Appendix III

Impacts of Alternatives Under Consideration in Amendment 5 to Allocate Observer Coverage on Limited Access Herring Vessels

1.0 INTRODUCTION AND BACKGROUND

Alternatives Under Consideration:

Alternative 1: No Action
Alternative 2: Require 100% Observer Coverage on Limited Access Herring Vessels
Alternative 3: Require SBRM Coverage Levels as Minimum Levels
Alternative 4: Allocate Observer Coverage Based on Council-Specified Targets/Priorities

Funding Options

Option 1: No Action
Option 2: Federal and Industry Funds

Options for Observer Service Providers

Option 1: No Action
Option 2: States Authorized as Service Providers

1.1 HERRING PDT ANALYSIS

The Herring PDT began working on analyses related to the allocation of observer coverage in the Atlantic herring fishery in 2009, as the Committee and Council continued to discuss issues and develop the details of the alternatives for Amendment 5. Much of the PDT's preliminary work/analysis during 2009 and 2010 informed decision-making and the development of the details of the Amendment 5 alternatives.

As an important step in this analysis, the Herring PDT reviewed in detail all available catch/bycatch sampling data for the Atlantic herring fishery. A preliminary analysis was conducted to examine similarities and differences between bycatch data collected by observers versus portside samplers (see Appendix IIA in Volume II). The PDT formed a working group to examine all available data from overlapping portside/sea sampling trips in detail to investigate differences between the data sets and discuss sampling methodologies. Understanding the reasons for the differences between portside and at-sea estimates will improve the overall understanding of the data and increase the usefulness of future data collected through both programs. The working group met informally between PDT meetings during 2010 and 2011 to wade through the details of the sampling data and develop general approaches to analyses prior to full PDT meetings.

The PDT continued to discuss data issues and conducted a second review of the sampling data in early/mid 2011, to further investigate sampling and bycatch estimation methods from both the at-sea and portside sampling programs, to consider the intensity of sampling, to gain a better understanding of how variation in the system may be influencing the analyses. This second phase of the PDT assessment (see

Appendix IIB in Volume II) will frame the recommendations in Amendment 5 regarding how portside sampling data can continue to be utilized to improve catch monitoring and bycatch estimation in the herring fishery. In general, the analysis shows that there is better agreement than previously thought between the two programs with respect to river herring bycatch estimation, although problems exist with specific portside methods. It will be important to identify and consider the strengths and weaknesses of both programs in order to determine the best way to combine the programs and generate the most precise estimate of bycatch, especially since a large component of the "bycatch" in this fishery is landed. However, sea sampling remains the best method for estimating bycatch and provides important information about catch and the operation of the fishery that cannot be generated from a portside sampling program.

During 2011, Council staff worked with NMFS NERO staff and the Herring PDT to review available data and develop/analyze potential management alternatives that capture the Council's intent with respect to the range of alternatives that was approved in January 2011. To streamline the Amendment 5 document and promote ease of understanding, several elements of the Amendment 5 measures were "packaged" into the range of alternatives that will be incorporated into the Draft EIS. As such, a few notable changes have been made to the management alternatives since the January 2011 version:

- When the Council approved the range of alternatives for Amendment 5, it eliminated alternatives that proposed to establish a Federal portside sampling program for the herring fishery from further consideration at this time. As a result, the ***Funding Options*** only apply to catch monitoring at-sea and have been incorporated into the alternatives described in this document.
- The fifth option approved by the Council for consideration in January is intended to improve the accuracy of river herring bycatch estimates by overlaying a seasonal stratification of SBRM-allocated observer days.. The Herring PDT explored this option and attempted to develop analyses to illustrate such an approach. However, the details of this approach could not be developed at this time because of data limitations (see additional discussion below). While this option no longer appears as a stand-alone alternative, Council staff and the PDT have incorporated the Council's intent into the range of alternatives under consideration to allocate observer days (for example, some of the alternatives propose to include a PDT process to supplement the SBRM process, to consider the allocation of additional observer days to address river herring priorities identified by the Council).

Several different management measures/options were approved by the Council in January 2011 to address the allocation of observer coverage in the Atlantic herring fishery. **These measures have now been developed into *Alternatives to Allocate Observer Coverage on Limited Access Herring Vessels*** (See Volume I). Each management alternative under consideration includes measures/options that:

1. Establish targets/priorities for annually allocating observer coverage sea days on limited access herring vessels (Categories A/B/C when on a declared herring trip);
2. Specify a process through which the distribution of observer days is evaluated and considered annually by the Council relative to other priorities and funding needs;
3. Specify a funding source (and any related provisions) for observer days that may be required beyond those that can be funded using Federal resources; and
4. Establish provisions for utilizing observer service providers and authorizing waivers, if necessary.

Once the general range of alternatives was approved in January 2011, the Herring PDT began to develop a more focused method of evaluating the approaches under consideration and assessing the potential impacts on the Atlantic herring fishery. The PDT discussed possible levels of coverage to consider in the context of the management options the Council had identified. Several options in the document focus on methodologies for determining observer coverage levels from the Standardized Bycatch Reporting

Methodology (SBRM). The Council has also developed an option that would require observer coverage to be at a level that would allow for catch estimates to be generated for herring and haddock with a 30% coefficient of variation (CV) and river herring with a 20% CV (i.e., more precise).

1.2 GENERAL IMPACTS OF ALTERNATIVES UNDER CONSIDERATION – HERRING PDT COMMENTS

The Herring PDT offers the following comments that apply to the alternatives under consideration to allocate observer coverage on limited access herring vessels.

An important consideration for **Alternative 1, Alternative 3, and Alternative 4** relates to understanding precision targets. CVs (coefficients of variation) provide a convenient way to compare the relative uncertainty of two estimates (lower is better), but they must be interpreted carefully. Assuming a normal distribution, ***doubling*** the CV produces the approximate 95% confidence interval. For example, a CV of ***0.30*** for a bycatch estimate (or 30%) means that if the data could be re-sampled or re-collected, the resulting new estimate would be within ***± 60%*** of the original estimate 95% of the time (the other 5% of the time the new estimate would be more than 60% different). Also, by not including certain sources of uncertainty (e.g. within-tow variability from basket sampling, fish stratification, other factors), the true uncertainty is even greater than what is suggested by SBRM calculations of CV.

- The Council is clearly interested in generating both precise and accurate estimates of catch and bycatch in the Atlantic herring fishery. The SBRM methodology relies on a ratio estimator, which carries an inherent bias that is inversely proportional to the sample size (i.e. more samples yields a smaller bias). Despite this slight bias, the ratio estimator is still desirable because it uses information about the total amount of catch to minimize the uncertainty surrounding the bycatch estimate. However, for this benefit to occur there has to be a positive relationship between the amount of bycatch and the total amount of catch. If this relationship does not exist, then the ratio estimator may not be an appropriate method of estimating bycatch in this fishery.
- There are costs associated with increasing the precision of bycatch estimates resulting from observer data. A lower target CV means more sea days/observer trips are required to achieve that level of precision. When observed bycatch events are infrequent yet highly variable, the additional sampling coverage required may be substantial. This tradeoff between precise estimates and the cost of sampling coverage must be thoroughly explored when designing an appropriate observer program and prioritizing available resources. An important question to consider, especially with respect to river herring bycatch, is how much (cost-wise) is it worth to generate a very precise estimate of what is expected to be a relatively low number? Similarly, if there is no reason to suspect that the fleet will encounter river herring in a particular strata, then how much funding should be directed at sampling that strata sufficient enough to try to achieve a specific CV?
- The PDT acknowledges the challenges associated with determining coverage levels and allocating limited sampling resources to achieve target CVs in all strata, particularly in the herring fishery where variability is significant both spatially and temporally. Moreover, the management measures proposed in Amendment 5 could require some sub-areas within the SBRM strata to require observer coverage, consequently moving the entire system away from a random stratified design and towards a more systematic sampling approach designed to meet certain objectives, which should be more clearly specified in the document. This will complicate the development of options designed to achieve target levels of precision across all strata in the fishery. Some bycatch problems can be moving targets, varying seasonally or annually due to regulations, environmental factors, and species abundance. Over the long-term, the process for optimizing the allocation of observer resources requires flexibility and adaptability.

- The vast majority of bycatch in the Atlantic herring fishery is retained and landed, as opposed to discarded at-sea. While this makes applying SBRM methodology difficult, it presents an opportunity to sample the catch portside, as it is offloaded. Initial investigations into the comparability of at-sea and portside sampling found troubling discrepancies between the two programs (Appendix IIA). However, a follow-up analysis identified the source of the discrepancy, and found generally good agreement between the two programs (Appendix IIB). This analysis and the PDT's findings directly relate to the fourth goal set by the Council for the Amendment 5 catch monitoring program: to determine if at-sea sampling provides bycatch estimates similar to dockside monitoring estimates (see Amendment 5 Goals and Objectives).

  This is a significant finding because portside sampling can be a far more efficient use of resources (e.g. $350 to sample a typical midwater trawl trip portside (based on a median trip size of 150 mt and five hours pump out), compared to $3,600 at-sea (based on a median trip length of three days at $1,200 for NEFOP observer coverage per sea day). If an alternative that requires additional observer coverage is adopted, portside sampling could provide a substantially lower cost solution.

2.0 IMPACTS OF ALTERNATIVE 1 (NO ACTION/STATUS QUO)

2.1 THE STANDARDIZED BYCATCH REPORTING METHODOLOGY (SBRM) AND ITS RELATIONSHIP TO THE AMENDMENT 5 ALTERNATIVES

The Standardized Bycatch Reporting Methodology (SBRM) Omnibus Amendment to the fishery management plans of the Northeast region was implemented in February 2008 to address the requirements of the Magnuson-Stevens Fishery Conservation and Management Act to include standardized bycatch reporting methodology in all FMPs of the New England Fishery Management Council and Mid-Atlantic Fishery Management Council.

The SBRM can be viewed as the combination of sampling design, data collection procedures and analyses used to estimate bycatch and allocate observer coverage across multiple fisheries. The SBRM provides a structured approach for evaluating the efficacy of the allocation of observer coverage (sea days) to multiple fisheries (52 fleets) to monitor a large number of species (15 SBRM species groups) under the 13 different fishery management plans, the Marine Mammal Protection Act, and the Endangered Species Act.

Proposed Rule August 21, 2007

Final Rule January 28, 2008

Implementation February 27, 2008

13 FMPs, 39 managed species, 14 types of fishing gear

The purpose of the SBRM amendment is to:

- Explain methods and processes by which bycatch is currently monitored and assessed
- Determine whether the current methods/processes need to be modified and/or supplemented
- Establish standards for precision of bycatch estimates for all Northeast Region fisheries, thereby documenting the SBRM

The SBRM Amendment addresses:

- Bycatch reporting and monitoring mechanisms
- Analytical techniques and allocation of at-sea observers

- SBRM performance standard
- Review and reporting process
- FWA and provisions for annual specifications
- Prioritization process
- Provisions for industry-funded observers and observer set-aside programs

Summary of the (2008) Northeast Region SBRM Amendment

1. **Methods by which data and information on discards are collected and obtained (status quo – NEFOP)**

   SBRM maintains the current methods by which discard data/information are collected and obtained. NEFOP continues to serve the primary mechanism to obtain data on discards in all Northeast Region commercial fisheries managed under one of the FMPs. The SBRM also will incorporate, to the extent practicable and appropriate for the NER, all surveys and data collection mechanisms implemented by NMFS as a result of the agency-wide redesign of the MRFSS Program.

2. **Methods by which the data from #1 are analyzed and utilized to determine the appropriate allocation of at-sea observers**

   SBRM amendment expands/refines the status quo methods by which data obtained through #1 are analyzed and utilized to determine the appropriate allocation of observers to fully incorporate all managed species and relevant gear types in the NER. All filters identified in the amendment will be applied to the results of the analysis to determine the observer coverage levels needed to achieve the objectives of the SBRM.

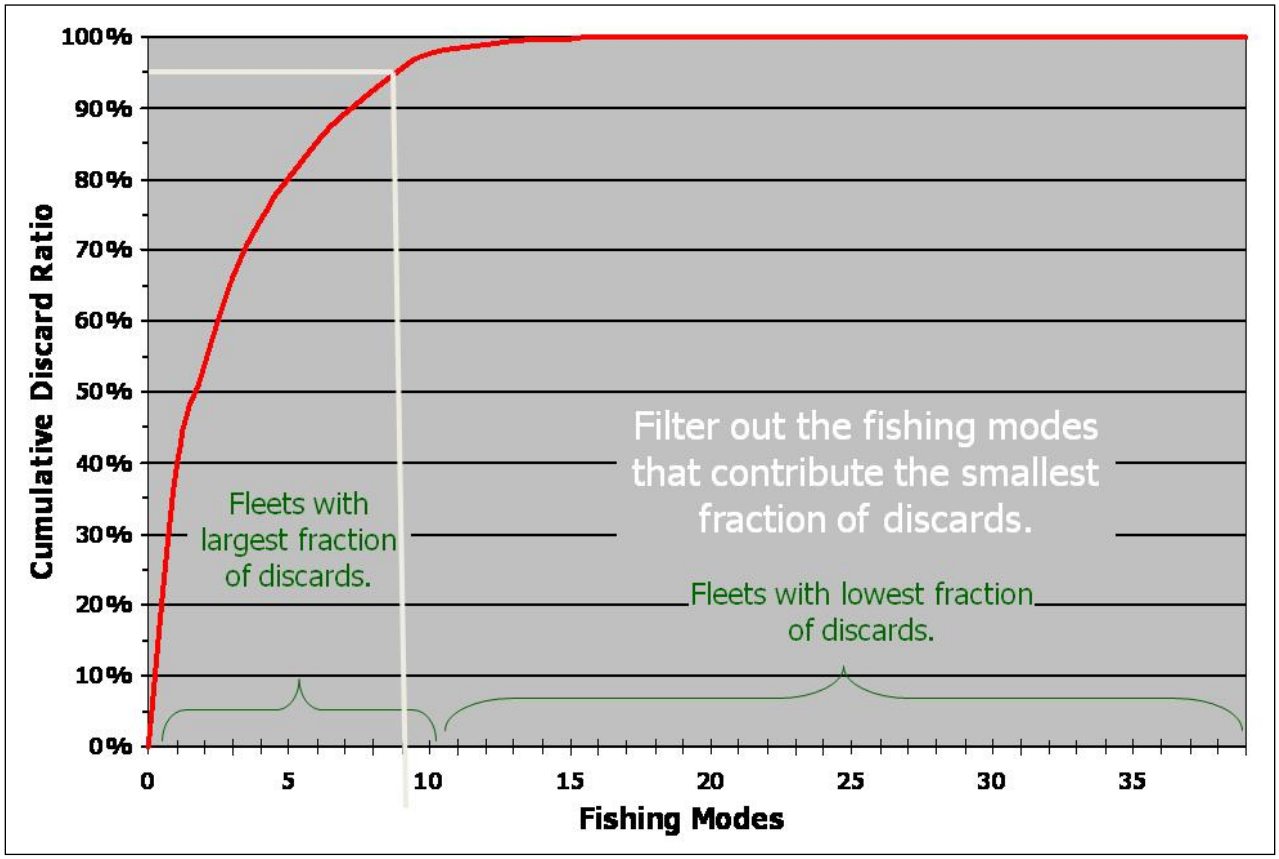
3. **Performance measure by which the effectiveness of the SBRM can be measured, tracked, and utilized to effectively allocate the appropriate number of observer sea days**

   Performance standard set at a 30% CV – to ensure the effectiveness of the SBRM so that it can be measured, tracked, and utilized to allocate the appropriate number of observer days. Each year, the NMFS Regional Administrator and Science Director will (subject to any external operational constraints) allocate observer coverage to the applicable NER fisheries sufficient to achieve a level of precision (measured as the CV) no greater than 30 percent for each applicable species/species group, subject to the filters identified in the amendment.

   Importance Filters: 95% of discards and 98% of total mortality

   If a particular stratum contributes less than 5% to the total discards or less than 2% of the total mortality of a particular species, it is not included in the allocation of observer sea days. An illustrative representation of the 95% discard filter is provided in Figure 1.

Figure 1 SBRM Importance Filter (95% Discards)



4. Process to provide the Council with periodic reports on discards and the effectiveness of the SBRM

SBRM amendment requires an annual report on discards to the Council, prepared by NMFS, and a report every three years that evaluates the effectiveness of the NER SBRM. SBRM amendment lays out the minimum requirements for each of these reports.

5. Measure to enable the Councils to make changes to the SBRM through framework adjustments and/or annual specification packages rather than full amendments;

Changes to the SBRM may be effected either through a framework adjustment or specifications process. Changes that can be considered through these processes include:

- Changes to the CV-based performance standard
- Means by which the discard data are collected/obtained for the fishery
- Reporting on discards or the SBRM
- Stratification (modes) used as the basis for SBRM-related analyses
- Establishment of a requirement for industry-funded observers
- Observer set-aside provisions.

6. **Process to provide the Councils and public with an opportunity to consider, and provide input to, the decisions regarding prioritization of observer coverage allocations**

   In any year in which external operational constraints would prevent NMFS from fully implementing the required observer coverage levels, the RA and Science Director will consult with the Councils to determine the most appropriate prioritization for how the available resources should be allocated. Includes requirements to provide the Councils with: (1) observer coverage levels required to attain the performance standard in each applicable fishery; (2) coverage levels that would be available if the resource shortfall was allocated proportionately across all applicable fisheries; (3) coverage levels that incorporate the recommended prioritization; and (4) rationale for recommended prioritization. Recommended prioritization should be based on meeting the data needs of upcoming stock assessments; legal mandates under MMPA, ESA, or other law; meeting the data needs of upcoming fisheries management actions, taking into account the status of the resource(s); improving the quality of discard data across all fishing modes; and/or other criteria identified by NMFS or the Councils.

7. **Implement consistent, cross-cutting observer service provider approval and certification procedures and enable the Councils to implement either a requirement for industry-funded observers or an observer set-aside program through a framework adjustment rather than FMP amendment**

   The SBRM amendment implements these procedures and enables the Councils to implement either a requirement for industry-funded observers or an observer set-aside program through a framework adjustment rather than full amendment. The intent of the SBRM amendment was to create a more efficient process for the Councils to develop industry-funded programs, should the need arise in any fishery. Actual implementation of an industry-funded observer program that would enable fishing vessels to select from a list of approved service providers would require the Council to initiate, develop, and have approved such a program for each particular fishery.

What does the SBRM do?

- The SBRM provides a general structure for defining fisheries into homogeneous groups and allocating observer coverage based on prior information and the expected improvement in overall performance of the program.
- The SBRM is intended to support the application of multiple bycatch estimation methods that can be used in specific stock assessments.
- The general structure helps identify gaps in existing coverage, similarities among groups that allow for realistic imputation, and the tradeoffs associated with coverage levels for different species.
- The SBRM uses the previous year's information on the precision of estimated discard totals to define sampling targets for an upcoming year.
- The SBRM estimates discards of all species, including river herring, for the 52 fleets in the Northeast region.
- The SBRM allows for continuous improvement in allocation as new information on the results of the previous year's data are obtained.

What does the SBRM not do?

- The SBRM does not estimate incidental catch, retained catch, or landed bycatch.
- The SBRM is not intended to be the definitive document on the estimation methods nor is it a compendium of discard rates and total discards (Wigley et al. (2007).
- The SBRM does not include river herring as one of the species that drives the allocation of observer days (because it is not a federally managed species).

Can the SBRM methodology be utilized to achieve precision targets for river herring bycatch estimates?

- Currently, the answer to this question is "no" because river herring is not listed as one of the bycatch species used in the SBRM to allocate observer days. The SBRM can be used to determine what levels of precision are being achieved under the current allocation of observer coverage across the 52 fleets, but the process does not utilize river herring as a species to determine allocations. If the Council determines that the precision of river herring bycatch estimates is an important factor for allocating observer coverage in the fishery, then this is one of the shortcomings of the no action alternative. Furthermore, most of the river herring bycatch in this fishery is retained (not discarded) and is therefore not addressed by SBRM methodology.
- There are a few important caveats to consider when applying the SBRM approach to river herring – the assumptions about linearity and normality in the SBRM analysis may not hold for river herring because the distribution of the data is not normal (there is a high proportion of zeros), and there is a high degree of variability associated with the data. Seasonality (of the fishery and of river herring migrations/encounters) is also very important to consider. The SBRM approach considers variability associated with observed trips, but does not consider variability associated with any strata where coverage has been limited or absent. It also does not consider the variability associated with sub-sampling and extrapolation, and portside versus at-sea coverage, all of which are important especially with respect to river herring. Other alternatives under consideration appear to more adequately address this particular issue.

How is "Herring NK" and "Fish NK" treated in the SBRM approach?

- Herring NK and Fish NK are not used in the numerator when developing a discard ratio (discarded/kept). Any species reported as Herring NK or Fish NK that are discarded are not incorporated into the SBRM analysis. Any Herring NK or Fish NK that are kept on the vessel are incorporated into the denominator (total catch). For more information about sampling and documenting Fish NK and Herring NK, see the analyses presented in Volume I of the Amendment 5 DEIS.

2.1.1 **Timing**

The SBRM Omnibus Amendment requires annual consultations with the Councils and public to summarize observed discard rates in the preceding year and more importantly to review and refine plans for monitoring commercial fishing fleets in the upcoming year. This annual cycle is synchronized with the availability of previous years' data (July to June), time to acquire and audit data (July-September), sufficient time to conduct the statistical analyses (October-December), annual Council meetings (January-April), and the normal federal budget and contracting cycle.

Table 1 Summary of Annual SBRM Reporting Cycle (Timing)

Annual SBRM Reporting Cycle	SBRM 2009	SBRM 2010	SBRM 2011
Data Used (12-month period)	Jul 2007 - Jun 2008	Jul 2008 - Jun 2009	Jul 2009 - Jun 2010
Data Entry Data Analysis and Document Preparation	Jul-Sep '08 Oct 2008 - Jan 2009	Jul-Sep '09 Oct 2009 - Jan 2010	Jul-Sep '10 Nov 2010 - Jan 2011
1) Annual Report, Sea Day Analysis and Prioritization documents; 2) Presentation to NEFMC/MAFMC; 3) Prioritization Comment Period; 4) Final Budget received, Consideration of Comments, Re-prioritization document	Jan 2009 – Mar 2009	Jan 2010 – Mar 2010	Jan 2011 – Mar 2011
Response to Comments and Re-prioritization document	Apr 2009	May 2010	Apr 2011
NEFOP Sea Day Schedule (12 month period)	Apr 2009 - Mar 2010	Apr 2010 - Mar 2011	Apr 2011 - Mar 2012

2.1.2 Relationship Between SBRM Fleets and Limited Access Herring Vessels (Categories A/B/C)

The SBRM is stratified by:

- Quarter (based on date landed)
- Geographic Region (NE/MA based on port of departure)
- Gear Type (based on *negear*, single/pair midwater trawl are combined)
- Mesh Size (>5.5"< for otter trawl and three groups for gillnets)
- Access Area (AA and OPEN)
- Trip Category (General Category/limited access Scallop)

=52 Fleets

The relationship between the SBRM fleets and the limited access herring vessels that would be subject to the Amendment 5 provisions is difficult to characterize and address in the analysis. Table 2 illustrates the relationship between the SBRM fleets and the limited access herring vessels. This analysis is based on VTR data and uses three metrics to correlate the SBRM Fleets to the limited access herring vessels – number of trips, number of permits, and pounds of fish. This shows whether or not the SBRM fleets – Mid-Atlantic purse seine, New England purse seine, Mid-Atlantic midwater trawl, and New England midwater trawl – are active in the herring fishery and/or other fisheries. The first three rows in the table demonstrate that the Mid-Atlantic purse seine fleet does not correlate with the Atlantic herring fleet; only

one Category A and one Category C vessel is represented by the data for this fleet. The Mid-Atlantic purse seine fleet is likely representative of the Atlantic menhaden fishery.

There is a strong relationship between the herring Category A vessels (most of the limited access directed fishery participants) and the New England midwater trawl fleet, the Mid-Atlantic midwater trawl fleet, and the New England purse seine fleet. **Therefore, the Herring PDT has determined that the SBRM process and the allocation of days to the New England and Mid-Atlantic midwater trawl and New England purse seine fleets through the SBRM analysis sufficiently covers the majority of the Category A limited access directed herring vessels**.

Category C vessels present more of a challenge because they are a more diverse fleet, and many of the Category C vessels use bottom trawls. The Herring PDT example analysis in **Alternative 4** (Section 5.1) includes bottom trawl vessels with Category A/B/C herring permits, so allocating an appropriate number of days to the small mesh bottom trawl herring vessels could be determined using an approach similar to SBRM, i.e., applying proportions based on fishing activity by these vessels in the previous year, under the assumption that the next year will be similar to the previous year.

Table 2 Relationship of SBRM Fleets to Herring Limited Access Vessels

SBRM Year	SBRM Fleet	PLAN	CAT	No. Trips	No. Permits	Total Lbs.	Herring Lbs.	Mackerel Lbs.	Squid/Mack/ Butter Lbs.	% of trips	% of permits	% of Lbs.
2010	MA PS			121	5	18,370,430	0	0	0	57.3%	71.4%	55.5%
2010	MA PS	HRG	A	21	1	5,045,000	0	0	0	10.0%	14.3%	15.2%
2010	MA PS	HRG	C	69	1	9,680,000	0	0	0	32.7%	14.3%	29.2%
2010	NE PS			35	6	7,621,685	800,180	0	2,130	11.7%	31.6%	10.0%
2010	NE PS	HRG	A	244	12	67,948,643	57,462,242	0	0	81.3%	63.2%	89.4%
2010	NE PS	HRG	C	21	1	429,850	0	0	0	7.0%	5.3%	0.6%
2010	MA MWT			3	1	250,000	0	0	250,000	4.3%	10.0%	1.1%
2010	MA MWT	HRG	A	65	8	22,115,218	12,732,000	9,233,218	9,383,218	92.9%	80.0%	98.7%
2010	MA MWT	HRG	C	2	1	45,784	0	0	0	2.9%	10.0%	0.2%
2010	NE MWT			9	1	15,529	0	1	14,701	2.9%	6.3%	0.0%
2010	NE MWT	HRG	A	305	15	141,874,785	106,092,660	35,765,850	35,770,150	97.1%	93.8%	100.0%
2011	MA PS			137	4	15,208,302	0	0	0	64.0%	80.0%	61.8%
2011	MA PS	HRG	C	77	1	9,400,000	0	0	0	36.0%	20.0%	38.2%
2011	NE PS			27	9	4,238,560	113,500	0	40	12.5%	39.1%	9.8%
2011	NE PS	HRG	A	146	11	37,696,726	34,476,726	0	0	67.6%	47.8%	87.4%
2011	NE PS	HRG	C	43	3	1,201,078	769,158	1,470	1,470	19.9%	13.0%	2.8%
2011	MA MWT	HRG	A	25	7	8,269,700	3,664,000	4,305,700	4,305,700	100.0%	100.0%	100.0%
2011	NE MWT			6	2	1,269	170	0	254	1.9%	11.1%	0.0%
2011	NE MWT	HRG	A	304	16	155,950,158	143,150,232	12,720,319	12,720,639	98.1%	88.9%	100.0%

2.1.2.1 Impacts of Alternative 1 on VECs

Impacts on Atlantic Herring

Since Alternative 1 (No Action) represents the status quo, no additional impacts on the Atlantic herring resource are expected.

Impacts on Non-Target Species and Other Fisheries

Since Alternative 1 (No Action) represents the status quo, no additional impacts on non-target species and other fisheries are expected.

Impacts on Physical Environment and EFH

Since Alternative 1 (No Action) represents the status quo, no additional impacts on EFH are expected.

Impacts on Protected Resources

Since Alternative 1 (No Action) represents the status quo, no additional impacts on protected resources are expected.

Impacts on Fishery-Related Businesses and Communities

Since Alternative 1 (No Action) represents the status quo, with no change, no additional impacts on herring-related businesses or communities are anticipated. Interviews with industry participants indicate that the current SBRM-based allocation of observer coverage is regarded as fair and adaptable to changes. Since this methodology also applies to other fisheries, herring fishery participants do not feel unduly targeted.

3.0 IMPACTS OF ALTERNATIVE 2 (100% OBSERVER COVERAGE)

3.1 IMPACTS OF FUNDING OPTIONS

Amendment 5 considers alternatives that would require additional observer coverage on herring limited access vessels and options that may require some/all of the additional coverage to be funded by the fishing industry. **Alternative 2** proposes 100% observer coverage on limited access herring vessels, which would require additional funds. **Alternative 3** and **Alternative 4** may also require additional funds to achieve the desired levels of coverage.

Funding Options

Option 1: No Action

Option 2: Federal and Industry Funds

Development of an industry-funded observer program will require clear and concisely documented goals, objectives and standards. An industry-funded observer program would require NMFS approval of an observer service provider based upon the published standards. The program would then require further development of the specific objectives of data collection, and data quality standards to be incorporated and merged with current and existing data collection and monitoring programs. Observer data would be delivered to the NEFOP for data editing, auditing, archiving and quality assurance control. Training of observers and data processing standards would be further developed by the NEFOP, in order to provide

consistency across data collection. A NEFOP observer is estimated to cost approximately $1,200 per sea day.

In order to place the costs of industry-funded observers into context, Table 3 summarizes average revenues per trip, average revenues per day absent, operating costs per trip, and operating costs per day absent, classified by gear type for 2008-2010. Revenues were calculated using the VTR and Dealer data while operating costs were based on data collected through the observer program. Operating costs in this fishery are primarily fuel expenses; the price of fuel has fluctuated (along with the price of crude oil) over the past three years. There has been very little observer coverage for Category A/B/C vessels using bottom trawl gear to fish for Atlantic herring. The bottom trawl trips which have been observed have tended to be shorter in length than those not observed (and reported through VTRs).

Table 3 2008-2010 Average Revenues, Costs Per Day and Average Revenues, Costs Per Trip for Category A/B/C Herring Vessels

	Revenue/Day	Revenue/Trip	Operating Costs/Day	Operating Costs/Trip
Single Midwater Trawl	$12,853	$41,721	$4,271	$12,608
Pair Trawl	$15,683	$43,166	$3,295	$9,372
Purse Seine	$18,557	$25,499	$1,798	$2,746
Bottom Trawl	$5,325	$7,863	$785	$524

Revenue Data is from VTR and Dealer (n=5,329)
Operating Costs data is from Observer (n=352)

Relative to the daily operating costs for the fishery, the cost of an observer is fairly high. For example, a NEFOP observer would increase the per-day costs of single midwater trawl, pair trawl, purse seine and bottom trawl by 28%, 36%, 67%, and 153% respectively (Table 4). However, relative to daily revenues, the cost of an observer is lower; an observer would cost 9%, 9%, 6%, and 22% of average daily revenues for the midwater, pair trawl, purse seine, and bottom trawl vessels respectively. These figures are presented for illustration; it is possible that the type of data required in this fishery would result in higher or lower per-day costs than the $1,200 amount used.

Table 4 Cost of a NEFOP Observer as a Percentage of Daily Revenues and Daily Operating Costs

	Revenue	Costs
Single Midwater Trawl	9.3%	28.1%
Pair Trawl	7.7%	36.4%
Purse Seine	6.5%	66.7%
Bottom Trawl	22.5%	152.8%

3.1.1 Options for States As Service Providers

The proposed ***Requirements for Service Providers*** (see Management Alternatives, Volume I) currently only apply to a Federal sea sampling program, should service providers be utilized to sample the fishery beyond the scope of Federal resources. The Council is considering an option to authorize State agencies to be service providers for catch monitoring (sea sampling/observer coverage).

Option 1: No Action. Under the no action option, States would not be authorized in Amendment 5 as service providers for observer coverage. If a State Agency intends to provide sea sampling services for Atlantic herring vessels, it would apply to NMFS to become an authorized service provider, consistent with the provisions specified in 50 CFR 648.11(h) and (i)– *Observer service provider approval and responsibilities* and *Observer certification.*

Option 2: States Authorized as Service Providers. Under this option, Amendment 5 would authorize all States in the Northeast Region as service providers for sea sampling on limited access Atlantic herring vessels (i.e., States would be "grandfathered" in as service providers). States would not be required to apply to NMFS for an authorization and comply with the provisions specified in 50 CFR 648.11(h) and (i).

Currently, the States are not providing observer services (i.e. are not acting as observer service providers for the federally funded observer program). The State of Maine does have an employee that collects data at sea in the Atlantic herring fishery, but the other states do not cover the herring fleet, although to a limited degree cover other fisheries. If State Agencies are interested in becoming a certified observer service provider, under the no action option, the States would need to acquire NMFS approval and follow the same procedures as any other service providers. The approval process would be very similar to that of non-state observer service providers as it asks for general standards and operational details for hiring and deploying observers, which need to be clear regardless of who is applying.

Under Option 2, the States would be grandfathered in, and would not be required to apply for approval. This option would limit the amount of information that is obtained and pre-defined, and the State Agencies' operational details would be unknown. NEFOP personnel have expressed support for Option 1 (no action) to ensure that State Agencies adhere to the same requirements as other service providers, should service providers be utilized for sea sampling in the herring fishery. It remains unclear what qualifications, insurance, observer support would be offered under Option 2. These details are important in the development of an observer program and will affect successful data collection.

During the public comment period on the Amendment 5 Draft EIS, Council staff will work with NMFS NERO and NEFOP staff to review the current provisions and requirements for service providers (50 CFR 648.11(h) and (i)– *Observer service provider approval and responsibilities* and *Observer certification*), based primarily on the observer program for the sea scallop fishery. Prior to final decision-making, Council staff will brief the Council on any substantive changes to be made to the regulations in order to accommodate an industry-funded observer program that utilizes service providers in the herring fishery, should the Council select to establish one in this amendment.

3.1.1.1 Impacts of Alternative 2 on VECs

Impacts on Atlantic Herring

All of the alternatives related to allocating observer coverage on limited access herring vessels have the potential to improve the precision of estimates of discards or landed bycatch. In the short-term, the increased precision may prevent premature fishery closures or the chance for ACL/sub-ACL overages. Consequently, Atlantic herring stock abundance would be more likely to remain above management targets. In the long-term, however, increased observer coverage may only have marginal effects on herring abundance.

Impacts on Non-Target Species and Other Fisheries

Requiring 100% observer coverage would represent a census the Atlantic herring fishery, which, in theory, should result in a CV of zero on estimates of bycatch. Because of the variability inherent in sampling of this fishery, it may be difficult, if not impossible, to generate bycatch estimates for non-target species like river herring with a CV of zero. There is not agreement across scientific literature about what sufficient levels of observer coverage may be, especially in high-volume fisheries where most bycatch is retained and landed. More observer coverage is clearly favored to increase precision and capture rare events. 100% observer coverage is usually regarded as ideal to accurately report bycatch and determine discard rates, but is financially challenging and may not be feasible for a variety of reasons. At minimum, "adequate" levels of observer coverage should be un-biased (taking into account non-random sampling and fishermen's behavior in the presence of observers).

In general, Alternative 2 would have a positive impact on non-target species and other fisheries simply from the significant increase in coverage and sampling that would result under 100% coverage of limited access herring vessels. However, if additional funding is not available, Alternative 2 could shift sampling resources away from other fisheries. Consequently, these under-sampled fleets would have less precise estimates of bycatch, which could lead to greater management uncertainty and a poorer understanding of their impacts on the resource.

Impacts on Physical Environment and EFH

Alternative 2 would increase observer coverage levels for limited access herring vessels to 100%, with two funding options: federal (option 1) and federal/industry (option 2), and an additional option to certify states as observer service providers (option 1 would not authorize states; option 2 would authorize states). This alternative could lead to a decrease in herring trips if industry funding is required and vessels are unwilling or unable to absorb the cost of observer coverage, given expected revenues and other costs. This decrease in fishing effort would be expected to lead to a decrease in herring fishery impacts on EFH, although the decrease in impacts would be small as the total magnitude of herring fishery impacts on EFH is minimal. If the increase in coverage is federally funded, a decrease in herring fishing effort, and thus in fishery impacts on EFH, would not be expected.

Impacts on Protected Resources

This option has the potential to have a low positive impact on protected resources. There is likely to be no increase or decrease in effort, but as was stated in the impacts on non-target and other species, 100% observer coverage would represent a census of the Atlantic herring fishery. The measure has the portential to therefore provide as much information as possible on any and all protected resources that were encountered by the fishery, to the extent that a service provider could possibly sample. A problem for protected resources, however, is similar to the problem with non-target and other species, where the

variability inherent in sampling of this fishery makes it difficult, if not impossible, to generate bycatch estimates with a CV of zero. More observer coverage, however, would capture the rarer events of encounters of protected species with the herring fisheries, and has the potential to improve general knowledge of them.

In comparison to the No Action Alternative, Alternative 2 has the potential to have a low positive impact on protected species by increasing the amount of information that is gathered, and therefore increasing the amount of knowledge with respect to those species. If additional funding is not available, however, Alternative 2 could shift sampling resources away from other fisheries, thereby decreasing the amount of knowledge gained by different types of vessels in different areas. Ultimately, this may lead to an imbalance in gathered information on species not encountered by the herring fishery. The uncertainty inherent in this Alterative due to potential funding problems means that the impacts of this action are difficult to determine, and therefore can be considered unknown.

Impacts on Fishery-Related Businesses and Communities

Alternative 2, requiring 100% observer coverage, would only create negative impacts on herring-related businesses or communities if Federal funds were not used to pay for the additional observer coverage. If Funding Option 1 (no action) were selected, the presumption is that Federal funds would be used. If Option 2 prevailed, requiring industry funds to cover costs when Federal funds were unavailable, negative impacts on herring fisheries participants are likely. Such increased economic costs could trigger additional losses of vessels and processing plants, thereby also affecting bait supplies for other fisheries.

In 2010, a NEFOP observer costs approximately $1,200 per day. If industry members were required to pay for observers for every fishing day, these extra costs would become a significant burden for those fishing for this modestly-priced product. While vessels that hold the highest volumes might be able to tolerate the expense, vessels with smaller capacity would be facing severe constraints, including the potential for losing their ability to fish for herring.

Further, with both at-sea and portside observer programs suggesting that the herring fishery is a relatively clean fishery, a requirement for 100% observer coverage that must be funded by industry seems unfair to participants, if not punitive. This is particularly noteworthy since the resource is not considered overfished, nor is overfishing occurring.

Category A/B Versus Category C Vessels

Information presented in the Affected Environment (Volume I) indicates that Category A herring vessels represent the vast majority of the fishery, landing more than 97% of the herring in 2010. An additional four limited access Category B vessels, all with Category C permits (for Area 1) landed close to 1% of all herring during the 2010 fishing year. There are another 55 Category C vessels that participate in various fisheries and catch herring incidentally, representing about 1% of the total herring landings in 2010. The costs of incorporating the additional 55 Category C vessels into an industry-funded observer program for the herring fishery should be considered relative to the goals of the monitoring program and the expected outcomes, especially given the level of participation by these vessels in the herring fishery.

Based on information from the 2009 fishing year, 100% coverage of Category A/B vessels would cost between $2.36M per year (see below). The herring fishing industry is likely to spend *fewer* days fishing in the future due to reductions in catch limits. Therefore, the cost of at-sea monitoring of the Category A/B vessels reported in this analysis should be regarded as an *upper bound* of the cost of monitoring. However, this also presumes that an observer could be placed on a Category A/B vessel before it began a herring fishing trip, through a Pre-Trip Notification.

To illustrate this and provide some perspective on costs associated with 100% observer coverage, data provided by Maine DMR was used to calculate the total number of days fished by each limited access herring vessel for 2007-2009. These were then aggregated by permit category. Results are presented in Table 5. Based on fishing patterns from 2007-2009, 100% observer coverage on Category A/B vessels would cost between $1.88M and $2.36M per year. The herring fishing industry has spent (in 2010 and 2011) and is likely to spend *fewer* days fishing in the future due to reductions in ACLs. Therefore, the cost of at-sea monitoring of the Category A and B vessels reported in this analysis may be interpreted as an *upper bound* of the cost of monitoring.

Category C vessels are *only* counted in Table 5 if they landed herring on a given fishing trip. The cost of observation should be regarded as a *lower bound* on the cost of monitoring the Category C vessels, when combined with Category A and B vessels. This analysis presumes that an observer would be placed to a Category C vessel only on trips that land more than 2,000 pounds of herring. The summary information presented in below (Table 6) suggests that costs could increase significantly if monitoring requirements are extended to Category C permit holders on all trips, not just herring trips.

Table 5 Aggregate Days Fished and Implied Costs of At-Sea Monitoring for 2000-2009 by Herring Permit Category

	Category A/B		Category C	
	Days	**Cost**	**Days**	**Cost**
2007	1,700	$2,040,000	151	$181,200
2008	1,564	$1,876,800	22	$26,400
2009	1,969	$2,362,800	96	$115,200

Approximately 50 additional vessels possess limited access Category C permits (25 mt possession limit), but only about 20% (or less) of these vessels were active in the herring fishery from 2007-2009 (landed 2,000 pounds or more herring). Table 6 summarizes the **total number of trips and days fished** by Category C permit holders. The Herring Category C permit holders were extracted from the Permit Databases, then cross-referenced with the Vessel Trip Report data for calendar years 2007, 2008, and 2009. Trips lasting a fraction of a day were rounded up to the next integer value. Both trips and days fished were then aggregated at the yearly level.

Based on the 2009 fishing year, 100% coverage of the Category C vessels on trips that land herring would cost approximately $115,000 per year. The number of observation days required and cost associated with those days should be regarded as a *lower bound* on the cost of monitoring the Category C vessels. It presumes that an observer could be placed on a Category C vessel before it began a herring fishing trip, through a Pre-Trip Notification. If this is not feasible, the cost of monitoring all trips by Category C vessels will be much higher, as suggested in Table 6.

Table 6 Number of Trips and Days Fished By Category C Herring Permit Holders

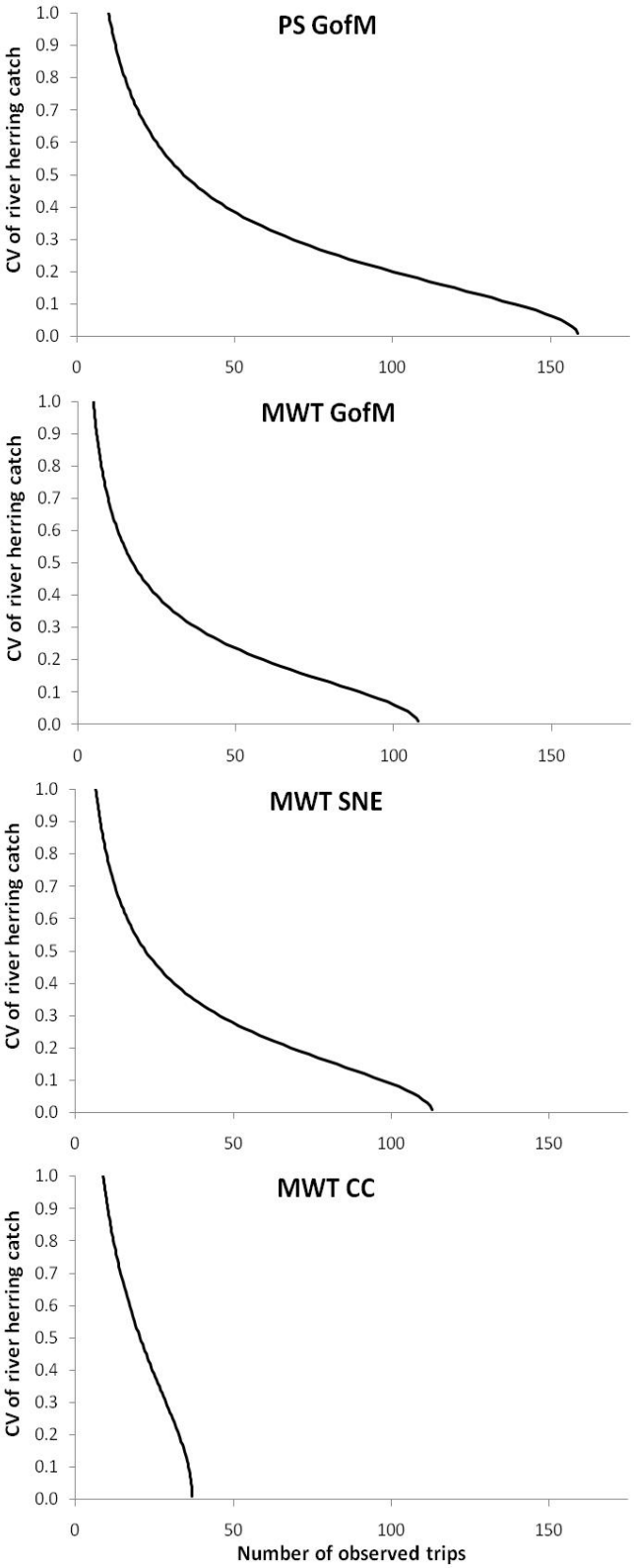
Year	Trips	Days Fished
2007	2,832	5,252
2008	3,646	6,896
2009	3,407	6,605

"Diminishing Returns"

Another important consideration in the SBRM and with all observer allocation programs is that there are diminishing returns, i.e., additional investment in observer effort yields increasingly smaller benefits in precision. As observer coverage approaches 100%, the CV goes to zero since this estimate essentially becomes a census of bycatch in the fishery (Figure 2). It is important to keep this relationship between observer coverage and precision in mind when evaluating the costs and benefits of requiring very high levels of observer coverage.

The Herring PDT notes that previous and ongoing analyses of coverage in the herring fishery suggests that a sizable increase in observer coverage does not always yield an expected increase in precision, due to the inter-annual variability in the abundance of Atlantic herring, bycatch species and how the fishery is prosecuted. The pre-trip notification system (PTNS) for the entire limited access herring fleet proposed in Amendment 5 should help to improve the predictability of fishing trips and the SBRM because the fleet's activity can be gauged on a more real-time basis.

Figure 2 Relationship Between Precision Surrounding Estimates of River Herring Bycatch and the Number of Observed Trips



4.0 IMPACTS OF ALTERNATIVE 3 (REQUIRE SBRM LEVELS AT A MINIMUM)

Impacts on Atlantic Herring

All of the alternatives related to allocating observer coverage on limited access herring vessels have the potential to improve the precision of estimates of discards or landed bycatch. In the short-term, the increased precision may prevent premature fishery closures or the chance for ACL/sub-ACL overages. Consequently herring stock abundance would be more likely to remain above management targets. In the long-term, however, increased observer coverage may only have marginal effects on herring abundance.

Impacts on Non-Target Species and Other Fisheries

Requiring SBRM levels of observer coverage for the Atlantic herring fishery would likely yield improved estimates of bycatch due to increased sample sizes. However, Alternative 3 still relies on the SBRM list of federally managed species, and therefore does not specifically address river herring bycatch. If additional funding is not available, Alternative 3 could shift sampling resources away from other fisheries. Consequently, these under-sampled fleets would have less precise estimates of bycatch, which could lead to greater management uncertainty and a poorer understanding of their impacts on the resource.

Impacts on Physical Environment and EFH

Alternative 3 would increase observer coverage levels to those specified in the SBRM amendment, at a minimum, with two funding options: federal (option 1) and federal/industry (option 2), and an additional option to certify states as observer service providers (option 1 would not authorize states; option 2 would authorize states). This alternative could lead to a decrease in herring trips if industry funding is required and vessels are unwilling to absorb the cost of observer coverage given expected revenues, although there would be less of a decrease expected as compared to 100% coverage. This decrease in fishing effort would be expected to lead to a decrease in herring fishery impacts on EFH, although the decrease in impacts would be small as the total magnitude of herring fishery impacts on EFH is minimal. If the increase in coverage is federally funded, a decrease in herring fishing, and thus in fishery impacts on EFH, would not be expected.

Impacts on Protected Resources

This measure will likely not increase or decrease effort in the fishery, but although this option has the potential to have a low positive impact on protected resources through the collection of more information on protected resources encountered by the herring fishery (in comparison to Alternative 1, the No Action alternative), the capture of rare events are not likely to increase in great magnitude in comparison to Alternative 2. Moreover, if additional funding is not available, Alternative 3 could shift sampling resources away from other fisheries, thereby decreasing the amount of knowledge of protected resources gained by observation on different types of vessels in different areas, and thereby negating the benefits of the extra coverage in the herring fishery. The impact of Alternative 3 on protected resources, overall, will therefore likely be neutral.

Impacts on Fishery-Related Businesses and Communities

Alternative 3 that would prohibit the Council from shifting SBRM Observer Coverage away from herring vessels could result in similar problems as Alternative 2, based on a potential lack of Federal funding. The impacts could be the same if industry was forced to pay for multiple days of observer coverage.

5.0 IMPACTS OF ALTERNATIVE 4 (COUNCIL-SPECIFIED TARGETS)

Alternative 4 includes a mechanism for either the NEFSC (Option 1) or the Herring PDT (Option 2) to prepare a supplemental analysis to relate SBRM fleets/coverage levels to the limited access herring vessels and evaluate the potential allocation of additional days on these vessels to achieve a 20% CV on river herring catch estimates and a 30% CV on haddock catch estimates and a 30% CV on Atlantic herring discards. The timing of the supplemental analysis would mirror the annual SBRM prioritization process, and the supplemental analysis/report would be presented to the Council by the NEFSC in conjunction with the annual SBRM Sea Day Analysis and Prioritization. The intent of this option is to provide a supplemental process to evaluate the sampling goals and performance standards identified in this amendment without compromising or formally changing the SBRM methodologies or the annual optimization process.

The PDT would not be limited to SBRM methodologies under this option. The Herring PDT could utilize different approaches (not only SBRM methods) to evaluate how to effectively increase the precision on estimates on river herring, haddock, and Atlantic herring catch on limited access herring vessels. The supplemental Herring PDT Report would evaluate CVs for river herring, haddock, and Atlantic herring catch estimates based on the previous year's data, relate the SBRM Sea Day Analysis and SBRM fleets identified in this alternative to the limited access herring vessels, provide information about the number and distribution of additional observer days to achieve the standards for the limited access herring fleet, and provide an estimate of the potential costs of those days.

SBRM allocations are based on data from July-June, and the Herring PDT analysis is based on a calendar year. This could be modified in the future if the Council adopts this approach. The analyses that the Herring PDT has provided thus far demonstrate that CVs for river herring catch estimates tend to vary substantially from year to year anyway, so timing may not be as important as simply identifying the strata (gear/area) where additional coverage would improve estimates of river herring removals from this fleet.

5.1 EXAMPLE – SUPPLEMENTAL ANALYSIS

This section provides an example of the kind of supplemental analysis that could be prepared – either by the NEFSC in conjunction with the SBRM process, or by the Herring PDT as a supplemental analysis. The following analysis utilizes methods that are similar to the SBRM, while accounting for the need to estimate river herring and haddock incidental catch (not just discarded bycatch) and target a CV for river herring that is more conservative than the current SBRM target for species that are included in the SBRM (30%). The analysis is based on 2010 observer data.

5.1.1 **Background**

An approach like SBRM can be used to accomplish the first step of setting a goal. As part of the development of the omnibus amendment to address standardized bycatch reporting methodology (SBRM), the National Working Group on Bycatch (NWGB) concluded that, "*for fishery resources, excluding protected species, caught as bycatch in a fishery, the recommended precision goal is a 20-30% CV for estimates of total discards (aggregated over all species) for the fishery; or if total catch cannot be divided into discards and retained catch then the goal is a 20-30% CV for estimates of total catch."* (NMFS 2004) As the NWGB pointed out, "Ideally, standards of precision would be based on the benefits and costs of increasing precision" (NMFS 2004). They also noted that under some circumstances, attaining the precision goal alone would not be an efficient use of the public resources. **The tradeoffs associated with increasing precision to meet a specified goal are very important to understand when developing an observer program**.

To begin to explore this issue in Amendment 5, the Herring PDT provided an *example approach* to determining levels of observer coverage necessary to meet a specific goal. These data were analyzed with formulae similar to those specified by the SBRM amendment to calculate variance and to estimate the number of trips necessary to achieve certain levels of precision for river herring over a range of desired CVs (a similar exercise will be performed for haddock and Atlantic herring in the Draft EIS). This example helps to better illustrate the trade-offs associated with the choices that would need to be made, based on goals and priorities for observer coverage as well as available resources. This exercise also shows how the SBRM approach can be used to develop a statistical approach to sampling the herring fishery to meet a specific goal under this option for observer coverage levels.

The preliminary analysis presented in this example highlights a few key points with respect to designing an observer program:

- The results suggest that, based on the SBRM approach, observer coverage should be increased in strata (gear type/area – purse seine, midwater trawl, otter trawl/GOM, GB, SNE) with high variability to reduce the CVs around catch/bycatch estimates. These are generally the strata with very limited observer coverage but high variability in estimates of river herring bycatch, but these may not be strata that one would expect to cover at higher rates.
- There are a few important caveats to consider when applying the SBRM approach to river herring – the assumptions about linearity and normality in the SBRM analysis may not hold for river herring because the distribution of the data is not normal (there is a high proportion of zeros), and there is a high degree of variability associated with the data. Seasonality (of the fishery and of river herring migrations/encounters) is also very important to consider.
- The SBRM approach considers variability associated with observed trips, but does not consider variability associated with any strata where coverage has been limited or absent. It also does not consider the variability associated with sub-sampling and extrapolation, and portside versus at-sea coverage, all of which are important especially with respect to river herring.

During 2011, the Herring PDT updated the analysis using 2010 observer data. The following analysis provides an example of the kind of information the Council would need to consider when developing recommendations about the allocation of observer days under Alternative 4. The costs of the additional days required to achieve the precision targets for river herring could be weighed by the Council against the potential benefits.

The current method for allocating observer coverage in all federally managed fisheries (SBRM) uses gear, quarter, and homeport to define fleets; and then examines the variability surrounding bycatch rates to determine the appropriate observer coverage level necessary to minimize uncertainty in discarded bycatch estimates. While this method has proven very useful for efficiently allocating limited observer resources across all fisheries, mangers of the Atlantic herring fisher had specific concerns that were not being met by the current observer allocation scheme (e.g. river herring are not included; retained bycatch are ignored).

Recently, mangers have refined their goals for monitoring this fishery. They have indicated a 20% CV for river herring removals, a 30% CV for haddock removals, and a 30% CV for Atlantic herring estimated discards as a management objective for the directed Atlantic herring fleet. To accomplish this goal, an analysis was developed that, while similar to the SBRM, differed in how it stratified catch and sampling, as well as how it defined the "directed Atlantic herring fishery."

5.1.1.1 Data and Methods

Data from the Vessel Trip Reporting system (VTR) and at-sea observer data where used to examine levels of coverage for calendar year 2010. Unlike the SBRM used in other New England fisheries, the objective here was to examine the directed herring fleet alone. To do so, the Vessel Monitoring System (VMS) was used to identify those vessels which were called into the Atlantic herring fishery (Category A, B, C vessels). Using these identified trips, both the VTR and Observer data were queried from their respective data warehouses at NMFS. This ensured that the directed herring fleet was identified, regardless of what was being fished for or landed, as long as the fishermen had identified the trip as a an Atlantic herring trip in their VMS reporting protocols.

VTR Data

Using the identified trips, vessel trip reports were collected and queried. These data reflect not only landings, but actual catch (as landings + discards) as reported by the fishermen on a trip-by trip basis. However, for purposes of this analysis, only retained catch (landings) were used in estimation. As such, this analysis not only utilized landings of Atlantic herring but used total landings of all species as well.

Observer Data

Data from the North East Fisheries Observer Program (NEFOP) for those identified Atlantic herring trips were gathered from the data warehouse located at NMFS. For this analysis, only sampled catch events were used and as such, fish designated as "kept and transferred to another vessel" were excluded as they are generally not sampled by the observer. Depending upon the species or group of interest, data were further filtered to examine catch and discards. In all cases, ratios of removals of a specific species (r below) to total kept (k below) were made, and are analogous to the "discard to kept ratio" of the SBRM methodology.

Discards of Atlantic herring typically occur as fish "fish not brought on board" (or "Fish NK" in the observer records for these trips), as fish are released from the net prior to pumping. As such, they are usually un-sampled. Therefore, unless the at-sea observer is able to document those fish as either Atlantic herring or "Herring unknown" (known Clupeid but species not known), these unidentified fish were not treated as either Atlantic herring or any other species.

Stratification

To combine VTR and NEFOP data, and to estimate removals by the directed Atlantic herring fleet, data were stratified by area and gear type. Stratification by gear included Bottom Trawls (all types), Midwater trawls (combined single and paired trawls), and Purse Seines. While the gear stratification was consistent for each of the species groups of interest, different geographic stratification was used for each group (Table 7 and Figure 3). No attempt was made at examination by quarters, or some sub component of year, because preliminary analysis showed many time-area cells with little or no coverage.

Table 7 Geographic Stratification Used in Analysis

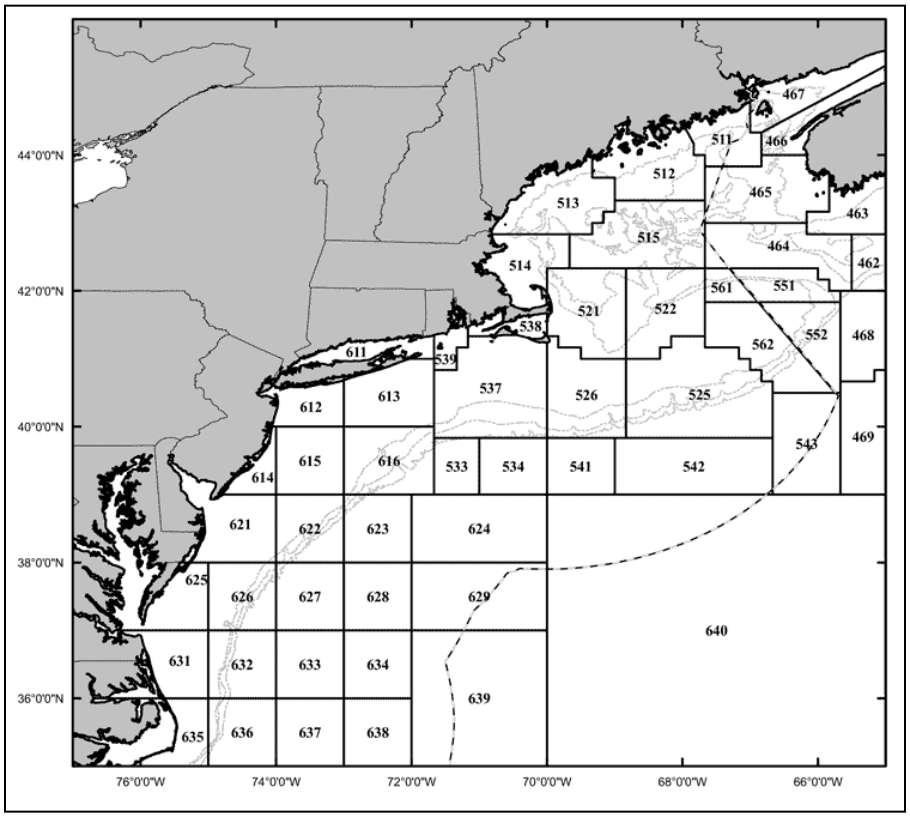
	River herring
	NMFS Stat Area
GOM	511,512, 513, 514, 515
CC	521
SNE	537, 538, 539, etc

	Haddock
	NMFS Stat Area
GOM	511,512, 513, 514, 515
GB	521, 522, 525, 526, 561, 562

	Atlantic herring
	NMFS Stat Area
GOM	511,512, 513, 514, 515
CC/GB	521, 522, 525, 526, 561, 562
SNE	537, 538, 539, etc

Note: GOM is Gulf of Maine, CC is Cape Cod (Stat area 522), GB is Georges Bank, and SNE is Southern New England

Figure 3 Northeast Region Statistical Areas



Estimations

Estimation of number of trips to achieve management goals is a three stage process. Specifically:

1. estimation of removals by strata;
2. estimation of variance associated by strata; and
3. estimation of trips needed to achieve management goals.

Total removals for each gear-area strata were estimated using a method similar to the SBRM and Lohr 1999, with a few distinct differences. Because the directed herring fleet does not "discard" fish prior to pumping into the hold, estimates of river herring and haddock were based on both discarded and retained fish. However, estimates of Atlantic herring discards were made using a method more similar to the SBRM and involved calculation of the standard "discard to kept ratio" (NEFMC, 2007). Discards of Atlantic herring typically occur as fish "fish not brought on board", or fish released from the net prior to pumping. As such, unless the at-sea observer is able to document fish as either Atlantic herring or "Herring unknown" (known Clupeid but species not known), they were excluded from the analysis.

More specially, removals by strata were estimated by:

$$\hat{R}_{ji} = \frac{\sum r_{ijh}}{\sum k_{ijh}}$$

Where R_{jh} is the bycatch rate of species group j in stratum h, r_{ijh} is the removals (pounds) for speciesgroup j within trip i in stratum h, and k_{ijh} is the kept weight (pounds) of all species within trip i in stratum h.

The variance of R can be calculated as:

$$V\left(\hat{R}_{ji}\right) = \left(\frac{N_h - n_h}{N_h}\right)\frac{1}{(n_h)\overline{k}_h^2}\left[\frac{\left(\sum r_{ijh}^2\right) + \hat{R}_{ji}^2\left(\sum k_{ijh}^2\right) - 2\hat{R}_{ji}\left(\sum r_{ijh}k_{ijh}\right)}{(n_h - 1)}\right]$$

where; n_h is the number of observed trips in stratum h; andN_h is the number ofVTR trips in stratum h.

The coefficient of variation of R can then be defined as:

$$CV\left(\hat{R}_{ji}\right) = \frac{\sqrt{V\left(\hat{R}_{ji}\right)}}{\hat{R}_{ji}}$$

The number of trips to achieve a typical management target (for example a 30 percent CV is therefore:

$$\hat{T}_{jh} = \frac{N_h\left(\frac{n_h N_h}{N_h - n_h}\right)V(\hat{R}_{jh})}{(0.09)\hat{R}^2 N_h + \left(\frac{n_h N_h}{N_h - n_h}\right)V(\hat{R}_{jh})}$$

Note that discards of Atlantic herring were estimated using the standard SBRM equations, since it was possible to rely on a discard to kept ratio (NEFMC, 2007).

5.1.1.2 Results and Discussion

After estimation of removals (or discards), variance, and number of trips needed to achieve management targets, the issue of high variability by strata was addressed. Within the SBRM is a mechanism or filter; which removes strata from coverage if their contribution to the overall removals (or discards) were less the 2% of the total (NEFMC, 2007). Application of these filter criteria are an important step in the SBRM process as it prevents strata with low removals, but high variability, from dominating the coverage rates. After discussions with other PDT members, it was decided to apply similar filters to this analysis. As such, pilot coverage was substituted instead. This pilot coverage was recommended as the greater of either 5% of the trips, or 3 trips for each filtered strata. As previously noted, pilot coverage was also recommended for strata which had zero, or few observations despite having landings.

2010 Observer Coverage

2010 observer coverage rates for river herring, haddock, and Atlantic herring are given in Table 8, Table 9, and Table 10, respectively. It should be noted that number of observed and total number of trips will vary as the geographic stratification are different by species group.

Overall, observer coverage in both number of trips and percentage were higher in 2010 than in reports for other years (Cieri, et al. 2008. Wigley et al, 2009). Implementation of 100% observer coverage in the groundfish zero mortality areas has significantly improved coverage rates even in the adjacent areas. This is due in part to the presence of an at-sea observer on trips where the captain *may* be going into Closed Area I. However, there are still a number of strata with very low to almost no coverage; including bottom trawl gears in Southern New England and the Gulf of Maine.

Table 8 Landings Total Trips by Fishery, Number of Observed Trips, and Percentage Coverage by At-Sea Observers by Strata for 2010 (River Herring)

Total Trips by fishery

Trips	Gear			
Area	BT	PS	MWT	Total
CC	0	1	37	38
GOM	143	159	108	410
SNE	60	[redacted]	113	173
Total	203	160	258	621

Pounds Landed all species

	Gear			
Area	BT	PS	MWT	Total
CC	0	20,000	12,298,341	12,318,341
GOM	763,766	16,567,910	40,094,010	57,425,686
SNE	6,029,289	[redacted]	42,222,557	48,251,846
Total	6,793,055	16,587,910	94,614,908	117,995,873

MT landed all species

	Gear			
Area	BT	PS	MWT	Total
CC	0	9	5,577	5,587
GOM	346	7,514	18,183	26,043
SNE	2,734	[redacted]	19,149	21,883
Total	3,081	7,523	42,909	53,513

Number of Observed trips

	Gear			
Area	BT	PS	MWT	Total
CC			22	22
GOM	5	21	31	57
SNE	3		24	27
Total	8	21	77	106

% Coverage

	Gear		
Area	BT	PS	MWT
CC	[redacted]		59
GOM	3	13	29
SNE	5	[redacted]	21

[redacted] Improbable

[redacted] No coverage

Table 9 Landings Total Trips by Fishery, Number of Observed Trips, and Percentage Coverage by At-Sea Observers by Strata for 2010 (Haddock)

Total Trips by fishery

	Gear			
Area	BT	PS	MWT	Total
GB	3	3	126	132
GOM	143	159	110	412
Total	203	160	258	621

Pounds Landed all species

	Gear			
Area	BT	PS	MWT	Total
GB	34,138	200,000	43,452,304	43,686,442
GOM	763,766	16,567,910	41,249,924	58,581,600
Total	797,904	16,767,910	84,702,228	102,268,042

MT landed all species

	Gear			
Area	BT	PS	MWT	Total
GB	15	91	19,706	19,812
GOM	346	7,514	18,707	26,568
Total	362	7,604	38,414	46,380

Number of Observed trips

	Gear			
Area	BT	PS	MWT	Total
GB	2	[redacted]	88	90
GOM	5	21	30	56
Total	7	21	118	146

% Coverage

	Gear		
Area	BT	PS	MWT
GB	67	[redacted]	70
GOM	3	13	27
	[redacted]	Improbable	

Table 10 Landings Total Trips by Fishery, Number of Observed Trips, and Percentage Coverage by At-Sea Observers by Strata for 2010 (Atlantic Herring)

Total Trips by fishery

Trips	Gear			
Area	BT	PS	MWT	Total
CC/GB	3	3	126	132
GOM	143	159	108	410
SNE	60		113	173
Total	203	160	258	621

Pounds Landed all species

	Gear			
Area	BT	PS	MWT	Total
CC/GB	34,138	200,000	43,452,304	43,686,442
GOM	763,766	16,567,910	40,534,010	57,865,686
SNE	7,586,649		42,811,557	50,398,206
Total	8,384,553	16,767,910	126,797,871	151,950,334

MT landed all species

	Gear			
Area	BT	PS	MWT	Total
CC/GB	15	91	19,706	19,812
GOM	346	7,514	18,383	26,243
SNE	3,441	0	19,416	22,856
Total	3,803	7,604	57,505	68,912

Number of Observed trips

	Gear			
Area	BT	PS	MWT	Total
CC/GB	2	0	88	90
GOM	6	21	31	58
SNE	3		24	27
Total	11	21	143	175

% Coverage

	Gear		
Area	BT	PS	MWT
CC/GB	67	0	70
GOM	4	13	29
SNE	5		21

Improbable

No coverage

River Herring Estimations and Trips Needed

Estimates of river herring removals and CV by strata for the directed fleet are given in Table 11. Overall, the variation in the estimates of removals for River herring was low, do in no small part by the high level over coverage. The CV for river herring was 36%; compared to 20% for the management objective. Total trips needed to achieve the management objective of a 20% CV, fishery wide, are given in Table 14. Trips needed to achieve a 20% CV fishery-wide are approximately 160 more than what was sampled in 2010. Surprisingly, the Gulf of Maine/Purse Seine stratum required the most trips (105 trips, or 66% coverage).

Table 11 Estimated Removals, Proportion of Total Removals, and CV by Strata for River Herring (2010)

Estimate (lbs.)

Area	BT	PS	MWT	Total
CC			96	96
GOM	1,053	4,548	144,333	149,934
SNE			15,885	15,885
Total	1,053	4,548	160,315	165,915

Proportion of total removal

Area	BT	PS	MWT	Total
CC			0.00	0.00
GOM	0.01	0.03	0.87	0.90
SNE			0.10	0.10
Total	0.01	0.03	0.97	1.00

CV

Area	BT	PS	MWT
CC			0.72
GOM		0.72	0.41
SNE			0.54

Less then 2% of total

Haddock Estimation and Trips Needed

Estimation of haddock removals for 2010 were approximately 222,524 lbs., with a CV of 28% (Table 12). This CV is slightly less than the CV management target of 30%. As a result, 40 less trips are needed to achieve a 30% CV (Table 14). Almost all of this coverage is for the Georges bank/Cape Cod midwater trawl fleet; with the rest as pilot coverage rates.

Table 12 Estimated Removals, Proportion of total removals, and CV by Strata for Haddock (2010)

Estimate (lbs.)

Area	BT	PS	MWT	Total
GB	66		218,410	218,476
GOM	356	2,852	840	4,048
Total	422	2,852	219,250	222,524

Proportion of total removal

Area	BT	PS	MWT	Total
GB	0.00		0.98	0.98
GOM	0.00	0.01	0.00	0.02
Total	0.00	0.01	0.99	1.00

CV

Area	BT	PS	MWT
GB	0.90		0.28
GOM	0.59	0.69	0.54

Atlantic Herring Estimation and Trips Needed

Overall, discards of Atlantic herring appear to be pretty low; approximately 360,000 lbs. or 0.25% of the Atlantic herring catch as reported from the 2010 IVRs (Table 13). In addition, there was a low amount of variability; CVs fishery-wide were 20%. As such, number of trips needed to achieve a management target of 30% CV is approximately 65 less than what occurred in 2010 (Table 14).

Table 13 Estimated Removals, Proportion of total removals, and CV by Strata for Atlantic Herring (2010)

Estimate (lbs.)

Area	BT	PS	MWT	Total
CC/GB	0		67,591	67,591
GOM	0	46,625	91,189	137,814
SNE	47,150	0	114,638	161,788
Total	47,150	46,625	273,419	367,194

Proportion of total removal

Area	BT	PS	MWT	Total
CC/GB			0.18	0.18
GOM	0.00	0.13	0.25	0.38
SNE	0.13		0.31	0.44
Total	0.13	0.13	0.74	1.00

CV

Area	BT	PS	MWT
CC/GB			0.24
GOM		0.33	0.38
SNE	0.82		0.40

Table 14 Number of Trips Needed by Strata and Percent Coverage for River Herring Catch, Haddock Catch, and Atlantic Herring Discards

A) River Herring

Trips needed

Area	BT	PS	MWT	Total
CC	3	3	3	9
GOM	7	105	68	180
SNE	3		75	78
total	10	108	145	267

% coverage

Area	BT	PS	MWT
CC		300	8
GOM	5	66	63
SNE	5		66

B) Haddock

Trips needed

Area	BT	PS	MWT	Total
GB	3	3	86	86
GOM	7	8	6	21
total	10	11	91	107

% coverage

Area	BT	PS	MWT
GB	100	100	68
GOM	5	5	5

Pilot coverage
improbable

C) Atlantic Herring

Trips needed

Area	BT	PS	MWT	Total
CC/GB	3	3	6	12
GOM	3	25	42	70
SNE	17		37	54
total	6	28	85	136

% coverage

Area	BT	PS	MWT
CC/GB	100	100	5
GOM	2	16	39
SNE	28		32

Combining Trips Across Areas and Species

Fortunately, at-sea observer sampling targeting one species group can also be used to document catch and bycatch of other species on the same trip. Therefore, for each stratum, the highest number of trips required to achieve the three management goals was used. However in the case of river herring, the geographic stratification differences in management are 1B and 3 need to be accounted for (See *Stratification* above). To accomplish this, a proration in number of trips needed in the Cape Cod (for River herring) and the Cape Cod/Georges bank (for haddock) strata was used. This proration was based on the percentage of landings which occur in those areas (Table 15).

Table 15 Combined Trips, Average Length of Trips, and Total Observer Days Needed to Meet CV Targets by Strata (Based on 2010)

Trips needed

Area	BT	PS	MWT	Total
CC	3	3	15	21
GB	7	[redacted]	71	78
CC/GB	10	3	86	99
GOM	7	105	68	180
SNE	17	[redacted]	75	92
total	34	108	228	371

Average days per trip

Area	BT	PS	MWT	Total
CC	2	3	2	7
GB	3	[redacted]	3	6
GOM	2	2	2	6
SNE	2	[redacted]	4	6
total	4	2	6	12

Total days

Area	BT	PS	MWT	Total
CC	6	9	30	45
GB	21	[redacted]	212	234
CC/GB	27	9	243	279
GOM	11	211	135	357
SNE	34	[redacted]	298	332
total	72	220	676	968

Note: This only includes at-sea time, and not transport to dock, set-up time, etc. for observers. Also, CC and GB are listed singly and combined (see text) as CC/Georges Bank.

5.1.1.3 Conclusions

In general, the limited access herring fishery experienced higher levels of observer coverage in 2010 than in previous years (Cieri et al. 2008 and Wigley et al. 2009), and a lower amount of variability was seen as well. This analysis indicates a lower level of river herring removals, haddock removals, and Atlantic herring discards than previous estimates. In addition, the degree of variability was also less.

It should be noted, however, that the year to year variability is not captured in this method. Cieri et al. 2008 and others have documented a high degree of variability within the same strata across years. Undoubtedly, fishing patterns, management actions, and availability of the fish to the fishery affect the estimates of removals and the variability associated with that estimate. As such should the levels of coverage suggested here be achieved, there is no guarantee that management targets on CV will be met.

It is important to note the lack of coverage in the southern New England bottom trawl fishery for Atlantic herring in 2010. In other analyses, this fleet has had both a high degree of variability and high estimates of removals for River herring. However; because there was no coverage in this area in 2010, the analysis suggest only pilot coverage should occur in 2012. Mangers may want to increase coverage in this area ad-hoc, given the results of prior analyses.

Also, this analysis is an example only of the types of analyzes that can be brought to bear on the issue of bycatch in the directed herring fishery. It should be viewed as a supplement, not a replacement, of the SBRM. However, using this sort of analysis can allow managers to tailor at-sea observer coverage to meet the species management goals and needs of the herring fishery.

5.2 IMPACTS OF ALTERNATIVE 4 ON VECS

Impacts on Atlantic Herring

All of the alternatives related to allocating observer coverage on limited access herring vessels have the potential to improve the precision of estimates of discards or landed bycatch. In the short-term, the increased precision may prevent premature fishery closures or the chance for ACL/sub-ACL overages. Consequently, Atlantic herring stock abundance would be more likely to remain above management targets. In the long-term, however, increased observer coverage may only have marginal effects on herring abundance.

Impacts on Non-Target Species and Other Fisheries

Alternative 4 would allocate additional observer coverage to specifically address the bycatch of river herring and haddock. This would lead to a greater understanding and reliability of bycatch estimates of these species in this fishery. Alternative 4 would not impact the SBRM allocation scheme, and would therefore not cause other fisheries to be under-sampled.

Impacts on Physical Environment and EFH

Alternative 4 would allocate observer coverage based on Council-specified targets and priorities, with two funding options: federal (option 1) and federal/industry (option 2), and an additional option to certify states as observer service providers (option 1 would not authorize states; option 2 would authorize states). This alternative would allow for additional analyses and recommendations from either the NEFSC or the Herring PDT to supplement SBRM coverage recommendations. As above, this alternative could lead to a

decrease in herring trips if industry funding is required and vessels are unwilling to absorb the cost of observer coverage given expected revenues, although there would be less of a decrease expected as compared to 100% coverage. This decrease in fishing effort would be expected to lead to a decrease in herring fishery impacts on EFH, although the decrease in impacts would be small as the total magnitude of herring fishery impacts on EFH is minimal. If the increase in coverage is federally funded, a decrease in herring fishing, and thus in fishery impacts on EFH, would not be expected.

Impacts on Protected Resources

Similar to the impacts of Alternative 3, Alternative 4 has the potential to have a low positive impact on protected resources through the collection of more information on protected resources encountered by the herring fishery (in comparison to Alternative 1, the No Action alternative). The measure is also not likely to increase or decrease effort in the fishery, thereby not increasing or decreasing the chance of encounters of protected resources. The capture of rare events, however, may or may not increase in magnitude in comparison to Alternative 2, depending on the specifications of the Council. Unlike Alternative 3, however, the SBRM allocation would not change under this alternative, and therefore it would not shift sampling resources away from other fisheries (thereby not decreasing the amount of knowledge of protected resources gained by observation on different types of vessels in different areas). The impact of Alternative 4, overall, is therefore likely to be a low positive impact.

Impacts on Fishery-Related Businesses and Communities

Alternative 4 would negatively impact herring-related businesses if this resulted in the industry having to pay for additional observer coverage. Like Alternative 2, it also implies that the limited access Atlantic herring fishing vessels have a disproportionate and greater impact on river herring and haddock than do other fisheries/vessels. While the extra coverage could provide the benefit of proving that their impact is the equivalent to other types of fishing, this proof could come at the financial burden of paying for extra observer coverage.

Category A/B Versus Category C Vessels

The example analysis provided in this document utilized an SBRM-like approach based on 2010 fishing data. Trip records were pulled for the limited access herring fishery, that is, the Category A/B and Category C vessels on trips when they were declared into the herring fishery. Category C vessels are primarily bottom trawl vessels that fish in a variety of fisheries and may only catch herring seasonally and/or incidentally, but they were incorporated into this analysis because they are part of the 100 vessels that represent the limited access herring fishery, the vessels to which the observer allocation alternatives are intended to apply. One of the benefits of the approach embedded in this alternative is that the Council has the flexibility to prioritize and allocate coverage based on the strata it deems most appropriate or most important at the time. If the Council selects this alternative and determines that Category C vessels should not be incorporated into the analysis or the allocation of observer coverage, then it can prioritize coverage for the A/B vessels and the PDT can conduct the supplemental analysis accordingly. At this point, however, the C trips that were declared into the herring fishery are incorporated because they represent the limited access trips for 2010; it is expected that the notification requirements proposed in this amendment will help to better target directed herring trips in the future so that the allocation of observers in the fishery can be optimized.