010	0.09	0.09	0.10	0.10	0.10	0.11	0.0042	4.32	0.24	1.00
	1	2011	0.09	0.09	0.10	0.10	0.10	0.11	0.0042	4.37	0.25	1.00
	1	2012	0.09	0.09	0.10	0.10	0.10	0.11	0.0042	4.36	0.25	1.00
Option 3	1	2010	0.17	0.18	0.18	0.18	0.19	0.21	0.0082	4.48	0.24	1.00
	2	2010	0.10	0.10	0.11	0.11	0.11	0.12	0.0048	4.57	0.24	1.00
	1	2011	0.11	0.12	0.12	0.12	0.12	0.14	0.0055	4.59	0.25	1.00
	1	2012	0.12	0.13	0.13	0.13	0.14	0.16	0.0061	4.55	0.25	1.00
Option 4A	1	2010	0.21	0.23	0.24	0.24	0.25	0.29	0.0136	5.69	0.24	0.63
	2	2010	0.12	0.13	0.14	0.14	0.14	0.17	0.0080	5.81	0.24	1.00
	1	2011	0.13	0.15	0.15	0.15	0.16	0.18	0.0085	5.63	0.25	1.00
	1	2012	0.15	0.16	0.16	0.17	0.17	0.20	0.0093	5.60	0.25	1.00
Option 4B	1	2010	0.19	0.21	0.23	0.23	0.24	0.28	0.0159	7.04	0.24	0.84
	2	2010	0.11	0.12	0.13	0.13	0.14	0.16	0.0092	7.05	0.24	1.00
	1	2011	0.13	0.14	0.15	0.15	0.15	0.18	0.0095	6.48	0.25	1.00
	1	2012	0.14	0.16	0.16	0.16	0.17	0.20	0.0098	6.03	0.25	1.00
Option 5	1	2010	0.21	0.22	0.22	0.23	0.23	0.25	0.0071	3.15	0.24	0.98
	2	2010	0.12	0.13	0.13	0.13	0.13	0.14	0.0041	3.18	0.24	1.00
	1	2011	0.14	0.14	0.15	0.15	0.15	0.16	0.0052	3.53	0.25	1.00
	1	2012	0.15	0.16	0.16	0.16	0.17	0.18	0.0060	3.72	0.25	1.00
Option 6	1	2010	0.21	0.22	0.22	0.23	0.23	0.26	0.0103	4.56	0.24	0.92
	2	2010	0.12	0.13	0.13	0.13	0.13	0.15	0.0059	4.55	0.24	1.00
	1	2011	0.13	0.14	0.14	0.15	0.15	0.17	0.0068	4.68	0.25	1.00
	1	2012	0.15	0.16	0.16	0.16	0.17	0.19	0.0080	4.90	0.25	1.00
No Action		2010	0.18	0.20	0.20	0.20	0.21	0.24	0.0093	4.53	0.24	1.00
		2011	0.20	0.22	0.22	0.22	0.23	0.26	0.0100	4.50	0.25	0.98
		2012	0.22	0.23	0.24	0.24	0.25	0.28	0.0109	4.52	0.25	0.81

Figure 42 Boxplots of Ratio of Inshore Catch to Inshore Biomass for Proposed Action and Other Non-Preferred Alternatives/Options



Redline is 0.24 exploitation ratio, the F_{MSY} ratio.
Proposed Action and No Action do not include alternatives for 2010, so only one result for 2010 is presented.

6.1.1.2.3 Comparison of Options – Relative Risk

Relative risk (as it relates to exploitation rates on the individual stock components) was used to provide pair-wise comparisons of options to each other and to the Proposed Action (below). Table 77 provides comparisons based on a relative exploitation ratio of 0.41, the approximate relative exploitation rate observed historically when the herring stock collapsed (see Appendix I for more information). Table 78 provides comparisons based on a relative exploitation ratio of 0.24, the approximate relative exploitation rate associated with F_{MSY}.

These tables provide a relatively easy way to compare options based on an odds-ratio, which is characterized as relative risk (similar to an odds ratio when the resulting probabilities are either very high or low). In the two tables below, the relative risks are presented as the proportion of results above the target/threshold for the option listed in the column heading divided by the proportion of results above the target/threshold for the row. Values near 1.00 indicate similar risks between the two options being compared. Values below 1.00 indicate that the option in the column has less risk associated with it than the option with which it is being compared in the row. For example, in Table 77, a cell comparing the Proposed Action (column) with non-preferred Option 1 (row) results in a relative risk value of 0.62. This indicates that Option 1 is 1.6 times as likely to exceed the ratio=0.41 than the Proposed Action. Values for 2011 and 2012 as well as values for Alternative 2 (non-preferred) in 2010 are not presented in the tables below.

Table 77 Relative Risk: Pair-wise Comparison of Proposed Action and Non-Preferred Options Based on Probability of Exceeding 0.41 (Shaded Column/Row) in 2010

		Proposed Action	Option 1	Option 2	Option 2A	Option 3	Option 4A	Option 4B	Option 5	Option 6	No Action
	P> 0.41	**0.53**	**0.85**	**0.36**	**0.51**	**0.40**	**0.03**	**0.09**	**0.06**	**0.07**	**0.93**
Proposed Action	**0.53**	1.00	1.60	0.68	0.96	0.75	0.06	0.17	0.11	0.13	1.75
Option 1	**0.85**	0.62	1.00	0.42	0.60	0.47	0.04	0.11	0.07	0.08	1.09
Option 2	**0.36**	1.47	2.36	1.00	1.42	1.11	0.08	0.25	0.17	0.19	2.58
Option 2A	**0.51**	1.04	1.67	0.71	1.00	0.78	0.06	0.18	0.12	0.14	1.82
Option 3	**0.40**	1.33	2.13	0.90	1.28	1.00	0.08	0.23	0.15	0.18	2.33
Option 4A	**0.03**	17.67	28.33	12.00	17.00	13.33	1.00	3.00	2.00	2.33	31.00
Option 4B	**0.09**	5.89	9.44	4.00	5.67	4.44	0.33	1.00	0.67	0.78	10.33
Option 5	**0.06**	8.83	14.17	6.00	8.50	6.67	0.50	1.50	1.00	1.17	15.50
Option 6	**0.07**	7.57	12.14	5.14	7.29	5.71	0.43	1.29	0.86	1.00	13.29
No Action	**0.93**	0.57	0.91	0.39	0.55	0.43	0.03	0.10	0.06	0.08	1.00

** Non-preferred options are based on Alternative 1 and fishing year 2010 from risk assessment for ratio=0.41.*

*** Relative risks are presented as the proportion of outcomes above the target/threshold for the option listed in the column heading divided by the proportion above the target/threshold for the row.*

**** Values greater than 1 indicate more risk, values less than 1 indicate less risk, and values near 1 indicate similar risks.*

Table 78 Relative Risk: Pair-wise Comparison of Proposed Action and Non-Preferred Options Based on Probability of Exceeding 0.24 (Shaded Column/Row) in 2010

		Proposed Action	Option 1	Option 2	Option 2A	Option 3	Option 4A	Option 4B	Option 5	Option 6	No Action
	P> 0.24	**0.98**	**1.00**	**0.95**	**0.98**	**0.95**	**0.42**	**0.59**	**0.59**	**0.59**	**1.00**
Proposed Action	**0.98**	1.00	1.02	0.97	1.00	0.97	0.43	0.60	0.60	0.60	1.02
Option 1	**1.00**	0.98	1.00	0.95	0.98	0.95	0.42	0.59	0.59	0.59	1.00
Option 2	**0.95**	1.03	1.05	1.00	1.03	1.00	0.44	0.62	0.62	0.62	1.05
Option 2A	**0.98**	1.00	1.02	0.97	1.00	0.97	0.43	0.60	0.60	0.60	1.02
Option 3	**0.95**	1.03	1.05	1.00	1.03	1.00	0.44	0.62	0.62	0.62	1.05
Option 4A	**0.42**	2.33	2.38	2.26	2.33	2.26	1.00	1.40	1.40	1.40	2.38
Option 4B	**0.59**	1.66	1.69	1.61	1.66	1.61	0.71	1.00	1.00	1.00	1.69
Option 5	**0.59**	1.66	1.69	1.61	1.66	1.61	0.71	1.00	1.00	1.00	1.69
Option 6	**0.59**	1.66	1.69	1.61	1.66	1.61	0.71	1.00	1.00	1.00	1.69
No Action	**1.00**	0.98	1.00	0.95	0.98	0.95	0.42	0.59	0.59	0.59	1.00

** Non-preferred options are based on Alternative 1 and fishing year 2010 from risk assessment for ratio=0.24.*

*** Relative risks are presented as the proportion of outcomes above the target/threshold for the option listed in the column heading divided by the proportion above the target/threshold for the row.*

**** Values greater than 1 indicate more risk, values less than 1 indicate less risk, and values near 1 indicate similar risks.*

6.1.1.2.4 Discussion and Conclusions

This analysis provides insights into the removal rates of landings from the inshore and offshore components under various options given uncertainty in the spatial-temporal mixing rates of the stock. Although the ABC is proposed to be set at 106,000 mt to account for scientific uncertainty in the assessment and OY is proposed to be set 14,800 mt lower than ABC to account for management uncertainty related to Canadian catch, these catch levels may not prevent excessive mortality rates on the smaller inshore component of the resource.

The preliminary analysis provided to the Council in November 2009 indicated that the options considered during the development of the herring fishery specifications and the no action alternative could be broken into two groups with approximately equal risks (risk is evaluated relative to the potential to fish the inshore stock component at a relative exploitation rate that is higher than that associated with the overfishing threshold for the entire Atlantic herring stock complex):

1. High Risk – with all or most of the distribution above 0.24 (Options 1, 2, 2A, 3, plus Alternative 1 in 2010 for 4B, 5, 6, and No Action); and
2. Low Risk – with approximately 40% or more of the ratio distribution below 0.24 (Options 4A, 4B, 5, excluding Alternative 1 in 2010).

For the high risk group, either total stock size would need to be higher than is projected, or the fraction of the stock comprised by the inshore component would need to be near 40% or higher to achieve a landings to biomass ratio near 0.24. Table 79 can be referenced for additional information, as it provides summary statistics for the proposed action based on the risk assessment and evaluates the probability of generating a relative exploitation ratio on the inshore stock that exceeds thresholds that were selected for evaluation in this assessment (see previous discussion).

A risk analysis of the historic landings data (1999-2008) resulted in a mean average ratio of 0.48 for the inshore stock (see Appendix II). The average ratio of inshore catch to inshore biomass is higher for Option 1, No Action, and Options 2, 2A and 3 under Alternative 1 in 2010 exceed the mean historic value of 0.48. Alternative 1 was not selected, however, and ABC and OY are proposed to be set substantially lower than the values considered as part of Alternative 1. None of the options that were considered during the specifications process pose a risk to the offshore component. This conclusion holds true for the Proposed Action as well.

The risk analysis for the proposed action was conducted by the Herring PDT following the November 2009 Council meeting using the same parameters used in analyzing the other alternatives/options that were considered during the specifications process. Summary statistics for the proposed action are provided in the table below (see previous subsections for more detail).

Table 79 Summary Order Statistics for Catch Over Inshore Biomass Under the Proposed Action

	Year	Min.	25th	Median	Mean	75th	Max	sd	cv	F_{MSY}-Based Ratio	P< target	P< 0.41
Proposed Action	2010	0.20	0.34	0.42	0.43	0.51	0.91	0.12	26.69	0.24	0.02	0.47
Proposed Action	2011	0.20	0.38	0.45	0.47	0.55	1.02	0.12	26.36	0.25	0.01	0.36
Proposed Action	2012	0.23	0.41	0.50	0.51	0.60	1.07	0.14	26.38	0.25	<0.01	0.25

The risk analysis does not incorporate scientific uncertainty about terminal or projected stock sizes. This analysis does not account for uncertainty caused by the substantial retrospective pattern in the assessment. For these simulations, the distribution of monthly landings by area closely follows the inputs, so uncertainty about management impacts on the temporal distribution of the fishery is not accounted for in this risk assessment. This is particularly true for Options 4A, 4B and 6 when landings in area 1A are constrained to the summer months when the inshore component and offshore components are mixed. Shifting the fishery to August or later would substantially increase removals from the inshore stock.

The Canadian catch has a large influence on the amount of removals from the inshore stock. Average landings of the inshore stock in 2010-2012 that produce a biomass ratio of 0.24 are: 25.4, 23.2 and 21.4 thousand tons. The average Canadian landings are 16.3 thousand tons, representing 64%, 70%, and 76% of the simulated inshore landings in 2010-2012, respectively. These landings are not predictable, particularly as the strength of recruiting year classes are not known for this assessment. Thus, the magnitude of the Canadian landings in 2010-2012 will have a large influence on the removal rates for the low risk options. The higher risk options are less sensitive to assumptions about Canadian catch, since they form a smaller fraction of the inshore removals. It is also important to note that within-year adjustments to the U.S. (Area 1A) ACL if the New Brunswick landings are below the management uncertainty amount of 14,500 mt will not impact removals from the inshore component because New Brunswick fish are all considered inshore fish.

6.1.2 Impacts on Non-Target and Bycatch Species

This action proposes herring fishery specifications for the 2010-2012 fishing years. The Proposed Action will not reduce the stock-wide TAC below 2008 landings levels in any of the three year time span covered by this action. The No Action Alternative would maintain the current specifications for the Atlantic herring fishery in the 2010-2012 fishing years (2009 TACs). The primary difference between the Proposed Action and the No Action Alternative is the reduction in the stock-wide TAC. The Proposed Action sets this at 91,200 mt and the No Action (2009 level) is 145,000 mt; a difference of of 53,800 mt (or a 37% reduction). Both alternatives have roughly the same distribution among the management areas (Area 1A has roughly 30% of the TAC; Area 3 has roughly 40%, etc.). Alternative 1 takes a step-wise reduction in the stock-wide TAC over the three years; Alternative 2 sets the stock-wide TAC at the SSC recommendation for all three years.

Mackerel is the primary non-target species; dogfish and herring are the predominant bycatch species. Mackerel and dogfish are managed under separate FMPs. A federal permit is required to land non-target species, and those landings would be subject to the quotas set by the FMP for the permit.

In general, the catch of non-target/bycatch species could theoretically go down under the Proposed Action, Alternative 1 and Alternative 2 because ABC is lowered. However, lower catch limits in the herring fishery might not relate to lower catch rates of non-target/bycatch species if fishing becomes more selective, in which case the catch rates could likely remain constant. For purposes of the analysis, it is assumed that the lower ABC would lead to efforts to reduce fishing costs (less time with gear in the water) and that the reduced ABC will lead to a step-wise decrease in catch of non-target/bycatch species. Discard rates per lbs of herring kept are variable between gear types used. For example, mid-water, pair trawl, and purse seines trips are generally more selective than bottom trawls (Tables 35-46). The Proposed Action does not propose any change to gear types and thus are not expected to alter the ratio of discards to target species. Therefore, non-target/bycatch species are expected to be caught in a relatively constant proportion to herring as a target stock. As such, the Proposed Action, Alternative 1, and Alternative 2 are expected to have minimal, yet beneficial impacts to stocks of non-target/bycatch species.

The No-Action Alternative would maintain the specifications as set for the previous fishing year, 2009. Under this alternative, vessels would continue to fish as they do under the specifications set for 2009, which would also be controlled by a cap. The overall effect of these vessels fishing under the 2009 specifications (No-Action) is expected to be negligible to non-target/bycatch species. Over the long-term, maintaining the 2009 specs for the next three years could have detrimental impacts on the stock and lead to negative impacts.

6.2 IMPACTS ON HABITAT AND EFH

The Magnuson-Stevens Fishery Conservation and Management Act as reauthorized in 2006 includes a requirement to evaluate the potential adverse effects of the Atlantic herring fishery on Atlantic herring EFH and on the EFH of other species. The EFH final rule specifies that measures to minimize impacts should be enacted when adverse effects that are more than minimal and not temporary in nature are anticipated.

This action proposes herring fishery specifications for the 2010-2012 fishing years. The no action alternative would maintain the current specifications for the Atlantic herring fishery in the 2010-2012 fishing years (2009 TACs). Table 80 compares the status quo (no action alternative) to the proposed specifications. The proposed catch limits for all management areas are lower than the status quo limits. Although some of the specifications listed above might eventually be eliminated by Amendment 4, these specifications are currently set to zero, so this future decision has no bearing on the potential impacts of the fishery on EFH.

An assessment of the potential effects of the directed Atlantic herring commercial fishery on EFH for Atlantic herring and other federally-managed species in the Northeast region of the U.S. was conducted as part of an EIS that evaluated impacts of the Atlantic herring fishery on EFH (NMFS 2005). This analysis was included in Appendix VI, Volume II of the FSEIS for Amendment 1 to the Atlantic Herring FMP. It found that midwater trawls and purse seines do occasionally contact the seafloor and may adversely impact benthic habitats utilized by a number of federally-managed species, including EFH for Atlantic herring eggs. **However, after reviewing all the available information, the conclusion was reached that if the quality of EFH is reduced as a result of this contact, the impacts are minimal and/or temporary and, pursuant to MSA, do not need to be minimized, i.e., that there was no need to take specific action at that time to minimize the adverse effects of the herring fishery on benthic EFH**. This conclusion also applied to pelagic EFH for Atlantic herring larvae, juveniles, and adults, and to pelagic EFH for any other federally-managed species in the region. The various species and life stages that might be affected are listed in the Affected Environment, Physical Environment, and EFH section of this document.

An evaluation of the impacts to EFH in the 2007-2009 specifications package stated that changes in the amount of herring caught and the distribution of the catch by area would have a negligible impact on EFH because the fishery as a whole has minimal and temporary impacts on EFH (the conclusion of the 2005 EIS). Because the TACs specified in this action are reduced as compared to the previous specifications (2009), the proposed action will not result in adverse impacts to EFH in comparison with the no action alternative. Given that impacts resulting from this action do not exceed the more than minimal/temporary threshold, no additional action to minimize adverse impacts to EFH is required. Therefore, as with the 2007-2009 specifications, this action does not require an EFH assessment. In summary, given: (1) the previous finding that the fishery, as it existed in 2005, was not having more than a minimal or temporary impacts on EFH, and (2) the fact that the proposed new specifications are expected to reduce any impacts caused by the occasional contact of the bottom by herring fishing gear (i.e., midwater trawls and purse seines) from previous levels as a result of lower catch limits, it can be concluded that the herring fishery continues to have no more than a minimal and temporary impacts on EFH.

Table 80 Comparison of No Action Alternative (Status Quo, 2009 TACs)) and Proposed Atlantic Herring Fishery Specifications for 2010-2012 (mt)

CURRENT SPECIFICATIONS	2009 Specifications (status quo)	2010-2012 Specifications (proposed action)
F_{MSY}-based Fishing Level	194,000	145,000 (2010) 134,000 (2011) 127,000 (2012)
Allowable Biological Catch (ABC)	194,000	106,000
U.S. Optimum Yield (OY)	145,000	91,200
Domestic Annual Harvesting (DAH)	145,000	91,200
Domestic Annual Processing (DAP)	141,000	87,200
Total Joint Venture Processing (JVPt)*	0	0
Joint Venture Processing (JVP)*	0	0
Internal Waters Processing (IWP)*	0	0
U.S. At-Sea Processing (USAP)	20,000 (Areas 2 & 3)	
Border Transfer (BT)	4,000	4,000
Total Allowable Level of Foreign Fishing (TALFF)*	0	0
RESERVE*	0	0
TAC Area 1A	45,000 (includes RSA)	26,546**
TAC Area 1B	10,000 (includes RSA)	4,362
TAC Area 2	30,000 (includes RSA)	22,146
TAC Area 3	60,000 (includes RSA)	38,146
Research Set-Aside	Area 1A RSA 1,350 Area 1B RSA 300 Area 2 RSA 900 Area 3 RSA 1,800	None
Fixed Gear Set-Aside (1A)	500	295

**Some specifications could be eliminated in the future by Amendment 4 to the FMP.*

***Specifications include possible allocation of 3,000 additional mt of herring to Area 1A in November and December of each year, depending on landings in the Canadian New Brunswick weir fishery.*

6.3 IMPACTS ON PROTECTED RESOURCES

The impacts of the Atlantic herring fishery on marine mammals and listed species were discussed in the Atlantic Herring FMP from September 1999 and subsequent amendments. Likewise, framework adjustments and specification packages that followed the FMP have addressed the impacts of the fishery and new management actions on potentially-impacted species.

The following discussion addresses the impacts of the options and alternatives for the proposed 2010-2012 specifications on the protected resources described in Section 2.0 of this document. Protected species interactions have been well-documented in the major gear types currently used in the Atlantic herring fishery. Also included in the section is a description of the fishery gear used in the Atlantic herring fishery, as well as the listed classifications for that gear from the Proposed *List of Fisheries for 2010* and a list of species interactions.

Some quantitative information exists for those species potentially affected by the herring fishery. For instance, estimates of mortality and Potential Biological Removal (PBR) were provided in the marine mammal stock assessment report (Waring et al. 2009) for white-sided dolphin and pilot whales. Both short-finned and long-finned pilot whales had a PBR of 249, as it was not possible to estimate them separately. The total annual estimated average of fishery-related mortality or serious injury to both short-finned and long finned pilot whales combined during 2002-2006 was 167 (CV 0.14). For both species the estimated annual fishery related mortalities in the Northeast Midwater trawl fishery, which included pair trawl, were (CV in parentheses): unknown in 2001-2002, 1.9 (CV=0.56) in 2003, 1.4 (CV=0.58) in 2004, 1.1(CV=.68) in 2005, and 0 in 2006. The Mid-Atlantic midwater Trawl fishery values, which also included the pair trawl, were (CV in parentheses): unknown in 2001-2002, 3.9 (CV=0.46) in 2003, 8.1 (CV=0.38) in 2004, 7.5 (CV=.76) in 2005, and 0 in 2006. The Atlantic white-sided dolphin had a PBR of 509 and a total annual estimated average fishery-related mortality or serious injury of 352 (CV=0.10) for 2002-2006. For the Northeast midwater trawl fishery, which included pair trawl, the estimated annual fishery related mortalities (CV in parentheses) were: unknown in 2001-2002, 24 (0.56) in 2003, 19 (0.58) in 2004, 15(.68) in 2005, and 19 (.44) in 2006. For the Mid-Atlantic midwater Trawl fishery, which also included the pair trawl, the values were (CV in parentheses): unknown in 2001-2002, 51 (0.46) in 2003, 105 (0.38) in 2004, 97(.76) in 2005, and 54 (.57) in 2006.

Overall, it is difficult to predict how the fishery will react to the options of the proposed specifications without a fully developed model and more information, and incorporation of the above information is difficult. Predicting the positive or negative impacts to the protected species that may interact with the fishery is therefore also difficult. Lack of comprehensive observer coverage hampers quantitative discussions of the impacts, but several issues are considered qualitatively.

6.3.1 Impacts of the F_{MSY}-Based Fishing Level, ABC, and OY on Protected Species

Although the chain of decisions leading to the F_{MSY}-based fishing level and subsequently the ABC are determined in this action, the TACs are also being determined as a quotient of the ABC. The impacts to protected species are therefore discussed in the following section which considers TACs. This allows for more specific discussion of the overall actions.

6.3.2 Impacts of the DAH, DAP, JVP, IWP, USAP, BT, TALFF and Reserve on Protected Species

The TALFF, JVP, IWP, and Reserve in the Proposed Action are to be set at 0 for the 2010-2012 fishing years, the same as they were for the 2007-2009 fishing years, therefore having no effect on protected species. The USAP is recommended to be reduced from the 2007-2009 level of 20,000 mt to 0. The specification for BT is recommended to stay at 4,000 mt, retaining the status quo. The DAH is proposed to be set equal to OY and the DAP at DAH – 4,000, for BT. Although the specifications of USAP, BT, DAH and DAP may result in social and economic consequences for the herring fishery, they will likely only have negligible effects on protected species that have the potential to interact with the gear types used in the fishery. They are therefore not discussed further in this section.

6.3.3 Impacts of TACs on Protected Species (Proposed Action)

An overview of the Proposed Action in comparison to the other considered alternatives and options in the 2010-2012 specifications package can be found in Table 81. The Proposed Action is not expected to result in an increase in observer coverage at sea; therefore the Proposed Action will have no effect on protected species monitoring.

According to the TRAC assessment for 2006, the productive potential of the herring stock complex has improved in recent years, although the predator consumption estimates of herring have increased since the mid-1980s. The uncertainty associated with the conflicting stock assessment estimates, however, makes it difficult to calculate the amount of surplus herring biomass that is currently available as forage for predators. It is therefore unknown at this time. Consequently, while management overall has been viewed as a benefit to protected resources inhabiting the herring management area, the impact of the fishery relative to prey availability has not been analyzed. The impacts of the Proposed Action on protected species' ability to forage for herring are likely to be slightly more positive than the options in which smaller TACs are assigned, including the status quo. However, this option also allows for more fishing than some of the other options, and if herring availability is smaller than in previous years, then the impact of the fishery may be slightly more detrimental to the accessibility of forage to protected species.

The assumed potential timing and location of the fishery in Area 1A used in the risk assessment and subsequently this protected species impact analysis is based on the observed monthly catch in 2009. Under the Proposed Action, the timing of the fishery is not expected to change from the most recent years, and therefore may not have an effect on protected species. The timing and areas of effort of the fishery will depend on the availability and abundance of herring in the considered areas, however, and are not expected to directly or indirectly impact protected species. An increase or decrease in the rate of effort in these areas is not expected either, and therefore will have not effect on protected species in the area.

Table 81 highlights the options which may be more likely to result in higher exploitation rates for the inshore stock component according to the risk assessment, and includes the Proposed Action. The higher the exploitation rate, the higher the risk of encounter with inshore protected species may be, in particular interactions with harbor porpoise, white sided dolphins, pilot whales as well as grey and harbor seals, which are seasonally abundant in the GOM. The risk of the Proposed Action is low relative to the other options in the high risk category and therefore the protected species are would most likely not be expected to be impacted by the Proposed Action.

In summary, the impacts of the proposed action's TACs on protected resources are expected to be minimal. This includes impacts on the amount of forage available to protected species. The risk of the impacts of the proposed action are low compared to the other alternatives spatially and temporally, and the rate of fishing is not expected to increase, so interactions with the herring fishery may be low, limiting the potential effects to protected species.

6.3.4 Impacts of TACs on Protected Species (Non-Preferred)

The Council set forth a number of options to consider for the TACs in each of the four management areas, all of which are non-preferred alternatives. Under each alternative for ABC, there are also two different options for dividing the ACLs amongst the management areas during the fishing years 2010-2012.

Table 81 summarizes the potential impacts on protected resources that may result from the proposed action as well as the different alternatives and options considered by the Council during the specifications process. The **effort** column utilizes the relative magnitude of the difference from the status quo to estimate what may happen to effort in the herring fishery as a result of the different alternatives and options. The **difference from the status quo** column gives the difference between the 2007-2009 specifications OY and the 2010-2012 specifications OY, where the 2007-2009 OY is subtracted from the 2010-2012 OY. The **forage** column indicates what change in the availability of forage may be experienced by protected species as a result of the effort change. The **timing** and **area shift** columns denote where and when the effort may be expected to shift, thereby indicating where and when protected species may be affected. The potential increase or decrease in the rate of fishing by the fleet is indicated by the **rate** column. The eight options and no action alternative can be broken into two groups with approximately equal risk of impacts on protected species, relative to the other groups, which are indicated in the **option comparisons** column as either higher impact or lower impact. The **monitor increase** column indicates if any of the alternatives or options will increase the amount of observer coverage or other monitoring of the herring fleet, which has the potential to benefit the monitoring of protected species.

Table 81 Analysis of Alternatives/Options Under Consideration in Relation to Protected Species

	Alt.	Year	Effort	Difference from Status Quo	Forage	Timing (1A only)	Area Shift	Rate	Option Comparisons	Monitor Increase
Proposed Action	**N/A**	2010	Major Reduction	-53,800	Larger Increase	Jun-Nov	Unk./Possibly Area 3	No Change	Higher Impact	No
	N/A	2011	Major Reduction	-53,800	Larger Increase	Jun-Nov	Unk./Possibly Area 3	No Change	Higher Impact	No
	N/A	2012	Major Reduction	-53,800	Larger Increase	Jun-Nov	Unk./Possibly Area 3	No Change	Higher Impact	No
Option 1 (Non-Preferred)	**1**	2010	Minor Reduction	-14,800	Smaller Increase	Jun-Nov	Unk./Possibly Area 3	No Change	Higher Impact	No
	2	2010	Major Reduction	-69,800	Larger Increase	Jun-Nov	Unk./Possibly Area 3	No Change	Higher Impact	No
	1	2011	Major Reduction	-69,800	Larger Increase	Jun-Nov	Unk./Possibly Area 3	No Change	Higher Impact	No
	1	2012	Major Reduction	-69,800	Larger Increase	Jun-Nov	Unk./Possibly Area 3	No Change	Higher Impact	No
Option 2 (Non-Preferred)	**1**	2010	Minor Reduction	-14,800	Smaller Increase	Jun-Nov	Unk./Possibly Area 3	No Change	Higher Impact	No
	2	2010	Major Reduction	-69,800	Larger Increase	Jun-Nov	Unk./Possibly Area 3	No Change	Higher Impact	No
	1	2011	Major Reduction	-69,800	Larger Increase	Jun-Nov	Unk./Possibly Area 3	No Change	Higher Impact	No
	1	2012	Major Reduction	-69,800	Larger Increase	Jun-Nov	Unk./Possibly Area 3	No Change	Higher Impact	No
Option 2A (Non-Preferred)	**1**	2010	Minor Reduction	-16,400	Smaller Increase	Jun-Nov	Unk./Possibly Area 3	No Change	Higher Impact	No
	2	2010	Major Reduction	-71,300	Larger Increase	Jun-Nov	Unk./Possibly Area 3	No Change	Higher Impact	No
	1	2011	Major Reduction	-77,321	Larger Increase	Jun-Nov	Unk./Possibly Area 3	No Change	Higher Impact	No
	1	2012	Major Reduction	-82,658	Larger Increase	Jun-Nov	Unk./Possibly Area 3	No Change	Higher Impact	No
Option 3 (Non-Preferred)	**1**	2010	Minor Reduction	-14,800	Smaller Increase	Jun-Nov	Unk./Possibly Area 3	No Change	Higher Impact	No
	2	2010	Major Reduction	-69,800	Larger Increase	Jun-Nov	Unk./Possibly Area 3	No Change	Higher Impact	No
	1	2011	Major Reduction	-69,801	Larger Increase	Jun-Nov	Unk./Possibly Area 3	No Change	Higher Impact	No
	1	2012	Major Reduction	-69,800	Larger Increase	Jun-Nov	Unk./Possibly Area 3	No Change	Higher Impact	No
Option 4A (Non-Preferred)	**1**	2010	Minor Reduction	-14,800	Smaller Increase	Jul-Sept	Into Areas 1B and 3	Increase in 1A	Lower Impact	No
	2	2010	Major Reduction	-69,800	Larger Increase	Jul-Sept	Into Areas 1B and 3	Increase in 1A	Lower Impact	No
	1	2011	Major Reduction	-69,800	Larger Increase	Jul-Sept	Into Areas 1B and 3	Increase in 1A	Lower Impact	No
	1	2012	Major Reduction	-69,800	Larger Increase	Jul-Sept	Into Areas 1B and 3	Increase in 1A	Lower Impact	No
Option 4B (Non-Preferred)	**1**	2010	Minor Reduction	-14,800	Smaller Increase	May-Jul	Into Areas 1B and 3	Increase in 1A	Higher Impact	No
	2	2010	Major Reduction	-69,800	Larger Increase	May-Jul	Into Areas 1B and 3	Increase in 1A	Lower Impact	No
	1	2011	Major Reduction	-69,800	Larger Increase	May-Jul	Into Areas 1B and 3	Increase in 1A	Lower Impact	No
	1	2012	Major Reduction	-69,800	Larger Increase	May-Jul	Into Areas 1B and 3	Increase in 1A	Lower Impact	No
Option 5 (Non-Preferred)	**1**	2010	Minor Reduction	-14,800	Smaller Increase	Jul-Sept	Into Areas 1B and 3	Increase in 1A	Higher Impact	No
	2	2010	Major Reduction	-69,800	Larger Increase	Jul-Sept	Into Areas 1B and 3	Increase in 1A	Lower Impact	No
	1	2011	Major Reduction	-69,800	Larger Increase	Jul-Sept	Into Areas 1B and 3	Increase in 1A	Lower Impact	No
	1	2012	Major Reduction	-69,800	Larger Increase	Jul-Sept	Into Areas 1B and 3	Increase in 1A	Lower Impact	No
Option 6 (Non-Preferred)	**1**	2010	Minor Reduction	-14,800	Smaller Increase	Jul-Sept	Into Areas 1B and 3	Increase in 1A	Higher Impact	No
	2	2010	Major Reduction	-69,800	Larger Increase	Jul-Sept	Into Areas 1B and 3	Increase in 1A	Lower Impact	No
	1	2011	Major Reduction	-69,800	Larger Increase	Jul-Sept	Into Areas 1B and 3	Increase in 1A	Lower Impact	No
	1	2012	Major Reduction	-69,800	Larger Increase	Jul-Sept	Into Areas 1B and 3	Increase in 1A	Lower Impact	No
No Action (Non-Preferred)	**1**	2010	No Change	0	No Change	Jun-Nov	No Change	No Change	Higher Impact	No
	2	2010	No Change	0	No Change	Jun-Nov	No Change	No Change	Lower Impact	No
	1	2011	No Change	0	No Change	Jun-Nov	No Change	No Change	Lower Impact	No
	1	2012	No Change	0	No Change	Jun-Nov	No Change	No Change	Lower Impact	No

**All comparisons have been made relative to the no action/status quo.*

No Action (Non-Preferred)

Under the no action or status quo alternative, impacts to the herring resource would remain largely unchanged from the present. The previous TACs from the 2009 fishing year would continue be used in the four management areas to minimize the risk of overfishing individual stock components. This scenario, however, would not be compliant with the recent MSA, as new terms of reference are being added by Amendment 4. Therefore, relative to the option actions, no action may have potentially less positive consequences for protected species from a forage perspective, based on the potential to overfish the herring stock complex with a previously specifications. Although the marine mammal/fishery interactions would remain at the current levels with the status quo option, this level of interaction could potentially be decreased if the newer specifications are adhered to.

Options 1-6 (Non-Preferred) – Availability of Forage

The difficulty in calculation of the amount of surplus herring biomass that is currently available as forage for predators was already explained in the Proposed Action section above. Alternative 1 for 2010 (non-preferred), which occurs under each option considered, has a larger ACL assigned to it and therefore the amount of harvest would be higher. The remaining year options have a lower ACL and therefore result in decreased effort. The impacts of the latter options on protected species ability to forage for herring are likely to be greater than the options in which a smaller ACL is assigned. The ACL has been set to the lower options due to management uncertainty, so it is also probable that the overall availability to forage may be decreased by lack of herring in those options, thereby negating the benefit to protected species. Similarly, if herring availability is smaller than in previous years and the higher alternatives are chosen then the impact of the fishery will be even more detrimental to the accessibility of forage to protected species.

It should be noted that any shift in available forage ought to be sufficiently small as to not impact the status of any protected species. The effects of fishing would continue to occur, with impacts principally on the species expected to interact with the fishery, but the overall effect of the herring fishery on protected species would be low.

Options 1-6 (Non-Preferred) – Area Shifts and Timing

Implementation of some of options 4A, 4B, 5 and 6 (all non-preferred) could mean that Area 1A closes earlier and opens later, thus reducing the amount of time the fleet can fish the area. Such a change may cause effort to shift to other areas, thereby potentially increasing the impact on protected species in the offshore areas, such as white-sided dolphin and pilot whales.

The distribution of the fishing industry over time and space is another important consideration, however, and depends on the availability and abundance of herring in these alternative areas. As an example, under Option 4B (non-preferred), Area 1A will only be open from May to July, significantly decreasing the effort in the Area 1A and therefore decreasing the potential interactions of protected species with the fishery. Areas 1B and 3, however, could experience an increase in fishing during the warmer months, since Area 2 is primarily a winter fishing ground. This is the time in which more protected species are likely to be in the area, thereby increasing the chance of interaction in those offshore areas, particularly for white-sided dolphin and pilot whales. Likewise, the availability of herring for forage may be decreased as well, although not enough to change the status of the protected species in consideration.

Cost of transportation to those areas and lack of vessel size, however, may provide a hindrance to the shift from the GOM to GB. The cost of steaming to and from the fishing grounds for more scattered fish will increase the cost for the fishery, and may deter inshore fishermen from shifting effort to offshore. Similarly, the vessels may not be fit for steaming on the open seas. If this does prove to be the case, then the impacts of the actions on protected species would be minimized, as the effort in the offshore areas where many migrating species occur would not experience as large of an increase in effort. The offshore areas may not be impacted during the warmer months, where migratory species are likely to be encountered, which would not see an increase in interaction with the fishery, and therefore animals such as white-sided dolphin and pilot whales would not be impacted. Indirect benefits could come from the enhanced prey species availably for protected species.

Options 1-6 (Non-Preferred) – Rate of Effort

As was previously stated, implementation of some of Options 4A, 4B, 5 and 6 (non-preferred) could mean that Area 1A closes earlier and opens later, thus reducing the amount of time the fleet can fish the area. The reduced amount of time to fish in Area 1A may create a derby-like situation, in which fishermen compete to get what quota they can in the small time allotted. This increase in the rate of effort would potentially result in an increase in the rate of encounter with protected species, particularly for the harbor porpoise, grey, and harbor seals which are seasonally abundant in the GOM. It also may reduce the amount of forage available in the area at the time that the rate of fishing increases, as more fish would be removed in a smaller amount of time, however the quotas proposed are low enough as to limit the potential effects to protected species.

Overall, however, if the most stringent of the options are chosen then the quota in all areas may be sufficiently small enough to deter fishing in Area 1. The lack of increase could result in benefits for the protected species in that area. Although the effort in Areas 1B and 3 may experience an increase in the amount of fishing, the effort will not be condensed into the few months in which protected species are not prevalent in the area, such as white-sided dolphin and pilot whales, thereby not increasing the chance of negative impacts on protected species. The amount of forage available would also not be lessened.

Options 1-6 (Non-Preferred) – Option Alternatives

In the risk assessment for the options under consideration, the options were divided into two risk categories; high and low. Those that have a higher impact listing in Table 81 are the options which may result in higher exploitation rates for the inshore stock component, and vice versa. The options which are less likely to have higher exploitation rates for the inshore stock component stand to benefit inshore protected species, in particular harbor porpoise, white-sided dolphin, pilot whales, grey and harbor seals which are seasonally abundant in the GOM, as less fishing may decrease the interaction with the herring fleet. The options which are lower risk also may also pose a potential benefit to protected species by providing more herring for forage in response to lower fishing rates. For those options which have a higher risk of impact the quotas being proposed are still low enough that the effects on protected species may still be low. There would be a slightly higher risk of interaction with protected species, in particular harbor porpoise, white-sided dolphin, pilot whales, grey, and harbor seals which are seasonally abundant in the GOM and the forage availability may be slightly less.

Options 1-6 (Non-Preferred) – Increase Monitoring

None of the options under consideration are expected to affect the levels of observer coverage at sea. More monitoring for the fishery would prove beneficial to protected species analysis as a more accurate rate of interaction with the fishery could be calculated. All options under consideration will therefore have no effect on protected species.

6.4 IMPACTS ON ATLANTIC HERRING FISHERY (ECONOMIC, SOCIAL AND COMMUNITY IMPACTS)

6.4.1 Economic Impacts

The economic impacts that result from the alternatives proposed in the 2010-2012 herring specifications fall into these general categories: 1) loss of revenue when expected landings based on OY fall below 2008 landings levels, 2) changes in harvest costs for alternatives that result in fishing activity taking place further from shore, 3) impacts to the lobster fleet for alternatives that restrict landings from Area 1A in the summer, 4) impacts to the mackerel fishery, and 5) impacts to herring processors. These impacts are discussed in more detail in the following subsections.

6.4.1.1 Impacts of Optimum Yield (OY) Specification

For the proposed action, with an effective total TAC/OY of 86,640 metric tons (95% of 91,200 metric tons), no loss of revenue is expected since this level is greater than recent landings.

OY for the fishery represents the F_{MSY}-based catch level reduced by both scientific and management uncertainty; this will become a stock-wide ACL with the implementation of Amendment 4. The 2010-2012 herring specifications alternatives propose OY alternatives that range from 75,200 mt to 130,200 mt with a variety of sub-options which distribute the yield to four management areas. After adjusting area closures at 95% of the TACs, the difference in OY between Alternative 1 and the non-preferred options under Alternative 2 in 2010 is 52,250 metric tons. If the herring industry landed this difference in 2010, valued at the 2008 average price of $260 per metric ton it would receive revenues of $13.6 million. The difference between Alternative 1 (non-preferred) and the Proposed Action is 37,050 metric tons with a value of $9.6 million.

Over the 1995 through 2008 period, the highest level of landings was 123,845 metric tons in 1997. In 2001, landings were 120,025 mt. Since 2001, landings have declined to around 100,000 metric tons even though the overall TAC was higher. Landings in 2007 and 2008 were just above 80,000 metric tons. While market conditions could have changed since 1997 and 2001, there may still be the potential for the herring industry to land 123,690 metric tons (95% of 130,000 metric tons, the proposed OY for 2010 under non-preferred Alternative 1). Even if the market could only absorb 100,000 metric tons, for example, the herring industry could still benefit from Alternative 1 by receiving revenues of $7.4 million (the value of the difference of 100,000 metric tons and 95% of the OY for the non-preferred Alternative 2 options at 2008 prices). The value of the difference between 100,000 metric tons and the Proposed Action is $3.5 million.

For 2011 and 2012, under Alternative 1 and all three years under the non-preferred Alternative 2 options, OY is below recent landings levels and will result in revenue losses. With total landings in 2008 of 80,800 mt (based on IVR data, dealer data reported landings of 78,500 mt), the alternatives/years that restrict landings to 71,440 mt (95% of 75,200 mt) result in a loss to the herring fleet and dependent industries of 9,360 mt. At an average price of $260 per metric ton (based on 2008 dealer data), this represents a total potential loss of revenue to the harvest sector of approximately $2.4 million dollars.

The revenue losses described above could be offset by a reduction in variable costs if vessels reduce the number or duration of trips. These losses may also be offset by an increase in herring prices due to a reduction in supply. However, a price model of the herring fishery, which could be used to estimate price changes, is not available. Figure 43 is provided to show the historical relationship between yearly average prices and landings. Note, however, that the quantity of landings in some years, particularly pre-1995, may not accurately reflect actual landings quantities due to incomplete reporting.

Figure 44 illustrates the difficulty in developing an accurate price model in that there does not appear to be a strong correlation between price and quantity at the weekly level. That is, for the majority of the range of weekly quantities, the observed average prices cluster around $250 per mt (in 2009 dollars). Prices and quantities at the monthly level (not provided) also show a low price/quantity correlation. This does not mean that herring prices would not increase due to a reduction in supply; it just means that change could not be predicted for this analysis. Therefore, for purposes of analysis price is assumed to remain constant.

For the 26 active vessels with Category A permits in 2008 (activity based on dealer data) which account for 97% of the landings, this is an average loss of $92,300 per vessel. The actual distribution of these losses will vary by individual circumstance. The most significant factors will be the allocation of the TAC by area and month as well as the affiliation particular vessels have with herring processors/dealers and their area of operation both at sea and on land. These factors will be discussed in subsequent sections.

Table 82 provides a breakdown of the landings by management area and gear type. Some vessels use multiple gear types. To see the breakdown by principal gear type, see Section 4.4.3 (Economic Factors). The tables in that section provide some context for understanding the relative dependence and level of activity of gear used within each management area. Additional information on the geographic distribution of landings is shown in Table 83. On average, 97% of the value of landings in 2007 and 2008 are split nearly equally between the ME/NH region and the MA/RI region.

The degree of dependence on herring is an important factor for understanding how vessels that land herring might adjust to reductions in the total TAC. Of the four vessels that used both purse seine and midwater trawl gear, all had greater than 75% of the value of their 2008 landings from herring (average dependence was 98%). Of the 6 that used only purse seine gear, one vessel was 50% to 75% dependent on herring and the other 5 average 96%. Of the 17 vessels that used midwater trawl gear (either paired or single), 9 were less than 50% dependent on herring, 5 had 50% to 75% dependency, and 3 had greater than 75% dependence. All but one of the bottom trawl vessels had less than 50% dependence. (see Table 84).

Figure 43 Herring Prices and Landings, 1950 to 2008 (Source: Fare and Kirkley, 2009)

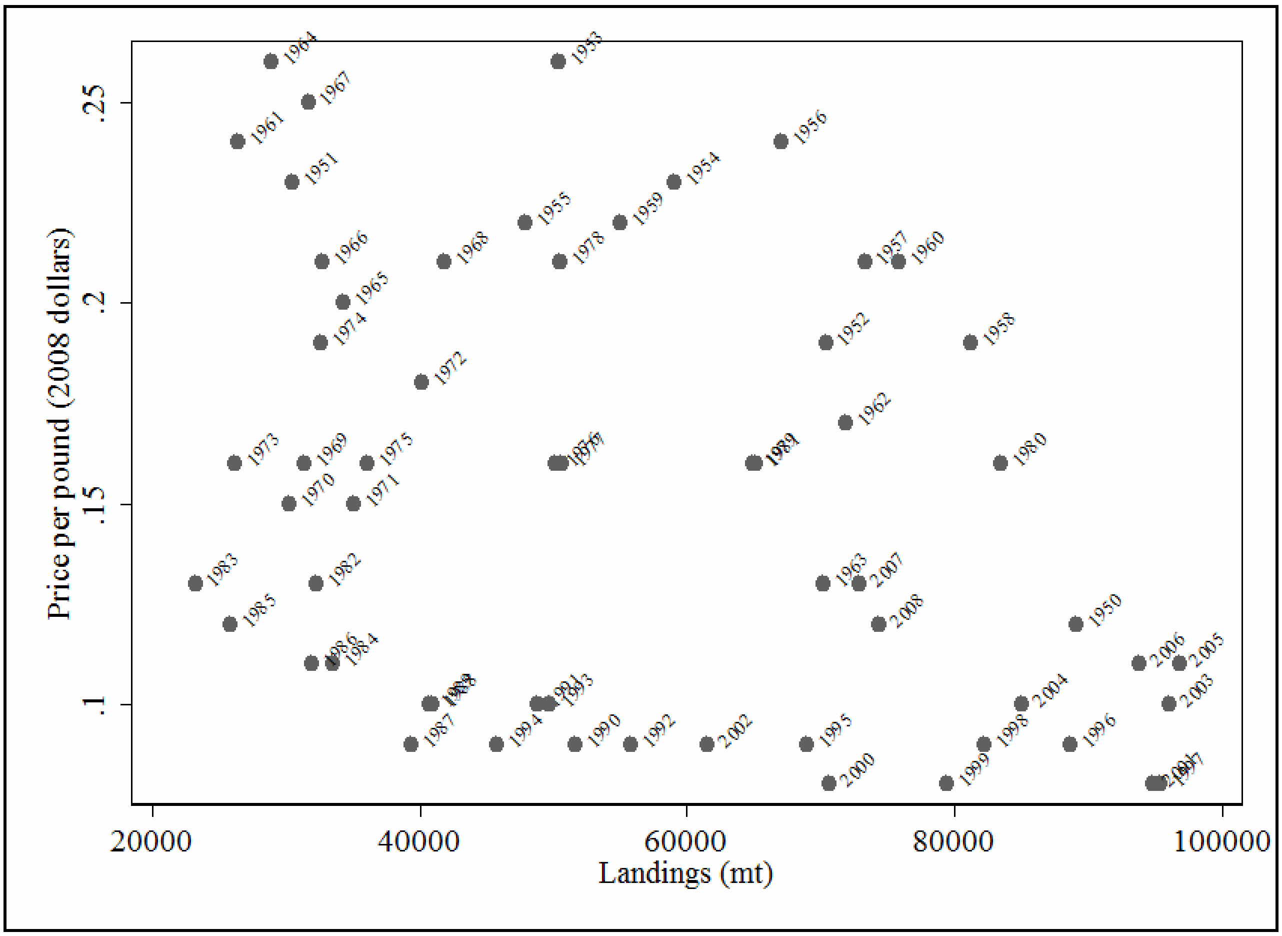


Figure 44 Weekly Herring Prices – All Uses

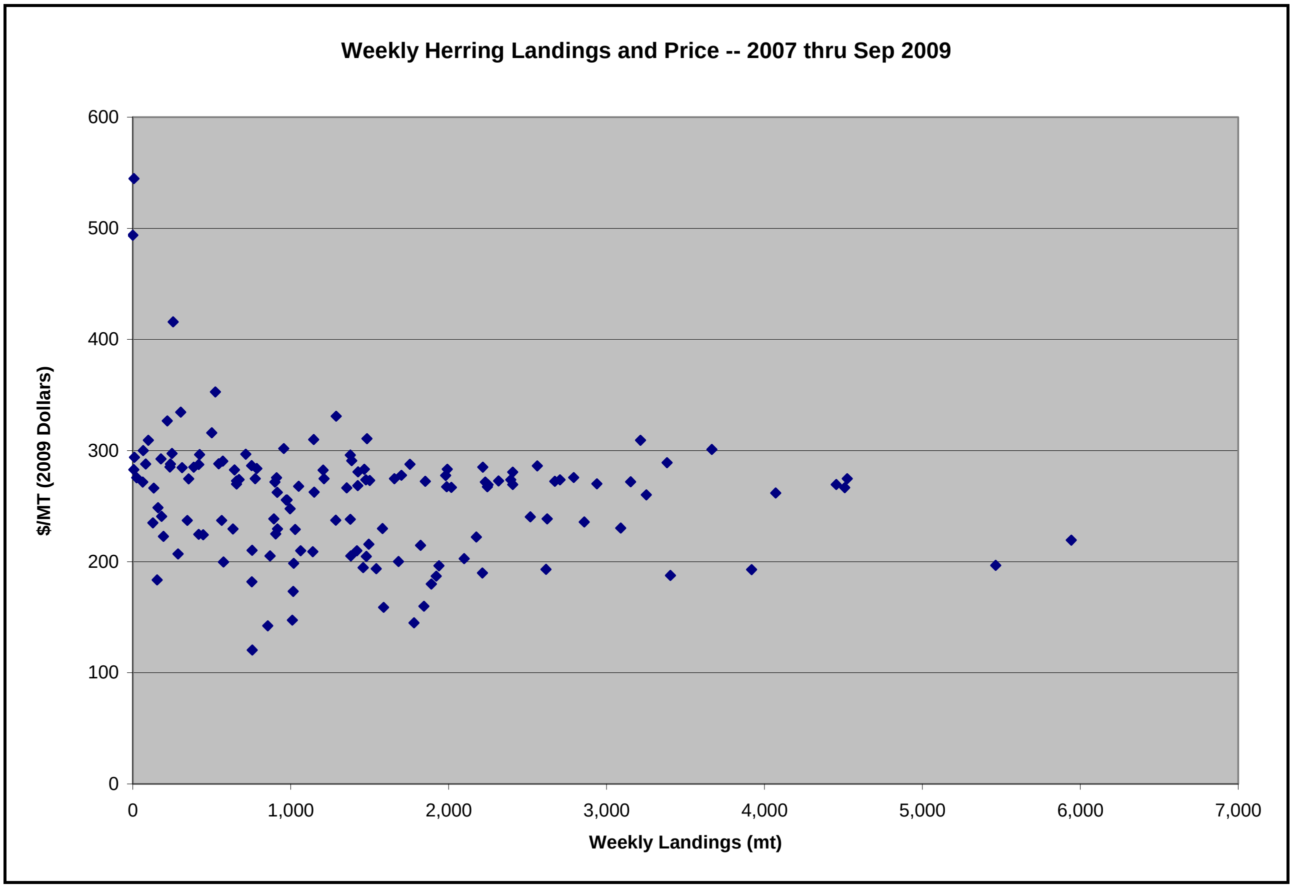


Table 82 Herring Landings and Value by Area and Gear (2007/2008 Logbook Data)

Area	Gear Type	2007 Landings (mt)	2007 Estimated Value ($240 per mt)	2008 Landings (mt)	2008 Estimated Value ($260 per mt)
Area 1A	BOTTOM TRAWL	720	172,757	223	58,073
	MW TRAWL	3,088	741,094	1,137	295,516
	OTHER	5	1,160	5	1,409
	PAIR TRAWL	11,553	2,772,697	14,987	3,896,527
	PURSE SEINE	29,812	7,154,930	24,038	6,249,868
Area 1A Total		**45,178**	**10,842,638**	**40,390**	**10,501,392**
Area 1B	MW TRAWL	1,612	386,917	797	207,104
	PAIR TRAWL	3,143	754,346	4,104	1,066,990
	PURSE SEINE	1,252	300,370	2,651	689,230
Area 1B Total		**6,007**	**1,441,699**	**7,551**	**1,963,324**
Area 2	BOTTOM TRAWL	7,163	1,719,010	2,401	624,187
	MW TRAWL	2,589	621,373	558	144,975
	OTHER	3	719	3	723
	PAIR TRAWL	10,424	2,501,738	19,534	5,078,844
Area 2 Total		**20,178**	**4,842,840**	**22,495**	**5,848,729**
Area 3	BOTTOM TRAWL	2	389	3	896
	MW TRAWL	1,046	250,993	1,531	398,018
	PAIR	9,169	2,200,492	11,520	2,995,160
	PURSE SEINE	54	13,061	90	23,347
Area 3 Total		**10,271**	**2,464,935**	**13,144**	**3,417,421**
Grand Total		**81,634**	**19,592,111**	**83,580**	**21,730,866**

Table 83 Herring Landings and Value by Region Landed (2007/2008 Dealer Data)

Landing Region		2007	2008
No region designated	Landed value	22,172	
	Landings, metric tons	96	
	Price per mt	232	
CT to NC	Landed value	472,037	468,333
	Landings, metric tons	2,840	3,039
	Price per mt	166	154
MA and RI	Landed value	7,822,471	11,413,789
	Landings, metric tons	36,665	44,779
	Price per mt	213	255
ME and NH	Landed value	9,180,265	8,495,139
	Landings, metric tons	33,421	30,601
	Price per mt	275	278
All NE region	Total landed value	17,496,945	20,377,261
	Total landings, metric tons	73,021	78,419
	Price per mt	240	260

Table 84 Dependence on Herring by Gear Type (2008)

Gear Type	Percent dependence on herring		
	< 50%	50% to 75%	75% to 100%
Midwater trawl (single and/or pair)	9 vessels	5 vessels	3 vessels
Purse seine only		1 vessel	5 vessels
Purse seine and midwater trawl (single and/or pair)			4 vessels

6.4.1.2 Trip Costs, Trip Length, and Revenue Per Day

Some of the alternatives/options shift significant portions of the Area 1A TAC to the other management areas. When Area 1A closes, effort will shift to these other areas. The distribution over time and space will depend on the availability and abundance of herring in these alternative areas and the cost of steaming to alternative sites. For example, if Area 1A closes in the middle of the summer, fish may only be available in Areas 1B and 3 since Area 2 is primarily a winter fishing ground. If fish are available in Areas 1B and 3, then vessels will have to incur additional expenses to reach those areas.

Steaming to offshore grounds increases the length of the fishing trip. In order to understand the potential financial impact of increased fishing/steam time, Northeast Fisheries Observer Program data was used to estimate the average trip and fuel costs per day for the different herring gear types. Trips with herring landings greater than 50% (by weight) from 2007 through June, 2009 were selected. See Table 85 for average trip and fuel costs per day by gear type.

To assess the differences in trip length by management area, vessel logbook data from 2007 and 2008 were used to obtain the average number of days absent by gear type and management area. Table 86 shows, for example, that the difference in days absent between Area 1A and Area 3 for vessels landing in ME/NH is from one to two days for the paired and single midwater trawl vessels. For midwater trawl vessels, the cost of operating the vessel for an additional day is estimated to be $2,863 (from Table 85.) For bottom trawl vessels, an additional day costs $503. For purse seine vessels landing in ME/NH, fishing in Area 3 adds just under a day to the trip length at a cost of $1,300 per day. Note that some purse vessels may be too small to safely fish offshore.

In addition to increased costs to harvest offshore vs. inshore herring, there may be differences in the catch rates by area. Table 86 shows that, for the most part, the revenue per day in Area 3 is lower than the Area 1A rate. For example, the average revenue per day for single midwater trawl vessels which land in MA/RI declines from $13,200 in Area 1A to $5,064 in Area 3. This is due to lower average catch per trip and longer trips.

Without a fully developed bio-economic model of the herring fishery, it is difficult to predict how fishing patterns will change and the associated changes in fleet profitability. However, examination of the information presented here reveals possible degrees of the magnitude of changes in costs and revenues. As a hypothetical example, if fishing in Area 3 adds one day to a two day trip, that would result in a 50% increase in trip costs. Based on Table 85, trip costs for a two day midwater trawl trip are $5,726. Adding a day increases trip costs to $8,589. Purse seine costs would increase from $2,622 to $3,933. In combination with reductions in revenue per day (Table 86 shows reductions of as much as 50% for vessels landings in ME/NH), impacts on vessel profit could be significant for alternatives/options with large reductions in Area 1A.

Table 85 Trip and Fuel Costs Per Day by Gear Type

Bottom Trawl	Average trip costs per day (2009 dollars)	503
	Average fuel cost per day (2009 dollars)	437
Midwater Trawl (single and pair)	Average trip costs per day (2009 dollars)	2,863
	Average fuel cost per day (2009 dollars)	2,681
Purse Seine	Average trip costs per day (2009 dollars)	1,311
	Average fuel cost per day (2009 dollars)	1,155

Table 86 Average Number of Days Absent, Landings Per Trip, and Revenue Per Day by Landing Region, Gear Type, and Management Area (2007 and 2008 logbook data)

			Management Area			
Landing region	**Gear type**		**1A**	**1B**	**2**	**3**
CT to NC	**Bottom trawl**	Average days absent	1.0		1.3	5.0
		Average landings (mt)	0.5		3.1	1.2
		Average revenue per day	118		619	65
	Single midwater trawl	Average days absent			2.9	
		Average landings (mt)			60.1	
		Average revenue per day			5,392	
	Pair trawl	Average days absent			3.9	
		Average landings (mt)			90.6	
		Average revenue per day			6,084	
MA/RI	**Bottom trawl**	Average days absent	1.0		1.8	1.8
		Average landings (mt)	0.6		32.1	0.4
		Average revenue per day	159		4,758	61
	Single midwater trawl	Average days absent	2.2	2.2	2.5	3.3
		Average landings (mt)	112.8	97.8	27.0	64.2
		Average revenue per day	13,200	11,659	2,798	5,064
	Pair trawl	Average days absent	2.2	1.9	3.3	3.2
		Average landings (mt)	185.1	139.1	146.0	193.8
		Average revenue per day	22,353	19,544	11,605	15,830
	Purse seine	Average days absent	2.3			
		Average landings (mt)	63.5			
		Average revenue per day	7,075			
ME/NH	**Bottom trawl**	Average days absent	1.0		8.0	
		Average landings (mt)	1.1		13.6	
		Average revenue per day	290		442	
	Single midwater trawl	Average days absent	1.4	2.0	7.0	3.1
		Average landings (mt)	64.2	148.1	5.3	212.3
		Average revenue per day	11,588	19,247	195	17,561
	Pair trawl	Average days absent	2.1	2.3		3.8
		Average landings (mt)	143.4	187.2		133.9
		Average revenue per day	17,922	20,856		9,286
	Purse seine	Average days absent	1.2	1.3		2.0
		Average landings (mt)	95.1	122.0		72.1
		Average revenue per day	19,846	23,596		9,374

6.4.1.3 Management Area Reductions

The alternatives and options considered for the 2010-2012 herring fishery specifications contain a wide variety of distribution of the total available OY to the four management areas. This will change fishing patterns by management area in ways that are difficult to predict. As discussed above, some vessels may be forced to fish further from shore resulting in higher trip costs. Some vessels may be too small to fish safely offshore and so would be more severely impacted if they did not have access to fish.

Figure 45 –Figure 48illustrate how important Area 1A is to ports in Maine and New Hampshire in the summer and fall seasons. To a lesser degree, Area 1A is important to ports in Massachusetts and Rhode Island in the fall season. Options with greatly reduced Area 1A TAC (Options 2-6) will likely result in impacts to these regions.

The primary area of uncertainty regarding the ability of vessels to make up for Area 1A reductions (particularly in the summer) is whether fish of sufficient quantity and aggregation will be available in Area 3. Historically, the Area 3 TAC has not been fully utilized but that may be because there has been a sufficient quantity of TAC in the other areas to meet market demand. Table 87 shows that Area 3 landing in 2007 and 2008 did not occur in significant quantities in the summer and becomes stronger beginning in September. However, as of October 2009, IVR landings from Area 3 are about 25,000 metric tons suggesting that Area 3 landings may have fish available during critical bait demand periods. While Area 3 may provide some relief to reduced Area 1A TAC reductions, there are concerns about haddock bycatch. If bycatch were to increase in Area 3, additional regulations may be adjusted to limit fishing there.

Options which not only significantly reduce the Area 1A TAC but also have monthly quotas (Options 4A through 6, non-preferred) are likely to create a series of fishing derby events which could in unsafe fishing and further add to harvest costs. These options are will also result in supply variability which could result in abnormal price fluctuations. This impacts processors and bait dealers in that it is difficult to plan production and meet customer needs. Vastly different distribution of TAC by management area may also result in increased on-land transportation costs since traditional landings patterns will change.

Table 87 Area 1A and 3 Herring Landings by Month (2007 and 2008)

	2007		2008	
Month	**Area 1A**	**Area 3**	**Area 1A**	**Area 3**
1	483	215	1	
2	983	1,110		
3	220		1	800
4	59	594		1,777
5	6,873	172		1,269
6	3,260		3,824	
7	6,206	54	9,208	186
8	8,532		11,152	508
9	8,256	127	834	1,085
10	10,304	1,253	7,863	6,173
11	1	1,502	7,505	1
12	1	5,244		1,345
Total	45,178	10,271	40,390	13,144

Figure 45 Herring Landed in Maine and New Hampshire Ports by Season and Management Area (2007)

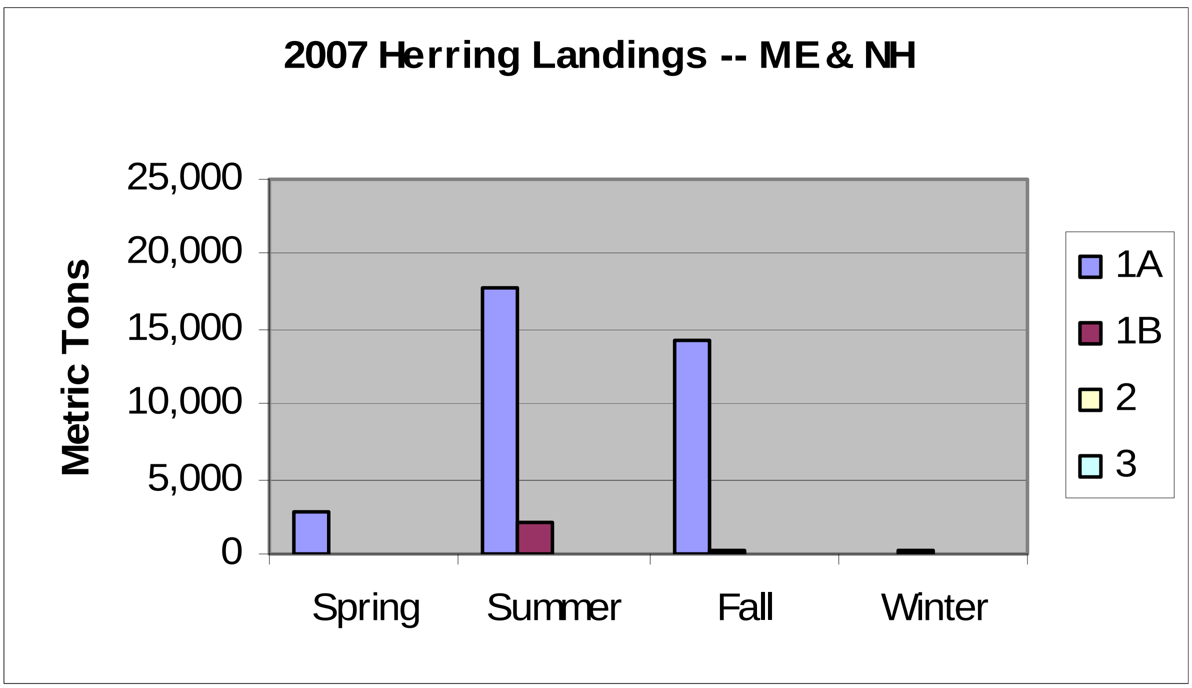


Figure 46 Herring Landed in Maine and New Hampshire by Season and Management Area (2008)

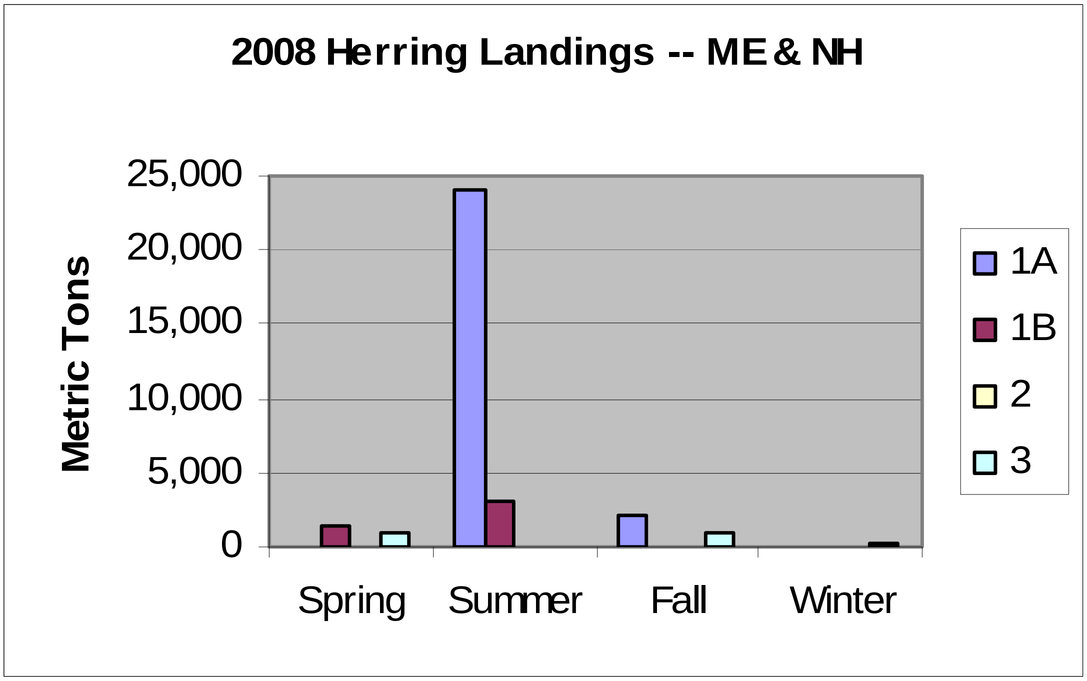


Figure 47 Herring Landed in Massachusetts and Rhode Island by Season and Management Area (2007)

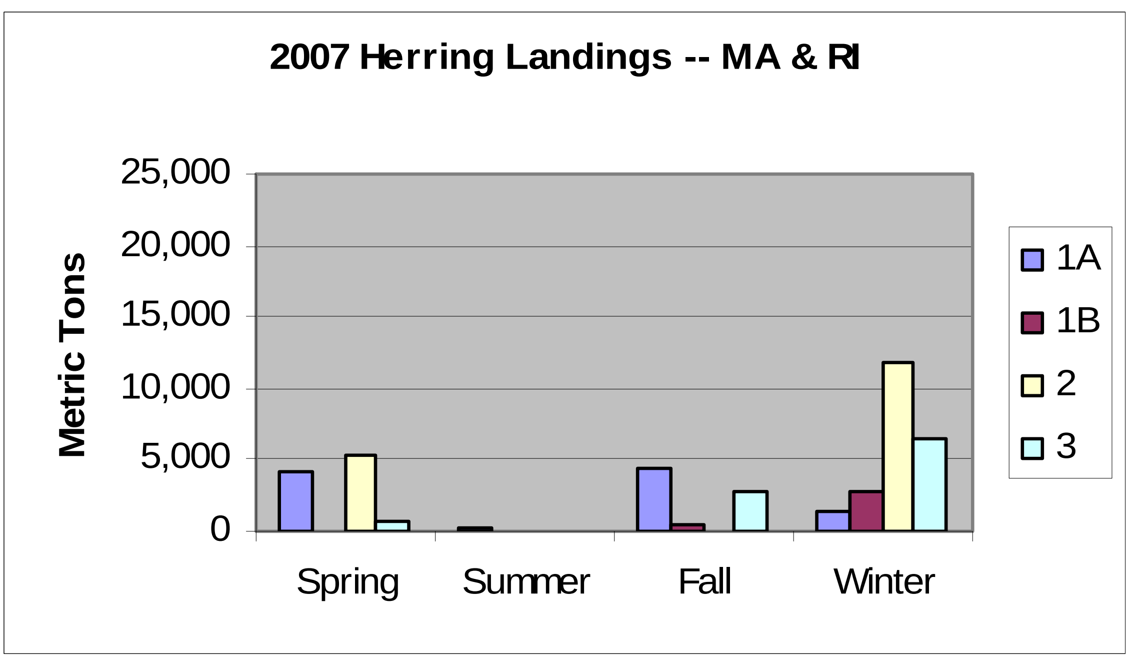
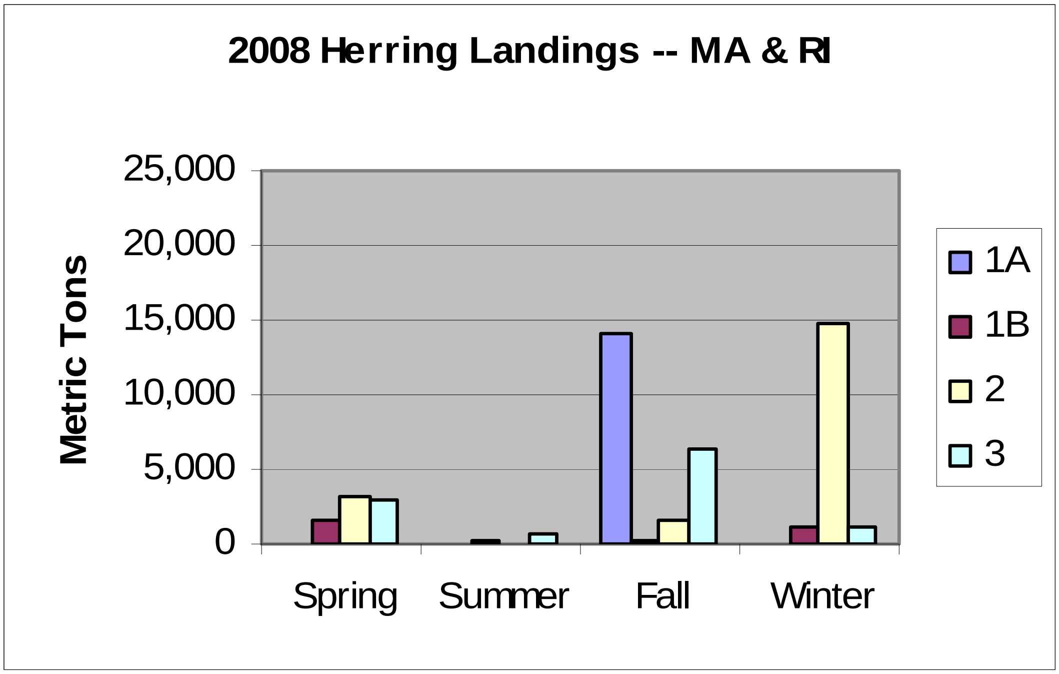


Figure 48 Herring Landed in Massachusetts and Rhode Island by Season and Management Area (2008)



6.4.1.4 Impacts to the Lobster Fishery

6.4.1.4.1 Background Information on Food and Bait Markets

While much of the information provided in this section is background and provides context, it is included in this section (instead of the Affected Environment) because it was considered during the assessment and forms the basis for the conclusions that are drawn.

During 2007 and 2008, 99% of the herring landings were coded by seafood dealers as entering either the human food market (primarily exported) or the lobster bait market. Note that some herring coded as entering the food market may have ultimately been sold in the bait market. The remaining 1% was coded as entering either the “canned pet food market” or the “animal food” market (see Table 88). Of the product entering the bait/food market in 2007 and 2008, approximately 63% is sold as lobster bait. Summer and fall are the important seasons for bait with an average of 69% (73% by value) going to the bait market during that time. Regionally, bait is landed at ports in RI and north with about 55% landed in ME/NH ports and 45% in MA/RI ports. In 2007, 94% of the ME/NH bait was landed during the summer and fall seasons but in 2008 81% was landed in the summer season alone. Less than 3% of the bait landed in MA/RI is landed in the summer. The remaining bait landings in MA/RI are distributed somewhat evenly over the other three seasons.

Prices for bait vs. food tend to track one another seasonally (see Figure 49 and Figure 50) with the lowest prices observed in the winter and the highest in the summer and fall (in 2007 prices were highest in the summer and in 2008 prices were highest in the fall). Across all regions, bait prices are at a slight premium over food prices with the difference somewhat more pronounced in 2008. When prices are broken down by landing region, similar patterns emerge (not shown).

Overall landings patterns by season are shown graphically in Figure 51 and Figure 52. Landings are heavily weighted to the bait market in the summer (fall as well in 2007) and heavily weighted to the food market in the winter.

Since the utilization code is only in the seafood dealer data, landings for the bait market cannot be readily described by management area or gear type since dealers don't report this information. Also, there is no direct link between logbook (which has gear and area information) and dealer data. In order to provide bait landings by gear type (see Table 89), logbook data was used to identify the gears used in 2007 and 2008 by individual vessel. This gear designation was then assigned to individual vessel landings in the dealer data to produce Table 89.

Table 88 Landings and Value by Region Landed, Season, and Product Utilization (2007 and 2008 seafood dealer data)

			2007				2007 Total	2008				2008 Total
			Spring	Summer	Fall	Winter		Spring	Summer	Fall	Winter	
CT thru NC	Food	Value of landings	86,965			354,623	441,588	74,337			391,089	465,426
		Landings (mt)	566			2,236	2,802	415			2,620	3,035
	Bait	Value of landings				28,066	28,066					0
		Landings (mt)				33	33					0
MA and RI	Food	Value of landings	729,612	29,642	316,462	2,093,359	3,169,075	249,400	120,357	2,741,939	2,227,040	5,338,736
		Landings (mt)	3,452	107	1,359	10,127	15,044	1,044	455	10,720	10,417	22,636
	Bait	Value of landings	1,445,579	58,778	1,383,087	1,646,606	4,534,050	1,580,041	153,094	3,130,501	1,029,380	5,893,016
		Landings (mt)	6,316	265	6,120	8,380	21,081	6,299	565	10,236	4,236	21,335
ME and NH	Food	Value of landings	142,675	1,018,312	609,718	6,904	1,777,609	65,482	1,119,505	286,945	12,260	1,484,192
		Landings (mt)	711	3,699	2,119	36	6,565	229	4,521	938	54	5,741
	Bait	Value of landings	299,015	4,057,163	2,944,857	101,621	7,402,656	565,437	5,619,673	746,692	79,145	7,010,947
		Landings (mt)	1,135	14,468	10,901	352	26,856	2,066	20,186	2,277	330	24,859
All Northeast	Food	Value of landings	959,252	1,047,954	926,180	2,454,886	5,388,272	389,219	1,239,862	3,028,884	2,630,389	7,288,354
		Landings (mt)	4,729	3,806	3,477	12,399	24,411	1,688	4,976	11,658	13,090	31,413
	Bait	Value of landings	1,744,594	4,115,941	4,327,944	1,776,293	11,964,772	2,145,478	5,772,767	3,877,193	1,108,525	12,903,963
		Landings (mt)	7,451	14,733	17,022	8,765	47,970	8,365	20,751	12,512	4,566	46,194

Figure 49 2007 Herring Food and Bait Prices

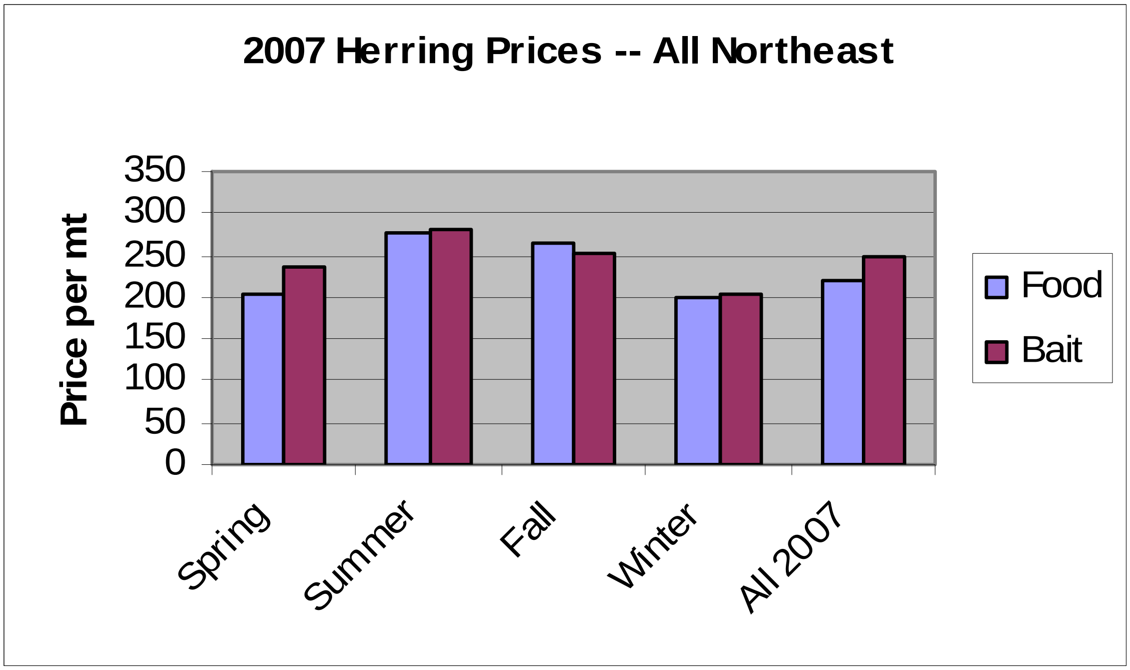


Figure 50 2007 Herring Food and Bait Prices by Season

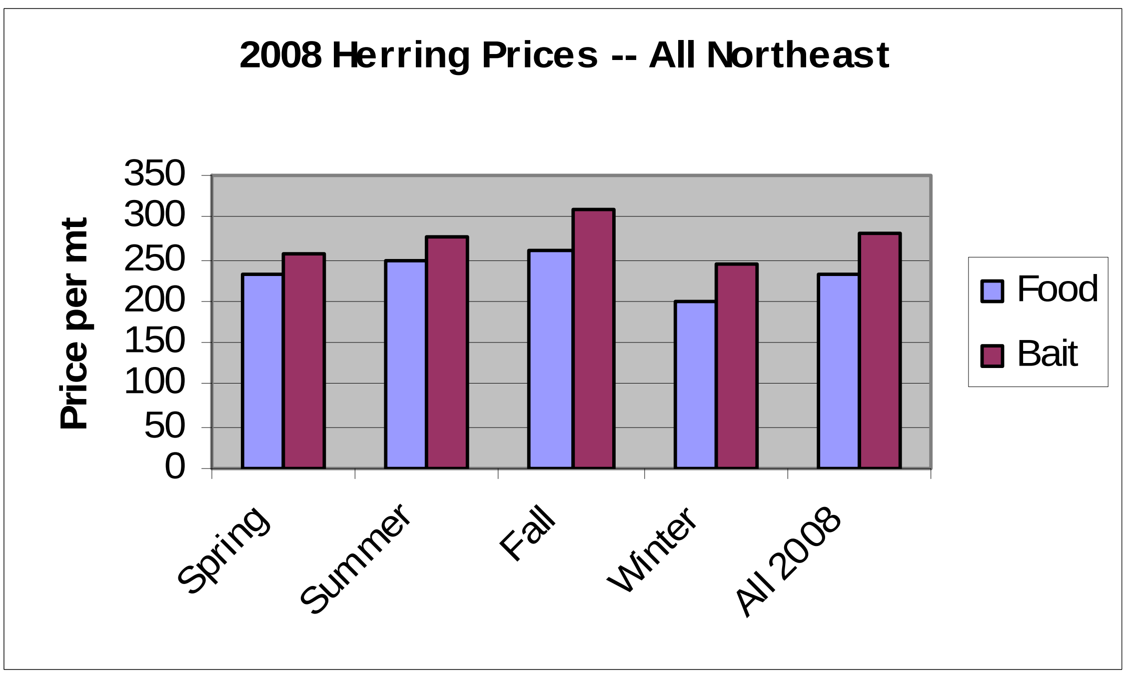


Figure 51 2007 Herring Food and Bait Landings by Season

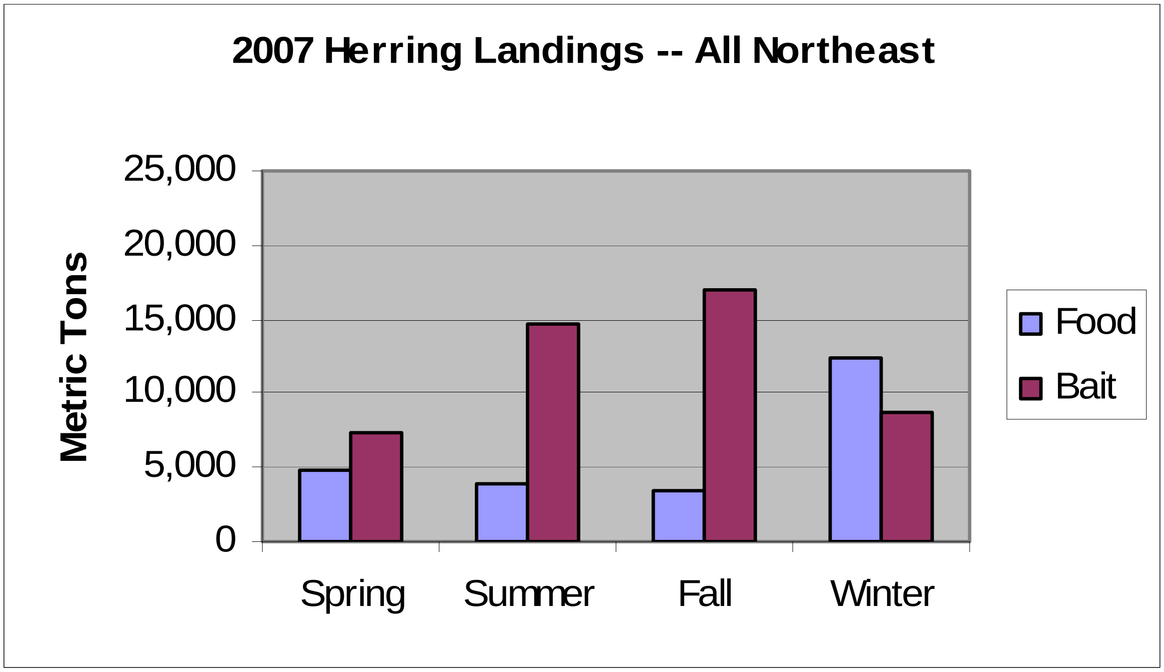


Figure 52 2008 Herring Food and Bait Landings by Season

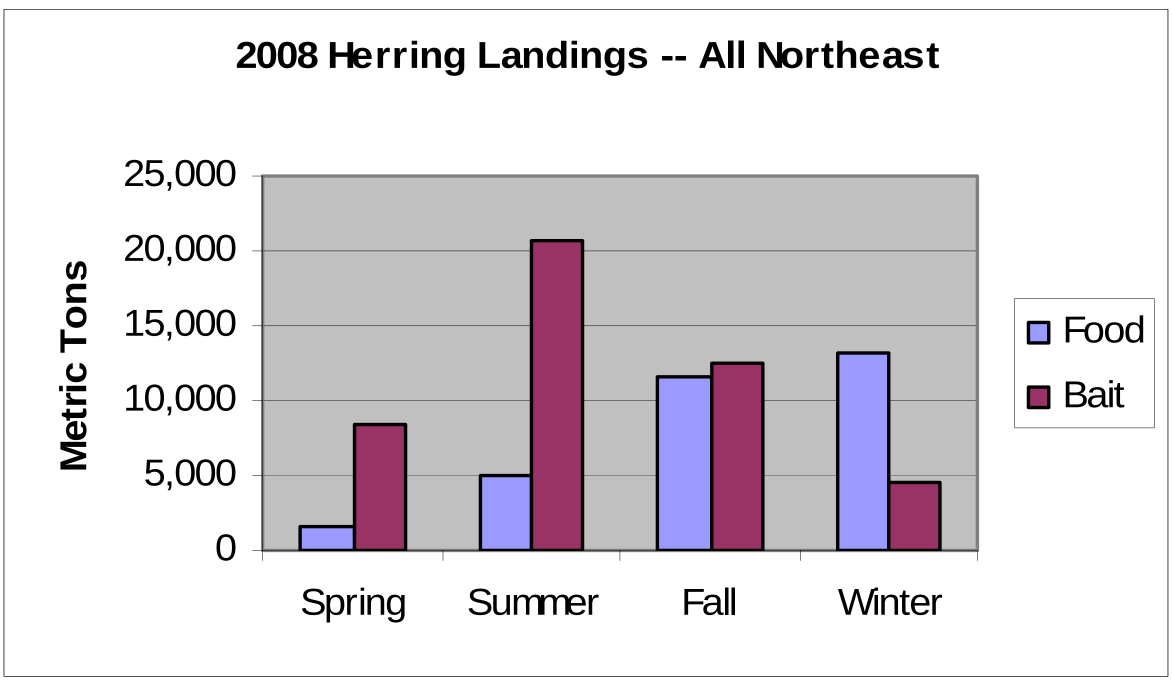


Table 89 Bait Landings by Gear Type (mt)

Gear used in 07/08	2007	2008
Bottom trawl only	1,622	711
Bottom trawl and single or paired midwater trawl	562	88
Single or paired midwater trawl only	14,632	9,259
Purse seine only	8,514	8,838
Purse seine and single or paired midwater trawl	19,593	26,789
Gear unknown	1,441	509
Total	46,363	46,194

6.4.1.4.2 Discussion of Impacts to the Lobster Fishery

Herring is an important input for the Northeast lobster fishery. As shown in Table 88, nearly 50,000 metric tons of herring is used as bait per year. According to a 2006 survey of 82 lobster fishermen administered by John Driscoll at Dalhousie University, 87% used salted herring, 5% used salted menhaden, 4% used redfish racks, and 4% used other types of bait.

Since seafood dealer data does not record the management area from which bait landings originated, precise information about bait landings by management area cannot be provided. However, it is widely understood that the majority comes from Area 1A. All but Option 1 propose to significantly reduce the Area 1A TAC. Options 2 through 6 have reductions that range from about half the status quo TAC of 45,000 mt to as little as a tenth. As discussed above, the reduction in Area 1A landings may be offset by landings from other areas. If the resulting harvest costs increase, these costs could be passed on to lobster fishermen. If fish are not readily available in Areas 1B and 3 in the summer when bait is most in demand, there could be significant shortages of herring.

Historical bait prices are not highly correlated with yearly landing quantities (see Figure 53). The observations in Figure 53 at the lower end of the quantity axis are from the early to mid 1980's. Since lobster landings averaged about 40 million pounds per year during that period, as opposed to twice that during 2000 to 2005 (Thunberg, 2007) bait prices were not higher than prices observed during time periods where both herring and lobster quantities were high. For these reasons, it may not be correct to assume that bait prices would not be affected by significant reductions in landings.

The average price for bait was $281 per metric ton in 2008 which was the highest price observed in the time series. Given high current bait prices coupled with high lobster landings and therefore high demand for bait, it is likely that such large reductions in Area 1A TAC could result in price increases in the bait market. The degree to which bait prices could rise is difficult to predict, however.

Options 4A, 4B, 5, and 6 (non-preferred), in addition to having the lowest Area 1A TACs, divide the 1A quota equally over three months in the spring/summer. This feature is likely to result in highly variable landings and prices. These periods of shortages and high prices will affect the profitability of the lobster fishery.

A 2006 survey by Market Decisions (as reported in Thunberg, 2007) showed that bait costs were 14% to 15% of gross landed value for full-time lobster fishermen in Lobster Conservation Management Area 1 (coastal Maine, New Hampshire, and the North and South Shore regions of Massachusetts). In Lobster Conservation Management Area 2 (coastal Rhode Island and coastal Massachusetts South of Cape Cod), bait costs were 11% to 12% of gross. For both lobster management areas, net returns as a percent of gross revenue was 32% to 33%.

Using the lobster fishing cost and revenue information from the Thunberg 2007 report, every 10% increase in bait costs translates to a reduction of 1% in net returns as a percent of gross revenue for full-time vessels with no stern man. For lobster vessels that use a stern man (gross revenues and bait costs are about double what they are for vessels with no stern man), a 10% increase in bait costs translates to a 1.5% reduction in net return as a percentage of gross revenue.

In a letter from the Maine Lobstermen's Association to Dr. Jane Lubchenco, Dr. Nancy Thompson, Mr. Paul Howard, and Mr. John O'Shea dated October 14, 2009, they estimate that bait costs as a percent of gross revenue are much higher than the 14% figure reported by lobster fishermen in the 2006 Market Decision survey since lobster prices have dropped 30% and bait prices have increased by 20% (dealer data shows a 10% increase in bait price from 2006 to 2008). Their estimates are that bait costs could range from 35% to 40% of gross revenue. With lower gross revenues and with bait becoming a larger portion of that revenue, lobster fishermen are likely to be severely impacted by shortages in bait supply and the potentially higher cost of obtaining bait.

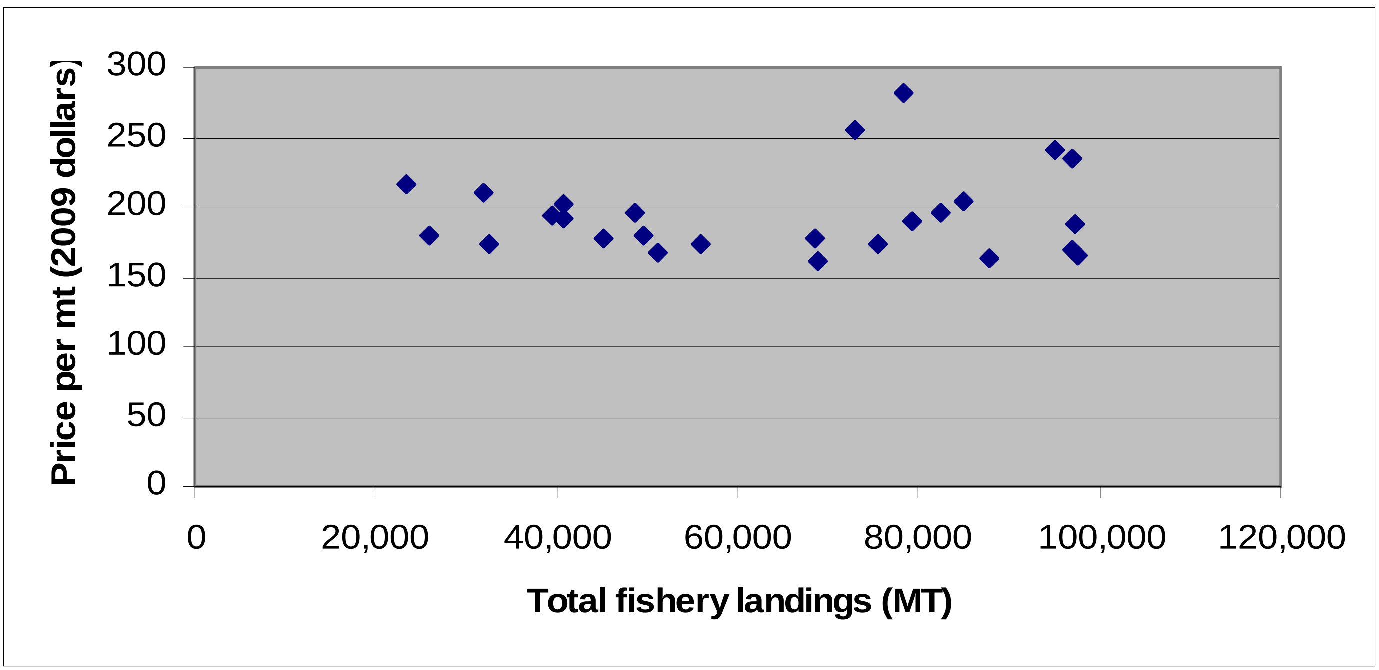
The MLA letter also states that 83% of the lobster landings occur during July through November which means that summer and fall are critical periods for finding bait supplies. In addition, they report that 20% of the landings occur in October. So, for Options 4A through 6 which limit landings to May through September, there would be no herring coming from Area 1A during the month with the highest demand for bait.

If the herring bait prices increase due to supply shortages, lobster fishermen will look to alternative types of bait. These alternatives could include the alternatives listed above as well as frozen herring and herring from Canada. The availability of these bait alternatives is unclear (implications of using frozen bait are discussed below). However, if demand for bait alternatives increase, prices could also increase.

With bait shortages, herring processors with the capability to freeze and store herring may attempt to supply lobster bait dealers with frozen product. There may be short-term barriers to adequately developing this as a viable alternative. The existing bait supply infrastructure is built around delivering barrels of salted herring. Most bait suppliers have trucks with lift gates so that barrels can be easily offloaded at the many drop-off points along the coast. Frozen herring is typically shipped on pallets of 50 boxes weighing 50 pounds each. This requires the use of fork lifts for off-loading which are not available at the drop-off points and so offloading must be done by hand. Frozen herring, once thawed, has a shorter shelf life than salted herring which may require different handling and delivery scheduling. Frozen herring is also more expensive that salted herring. As of October, 2009, frozen herring was 20 cents per pound versus 12 cents a pound for salted herring, according to Purse Line Bait Company. Herring from Canada is another alternative but supplies are limited and the price is about 23 cents per pound (Purse Line Bait Co, Oct 2009).

Menhaden is another bait alternative. At times, it is available in Maine but when it is not it must be hauled from NJ. The added shipping costs increase the price and the quantities are usually larger which presents handling problems. The quality of trucked menhaden is inferior to menhaden caught in Maine and delivered directly to bait dealer.

Figure 53 Bait Prices and Total Herring Fishery landings, 1983 – 2008



The No-Action Alternative would maintain the specifications as set for the previous fishing year, 2009. Under this alternative, vessels would continue to fish as they do under the specifications set for 2009, which would also be controlled by a cap. The overall effect of these vessels fishing under the 2009 specifications (No-Action) is expected to be negligible. Over the long-term, maintaining the 2009 specs for the next three years could have detrimental impacts on the stock and lead to negative impacts.

6.4.1.5 Impacts on the Mackerel Fishery

Background Information

While much of the information provided in this section is background and provides context, it is included in this section (instead of the Affected Environment) because it was considered during the assessment and forms the basis for the conclusions that are drawn.

Table 90 summarizes the Amendment 1 (herring) permit category and the average herring landings for vessels that participated in the mackerel fishery during 2007, based on vessel trip reports (VTRs). Note that since Amendment 1 to the Herring FMP was not implemented until June 1, 2007, there are three vessels with no herring permits in 2007 (they possessed open access permits for herring prior to the implementation of the Amendment 1 limited access permit program). Herring landings were insignificant and mackerel landings were less than 1,000 mt for these vessels during 2007.

According to Table 90, every vessel that landed more than 1,000 mt of Atlantic mackerel during 2007 qualified for and obtained a limited access directed fishery permit to fish in all management areas for herring (Category A). These vessels are therefore allowed to fish for and land herring in unrestricted amounts until a TAC is reached in a management area and the area closes. All other vessels with mackerel landings (71) reported less than 1,000 mt total for the fishing year. Thirteen of these vessels qualified for an unrestricted herring limited access permit for all areas (Category A), two qualified for unrestricted limited access permits in Areas 2/3 only (Category B), and two qualified for limited access incidental catch permits with a 25 mt possession limit restriction. There were 51 vessels that reported mackerel landings in 2007 that did not qualify for a limited access permit but obtained the open access incidental catch permit with an associated herring possession limit of 3 mt. These 51 vessels averaged 17 mt of herring landings total during the 2007 fishing year. It is important to keep in mind that this analysis considers activity during the 2007 fishing year only, and 2007 saw a substantial reduction in the Atlantic mackerel fishery (see Section II of this document for additional information).

Table 90 Amendment 1 Permit Category for Vessels with Reported Mackerel Landings in 2007

2007 Mackerel Landings		**Herring Permit Category**					
		A	**B**	**C**	**D**	**None**	**Total**
< 1,000 mt	Number of Vessels	13	2	2	51	3	**71**
	Avg 2007 Herring Landings (mt)	2,043	Cannot report	Cannot report	17	0	**401**
1,000 - 2,000 mt	Number of Vessels	8					**8**
	Avg 2007 Herring Landings (mt)	2,119					**2,119**
2,000 - 4,000 mt	Number of Vessels	5					**5**
	Avg 2007 Herring Landings (mt)	3,395					**3,395**
Total number of vessels		26	2	2	51	3	**84**
Overall Avg 2007 Herring Landings (mt)		2,326	Cannot report	Cannot report	17	0	**743**

The Amendment 1 limited access permit program was implemented on June 1, 2007.

Herring permit data were also queried to characterize the location of the vessels that reported Atlantic mackerel landings in their logbooks during 2007 (Table 91). Table 91 describes the same set of vessels that are described above in Table 90. The majority of Category A mackerel vessels (limited access herring permits for all management areas) are homeported in Massachusetts, New Jersey, and Rhode Island. The majority of Category D mackerel vessels (open access herring permit for 3 mt) are homeported in New Jersey, New York, and Rhode Island, which is consistent with trends in participation and activity in the Atlantic mackerel fishery. It is likely that the Category D vessels from NY, NJ, and RI are some of the vessels for which there may be concern about potential herring bycatch, especially if their activity in the mackerel fishery increases.

Table 91 Amendment 1 Permit Category and Home Port State for Vessels with Reported Mackerel Landings in 2007

Home Port State	Herring Permit Category					
	A	B	C	D	None	Total
CT				3		**3**
MA	12			6	1	**19**
ME	1			2		**3**
NC	1			2		**3**
NE	1					**1**
NH	2				1	**3**
NJ	5			7		**12**
NY				17	1	**18**
RI	4	2	2	14		**22**
Total	**26**	**2**	**2**	**51**	**3**	**84**

The Amendment 1 limited access permit program was implemented on June 1, 2007.

Since Amendment 1 was implemented on June 1, 2007 and the Atlantic mackerel fishery occurs primarily from December through April, 2008 is the first year in which a full mackerel season occurred while under Amendment 1 regulations. This year is used to provide some perspective on recent activity in the Atlantic mackerel fishery, including activity by vessels that may not have qualified for herring limited access permits.

The 2008 data are preliminary, so all trips may not have been entered into the database, and fishing activity during December has obviously not occurred. Table 92 reports the total landings of herring and mackerel by month through July 2008.

Table 92 2008 Monthly Landings of Atlantic Herring and Mackerel Through July 2008

January 2008	Herring landed (mt)	7,105
	Mackerel landed (mt)	11,539
February 2008	Herring landed (mt)	7,897
	Mackerel landed (mt)	2,442
March 2008	Herring landed (mt)	3,441
	Mackerel landed (mt)	2,513
April 2008	Herring landed (mt)	2,922
	Mackerel landed (mt)	5,511
May 2008	Herring landed (mt)	4,179
	Mackerel landed (mt)	27
June 2008	Herring landed (mt)	5,473
	Mackerel landed (mt)	13
July 2008	Herring landed (mt)	6,143
	Mackerel landed (mt)	1
Total	**Herring landed (mt)**	**37,160**
	Mackerel landed (mt)	**22,047**

Summary of Potential Impacts

Mackerel fishing takes place in the winter and early spring months in herring management Area 2. In the winter, herring migrate to Area 2. The co-occurrence of both these fisheries in Area 2 during the winter results in herring being caught as bycatch in the mackerel fishery. Many of the same vessels participate in both fisheries. Some mackerel vessels, however, do not have limited access herring permits and are limited to 2,000 pounds of herring per trip.

Options that restrict the Area 2 TAC below historical landings from Area 2 of about 20,000 to 22,000 metric tons have the potential to impact the mackerel fishery. In particular, Option 4A (non-preferred) limits the Area 2 TAC to 3,817 metric tons in 2012. Based on personal communications with mackerel fishery participants, they estimate that as much as 10,000 metric tons of herring is needed to keep mackerel vessels fishing. Low Area 2 TACs will force mackerel fishing vessels to take additional, and potentially more costly, steps to avoid catching herring as bycatch. In some instances, mackerel fishing cease because mackerel fishermen will not want to risk exceeding herring limits.

6.4.1.6 Impacts on Herring Processors

From the perspective of reductions in the total TAC/OY, herring processors will be impacted by losses in profits from having less herring to process. This will result in running fewer production shifts affecting not only plant profits but wages paid to processing employees. Options that allocate a high percentage of the OY to Area 3 could result in the TAC not being reached if harvesting in Area 3 is limited due to the seasonal migration of herring and aggregation levels.

Changes in landings patterns could result in higher shipping costs if herring must be trucked from other regions to fill supply voids.

The cannery in Maine is particularly vulnerable to options that significantly reduce the Area 1A TAC since the cannery has traditionally been dependant on that area in the summer. Reductions in available herring, highly variable landings, and increased cost of herring will make it difficult for the cannery to continue to produce canned herring at a profit and keep employees working.

6.4.1.7 Discussion of Proposed Action

The Proposed Action includes a total TAC/OY of 91,200 metric tons. Since management areas close to directed fishing when 95% of the TAC is projected to be reached, the effective stock-wide TAC is 86,640 metric tons. While this is a significant reduction from the no-action alternative total effective TAC of 137,750 metric tons (95% of 145,000 metric tons), it is not lower than 2008 landings of 80,800 metric tons. However, as discussed above, OY in the proposed action is lower than 1997 and 2001 landings of 123,845 and 120,025 metric tons, respectively; suggesting a potential loss of revenue if market conditions and resource availability are favorable.

As compared to Alternative 1, the Proposed Action reduces the effective stock-wide TAC immediately in 2010 to 86,640 metric tons rather than keeping it at 123,690 (95% of 130,200 metric tons). While this represents a loss in potential revenue in 2010, the proposed action does not further reduce the effective stock-wide TAC in 2011 and 2012 as does Alternative 1 and the non-preferred options in Alternative 2. The difference in effective stock-wide TAC in 2011 and 2012 between the Proposed Action and all other options is 15,200 metric tons. The value of this difference at the 2008 average price of $260 per metric ton is $3.95 million.

The most significant difference between the proposed action and the no-action alternative is the reduction in the Area 1A and 1B TACs. The proposed action will reduce the Area 1A TAC from 45,000 metric tons to 26,546 metric tons and the Area 1B TAC from 10,000 metric tons to 4,362 metric tons. One impact of the reduced Area 1 TACs is that these areas are likely to close earlier in the season which will result in increased trip costs due to vessels fishing further from shore (see discussion above). Small vessels which are unable to fish offshore may not be able to make up for lost revenue. The other impact is that Area 1 is an important area for supplying the summertime lobster bait market. As discussed above, if fish are not readily available in other areas, there may be shortages of supply. Some of these impacts may be mitigated if 3,000 mt of fish can be re-allocated to Area 1A for November and December based on catch in the NB weir fishery.

The Area 2 TAC for the proposed action is 22,146 metric tons. Recent landings were about 20,000 to 22,000 metric tons so the effect on the winter mackerel fishery should be minimal unless activity in the mackerel fishery increases significantly. The Area 3 TAC is decreased from 60,000 metric tons to 38,146 metric tons under the proposed action. While this is a reduction in TAC, only 13,000 metric tons were taken from Area 3 in 2008. Therefore, this provides some opportunity for the 18,454 metric tons that were removed from Area 1A (as well as the 5,638 metric ton reduction in Area 1B) under the proposed action to be made up by increasing catch from Area 3 if fishing conditions are favorable. As discussed above, the cost of harvesting in Area 3 is likely to be higher than the cost of harvesting it in Area 1.

6.4.1.8 The No-Action Alternative

The No-Action Alternative would maintain the specifications as set for the previous fishing year, 2009. Under this alternative, vessels would continue to fish as they do under the specifications set for 2009, which would also be controlled by a cap. The short term effect of these vessels fishing under the 2009 specifications (No-Action) is expected to be negligible. Over the long-term, maintaining the 2009 specs for the next three years could have detrimental impacts on the stock and lead to greater negative impacts.

6.4.2 Social and Community Impacts

Aside from the No Action Alternative, this specifications plan involves deep reductions in ABC for the Atlantic Herring Fishery. However, The Proposed Action will not reduce the stock-wide TAC below what was actually landed by the industry in 2008 in any of the three year time span covered by this action. The reductions in ABC for Alternatives 1 and 2 are likely to correspond with short term negative impacts to the lobster/bait industries, herring freezer plants and other direct consumers of the herring resource. Over the long term, sustaining the herring resource may also have benefits – particularly for those who benefit indirectly from the existence of a large and healthy herring stock (whale watching businesses, tuna fishermen and other fishermen who pursue stocks that rely on herring for forage). Given the proposed reductions for 2010-2012, this assessment focuses on the possible short-term (within three years) impacts related to the proposed action.

Moreover, quantification of social and community impacts is not possible at this time, primarily due to a lack of data on which to base an impact assessment. Without the systematic collection of information and data related to key social indicators for fishing families and communities, the social impact assessment must be largely predictive and qualitative. The assessment builds on the quantitative information provided in the economic impact analysis (Section 6.4.1 of this document) and discusses the possible implications of those economic impacts on fishing families and communities that are engaged in and/or dependent on the Atlantic herring fishery. Additional research and systematic social data collection is necessary for more quantitative approaches to assessing social impacts of fishing regulations in the future.

Most of the Alternatives/Options for the 2010-2012 specifications package will significantly reduce the quantities of herring that may be landed from what has traditionally been the most productive area, that is, Area 1A. However, the Proposed Action will not reduce the stock-wide TAC below 2008 landings levels in any of the three year time span covered by this action. Furthermore, given that stock-wide TACs will be reduced, losses from 1A cannot be fully mitigated by fishing in alternative areas. Clearly, the most immediate and apparent impacts of the reductions are economic, that is, the effect on individual and business income. In this section, however, the socio-cultural implications of income reduction as well as other impacts are considered. Among the social factors of interest are: quality of life, community dynamics and/or stability, governance, access to resources, distribution of resources among user groups (equity and justice concerns), and the role of fishing in American culture and tradition.

Because the herring biomass is not considered overfished, nor is overfishing occurring, there is considerable surprise and dismay among the herring industry participants and their customers regarding the proposed specifications and the reductions that are likely during 2010-2012. While there was a reduction in Area 1A quota in 2008 and again in 2009 that participants had some difficulty adjusting to, they did not anticipate additional extreme cuts. Nevertheless, the Council has proposed setting the ABC for 2010-2012 fishing years at 106,000mt. The TAC for Area 1A that had landings of 40,390 mt in 2008 is to be set at 26,546mt. Area 1B had landings of 7,551 in 2008 and the TAC is to be set at 4,362. Area 2 will only be modestly affected since it had landings of 22,495mt in 2008 and the TAC is set at 22,146. Area 3 had landings of 13,144mt in 2008 so the TAC of 38,146 is not likely to have a negative impact.

While the herring fishery is not a large fishery in terms of number of harvesters and vessels, a broader look at the production system indicates that there are many individuals who currently depend on herring as a source of employment (processing) and a large number of lobster fishermen whose operations currently rely on herring as a preferred and primary source of bait. Interruptions of supply are likely to disrupt these activities and could have a potentially significant ripple affect on harvesters, processors, and consumers of herring. As mentioned above, in a few instances, the potential effects are likely to benefit specific other groups. The following paragraphs attempt to characterize the negative impacts disaggregating them among groups.

The socio-cultural impacts of the reduction in herring landings vary markedly with differences in the vessels, gear used, homeports and associated communities, other species targeted, and the available markets (use of the product). Clusters of these differences tend to be associated with specific management areas. Therefore, for purposes of this specification package, the impacts associated with reductions of catch in the different management areas will be highlighted. The history of herring management in the region will also be briefly considered in the analysis of impacts.

6.4.2.1 Area 1A

The highest landings of Atlantic herring are harvested from Area 1A (see Table 30) in Economic Impacts Section of this document). In 2008, Maine vessels landed 26,119 mt from 1A and Massachusetts vessels landed 14,182mt (89 mt by other vessels for total landings of 40,390mt).

In contrast, the proposed action will limit the total landings from Area 1A to 26,546 mt, a decrease of 13,844 mt. Importantly, landings from 1A are directly linked with more local livelihoods than landings from other areas. Those individuals likely to be affected include those involved in the lobster fishery as well as those who work in the cannery in Prospect Harbor, Maine. Those currently reliant on Atlantic Herring also tend to live and/or work in areas that have relatively large percentages of the population living under the poverty line, higher levels of unemployment than the national average, and few opportunities for alternative employment (Table 93). Reductions of Atlantic Herring landings in Area 1A could negatively impact the following stakeholder groups:

- Lobster fishery participants
- Herring harvesters
- Bait dealers
- Trucking industry
- Prospect Harbor cannery
- Other processing plants

Baseline information about these stakeholder groups can be found in section 4.4.7 and the detailed Affected Human Environment section presented in Amendment 1 to the Atlantic Herring FMP and will be updated in the Draft EIS for Amendment 5 to the Herring FMP (under development).

Table 93 Primary Ports' Unemployment, Poverty Rate and Median Incomes

	Unemployment	Percent Below Poverty	Median Income
National	9.8%	13.2%	$41,994-$44,684
Massachusetts	9.3%	10.0%	$62,365.00
Gloucester	10.0%	10.3%	$65,325.00
New Bedford	14.0%	20.2%	$34,607.00
Maine	7.8%	12.0%	$37,240.00
Portland	6.5%	13.0%	$40,609.00
Rockland	11.3%	16.2%	$37,410.00
Stonington	13.4%	13.7%	$32,333.00
Vinalhaven	11.2%	9.9%	$44,408.00
Lubec	13.9%	20.3%	$20,565.00
Port Clyde			$36,774.00
Gouldsboro	12.0%	11.6%	$36,542.00
Jonesport	13.6%	22.0%	$28,183.00
Rhode Island	12.0%	11.6%	$53,568.00
Pt. Judith	9.9%	16.2%	$50,363.00
Newport	11.4%	16.9%	$35,669.00
Kingston	9.9%	8.9%	$61,507.00
New Jersey			
Cape May	16.1%	9.2%	$51,058.00

**These statistics are from Census estimates for each port dating 2007 to 2008.*

The No-Action Alternative would maintain the specifications as set for the previous fishing year, 2009. Under this alternative, vessels would continue to fish as they do under the specifications set for 2009, which would also be controlled by a cap. The short term effect of these vessels fishing under the 2009 specifications (No-Action) is expected to be negligible to these stakeholder groups. Over the long-term, maintaining the 2009 specs for the next three years could have detrimental impacts on the stock and lead to negative impacts.

6.4.2.1.1 Impacts on the Herring Fleet

While consideration of the impacts on the herring fleet are considered in the section on Economic Impacts, this section highlights the potential social impacts to the fleet resulting from reductions in the Area 1A TAC (Proposed Action, Options 2-6).

Potential impacts:

- Less fish, fewer crew, lower wages, fewer jobs. This may be more pronounced for those working on purse seiners, as they tend to be more dependent on herring than other gear types (see economic analysis).
- Because several of the options propose restricting landings from Area 1A to summer months (June-August or July-September) midwater trawl vessels are effectively excluded from Area 1A almost all year. Days out of the fishery already preclude fishing in Area 1A from January–May, and the purse seine/fixed gear only area is effective from June-September. The options that restrict landings only to certain months between June and September completely exclude midwater trawl vessels (these options were not selected, however, and the proposed action does not include a seasonal restriction for landings, although ASMFC will likely continue to restrict landings through days out provisions).
    - Because Area 1A has typically been the most productive area, this exclusion could lead to anger and frustration in addition to the financial costs among those shut out.
    - Midwater trawler owners might take the financial risk of converting to purse seiners (financial stress)
    - Midwater trawlers might go out of business
        - Less fish, fewer crew, lower wages and fewer jobs might result
        - Unemployment, household stress might result.
    - Though no scientific study has yet been completed that measures the effect of the purse seine/fixed gear only restrictions, some fishermen report that they see what they regard as ecologically beneficial effects. If these reports prove accurate, the benefits generated could help the groundfish resources rebuild; provide a cushion dampening the effect of the "naturally highly variable herring populations" (NOAA 2009) and help the industries that rely on species that are attracted to herring, e.g., whale watchers.
    - The viability of purse seine vessels is aided by the option to retain purse seine/fixed gear only restriction. Before this restriction was implemented, active purse seines were considered disadvantaged due to their size and inability to travel far and/or to compete with trawls. Reducing the quota will, however, put negative pressure on the purse seiners.
- Safety issues:
    - Potential for a "race to fish" is created by the demand for a secure source of lobster bait
        - The seasonal availability is of concern since the peak season for lobster is July-November (thus highest demand for bait). For companies or

cooperatives with freezer storage capacity, early landings of herring would ensure supply.

  - To the extent that the percentage of available quota shifts out of Area 1A, vessels that have typically fished in 1A may feel compelled to seek herring in the more distant areas thus creating a safety hazard.

- A number of vessels invested approximately a half-million dollars to convert their midwater trawlers to purse seines when Amendment 1 established a purse seine/fixed gear restriction in Area 1 for the summer months (June 1 to September 30). Reductions in the availability of herring in Area 1A make it harder for these vessels to recoup their conversion expenses.

The No-Action Alternative would maintain the specifications as set for the previous fishing year, 2009. Under this alternative, vessels would continue to fish as they do under the specifications set for 2009, which would also be controlled by a cap. The short term effect of these vessels fishing under the 2009 specifications (No-Action) is expected to be negligible to these herring vessels. Over the long-term, maintaining the 2009 specs for the next three years could have detrimental impacts on the stock and lead to negative impacts.

6.4.2.1.2 Impacts on the Lobster Industry

1. Importance of Atlantic herring to the lobster fishery:

Area 1A is the primary source for Maine's lobster bait of choice

- Herring is considered essential for lobster fishing in Maine. The current system is based on herring as the primary source of bait. Major reductions would certainly modify these systems of production/distribution though it is difficult to predict exactly how.
- While other fish species have been used for bait in the past (e.g., redfish), because this catch reduction is eminent, there will be little time to adapt, that is, to identify an effective and comparably priced alternative bait and a reliable source.
- There are extra costs and problems associated with sourcing sufficient quantities of alternative bait
  - Timing of the availability of alternatives will be critical for viability; predictability of supply is a major concern
  - Perhaps there are opportunities for innovation
- Lobster fishing is a "way of life," a source of identity.
  - Lobstermen in Maine have on average held a lobster permit for 29 years and were involved in the industry for 2 to 4 years before obtaining a license (Taylor Singer and Holland, 2008).
  - Mainers are more likely to have children who are involved in or intend to enter the lobster fishery (Ibid).
  - Before limited entry was instituted in most fisheries in the Gulf of Maine, lobstering was often a part-time activity, but now "many fishermen are exclusively dependent on the lobster resource" (Taylor Singer and Holland, 2008).

  - Despite this dependency, the “net revenues of lobstermen after accounting for operating expense are not high on average,” except for those who fish offshore (i.e., ASMFC Lobster Conservation Management Area 3) (Ibid).
  - Over half of active lobstermen use personal or family savings to finance their business (Ibid).
  - Many use their homes as collateral on business loans
  - In LCMA 1 ME, only 16% of household income comes from another household member and the lobstermen who fish in LCMA 1 are less likely than any other group to have retirement benefits (ibid).

2. Vulnerability of Maine’s lobstering communities:
Maine communities that are dependent on lobster fishing and consequently, herring, also tend to be more geographically isolated than communities associated with landings from Areas 2 and 3.

- There are fewer alternative sources of employment, especially with comparably profitable occupations, and fewer resources.
- “Many rural coastal towns now depend almost entirely on lobstering to support the local economy” (Taylor Singer and Holland, 2008).
- Higher rates of unemployment than the national average in most areas.
- Higher rates of families below the poverty line than the national average.

All these factors make these communities more vulnerable to major shocks or changes to employment structures. While it is uncertain whether reductions in Atlantic herring landings would result in large number of lobstermen going out of business, these factors in the current economic climate would make them less resilient to restructuring their livelihoods.

- Lobster fishing has recently suffered some economic losses, so the cumulative impact of reducing the supply of herring is a concern.
  - Lobster prices fell
  - Fuel and gear costs have increased since Amendment 1, though this may have been a short-term problem.

3. Distributional considerations/social networks
While all options will provide for some bait, major reductions in ABC (Proposed Action and Alternatives 1 and 2) may affect lobstermen’s access to bait. Despite these reductions, the Proposed Action will not reduce the stock-wide TAC below what was actually landed by the industry in 2008 in any of the three year time span covered by this action.

Social relationships, distance to markets, and ability to pay are likely to be determining factors. Currently, when bait becomes scarce, distribution is largely based on the social relationships between bait dealers or coops and lobstermen. Those in good standing with high levels of social capital are likely to receive bait before other lobstermen. Maintenance of relationships with dealers/brokers/coops is important to retain access to herring when it is scarce.

- Bait dealers in many cases have been in the same community, servicing the same fishermen for several generations.
  - Loss of access to herring could disrupt social as well as business networks
  - Some of the bait dealers have formal or informal contracts with individual vessels whose whole catch they purchase (Brandt and McEvoy 2006)
- These relationships between dealers and lobstermen could be strained with shortages.
- Those lobstermen that do not enjoy high levels of social capital with their dealers may not be able to garner the necessary bait to supply their traps throughout the season. Financially secure fishermen may be able to pay higher prices for bait thus pricing out those lobstermen operating at a tighter margin. Additionally, geographically isolated lobstermen could be at a disadvantage if bait is sold before reaching them.

The No-Action Alternative would maintain the specifications as set for the previous fishing year, 2009. Under this alternative, vessels would continue to fish as they do under the specifications set for 2009, which would also be controlled by a cap. The short term effect of these vessels fishing under the 2009 specifications (No-Action) is expected to be negligible to the lobster fishery and lobster communities. Over the long-term, maintaining the 2009 specs for the next three years could have detrimental impacts on the stock and lead to negative impacts.

6.4.2.1.3 Impacts on Cannery

There is only one herring cannery left in Maine, a remnant of a long history and tradition of canning of herring that was common along the northeastern seaboard. The cannery has struggled over the years and a reduction in quota will have a negative on sourcing for the cannery. The alternatives for the specification for 2010-2012 do call for reductions in ABC; however, the Proposed Action will not reduce the stock-wide TAC below what was actually landed by the industry in 2008 in any of the three year time span covered by this action.

- Prior quota reductions in Area 1A already affected the cannery's supply
- The cannery pays less per pound than bait buyers pay, so during a shortage they are less likely to be able to purchase from US suppliers
  - They will buy fish from as far south as Cape May, but transportation costs are then higher
- The cannery buys frozen fish from Canada when necessary
  - More expensive to produce canned product from frozen
- Herring has also been purchased from Europe in the past, but is it more expensive

The cannery employs about 100 people. Located in Prospect Harbor, Maine a very small town with very few other sources of employment. Interviews with processing workers at the plant in 2007 reveal the significant role and meaning of the cannery in the lives of those who work there.

There are a number of reasons to suggest that those employed at this plant may have a difficult time adapting should the plant shut down or reduce the number of employees. Mainly women, the labor force is not highly educated and would likely need to retrain in order to shift to another source of employment. Some employees have worked there for over 50 years – not only does their income come from the cannery but so do many of their social relationships and networks. It is not just a job, but as with many lobstermen, it is a source of identity. Interviews with cannery staff differ substantially from those in processing (not necessarily herring) plants in Southern New England where interviewees often were unfamiliar with, even unable to name, the species that they worked with.

The No-Action Alternative would maintain the specifications as set for the previous fishing year, 2009. Under this alternative, vessels would continue to fish as they do under the specifications set for 2009, which would also be controlled by a cap. The short term effect of these vessels fishing under the 2009 specifications (No-Action) is expected to be negligible to the cannery. Over the long-term, maintaining the 2009 specs for the next three years could have detrimental impacts on the stock and lead to negative impacts.

6.4.2.1.4 Impacts on Other Processing Plants

Three packing-freezing processing plants in Gloucester, New Bedford, and Cape May have formal contracts or informal relationships with trawlers to insure access to supply. Informal interviews indicate that the summer purse seine/fixed gear only restriction in Amendment 1 has limited their access to product. Whether a shift of available quota to Areas 3 will mitigate the lack of access to Area 1A depends on the vessels' success in finding herring and the variable costs associated with longer trips.

- At least two of these three retrofitted trawlers (installing refrigerated sea water systems to the vessels) to improve the quality of herring landed in order to be able to deliver food-grade fish. If the financial obligations cannot be met, the social impacts of unemployment, lower quality of life, etc. are likely to follow.
- While a control date (warning of the potential institution of limited entry) was set for 1999, the two companies in Massachusetts were established in 2001 and 2002 with the strong support of Gloucester and New Bedford. Again depending on the economic viability of the plants, the lower quota coupled with lack of access to Area 1A could affect community stability, though both companies are in urban areas that have other, if limited, business and employment opportunities.
    - Full-time, permanent employment in both the Massachusetts plants is very limited. The majority of workers are hired as temporary employees, some from other communities.

Since Area 2's quota was reached before December when the mackerel fishery is most active in Area 2, herring bycatch limits are likely to reduce the mackerel fishery, further threatening the viability of the processing plants. The proposed action reduces the quota in Area 2 slightly from what was caught in 2008 (22,495mt) to a TAC of 22,146mt. (See additional discussion below under the Area 3 category.)

The No-Action Alternative would maintain the specifications as set for the previous fishing year, 2009. Under this alternative, vessels would continue to fish as they do under the specifications set for 2009, which would also be controlled by a cap. The short term effect of these vessels fishing under the 2009 specifications (No-Action) is expected to be negligible to other processing facilities. Over the long-term, maintaining the 2009 specs for the next three years could have detrimental impacts on the stock and lead to negative impacts.

6.4.2.1.5 Impacts on Trucking Industry

Efforts to spread the herring catch out over a longer period, to ensure availability for bait when lobster fishing is most active by reducing landings to one or two days per week, has already strained transportation networks. If landing days are further reduced to accommodate the reductions in the amount of herring that can be landed from Area 1A, the transportation networks will be further strained.

- To the extent that the trucking businesses can extend their networks to reach ports landing herring from other management areas, the impact may be mitigated.
- If landing days could be selected by vessels and spread out over the week, transportation networks would be able to adapt more easily.

The No-Action Alternative would maintain the specifications as set for the previous fishing year, 2009. Under this alternative, vessels would continue to fish as they do under the specifications set for 2009, which would also be controlled by a cap. The short term effect of these vessels fishing under the 2009 specifications (No-Action) is expected to be negligible to the trucking industry. Over the long-term, maintaining the 2009 specs for the next three years could have detrimental impacts on the stock and lead to negative impacts.

6.4.2.2 Areas 2 and 3

Though Area 2 is considered a winter fishing ground, ninety percent of the quota for Area 2 was taken in early 2009, and the area was closed to directed fishing (a bycatch of 2,000 pounds is permitted).

Alternatives and Options that involve a quota reduction in Area 2 could negatively impact the mackerel fishery since a bycatch of herring is common, but the mackerel fishery is most active in Area 2 in December when herring bycatch is limited to 2000 pounds because 90% of the herring quota has been taken. Efforts to limit discards could effectively limit these vessels ability to fish for mackerel. Further, the Proposed Action will not reduce the stock-wide TAC below 2008 landings levels in any of the three year time span covered by this action.

The quota for Area 3 has never been reached (2008 landings were 13,144 mt), but the proposed reduction in quota and a shift from area 1A could negatively impact the vessels and companies that depend on Areas 2 and 3 if more vessels shift offshore by increasing competition. Furthermore, because the quota has not been reached in Area 3, some question the availability of herring in the area and the ability of the vessels to catch it.

While the herring landings for 14 of the vessels that fish in Areas 2 and 3 using midwater trawl gear (single and/or paired) in 2008 constituted less than 75% of the value of their landings, herring is a necessary (if not sufficient) part of their business as well as the herring freezer plants.

Areas 2 and 3 provide herring to Gloucester and New Bedford, as well as Cape May. In each case, a landing facility and freezing plant was established in response to assessments of large quantities of herring and encouragement to more fully exploit this resource. These facilities also land and process mackerel.

To the extent that the reduction in quota/annual catch limits (Proposed Action, Alternatives 1 and 2) threatens the viability of these facilities, the impacts could reverberate through the communities. While the facilities do not have large numbers of employees, they provide steady employment for a few. Furthermore, they either own or have contracts with certain herring vessels to ensure a supply of product. A portion of the product is given food-quality care, packed, and frozen. Some is exported to Europe and/or Africa. Generally, New Bedford is an economically depressed area, so the employees in the plant, on the vessels and transportation vehicles (trucks and trains) could have difficulty finding alternative employment should these companies fail. Suppliers to the plant (e.g., cardboard boxes) would also be affected. The towns would also lose tax revenue and possibly, tarnish their reputation as business-friendly. Both Gloucester and New Bedford city officials strongly encouraged the development of their respective herring plants.

The No-Action Alternative would maintain the specifications as set for the previous fishing year, 2009. Under this alternative, vessels would continue to fish as they do under the specifications set for 2009, which would also be controlled by a cap. The short term effect of these vessels fishing under the 2009 specifications (No-Action) is expected to be negligible to those dependent on Areas 2 and 3. Over the long-term, maintaining the 2009 specs for the next three years could have detrimental impacts on the stock and lead to negative impacts.

6.4.2.3 Impacts on Communities of Interest

Communities of interest for the Atlantic herring fishery are identified in section 4.4.7 and described in detail in Amendment 1 to the Herring FMP, which should be referenced for additional information. This section summarizes key points associated reductions in ABC (Proposed Action, Alternatives 1 and 2) and provides new information about communities that may be affected by the proposed herring fishery specifications. Despite the reduction of ABC under the Proposed Action, it will not reduce the stock-wide TAC below what was actually landed in 2008 in any of the three year time span covered by this action.

Governance

Twenty-six vessels with Category A permits landed 97% of the herring in 2008. The majority of owner-operators of these vessels are members of organizations that send representatives to Fishery Management Council, Herring Committee, Plan Development Team, Atlantic States Marine Fisheries Commission and Technical Committee Meetings, as well as Industry Advisory Panel meetings. The representatives of the herring industry generally support one another's interests in these meetings, if the reductions and shifting of quota result in loss of businesses, governance, and representation could be negatively affected.

Herring as Prey

Whales and tuna, among other species, rely on herring for prey. Businesses such as whale watch boats and tuna fishermen could benefit from a reduction in commercial fishing quota if that results in more forage for the species upon which they depend. To the extent that these businesses are located in communities that currently host harvesting and processing operations (e.g., Gloucester), there may be some mitigation of the negative social impacts of the reduction in ABC.

Other Businesses

Herring is frozen and sold as zoo food and it is also turned fish oil capsules (Omega-3s). The lower ABC could affect access to herring for these businesses, or cause an increase in price.

The No-Action Alternative would maintain the specifications as set for the previous fishing year, 2009. Under this alternative, vessels would continue to fish as they do under the specifications set for 2009, which would also be controlled by a cap. The short term effect of these vessels fishing under the 2009 specifications (No-Action) is expected to be negligible to these stakeholders. Over the long-term, maintaining the 2009 specs for the next three years could have detrimental impacts on the stock and lead to negative impacts.

6.5 CUMULATIVE EFFECTS

The term “cumulative effects” is defined in the Council of Environmental Quality’s (CEQ) regulations in 40 CFR Part 1508.7 as:

“The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.”

Cumulative effects are linked to incremental actions or policy changes that individually may have small outcomes, but that, in the aggregate and combined with other factors, can result in greater environmental effects on the affected environment. At the same time, the CEQ guidelines recognize that it is not practical to analyze the cumulative effects of an action on the universe; analyses focus on those effects that are truly meaningful.

The following analysis will identify and characterize the impact on the environment from the proposed 2010-2012 herring specifications when analyzed in the context of other past, present, and reasonably foreseeable future actions. The analysis is generally qualitative in nature because of the limitations of determining effects over the large geographic areas under consideration. This analysis is also based on the cumulative effects analysis presented in the Final Amendment 1 EIS document as well as the 2007-2009 herring specifications package and updates information as appropriate. The Amendment 1 and 2007-2009 herring specifications’ cumulative effects analysis (CEA) should be referenced for additional information.

Consistent with the guidelines for CEA, cumulative effects can be more easily identified by analyzing the impacts of the proposed action on valued ecosystem components (VECs). The affected environment is described in this document based on VECs that were identified for consideration relative to the proposed specifications. The VECs described in this document and considered in this CEA include: Atlantic herring resource; habitat and essential fish habitat (EFH); protected resources (marine mammals and protected species); and the Atlantic herring fishery (fishery-related businesses and communities). Although not specifically identified as a VEC for this analysis, the assessment does consider impacts on "non-target species," or bycatch in the herring fishery, which is described in Section 4.4.4of this document. Because of the nature of impacts of the proposed 2010-2012 fishery specifications, non-target species are considered in this document primarily as they relate to bycatch in the directed herring fishery.

VECs represent the resources, areas, and human communities that may be affected by a proposed action or alternatives and by other actions that have occurred or will occur outside the proposed action. VECs are generally the "place" where the impacts of management actions are exhibited. An analysis of impacts is performed on each VEC to assess whether the direct/indirect effects of an alternative adds to or subtracts from the effects that are already affecting the VEC from past, present and future actions outside the proposed action (i.e., cumulative effects).

Changes to the Herring FMP have potential to directly affect the Atlantic herring resource. The habitat and EFH VEC focuses on habitat types vulnerable to activities related to directed fishing for herring. The protected resources VEC focuses on those protected species with a history of encounters with the herring fishery. The herring fishery VEC could be affected directly or indirectly through a variety of complex economic and social relationships associated with either the managed species (herring) or any of the other VECs.

The geographic area that encompasses the physical, biological, and human environmental impacts to be considered in the cumulative effects analysis is described in detail in Section 7.0 of the Amendment 1 document. The physical environment, including habitat and EFH, is bounded by the range of the Atlantic herring fishery, from the GOM through the mid-Atlantic Bight, and includes adjacent upland areas (from which non-fishing impacts may originate). The geographic range for impacts to fish species is the range of each fish species in the western Atlantic Ocean, as described in the Affected Environment. For Protected Species, the geographic range is the total range of Atlantic herring. The geographic range for the human environment is defined to be those fishing communities bordering the range of the herring fishery.

Overall, while the effects of the historical herring fishery are important and are considered in the analysis, the temporal scope of past and present actions for Atlantic herring, the physical environment and EFH, protected species, fishery-related businesses and communities, and non-target species is focused principally on actions that have occurred since 1996, when the Magnuson-Stevens Fishery Conservation and Management Act was enacted and implemented new fisheries management and EFH requirements. The temporal scope for marine mammals begins in the mid-1990s, when NMFS was required to generate stock assessments for marine mammals that inhabit waters of the U.S. EEZ that create the baseline against which current stock assessments are evaluated. For turtle species, the temporal scope begins in the 1970s, when populations were noticed to be in decline. The temporal scope for Atlantic herring is focused more on the time since the Council's original Herring FMP was implemented at the beginning of the 2001 fishing year. This FMP serves as the primary management action for the Atlantic herring fishery and has helped to shape the current condition of the resource.

Consistent with the cumulative effects analysis in Amendment 1, the temporal scope of future actions for all VECs, which includes the proposed fishery specifications for 2010-2012, extends five years into the future. This period was chosen because of the dynamic nature of resource management and lack of specific information on projects that may occur in the future, which make it difficult to predict impacts beyond this time frame with any certainty. This is also the rebuilding time frame for the Atlantic herring resource, as defined in the Herring FMP, should the resource become overfished and subject to a rebuilding program in the future.

6.5.1 Atlantic Herring Resource

Past and Present Actions: Atlantic herring management measures were implemented in two related, but separate FMPs in 1999 – one by the federal government (NEFMC 1999, amended in 2006) and one by the states (ASMFC 1999, amended in 2006). Amendment 1 to the NEFMC Atlantic Herring FMP was implemented in 2007 and included the following measures, some of which affect the Atlantic herring resource: specification of maximum sustainable yield (MSY); adjustments to the specification process for the Atlantic herring fishery; a limited access program for the herring fishery; adjustment to Atlantic herring management areas; other modifications to permit and reporting requirements; establishment of a purse seine and fixed gear-only area; and other administrative and procedural measures or adjustments. Relative to the Atlantic herring resource, the overall conclusion in Amendment 1 was that the direct impacts of the management action on the Atlantic herring resource – the biological impacts – are not likely to be significant, but there should be long-term benefits to the resource resulting from the Amendment 1 management measures.

The status of the herring resource was updated in the 2007-2009 herring specifications package and is further updated in Section 4.1 of this document. The offshore stock has recovered from its collapse in the early 1970s and, overall, the coastal Atlantic herring resource is not overfished, and overfishing is not occurring.

The ASMFC adopted Amendment 2 in March of 2006 to herring management in state waters which revised management area boundaries, biological reference points, the specification process, research set-asides, internal waters processing operations, and measures to address fixed gear fisheries and required fixed gear fishermen to report herring catches through the IVR program. Further discussion can be found in the 2007-2009 Atlantic Herring specifications package.

The Council is currently finalizing Amendment 4 to the Atlantic Herring FMP, which will modify the herring fishery specification process to comply with the new provisions of the reauthorized MSA. The two primary purposes of Amendment 4 are to establish ACLs and AMs within the specifications process. Under the establishment of ACLs, the secondary purposes of this amendment are to:

1. Establish new definitions for terms used in when setting specifications which change the process, allow for further considerations of non-target stocks, and establish an ABC control rule based on guidance from the SSC;
2. Make administrative adjustments which alter the process by manipulating where calculations for the specifications package will be performed, although the factors considered remain the same;
3. Prevent overfishing on a sub-component level by specifying sub-ACLs; and
4. Guide the administrative steps and timing involved in setting specifications.

The secondary purposes of Amendment 4 for the setting of AMs are to:

1. Modify the current regulations to serve more effectively as accountability measures;
2. Establish a reactive AM which provides consequences for overages within during a fishing year; and
3. Provide an AM for the current haddock catch cap.

Because Amendment 4 is largely procedural, the impacts of the amendment on the Atlantic herring resource are expected to be neutral. However, the process for setting ACLs and AMs is intended to further ensure that overfishing does not occur on the herring resource by providing a specific process for accounting for uncertainties related to scientific information and the management program. To the extent that this process provides for more assurance that the stock will not be overfished nor will overfishing be occurring, the long-term impacts on the Atlantic herring resource are expected to be positive.

The ASMFC is currently developing Addendum II to the Interstate FMP for Herring, which proposes modifications to Amendment 1 and Amendment 2 that would change the specification setting process and associated definitions. Based on the difficulty of having two sets of acronyms, one for the NEFMC plan and one for the ASMFC plan, for one cooperatively-managed species the addendum was developed to establish an identical set of definitions and acronyms as those that the NEFMC is required to use under MSA. The addendum also proposes to establish a new specification setting process that is more in line with the ASMFC Sea Herring Section’s usual process for setting specifications while taking into account the new process being established in the Council’s Amendment 4.

Although difficult to quantify at this time (as the addendum has not been implemented), the impact of the ASMFC Addendum on the Atlantic herring resource will be similar to those predicted in Amendment 4. The action will be mainly procedural, and the effect of the change in the process will be evaluated in future considerations of the specifications. The implementation of a new specifications process, however, has the ability to alter the amount of fishery effort, and by extension positively or negatively influence the herring resource. The impact of the new specifications process on the fishery will be evaluated further once the addendum has been enacted.

Reasonably Foreseeable Future Actions: One of the reasonably foreseeable future actions that will likely affect the Atlantic herring resource is Amendment 5 to the herring FMP. Measures under consideration in Amendment 5 include a catch monitoring program for the herring fishery, river herring bycatch measures, criteria for midwater trawl access to groundfish closed areas, measures to address interactions with the Atlantic mackerel fishery, and measures to protect herring spawning components. While some elements of the amendment were complete and ready to move forward at this time, the larger, more significant components of the catch monitoring program and other measures (river herring bycatch measures, groundfish closed area access) still require additional work and/or discussion. As such, the impacts of the proposed measures cannot be predicted at this time and will be evaluated further in the EIS for Amendment 5.

EFH Omnibus Amendment 2 is scheduled for implementation in September 2011. This amendment could positively affect Atlantic herring via increased protection of benthic habitats used by the species from the adverse effects of various regional fisheries. Further, NMFS is currently in a rule-making process to propose changes to the Harbor Porpoise Take Reduction Plan which are intended to reduce harbor porpoise mortalities (74 FR 36058, July 21, 2009). This action would likely result in vessels facing additional restrictions, possibly resulting in positive impacts to herring and other species taken incidentally.

The sea turtle Strategy is a gear-based approach to addressing sea turtle bycatch. NMFS is currently considering proposing changes to the regulatory requirements for trawl fisheries to protect sea turtles. As described in a NOI to prepare an EIS (74 FR 88 May 8, 2009), NMFS is considering expanding the use of TEDs to other trawl fisheries and modifying the geographic scope of the TED requirements. This measure is likely to be neutral for the herring resource as it will not affect herring directly.

Summary of Impacts:
Analysis of the proposed 2010-2012 herring fishery specifications has considered the potential impacts of the proposed action and other alternatives on the Atlantic herring resource, in combination with relevant past, present, and reasonably foreseeable future actions as well as applicable non-fishing impacts. The incremental benefits from the proposed action are not likely to result in significant cumulative effects on the Atlantic herring resource. The significance criteria that applies to the herring resource requires the consideration of whether or not the proposed action is reasonably expected to jeopardize the sustainability of any target species (herring) and whether or not the proposed action is expected to result in cumulative adverse impacts with a substantial effect on herring.

The Council met the requirements of the MSA and National Standard 1 when it developed the Herring FMP as well as Amendment 1, and implemented conservation and management measures that are intended to prevent overfishing and achieve, on a continuing basis, OY for the Atlantic herring fishery. The 2010-2012 Atlantic herring fishery specifications have been developed in accordance with the provisions and new requirements of the Magnuson-Stevens Fishery Conservation and Management Act, including the requirement to establish a process for and specifications for ACLs and AMs for Atlantic herring by 2011. Amendment 4 to the Herring FMP is currently under development and includes the provisions for the ACL/AM process. The 2011-2012 specifications are consistent with the process proposed in Amendment 4 for specifying ACLs and AMs through the fishery specification process. Amendment 4 is scheduled to be finalized by the Council in early 2010 and implemented prior to the start of the 2011 fishing year. The proposed 2010-2012 fishery specifications are based on the process/provisions currently included in the Herring FMP but provide the necessary elements for a transition to the new ACL/AM process that will be implemented in Amendment 4.

The direct and indirect impacts of the proposed specifications on the Atlantic herring resource are discussed in detail in Section 6.1 of this document and are intended to achieve the goals and objectives of the FMP and the MSA by preventing overfishing and maintaining the Atlantic herring resource at sustainable levels. The proposed action reduces the total allowable yield (OY) for the U.S. herring fishery by 53,800 mt. This buffer between the F_{MSY}-based catch level and ABC accounts for scientific and management uncertainty and ensures that fishing mortality will not exceed threshold levels, despite uncertainty associated with the stock assessment results. In addition, the TAC for Area 1A, where fishing effort on the inshore stock component tends to be concentrated, is proposed to be reduced by more than 18,000 mt, a conservative measure that addresses the Council's goal to minimize the risk of overfishing of individual spawning components.

The biological analyses provided in this document suggest that the impacts of the proposed action on the Atlantic herring resource will not be significant. While the biomass is projected to decline under the proposed action, the herring resource is not expected to decline substantially or into an overfished condition, and overfishing is not projected to occur. The impacts of the proposed action on herring are more positive than the impacts of the status quo or some of the other alternatives/options the Council considered during the development of the 2010-2012 specifications. The impacts of the TACs are evaluated through a risk assessment; risk is considered based on the likelihood of producing an exploitation rate on an individual stock component that may be higher than that associated with the overfishing threshold for the entire stock complex. Overall, the proposed TACs are associated with less risk than the no action alternative.

6.5.2 Habitat and EFH

Past and Present Actions: The Herring EFH designation, which was developed as part of an EFH Omnibus Amendment prepared by NEFMC for all its managed species, is provided in Section 4.2.2 of this document. The EFH Omnibus Amendment was approved for Atlantic herring by the Secretary of Commerce on October 27, 1999. The final rule implementing the Atlantic herring FMP to allow for the development of a sustainable Atlantic herring fishery was published on December 11, 2000 (65 FR 77450).

Because the gears used in the herring fishery have only occasional bottom contact with the primary substrates used by herring for egg deposition, and because the noises produced by herring fishing operations only temporarily disperse schools of juvenile and adult herring, EFH impacts assessments for the fishery have concluded that it does not have an adverse effect on herring EFH. In addition, these assessments have concluded that the herring fishery does not have an adverse impact on EFH designated for non-herring species.

Various measures have been implemented in the Northeast Region to protect the EFH of NEFMC-managed species. In particular, all bottom-tending mobile gear is prohibited from the level 3 Habitat Closed Areas (HCAs) established in 2004 under Amendment 13 to the Northeast Multispecies FMP and Amendment 10 to the Atlantic Sea Scallop FMP. In large part, these HCAs overlap with areas established in 1994 and 1998 to protect overfished stocks of cod, haddock, and other groundfish species. As mobile bottom-tending gear is largely prohibited from the groundfish closures, they have incidental EFH protection benefits. Other measures to protect EFH include spatially-specific roller gear restrictions in the Multispecies and Monkfish fisheries.

Reasonably Foreseeable Future Actions: At the present time, it is not known how Amendment 5 to the Atlantic Herring FMP will affect EFH, however there are likely to be some effects as a result of the measures. The catch monitoring program, river herring bycatch measures, criteria for midwater trawl access to groundfish closed areas, and measures to address interactions with the Atlantic mackerel fishery all stand to alter fishing effort, thereby reducing or increase gear interaction with the seabed. However the larger, more significant components of the catch monitoring program and other measures still require additional work and/or discussion, and so the effects of the measures cannot be predicted at this time and will be evaluated thoroughly in the EIS for Amendment 5.

Reasonably foreseeable future actions that will likely affect habitat include the next EFH Omnibus Amendment, currently under development. This action reviews and updates EFH designations, identifies Habitat Areas of Particular Concerns (HAPCs), reviews prey information for all managed species, reviews non-fishery impacts to EFH, and reviews the current science on fishing impacts to habitat. It will also include coordinated and integrated measures intended to minimize the adverse impact of NEFMC-managed fishing on EFH. The net effect of new EFH and HAPC designations and more targeted habitat management measures should be positive for EFH.

The Strategy for Sea Turtle Conservation and Recovery in Relation to Atlantic Ocean and Gulf of Mexico ("Strategy") is a gear-based approach to addressing sea turtle bycatch. NMFS is currently considering proposing changes to the regulatory requirements for trawl fisheries to protect sea turtles. As described in a Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) for Sea Turtle Conservation and Recovery in Relation to the Atlantic Ocean and Gulf of Mexico Trawl Fisheries (74 FR 88 May 8, 2009), NMFS is considering expanding the use of TEDs in trawl fisheries and modifying the geographic scope of the TED requirements. Since TED requirements may decrease the catch retention of some target species, vessels may tow longer to offset this loss of catch, likely resulting in negative impacts to habitat and EFH.

Summary of Impacts:
Section 6.2 of this document addresses the impacts of the proposed specifications for the 2010-2012 fishing years on habitat and EFH. After review of available information as well as the assessment of impacts of the 2010-2012 fishery specifications, it was determined that given: (1) the previous finding that the fishery, as it existed in 2005, was not having more than a minimal or temporary impacts on EFH, and (2) the fact that the proposed new specifications are expected to reduce any impacts caused by the occasional contact of the bottom by herring fishing gear (i.e.,

midwater trawls and purse seines) from previous levels as a result of lower catch limits, it can be concluded that the herring fishery continues to have no more than a minimal and temporary impacts on EFH.

The cumulative impact of the proposed action on habitat is minimal and not significant. The proposed action for the 2010-2012 Atlantic herring fishery specifications will likely reduce the amount of herring caught and the geographic distribution of fishing activity between management areas. However, because fishing with midwater trawls and purse seines, the gears used in the directed herring fishery, does not impact EFH in a manner that is more than minimal or more than temporary in nature, the impacts to EFH of these alternatives are negligible, regardless of how much fishing takes place in any particular area.

6.5.3 Protected Resources

Past and Present Actions: A general description of protected species that may be affected by the proposed action is provided in Section 4.3 of this document and in more detail in Amendment 1 to the FMP.

Large whales may be adversely affected by habitat degradation, habitat exclusion, acoustic trauma, harassment, or reduction in prey resources due to trophic effects resulting from a variety of activities including the operation of commercial fisheries. Ship strikes and fishing gear entanglement continue to be the most likely sources of human-related injury or mortality for right, humpback, fin and minke whales. Sei, blue and sperm whales are also vulnerable, but fewer ship strikes or entanglements have been recorded. Mobile bottom trawls, as well as midwater trawl gear, appear to be less of a concern for the large whale species. Small cetaceans (white-sided dolphins, pilot whales), however, are most vulnerable to entanglement in midwater trawl gear. Seals, on the other hand, are commonly encircled by the herring purse seine fishery; however, the majority are released alive.

NMFS has implemented specific regulatory actions to reduce injuries and mortalities from gear interactions. The Atlantic Trawl Gear Take Reduction Strategy (ATGTRS) is designed specifically to address protected species interactions in both bottom and midwater trawl fisheries (primarily through research, education and outreach), and its existence is highlighted and detailed in Section 4.3.5.1 of this document The other TRP's, the HPTRP and the ALWTRP, are relevant from the respect of other gears that interact with protected species as the plans in place to reduce mortality. However, they have no relevance to the reducing mortality attributed to midwater trawl gear.

Turtles in general have documented entanglements in shrimp trawls, pound nets, bottom trawls and sink gillnets. Shrimp trawls are required to use turtle excluder devices. The diversity of the sea turtle life history also leaves them susceptible to many other human impacts, including impacts on land, in the benthic environment, and in the pelagic environment. Anthropogenic factors that impact the success of nesting and hatching include: beach erosion, beach armoring and nourishment; artificial lighting; beach cleaning; increased human presence; recreational beach equipment; beach driving; coastal construction and fishing piers; exotic dune and beach vegetation; and poaching. An increased human presence at some nesting beaches or close to nesting beaches has led to secondary threats such as the introduction of exotic fire ants, and an increased presence of native species (e.g., raccoons, armadillos, and opossums) which raid and feed on turtle eggs. Entanglement in debris or ingestion of marine debris are also seen as possible threats.

Reasonably Foreseeable Future Actions: Amendment 5 to the Herring FMP would enact measures currently under development, which include a catch monitoring program, river herring bycatch measures, criteria for midwater trawl access to groundfish closed areas, measures to address interactions with the Atlantic mackerel fishery. While some elements of the amendment were complete and ready to move forward at this time, the larger, more significant components of the catch monitoring program and other measures (river herring bycatch measures, groundfish closed area access) still require additional work and/or discussion. As such, the impacts of the proposed measures cannot be predicted at this time, and analysis of the effects will be evaluated in a full EIS when the amendment is finalized.

The likely impacts of the Omnibus EFH Amendment on protected resources cannot be determined at this time.

The sea turtle Strategy is a gear-based approach to addressing sea turtle bycatch. Under the Strategy, NMFS has identified trawl gear as a priority for reducing sea turtle bycatch and is considering proposing changes to the TED requirements in the trawl fisheries. TED requirements are designed to have a positive effect on protected resources, specifically turtles by allowing for most turtles caught in trawl nets to escape. NMFS is working to develop and implement bycatch reduction measures in all trawl fisheries in the Atlantic and Gulf of Mexico when and where sea turtle takes have occurred or where gear, time, location, fishing method, and other similarities exist between a particular trawl fishery and sea turtle takes have occurred by trawls (72 FR 7382, February 15, 2007). On February 15, 2007, NMFS issued an advance notice of proposed rulemaking to announce that it is considering amendments to the regulatory requirements for TEDs (72 FR 7382). On May 8, 2009, NMFS issued a NOI to prepare an EIS (74 FR 88 May 8, 2009), and held public scoping meetings throughout the East coast.

Summary of Impacts:

Section 6.3 of this document addresses the impacts of the proposed specifications for the 2010-2012 fishing years on protected species and supports the conclusion that no significant impacts on protected species are expected from the proposed action.

In general, many of the populations of potentially-affected protected species are increasing or stable with notable increases in recent years for some seal populations. Nonetheless, protected species interactions do occur and have been well-documented in the major gear types currently used in the Atlantic herring fishery. Purse seines operating in this fishery are known to take several species of seals and harbor porpoise, while midwater trawl gear (including paired midwater trawls) has had documented interactions with pilot whales, white-sided dolphins, and seals.

Because of their vulnerability to the gear types used, and also because herring is a primary prey species for seals, porpoises and some whales, protected species interactions with the herring fishery are likely to continue. The proposed action may decrease or otherwise not affect protected species beyond status quo. Indirect positive benefits may occur due to an increase in forage for protected species in the inshore Gulf of Maine as a result of the reduction in OY and the proposed TACs. This positive outcome could occur if effort is reduced in Area 1A and does not shift into Area 2 or 3. Despite ongoing negative effects on protected species as described above, the proposed action will not add or significantly contribute to negative cumulative effects.

In summary, the impacts of the proposed action's TACs on protected resources are expected to be minimal. This includes impacts on the amount of forage available to protected species. The risk of the impacts of the proposed action are low compared to the other alternatives spatially and temporally, and the rate of fishing is not expected to increase, so interactions with the herring fishery may be low, limiting the potential effects to protected species.

6.5.4 Atlantic Herring Fishery

Past and Present Actions: Updated information about the human environment is provided in Section 4.4 of this document. Landings have declined dramatically since the 1960s but have been variable since then, averaging about 100,000 mt/year and have declined in more recent years due to reductions in the Area 1A TAC as well as other factors. There was a shift to more mobile gear (purse seines and midwater trawls) from fixed gear in the early 1980s. With that change, the domestic fishery transformed from what was primarily a canning industry for human consumption to a fishery that supplies lobster bait and an overseas market for frozen herring. The economic and social structure of the industry has adjusted to these changes and has not changed significantly in recent years. Additional past and present actions that affect the human environment (fishery-related businesses and communities) are discussed in other sections.

The ASMFC adopted Amendment 2 in March of 2006 to herring management in state waters which revised management area boundaries, biological reference points, the specification process, research set-asides, internal waters processing operations, and measures to address fixed gear fisheries and required fixed gear fishermen to report herring catches through the IVR program. Further discussion can be found in the 2007-2009 Atlantic herring specifications package.

The Council is currently finalizing Amendment 4 to the Atlantic Herring FMP, which will modify the herring fishery specification process to comply with the new provisions of the reauthorized MSA. The two primary purposes of Amendment 4 are to establish ACLs and AMs within the specifications process. Under the establishment of ACLs, the secondary purposes of this amendment are to:

1. Establish new definitions for terms used in when setting specifications which change the process, allow for further considerations of non-target stocks, and establish an ABC control rule based on guidance from the SSC;
2. Make administrative adjustments which alter the process by manipulating where calculations for the specifications package will be performed, although the factors considered remain the same;
3. Prevent overfishing on a sub-component level by specifying sub-ACLs; and

4. Guide the administrative steps and timing involved in setting specifications.

The secondary purposes of Amendment 4 for the setting of AMs are to:

1. Modify the current regulations to serve more effectively as accountability measures;
2. Establish a reactive AM which provides consequences for overages within during a fishing year; and
3. Provide an AM for the current haddock catch cap.

Because Amendment 4 is largely procedural, the impacts of the amendment on the Atlantic herring fishery are not expected to be significant. However, the process for setting ACLs and AMs is intended to further ensure that overfishing does not occur on the herring resource by providing a specific process for accounting for uncertainties related to scientific information and the management program. To the extent that this process leads to further changes to the available catch for the fishery and/or any management area TACs, impacts on the Atlantic herring fishery may be expected and will be more thoroughly evaluated in the specifications package that may implement those changes.

The ASMFC is currently developing Addendum II to the Interstate FMP for Herring, which proposes modifications to Amendment 1 and Amendment 2 that would change the specification setting process and associated definitions. Based on the difficulty of having two sets of acronyms, one for the NEFMC plan and one for the ASMFC plan, for one cooperatively-managed species the addendum was developed to establish an identical set of definitions and acronyms as those that the NEFMC is required to use under MSA. The addendum also proposes to establish a new specification setting process that is more in line with the ASMFC Sea Herring Section's usual process for setting specifications while taking into account the new process being established in the Council's Amendment 4.

Although difficult to quantify at this time (as the addendum has not been implemented), the impact of the ASMFC measures which implements the same language being considered in this amendment on the VECs under consideration will likely be neutral. Similar to the Council's Amendment 4 (under development), the action will be mainly procedural, and the effect of the change in the process will be evaluated in future considerations of the specifications. The implementation of a new specifications process, however, has the ability to alter the amount of fishery effort, and by extension positively or negatively influence the herring fishery by increasing or decreasing revenue. The impact of the new specifications process on the fishery will be evaluated further once the addendum has been enacted.

Reasonably Foreseeable Future Actions: One of the reasonably foreseeable future actions that will likely affect the Atlantic herring fishery is Amendment 5 to the herring FMP. Measures that will be developed under this amendment include a catch monitoring program, river herring bycatch measures, criteria for midwater trawl access to groundfish closed areas, measures to address interactions with the Atlantic mackerel fishery. Although the measures and associated analysis have not been fully developed, this action could potentially reduce fishing effort and/or impose additional costs for monitoring the fishery; therefore, some negative impacts may be predicted for the herring fishery. Again, however, this analysis is not complete and the impacts will be discussed in future documents relating to Amendment 5.

The future actions of the Harbor Porpoise Take Reduction Plan could have negative impacts if it reduces effort, as the reduction may also mean a loss in revenues. Cumulative effects of the Omnibus EFH Amendment cannot easily be determined, but if additional effort restrictions were implemented, or if new areas are closed for habitat protection that further restrict access to fishing grounds this action too would likely have a negative impact.

The sea turtle Strategy is a gear-based approach to addressing sea turtle bycatch. NMFS is currently considering proposing changes to the regulatory requirements for trawl fisheries to protect sea turtles. As described in an NOI to prepare an EIS (74 FR 88 May 8, 2009), NMFS is considering expanding the use of TEDs to other trawl fisheries and modifying the geographic scope of the TED requirements. TED requirements would likely have a negative economic effect because of the costs associated with adding and/or modifying TEDs to comply with the new regulation and the costs associated with a decrease in landed species if vessels would not offset a loss in catch.

Summary of Impacts:
The direct and indirect impacts of the proposed specifications on the affected environment and the Atlantic herring fishery are discussed in detail in Section 6.4 of this document. The TACs are intended to achieve the goals and objectives of the FMP and the MSA by preventing overfishing and reducing the risk of overfishing individual stock components.

There are four general economic impacts that result from the alternatives proposed in the 2010-12 herring specifications. Impacts fall into these categories: 1) loss of revenue when expected landings based on stock-wide TACs fall below 2008 landings levels, 2) changes in harvest costs for alternatives that result in fishing activity taking place further from shore, 3) impacts to the lobster fleet for alternatives that restrict landings from Area 1A in the summer, 4) impacts to the mackerel fishery, and 5) impacts to herring processors.

The Proposed Action will not reduce the stock-wide TAC below 2008 landings levels in any of the three year time span covered by this action. So, in terms of the ability of the fleet to land the same quantity of herring as in the recent pass, the Proposed Action would not negatively impact the fishery. All other options under Alternative 2 would reduce the stock-wide TAC to 75,200 metric tons. Since the management areas close when 95% of the TAC is reached, landings would be capped at 71,440 metric tons which is 9,360 metric tons less than 2008 landings. At the average 2008 price of $260 per metric ton, the value of the difference is approximately 2.4 million dollars.

All options except for Alternative 1/Option1 and the no-action alternative reduce the Area 1A TAC. The Proposed Action reduces the Area 1A TAC by 41% from 45,000 metric tons to 26,546 metric tons. Other options reduce the Area 1A TAC by less than 10% while others reduce it by as much as 90%. Options with large Area 1A reductions are generally associated with TACs in Areas 2 and 3 that are higher than historical Area 2 and 3 landings. However, harvesting fish from these areas when the Area 1A TAC is reached may not always be ideal. If

Area 1A closes in the summer, fish will not be in Area 2 that time of year. As far as Area 3, it is uncertain whether fish will aggregate in such a way that normal fishing operations can occur. Also, Area 3 is a large area offshore area and so finding fish may be problematic. In addition, some smaller/coastal vessels are not able to safely fish offshore.

Increases in the amount of offshore fishing will increase operating costs. Since search time is likely to increase, the length of the trip will increase which means fuel and other expenses will increase. The length of the trip will also increase since the fishing grounds are further from shore. The degree to which fishing cost will change is difficult to predict so an overall estimate of increased cost is not provided. However, observer data shows that for midwater trawl vessels each additional day at sea increased costs by $2,800 on average.

Impacts to the lobster fishery are expected for options, including the Proposed Action, that significantly reduce the Area 1A TAC. Herring is used for bait in the lobster fishery and nearly 50,000 metric tons of herring is used as bait per year. A 2006 survey by Market Decisions (as reported in Thunberg, 2007) showed that bait costs were 14% to 15% of gross landed value for full-time lobster fishermen in Lobster Conservation Management Area 1 (coastal Maine, New Hampshire, and the North and South Shore regions of Massachusetts). In Lobster Conservation Management Area 2 (coastal Rhode Island and coastal Massachusetts South of Cape Cod), bait costs were 11% to 12% of gross. Shortages in supply, particularly in the summer months could cause price spikes thereby cutting into profit margins. If price increases are high enough, lobster fishermen will seek bait alternatives which may be inferior. Businesses that supply bait may also be impacted since much of the infrastructure is based on delivering salted herring in barrels. Changing to other sources may be costly in the short run.

Options that restrict the Area 2 TAC below historical landings from Area 2 of about 20,000 to 22,000 metric tons have the potential to impact the mackerel fishery. Mackerel fishing takes place in the winter and early spring months in herring management Area 2. In the winter, herring migrate to Area 2. The co-occurrence of both these fisheries in Area 2 during the winter results in herring being caught as bycatch in the mackerel fishery. Many of the same vessels participate in both fisheries. Some mackerel vessels, however, do not have limited access herring permits and are limited to 2,000 pounds of herring per trip. The Area 2 TAC under the Proposed Action is 22,146 metric tons so impacts to the mackerel fishery are not expected to be large.

If the proposed reduction in the Area 1A TAC leads to healthier herring stocks, then these measures may have positive benefits for all fishery participants over the long-term. Healthy fish stocks are an essential foundation for economic and social sustainability in relation to this fishery. More plentiful herring could also lead to greater participation of the stop seine or weir fishery which depends on herring coming in shore. Moreover, where this action encourages activity in the offshore management areas, these fisheries may be further developed and may result in improved information about the location of stocks – an area where there is room for growth.

This analysis has considered the potential impacts of the proposed action and other alternatives on the Atlantic herring fishery (fishery-related businesses and communities), in combination with relevant past, present, and reasonably foreseeable future actions as well as applicable non-fishing impacts. The incremental benefits from the proposed action are not likely to result in significant cumulative effects on the Atlantic herring fishery. The influence of the impacts of related future actions (Amendment 5) makes it difficult to predict with any certainty whether or not significant cumulative impacts will be realized in the fishery. While negative economic impacts are expected for a number of individual participants, overall, the long-term impacts of the measures proposed to maintain a healthy herring resource, including those in the action proposed in this document, are expected to be positive.

Non-Target Species

Past and Present Actions: Updated information about non-target species (bycatch) affected by the herring fishery is provided in Section 4.4.4 of this document. In recent years, Atlantic herring, spiny dogfish, Atlantic mackerel, and haddock have represented the majority of observed bycatch by directed herring vessels. Bycatch of haddock in the herring fishery was addressed through Framework 43 to the Northeast Multispecies FMP, and a description of the framework can be found in the 2007-2009 Atlantic Herring Specifications in which Amendment 2 to the AMFC Interstate Herring FMP was also discussed.

Non-target species are also addressed in Amendment 1 in the context of "other fisheries," namely the mackerel and lobster fisheries. The potential impacts of the proposed specifications on other fisheries is unclear because they may be influenced by changes in fishing behavior and/or adaptations by bait dealers and other processors. While the seasonal supply of herring for lobster bait may be affected by the proposed action, it is unclear at this time how they will be directly affected, and the results will be evaluated in future specifications.

The Council is currently finalizing Amendment 4 to the Atlantic Herring FMP, which will modify the herring fishery specification process to comply with the new provisions of the reauthorized MSA. The two primary purposes of Amendment 4 are to establish ACLs and AMs within the specifications process. Under the establishment of ACLs, the secondary purposes of this amendment are to:

1. Establish new definitions for terms used in when setting specifications which change the process, allow for further considerations of non-target stocks, and establish an ABC control rule based on guidance from the SSC;
2. Make administrative adjustments which alter the process by manipulating where calculations for the specifications package will be performed, although the factors considered remain the same;
3. Prevent overfishing on a sub-component level by specifying sub-ACLs; and
4. Guide the administrative steps and timing involved in setting specifications.

The secondary purposes of Amendment 4 for the setting of AMs are to:

1. Modify the current regulations to serve more effectively as accountability measures;
2. Establish a reactive AM which provides consequences for overages within during a fishing year; and
3. Provide an AM for the current haddock catch cap.

Because Amendment 4 is largely procedural, the impacts of the amendment on non-target species are not expected to be significant. However, the process for setting ACLs and AMs is intended to further ensure that overfishing does not occur on the herring resource by providing a specific process for accounting for uncertainties related to scientific information and the management program. To the extent that this process leads to further changes to the available catch for the fishery and/or any management area TACs, impacts on non-target species may be expected and will be more thoroughly evaluated in the specifications package that may implement those changes.

The ASMFC is currently developing Addendum II to the Interstate FMP for Herring, which proposes modifications to Amendment 1 and Amendment 2 that would change the specification setting process and associated definitions. Based on the difficulty of having two sets of acronyms, one for the NEFMC plan and one for the ASMFC plan, for one cooperatively-managed species the addendum was developed to establish an identical set of definitions and acronyms as those that the NEFMC is required to use under MSA. The addendum also proposes to establish a new specification setting process that is more in line with the ASMFC Sea Herring Section's usual process for setting specifications while taking into account the new process being established in the Council's Amendment 4.

Although difficult to quantify at this time (as the addendum has not been implemented), the impact of the ASMFC measures which implements the same language being considered in this amendment on the VECs under consideration will likely be neutral. Similar to the Council's Amendment 4 (under development), the action will be mainly procedural, and the effect of the change in the process will be evaluated in future considerations of the specifications. The impact of the new specifications process on non-target species will be evaluated further once the addendum has been enacted.

Reasonably Foreseeable Future Actions: Amendment 5 to the Herring FMP could result in benefits to non-target species, as measures under development such as the catch monitoring program, river herring bycatch measures, and measures to address interactions with the Atlantic mackerel fishery all have the possibility of directly and positively effecting bycatch. A criteria for midwater trawl access to groundfish closed areas is also under development and may also alter impacts of the herring fishery on non-target species. Although the analysis is not complete because the larger and more significant components of the catch monitoring program and other measures (river herring bycatch measures, groundfish closed area access) still require additional work and/or discussion, this action could produce positive impacts for non target species. The impacts of the proposed measures cannot be predicted at this time, however, and will be evaluated more thoroughly in the EIS for Amendment 5.

Implementation of the Omnibus EFH Amendment may also result in additional habitat protections for which there is an indirect positive effect to bycatch species, as they would also receive protection. As with allocated target species, if revisions are made to the Harbor Porpoise Take Reduction Plan, vessels could face additional restrictions, possibly resulting in positive impacts to bycatch through effort reductions.

NMFS is currently considering proposing changes to the regulatory requirements for trawl fisheries to protect sea turtles. As described in a NOI to prepare an EIS (74 FR 88 May 8, 2009), NMFS is considering expanding the use of TEDs to other trawl fisheries and modifying the geographic scope of the TED requirements. TED requirements would likely have a positive effect on bycatch and discards as they would likely exclude some of these species from capture in the codend.

Summary of Impacts:
A more thorough discussion of non-target species, including the relationship of herring to other fisheries (mackerel and lobster), is provided in Amendment 1 to the Herring FMP. The focus of the cumulative effects analysis for the fishery specifications as they impact non-target species is bycatch in the directed herring fishery.

The impacts of the proposed action on non-target species are likely to be small. The overall reduction in OY could reduce fishing effort and, consequently, interactions with non-target species. However, the impacts are difficult to predict because the proposed OY for 2010-2012, although reduced considerably from the 2007-2009 levels, reflects current levels of catch in the fishery and may not result in a substantial direct reduction in fishing effort. The proposed reduction in the Area 1A TAC may benefit some non-target species in the Gulf of Maine if the herring fishery closes early and the catch of non-target species is consequently reduced. These impacts, however, are difficult to predict at this time, as they rely on changes in fishing patterns and adaptations that fishery participants may make in response to the new TACs (for example, increasing effort in offshore areas).

All species caught to any degree in the herring fishery, such as alewives, spiny dogfish, blueback herring, and Atlantic mackerel are managed under other FMPs. These FMPs identify significant sources of mortality or other fisheries impacts. Haddock bycatch in the herring fishery was addressed in Framework 43 to the Multispecies FMP (see previous discussion). Overall, the impacts of the proposed action, when combined with past, present, and reasonably foreseeable future actions, are not expected to be significant.

6.5.5 Non-Fishing Effects – Past, Present, Reasonably Foreseeable Future Actions

Non-fishing activities that occur in the marine nearshore and offshore environments and their watersheds can cause the loss or degradation of habitat and/or affect the species that reside in those areas. The following discussions of impacts are based on past assessments of activities and assume these activities will likely continue into the future as projects are proposed. More detailed information about these and other activities and their impacts are available in the publications by Hansen (2003) and Johnson et al. (2008).

Construction/Development Activities and Projects: Construction and development activities include, but are not limited to, point source pollution, agricultural and urban runoff, land (roads, shoreline development, wetland loss) and water-based (beach nourishment, piers, jetties) coastal development, marine transportation (port maintenance, shipping, marinas), marine mining, dredging and disposal of dredged material and energy-related facilities, all of which are discussed in detail in Johnson et al. (2008). These activities can introduce pollutants (through point and non-point sources), cause changes in water quality (temperature, salinity, dissolved oxygen, suspended solids), modify the physical characteristics of a habitat or remove/replace the habitat altogether. Many of these impacts have occurred in the past and present and their project effects would likely continue in the reasonably foreseeable future. It is likely that these projects would have negative impacts caused from disturbance, construction, and operational activities in the area immediately around the affected project area. However, given the wide distribution of the affected species, minor overall negative effects to offshore habitat, protected resources, and target and non-target species are anticipated since the affected areas are localized to the project sites, which involve a small percentage of the fish populations and their habitat. Thus, these activities for most biological VECs would likely have an overall low negative effect due to limited exposure to the population or habitat as a whole. Any impacts to inshore water quality from these permitted projects, including impacts to planktonic, juvenile, and adult life stages, are uncertain but likely minor due to the transient and limited exposure. It should be noted that wherever these activities co-occur, they are likely to work additively or synergistically to decrease habitat quality and, as such, may indirectly constrain the sustainability of the target species, other non-target species, and protected resources.

Similar to the discussion above on non-fishing impacts to fish habitat, generally the closer the proximity of herring stocks to the coast, the greater the potential for impact (although predation, a non-fishing impact, would be one threat that would occur everywhere). Herring reside in both inshore and offshore areas at different stages of their lives and during different seasons throughout the year.

These projects are permitted by other federal and state agencies that conduct examinations of potential biological, socioeconomic, and habitat impacts. In addition to guidelines mandated by the Magnuson Act, and the Fish and Wildlife Coordination Act, NMFS, the Councils, and the other federal and state regulatory agencies review these projects through a process required by the Clean Water Act; Rivers and Harbors Act; and the Marine Protection, Research, and Sanctuaries Act for certain activities that are regulated by federal, state, and local authorities. These reviews limit and often mitigate the impact of these projects. The jurisdiction of these authorities is in the “waters of the U.S.” and ranges from inland riverine to marine habitats offshore in the EEZ.

Restoration Projects: Other regional projects that are restorative or beneficial in nature include estuarine wetland restoration; offshore artificial reef creation, which provides structure and habitat for many aquatic species; and eelgrass (*Zostera marina*) restoration, which can provide habitat. Due to past and present adverse impacts from human activities on these types of habitat, restorative projects likely have slightly positive effects at the local level.

Protected Resources Rules: The NMFS final Rule on Ship Strike Reduction Measures (73 CFR 60173, October 10, 2008) is a non-fishing action in the United States-controlled North-Atlantic that is likely to affect endangered species and protected resources. The goal of this rule is to significantly reduce the threat of ship strikes on North-Atlantic right whales and other whale species in the region. Ship strikes are considered the main threat to North-Atlantic right whales; therefore, NMFS anticipates this regulation will result in population improvements to this critically endangered species.

Energy Projects: Cape Wind Associates (CWA) proposes to construct a wind farm on Horseshoe Shoal, located between Cape Cod and Nantucket Island in Nantucket Sound, Massachusetts. The CWA project would have 130 wind turbines located as close as 4.1 miles off the shore of Cape Cod in an area of approximately 24 square miles with the turbines being placed at a minimum of 1/3 of a mile apart. The turbines would be interconnected by cables, which would relay the energy to the shore-based power grid. If constructed, the turbines would preempt other bottom uses in an area similar to oil and natural gas leases. The potential impacts associated with the CWA offshore wind energy project include the construction, operation, and removal of turbine platforms and transmission cables; thermal and vibration impacts; and changes to species assemblages within the area from the introduction of vertical structures.

Other offshore projects that can affect VECs include the construction of offshore liquefied natural gas (LNG) facilities such as the project "Neptune." The first phase of this project construction was completed in September 2008, which includes the installation of a 13-mile subsea pipeline. The second phase will connect the new pipeline to an existing pipeline network called HubLine east of Marblehead, and will install the two off-loading buoys 10 miles off the coast of Gloucester, Massachusetts. Upon completion, the LNG facility will consist of an unloading buoy system where specially designed vessels will moor and offload their natural gas into a pipeline, which will deliver the product to customers in Massachusetts and throughout New England. This project is expected to have small, localized impacts where the pipelines and buoy anchors contact the bottom.

Summary of Impacts: Non-fishing activities pose a risk to the herring resource. As discussed in detail in the draft Herring EFH EIS (NMFS, July 1, 2004), impacts resulting from non-fishing activities like projects permitted under the Clean Water Act and Ocean Dumping Act, pollution, loss of coastal wetlands, marine transportation, and marine mining are unknown and/or unquantifiable. In general, the greatest potential for adverse impacts to herring and herring EFH occurs in close proximity to the coast where human induced disturbances, like pollution and dredging activities, are occurring. Because inshore and coastal areas support essential egg, larval and juvenile herring habitats, it is likely that the potential threats to inshore and coastal habitats are of greater importance to the species than threats to offshore habitats. It is also likely that these inshore activities will continue to grow in importance in the future. Activities of concern include chemical pollutants, sewage, changes in water temperature, salinity and dissolved oxygen, suspended sediment and activities that involve dredging and the disposal of dredged material. These impacts are discussed thoroughly in Amendment 1 to the Herring FMP.

Though largely unquantifiable, it is likely that the non-fishing activities noted above would have negative impacts on habitat quality from disturbance and construction activities in the area immediately around the affected area. Given the wide distribution of the affected species, minor overall negative effects to offshore habitat are anticipated since the affected areas are localized to the project sites, which involve a small percentage of the fish populations and their habitat. Any impacts to inshore water quality from permitted projects and other non-fishing activities, including impacts to planktonic, juvenile, and adult life stages, are unknown but likely to be negative in the immediate vicinity of the activity.

7.0 RELATIONSHIP TO APPLICABLE LAW

7.1 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT/MAGNUSON-STEVENS REAUTHORIZATION ACT

The proposed specifications for the Atlantic herring fishery were developed in a manner that is consistent with the provisions of the Atlantic Herring FMP, which established the specification process and its related requirements, as well as Amendment 1 to the Herring FMP. The Atlantic Herring FMP was found to be in compliance with the National Standards and other required provisions of the MSFCMA/MSA.

Adjustments to the specification process to comply with the new provisions of the MSA, including the establishment of ACLs and AMs, are proposed in Amendment 4 (under development), and are presumed also to be consistent with the National Standards and other required provisions of the MSA.

7.2 NATIONAL ENVIRONMENTAL POILICY ACT (NEPA)

NEPA provides a mechanism for identifying and evaluating the full spectrum of environmental issues associated with federal actions, and for considering a reasonable range of alternatives to avoid or minimize adverse environmental impacts. This document is designed to meet the requirements of both the MSA and NEPA. The Council on Environmental Quality (CEQ) has issued regulations specifying the requirements for NEPA documents (40 CFR 1500 – 1508). All of those requirements are addressed in this document, as referenced below.

7.2.1 Environmental Assessment

The required elements of an Environmental Assessment (EA) are specified in 40 CFR 1508.9(b). They are included in this document as follows:

- The need for this action is described in Section 1.2;
- The alternatives that were considered are described in Section 2.0 (Proposed Action) and Section 3.0 (Other Alternatives/Options Considered by the Council);
- The environmental impacts of the Proposed Action are described in Section 6.0;
- The agencies and persons consulted on this action are listed in Section 9.0.

This document also includes many additional sections that are based on requirements for an Environmental Impact Statement (EIS), such as:

- An Executive Summary (beginning of the document);
- A Table of Contents (beginning of the document);
- Background and purpose are described in Section 1.1 and 1.2.
- A description of the affected environment is found in Section 4.0.
- Cumulative impacts of the Proposed Action are described in Section 6.5.

- A finding of no significant impact is provided in Section 7.2.2 (below).
- A list of preparers is in Section 9.0.

7.2.2 Finding of No Significant Impact (FONSI)

National Oceanic and Atmospheric Administration Order (NAO) 216-6 (revised May 20, 1999) provides sixteen criteria for determining the significance of the impacts of a final fishery management action. These criteria are discussed below:

1. **Can the Proposed Action reasonably be expected to jeopardize the sustainability of any target species that may be affected by the action?**

Response: The proposed action is not expected to jeopardize the sustainability of the target species affected by this action – Atlantic herring. Relative to the no action alternative, the proposed action is more conservative, is intended to minimize the risk of overfishing discrete spawning components, and is consistent with the best available scientific information (TRAC 2009). Overall, based on the updated stock assessment and related recommendations provided by the Herring PDT and the SSC, the Council has concluded the Atlantic herring resource is healthy at this time, and the proposed action is therefore biologically sound.

The proposed action reduces harvest levels in the Atlantic herring fishery from levels observed historically and in recent years. ABC is proposed to be reduced from 194,000 mt to 106,000 mt, and total allowable yield (OY) is proposed to decrease by 53,800 mt from 145,000 mt to 91,2000 mt. The reductions are being proposed to account for scientific and management uncertainty and ensure that fishing mortality remains below threshold levels despite any uncertainty related to stock status. In addition, the TAC for Area 1A, where fishing effort tends to be concentrated, is proposed to be reduced by 18,454 mt from 2009 levels, a conservative measure that addresses concerns about the health of the inshore Gulf of Maine stock component.

2. **Can the Proposed Action reasonably be expected to jeopardize the sustainability of any non-target species?**

Response: This action cannot reasonably be expected to jeopardize the sustainability of any non-target species that may be affected by the action. The proposed action reduces harvest levels in the Atlantic herring fishery from levels observed in recent years and reduces allowable catch in Area 1A where the majority of the fishery is concentrated during summer months. The proposed measures will likely reduce fishing effort and may therefore reduce interactions between herring fishing vessels and non-target species.

3. **Can the Proposed Action reasonably be expected to cause substantial damage to the ocean and coastal habitats and/or essential fish habitat as defined under the Magnuson-Stevens Act and identified in FMPs?**

Response: The Proposed Action cannot be reasonably expected to cause substantial damage to the ocean and coastal habitats and/or essential fish habitat as defined under the Magnuson-Stevens Act and identifies in the FMP. EFH and habitat are generally described in Section 4.2 of this document, and impacts are discussed in Section 6.2. This action is not expected to allow substantial damage to the ocean and coastal habitats and/or EFH as defined under the Magnuson-Stevens Act and identified in the FMP. In general, EFH that occurs in areas where the fishery occurs is designated as the bottom habitats consisting of varying substrates (depending upon species) within the Gulf of Maine, Georges Bank, and the continental shelf off southern New England and the Mid-Atlantic south to Cape Hatteras. The primary gears utilized to harvest Atlantic herring are purse seines and midwater trawls which typically do not impact bottom habitats.

An evaluation of the impacts to EFH in the 2007-2009 specifications package stated that changes in the amount of herring caught and the distribution of the catch by area would have a negligible impact on EFH because the fishery as a whole has minimal and temporary impacts on EFH (the conclusion of the 2005 EIS). Because the TACs specified in this action are reduced as compared to the previous specifications, the proposed action will not result in adverse impacts to EFH in comparison with the no action alternative.

4. Can the Proposed Action be reasonably expected to have a substantial adverse impact on public health or safety?

Response: Nothing in the Proposed Action can reasonably be expected to have a substantial adverse impact on public health or safety. When developing management measures, the Council usually receives extensive comments from affected members of the public regarding the safety implications of measures under consideration. No such impacts were expected from specifications for previous years, and the Council has received no comments from affected members of the public suggesting that such impacts could be expected from the specifications that are proposed for the 2010-2012 fishing years.

5. Can the Proposed Action reasonably be expected to adversely affect endangered or threatened species, marine mammals, or critical habitat of these species?

Response: Protected resources that may be affected by the proposed action are generally described in Section 4.3 of this document, and impacts are discussed in Section 6.3. The proposed action is not reasonably expected to have an adverse impact on endangered or threatened species, marine mammals, or critical habitat for these species. The activities to be conducted under the proposed action are within the scope of the FMP and do not change the basis for the determinations made in previous consultations. Specifically, the proposed action should decrease interactions with protected species as compared to the status quo and may have indirect positive benefits relative to herring as forage for protected species in the inshore Gulf of Maine.

6. Can the Proposed Action be expected to have a substantial impact on biodiversity and/or ecosystem function within the affected area (e.g., benthic productivity, predator-prey relationships, etc.)?

Response: The proposed action is not expected to have a substantial impact on biodiversity and ecosystem function within the affected area. While herring is recognized as one of many important forage fish for marine mammals, other fish, and birds throughout the region, the resource appears to be large enough at this time to accommodate all predators including Atlantic bluefish, Atlantic striped bass, and several other pelagic species such as shark and tunas. The Atlantic herring itself is not known to prey on other species of fish but prefers chaetognaths and euphausiids.

The proposed action is intended to continue to ensure biodiversity and ecosystem stability over the short-term. The Council is proposing to reduce OY considerably from 2009 levels to account for scientific and management uncertainty. The proposed buffer between the F_{MSY}-based catch level and the U.S. OY should ensure that an adequate forage base continues to be available for important fish, marine mammal, and bird species in the Gulf of Maine region.

7. Are significant social or economic impacts interrelated with natural or physical environmental effects?

Response: A complete discussion of the potential impacts of the proposed action is provided in Section 6.0 of this document. The environmental assessment documents that no significant natural or physical effects will result from the implementation of the Proposed Action. The Proposed Action is designed to implement specifications to continue to harvest the Atlantic herring resource consistent with the definition of overfishing contained in the Atlantic Herring FMP and prevent overfishing. As described in Section 6.1, the action is expected to continue this trajectory. The action cannot be reasonably expected to have a substantial impact on habitat or protected species, as the impacts are expected to fall within the range of those resulting from Amendment 1. The action's potential social and economic impacts are also addressed in the environmental assessment and more specifically in the Executive Order 12866 review.

NMFS has determined that despite the potential socio-economic impacts resulting from this action, there is no need to prepare an EIS. The purpose of NEPA is to protect the environment by requiring Federal agencies to consider the impacts of their Proposed Action on the human environment, defined as "the natural and physical environment and the relationship of the people with that environment." The EA for the Atlantic Herring Specifications for 2010-2012 describes and analyzes the proposed measures and alternatives and concludes there will be no significant impacts to the natural and physical environment. While some fishermen, shore-side businesses and others may experience impacts to their livelihood, these impacts in and of themselves do not require the preparation of an EIS, as supported by NEPA's implementing regulations at 40 C.F.R. 1508.14. Consequently, because the EA demonstrates that the action's potential natural and physical impacts are not significant, the execution of a FONSI remains appropriate under criteria 7.

8. Are the effects on the quality of the human environment likely to be highly controversial?

Response: The effects of the proposed action on the quality of human environment are not expected to be highly controversial. The need to maintain a sustainable herring resource is grounded in Federal fisheries law and forms the basis of the goals and objectives of the herring management program, as described in the Herring FMP. While there was substantial debate over the status of the inshore component the impact of the directed fishery in the inshore Gulf of Maine, and the impact of the proposed reductions in the TACs, the Council developed the 2010-2012 herring fishery specifications while considering the needs of herring fishery participants, other fishery-related interests, and the long-term health of the Atlantic herring resource.

9. Can the Proposed Action reasonably be expected to result in substantial impacts to unique areas, such as historic or cultural resources, park land, prime farmlands, wetlands, wild and scenic rivers or ecologically critical areas?

Response: The proposed action is not expected to result in substantial impacts to unique areas, such as historic or cultural resources, park land, prime farmlands, wetlands, wild and scenic rivers or ecologically critical areas. The proposed action affects fishing for herring in the U.S. Exclusive Economic Zone and is not expected to have any impacts on shoreside historical and/or cultural resources. In addition, the proposed action is not expected to substantially affect fishing and other vessel operations around the unique historical and cultural resources encompassed by the Stellwagen Bank National Marine Sanctuary.

10. Are the effects on the human environment likely to be highly uncertain or involve unique or unknown risks?

Response: The Proposed Action is not expected to result in highly uncertain effects on the human environment or involve unique or unknown risks. The specifications proposed in this document are generally consistent with those adopted in past years and are based on the provisions for the specifications process outlined in the Herring FMP. Scientific uncertainty related to the herring stock assessment is addressed through the reduction in the F_{MSY}-based catch level to the proposed ABC level. Management uncertainty related to Canadian catch is addressed through the reduction in the ABC to the total U.S. OY. The proposed specifications account for uncertainty such that the risk of overfishing the resource has been minimized to the extent practicable.

While there is uncertainty related to the biomass of the inshore stock component and the inshore/offshore mixing rates, the analytic tools used to evaluate the proposed action and other alternatives account for this by evaluating the proposed measures across a range of mixing ratios. The analytic methodology was applied in previous actions (2005/2006 and 2007-2009 specifications), and related uncertainties have been further addressed in this assessment by refining and improving the risk assessment model. In addition, while there may be some degree of uncertainty related to how fishery participants may respond to the proposed specifications, potential impacts, adaptations, and responses have been considered to the extent possible in this analysis.

11. Is the Proposed Action related to other actions with individually insignificant, but cumulatively significant impacts?

Response: The Proposed Action is not related to other actions with individually insignificant but cumulatively significant impacts. The cumulative effects analysis presented in Section 6.5 of this document considers the impacts of the proposed action in combination with relevant past, present, and reasonably foreseeable future actions and concludes that no additional significant cumulative impacts are expected from the 2010-2012 herring specifications.

12. Is the Proposed Action likely to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural or historical resources?

Response: The proposed action is not likely to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places, nor is the proposed action expected to cause loss or destruction to significant scientific, cultural, or historical resources. The proposed action is specific only to the specifications and TACs for the Atlantic herring fishery, which occurs primarily in the Exclusive Economic Zone (EEZ).

13. Can the Proposed Action reasonably be expected to result in the introduction or spread of a non-indigenous species?

Response: The proposed action is not expected to result in the introduction or spread of a non-indigenous species. The proposed action relates specifically to removals of Atlantic herring in the Northeast Region using traditional fishing practices. Vessels affected by the proposed action are those currently engaged in the Atlantic herring fishery. The fishing-related activity of these vessels is anticipated to occur solely within the Northeast Region and should not result in the introduction or spread of a non-indigenous species.

14. Is the Proposed Action likely to establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration?

Response: The proposed action is not likely to establish a precedent for future actions with significant effects and does not represent a decision in principle about a future consideration. The proposed action adopts specifications for the 2010-2012 fishing years only, with flexibility for the Council to adjust the specifications during the interim years if the need arises or if new information becomes available. This action is consistent with specifications adopted in past years and is based on the provisions for the specifications process outlined in the Atlantic Herring FMP. The intent of the process is to establish specifications and other TACs for a short time frame (in this case, three years) so that new stock and fishery information can be reviewed and considered prior to making decisions about specifications in future years. The measures are designed to specifically address current stock and fishery conditions and are not intended to represent a decision about future management actions that may include other measures.

15. Can the Proposed Action reasonably be expected to threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment?

Response: The proposed action is intended to establish fishery specifications and TACs that will offer further protection to marine resources, particularly Atlantic herring, and would not threaten a violation of Federal, State, or Local law or other requirements to protect the environment. NMFS will determine whether this action is consistent with the Coastal Zone Management Act (CZMA) requirements of the affected States.

16. Can the Proposed Action reasonably be expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species?

Response: As specified in the responses to the first two criteria of this section, the proposed action is not expected to result in cumulative adverse effects that would have a substantial effect on target or non-target species. As described in the sub-sections contained in Section 6.0 of this document, impacts on resources encompassing herring and other stocks are expected to be minimal.

In view of the analysis presented in this document, the EIS for Amendment 1 to the Atlantic Herring FMP, and the EA/RIR/IRFA for the 2007-2009 Atlantic herring fishery specifications, establishment of the herring fishery specifications for the 2010-2012 fishing years will not have a significant effect on the human environment, with specific reference to the criteria contained in Section 6.02 of NOAA Administrative Order NAO 216-6, Environmental Review Procedures for Implementing the National Environmental Policy Act, May 20, 1999. Accordingly, the preparation of a Supplemental Environmental Impact Statement for the action proposed in this document is not necessary.

[signature] for Patricia Kurkul — 6/29/10

Assistant Administrator for Fisheries, NOAA — *Date*

7.3 MARINE MAMMAL PROTECTION ACT (MMPA)

The NEFMC has reviewed the impacts of the 2010-2012 Atlantic herring specifications on marine mammals and has concluded that the management actions proposed are consistent with the provisions of the MMPA, and will not alter existing measures to protect the species likely to inhabit the herring management unit. For further information on the potential impacts of the fishery and the proposed management action on marine mammals, see Section 6.3 of this document.

7.4 ENDANGERED SPECIES ACT (ESA)

Section 7 of the ESA requires Federal agencies conducting, authorizing, or funding activities that affect threatened or endangered species to ensure that those effects do not jeopardize the continued existence of listed species. The Council has concluded that the proposed 2010-2012 specifications for Atlantic herring and the prosecution of the associated fisheries are not likely to result in jeopardy to any ESA-listed species under NOAA Fisheries Service jurisdiction, or alter or modify any critical habitat, based on the analysis in this document. For further information on the potential impacts of the fisheries and the proposed management action, see Section 6.0 of this document. The previous formal consultation on the herring fisheries was completed on September 17, 1999, and concluded that the operation of the MSB fisheries was not likely to jeopardize the continued existence of listed species and would not result in the destruction or adverse modification of designated critical habitat. Consultation on the herring fisheries was reinitiated on March 23, 2005, after new information revealed that the herring fisheries may affect Atlantic salmon to an extent not previously considered. Additional information will be evaluated as it becomes available.

7.5 ADMINISTRATIVE PROCEDURES ACT (APA)

This action was developed in compliance with the requirements of the Administrative Procedures Act, and these requirements will continue to be followed when the proposed regulation is published. Section 553 of the Administrative Procedure Act establishes procedural requirements applicable to informal rulemaking by Federal agencies. The purpose of these requirements is to ensure public access to the Federal rulemaking process, and to give the public adequate notice and opportunity for comment. At this time, the Council is not requesting relief from the requirements of the APA for notice and comment rulemaking.

7.6 PAPERWORK REDUCTION ACT (PRA)

The purpose of the PRA is to control and, to the extent possible, minimize the paperwork burden for individuals, small businesses, nonprofit institutions, and other persons resulting from the collection of information by or for the Federal Government. The authority to manage information and recordkeeping requirements is vested with the Director of the Office of Management and Budget (OMB). This authority encompasses establishment of guidelines and policies, approval of information collection requests, and reduction of paperwork burdens and duplications.

The proposed Atlantic herring fishery specifications contain no new or additional collection-of-information requirements.

7.7 COASTAL ZONE MANAGEMENT ACT (CZMA)

Section 307(c)(1) of the Federal CZMA of 1972 requires that all Federal activities that directly affect the coastal zone be consistent with approved state coastal zone management programs to the maximum extent practicable. Pursuant to the CZMA regulations at 15 CFR 930.35, a negative determination may be made if there are no coastal effects and the subject action: (1) Is identified by a state agency on its list, as described in § 930.34(b), or through case-by-case monitoring of unlisted activities; or (2) which is the same as or is similar to activities for which consistency determinations have been prepared in the past; or (3) for which the Federal agency undertook a thorough consistency assessment and developed initial findings on the coastal effects of the activity.

Upon the Council's submission of the 2010-2012 Atlantic herring fishery specifications package, NMFS will review the proposed 2010 specifications for consistency with the approved coastal management programs of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina.

7.8 INFORMATION QUALITY ACT (IQA)

Pursuant to NOAA Fisheries guidelines implementing Section 515 of Public Law 106-554 (Information Quality Act), all information products released to the public must first undergo a Pre-Dissemination Review to ensure and maximize the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by Federal agencies. The following section addresses these requirements.

Utility

Utility means that disseminated information is useful to its intended users. "Useful" means that the content of the information is helpful, beneficial, or serviceable to its intended users, or that the information supports the usefulness of other disseminated information by making it more accessible or easier to read, see, understand, obtain or use. The information presented in this document is helpful to the intended users (the affected public) by presenting a clear description of the purpose and need of the proposed action, the measures proposed, and the impacts of those measures. A discussion of the reasons for selecting the proposed action is included so that intended users may have a full understanding of the proposed action and its implications. The intended users of the information contained in this document are participants in the Atlantic herring fishery and other interested parties and members of the general public. The information contained in this document may be useful to owners of vessels holding an Atlantic herring permit as well as Atlantic herring dealers and processors since it serves to notify these individuals of any potential changes to management measures for the fishery. This information will enable these individuals to adjust their fishing practices and make appropriate business decisions based on the new management measures and corresponding regulations.

The information being provided in this specifications package concerning the status of the Atlantic herring fishery is updated based on landings and effort information through the 2008 fishing year. Information presented in this document is intended to support the proposed specifications for the 2010-2012 fishing years, which have been developed through a multi-stage process involving all interested members of the public. Consequently, the information pertaining to management measures contained in this document has been improved based on comments from the public, fishing industry, members of the Council, and NOAA Fisheries.

The media being used in the dissemination of the information contained in this document will be contained in a *Federal Register* notice announcing the Proposed and Final Rules for this action. This document is available in several formats, including printed publication, CD-ROM, and online through the Council's web page. The *Federal Register* notice that announces the Proposed Rule and the Final Rule and implementing regulations will be made available in printed publication, on the website for the Northeast Regional Office, and through the Regulations.gov website.

Integrity

Integrity refers to security – the protection of information from unauthorized access or revision, to ensure that the information is not compromised through corruption or falsification. Prior to dissemination, information associated with this action, independent of the specific intended distribution mechanism, is safeguarded from improper access, modification, or destruction, to a degree commensurate with the risk and magnitude of harm that could result from the loss, misuse, or unauthorized access to or modification of such information. All electronic information disseminated by NOAA Fisheries Service adheres to the standards set out in Appendix III, "Security of Automated Information Resources," of OMB Circular A-130; the Computer Security Act; and the Government Information Security Act. All confidential information (e.g., dealer purchase reports) is safeguarded pursuant to the Privacy Act; Titles 13, 15, and 22 of the U.S. Code (confidentiality of census, business, and financial information); the Confidentiality of Statistics provisions of the Magnuson-Stevens Act; 50 CFR 229.11, Confidentiality of Information collected under the Marine Mammal Protection Act; and NOAA Administrative Order 216-100, Protection of Confidential Fisheries Statistics.

Objectivity

Objective information is presented in an accurate, clear, complete, and unbiased manner, and in proper context. The substance of the information is accurate, reliable, and unbiased; in the scientific, financial, or statistical context, original and supporting data are generated and the analytical results are developed using sound, commonly-accepted scientific and research methods. "Accurate" means that information is within an acceptable degree of imprecision or error appropriate to the particular kind of information at issue and otherwise meets commonly accepted scientific, financial, and statistical standards.

For purposes of the Pre-Dissemination Review, this document is considered to be a "Natural Resource Plan." Accordingly, the document adheres to the published standards of the Magnuson-Stevens Act; the Operational Guidelines, Fishery Management Plan Process; the Essential Fish Habitat Guidelines; the National Standard Guidelines; and NOAA Administrative Order 216-6, Environmental Review Procedures for Implementing the National Environmental

Policy Act. Several sources of data were used in the development of this document, including the analysis of potential impacts. These data sources include, but are not limited to: landings data from vessel trip reports, landings data from individual voice reports, information from resource trawl surveys, data from the dealer weighout purchase reports, descriptive information provided (on a voluntary basis) by processors and dealers of Atlantic herring, and ex-vessel price information. Although there are some limitations to the data used in the analysis of impacts of management measures and in the description of the affected environment, these data are considered to be the best available.

This information product uses information of known quality from sources acceptable to the relevant scientific and technical communities. Stock status (including estimates of biomass and fishing mortality) reported in this product are based on either assessments subject to peer-review through the Transboundary Resource Assessment Committee (TRAC) or on updates of those assessments. Landing and revenue information is based on information collected through the Vessel Trip Report, Interactive Voice Response, and Commercial Dealer databases. Information on catch composition and bycatch is based on reports collected by the NOAA Fisheries Service observer program and incorporated into the sea sampling or observer database systems. These reports are developed using an approved, scientifically valid sampling process. In addition to these sources, additional information is presented that has been accepted and published in peer-reviewed journals or by scientific organizations. Original analyses in this document were prepared using data from accepted sources, and the analyses have been reviewed by members of the Herring Plan Development Team.

The policy choices (i.e., management measures) proposed in this specifications package are supported by the best available scientific information. The supporting science and analyses, upon which the policy choices are based, are summarized and described in Section 4.0 of this document. All supporting materials, information, data, and analyses within this document have been, to the maximum extent practicable, properly referenced according to commonly accepted standards for scientific literature to ensure transparency. Qualitative discussion is provided in cases where quantitative information was unavailable, utilizing appropriate references as necessary.

The review process for any action under an FMP involves the Northeast Regional Office (NERO) of NOAA Fisheries, the Northeast Fisheries Science Center (Center), and NOAA Fisheries Headquarters (Headquarters). The Council review process involves public meetings at which affected stakeholders have the opportunity to provide comments on the proposed changes to the FMP. Reviews by staff at NERO are conducted by those with expertise in fisheries management and policy, habitat conservation, protected species, and compliance with the applicable law. The Center's technical review is conducted by senior-level scientists with specialties in population dynamics, stock assessment methodology, fishery resources, population biology, and the social sciences.

Final approval of this specification package and clearance of the Proposed and Final Rules is conducted by staff at NOAA Fisheries Headquarters, the Department of Commerce, and the U.S. Office of Management and Budget. This review process is standard for any action under an FMP, and provides input from individuals having various expertise who may not have been directly involved in the development of the proposed action. Thus, the review process for any FMP modification, including the herring specifications for the 2010-2012 fishing years, is performed by technically-qualified individuals to ensure the action is valid, complete, unbiased, objective, and relevant.

7.9 IMPACTS ON FEDERALISM/E.O. 13132

The Executive Order on Federalism established nine fundamental federalism principles to which Executive agencies must adhere in formulating and implementing policies having federalism implications. The E.O. also lists a series of policy making criteria to which agencies must adhere when formulating and implementing policies that have federalism implications. However, no federalism issues or implications have been identified relative to the proposed action.

The proposed action does not contain policies with federalism implications sufficient to warrant preparation of an assessment under E.O. 13132. The affected States have been closely involved in the development of the proposed specifications through their involvement in the Regional Fishery Management Council process (i.e., all affected states are represented as voting members on at least one Council) and the ASMFC process. The proposed specifications were developed with the full participation and cooperation of the state representatives of the New England Council and the ASMFC Atlantic Herring Section. No comments were received from any state officials relative to any federalism implications of the proposed specifications.

7.10 REGULATORY FLEXIBILITY ACT/E.O. 12866

7.10.1 Regulatory Impact Review and Initial Regulatory Flexibility Analysis (IRFA)

This section provides the analysis and conclusions to address the requirements of Executive Order 12866 and the Regulatory Flexibility Act (RFA). Since many of the requirements of these mandates duplicate those required under the Magnuson-Stevens Act and NEPA, this section contains references to other sections of this document.

7.10.2 Description of Management Objectives

The goals and objectives of the management plan for the Atlantic herring resource are stated in Section 2.3 of the Atlantic Herring FMP and are modified in Section 3.2 of Amendment 1. The proposed action is consistent with these goals and objectives and is designed to achieve many of the objectives, as discussed in Section 1.2 of this document.

7.10.3 Description of the Fishery

Section 4.0 of the Herring FMP contains a detailed description of the Atlantic herring fishery. Section 7.4 of Amendment 1 updates the information in the Herring FMP and provides a comprehensive description of fishery-related businesses and communities. In addition, following development of the Herring FMP, Stock Assessment and Fishery Evaluation (SAFE) Reports have been prepared by the Herring PDT for each fishing year. The 2007-2009 herring fishery specifications updates the information provided in Amendment 1 through the 2005 and 2006 fishing year where possible. This specifications document provides updated information about the Atlantic herring fishery through the 2008 fishing year where possible. The updated fishery information is presented in Section 4.4 of this document.

7.10.4 Statement of the Problem

The purpose and need for this action is identified in Section 1.2 of this document. The Herring FMP requires that the Council and the Regional Administrator annually review the best available stock and fishery data when developing specifications for the upcoming fishing years.

7.10.5 Description of the Alternatives

The proposed action is described in Section 2.0 of this document. Alternatives to the proposed action that were considered during the specification process, in addition to the no action alternative, are described in Section 3.0 of this document.

7.10.6 Economic Analysis

The economic impacts of the proposed action as well as other alternatives considered during the specification process are discussed in detail in Section 6.4.1 of this document.

There are four general economic impacts that result from the alternatives proposed in the 2010-12 herring specifications. Impacts fall into these categories: 1) loss of revenue when expected landings based on stock-wide TACs fall below 2008 landings levels, 2) changes in harvest costs for alternatives that result in fishing activity taking place further from shore, 3) impacts to the lobster fleet for alternatives that restrict landings from Area 1A in the summer, 4) impacts to the mackerel fishery, and 5) impacts to herring processors.

The Proposed Action will not reduce the stock-wide TAC below 2008 landings levels in any of the three year time span covered by this action. So, in terms of the ability of the fleet to land the same quantity of herring as in the recent pass, the Proposed Action would not negatively impact the fishery. All other options under Alternative 2 would reduce the stock-wide TAC to 75,200 metric tons. Since the management areas close when 95% of the TAC is reached, landings would be capped at 71,440 metric tons which is 9,360 metric tons less than 2008 landings. At the average 2008 price of $260 per metric ton, the value of the difference is approximately 2.4 million dollars.

All options except for Alternative 1/Option1 and the no-action alternative reduce the Area 1A TAC. The Proposed Action reduces the Area 1A TAC by 41% from 45,000 metric tons to 26,546 metric tons. Other options reduce the Area 1A TAC by less than 10% while others reduce it by as much as 90%. Options with large Area 1A reductions are generally associated with TACs in Areas 2 and 3 that are higher than historical Area 2 and 3 landings. However, harvesting fish from these areas when the Area 1A TAC is reached may not always be ideal. If Area 1A closes in the summer, fish will not be in Area 2 that time of year. As far as Area 3, it is uncertain whether fish will aggregate in such a way that normal fishing operations can occur.

Also, Area 3 is a large area offshore area and so finding fish may be problematic. In addition, some smaller/coastal vessels are not able to safely fish offshore.

Increases in the amount of offshore fishing will increase operating costs. Since search time is likely to increase, the length of the trip will increase which means fuel and other expenses will increase. The length of the trip will also increase since the fishing grounds are further from shore. The degree to which fishing cost will change is difficult to predict so an overall estimate of increased cost is not provided. However, observer data shows that for midwater trawl vessels each additional day at sea increased costs by $2,800 on average.

Impacts to the lobster fishery are expected for options, including the Proposed Action, that significantly reduce the Area 1A TAC. Herring is used for bait in the lobster fishery and nearly 50,000 metric tons of herring is used as bait per year. A 2006 survey by Market Decisions (as reported in Thunberg, 2007) showed that bait costs were 14% to 15% of gross landed value for full-time lobster fishermen in Lobster Conservation Management Area 1 (coastal Maine, New Hampshire, and the North and South Shore regions of Massachusetts). In Lobster Conservation Management Area 2 (coastal Rhode Island and coastal Massachusetts South of Cape Cod), bait costs were 11% to 12% of gross. Shortages in supply, particularly in the summer months could cause price spikes thereby cutting into profit margins. If price increases are high enough, lobster fishermen will seek bait alternatives which may be inferior. Businesses that supply bait may also be impacted since much of the infrastructure is based on delivering salted herring in barrels. Changing to other sources may be costly in the short run.

Options that restrict the Area 2 TAC below historical landings from Area 2 of about 20,000 to 22,000 metric tons have the potential to impact the mackerel fishery. Mackerel fishing takes place in the winter and early spring months in herring management Area 2. In the winter, herring migrate to Area 2. The co-occurrence of both these fisheries in Area 2 during the winter results in herring being caught as bycatch in the mackerel fishery. Many of the same vessels participate in both fisheries. Some mackerel vessels, however, do not have limited access herring permits and are limited to 2,000 pounds of herring per trip. The Area 2 TAC under the Proposed Action is 22,146 metric tons so impacts to the mackerel fishery are not expected to be large.

Since reductions in overall landings are not expected from the Proposed Action, herring processors should not be impacted except in the event that seasonal shortages disrupt the flow of production and/or market opportunities are lost. For options that reduce landings, there would be revenue losses to herring processors and impacts on processing plant employees. The cannery in Maine is particularly vulnerable to options that significantly reduce the Area 1A TAC since the cannery has traditionally been dependant on that area in the summer. Reductions in available herring, highly variable landings, and increased cost of herring will make it difficult for the cannery to continue to produce canned herring at a profit and keep employees working.

7.10.7 Determination of Significance Under E.O. 12866

NMFS Guidelines provide criteria to be used to evaluate whether a proposed action is significant. A significant regulatory action means any regulatory action that is likely to result in a rule that may:

1. *Have an annual effect on the economy of $100 million or more, or adversely effect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local or tribal governments or communities.*

The proposed action will not have an effect on the economy in excess of $100 million. The proposed action is not expected to adversely impact in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local or tribal governments or communities. Disruptions to the Northeast lobster fishery bait market are expected. The result is likely to be an increase in the cost of bait for lobster fishermen. While this is a an important fishery with ex-vessel values on the order of $400 million, the bait market disruptions are not expected to cause large-scale reductions in lobster landings.

2. *Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency.*

The proposed action will not create a serious inconsistency with or otherwise interfere with an action taken or planned by another agency. No other agency has indicated that it plans an action that will affect the Atlantic herring fishery in the EEZ.

3. *Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof.*

The proposed action will not materially alter the budgetary impact of entitlements, grants, user fees or loan programs, or the rights and obligations of their participants.

4. *Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.*

The proposed action does not raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in E.O. 12866.

7.10.8 Initial Regulatory Flexibility Analysis

The following sections contain analyses of the effect of the proposed action on small entities. Under Section 603(b) of the RFA, each initial regulatory flexibility analysis is required to address:

1. Reasons why the agency is considering the action,
2. The objectives and legal basis for the proposed rule,
3. The kind and number of small entities to which the proposed rule will apply,
4. The projected reporting, record-keeping and other compliance requirements of the proposed rule, and
5. All Federal rules that may duplicate, overlap or conflict with the proposed rule.

7.10.8.1 Reasons for Considering the Action

The purpose and need for this action is identified in Section 1.2 of this document. The Herring FMP requires that the Council and the Regional Administrator annually review the best available stock and fishery data when developing specifications for the upcoming fishing years.

7.10.8.2 Objectives and Legal Basis for the Action

The objective of the proposed action is to implement specifications for the 2010-2012 Atlantic herring fishery, as required under the regulations implementing the Atlantic Herring FMP, which are provided in 50 CFR 648.

7.10.8.3 Description and Number of Small Entities to Which the Rule Applies

All of the potentially affected businesses are considered small entities under the standards described in NOAA Fisheries guidelines because they have gross receipts that do not exceed $4 million annually. Section 4.4.3 of this document (Economic Factors) provides information to support this determination.

7.10.8.4 Recordkeeping and Reporting Requirements

The proposed action does not introduce any new reporting, recordkeeping, or other compliance requirements.

7.10.8.5 Duplication, Overlap, or Conflict with Other Federal Rules

The proposed action does not duplicate, overlap or conflict with any other Federal rules.

7.10.8.6 Economic Impacts on Small Entities Resulting from the Proposed Action

The economic impacts of the proposed action as well as other alternatives considered during the specification process are discussed in detail in Section 6.4.1 of this document.

The Proposed Action will not reduce the stock-wide TAC below 2008 landings levels in any of the three year time span covered by this action. So, in terms of the ability of the fleet to land the same quantity of herring as in the recent pass, the Proposed Action would not negatively impact the fishery. All other options under Alternative 2 would reduce the stock-wide TAC to 75,200 metric tons. Since the management areas close when 95% of the TAC is reached, landings would be capped at 71,440 metric tons which is 9,360 metric tons less than 2008 landings. At the average 2008 price of $260 per metric ton, the value of the difference is approximately 2.4 million dollars.

All non-preferred options except for Alternative 1/Option1 and the no-action alternative reduce the Area 1A TAC. The Proposed Action reduces the Area 1A TAC by 41% from 45,000 metric tons to 26,546 metric tons. Other options reduce the Area 1A TAC by less than 10% while others reduce it by as much as 90%. Options with large Area 1A reductions are generally associated with TACs in Areas 2 and 3 that are higher than historical Area 2 and 3 landings. However, harvesting fish from these areas when the Area 1A TAC is reached may not always be ideal. If Area 1A closes in the summer, fish will not be in Area 2 that time of year. As far as Area 3, it is uncertain whether fish will aggregate in such a way that normal fishing operations can occur. Also, Area 3 is a large area offshore area and so finding fish may be problematic. In addition, some smaller/coastal vessels are not able to safely fish offshore.

Increases in the amount of offshore fishing will increase operating costs. Since search time is likely to increase, the length of the trip will increase which means fuel and other expenses will increase. The length of the trip will also increase since the fishing grounds are further from shore. The degree to which fishing cost will change is difficult to predict so an overall estimate of increased cost is not provided. However, observer data shows that for midwater trawl vessels each additional day at sea increased costs by $2,800 on average.

Options that restrict the Area 2 TAC below historical landings from Area 2 of about 20,000 to 22,000 metric tons have the potential to impact the mackerel fishery. Mackerel fishing takes place in the winter and early spring months in herring management Area 2. In the winter, herring migrate to Area 2. The co-occurrence of both these fisheries in Area 2 during the winter results in herring being caught as bycatch in the mackerel fishery. Many of the same vessels participate in both fisheries. Some mackerel vessels, however, do not have limited access herring permits and are limited to 2,000 pounds of herring per trip. The Area 2 TAC under the Proposed Action is 22,146 metric tons so impacts to the mackerel fishery are not expected to be large.

8.0 REFERENCES

8.1 GENERAL REFERENCES

For the description of the affected environment (Section 4.0), the references included in Section 14.0 of the Amendment 1 document apply to this document and are incorporated by reference. The references listed below are those in addition to references in Amendment 1 and/or those that were specifically referenced for the purposes of preparing this specifications document.

Atlantic States Marine Fisheries Commission (ASMFC). 1999. Amendment 1 to the Interstate Fishery Management Plan for Atlantic Sea Herring. Fishery Management Report No. 33.

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New England Fishery Management Council (NEFMC). 2006. Final Amendment 1 to the Atlantic Herring Fishery Management Plan. Incorporating the supplemental environmental impact statement and regulatory impact review. Volume I and II. NEFMC in consultation with the ASMFC, MAFMC, and NMFS. Final document submitted May 3, 2006.

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9.0 LIST OF PREPARERS AND AGENCIES CONSULTED

This document was prepared by the New England Fishery Management Council and the National Marine Fisheries Service, in consultation with the Atlantic States Marine Fisheries Commission and the Mid-Atlantic Fishery Management Council. Members of the New England Fishery Management Council's Herring Plan Development Team and the ASMFC Herring Technical Committee include:

- Lori Steele, NEFMC Staff, Herring PDT Chair
- Matt Cieri, ME DMR Biologist, ASMFC Herring TC Chair
- Gary Shepherd, NEFSC Population Dynamics
- Steve Correia, MA DMF Biologist
- Drew Kitts, NEFSC Social Sciences
- Madeleine Hall-Arber, MIT Sea Grant
- Patricia Pinto da Silva, NEFSC Social Sciences
- Jason Stockwell, Gulf of Maine Research Institute
- Jamie Cournane, Environmental Defense
- Carrie Nordeen, NMFS NERO
- Hannah Goodale, NMFS NERO
- Cheryl Quaine, NMFS NERO
- Talia Bigelow, NEFMC Staff
- Michelle Bachman, NEFMC Staff
- Chris Vonderweidt, and Bob Beal, ASMFC Staff
- Najih Lazar, RI DFW
- Kurt Gottshall, CT DEP

The following agencies were consulted during the development of the herring fishery specifications, either through direct communication/correspondence and/or participation on the Herring Committee or PDT:

- NOAA Fisheries, National Marine Fisheries Service, Northeast Regional Office, Gloucester MA
- Northeast Fisheries Science Center, Woods Hole MA
- Atlantic States Marine Fisheries Commission and Atlantic Herring Section
- Mid-Atlantic Fishery Management Council

NEW ENGLAND FISHERY MANAGEMENT COUNCIL

2010-2012 Atlantic Herring Fishery Specifications

APPENDIX I:

2009 TRAC Status Report and Related ABC Documents

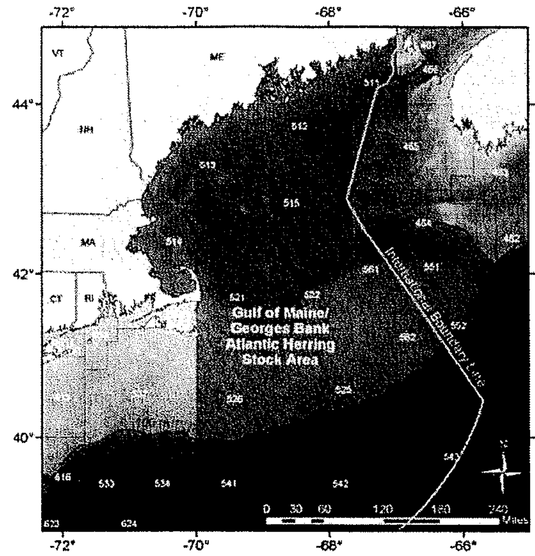
Fisheries and Oceans Canada Pêches et Océans Canada

NOAA FISHERIES NATIONAL MARINE FISHERIES SERVICE

Transboundary Resources Assessment Committee

Status Report 2009/04

GULF OF MAINE-GEORGES BANK HERRING STOCK COMPLEX



Summary

- Combined Canada and USA herring landings increased from 106,000 mt in 2005 to 116,000 mt in 2006, then declined to 90,000 mt in 2008.

- Stock biomass (2+, January 1) increased steadily from about 111,600 mt in 1982 to almost 830,000 mt in 1997, fluctuated without trend since then, and was estimated to be 652,000 mt at the beginning of 2008. This is below B_{msy} (670,600 mt).

- Recruitment at Age 2 from the 2004 and 2006 year classes appear weaker than the long-term (1967-2005) average of 2.3 billion fish. The 2005 year class abundance estimate is above average abundance at 3.3 billion fish.

- Fishing mortality (Age 2+) declined to 0.14 in 1993 and has remained stable at about 0.16 from 2002 onwards (Figure 1). Estimated fishing mortality in 2008 was 0.14. This is below F_{msy} (0.27).

Landings, 2+ Biomass (thousands mt); Recruits (millions)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Avg[1]	Min[1]	Max[1]
Canada Landed	18.6	17.1	24.8	13.4	9.0	20.6	12.6	12.9	30.9	6.4	23.1	6.4	44.1
USA Landed	110.6	108.8	120.0	93.2	100.8	94.4	93.3	103.1	81.7	83.6	80.6	33.2	123.6
Total Landed	129.1	125.9	144.8	106.6	109.8	115.0	105.9	116.0	112.6	90.0	103.7	44.6	144.8
2+ Biomass	735	854	790	670	674	711	684	690	697	652	529	112	1,294
Age 2 Recruits	1032	3828	1033	1275	2739	3775	1616	1318	3252	265	2268	265	8758
Fishing Mortality	0.19	0.16	0.20	0.17	0.17	0.17	0.16	0.17	0.17	0.14	0.37	0.14	0.80
Exploitation Rate	0.16	0.13	0.16	0.14	0.14	0.14	0.13	0.14	0.14	0.12	0.28	0.12	0.50

[1] 1978-2008 for landings (thousands mt)
1967-2008 for 2+ biomass (thousands mt), recruitment (millions) and F(2+)

Fishery

Combined Canada/USA landings. Combined Canada/USA landings averaged 90,000 mt during 1978-1994 (Figure 1). Landings increased during 1995-2001, averaging 133,000 mt, and peaking at 145,000 mt in 2001. Landings declined slightly during 2002-2005, and averaged 109,000 mt. During 1978-2005, the USA accounted for about 76% of the total landings, but during the most recent decade, this percentage increased to about 85%.

Canadian landings. Landings by Canada averaged about 27,000 mt during 1978-1994, declined to an average of 19,000 mt during 1995-2001, and declined further to 14,000 mt during 2002-2005. Landing from 2006-2008 average 16,800 mt although landings in 2007 peaked at 31,000 mt. Canadian landing have been dominated by the New Brunswick weir fishery.

USA landings. Landings by the United States averaged about 62,300 mt during 1978-1994, increased to an average of 103,000 mt during 1995-2001, and declined to an average of 95,000 mt during 2002-2005. Landings since 2005 have averaged 89,000 mt. During 1978-1982, USA landings were about equally split between the weir fisheries and purse seines. During 1983-1992, most USA landings were taken by purse seines but subsequently single mid-water and paired mid-water trawling have dominated the landings, with purse seining accounting for only about 10-15% of the total USA landings during 2000-2005. Since 2005 purse seining has increased while pair and single midwater trawling has decreased with pair trawling accounting for 56%, single midwater trawling 12% and purse seine 26%.

Harvest Strategy and Reference Points

The Atlantic herring 2006 TRAC recommended that a strategy be adopted to maintain a low to neutral risk of exceeding the fishing mortality limit reference point, and that when stock conditions are poor, fishing mortality rates should be further reduced to promote rebuilding. A Fox surplus production model estimated F_{msy} = 0.27, MSY = 178,374 mt, and B_{msy} = 670,600 mt. Yield per recruit reference points (proxies for F_{msy}) were estimated as: $F_{0.1}$=0.21, and $F_{40\%}$=0.20.

State of Resource

The state of the resource was based on results from an age-structured, analytical assessment which used fishery catch statistics and biological samples to characterize the size and age composition of the catches during 1967 to 2008. Even though this was an update assessment, the suite of indices used was re-evaluated. All formulations showed similar trends in stock size but differed in scale. The final formulation was selected, with some difficulty, to balance various data sources and their uncertainty, and was calibrated to trends in abundance from the NMFS spring and fall bottom trawl surveys. In addition, a revised landings at age was applied, as recommended in the benchmark. This resulted in changes to biomass estimates that will be reviewed in more detail at the next benchmark.

Retrospective analyses were used to detect any patterns to overestimate - or underestimate - fishing mortality, biomass and recruitment relative to the terminal year estimates. A significant retrospective pattern was detected in this assessment in overestimating SSB relative to the current estimate (averaging + 42%/year, and ranging between 14-56%) and this is a concern (Figure 2). The pattern has persisted for several years and is expected to continue in the future.

Stock biomass (2+, January 1) increased steadily from about 111,600 mt in 1982 to almost 830,000 mt in 1997, fluctuated without trend since then, and was estimated to be 650,700 mt at the beginning of 2008. This is below B_{msy} (670,600 mt). Biomass increases in the late 1990s were due to improved recruitment, especially from two very large year classes, 1994 and 1998 (Figure 3). Weights-at-age in the population declined in the late 1980s but have remained steady since 1995.

Recruitment (at Age 2) markedly improved in the late 1980s with several moderate year classes and three large year classes (1994 cohort: 6.3 billion; 1998 cohort: 3.8 billion; and the 2002 cohort: 3.8 billion). Recruitment from the 2004 and 2006 year classes appear weaker than the long-term (1967-2005) average of 2.3 billion fish. The 2005 year class abundance estimate is above average abundance at 3.3 billion fish.

Fishing mortality (Age 2+) declined from peak values above 0.7 in the 1970s to an average of 0.4 during the mid-late 1980s (Figure 1). Fishing mortality declined to 0.14 in 1993 and has remained stable at about 0.16 from 2002 onwards (Figure 1). Estimated fishing mortality in 2008 was 0.14. This is below F_{msy} (0.27).

Productivity

Age structure, spatial distribution, and fish growth reflect changes in the productive potential of the stock complex. The **population age structure** shows an increase in abundance of ages 6+ in 1995, remaining relatively constant since then, consistent with lowered exploitation. Increasing abundance of older fish in the landings-at-age and future surveys would help to confirm this pattern. **Spatial distribution** patterns of herring in recent NMFS fall bottom trawl surveys (1998-2008) were similar to patterns observed in the 1960s, prior to the collapse of the offshore stock component. Declines in **weights-at-age** are a factor in limiting increases in the population biomass. On balance, however, the productive potential of the herring stock complex has improved in recent years.

Outlook

An outlook is provided in terms of the consequences on SSB and for landings in 2009, 2010 and 2011 of fishing at the current F=0.14. Additional projections will be run at various Fs as required by management. Although uncertainty in stock size and recruitment generates uncertainty in forecast results, a formal risk analysis was not undertaken due to the significant retrospective pattern in SSB and the difficulty and uncertainty in selecting the final model formulation. Nevertheless, the forecasts are considered useful for general management guidance.

The projections assumed that recruitment of the 2009-2011 year classes was equal to the recent 10-year average (2.0 billion fish at Age 2) (Figures 3 and 4). A fishing mortality of F=0.14 in 2009 generates a landings of 82,403 mt and an SSB in 2009 of 460,343 mt, a decline of about 11%. Continuing to fish at F=0.14 in both 2010 and 2011 produces annual landings of 81,154 mt and 82,625 mt, respectively, and results in a slight decline in SSB in 2011 to 444,532 mt.

	2+ Biomass	SSB	Landings	F
2009	694.3	460.3	82.4	0.14
2010	683.8	440.0	81.2	0.14
2011	692.2	444.5	82.6	0.14

Special Considerations

The 2005 year class dominated landings in 2006 and 2007 at ages 1 and 2 respectively, and landings over the next several years are therefore dependent on the magnitude of the 2005 year class, which still has high uncertainty.

The retrospective pattern in SSB that has persisted in the last several assessments is an issue and will continue to be investigated in the next benchmark. Ignoring the retrospective pattern in biomass could increase the risk of not meeting conservation objectives.

Analysis of predator consumption and mortality, as well as the use of a larval index to estimate SSB, were discussed. It was considered possible to incorporate these into the assessment, and they will be investigated further at the next benchmark.

Ongoing issues with aging will be addressed further to determine the age at which adequate resolution is achieved. Additional otolith exchanges, workshops and development of common protocols are encouraged.

Source Documents

Overholtz, W.J., and J.S. Link. 2007. Consumption Impacts by Marine Mammals, Fish and Seabirds on the Gulf of Maine-Georges Bank Atlantic Herring (*Clupea harengus*) Complex During the Years 1977-2002. ICES Journal of Maine Science, 64:83-96.

Overholtz, W.J., L.D. Jacobson, G.D. Melvin, M. Cieri, M. Power, D. Libby, and K. Clark. 2004. Stock Assessment of the Gulf of Maine-Georges Bank Atlantic Herring Complex, 2003. Northeast Fisheries Science Center Reference Document 04-06, 290 p.

TRAC. 2006. Gulf of Maine-Georges Bank Herring Stock Complex. TRAC Status Report 2006/01.

Correct Citation

TRAC. 2009. Gulf Of Maine-Georges Bank Herring Stock Complex. TRAC Status Report 2009/04.

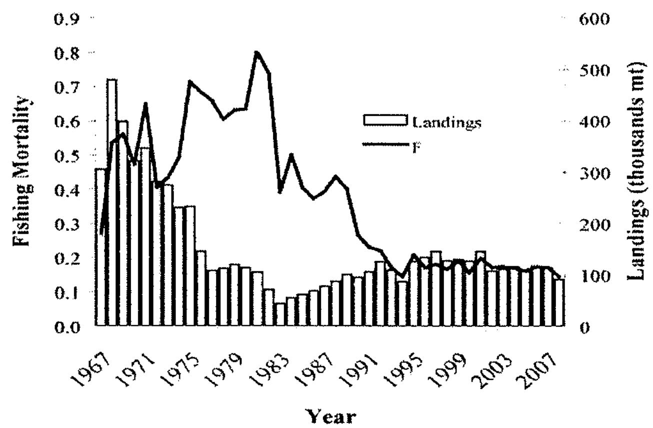


Figure 1. Gulf of Maine/Georges Bank Atlantic herring landings and Age 2+ fishing mortality.

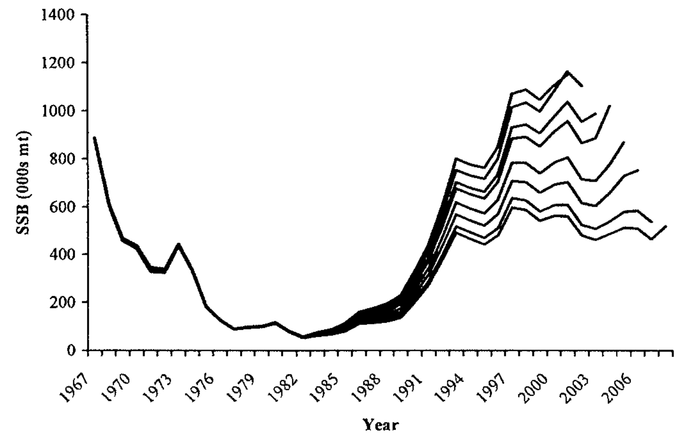


Figure 2. Retrospective pattern of Gulf of Maine/Georges Bank Atlantic herring spawning stock biomass.

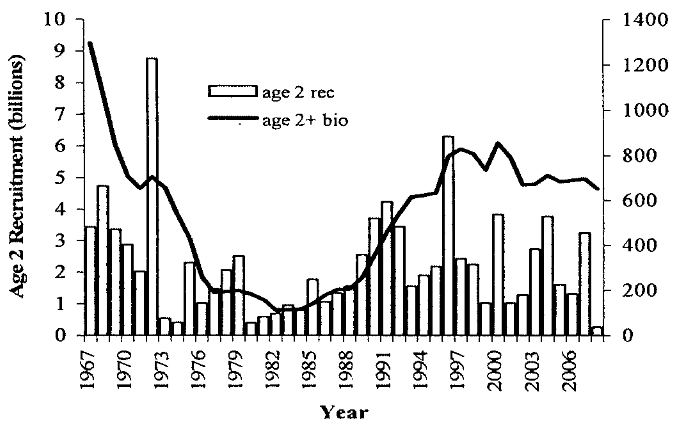


Figure 3. Gulf of Maine/Georges Bank Atlantic herring Age 2+ biomass and Age 2 recruitment.

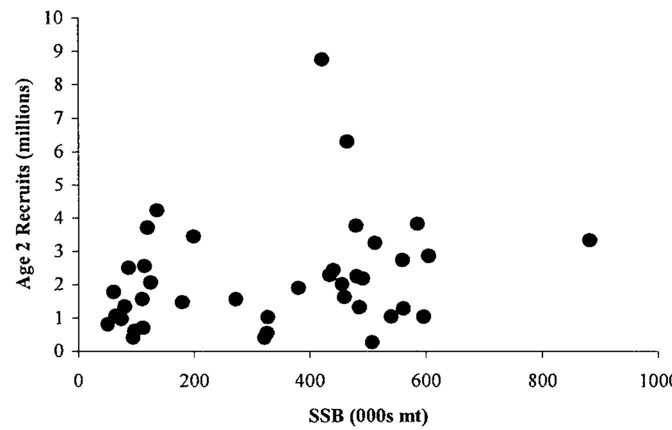


Figure 4. Gulf of Maine/Georges Bank Atlantic herring SSB and Age 2 recruitment.

New England Fishery Management Council
50 WATER STREET | NEWBURYPORT, MASSACHUSETTS 01950 | PHONE 978 465 0492 | FAX 978 465 3116
John Pappalardo, *Chairman* | Paul J. Howard, *Executive Director*

MEMORANDUM

DATE: July 28, 2009

TO: Scientific and Statistical Committee (SSC) Members

FROM: Lori Steele, NEFMC Staff, Herring PDT Chair

SUBJECT: **Atlantic Herring Assessment Results and Preliminary Guidance Re. Specification of Allowable Biological Catch (ABC)**

Background

The Transboundary Resource Assessment Committee (TRAC) Atlantic Herring Stock Assessment was conducted in early June 2009 in St. Andrews, New Brunswick, Canada. This assessment served as an update; Atlantic herring for the Gulf of Maine/Georges Bank area were last assessed in a benchmark assessment in May 2006 (O'Boyle and Overholtz 2006). At the 2006 assessment meeting, it was agreed that the Age Structured Assessment Program (ASAP) Base model showed the least retrospective pattern and was the preferred approach amongst all the model formulations. The purpose of the 2009 assessment meeting was to update both independent and dependent data, and use it in the established benchmark formulation to determine the current status of the Atlantic herring resource. The updated assessment model also prompted revision of the biological reference points to reflect the new results.

The TRAC update assessment results estimate that Atlantic herring biomass was 651,700 mt at the beginning of 2008, which is below B_{MSY} (670,600 mt). Estimated fishing mortality in 2008 was 0.14, which is below F_{MSY} (0.27).

The Atlantic herring stock complex is above ½ B_{MSY} and fishing mortality is below F_{MSY}, so the stock is not overfished and overfishing is not occurring. The current overfishing definition for Atlantic herring is provided below.

> *If stock biomass is equal or greater than B_{MSY}, overfishing occurs when fishing mortality exceeds F_{MSY}. If stock biomass is below B_{MSY}, overfishing occurs when fishing mortality exceeds the level that has a 50 percent probability to rebuild stock biomass to B_{MSY} in 5 years ($F_{Threshold}$). The stock is in an overfished condition when stock biomass is below ½ B_{MSY} and overfishing occurs when fishing mortality exceeds $F_{Threshold}$. These reference points are thresholds and form the basis for the control rule.*

The control rule also specifies risk averse fishing mortality targets, accounting for the uncertainty in the estimate of F_{MSY}. If stock biomass is equal to or greater than $1/2B_{MSY}$, the target fishing mortality will be the lower level of the 80 percent confidence interval about F_{MSY}. When biomass is below B_{MSY}, the target fishing mortality will be reduced consistent with the five-year rebuilding schedule used to determine $F_{Threshold}$.

Table 1 Current (TRAC 2009) Biomass and Fishing Mortality Status/Reference Points for the Atlantic Herring Stock Complex

	BIOMASS	FISHING MORTALITY
REFERENCE POINTS **(MSY = 178,374 mt)**	B_{MSY}= 670,600 mt $B_{Threshold}$ = 335,290 mt	F_{MSY} = 0.27 F_{Target} = Unknown*
2008 ESTIMATES (TRAC 2009)	651,700 mt	0.14

**The methods for calculating reference points in the TRAC assessment do not yield probability distributions, so the 80% confidence interval cannot be calculated.*

Several issues associated with the current overfishing definition for Atlantic herring, which is provided from the original Herring FMP (1999), need attention. The current control rule (with target F) may be inconsistent in light of the new MSRA requirements and associated National Standard Guidelines or have estimation problems (developing confidence limits around F_{MSY}). The definition of overfishing is contingent on the relationship of current biomass to B_{MSY}. For biomass at or above B_{MSY}, overfishing is defined as fishing above F_{MSY}. However, when biomass is between ½ B_{MSY} and B_{MSY}, overfishing is defined as exceeding the rebuilding F, specified as an F that allows rebuilding within 5 years with 50% probability. Currently, the population does not rebuild to B_{MSY} using long-term projections using F_{MSY} and empirical recruitment model. The inconsistency between the long-term projections (required to develop rebuilding F and time periods and stock determination overfishing criterion when B is below B_{MSY}) and the reference points (to define stock status) needs reconciling in order to have a functional control rule.

More importantly, the FMP utilizes target F, defined as the lower bound of the percentile of the confidence limits around F_{MSY}. The explicit goal of the Ftarget is to take into account the uncertainty with the F_{MSY} estimate. Two problems with the Ftarget approach are: the current external Fox production model used to define the Fthreshold does not generate 80% confidence limits of the F_{MSY} estimate needed to estimate the Ftarget; and the Ftarget does not explicitly account for other sources of scientific uncertainty such as retrospective pattern in the assessment because confidence intervals are not generated from the model. Without the necessary information, overfishing determinations and target fishing mortality rates cannot be determined. However, given current F (about ½ F_{MSY}) and current B (97% of B_{MSY}), assuming that overfishing is not occurring is reasonable. An appropriate target F based on the current control rule definition still remains unknown, and whether Ftarget is even necessary under the new approach to specifying an ABC and ABC control rule is unclear. A benchmark stock assessment is needed to resolve the technical issues related to the current overfishing definition, and guidance from the NMFS Regional Office is appropriate regarding the need to specify a target F.

Atlantic herring fishery specifications for the 2007-2009 fishing years are based on the 2006 TRAC assessment results and include a specification of allowable biological catch equivalent to the 2006 MSY value of 194,000 mt (Table 2). Optimum yield for the fishery is currently set at 145,000 mt, and the buffer between MSY and OY accounts for Canadian catch (20,000 mt), the retrospective pattern in the stock assessment, other sources of assessment/scientific uncertainty, and the important role of herring in the Northwest Atlantic ecosystem. The herring fishery specifications for 2010-2012 should be adjusted to ensure compliance with new provisions of the Magnuson-Stevens Reauthorization Act (MSRA) and the National Standard 1 Guidelines published by NOAA Fisheries in January 2009.

Table 2 Atlantic Herring Fishery Specifications for the 2007-2009 Fishing Years (January 1 – December 31)

	2007	2008/2009
Allowable Biological Catch (ABC)	194,000	194,000
U.S. Optimum Yield	145,000	145,000
Domestic Annual Harvesting (DAH)	145,000	145,000
Domestic Annual Processing (DAP)	141,000	141,000
Joint Venture Processing Total (JVPt)	0	0
JVP	0	0
Internal Waters Processing (IWP)	0	0
U.S. At-Sea Processing (USAP)	20,000 (Areas 2 and 3 only)	20,000 (Areas 2 and 3 only)
Border Transfer (BT)	4,000	4,000
Total Allowable Level of Foreign Fishing (TALFF)	0	0
RESERVE	0	0
TAC Area 1A	50,000 (5,000 Jan-May)	45,000 (43,650 fishery; 5,000 Jan-May)
TAC Area 1B	10,000	10,000 (9,700 fishery)
TAC Area 2	30,000	30,000 (29,100 fishery)
TAC Area 3	55,000	60,000 (58,200 fishery)
Research Set-Aside (RSA)	N/A	Area 1A RSA 1,350 Area 1B RSA 300 Area 2 RSA 900 Area 3 RSA 1,800

Table 3 provides IVR catches for the 2008 fishing year. Overall, the IVR reports totaled 80,800 mt of herring across all management areas in 2008, which represents about 56% of the OY for the U.S. fishery (145,000 mt) . Consistent with previous years, the majority of the landings were taken from Area 1 (1A and 1B). Part of the reduction in total landings since 2006 is attributable to a 15,000 mt decrease in the TAC for Area 1A. In 2008, the Area 1A fishery closed on November 14, 2008.

Table 4 reports IVR catches to date for the 2009 fishing year (through July 6, 2009). State restrictions (ME, NH, MA) preclude landings from Area 1A until June 1, so the fishery in Area 1A is just beginning, but it is expected that 95% of the 1A TAC will be taken before December 31. There was more activity in the Area 2 winter fishery (Jan-April) in 2009 than 2008, and the majority of the Area 2 TAC has already been taken. It is anticipated that all of the Area 1A quota will be taken during 2009. With the additional catch from Area 2, total 2009 catch is predicted to be about 8,000 mt higher than in 2008.

Table 3 IVR Herring Catch for 2008 Fishing Year

Management Area	IVR Catch (mt)	% of TAC
Area 1A (Jan 1st – May 31st)	0	N/A
Area 1A (June 1st – Dec 31st)	41,640	N/A
Area 1A TOTAL	41,640	92.5%
Area 1B	8,104	81%
Area 2	19,256	64.2%
Area 3	11,800	19.7%
Total	**80,800**	**55.7%**

Table 4 2009 IVR Herring Catch (Supplemented with Dealer Data, through July 6, 2009)

Management Area	IVR Catch (mt)	% of TAC
Area 1A (Jan 1st – May 31st)	0	N/A
Area 1A (June 1st – Dec 31st)	5,105	N/A
Area 1A TOTAL	5,105	10%
Area 1B	1,589	16%
Area 2	27,087	90%
Area 3	1,296	2%
Total	**35,076**	**24%**

Amendment 4 to the Atlantic Herring FMP establishes a process for developing annual catch limits (ACLs) and accountability measures (AMs) consistent with the MSRA, including provisions for the SSC to specify an acceptable biological catch (ABC) for the herring fishery. As previously noted, the current overfishing limit for the Atlantic herring fishery is specified as *allowable biological catch*, which is based on the most recent scientifically-accepted estimate of MSY for the stock complex. The current specification of ABC is different from the MSRA's requirement to specify ABC, the *acceptable biological catch*, and changes are proposed in Amendment 4 to reflect the new requirements of the MSRA. The MSRA's interpretation of

ABC includes consideration of biological uncertainty (stock structure, stock mixing, and other stock assessment issues, for example), and recommendations for ABC should come from the SSC.

Several modifications to the specification process are required to bring the Atlantic Herring FMP into compliance with the MSRA, most notably the introduction of new terminology, changes to the ABC specification, the addition of the Council's SSC to the process for setting ABC, and separate consideration of scientific and management uncertainty during the ACL-setting process. Based on the new MSRA requirements, once scientific uncertainty is accounted for and the OFL for Atlantic herring is adjusted accordingly to a level corresponding to *acceptable biological catch* (ABC) based on recommendations from the Council's SSC, an ACL for the stock complex may be established, and the ACL can be divided into TACs or sub-ACLs, which can be specified for each management area. The sub-ACLs (TACs for the management areas) should be set such that the risk of overfishing a stock component is minimized to the extent possible.

Overfishing Level

The overfishing level (OFL) is defined in Amendment 4 as the *catch that results from applying the maximum fishing mortality threshold to a current or projected estimate of stock size.* When the stock is not overfished and overfishing is not occurring, the maximum fishing mortality threshold is F_{MSY} or its proxy. The Atlantic herring stock complex is not overfished, and the current (2009 TRAC) estimate of F_{MSY} is 0.27.

To estimate the 2010 OFL, the Herring PDT applied the 2008 catch to the 2008 biomass estimate for the herring complex to estimate the 2009 starting biomass. The PDT then estimated a fishing mortality rate for 2009 based on the 2008 landings plus an additional 7,800 mt to account for the increased catch in Area 2. The projected F for 2009 is 0.16. Applying 0.16 to the estimated biomass in 2009 yields a projected biomass in 2010. F_{MSY} can then be applied to the 2010 biomass projection to derive an overfishing level (F_{MSY} x B) for 2010. The resulting OFL for 2010 is **143,845 mt** (Table 5).

Table 5 Projected OFL for 2010

LANDINGS	(000 mt)		2009F = 0.16 2010F and 2011F = 0.27
YEAR	AVG	STD	
2009	93.292	12.135	
2010	144.806	19.827	
2011	132.512	21.913	

PERCENTILES OF LANDINGS			(000 MT)						
YEAR	1%	5%	10%	25%	50%	75%	90%	95%	99%
2009	68.5	75.3	78.1	84.5	92.078	101.0	109.9	115.6	124.2
2010	104.7	114.5	119.7	130.0	143.845	158.3	171.4	178.9	193.7
2011	88.7	98.3	104.0	116.0	132.019	147.3	162.2	170.3	183.7

Addressing Scientific Uncertainty and Specifying ABC

Allowable Biological Catch (ABC) is defined in Amendment 4 as the maximum catch that is recommended for harvest, consistent with meeting the biological objectives of the management plan. ABC can equal but never exceed the OFL. While the amendment states that ABC should be based on F_{MSY} or its proxy for the stock if overfishing is not occurring and/or the stock is not in a rebuilding program, the specification of ABC must consider/address scientific uncertainty.

At its September 16, 2009 meeting, the SSC is scheduled to review available information and provide its recommendations regarding the specification of allowable biological catch (ABC) for the 2010-2012 fishing years as well as the ABC control rule. The Herring PDT will provide projections and other information related to the specification of ABC for the Atlantic herring fishery. However, uncertainty related to the recent stock assessment update warrants some initial discussion with the SSC; the Herring PDT is seeking preliminary guidance from the SSC regarding approaches that may be used to account for scientific uncertainty.

The most significant source of uncertainty relates to the **retrospective pattern** that continues to be apparent in the stock assessment and has worsened since the last benchmark (see TRAC Assessment Document). Substantial retrospective patterns persisted in all model variations examined. Generally, fishing mortality estimates behaved better than biomass, biomass estimates averaged + 42%/year, and ranged between 14-56%.

Three primary sources of uncertainty exist within the model applied to the 2009 update: (1) the effects of changing the catch-at-age input; (2) the effects of the model formulation and the variation within the model (input data); and (3) the retrospective pattern. The effects of the estimates of natural mortality are also uncertain. There also appears to be considerable uncertainty regarding the estimation of the biological reference points (BRPs). BRPs for Gulf of Maine/Georges Bank Atlantic herring were calculated using biomass and landing estimates from 1967-2008. The first two years in the time series are highly influential in fitting the Fox surplus production model. Removal of either one or two of these values produce B_{MSY} estimates ranging from 575,700 mt to 707,401 mt. In addition, a 30 year projection of 2008 age 2+ biomass at F_{MSY} (0.27) produces average biomass of 591,000 mt ($\pm$ 1 std dev ranges from 423,100 to 759,400 mt).

While other sources of scientific uncertainty clearly exist, the retrospective pattern is significant enough that the PDT feels that accounting for the retrospective pattern will account for other uncertainty related to the stock assessment. The PDT is seeking preliminary guidance on how to address issues related to the retrospective pattern in the assessment when specifying ABC for 2010-2012.

Herring PDT Questions

- Given the scientific uncertainties in this assessment and given time/analysis constraints (documents for the SSC need to be finalized no later than September 3, 2009): What kind(s) of ABC control rule(s) should the Herring PDT evaluate? For example:
    - ABC based on a general approach using a target F (a fraction of F_{MSY} or a percentile of the F_{MSY} estimate)?
    - ABC based on a specified fraction of the OFL?
    - ABC based on a quantitative adjustment (reduction) to account for the retrospective pattern and/or other scientific uncertainty? How could this adjustment be made (direct rho-based adjustment to catch, direct rho-based adjustments to exploitable biomass, rho-adjusted starting number-at-age projections)?
- The herring stock complex is believed to be composed of individual spawning components that mix seasonally in different areas. Considerable uncertainty exists about the mixing rates as well as the exploitation rates on the individual components. This element of scientific uncertainty may play a role when setting the sub-ACLs in order to prevent localized overfishing on the individual spawning components. The stock-wide ABC will be adjusted to a stock-wide ACL (after accounting for management uncertainty), which will be separated into sub-ACLs based on the management areas for the herring fishery. The PDT believes that taking all of the ABC to be taken from one management area is undesirable, as overfishing of a stock subcomponent would likely result. The sub-ACLs are intended to minimize the risk of overfishing on individual stock components while still allowing for full exploitation. In general, should the PDT account for this stock structure uncertainty in setting ABC for a stock complex or should this scientific uncertainty be incorporated in the setting of sub-ACLs (analogous to the previous practice of setting subarea TACs)?

New England Fishery Management Council
50 WATER STREET | NEWBURYPORT, MASSACHUSETTS 01950 | PHONE 978 465 0492 | FAX 978 465 3116
John Pappalardo, *Chairman* | Paul J. Howard, *Executive Director*

MEMORANDUM

DATE: September 8, 2009

TO: Scientific and Statistical Committee (SSC) Members

FROM: Lori Steele, NEFMC Staff, Herring PDT Chair

SUBJECT: **Herring Plan Development Team (PDT) Recommendations for Specifying Atlantic Herring ABC for the 2010-2012 Fishing Years**

- Causes for the retrospective pattern are unknown in the case of Atlantic herring, but general causes can include misspecification of catch, ageing problems, changes in natural mortality (M), changes in survey catchability, differences in fishery selectivity difference among stock components or across time, etc. The range of uncertainty in the retrospective analysis in the final model encompasses the range of uncertainty found in the various model formulations. The Herring PDT concludes that the retrospective adjustment in the projections should provide adequate precaution for these scientific uncertainties.
- The Herring PDT recommends changing the control rule specified in the Herring FMP so that it is more useful and consistent with control rules for other stocks. The proposed modification to the control rule provides a more appropriate approach that recognizes natural variability associated with maintaining a stock at B_{MSY} (see Herring PDT memo: *Atlantic Herring Overfishing Definition – Proposed Modification to Control Rule*).
- Because stock biomass is estimated from the TRAC assessment to be at 97% of B_{MSY} and given the recommended changed to the control rule, the Herring PDT recommends basing overfishing level (OFL) for herring on F_{MSY} for 2010-2012 and applying a retrospective adjustment to the terminal year stock size in order to derive acceptable biological catch (ABC) and account for scientific uncertainty (see Herring PDT Discussion Paper *Projected Landings and Stock Biomass Under Different Fishing Mortality Scenarios for Atlantic Herring*).

Herring PDT Recommendations for OFL and ABC 2010-2012

YEAR	OFL ('000 mt)	ABC ('000 mt)
2010	144.996	92.135
2011	134.493	97.690
2012	126.966	102.943

OFL is based on F_{MSY} applied to stock biomass projected from the assessment.
Projections of ABC incorporate a retrospective adjustment from the AGEPRO projection model.

- The Atlantic herring stock is a complex composed of several spawning components, which mix at different rates during the year. Annual catch limits (ACLs) will be set for four management areas (1A, 1B, 2, and 3). The risk of these ACLs to the inshore component of the stock will be analyzed by the PDT during the ACL setting process.

New England Fishery Management Council
50 WATER STREET | NEWBURYPORT, MASSACHUSETTS 01950 | PHONE 978 465 0492 | FAX 978 465 3116
John Pappalardo, *Chairman* | Paul J. Howard, *Executive Director*

MEMORANDUM

DATE: September 9, 2009

TO: Steve Cadrin, Chairman, Scientific and Statistical Committee (SSC)

FROM: John Pappalardo, Chairman, NEFMC

SUBJECT: **Herring Committee Questions for SSC Consideration**

The Herring Committee met on August 6, 2009 to review and discuss the recent results of the Transboundary Resource Assessment Committee (TRAC) update assessment for the Atlantic herring stock complex. Following a thorough discussion of the TRAC results, the Herring Committee generated the following questions regarding the assessment for the Scientific and Statistical Committee (SSC) to consider at its September 16, 2009 meeting and/or during the SSC report at the upcoming Council meeting. The Herring Committee's discussion centered on the prominent retrospective pattern present in the TRAC assessment, and how to interpret the assessment from data with high margins of error and uncertainty.

1. Can the SSC reconcile its guidance to the Herring PDT about accounting for the retrospective pattern in setting the ABC with the recommendation of the Retrospective Working Group in January 2008 that a strong retrospective pattern is grounds to reject the assessment model as an indication of stock status or the basis for management advice? If the assessment is to be used to form the basis of management advice, is it robust enough for a three-year TAC setting process?
2. Is it appropriate to use the age-structured ASAP model when considering the significant disagreement between the three primary labs that age herring?
3. Since the stock is not considered to be overfished and overfishing is not occurring, what value of F would be appropriate to use in 2010?
4. Would it be appropriate to use the TRAC assessment results with a higher M to address previous recommendations, and if so what would be the implications of a higher mortality rate, and would there be an effect on those reference points?
5. Given that the herring resource is composed of smaller spawning components and the mixing ratios and migratory patterns remain somewhat uncertain, how does the Committee prevent double counting scientific uncertainty?

6. What is the impact of the uncertainty related to the 2005 year class? What was the impact of the Canadian catch of the 2005 year class on stock abundance? Would the assessment be improved by adding age 1 fish caught in both the New Brunswick weir fishery and the U.S. fishery?
7. The reasons for eliminating the winter survey from the assessment model appear unclear. Does the SSC agree with the elimination of the winter survey from the updated assessment?

New England Fishery Management Council
50 WATER STREET | NEWBURYPORT, MASSACHUSETTS 01950 | PHONE 978 465 0492 | FAX 978 465 3116
John Pappalardo, *Chairman* | Paul J. Howard, *Executive Director*

To: Paul J. Howard, Executive Director
From: Dr. Steve Cadrin, Chairman, Scientific and Statistical Committee
Date: September 23, 2009

Subject: **Acceptable Biological Catch (ABC) value for the Gulf of Maine / Georges Bank Atlantic herring complex**

The Scientific and Statistical Committee (SSC) was asked to review the available information provided by the Herring Plan Development Team (PDT) and develop recommendations regarding the specification of acceptable biological catch (ABC) for the 2010-2012 fishing years, as well as an ABC control rule. On August 11 and September 16 2009, the SSC reviewed several sources of information and associated presentations by the Herring Plan Development Team (PDT):

1. 2006 TRAC Benchmark Assessment Proceedings
2. 2006 TRAC Benchmark Assessment Status Report
3. 2009 Herring TRAC Update Assessment Document
4. 2009 Herring TRAC Update Assessment Status Report
5. July 28, 2009 Memo from Herring PDT: Atlantic Herring Assessment Results and Preliminary Guidance Re. Specification of Allowable Biological Catch (ABC)
6. Herring PDT Discussion Paper: Projected Landings and Stock Biomass Under Different Fishing Mortality Scenarios for Atlantic Herring
7. Herring PDT Memo: Atlantic Herring Overfishing Definition – Proposed Modification to Control Rule
8. Herring PDT Memo: PDT Recommendations for Specifying Atlantic Herring ABC for the 2010-2012 Fishing Years
9. Report of the Retrospective Working Group (NEFSC Reference Document 09-01)

The SSC endorses the 2009 stock assessment produced by the Transboundary Resources Assessment Committee (TRAC) as a basis for projection, derivation of overfishing limit (OFL) and Acceptable Biological Catch (ABC) but recognizes considerable uncertainty in the assessment. Two aspects of the uncertainty in the assessment influence the derivation of OFL and ABC: 1) The assessment has a strong 'retrospective pattern' in which estimates of stock size are sequentially revised downward as new data are added to the assessment; and 2) Maximum sustainable yield reference points estimated from the biomass dynamics model are inconsistent with the age-based, stochastic projection; such that fishing at the current estimate of F_{MSY} is expected to maintain equilibrium biomass that is less than the current estimate of B_{MSY}. Given the magnitude of uncertainty in the herring assessment and reference points, an ABC control rule cannot be derived at this time, and the SSC recommends a new benchmark assessment of herring as soon as possible. The SSC suggests that the next benchmark assessment should revise MSY reference points to be consistent with the assessment method and consider including estimates of consumption and spatial structure in the assessment.

The SSC requires further clarification of the PDT's proposed revision to the overfishing definition before it can recommend a revision to the Council. Therefore, the SSC based its OFL calculation on the existing overfishing definition (The maximum fishing mortality threshold is F_{MSY} when stock size is greater than B_{MSY}, and the fishing mortality that allows rebuilding in five years when biomass is less than B_{MSY}). The 2008 estimate of biomass is substantially greater than the biomass expected from long-term stochastic projection at F_{MSY}. Accordingly, the SSC's calculation of OFL is based on F_{MSY} projections.

Given the substantial uncertainty in the assessment, the SSC based its ABC recommendation on two general approaches that produce consistent catch advice: 1) uncertainty in OFL and 2) a magnitude of removals that appears to sustain a relatively abundant stock. National Standard 1 Guidelines suggest that ABC should be less than OFL, and that the 'buffer' between OFL and ABC should account for scientific uncertainty. The average retrospective inconsistency in the estimate of exploitable biomass is approximately 40%, and according to the 2009 TRAC, "uncertainty due to model configuration is dwarfed by uncertainty due to retrospective bias." Therefore, the SSC considers that the magnitude of retrospective inconsistency accounts for the major sources of uncertainty in the assessment, and the buffer between OFL and ABC should be 40% (approximately 90,000 mt in 2010). Alternatively, the stock assessment suggests that recent catches have maintained a relatively abundant stock size (estimates of stock biomass from 1998 to 2008 have been greater than B_{MSY}) and low fishing mortality (estimates 1998 to 2008 fishing mortality have been less than F_{MSY}). Total catch of the Gulf of Maine / Georges Bank herring complex by U.S. and Canada in 2008 was 90,000 mt. Given the consistency in catch advice from these two approaches, the SSC's recommendation is that ABC should be 90,000 mt each year until the stock assessment is revised.

The SSC recommends that:

1. **The Overfishing Limit (OFL) is 145,000 mt in 2010, 134,000 mt in 2011 and 127,000 mt in 2012 based on projections of fishing at the current estimate of F_{MSY}.**
2. **Acceptable Biological Catch (ABC) is 90,000 mt each year for 2010 to 2012.**
3. **Catch recommendations include combined U.S. and Canadian catch of the Gulf of Maine / Georges Bank Atlantic herring complex.**
4. **A new benchmark assessment should be scheduled as soon as possible to address sources of uncertainty, re-estimate MSY reference points and consider including estimates of consumption and spatial structure in the assessment.**

Commonwealth of Massachusetts
Division of Marine Fisheries
251 Causeway Street, Suite 400
Boston, Massachusetts 02114
(617)626-1520
fax (617)626-1509

Paul J. Diodati
Director

Deval Patrick
Governor
Ian A. Bowles
Secretary
Mary B. Griffin
Commissioner

October 5, 2009

Mr. John Pappalardo, Chairman
New England Fishery Management Council
50 Water St.
Newburyport, MA 01950

Dear John:

The Council and ASMFC are being challenged and tested by the absence of a benchmark assessment for sea herring, the 2010-2012 specification process, and our self-imposed drastic reduction in the sea herring quota(s) as a consequence of our apparent belief that a SSC-recommended ABC and Council ACLs must be set beginning next year. At the Council's request and with PDT involvement, we asked the SSC for 2010-12 specification recommendations, and it responded with annual ABCs of 90,000 mt (OFL reduced by 40% in 2010). The SSC noted that total catch of the Gulf of Maine/Georges Bank complex by the U.S. and Canada was 90,000 mt in 2008.

As a result, we all find ourselves in a surreal situation: sea herring is not overfished and overfishing is not occurring yet we will dramatically reduce herring catch next year. In fact, according to the SSC, recent catches have maintained a relatively abundant stock size (estimates of stock biomass from 1998 to 2008 have been greater than B_{MSY}) and low fishing mortality (estimates 1998 to 2008 fishing mortality have been less than F_{MSY}).

On further reflection about the seriousness of this situation, i.e., (1) a very large decrease in area quotas especially for 2010 in Area 1A (42,000 mt decrease to perhaps 10,000 mt, or thereabouts), (2) a resulting dramatic shortage of bait for the lobster fishery, and (3) Canada having no restrictions on its GOM New Brunswick fishery (e.g., 30,145 mt in 2007) and no need/requirement to cut its catch in 2010 (or any year), it occurred to me that we do not have to set an ABC for 2010. We are not overfishing, and that conclusion is indisputable. The SSC has confirmed this all-important fact and has noted the previous years' long-term stability of the resource and fishery.

I suggest that the Council does not have to set an annual catch limit (ACL) for 2010 because overfishing is not occurring and has not occurred for many years. My argument is supported by NS #1 guidelines regarding Council actions to address overfishing and rebuilding for stocks and stock complexes in the fishery. If overfishing is occurring then ACLs and AM mechanisms must be established in 2010. If not, then ACLs and AMs are to be established in 2011.

Furthermore, ABC can equal OFL. In the Guidelines it states: "...NMFS expects that in most cases ABC will be reduced from OFL to reduce the probability that overfishing might occur in a year..." With a 2010 ABC of 145,000 mt corresponding to catch at F_{msy} and our expecting that catch still will be at or near status quo of 90,000 mt in 2010, F_{msy} will not be exceeded.

Consequently, I suggest the specification for 2010 can be status quo at 145,000 mt. The 2009 ABC was 194,000 mt reduced to 145,000 mt (OY). To do otherwise will force the Council and the ASMFC Sea Herring Section to set the ABC at 90,000 mt (40% reduction from 145,000 mt) resulting in a one-year drastic decrease in ABC from 194,000 mt in 2009 to 90,000 mt in 2010 – a 54% decrease. This will occur even though stock biomass is just below B_{msy} (652,000 mt versus 670,600 mt).

I understand a benchmark assessment may occur in 2011. Ideally, we would wait until then to adjust the ABC. However, it appears we are required to adopt the SSC's ABC values for 2011 and 2012 that are the OFLs reduced by 40% to account for scientific uncertainty. Even though I believe that adjustment is too high and recent years' retrospective difference (about 15%) should be used instead of the 40% (average) and we await the SSC to revisit this issue (Council vote), for now it appears the 90,000 ABC will be required for 2011 and 2012. These ABCs may have to be adjusted up or down to account for benchmark assessment findings.

I end by emphasizing our need to be sensitive to stock status. We all should be heartened by the SSC acceptance of TRAC findings, i.e., "recent catches have maintained a relatively abundant stock size (estimates of stock biomass from 1998 to 2008 have been greater than B_{MSY}) and low fishing mortality (estimates 1998 to 2008 fishing mortality have been less than F_{MSY}). Those conclusions justify waiting until 2011 before implementing the SSC's ABCs, unless of course the SSC after revisiting the extent to which the OFL should be reduced, provides a different recommendation.

Sincerely yours,

David E. Pierce, Ph.D.

cc
Paul Diodati
Paul Howard

NEW ENGLAND FISHERY MANAGEMENT COUNCIL

2010-2012 Atlantic Herring Fishery Specifications

APPENDIX II:

Simulating Removals of the Inshore Component for the Herring Fishery for Years 1999-2008 Using the Herring PDT's Risk Assessment Methodology

Simulating Removals of the Inshore Component for the Herring Fishery for Years 1999-2008 Using the Herring PDT's Risk Assessment Methodology

Steven Correia
Massachusetts Division of Marine Fisheries
September 24, 2009

Introduction

Atlantic sea herring complex is assessed as a combined Gulf of Maine and Nantucket shoals/Georges Bank unit stock. The inshore Gulf of Maine and offshore Georges Bank stock are segregated during spawning season, but mix during feeding and movement during the year. During the 2006 TRAC assessment three approaches (commercial acoustic survey biomass estimates, NEFSC autumn survey swept biomass ratios, and morphometric) were used to estimate the proportions by spawning component (Table 1). TRAC 2006 concluded that each method was "equally valid and that the overall average be based on the unweighted average of each estimate. The mean of the three estimates is 17.667%.

Table 1. Inshore component as a percentage of total stock by three methods.

Method	Inshore component as percentage of total biomass
Acoustic Survey (biomass)	10%
Morphometrics (numbers)	13%
NEFSC area swept biomass	30%

We applied the PDT's risk assessment simulation to historical landings by management age for 1999-2008 to assess removals from the inshore component of the stock.

Methodology and model inputs

The PDT's risk analysis uses Monte Carlo simulation to assess the amount of inshore removals, the ratio of inshore removals to inshore biomass and the size of the inshore biomass given uncertainty in the size of the inshore component and the monthly landings by management area. Model inputs include landings by month within each management area. The mixing percentages given as inshore biomass as a percentage of total stock by month and area is shown in Table 2. The pop mixing rate was randomly drawn from a triangular distribution with the minimum set to 0.10, maximum set to 0.30, and the mode set to 0.13. This gives an average percentage of 0.17667 and a median percentage of 0.13. The summer mixing rate was drawn from a uniform distribution with minimum value set at 0.2 and maximum value set at 0.8. This gives a mean and median summer mixing percentage at 0.5.

Table 2. Mixing percentages (inshore component as percent of total) by month and area.

Month	Area 1A	Area 1B	Area 2	Area 3
January	100%	Pop mixing	Pop mixing	0%
February	100%	Pop mixing	Pop mixing	0%
March	100%	Pop mixing	Pop mixing	0%
April	Summer mix	Pop mixing	0%	0%
May	Summer mix	Pop mixing	0%	0%
June	Summer mix	Pop mixing	0%	0%
July	Summer mix	Pop mixing	0%	0%
August	100%	Pop mixing	Pop mixing	0%
September	100%	Pop mixing	Pop mixing	0%
October	100%	Pop mixing	Pop mixing	0%
November	100%	Pop mixing	Pop mixing	0%
December	100%	Pop mixing	Pop mixing	0%

Year specific total stock biomass (1999-2008) was taken from the 2009 TRAC assessments. The inshore biomass was simulated by applying the population mixing rate value to the total stock biomass.

The risk analysis model also uses monthly landings by management area as a proportion of total landings by management area as an input. Uncertainty is simulated by drawing monthly proportions for each management area from a multinomial distribution. Effective sample size is an input parameter and controls the amount of uncertainty in the monthly proportions. We used year specific observed landings by management area and set the effective sample size to 10,000 so that the distribution of simulated landings by month and area match the observed landings for 1999-2008.

Canadian age 2+ landings are simulated using a random draw from the 1995-2008 time series. In the historical comparisons runs, year specific Canadian landings were used in the simulation and Canadian landings are assumed to be from entirely from the inshore component.

For each simulation, a single value of the population mixing rate is randomly drawn from the triangular distribution and a single value of the summer mixing rate is randomly drawn from the uniform distribution. These mixing rates were applied to landings taken from month-area combination shown in Table 2 to apportion the landings to the inshore and offshore components of the stock. The population mixing rate is also applied to the January 1 2+ stock biomass to provide an estimate of the inshore biomass. A ratio of inshore landings over total January 1 inshore biomass was calculation.

Each year consisted of 5,000 simulations.

Catch curve analysis

Total mortality (Z) was estimated on an catch at age developed from catches taken when the inshore component was on the spawning grounds using catch curve analysis. Details are provided in Correia and Cierri (2009). Log_e catch in number was modeled as a regression of age and cohort (with separate slopes and intercepts for each cohort). Exploratory analysis suggested that ages 6-9 were "fully-selected" and these were the ages selected for the analysis. Note that knife-edge selectivity is set at age 2 in the TRAC assessment.

Log_e catch (000's) was modeled as multiple regression using cohort and area as factors and age (6-9) as a covariate. Initial models included first and second order interactions. Reference levels was the 1991 cohort in GOM. Stepwise regression using AIC suggested including all interaction. An analysis of variance suggested a simpler model with cohort and age plus an age:cohort interaction. Residual patterns indicated that this model tended to overestimate catch at age 6 and 9 and underestimate catch at ages 7 and 8. Given the improvement in diagnostics and the AIC values, a full model was used. Slopes represent estimates of –Z. F was estimated by subtracting M (0.2) from the absolute value of the slope. For each year, an annual F was estimated using a catch-weighted average of cohort F within each year. These annual F's were converted to exploitation rates using Ricker's formula for a type 2 fishery.

For comparative purposes, catch curve analysis was applied to the total catch at age used in the assessment. Here we used ages 2-5 in the regression. In some years, age 2 appeared to be partially recruited. The final selected model estimated a slope and intercept for each cohort.

Results

Summary statistics of inshore biomass, catch from the inshore component and the ratio of inshore catch to inshore biomass, and size of the inshore biomass by year are shown in Table 3. Density plots of the distributions of inshore biomass, ratio inshore landings/inshore biomass and inshore landings are shown in Figures 1-3, respectively.

The simulations indicate that the mean inshore removals peaked at 75,900 tons in 1999 (Table 3), fluctuated around 56,500 tons from 2000-2007, and declined to 42,100 in 2008. The ratio of inshore landings to inshore biomass shows a similar trend with a peak of 0.62 in 1999, fluctuations around 0.47 from 2000-2007 and a decline to 0.39 in 2008. For 1999, approximately 1% of the landings over inshore biomass ratio exceeded 1. This is caused by the combination of a large amount of landings taken out of area 1A, drawing a low value for the inshore biomass (e.g., near 10%) , and drawing a high value for the summer mix (e.g., 80%). From 2006-2007, F_{msy} =0.31, equivalent to an exploitation rate of 0.24 (based on catch in number). The ratio of inshore catch to January 1 inshore biomass can be considered as proxy for the exploitation rate because all ages are fully selected by the fishery. The ratio of catch biomass over January 1 biomass from the assessment is compared with the exploitation rate calculated from the fully recruited F is shown in Table 4. The ratio of inshore catch over inshore biomass deviates from the exploitation rate by not accounting for biomass growth during the year (i.e., the exploitation rate should be calculated as catch biomass over mean biomass, rather than catch in number over January 1 abundance). For 2006-2007, the lower quartile of catch over inshore biomass is higher than 0.24, suggesting that removals on the inshore stock may be result in localized exploitation rates higher than with F_{msy}.

Catch curve analysis from catch at age developed from the inshore stock during spawning results in annual catch weighted F that ranged from 1.21 to 0.67. The F and exploitation rate from the cohort analysis is compared with the ratio of inshore catch to inshore biomass in Table 4. Overall, the exploitation rates derived via the catch curve are similar in magnitude to the catch over inshore biomass ratios from the simulations. Although there is not a lot of contrast in the exploitation rates, the highest and lowest exploitation occur in the same year for both methods. The ratio of catch biomass over January 1 biomass from the assessment is compared with the exploitation rate calculated from the fully recruited F in Table 6. These values are similar in magnitude, with the catch curve giving lower values than the assessment. This difference between assessment F and catch curve F is likely related to age 2 appearing to be partially selected relative to older ages used in the catch curve analysis, whereas it is considered fully recruited in the assessment.

Conclusions

Comparison of relative exploitation rates (Inshore Catch/ Inshore Biomass) derived from the Monte Carlo simulations are similar in magnitude to exploitation rates derived from catch curve analysis of the inshore spawning catch at age matrix derived under a set of assumptions independent of assumptions used in the Monte Carlo simulations. These results suggest that this simulation tool can be used to compare the removals from the inshore component from various TAC allocation to management areas.

Results from applying the simulation tool to herring catches by management area from 1999 through 2008 suggest that removals from the inshore component have been consistently higher than the exploitation rate associated with current F_{MSY} estimate for the entire stock. Differences in productivity among the individual subcomponents of the stock complex are not known and reference points (and therefore status determination criteria) are only available for the stock complex. Therefore, the OFL catch to total biomass ratio should be taken as an approximate target rather than a hard threshold.

Table 3. Summary statistics for inshore landings, landings over inshore biomass, and inshore biomass based on 5,000 simulations. CV is the coefficient of variation for the distribution.

Landings (000's tons)

year	Minimum	1st Quartile	Median	Mean	3rd Quartile	Maximum	Standard deviation	CV
1999	56.0	70.3	75.9	75.9	81.5	95.6	7.75	10.2
2000	38.2	52.3	58.0	58.0	63.5	77.9	7.75	13.4
2001	35.6	49.2	54.4	54.4	59.6	73.3	7.37	13.5
2002	41.5	51.2	55.2	55.3	59.3	69.5	5.60	10.1
2003	45.7	53.4	56.6	56.7	59.9	68.2	4.39	7.7
2004	40.9	54.2	59.6	59.6	65.1	78.6	7.51	12.6
2005	44.6	54.1	57.9	57.9	61.8	70.9	5.33	9.2
2006	39.2	50.1	54.5	54.6	59.0	69.3	5.79	10.6
2007	35.5	48.4	56.0	55.9	63.4	75.9	9.22	16.5
2008	33.7	39.8	42.1	42.1	44.4	51.0	3.19	7.6

Landings over inshore biomass

year	Minimum	1st Quartile	Median	Mean	3rd Quartile	Maximum	Standard deviation	CV
1999	0.30	0.50	0.61	0.62	0.73	1.14	0.16	25.3
2000	0.18	0.33	0.40	0.41	0.48	0.83	0.11	25.8
2001	0.19	0.33	0.40	0.41	0.49	0.82	0.11	26.3
2002	0.23	0.39	0.48	0.49	0.58	0.90	0.12	25.3
2003	0.25	0.41	0.50	0.51	0.60	0.89	0.13	24.7
2004	0.23	0.40	0.49	0.51	0.60	0.97	0.13	26.1
2005	0.25	0.41	0.50	0.51	0.60	0.96	0.13	24.7
2006	0.24	0.38	0.46	0.47	0.56	0.89	0.12	25.0
2007	0.21	0.38	0.47	0.48	0.57	0.97	0.13	27.9
2008	0.21	0.31	0.38	0.39	0.45	0.66	0.09	22.9

(Jan 1) 2+ inshore biomass (000's tons)

year	Minimum	1st Quartile	Median	Mean	3rd Quartile	Maximum	Standard deviation	CV
1999	73.8	103.0	124.8	129.9	152.6	219.7	32.9	25.3
2000	85.8	119.7	144.5	150.4	176.3	253.9	37.5	24.9
2001	80.2	110.9	134.1	139.2	163.9	235.9	34.5	24.8
2002	67.7	94.6	114.2	118.7	139.3	199.3	29.3	24.6
2003	67.5	94.1	113.2	118.5	140.0	200.4	29.9	25.3
2004	71.9	99.9	120.1	124.8	145.8	212.1	30.6	24.5
2005	68.6	95.8	114.9	120.5	141.6	202.3	30.0	24.9
2006	69.6	96.9	117.2	122.0	143.7	205.8	30.3	24.8
2007	70.6	96.9	117.7	122.5	143.8	205.7	30.8	25.1
2008	65.6	91.1	111.3	115.4	136.0	194.3	29.1	25.2

Table 4. Comparison of the ratio of catch biomass over January biomass from stock assessment with exploitation rate calculated from assessment F.

Year	Assessment catch biomass over January 1 biomass	Exploitation rate based on assessment fully recruited F
1999	0.18	0.16
2000	0.15	0.13
2001	0.18	0.16
2002	0.16	0.14
2003	0.16	0.14
2004	0.16	0.14
2005	0.16	0.13
2006	0.16	0.14
2007	0.16	0.14
2008	0.14	0.12

Table 5. Comparison of annual catch weighted F from catch curve analysis of inshore spawning component, exploitation rate and the ratio of inshore catch to inshore biomass.

year	Catch Curve F	exploitation rate from catch curve F	Simulated ratio inshore catch to inshore biomass
1999	1.21	0.65	0.62
2000	1.11	0.62	0.41
2001	0.77	0.49	0.41
2002	0.75	0.48	0.49
2003	0.67	0.45	0.51
2004	0.68	0.45	0.51
2005	0.66	0.44	0.51
2006	0.67	0.45	0.47
2007	0.66	0.44	0.48
2008	0.67	0.45	0.39

Table 6. Comparison of annual catch weighted F from catch curve analysis on entire stock catch at age and fully recruited F from the assessment.

year	cohort weighted	F from assessment
1992	0.20	0.22
1993	0.17	0.17
1994	0.15	0.14
1995	0.11	0.21
1996	0.10	0.17
1997	0.10	0.18
1998	0.10	0.17
1999	0.10	0.19
2000	0.10	0.16
2001	0.09	0.20
2002	0.09	0.17
2003	0.09	0.17

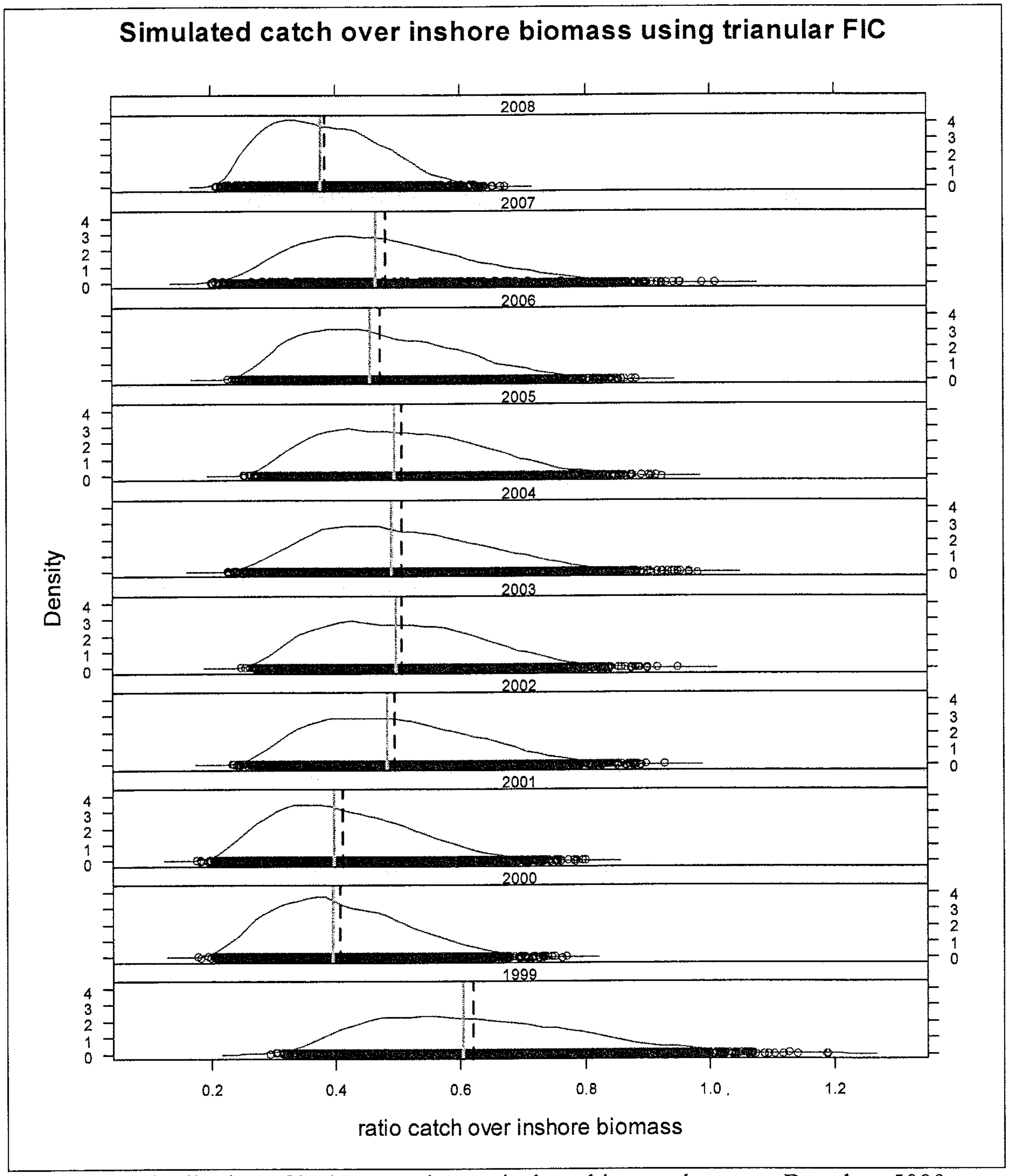


Figure 3. Distribution of inshore catch over inshore biomass by year. Based on 5000 simulations per year. Red dashed line is mean, solid gray line is median.

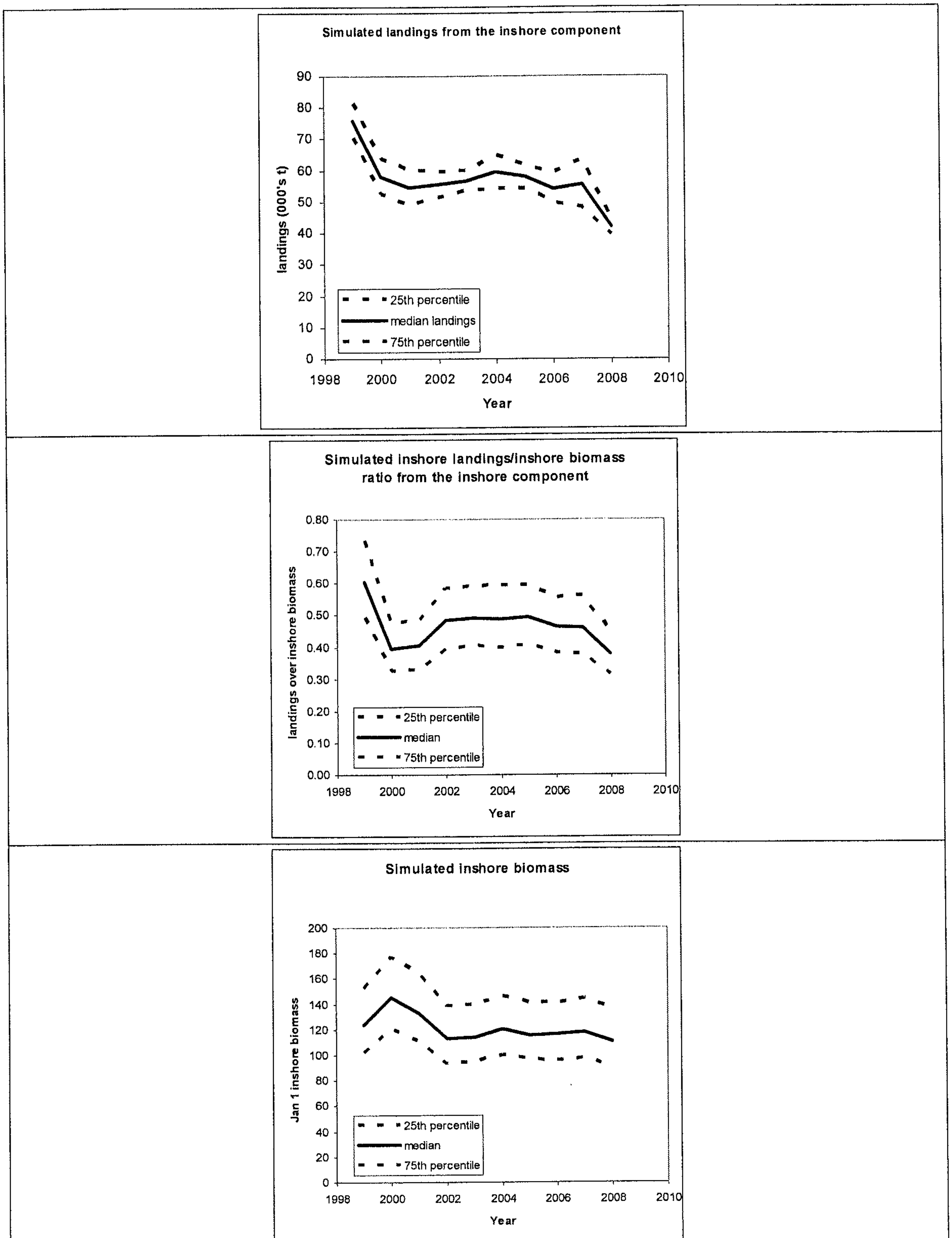


Figure 4. Top panel: trends in landings from inshore component. Middle panel: trends in ratio of inshore landings to inshore biomass. Bottom Panel: trends in inshore biomass. Solid line=median, dashed line interquartile values.

Literature cited.

O' Boyle, R and W. Overholtz. 2006. Proceedings of the Transboundary Resources Assessment Committee (TRAC). Benchmark review of Stock Assessment Models for Gulf of Maine and Georges Bank herring. 2-5 May 2006. Woods Hole, Massachusetts. http://www.mar.dfo-mpo.gc.ca/science/TRAC/trac.htlm.

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2010-2012 Atlantic Herring Fishery Specifications

APPENDIX III:

Herring PDT Risk Assessment: Complete Results for Options Under Consideration for the 2010-2012 Fishery Specifications

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CURRENT (2009) HERRING FISHERY SPECIFICATIONS

Table 1 Atlantic Herring Fishery Specifications for the 2007-2009 Fishing Years (January 1 – December 31)

	2007	2008/2009
Allowable Biological Catch (ABC)	194,000	194,000
U.S. Optimum Yield	145,000	145,000
Domestic Annual Harvesting (DAH)	145,000	145,000
Domestic Annual Processing (DAP)	141,000	141,000
Joint Venture Processing Total (JVPt)	0	0
JVP	0	0
Internal Waters Processing (IWP)	0	0
U.S. At-Sea Processing (USAP)	20,000 (Areas 2 and 3 only)	20,000 (Areas 2 and 3 only)
Border Transfer (BT)	4,000	4,000
Total Allowable Level of Foreign Fishing (TALFF)	0	0
RESERVE	0	0
TAC Area 1A	50,000 (5,000 Jan-May)	45,000 (43,650 fishery; 5,000 Jan-May)
TAC Area 1B	10,000	10,000 (9,700 fishery)
TAC Area 2	30,000	30,000 (29,100 fishery)
TAC Area 3	55,000	60,000 (58,200 fishery)
Research Set-Aside (RSA)	N/A	Area 1A RSA 1,350 Area 1B RSA 300 Area 2 RSA 900 Area 3 RSA 1,800

**Area 2 and 3 RSA was not utilized and was re-allocated to the management area TACs for the remainder of the fishing year.*

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Table 2 2010-2012 OPTIONS UNDER CONSIDERATION

		ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVES 1 and 2	
		2010	2010	2011	2012
OFL		145,000	145,000	134,000	127,000
ABC		145,000	90,000	90,000	90,000
Mgmt Uncertainty		14,800	14,800	14,800	14,800
Stockwide ACL/OY		130,200	75,200	75,200	75,200
Option 1 (historical)	1A	76,000	43,900	40,313	37,135
	1B	6,500	3,700	3,398	3,130
	2	24,100	13,900	12,764	11,758
	3	23,600	13,700	18,725	23,177
Option 2 (2001 with reserve)	1A	31,200	18,000	16,529	15,226
	1B	5,200	3,000	2,755	2,538
	2	67,700	39,100	35,906	33,075
	3	26,100	15,100	20,010	24,361
Option 2A (2001 without reserve)	1A	45,400	26,000	23,876	21993
	1B	7,600	4,300	3,949	3,637
	2	37,800	21,700	19,927	18,356
	3	37,800	21,700	19,927	18,356
Option 3 (2009)	1A	40,400	23,300	21,396	19,709
	1B	9,000	5,200	4,775	4,399
	2	27,000	15,600	14,325	13,196
	3	53,800	31,100	34,703	37,896
Option 4A (Max 1A)	1A	19,771	11,419	10,486	9,659
	1B	8,593	4,963	4,558	4,198
	2	7,812	4,512	4,143	3,817
	3	94,024	54,306	56,013	57,526
Option 4B (Max 1A)	1A	32,778	18,931	16,000	13,000
	1B	8,593	4,963	4,500	3,500
	2	7,812	4,512	4,000	4,000
	3	81,017	46,794	50,700	54,700
Option 5 (Max 2)	1A	11,197	6,467	5,000	4,000
	1B	8,723	5,038	4,500	4,000
	2	52,080	30,080	26,000	24,000
	3	58,200	33,615	39,700	43,200
Option 6 (Balanced)	1A	17,690	10,217	8,500	7,000
	1B	8,854	5,114	4,500	3,500
	2	17,707	10,227	8,500	7,000
	3	85,949	49,642	53,700	57,700

Table 3 2010-2012 PROPOSED MONTHLY CATCH PROPORTIONS

	OPTION 1 (Historical)	OPTION 2 (2001)	OPTION 3 (2009)	OPTION 4A (Max 1A)	OPTION 4B (Max 1A)	OPTION 5 (Max 2)	OPTION 6 (Balanced)
	AREA 1A	AREA 1A	AREA 1A	AREA 1A	AREA 1A	AREA 1A	AREA 1A
JAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FEB	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MARCH	0.00	0.00	0.00	0.00	0.00	0.00	0.00
APRIL	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAY	0.00	0.00	0.00	0.00	0.33	0.00	0.00
JUNE	0.09	0.09	0.09	0.00	0.33	0.00	0.00
JULY	0.23	0.23	0.23	0.33	0.33	0.40	0.33
AUGUST	0.28	0.28	0.28	0.33	0.00	0.30	0.33
SEPT	0.02	0.02	0.02	0.33	0.00	0.30	0.33
OCT	0.19	0.19	0.19	0.00	0.00	0.00	0.00
NOV	0.19	0.19	0.19	0.00	0.00	0.00	0.00
DEC	0.00	0.00	0.00	0.00	0.00	0.00	0.00

**Note: Options 1-3 (shaded) indicate the catch proportions used in the Herring PDT's risk assessment, which are based on the best available information about 2009 proportion of monthly catches. The catch proportions in Options 1 – 3 are not proposed to be implemented as regulations. The catch proportions in Options 4- 6 would, however, be implemented (i.e., Options 4 – 6 include a seasonal allocation of the 1A quota).*

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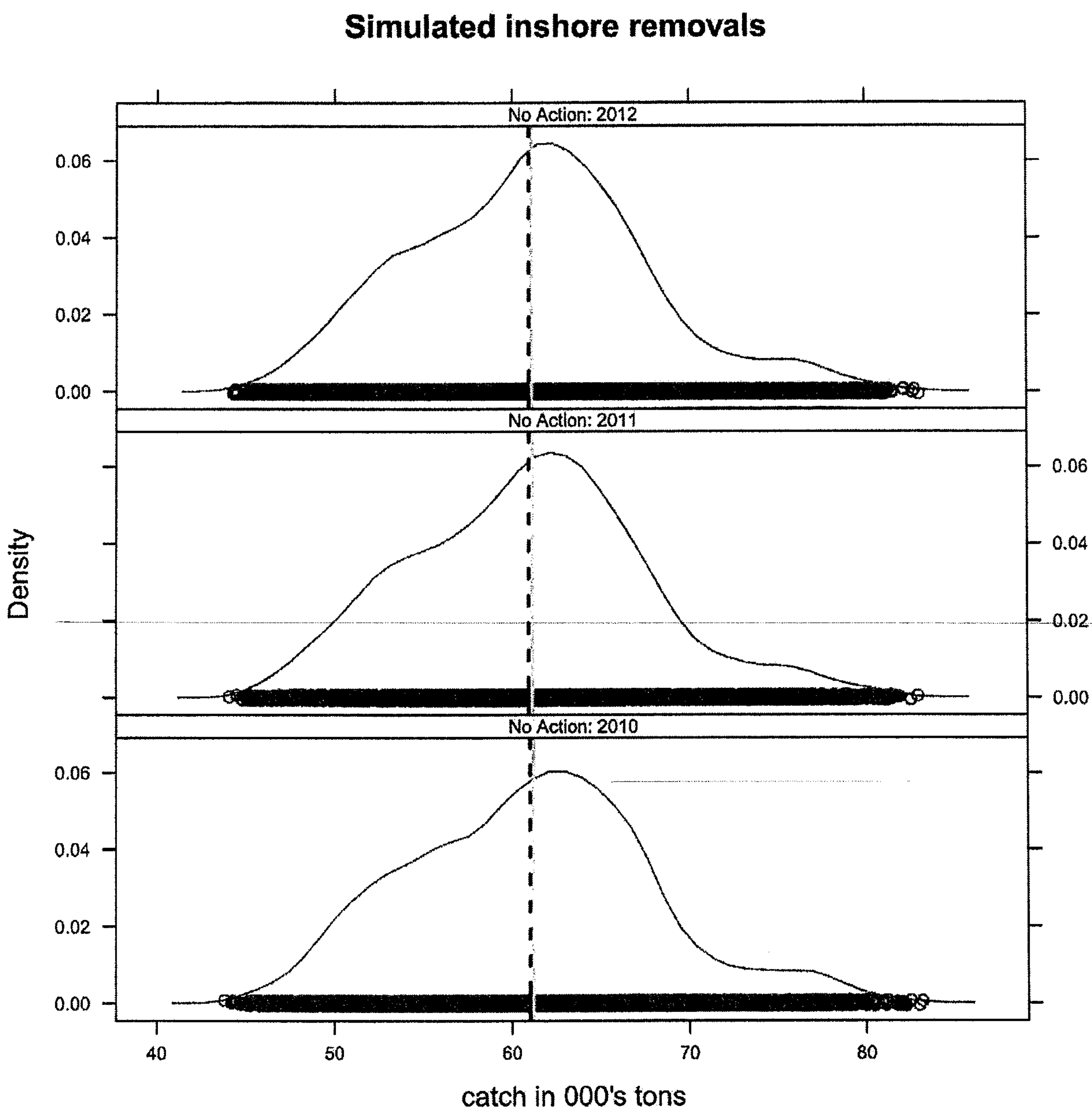
2010-2012 Atlantic Herring Fishery Specifications

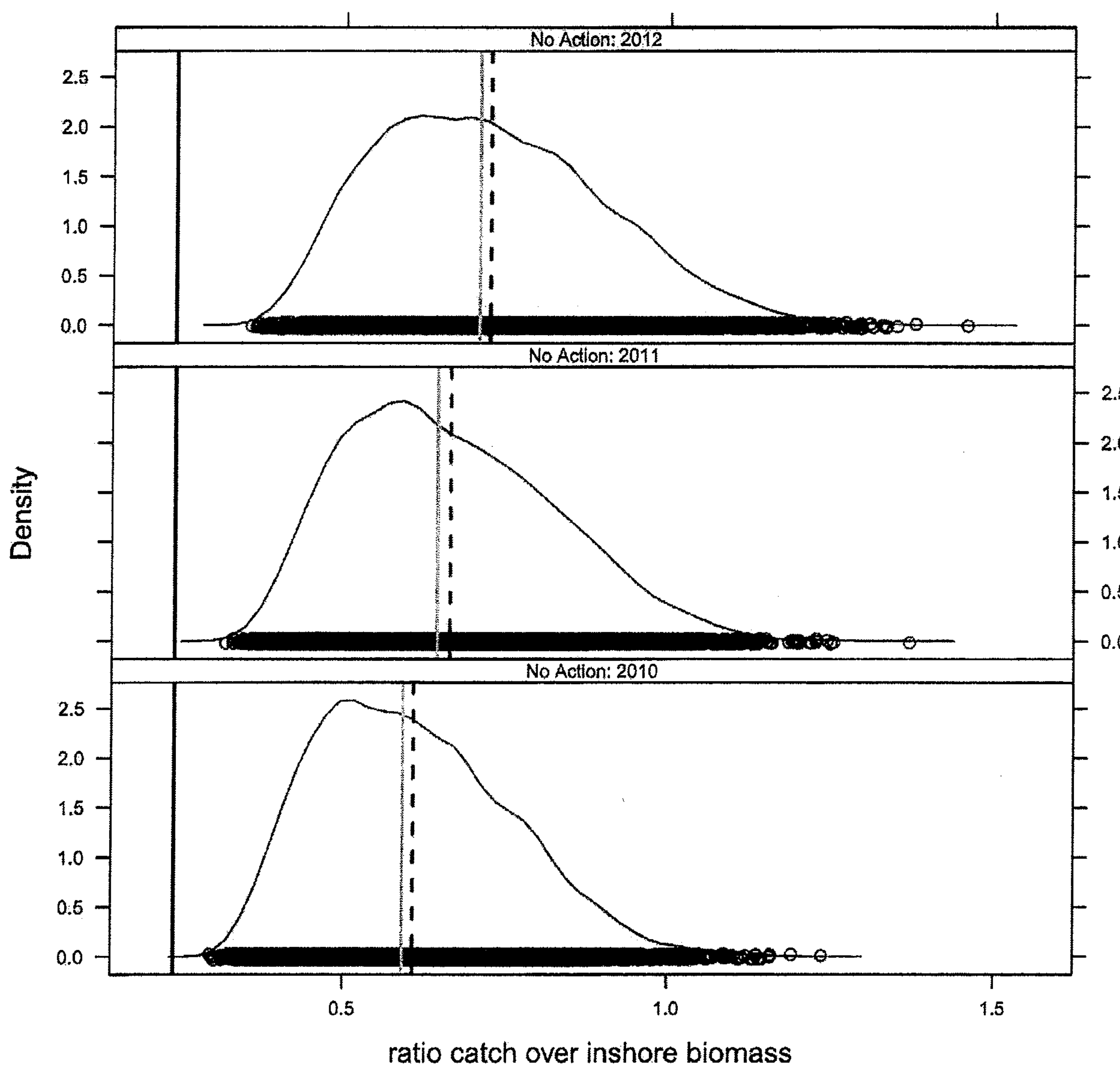
APPENDIX III:

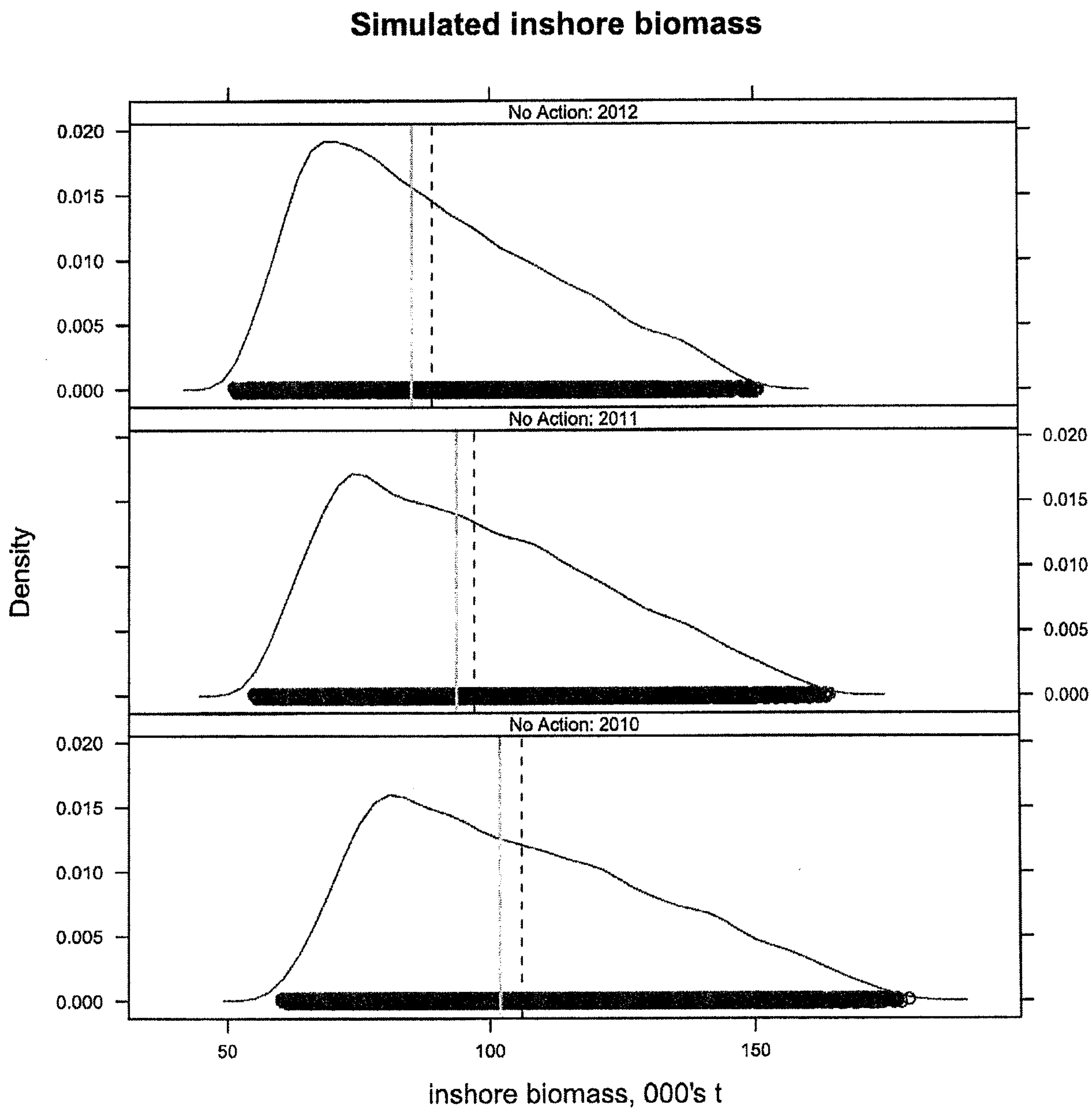
NO ACTION ALTERNATIVE



Simulated inshore removals
No Action: 2012
No Action: 2011
No Action: 2010
Density
0.06
0.04
0.02
0.00
40
50
60
70
80
catch in 000's tons

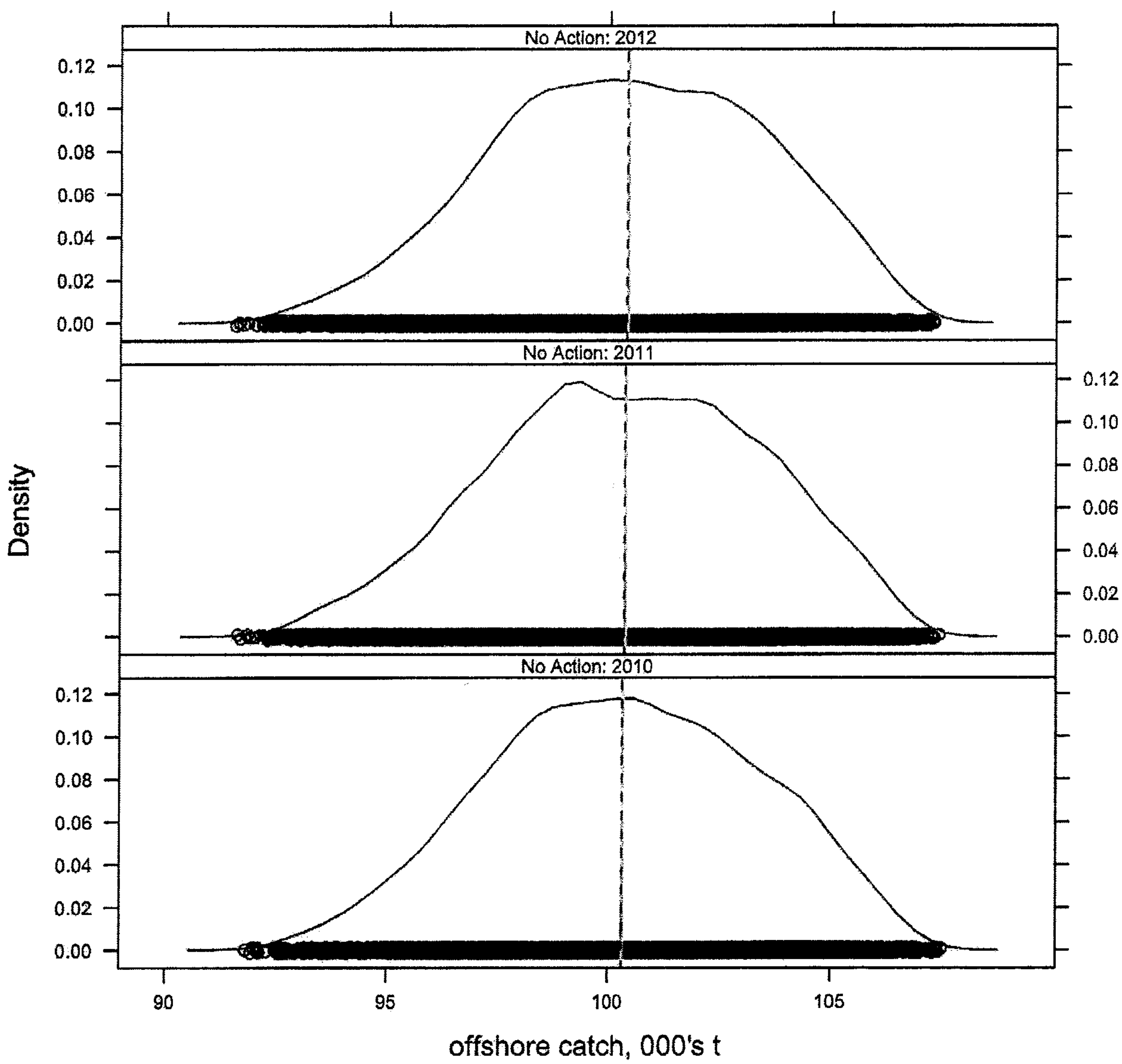
Simulated catch over inshore biomass

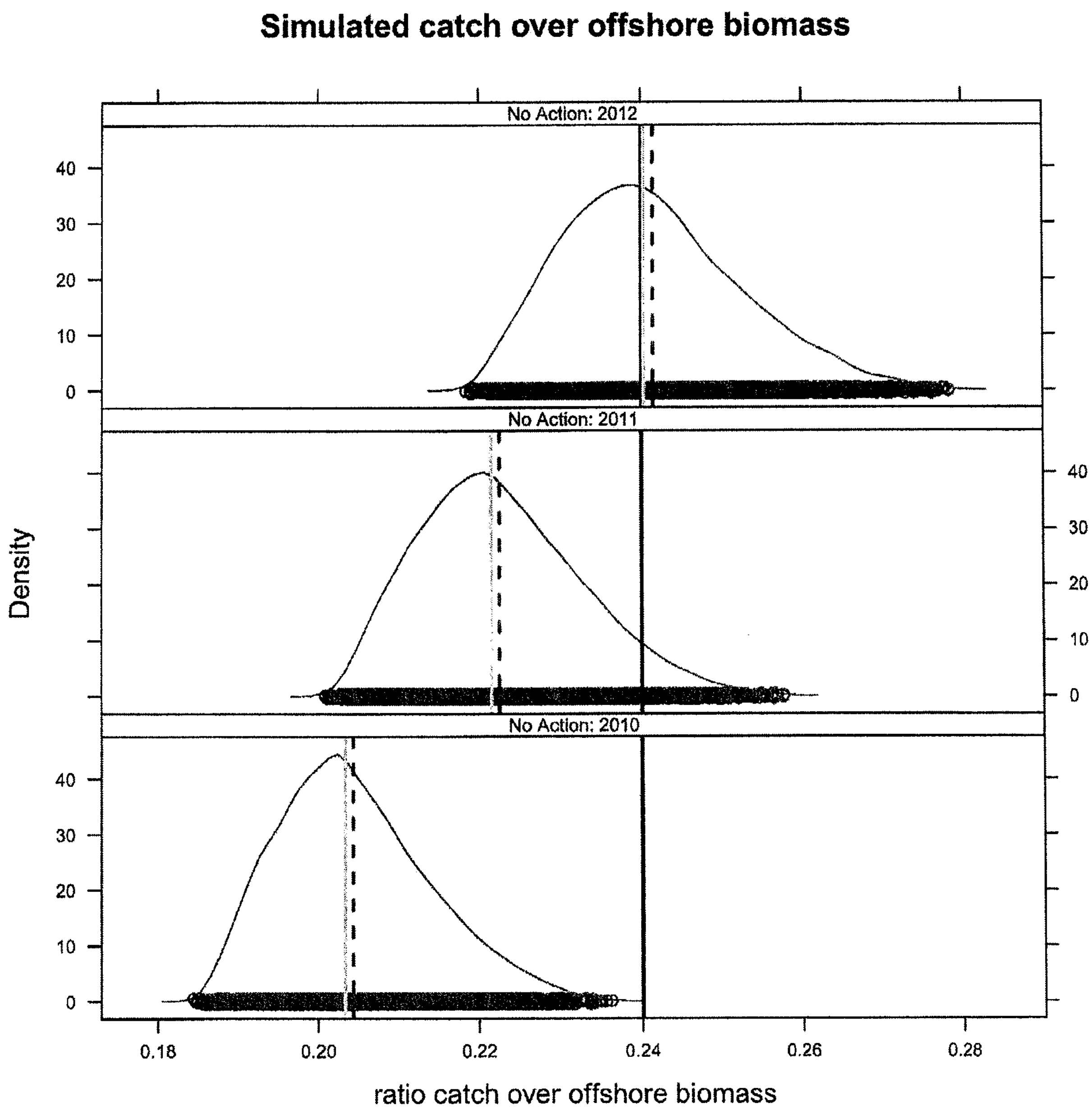


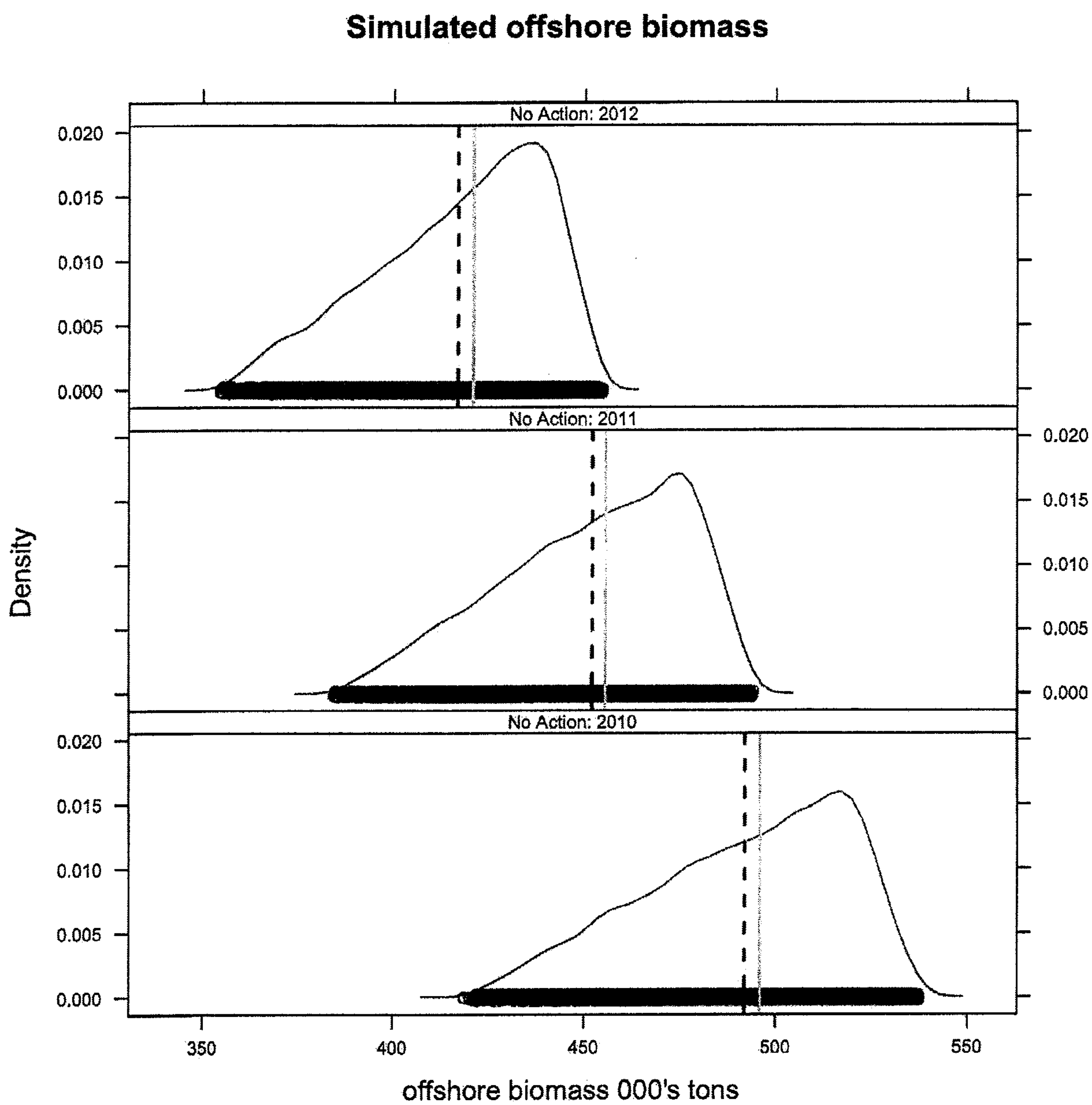


Simulated inshore biomass
No Action: 2012
No Action: 2011
No Action: 2010
0.020
0.015
0.010
0.005
0.000
Density
50
100
150
inshore biomass, 000's t

Simulated offshore catch




Simulated catch over offshore biomass
No Action: 2012
No Action: 2011
No Action: 2010
Density
40
30
20
10
0
0.18
0.20
0.22
0.24
0.26
0.28
ratio catch over offshore biomass


Simulated offshore biomass
No Action: 2012
No Action: 2011
No Action: 2010
Density
0.020
0.015
0.010
0.005
0.000
350
400
450
500
550
offshore biomass 000's tons

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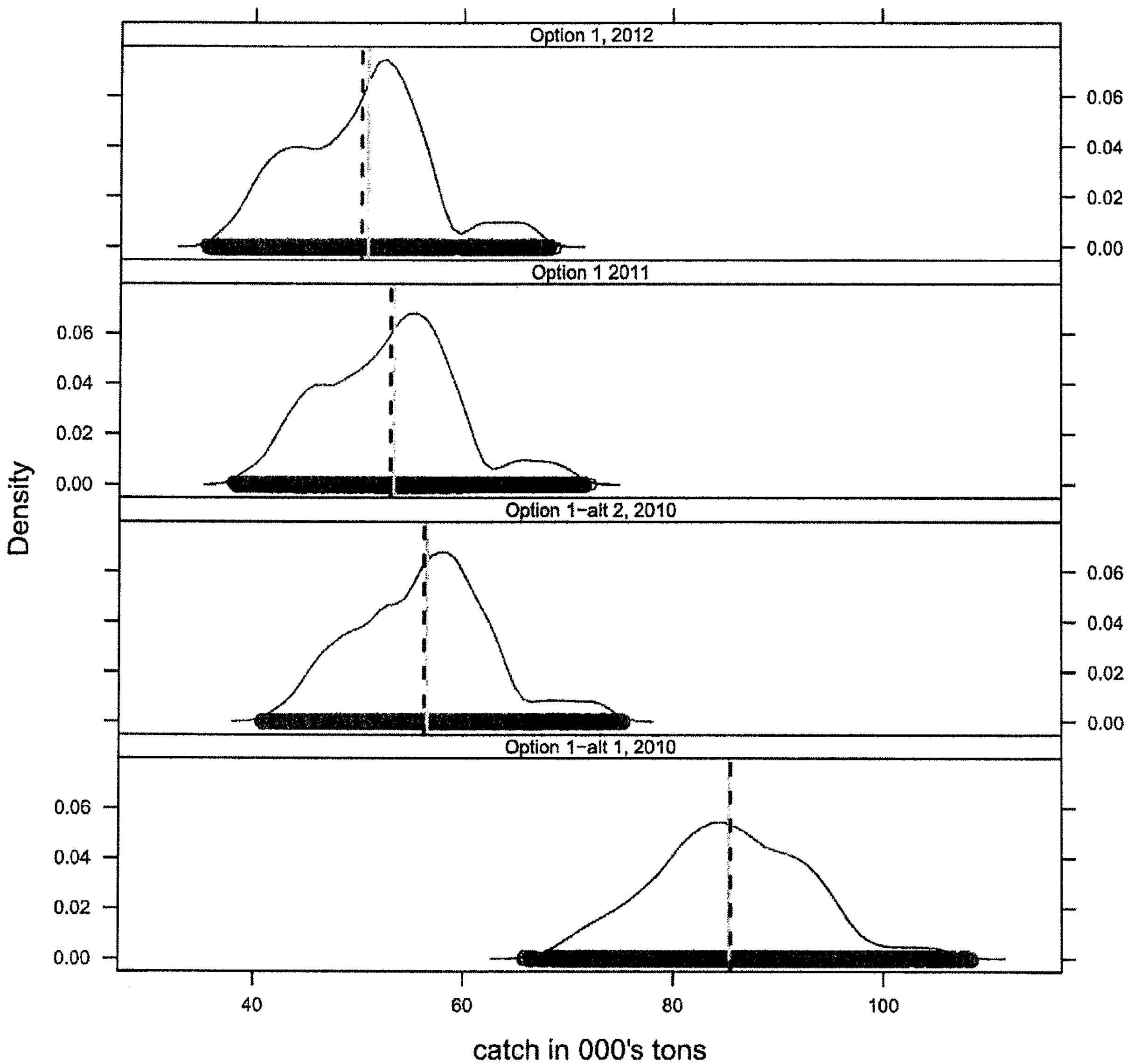
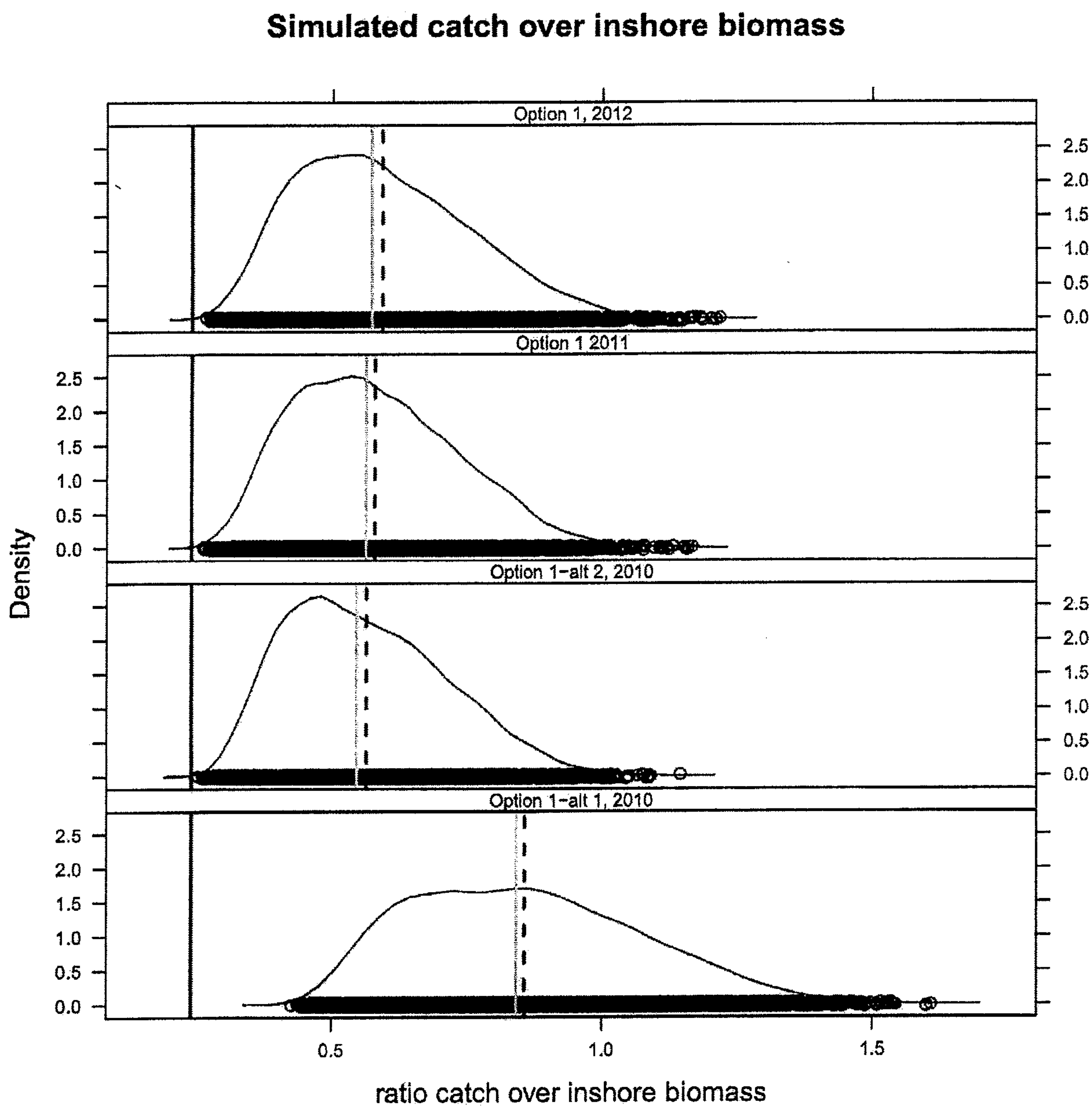
APPENDIX III:

OPTION 1

Intentionally Blank

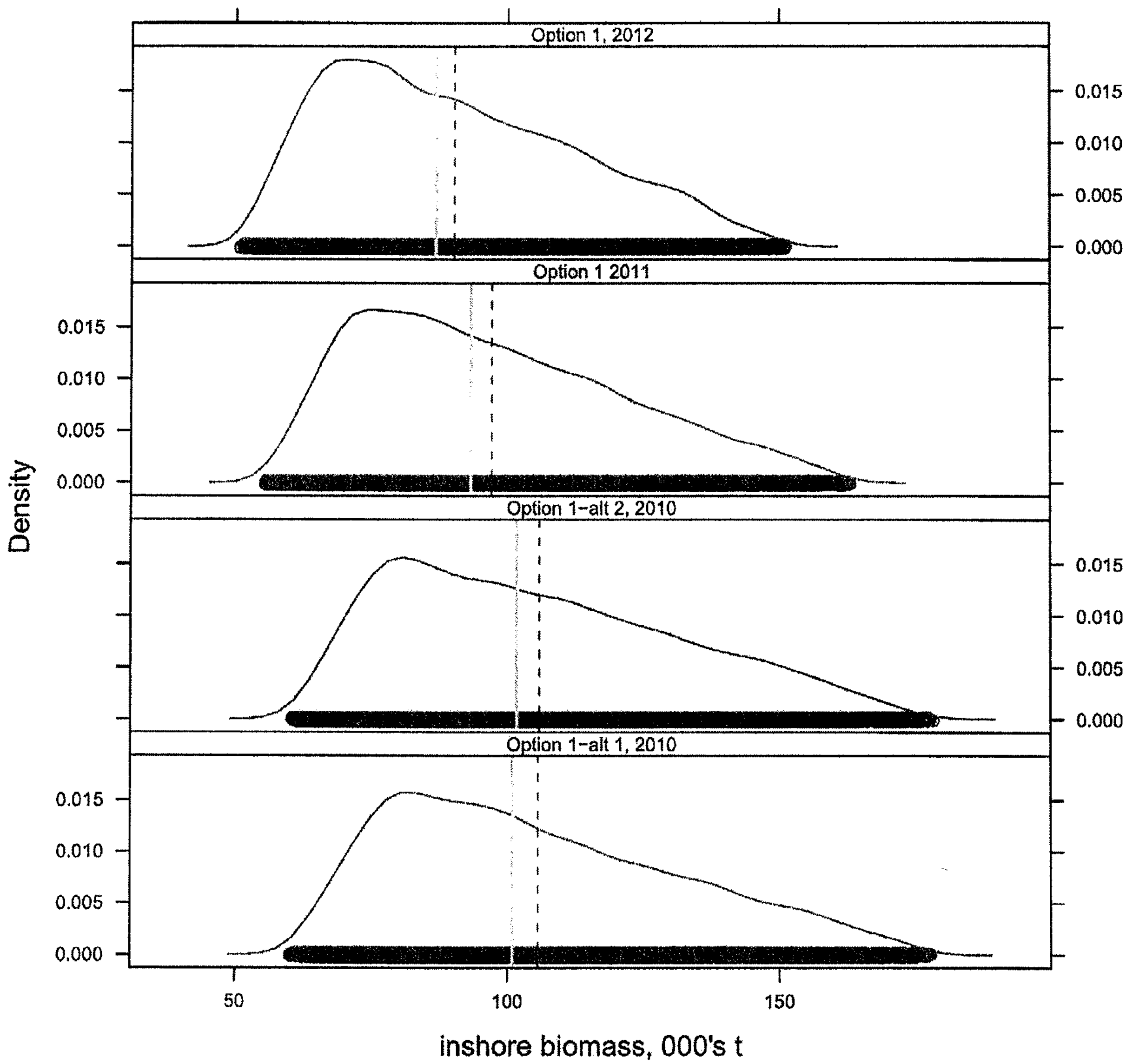
Simulated inshore removals



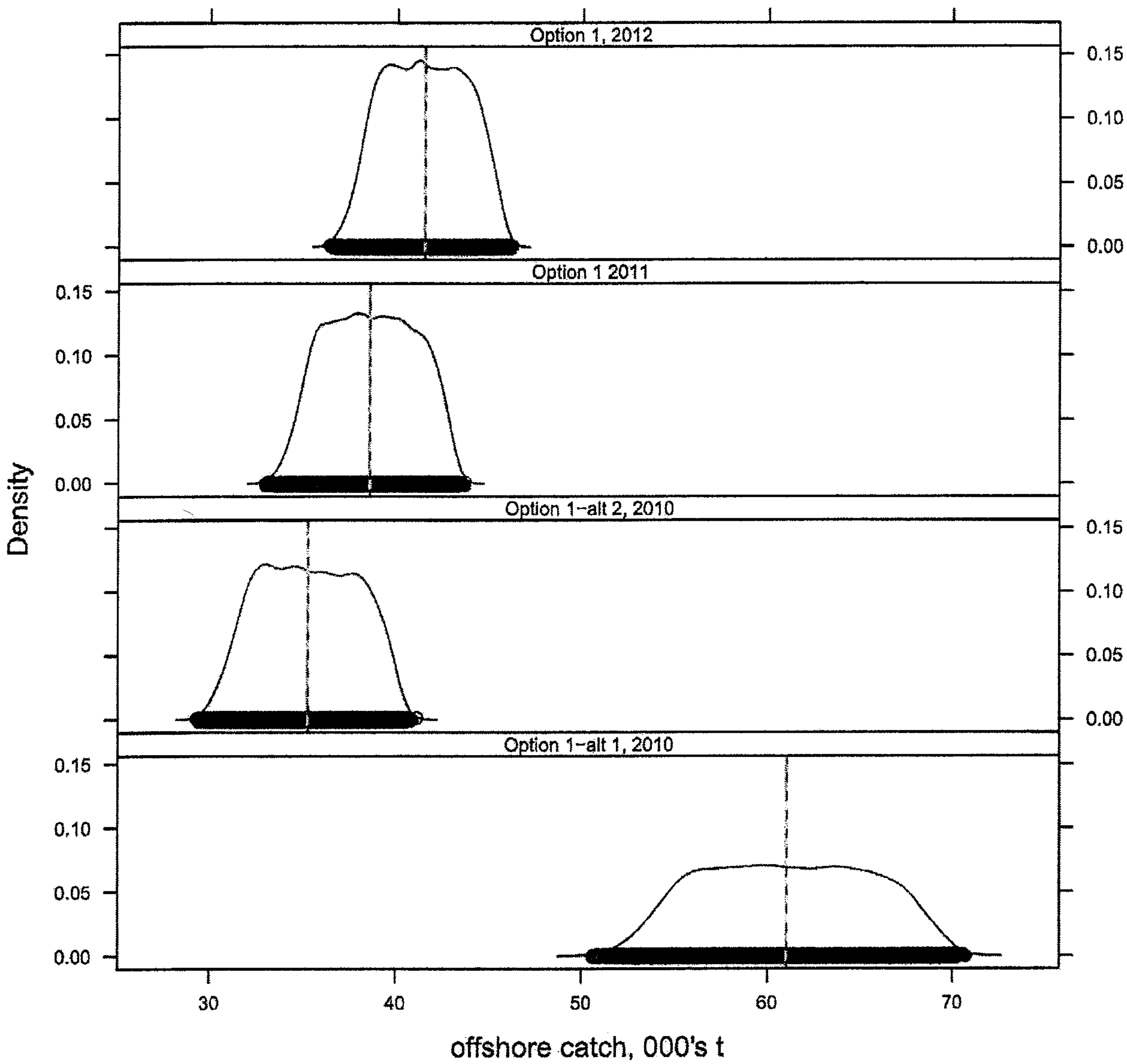


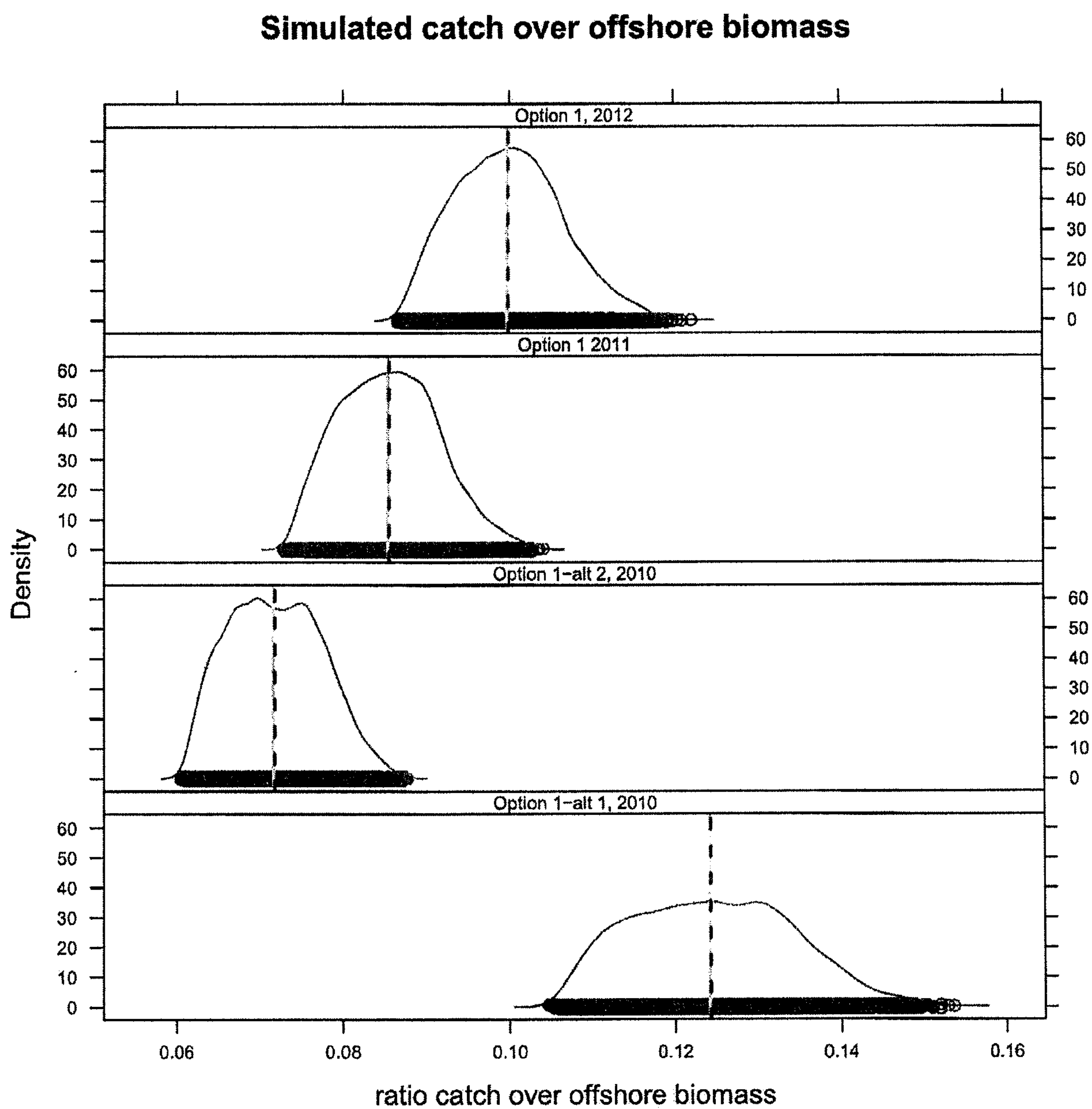
Simulated catch over inshore biomass
Option 1, 2012
Option 1 2011
Option 1-alt 2, 2010
Option 1-alt 1, 2010
Density
ratio catch over inshore biomass
0.5
1.0
1.5
0.0
2.0
2.5

Simulated inshore biomass

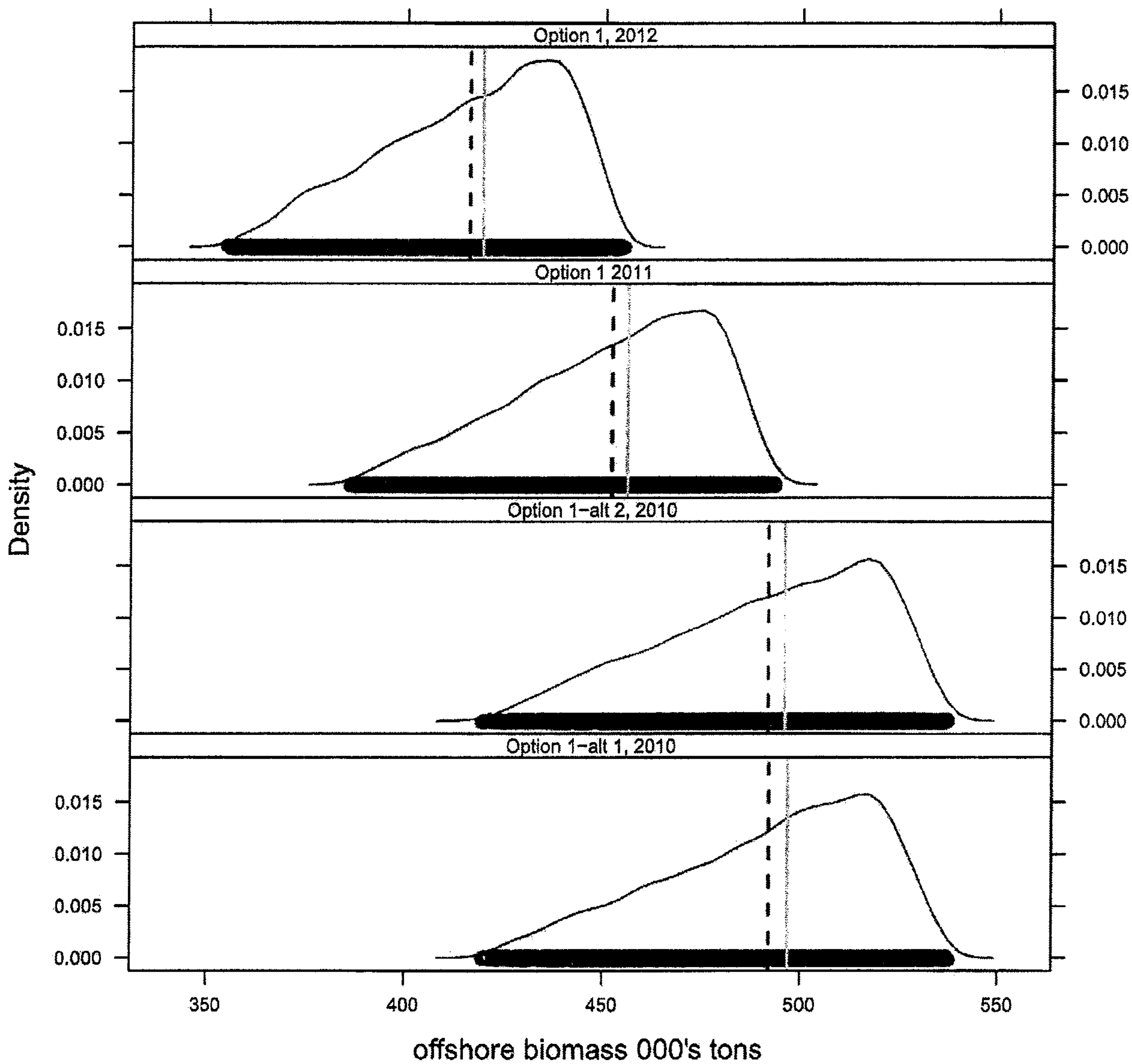


Simulated offshore catch




Simulated catch over offshore biomass
Option 1, 2012
Option 1 2011
Option 1-alt 2, 2010
Option 1-alt 1, 2010
Density
0
10
20
30
40
50
60
0.06
0.08
0.10
0.12
0.14
0.16
ratio catch over offshore biomass

Simulated offshore biomass



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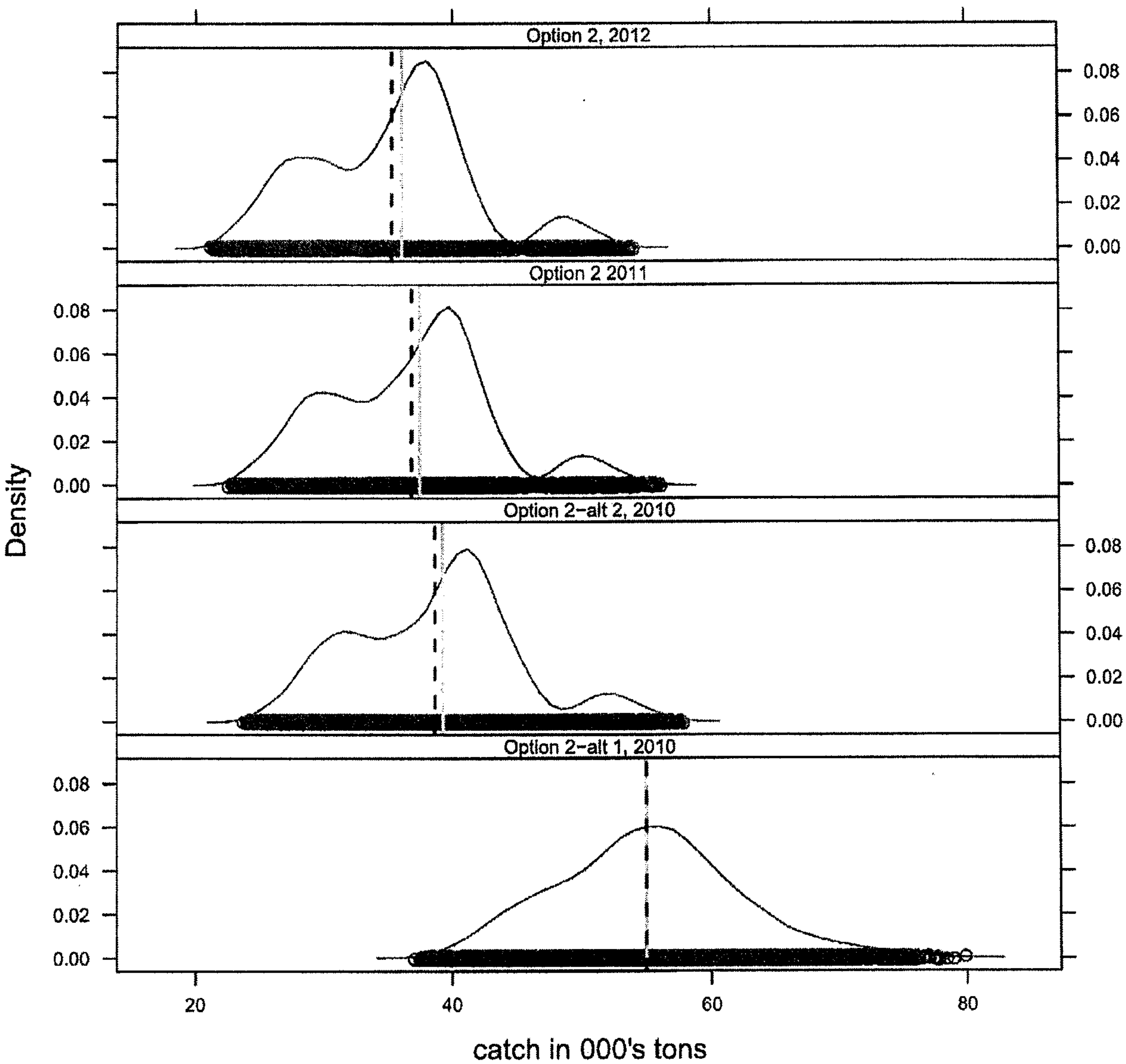
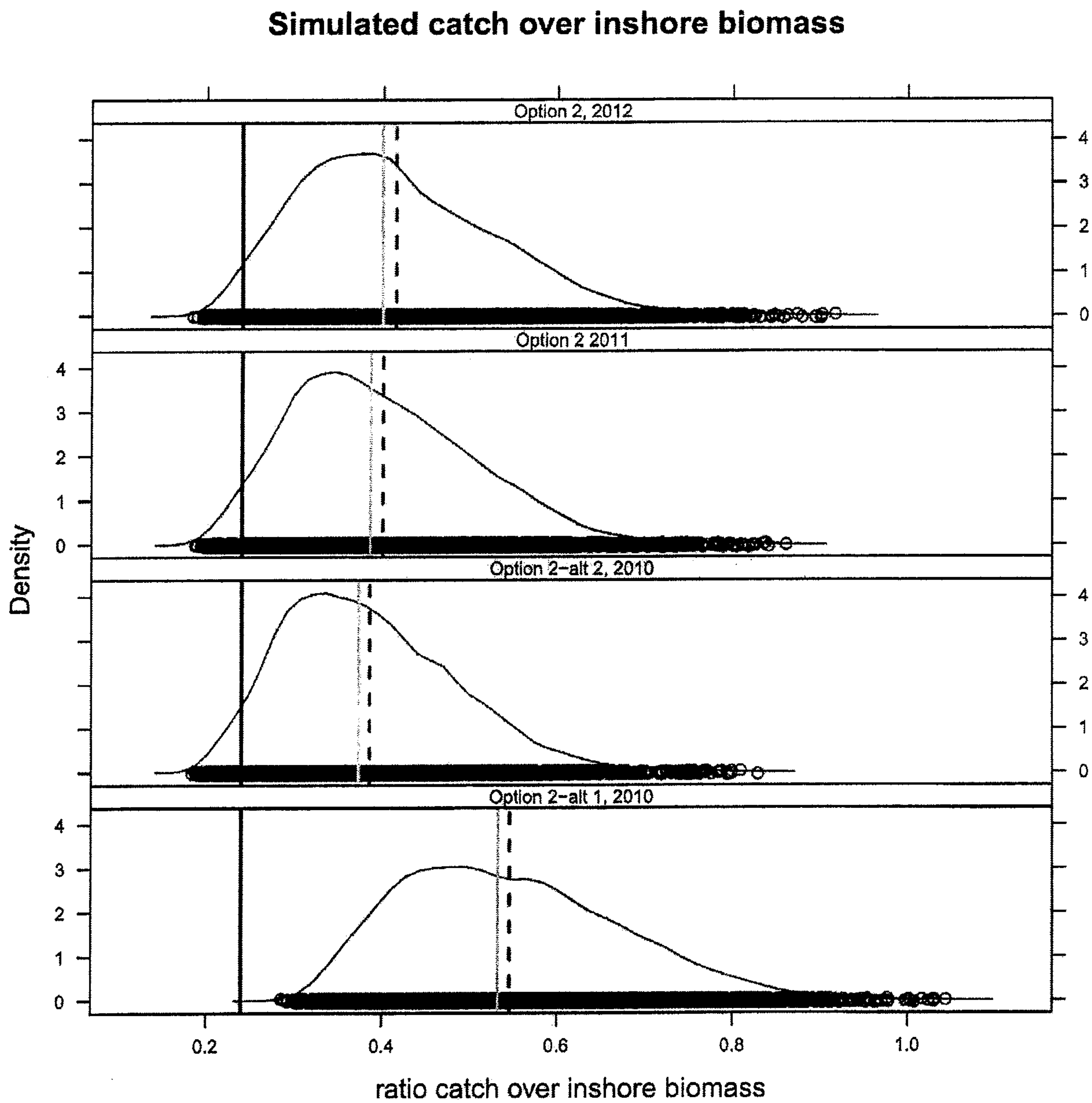
APPENDIX III:

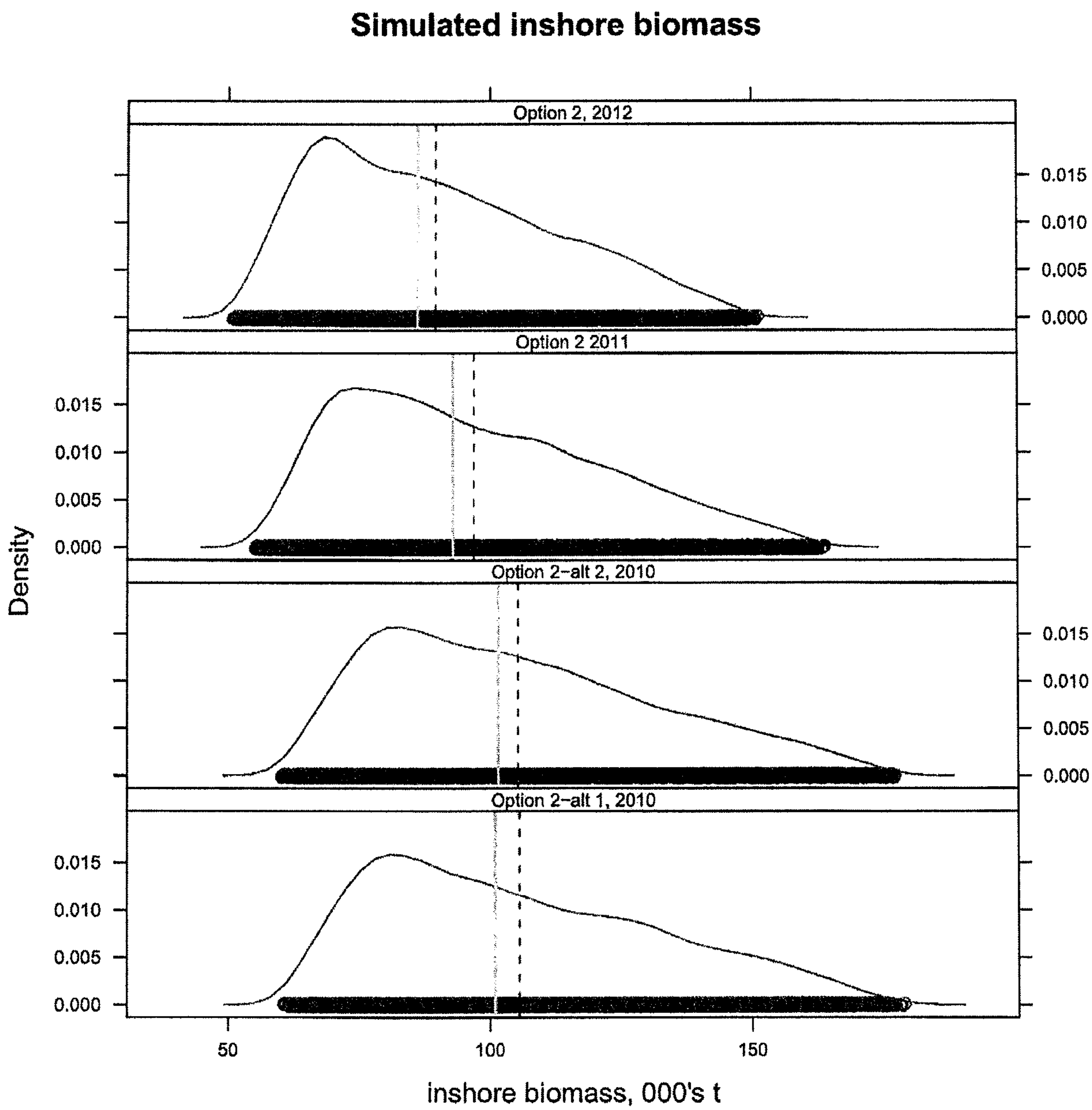
OPTION 2

Intentionally Blank

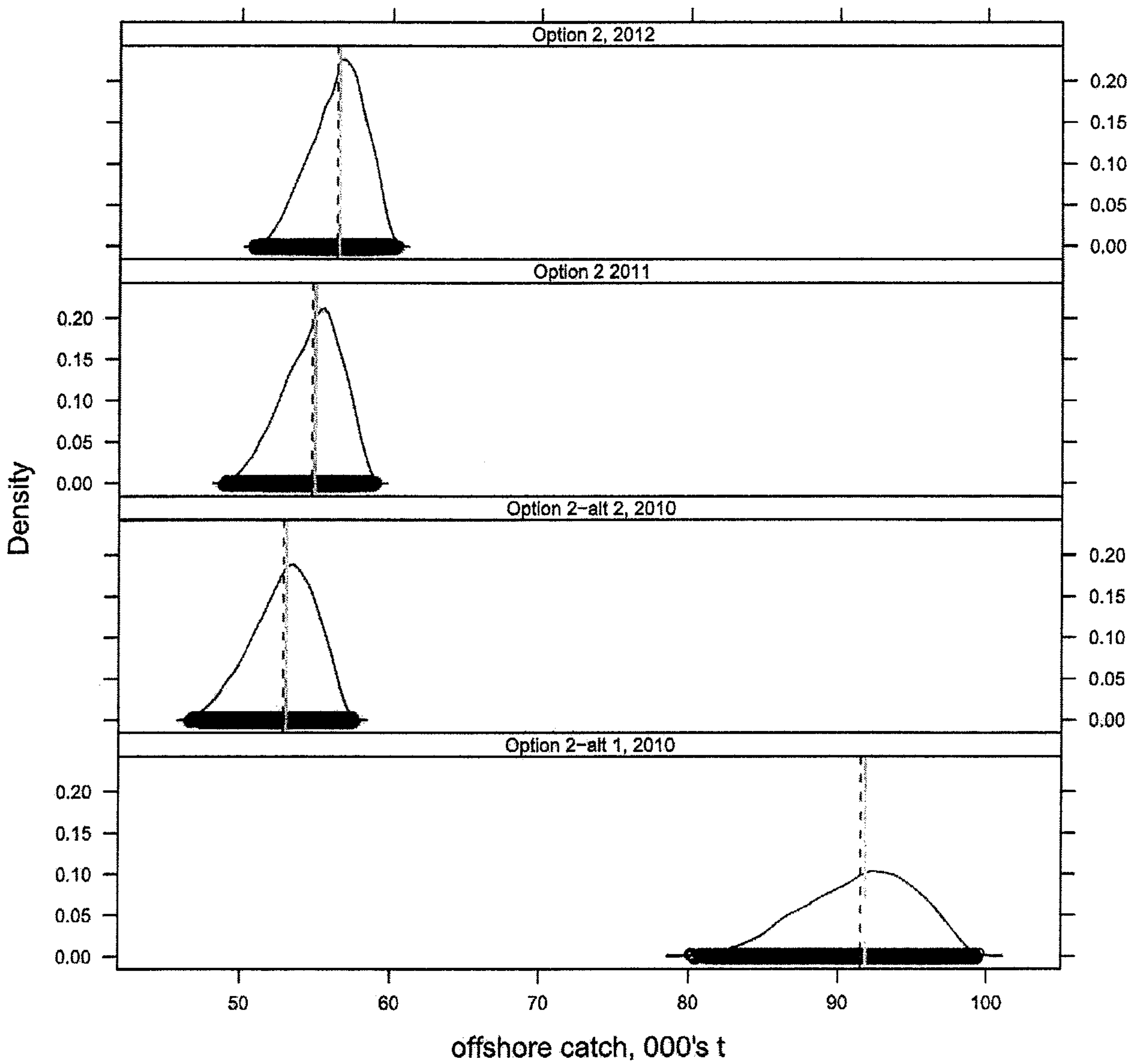
Simulated inshore removals

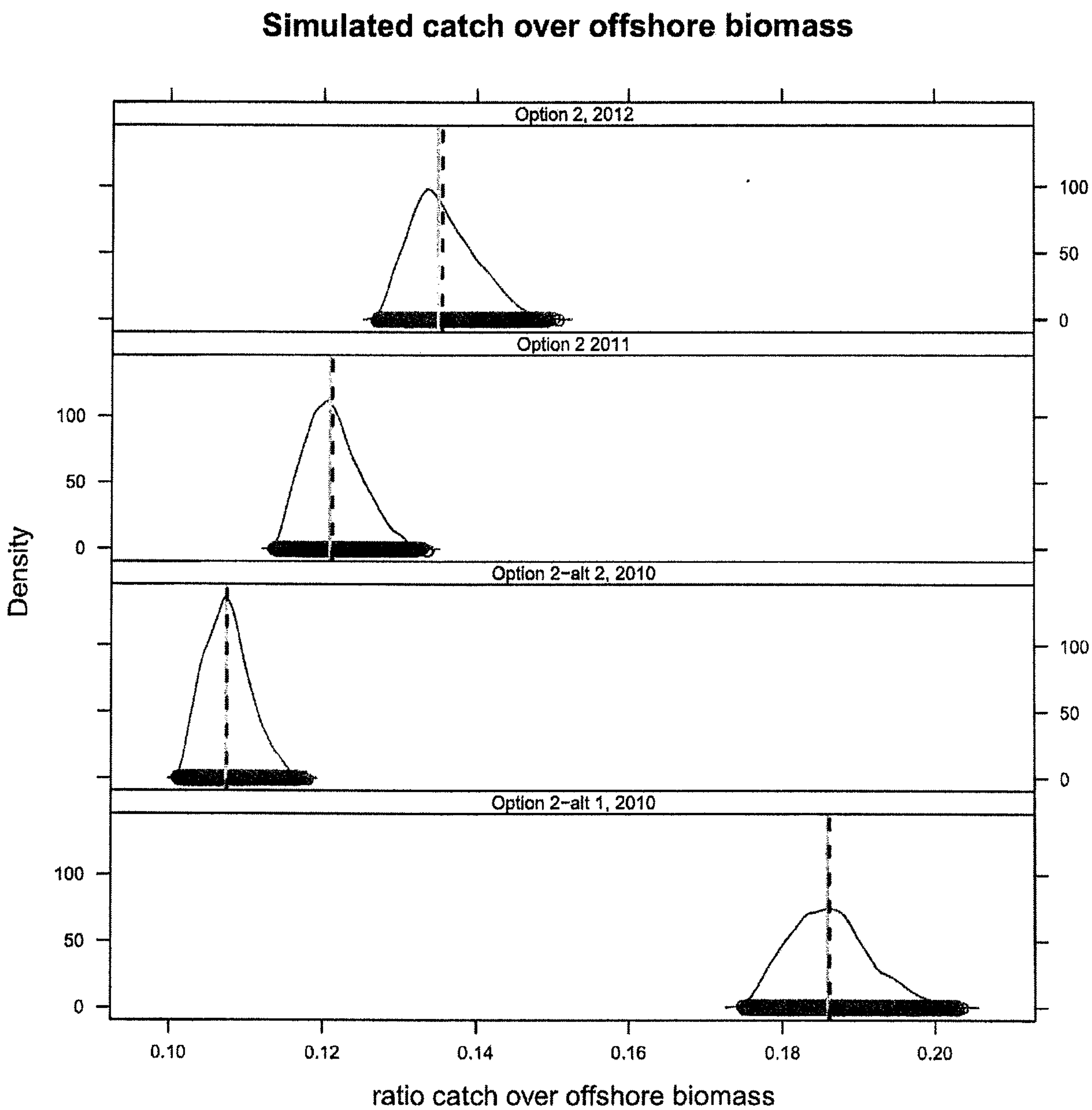



Simulated catch over inshore biomass
Option 2, 2012
Option 2 2011
Option 2-alt 2, 2010
Option 2-alt 1, 2010
Density
0
1
2
3
4
0.2
0.4
0.6
0.8
1.0
ratio catch over inshore biomass

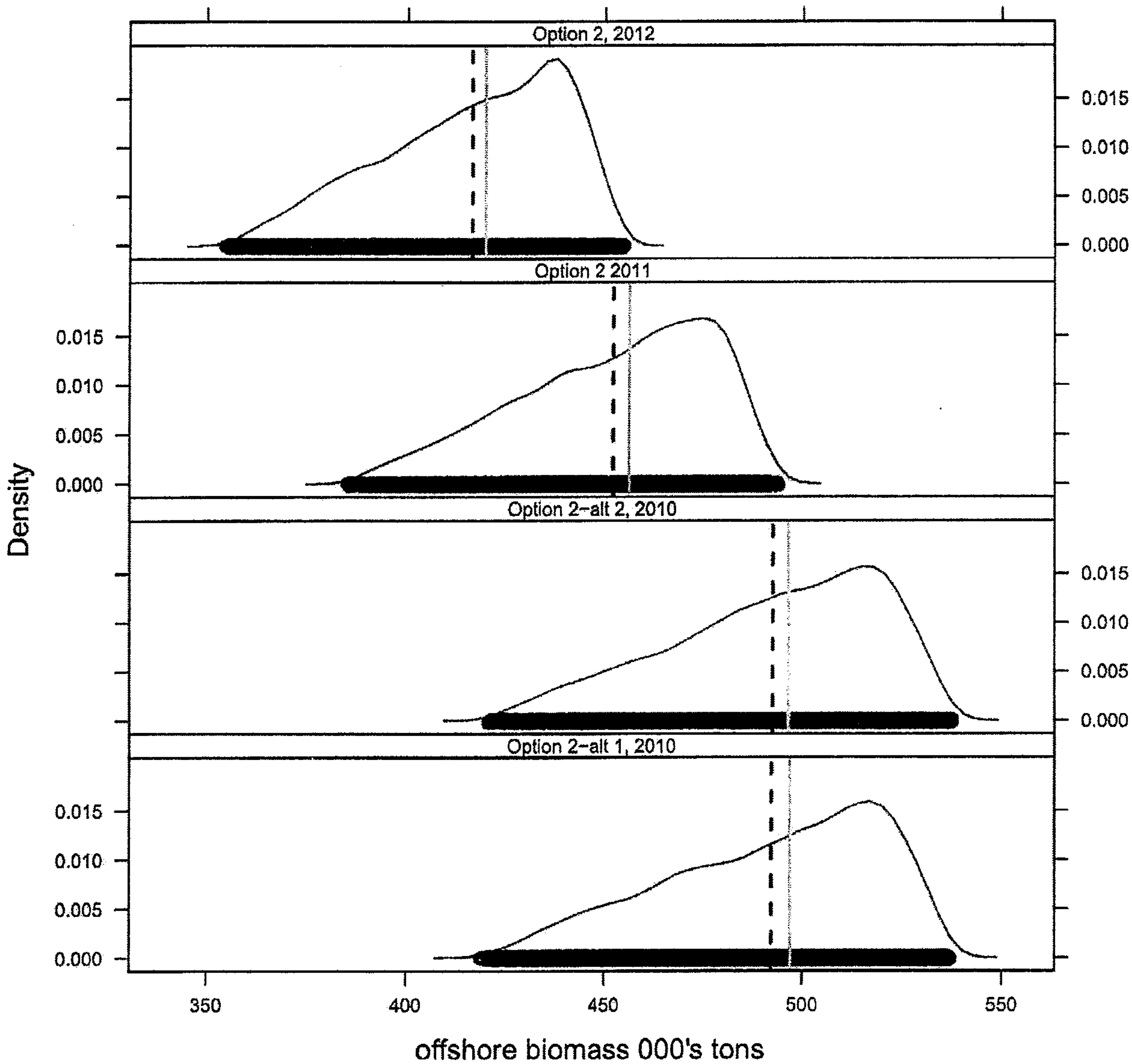

Simulated inshore biomass
Option 2, 2012
Option 2 2011
Option 2−alt 2, 2010
Option 2−alt 1, 2010
0.015
0.010
0.005
0.000
Density
50
100
150
inshore biomass, 000's t

Simulated offshore catch




Simulated catch over offshore biomass
Option 2, 2012
Option 2 2011
Option 2-alt 2, 2010
Option 2-alt 1, 2010
Density
100
50
0
0.10
0.12
0.14
0.16
0.18
0.20
ratio catch over offshore biomass

Simulated offshore biomass



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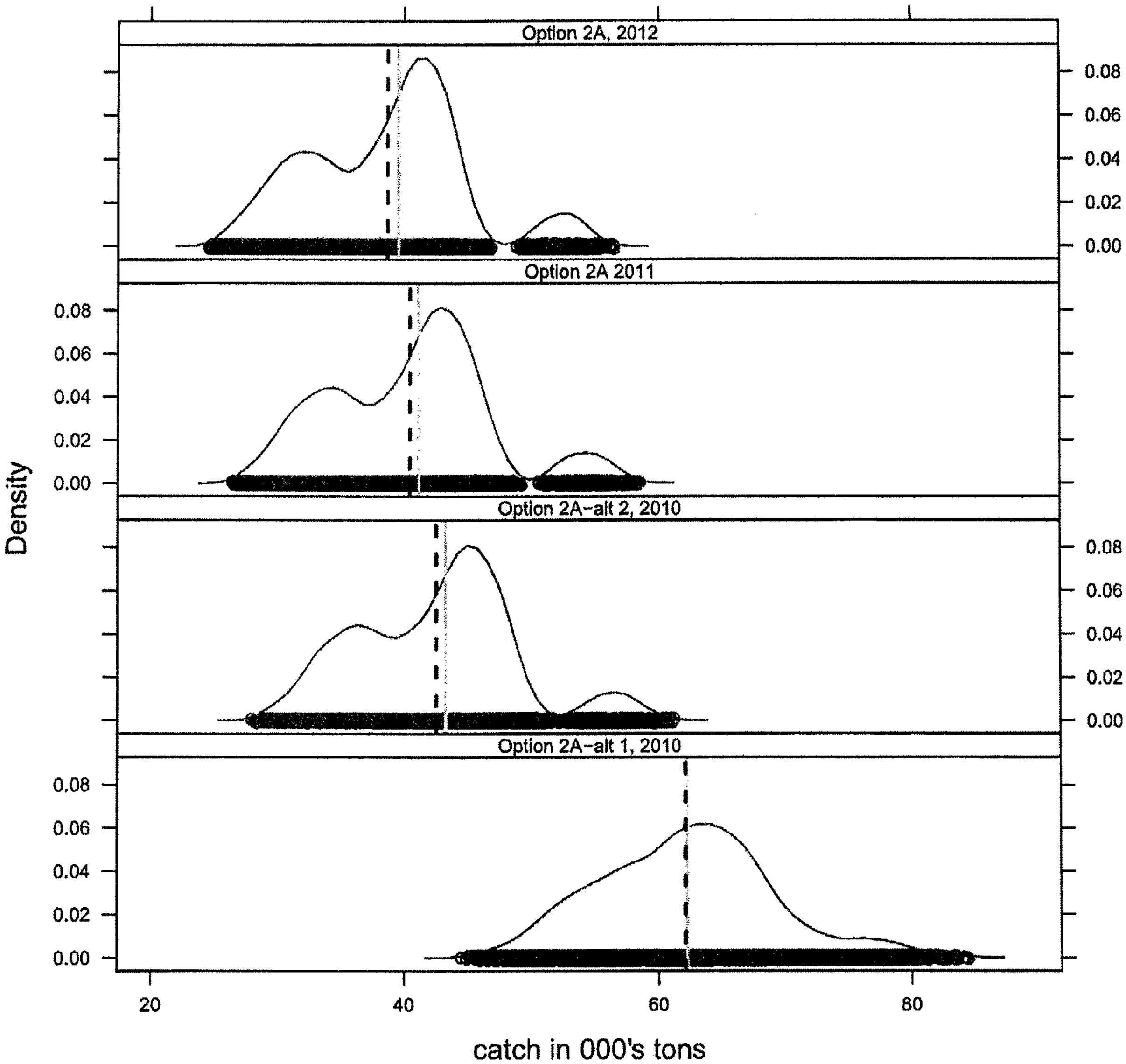
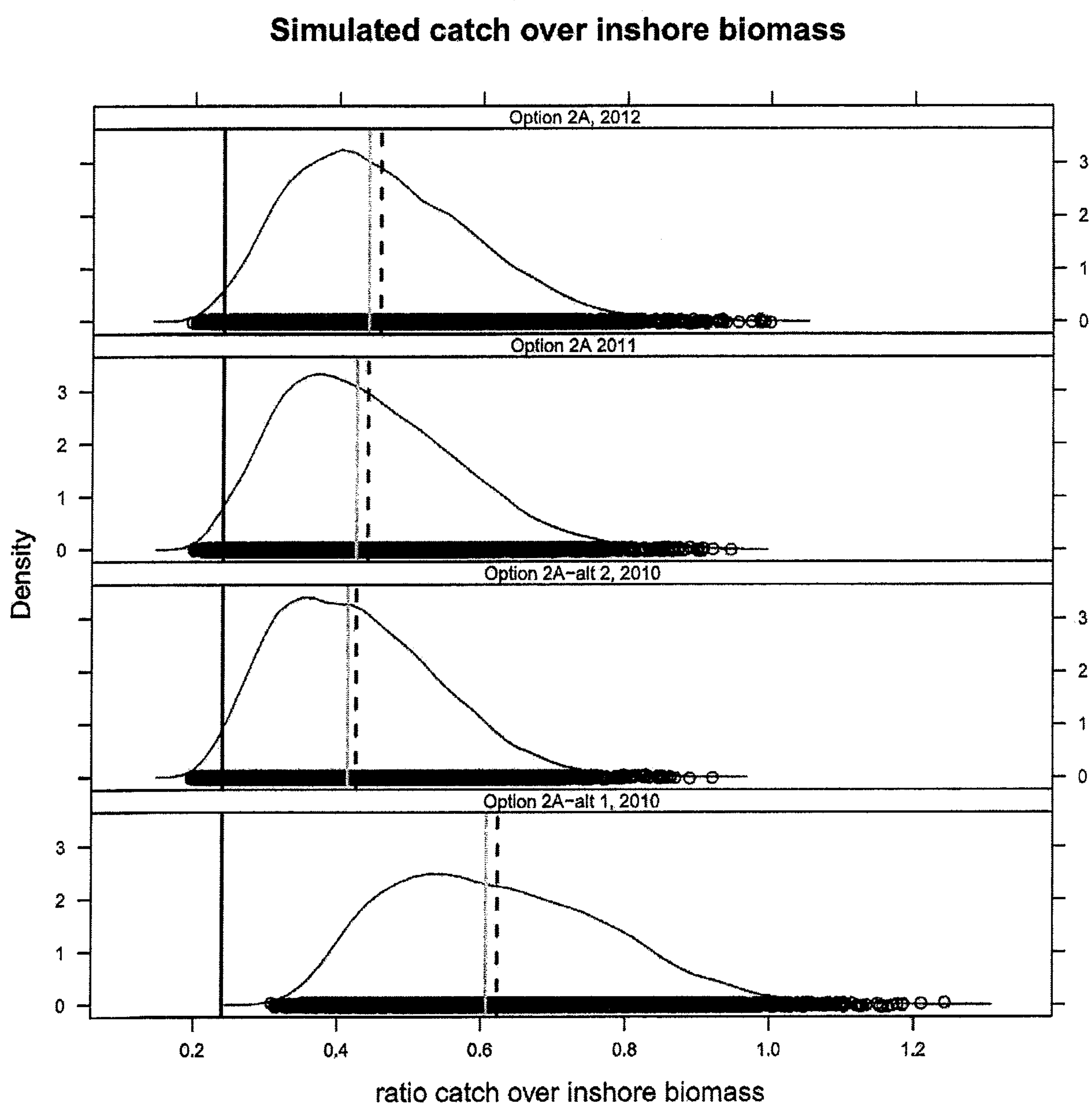
APPENDIX III:

OPTION 2A

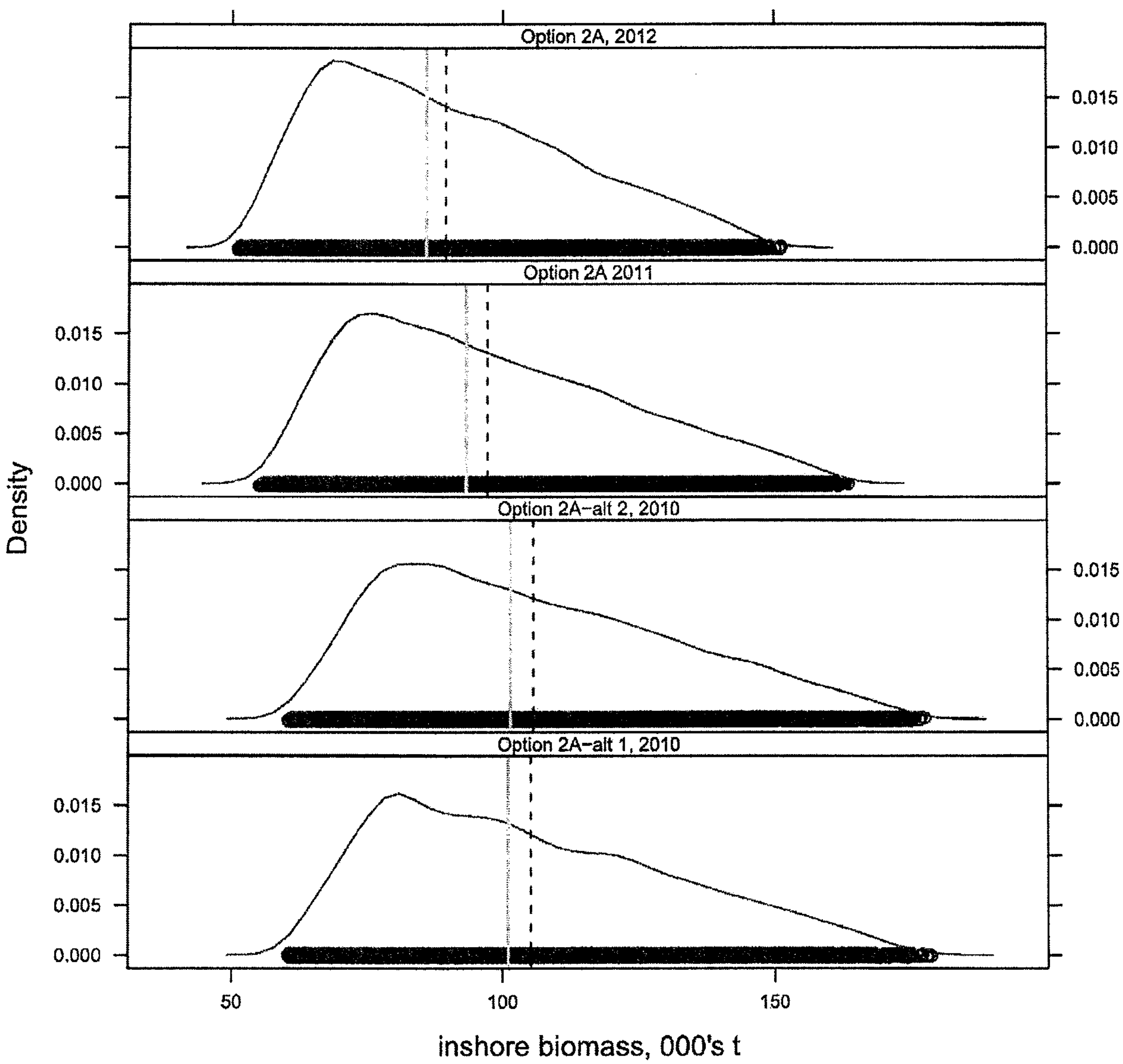
Intentionally Blank

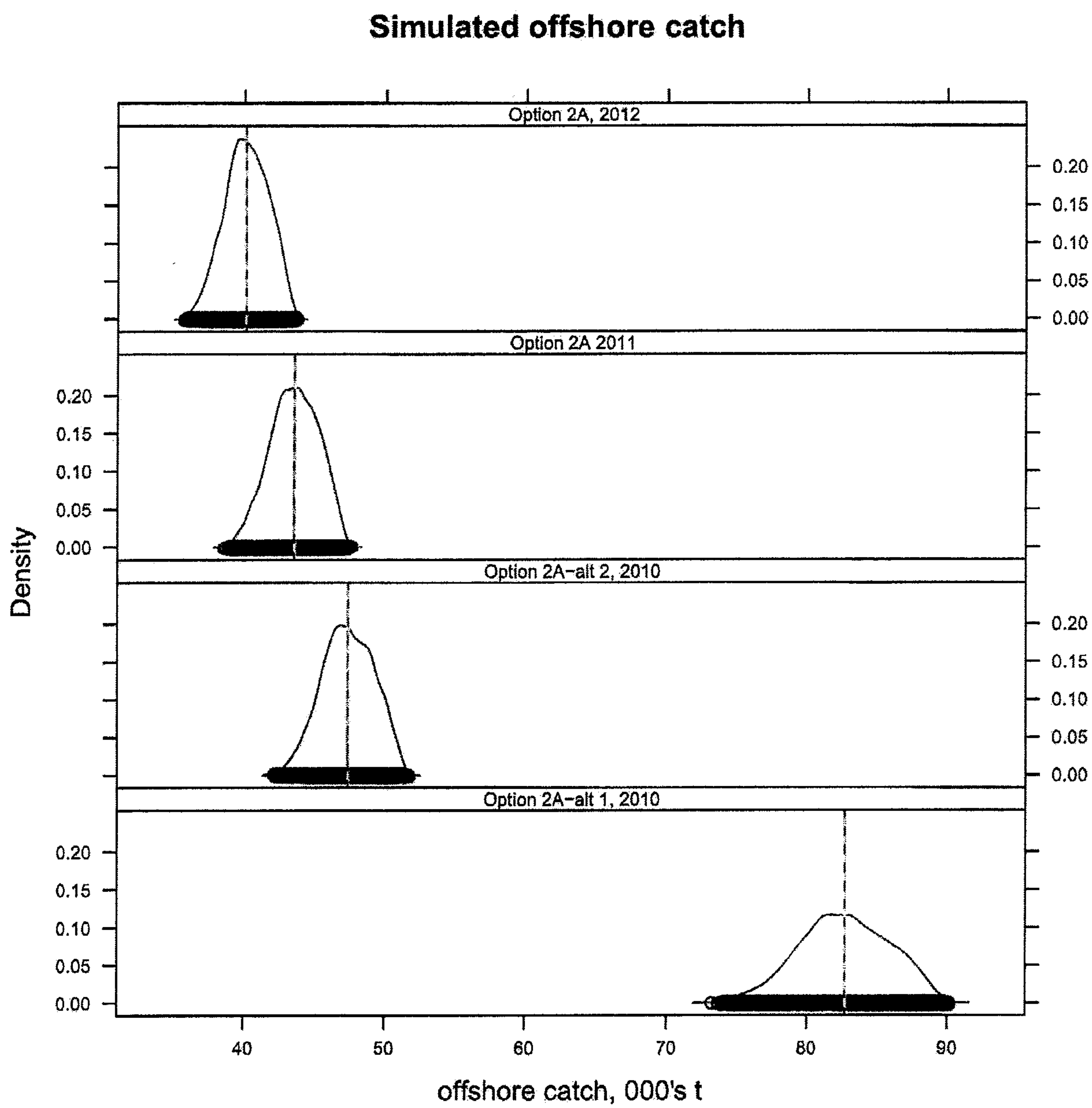
Simulated inshore removals




Simulated catch over inshore biomass
Option 2A, 2012
Option 2A 2011
Option 2A-alt 2, 2010
Option 2A-alt 1, 2010
Density
0
1
2
3
0.2
0.4
0.6
0.8
1.0
1.2
ratio catch over inshore biomass

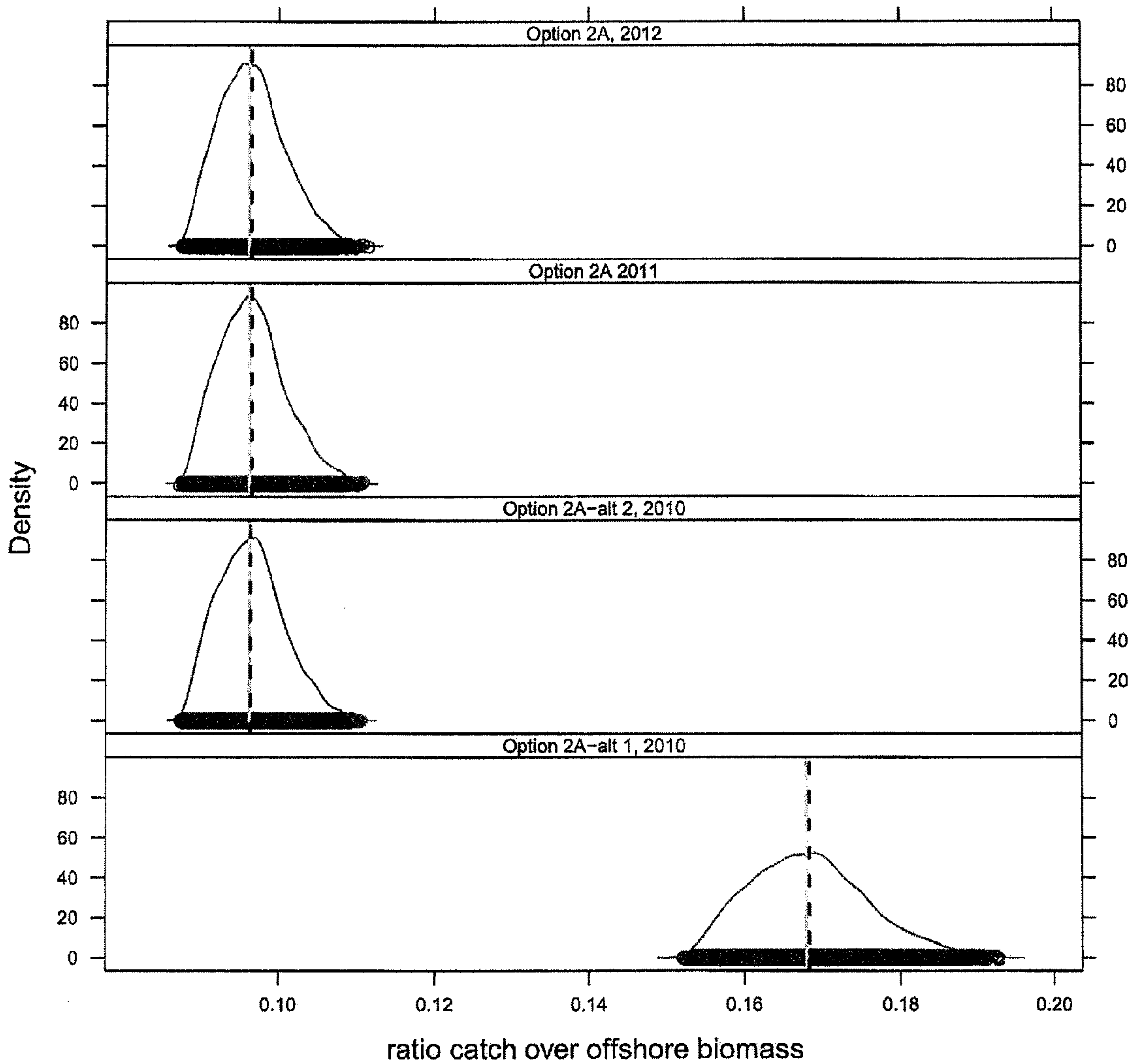
Simulated inshore biomass



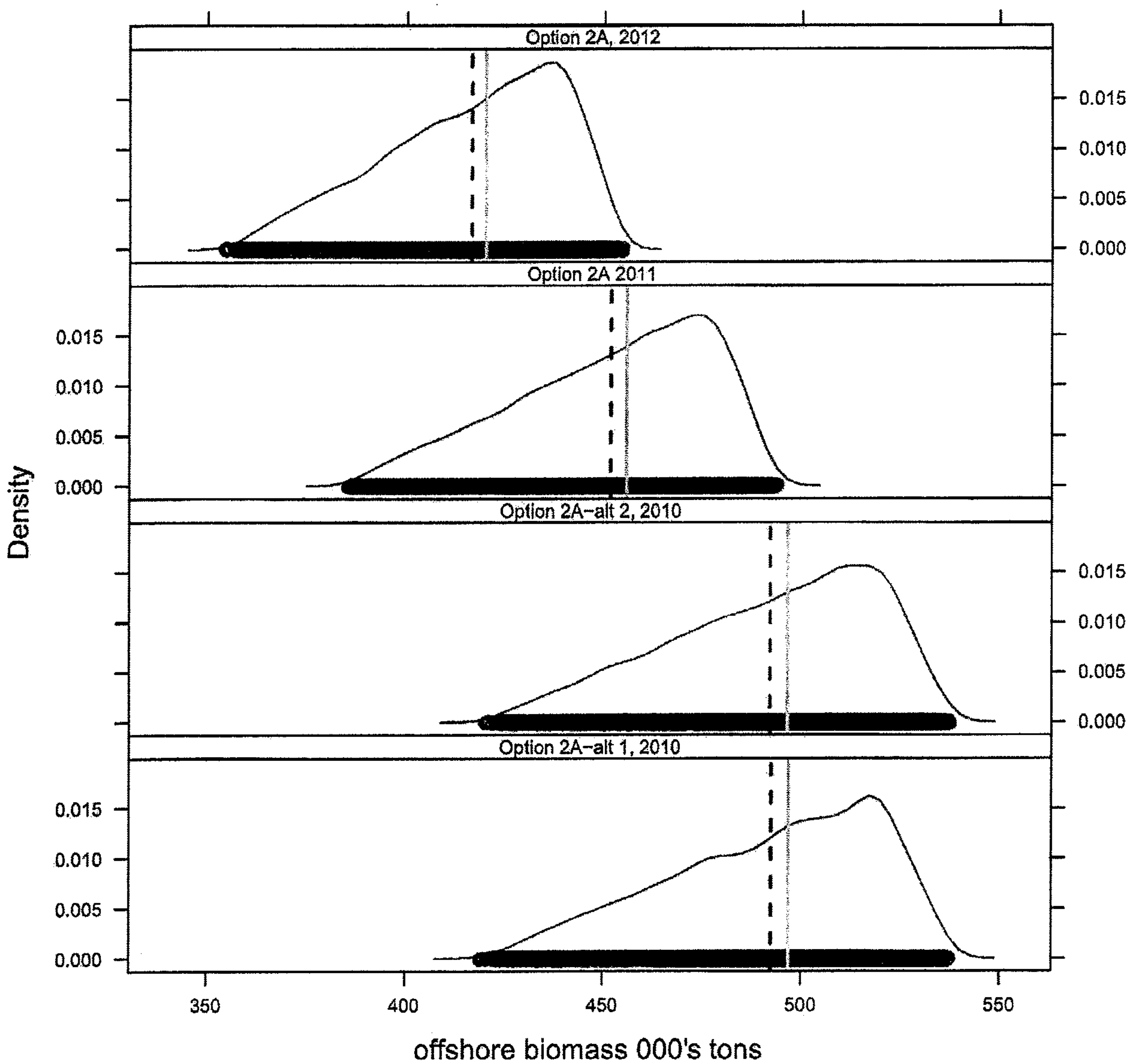


Simulated offshore catch
Option 2A, 2012
Option 2A 2011
Option 2A-alt 2, 2010
Option 2A-alt 1, 2010
Density
0.00
0.05
0.10
0.15
0.20
40
50
60
70
80
90
offshore catch, 000's t

Simulated catch over offshore biomass



Simulated offshore biomass



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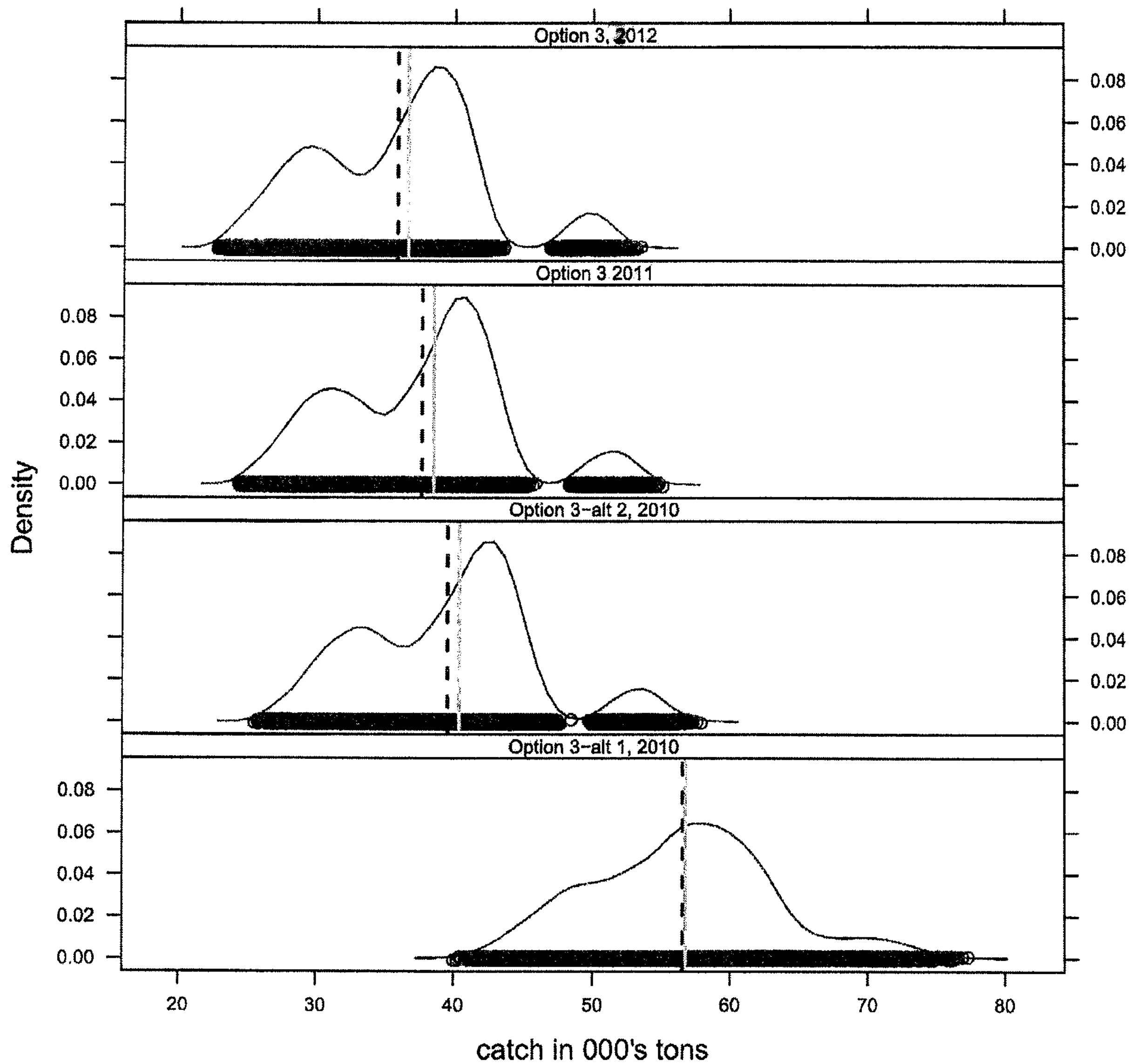
APPENDIX III:

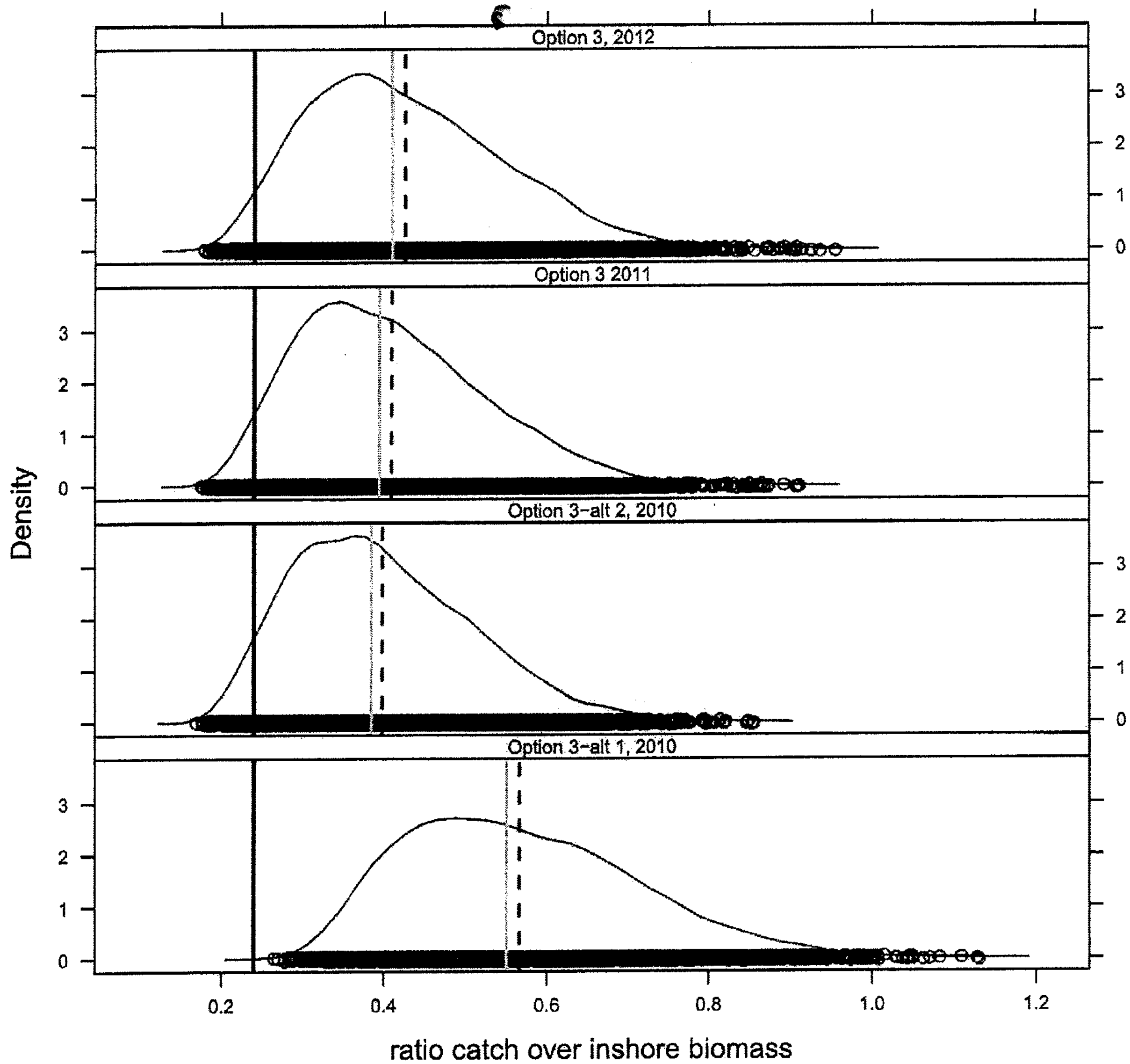
OPTION 3

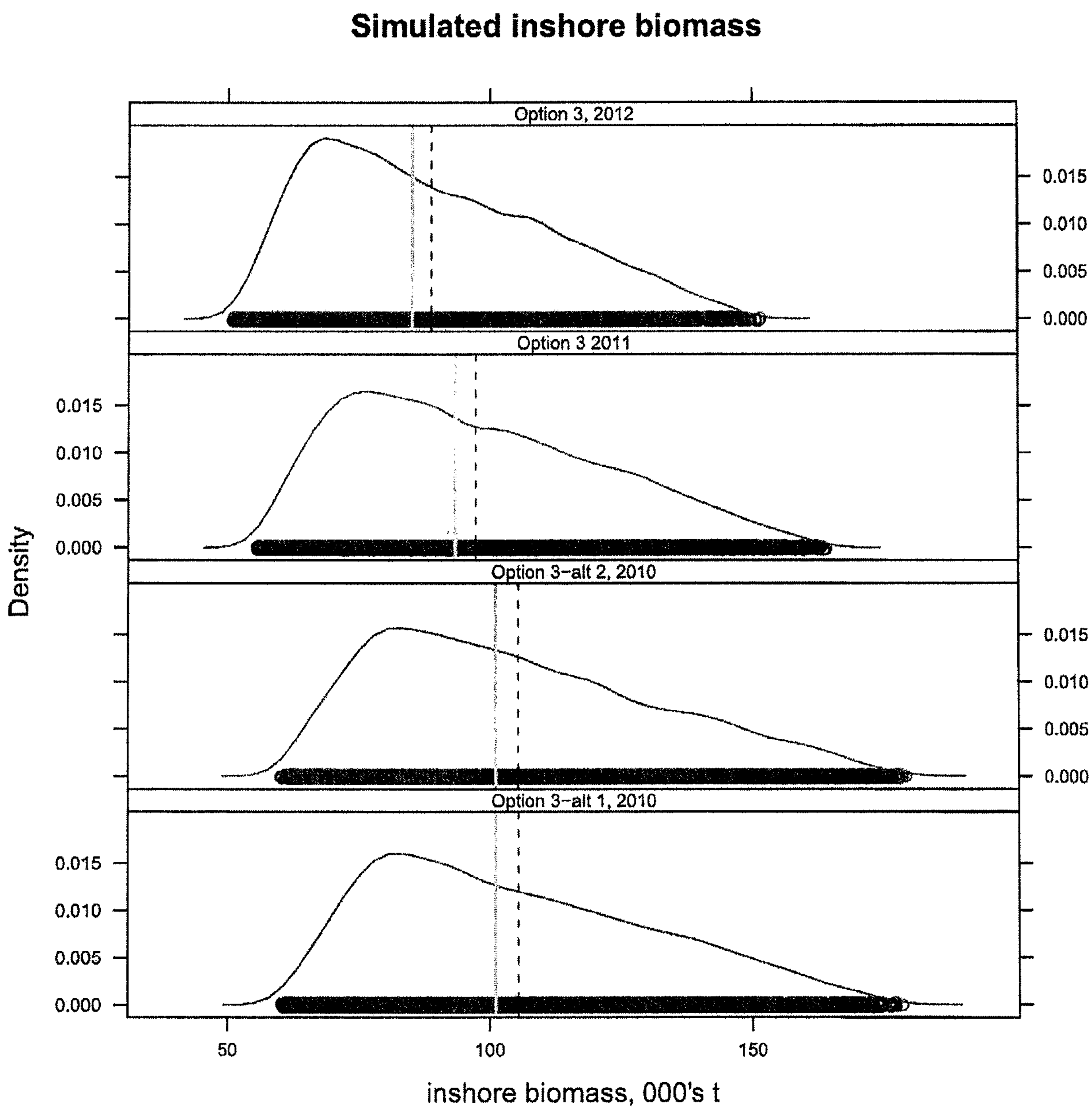
Intentionally Blank

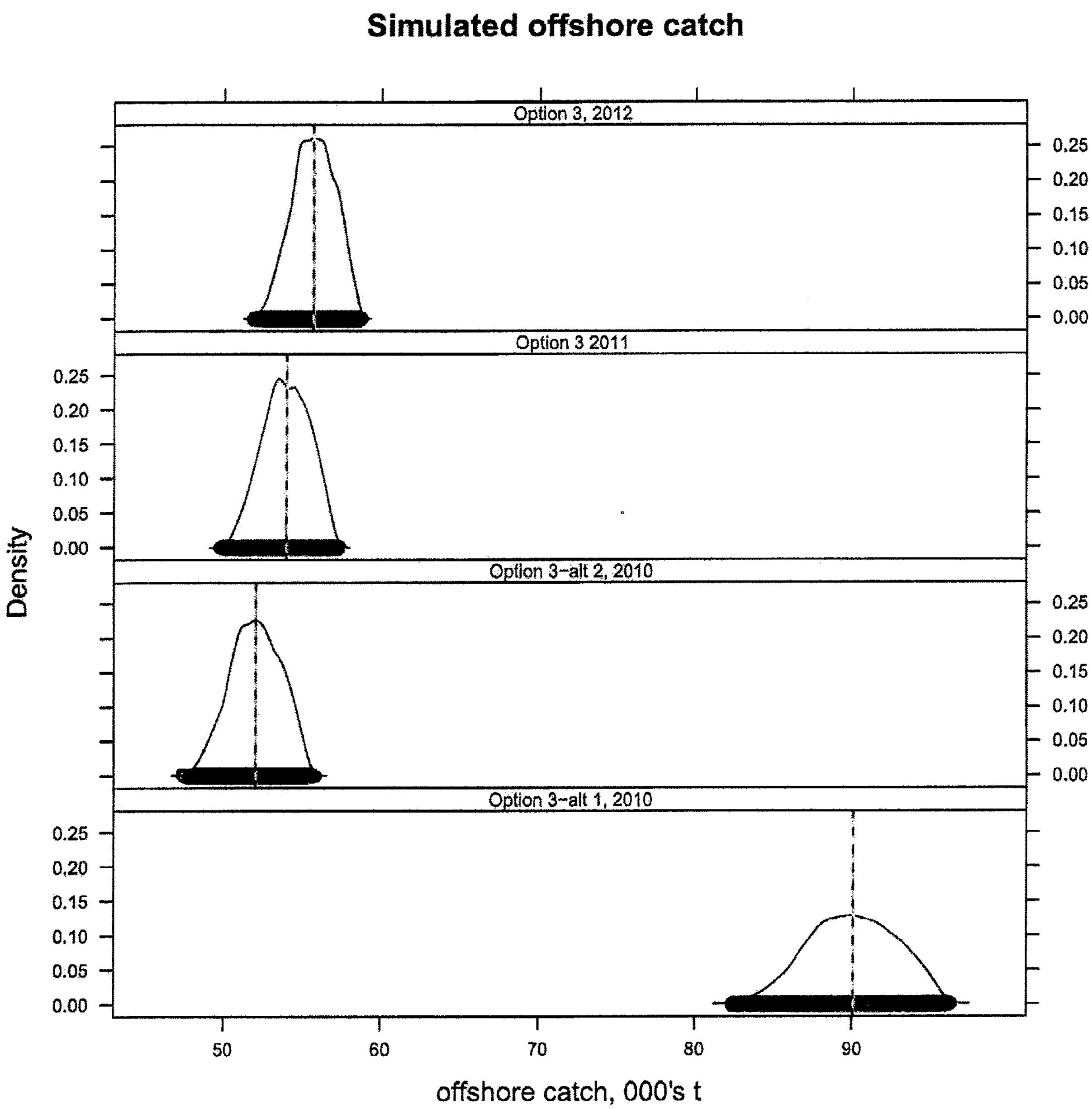
Simulated inshore removals



Simulated catch over inshore biomass

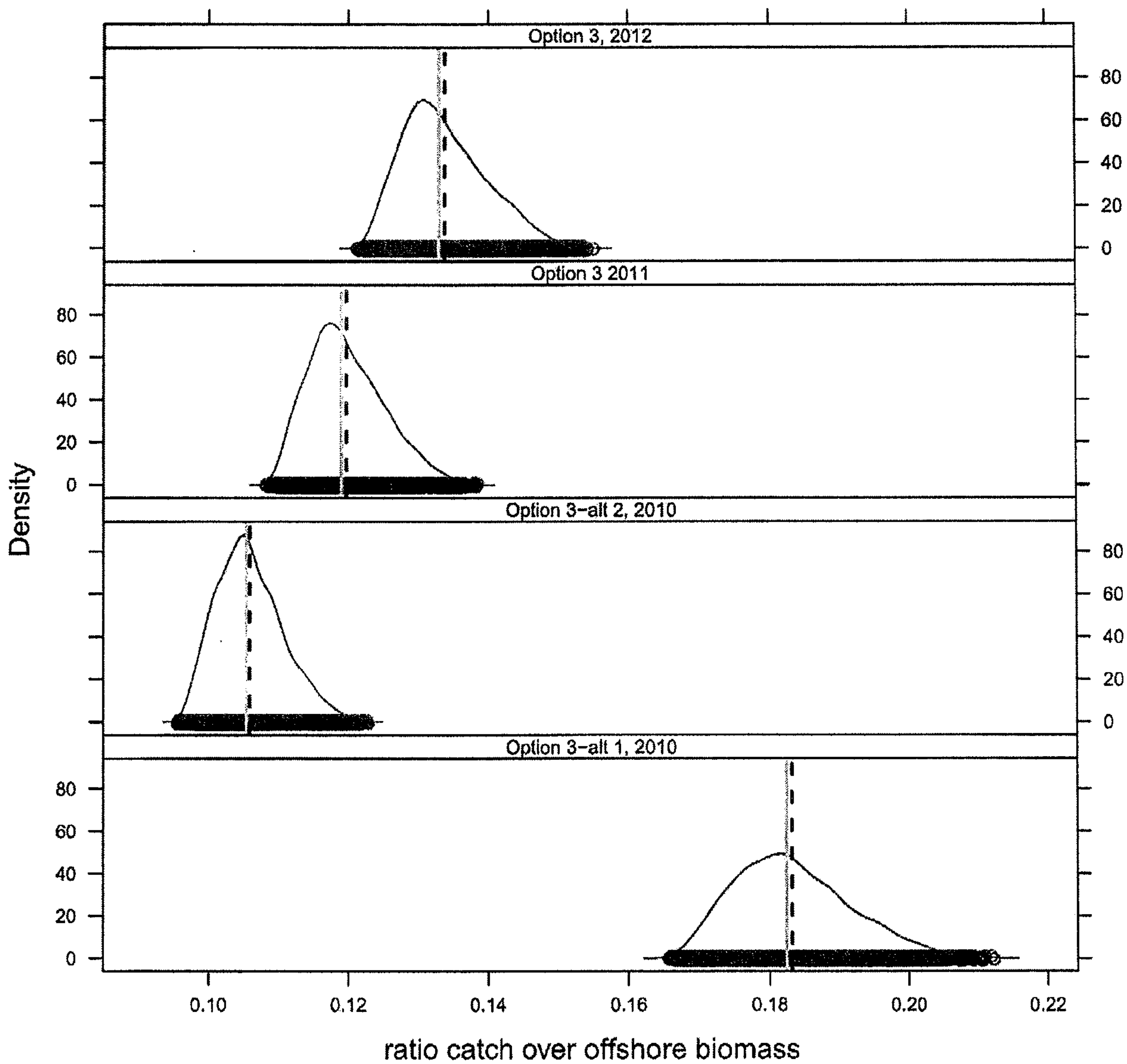


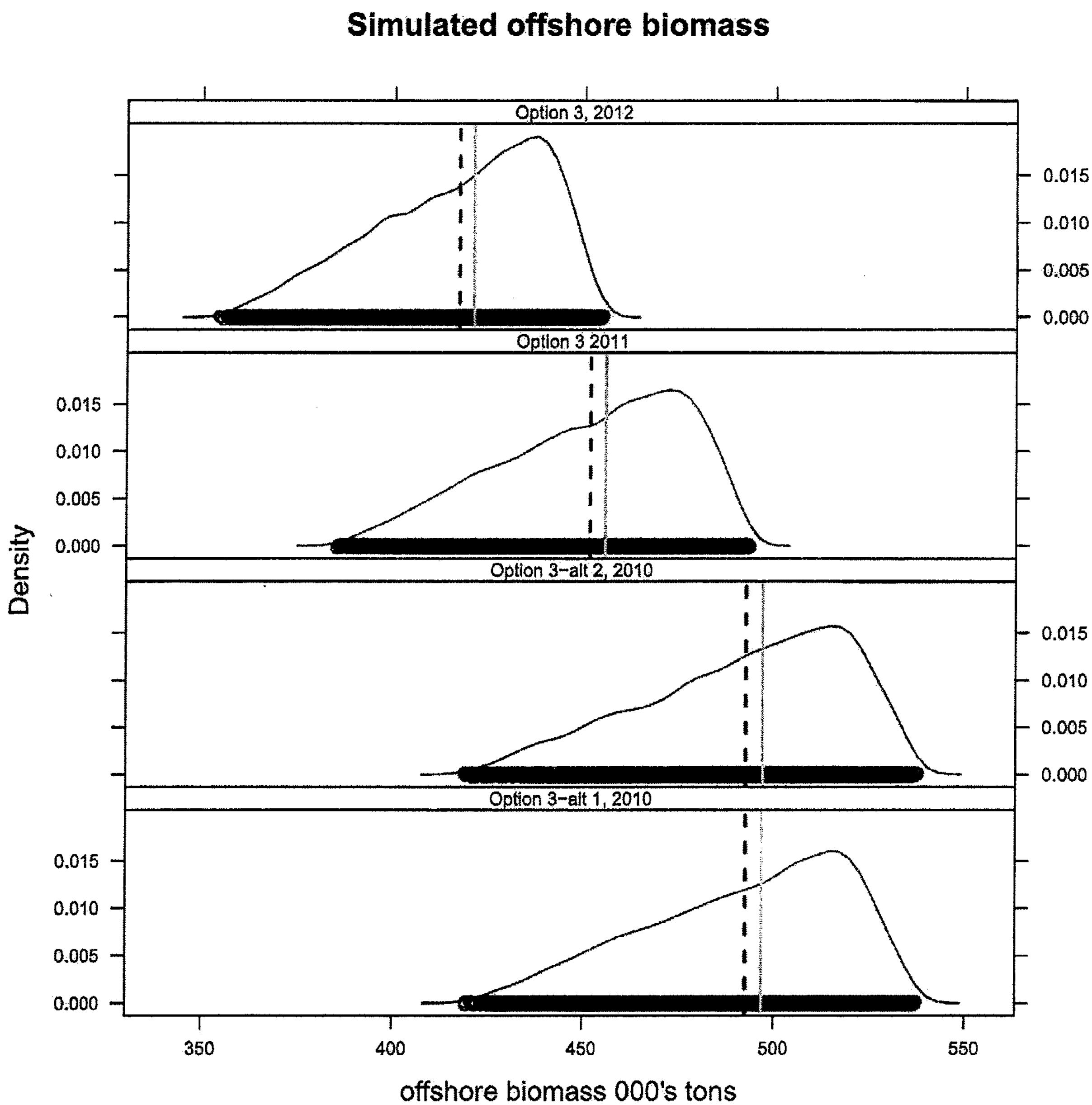

Simulated inshore biomass
Option 3, 2012
Option 3 2011
Option 3−alt 2, 2010
Option 3−alt 1, 2010
Density
0.000
0.005
0.010
0.015
50
100
150
inshore biomass, 000's t



Simulated offshore catch
Option 3, 2012
Option 3 2011
Option 3−alt 2, 2010
Option 3−alt 1, 2010
Density
0.25
0.20
0.15
0.10
0.05
0.00
50
60
70
80
90
offshore catch, 000's t

Simulated catch over offshore biomass





Simulated offshore biomass
Option 3, 2012
Option 3 2011
Option 3−alt 2, 2010
Option 3−alt 1, 2010
0.015
0.010
0.005
0.000
Density
350
400
450
500
550
offshore biomass 000's tons

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APPENDIX III:

OPTION 4A

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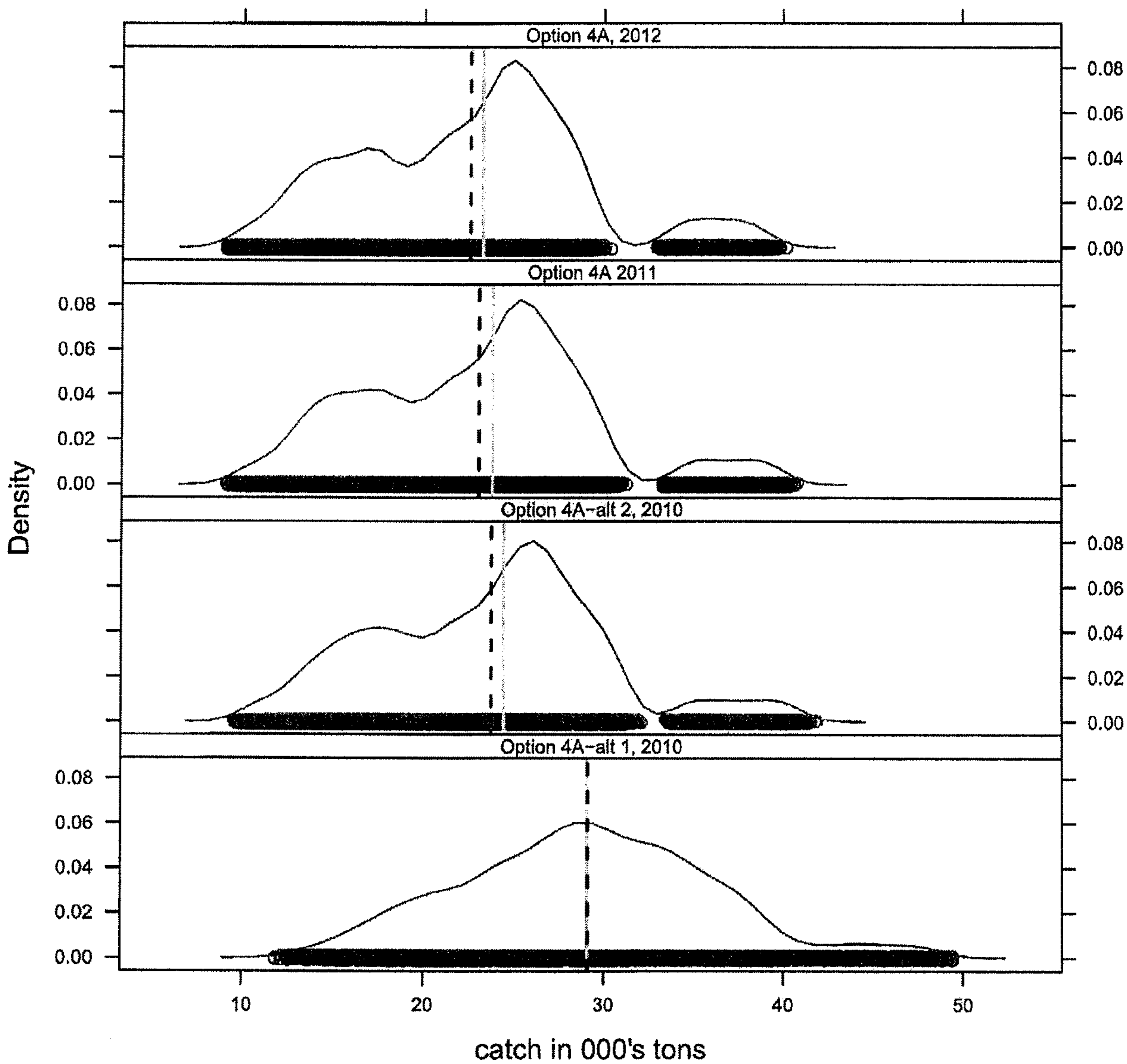
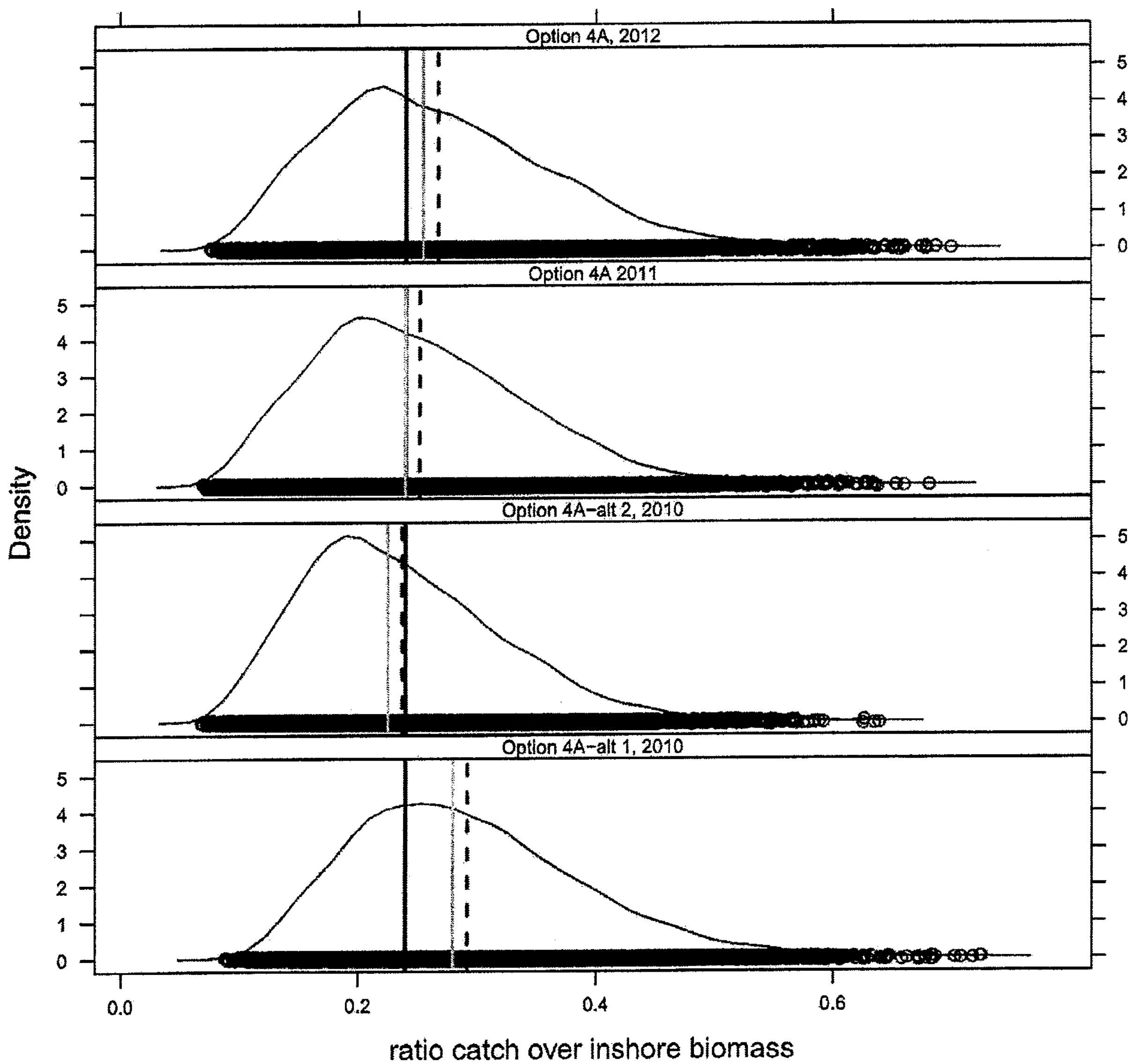
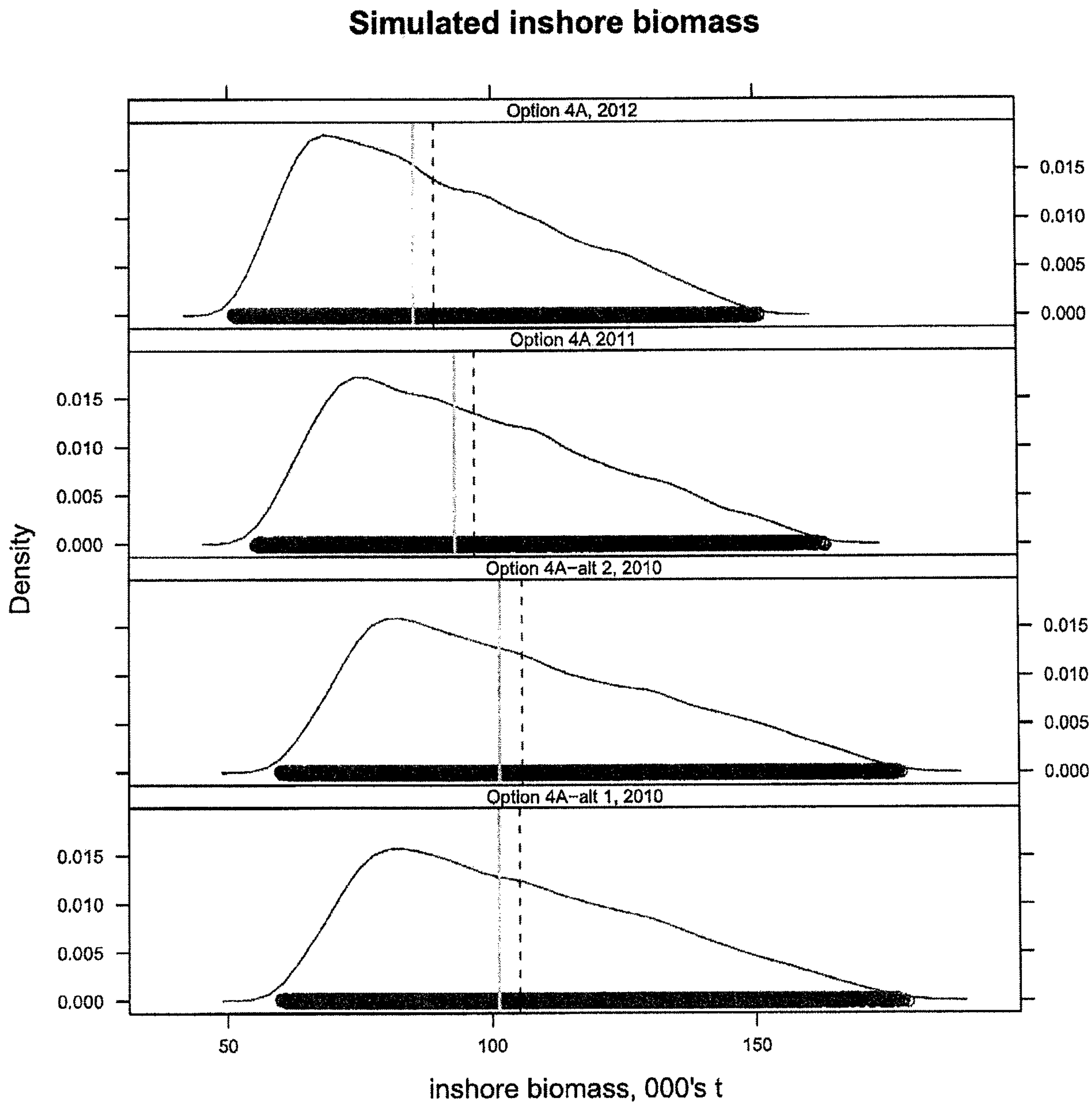
Simulated inshore removals



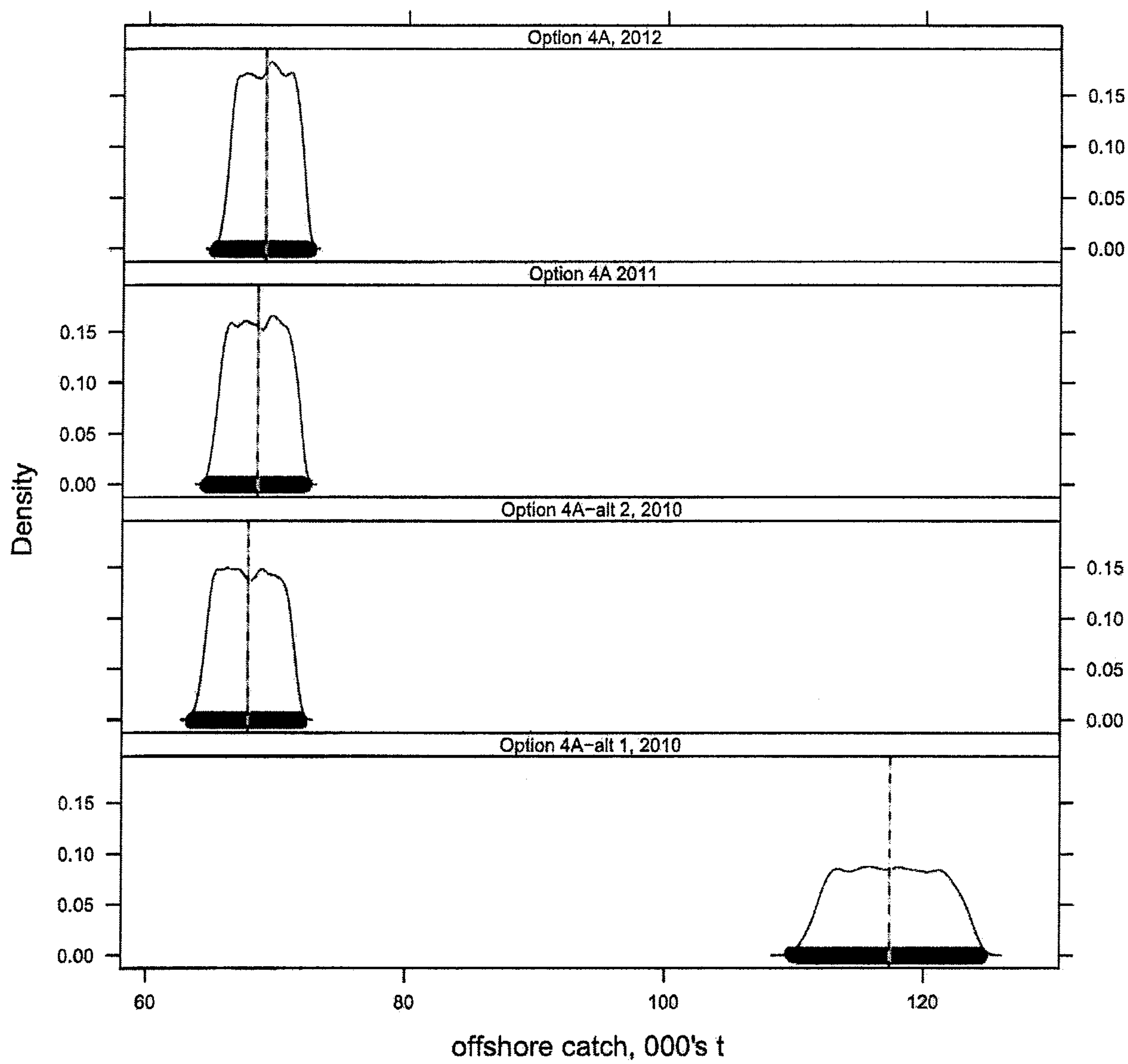
Simulated catch over inshore biomass

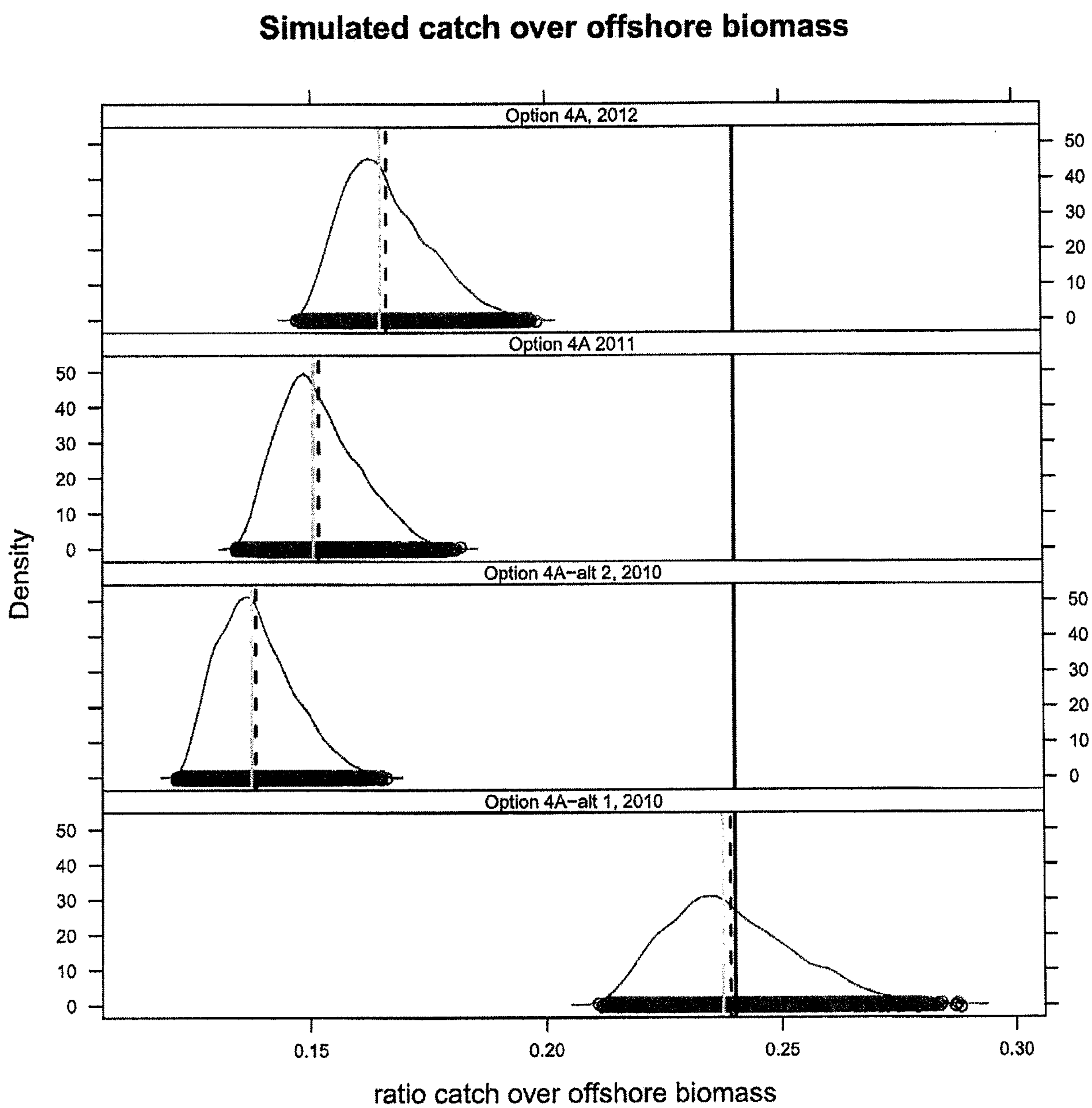


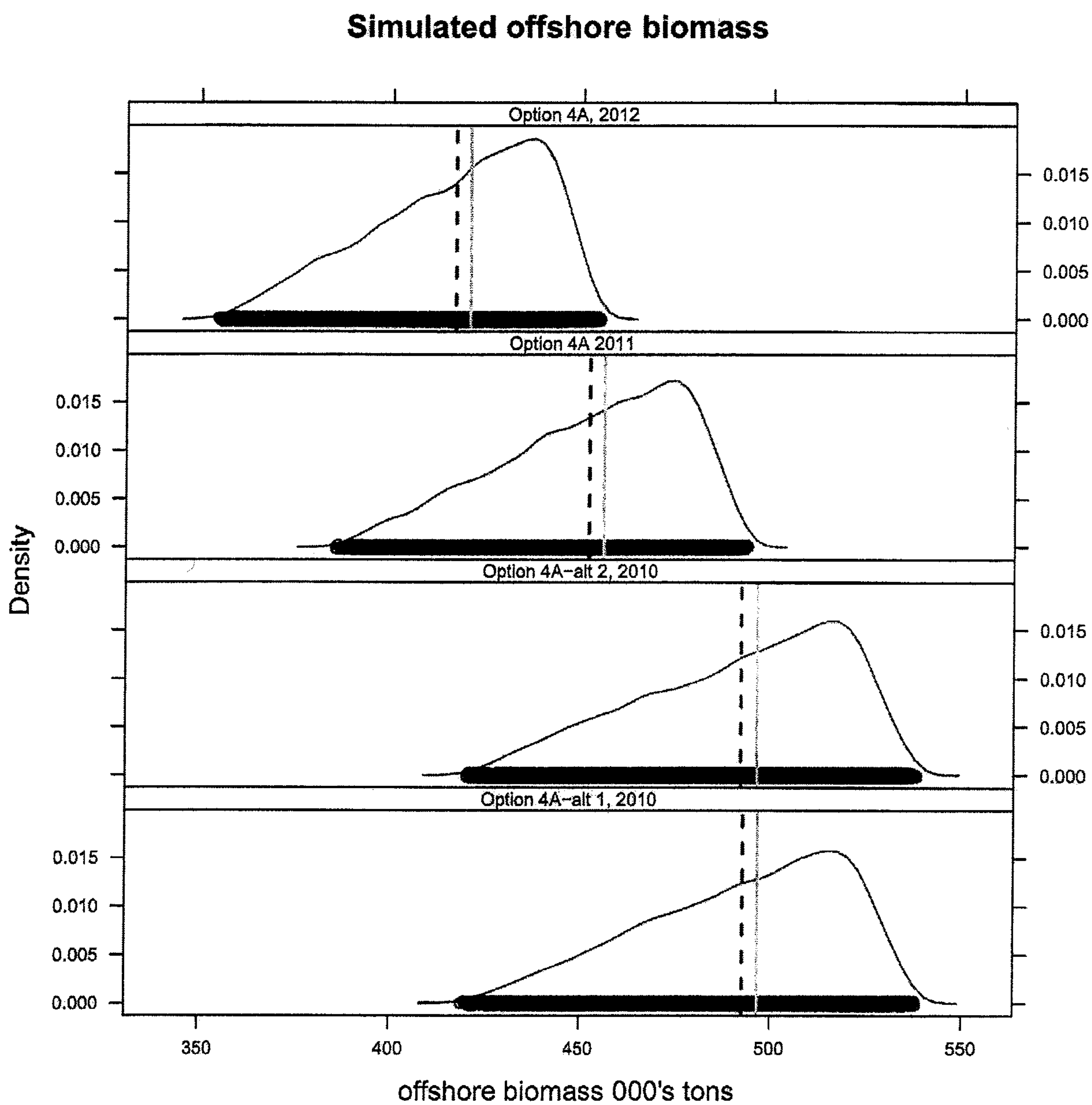


Simulated inshore biomass
Option 4A, 2012
Option 4A 2011
Option 4A−alt 2, 2010
Option 4A−alt 1, 2010
0.015
0.010
0.005
0.000
Density
50
100
150
inshore biomass, 000's t

Simulated offshore catch




Simulated catch over offshore biomass
Option 4A, 2012
Option 4A 2011
Option 4A–alt 2, 2010
Option 4A–alt 1, 2010
Density
50
40
30
20
10
0
0.15
0.20
0.25
0.30
ratio catch over offshore biomass


Simulated offshore biomass
Option 4A, 2012
Option 4A 2011
Option 4A−alt 2, 2010
Option 4A−alt 1, 2010
Density
0.000
0.005
0.010
0.015
350
400
450
500
550
offshore biomass 000's tons

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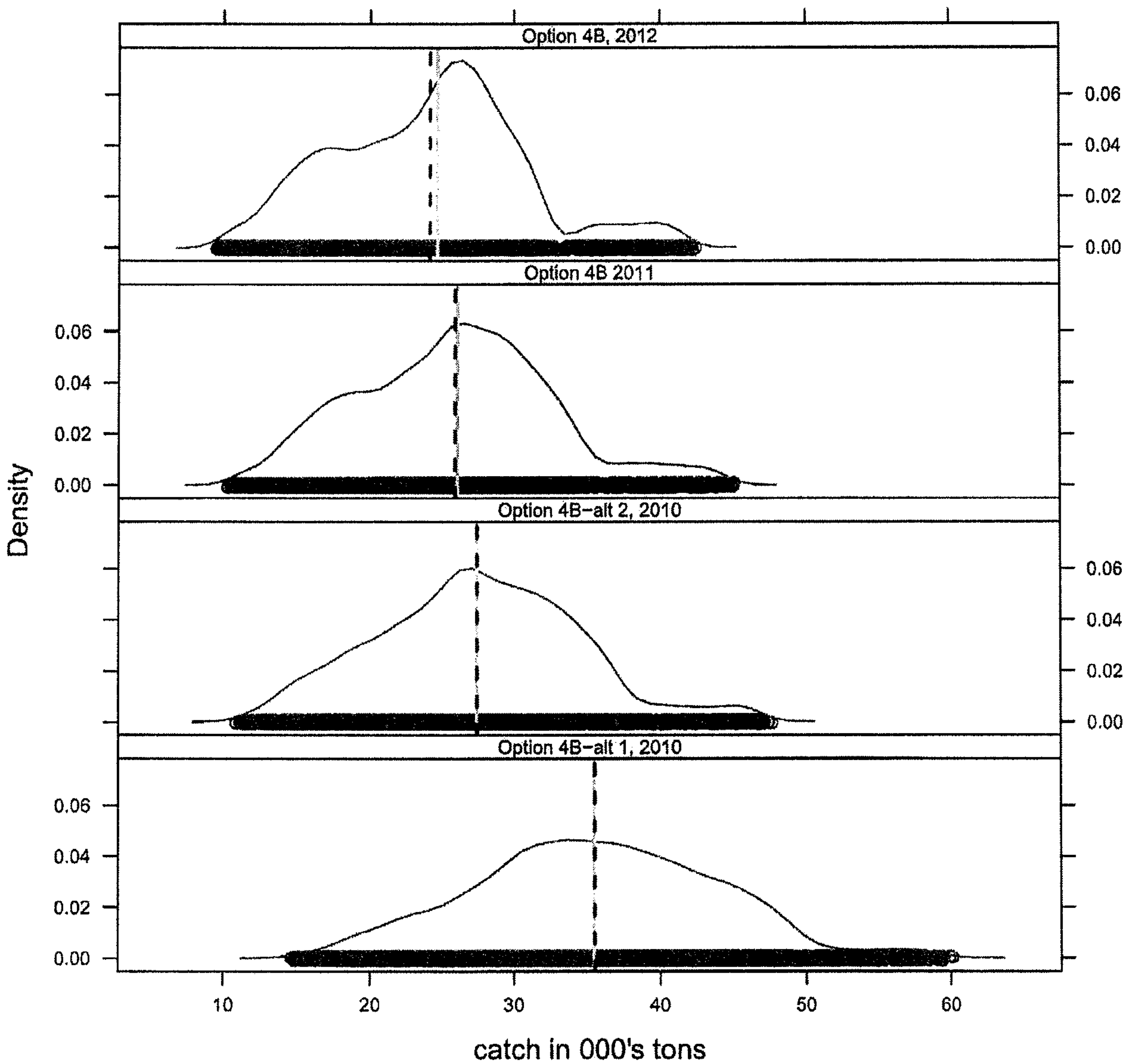
APPENDIX III:

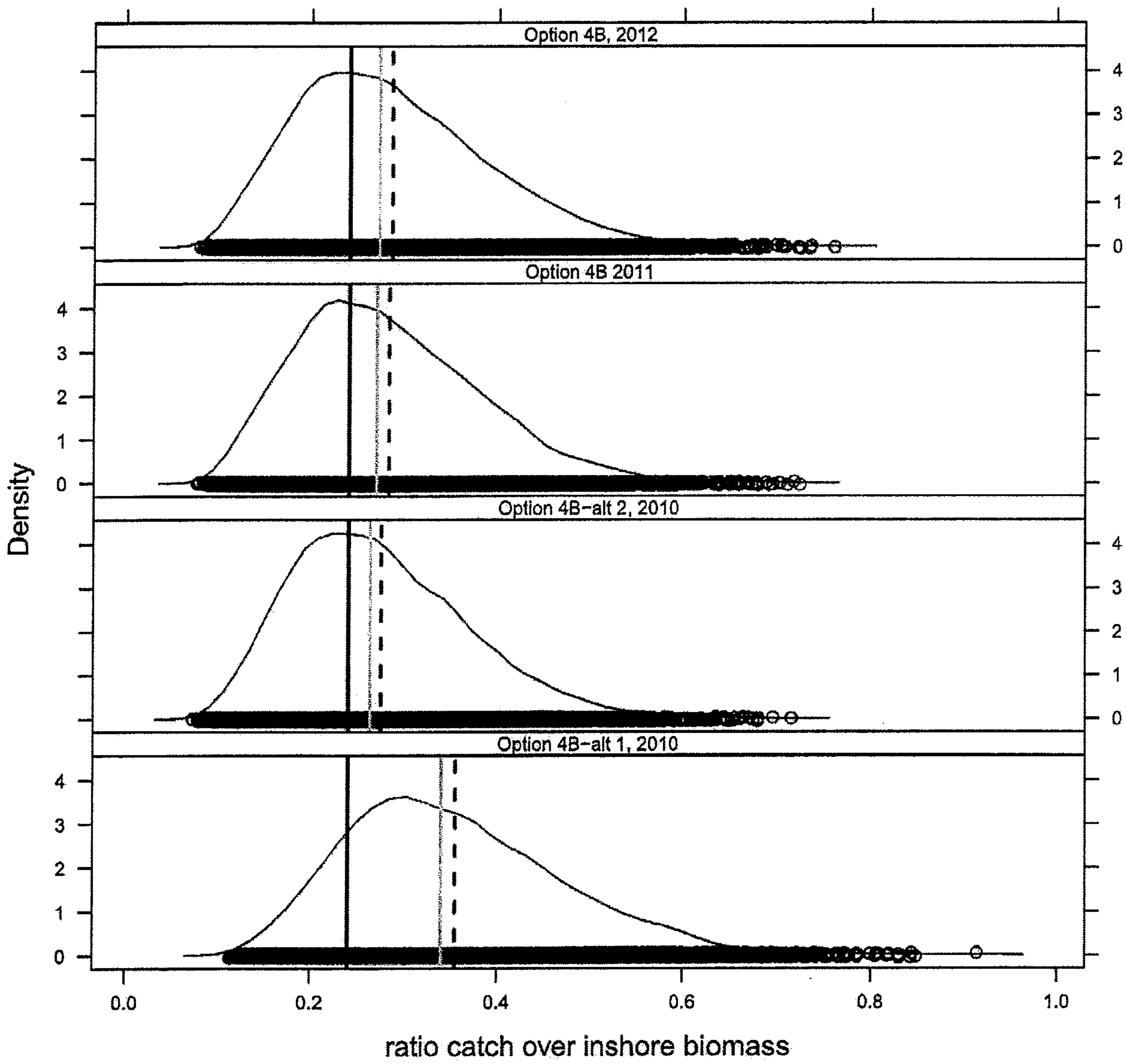
OPTION 4B

Intentionally Blank

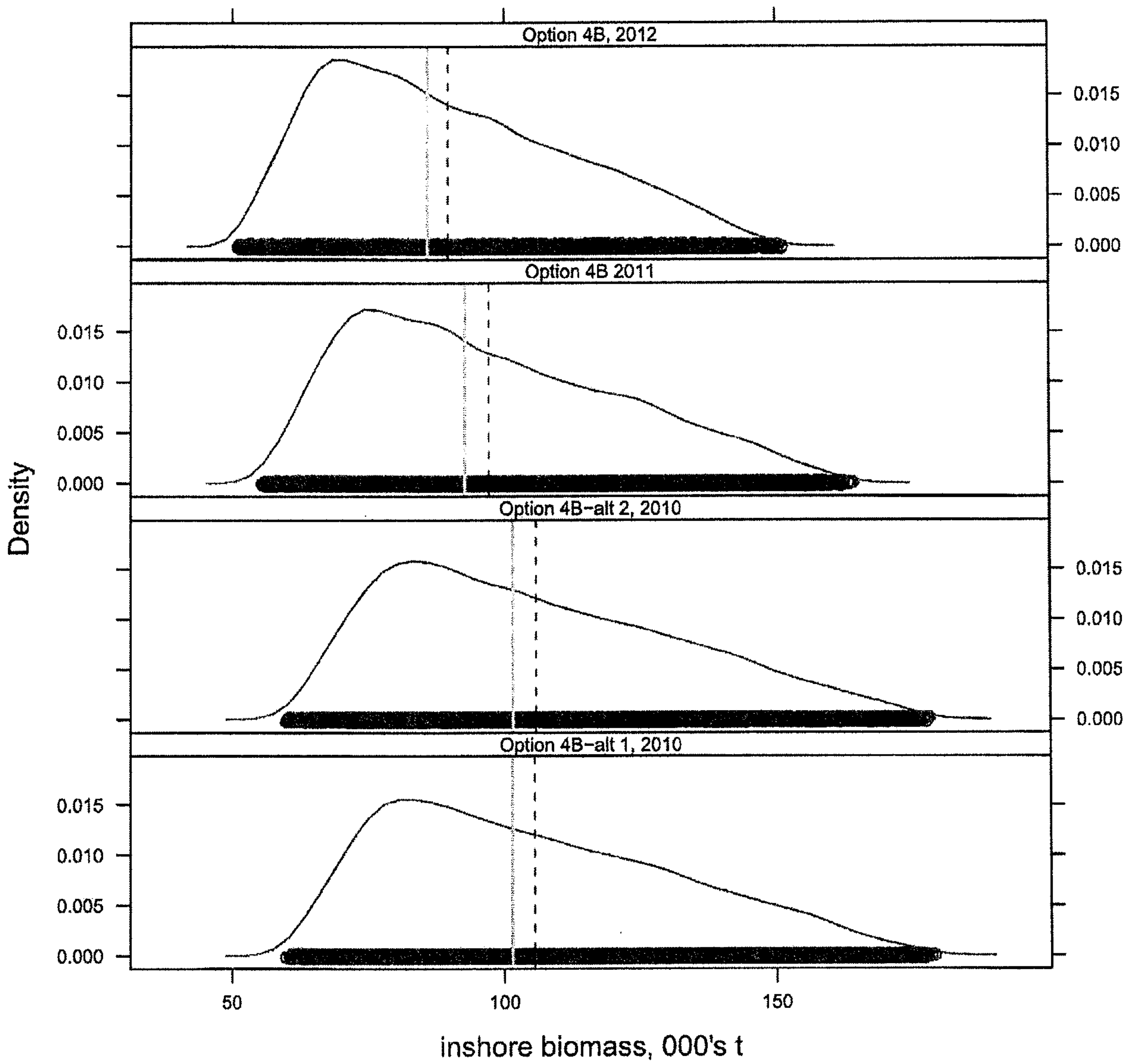
Simulated inshore removals

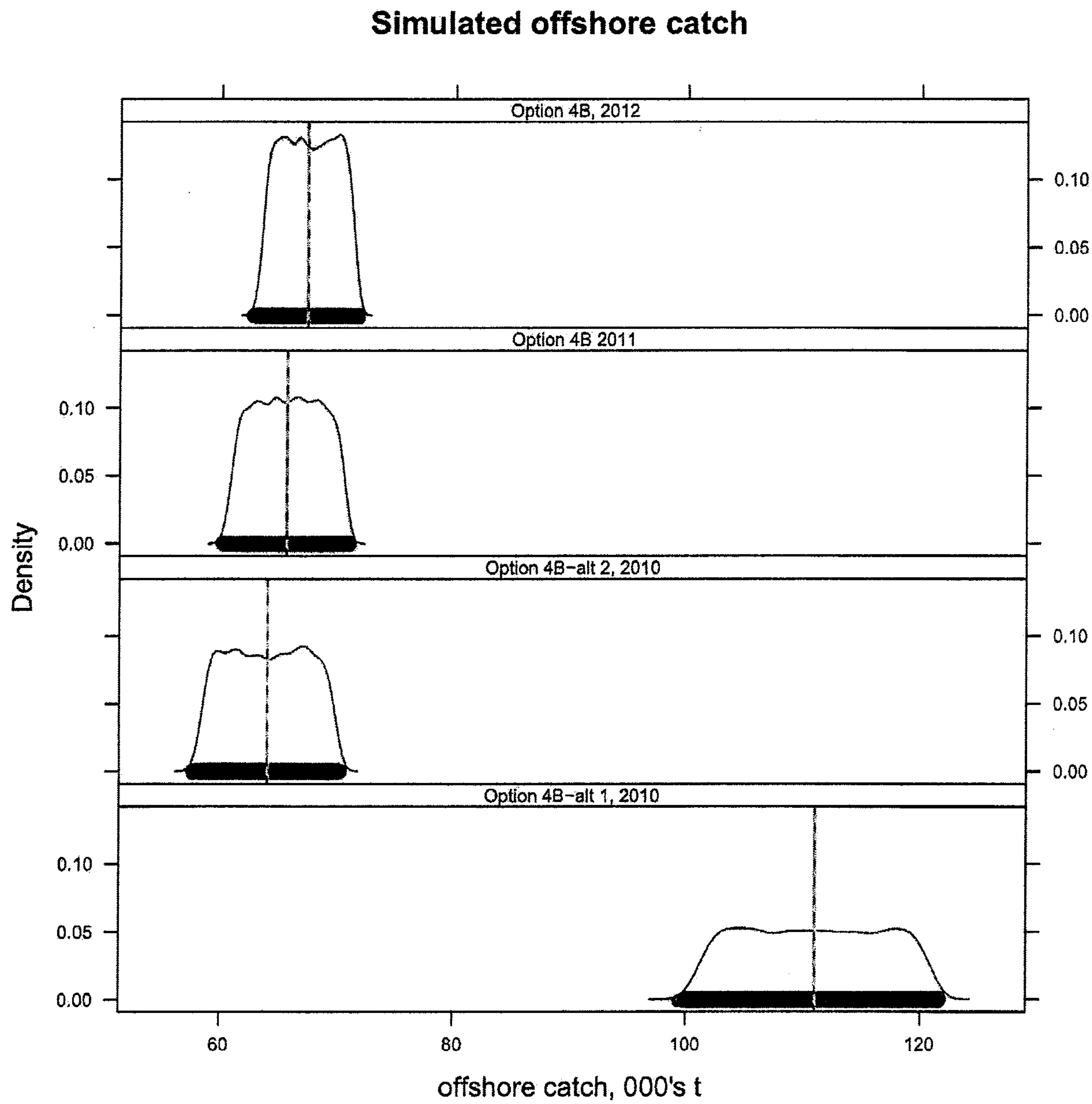


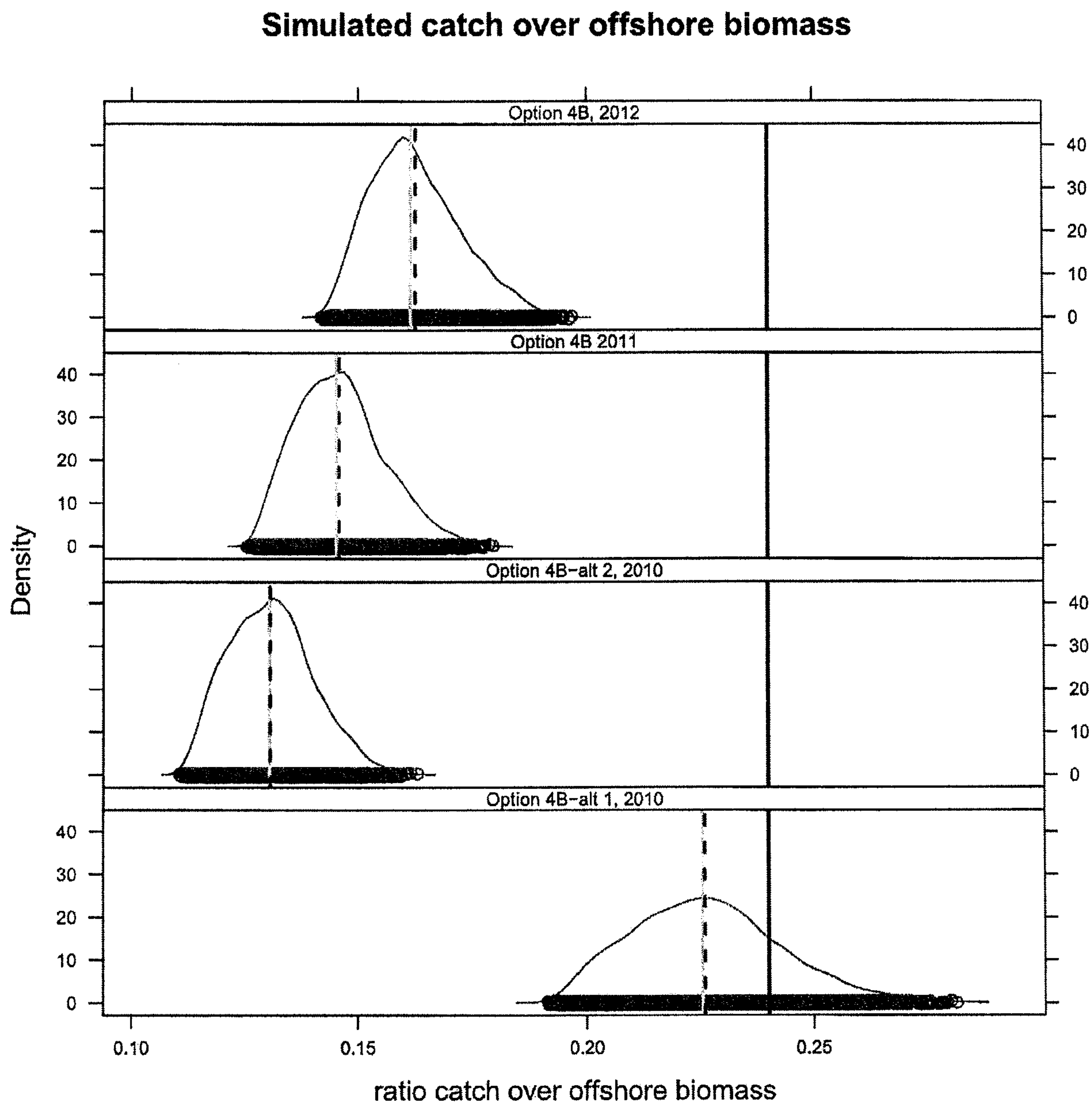
Simulated catch over inshore biomass

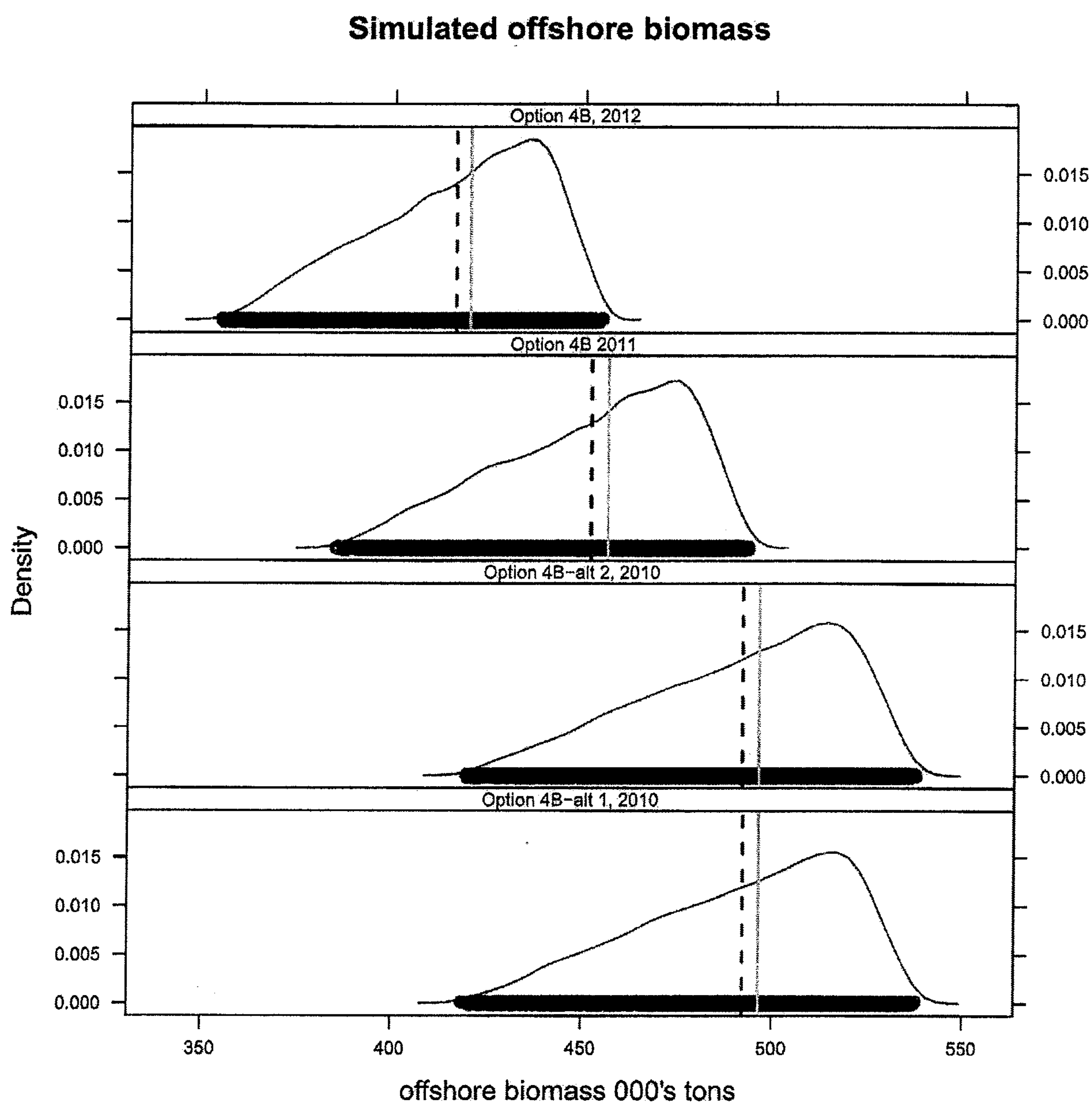


Simulated inshore biomass




Simulated offshore catch
Option 4B, 2012
Option 4B 2011
Option 4B-alt 2, 2010
Option 4B-alt 1, 2010
Density
0.00
0.05
0.10
60
80
100
120
offshore catch, 000's t


Simulated catch over offshore biomass
Option 4B, 2012
Option 4B 2011
Option 4B-alt 2, 2010
Option 4B-alt 1, 2010
Density
40
30
20
10
0
0.10
0.15
0.20
0.25
ratio catch over offshore biomass


Simulated offshore biomass
Option 4B, 2012
Option 4B 2011
Option 4B-alt 2, 2010
Option 4B-alt 1, 2010
Density
0.000
0.005
0.010
0.015
350
400
450
500
550
offshore biomass 000's tons

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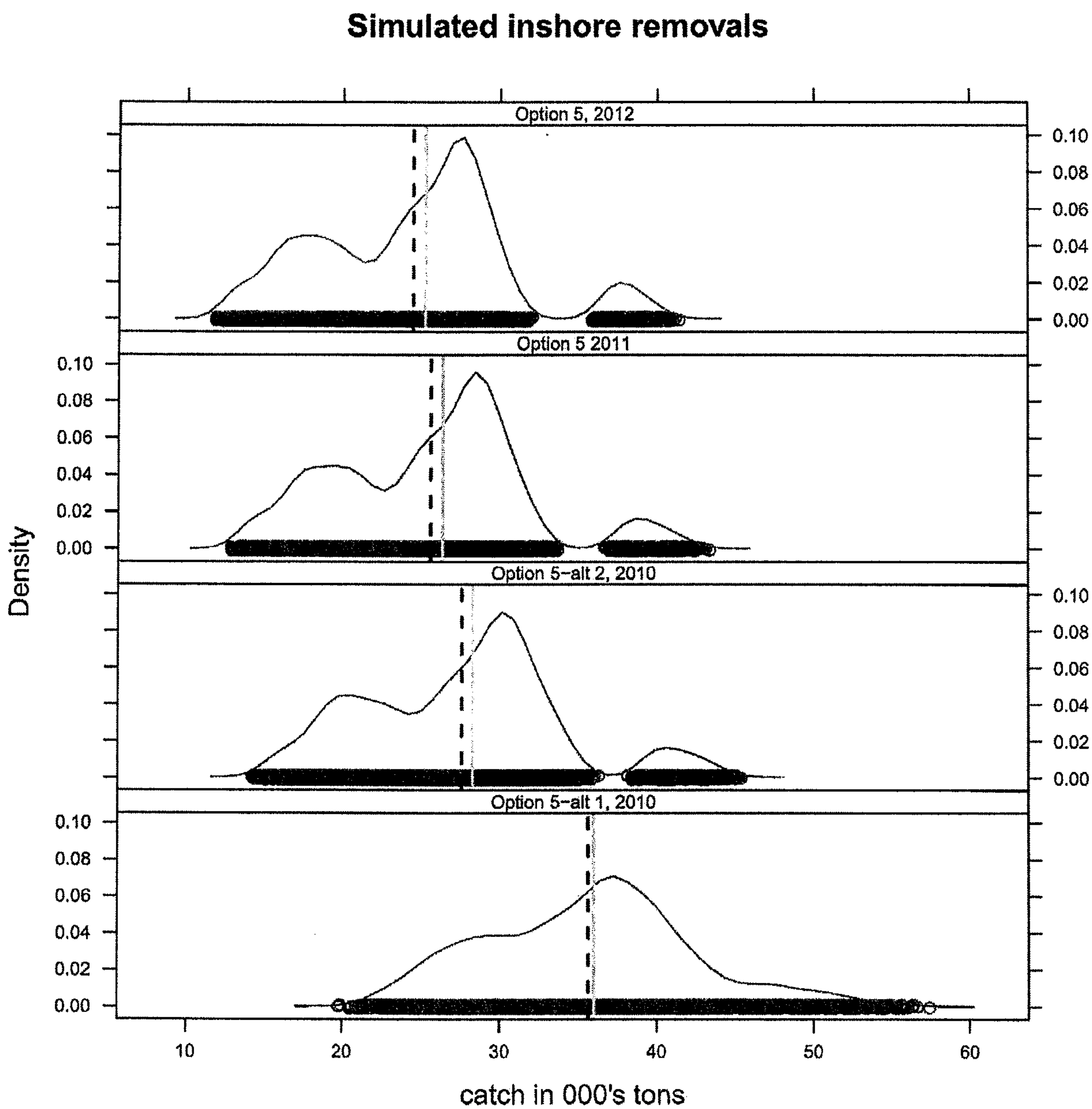
APPENDIX III:

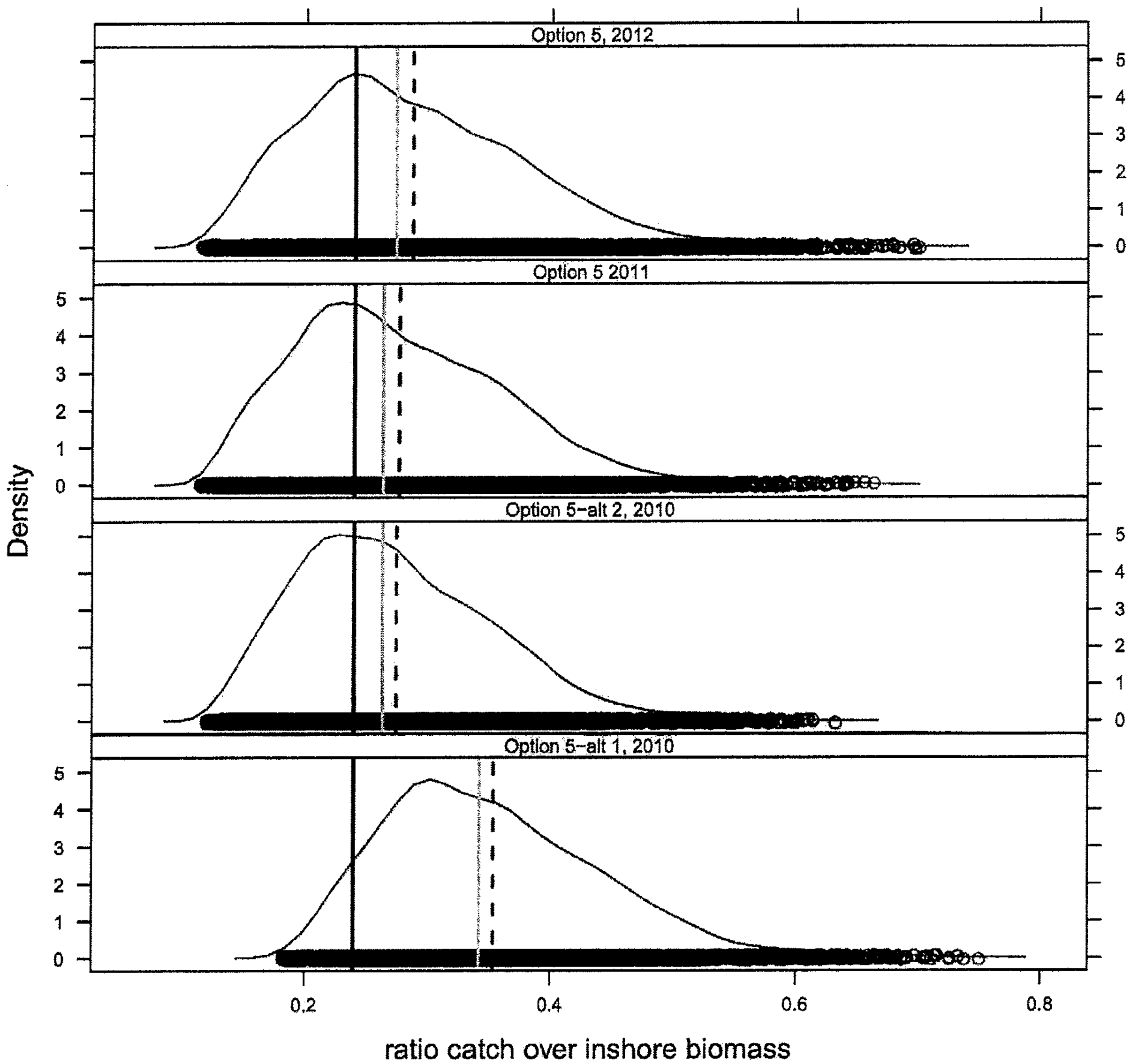
OPTION 5

Intentionally Blank

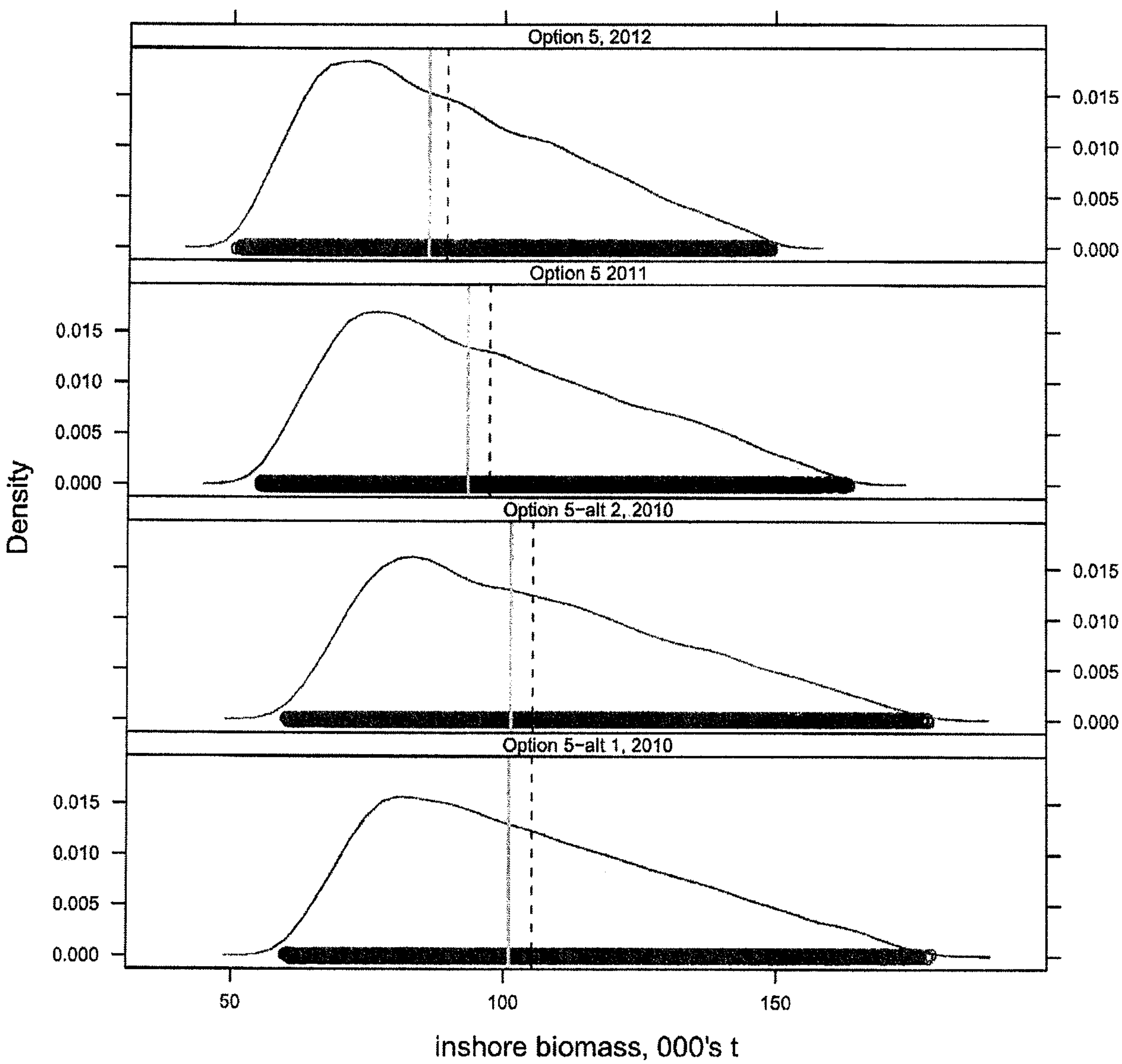


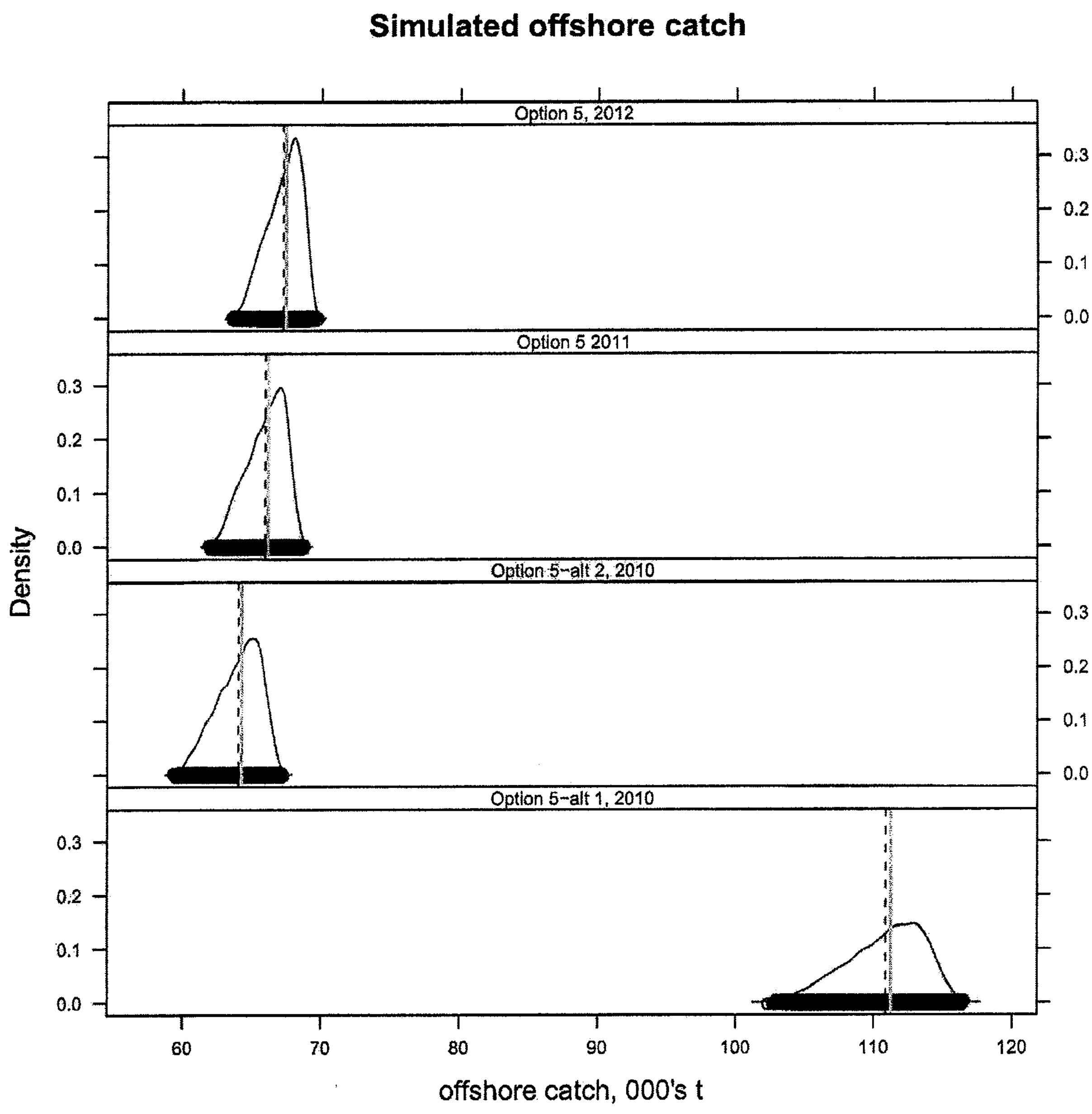
Simulated inshore removals
Option 5, 2012
Option 5 2011
Option 5-alt 2, 2010
Option 5-alt 1, 2010
Density
0.10
0.08
0.06
0.04
0.02
0.00
10
20
30
40
50
60
catch in 000's tons

Simulated catch over inshore biomass

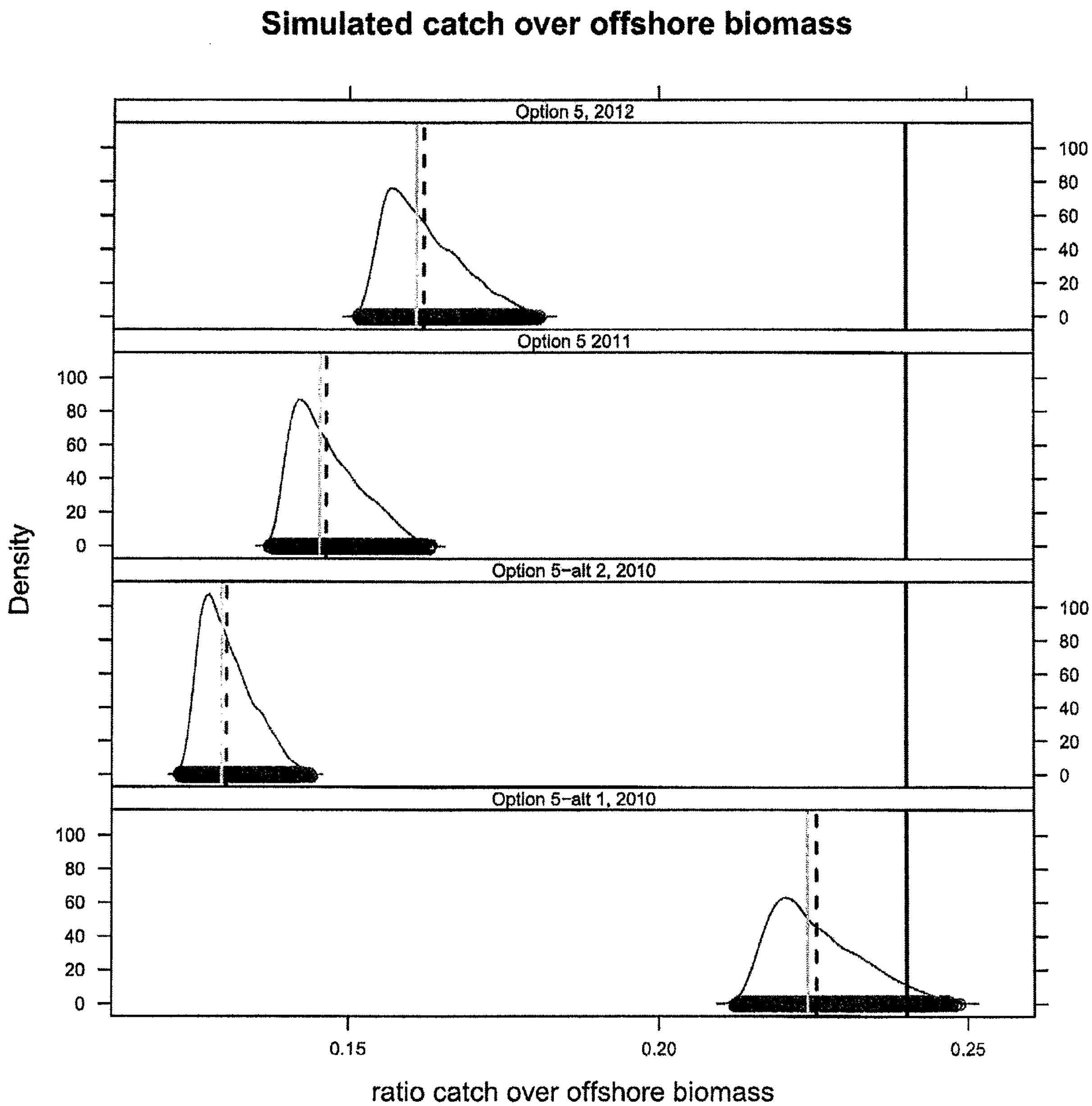


Simulated inshore biomass

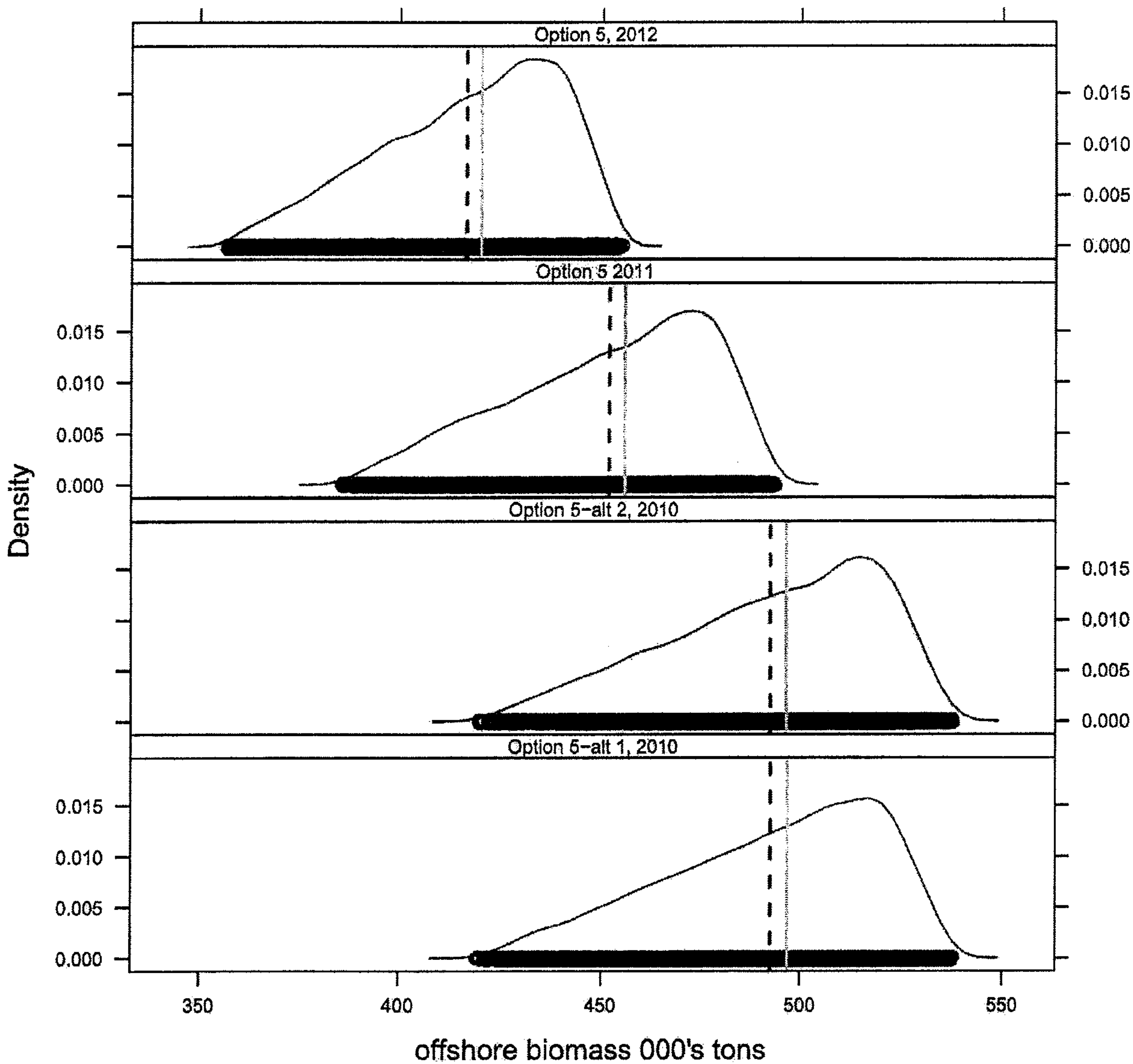




Simulated offshore catch
Option 5, 2012
Option 5 2011
Option 5-alt 2, 2010
Option 5-alt 1, 2010
Density
0.0
0.1
0.2
0.3
60
70
80
90
100
110
120
offshore catch, 000's t


Simulated catch over offshore biomass
Option 5, 2012
Option 5 2011
Option 5-alt 2, 2010
Option 5-alt 1, 2010
Density
0
20
40
60
80
100
0.15
0.20
0.25
ratio catch over offshore biomass

Simulated offshore biomass



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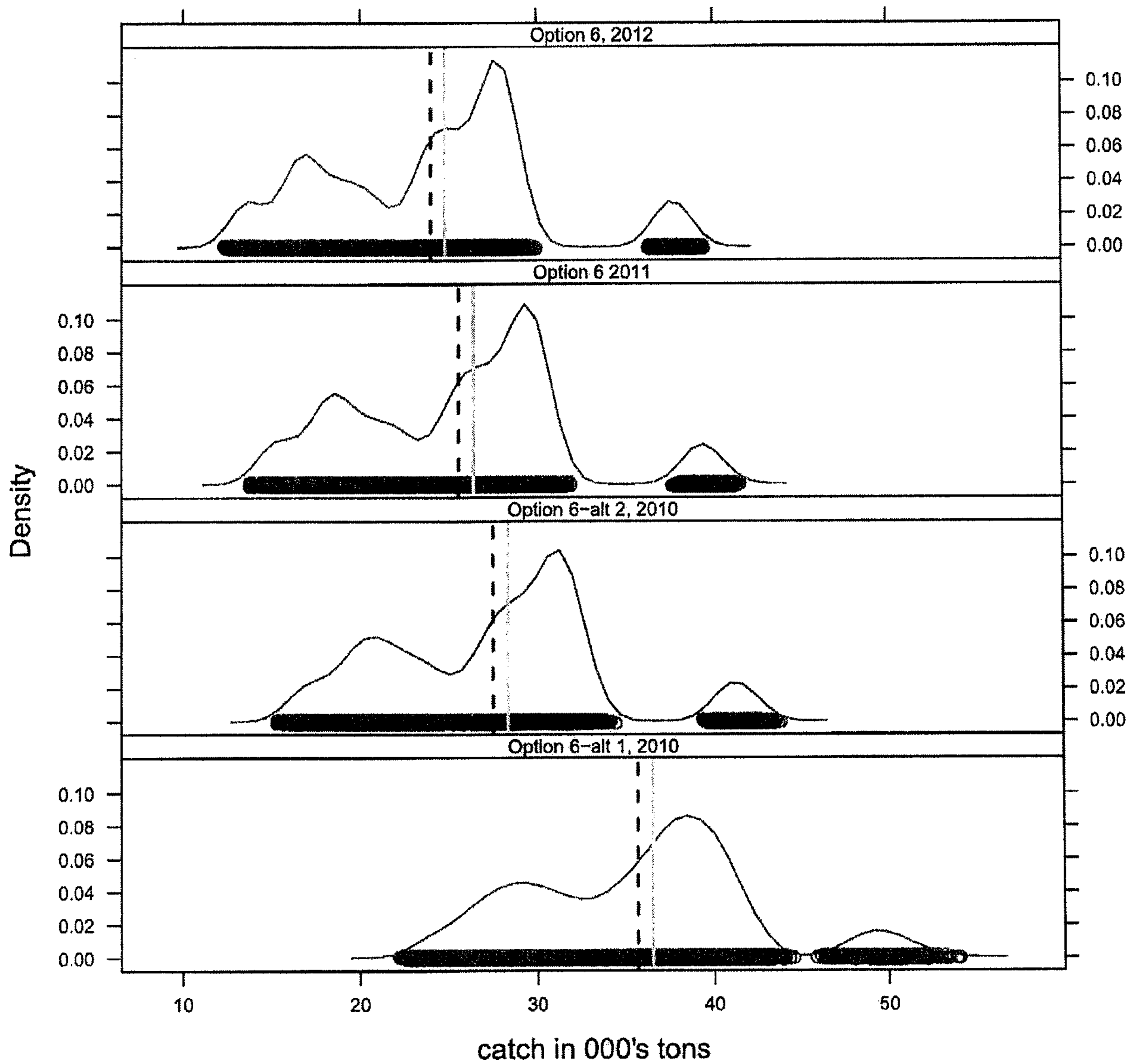
APPENDIX III:

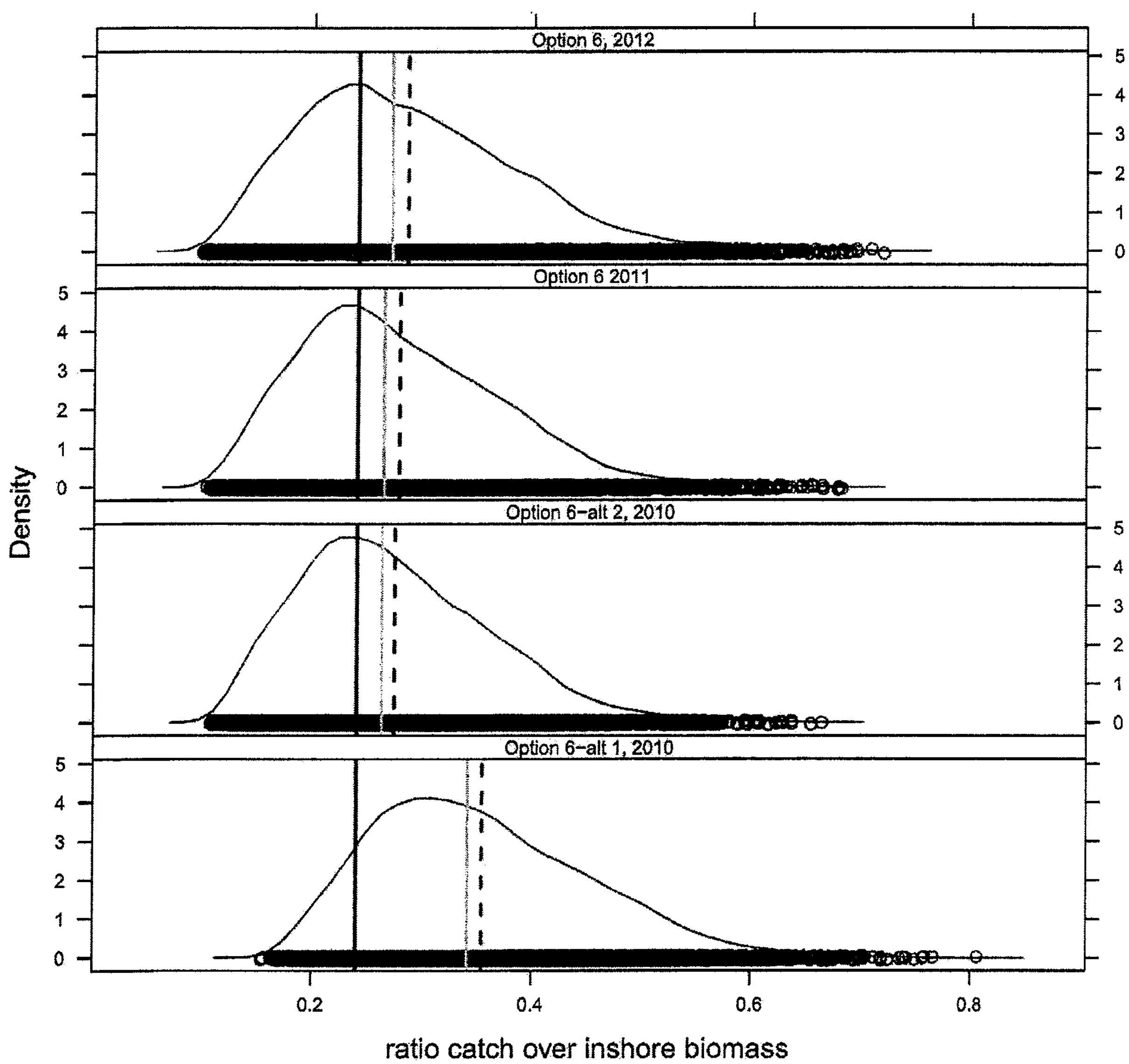
OPTION 6

Intentionally Blank

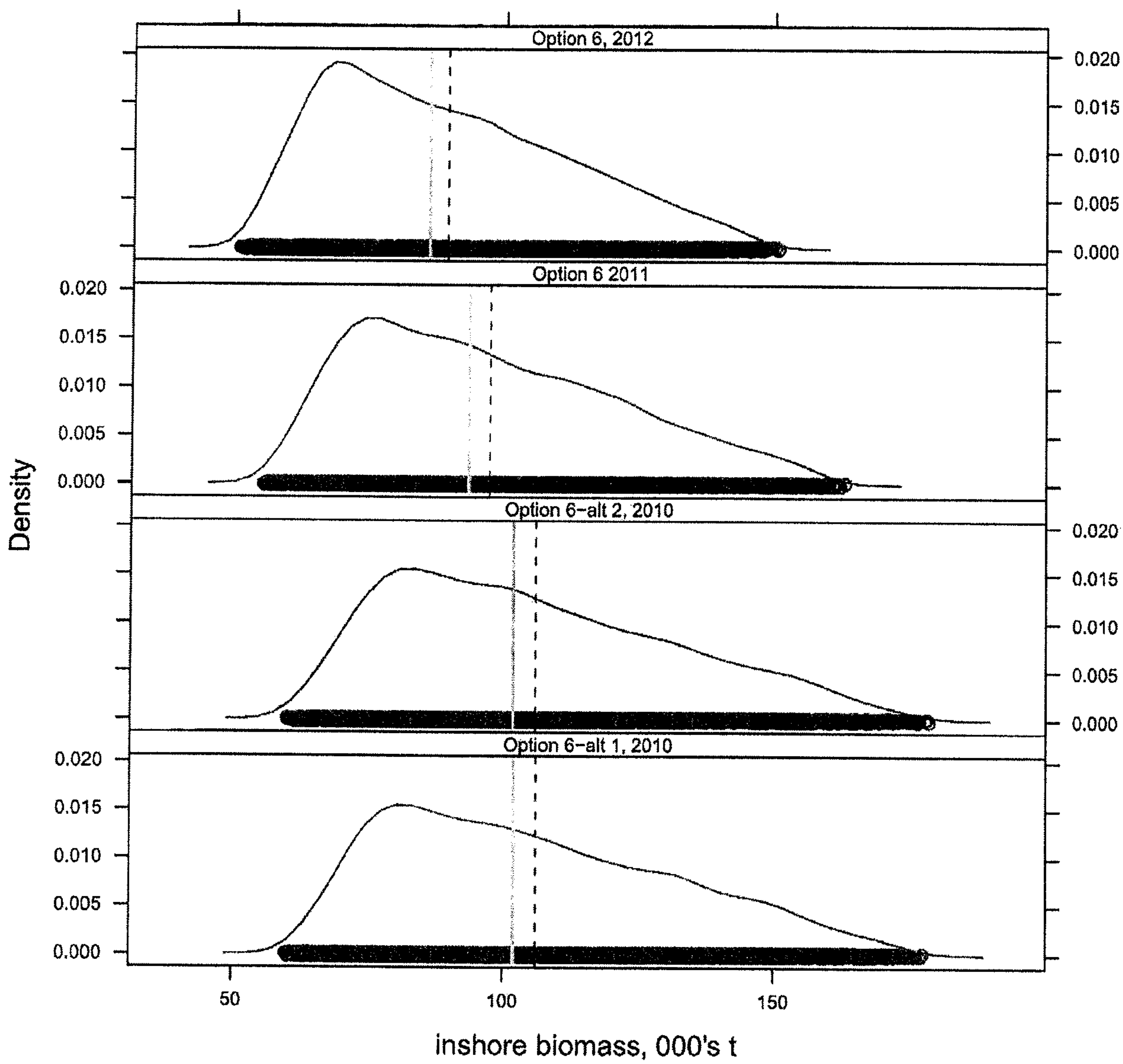
Simulated inshore removals

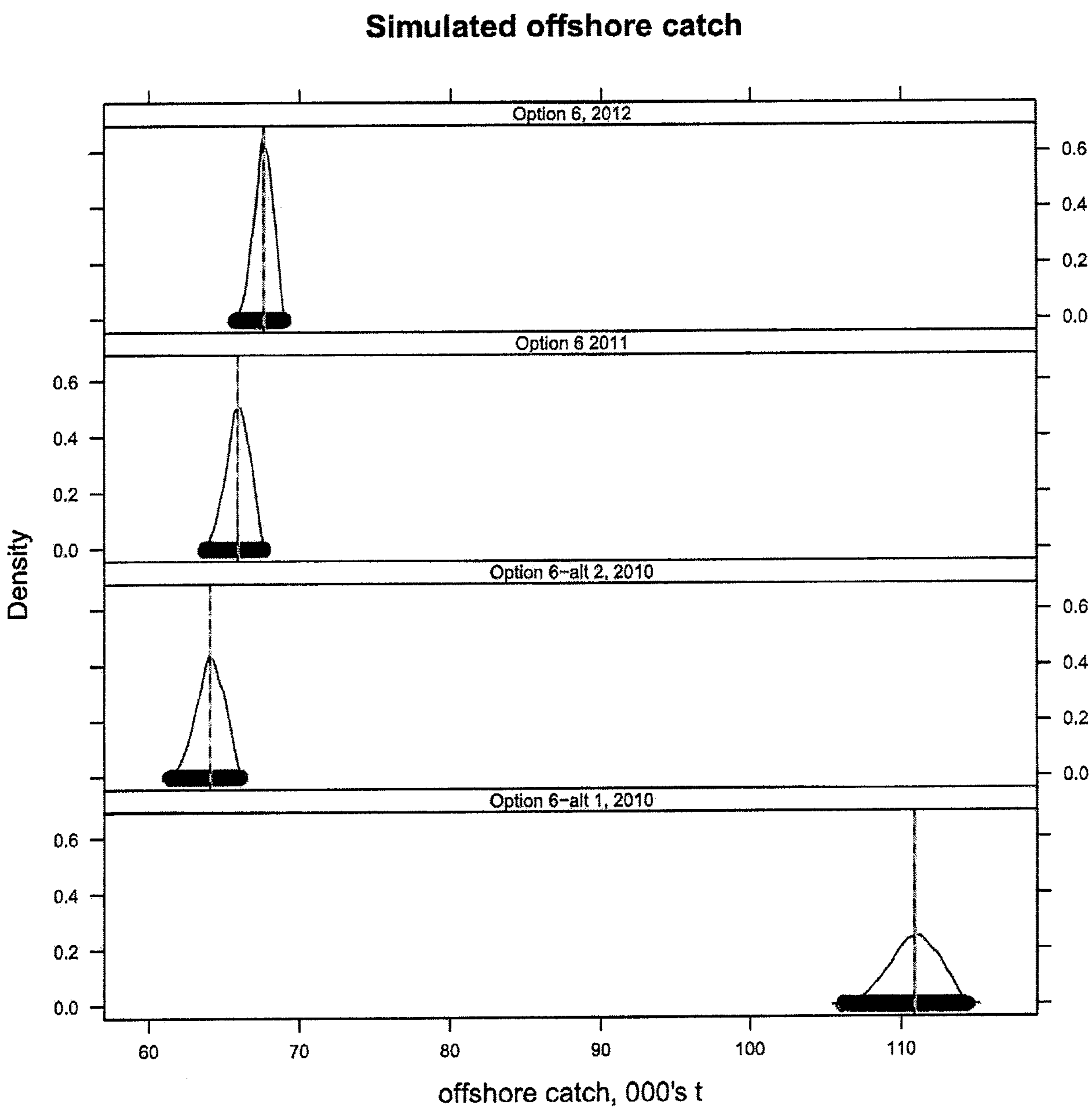


Simulated catch over inshore biomass



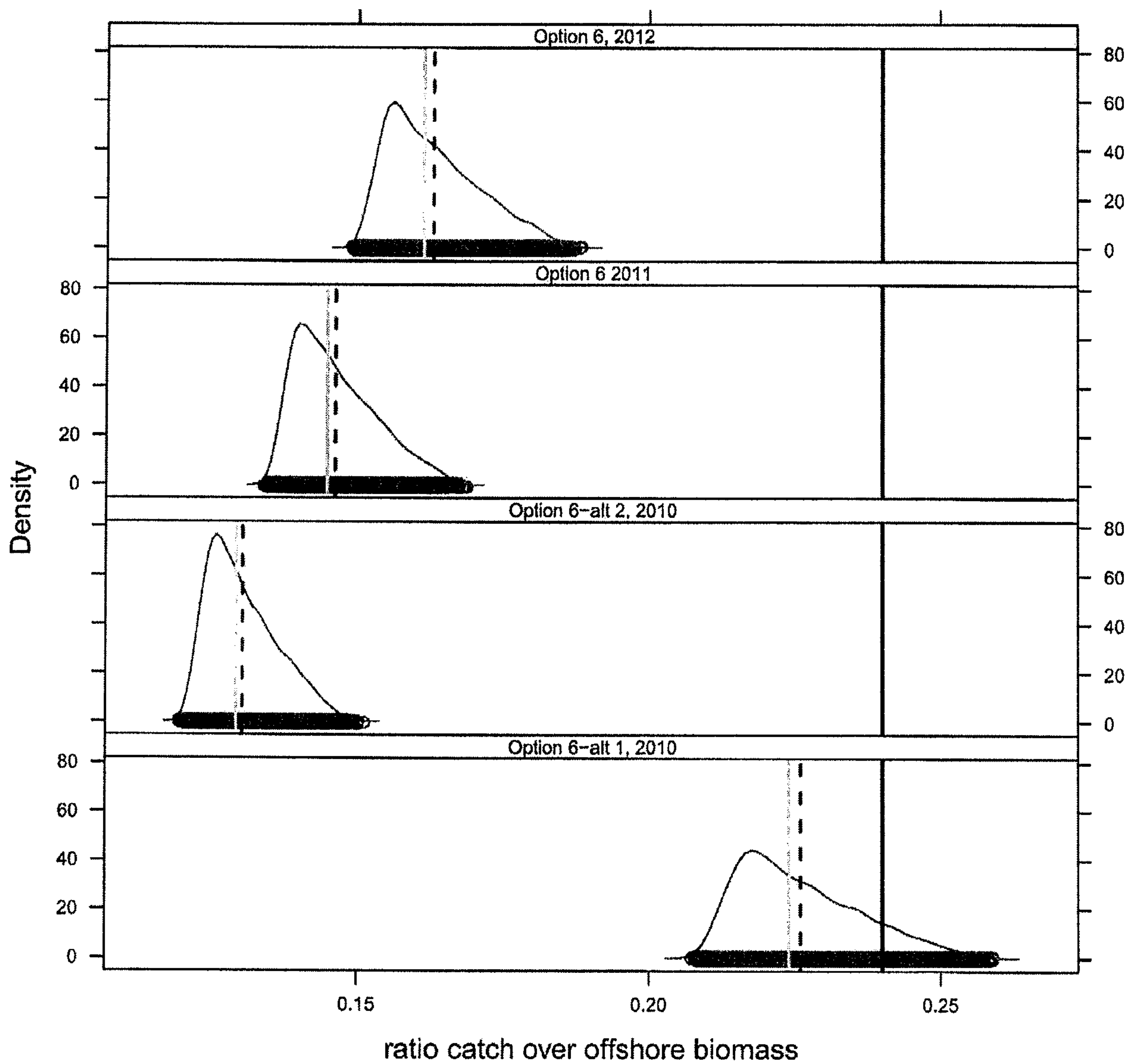
Simulated inshore biomass

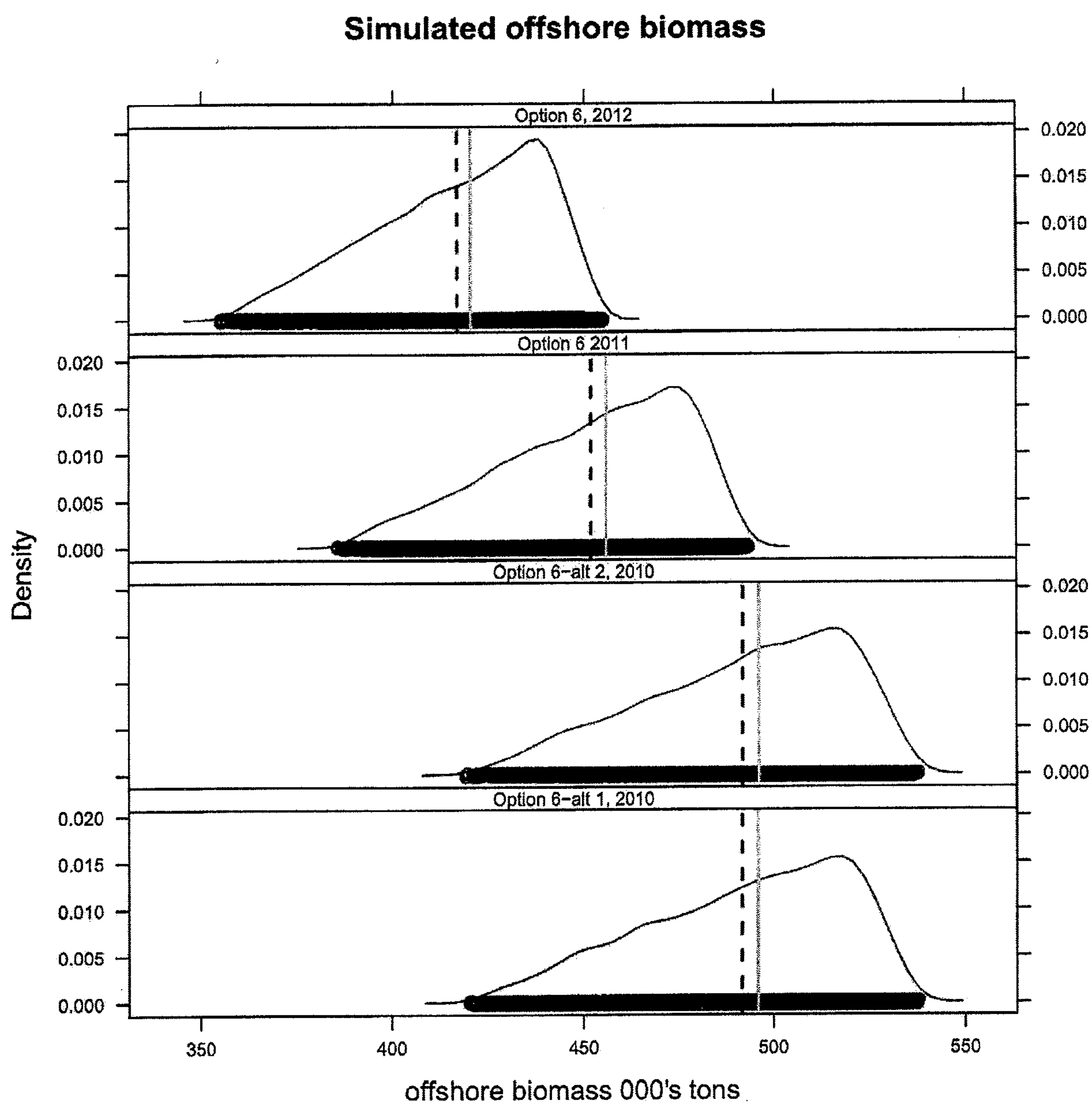




Simulated offshore catch
Option 6, 2012
Option 6 2011
Option 6-alt 2, 2010
Option 6-alt 1, 2010
Density
0.0
0.2
0.4
0.6
60
70
80
90
100
110
offshore catch, 000's t

Simulated catch over offshore biomass





Simulated offshore biomass
Option 6, 2012
Option 6 2011
Option 6-alt 2, 2010
Option 6-alt 1, 2010
Density
0.020
0.015
0.010
0.005
0.000
350
400
450
500
550
offshore biomass 000's tons