Appendix 1

Text from Greater Atlantic Region disapprovals regarding industry-funded monitoring

Excerpt from the Final Rule for Framework Adjustment 48 to the Northeast Multispecies FMP (78 FR 26118; May 3, 2013)

2. At-Sea Monitoring Cost-Sharing

To serve as a more long-term solution to the cost burden of at-sea monitoring to sectors, Framework 48 proposed a mechanism for sharing of at-sea monitoring costs between sectors and NMFS. Framework 48 proposed that the industry would only ever be responsible for paying the direct costs of at-sea monitoring, specifically the daily salary of the at-sea monitor. All other programmatic costs would be the responsibility of NMFS, including, but not limited to: Briefing, debriefing, training and certification costs (salary and non-salary); sampling design development; data storage, management and security; data quality assurance and control; administrative costs; maintenance of monitoring equipment; at-sea monitor recruitment, benefits, insurance and taxes; logistical costs associated with deployment; and at-sea monitor travel and lodging. This measure was intended to reduce the cost burden of at-sea monitoring to sectors and thereby increase their profitability.

NMFS has disapproved this cost-sharing measure because it is not consistent with other applicable laws as developed. Specifically, the Anti-Deficiency Act and other appropriations law prohibits Federal agencies from obligating the Federal government except through appropriations and from sharing the payment of government obligations with private entities. Framework 48 proposed to require NMFS to pay for some portion of the costs of at-sea activities, such as logistical costs generated by deployment, which are outside its statutory obligations under the Magnuson-Stevens Act. As written, this measure would also have required NMFS and sectors to share payment of obligations defined as belonging to one or the other. For example, Framework 48 proposed to require NMFS to pay some costs related to at-sea activities, such as benefits and insurance for at-sea monitors, while sectors would pay other portions of at-sea costs, like the salary for at-sea monitors. Because such action would be prohibited under the law, NMFS has disapproved this measure in Framework 48.

Although this measure was not approvable as developed, NMFS shares the Council and industry's concern about the ability of sectors to bear the full costs of monitoring in future fishing years. NMFS believes this approach to cost sharing, which defines the items that NMFS versus sectors should be responsible for, could be viable if restructured and may be worth pursuing in a future action. NMFS is already working with the New England and Mid-Atlantic Councils' joint Herring/Mackerel Plan Development Team (PDT)/Fishery Management Action Team (FMAT) to pursue cost-sharing options such as this one for those fisheries for FY 2014. The Council could consider including the NE Multispecies FMP in this joint effort to develop a workable and consistent cost-sharing mechanism for the Northeast region.

Excerpt from the Final Rule for Amendment 5 to the Atlantic Herring FMP

1. Increased Observer Coverage Requirements

As described previously, the NEFSC determines observer coverage levels in the herring fishery based on the SBRM. Observer coverage in the herring fishery is currently fully funded by NMFS. Amendment 5 proposed increasing observer coverage in the herring fishery by requiring 100-percent observer coverage on Category A and B vessels. Many stakeholders believe this measure is necessary to accurately determine the extent of bycatch and incidental catch in the herring fishery. The Council recommended this measure to gather more information on the herring fishery so that it may better evaluate and, if necessary, implement additional measures to address issues involving catch and discards. The 100-percent observer requirement is coupled with a target maximum industry contribution of $325 per day. There are two types of costs associated with observer coverage: (1) Observer monitoring costs, such as observer salary and travel costs, and (2) NMFS support and infrastructure costs, such as observer training and data processing. The monitoring costs associated with an observer in the herring fishery are higher than $325 per day. Cost-sharing of monitoring costs between NMFS and the industry would violate the Anti-Deficiency Act. Therefore, there is no current legal mechanism to allow cost-sharing of monitoring costs between NMFS and the industry.

Throughout the development of Amendment 5, NMFS advised the Council that Amendment 5 must identify a funding source for increased observer coverage because NMFS's annual appropriations for observer coverage are not guaranteed. Some commenters claim that the $325 per day industry contribution was not a limit, but a target, and that the Council intended the industry to pay whatever was necessary to ensure 100-percent observer coverage. NMFS disagrees, and does not believe the amendment specifies that the industry would pay all the monitoring costs associated with 100-percent observer coverage, nor does it analyze the economic impacts of the industry paying all the monitoring costs. The FEIS for Amendment 5 analyzed alternatives with the industry paying $325 per day or $1,200 per day (estimated sum of observer monitoring costs and NMFS support and infrastructure costs), but it did not analyze a range of alternatives that would approximate total monitoring costs. Budget uncertainties prevent NMFS from being able to commit to paying for increased observer coverage in the herring fishery. Requiring NMFS to pay for 100-percent observer coverage would amount to an unfunded mandate. Because Amendment 5 did not identify a funding source to cover the costs of increased observer coverage, the measure is not sufficiently developed to approve at this time. Therefore, NMFS had to disapprove the 100-percent observer coverage requirement. With the disapproval of this measure, this action maintains the existing SBRM observer coverage levels and Federal observer funding for the herring fishery.

Recognizing funding challenges, Amendment 5 specified status quo observer coverage levels and funding for up to 1 year following the implementation of Amendment 5, with the 100-percent observer coverage and partial industry funding requirement to become effective 1 year after the implementation of Amendment 5. During that year, the Council and NMFS, in cooperation with the industry, were to attempt to develop a way to fund 100-percent observer coverage.

During 2013, a working group was formed to identify a workable, legal mechanism to allow for industry-funded observer coverage in the herring fishery; the group includes staff from the New England and

Mid-Atlantic Councils and NMFS. To further explore the legal issues surrounding industry-funded observer coverage, NMFS formed a working group of Northeast Regional Office, NEFSC, General Counsel, and Headquarters staff. The NMFS working group identified an administrative mechanism to allow for industry funding of observer monitoring costs in Northeast Region fisheries, as well as a potential way to help offset funding costs that would be borne by the industry, subject to available funding. This administrative mechanism would be an option to fund observer coverage targets that are higher than SBRM coverage levels. The mechanism to allow for industry-funded observer coverage is a potential tool for all Northeast Region FMPs, but it would need to be added to each FMP through an omnibus amendment to make it an available tool, should the Council want to use it. Additionally, this omnibus amendment could establish the observer coverage targets for Category A and B herring vessels.

In a September 20, 2013, letter to the Council, NMFS offered to be the technical lead on an omnibus amendment to establish the administrative mechanism to allow for industry-funded observer coverage in New England and Mid-Atlantic FMPs. At its September 2013 meeting, the Council considered NMFS's offer and encouraged NMFS to begin development of the omnibus amendment. At this time, NMFS expects to present a preliminary range of alternatives for the omnibus amendment to the New England and Mid-Atlantic Councils in early 2014.

Additionally, other Amendment 5 measures implemented in this action help improve monitoring in the herring fishery. These measures include the requirement for vessels to contact NMFS at least 48 hr in advance of a fishing trip to facilitate the placement of observers, observer sample station and reasonable assistance requirements to improve an observer's ability collect quality data in a safe and efficient manner, and the slippage prohibition and the sampling requirements for midwater trawl vessels fishing in groundfish closed areas to minimize the discarding of unsampled catch.

The same measure that would have required 100-percent observer coverage, coupled with a $325 contribution by the industry, would have also required that: (1) The 100-percent coverage requirement be re-evaluated by the Council 2 years after implementation; (2) the 100-percent coverage requirement be waived if no observers were available, but not waived for trips that enter the River Herring Monitoring/Avoidance Areas; (3) observer service provider requirements for the Atlantic sea scallop fishery apply to observer service providers for the herring fishery; and (4) states be authorized as observer service providers. NMFS believes these additional measures are inseparable from the 100-percent observer coverage requirement; therefore, NMFS had to disapprove these measures too. With the disapproval of these measures, the existing waiver and observer service provider requirements remain in effect.

Excerpt from Amendment 14 to the Atlantic Mackerel, Squid, and Butterfish FMP (79 FR 10029; February 24, 2014)

1. Increased Observer Coverage Requirements

Currently, the NMFS Northeast Fisheries Science Center (NEFSC) determines observer coverage levels in the mackerel fishery based on the standardized bycatch reporting methodology (SBRM) and after consultations with the Council. Observer coverage in the mackerel fishery is currently fully funded by

NMFS. In Amendment 14, the Council recommended increases in the observer coverage in the mackerel fishery, specifically 100-percent observer coverage on all limited access mackerel vessels using midwater trawl (i.e., Tiers 1, 2 and 3) and Tier 1 mackerel vessels using small-mesh bottom trawl, 50-percent coverage on Tier 2 mackerel vessels using small-mesh bottom trawl, and 25-percent on Tier 3 mackerel vessels using small-mesh bottom trawl. Many stakeholders believe this measure is necessary to accurately determine the extent of bycatch and incidental catch in the mackerel fishery. The Council recommended this measure to gather more information on the mackerel fishery so that it may better evaluate and, if necessary, implement additional measures to address catch and discards of river herring and shad. The increased observer coverage level recommendations were coupled with a target maximum industry contribution of $325 per day. There are two types of costs associated with observer coverage: Observer monitoring costs, such as observer salary and travel costs; and NMFS support and infrastructure costs, such as observer training, data processing, and infrastructure. The monitoring costs associated with an observer in the mackerel fishery are higher than $325 per day. Upon legal analysis of this measure, the cost-sharing of monitoring costs between NMFS and the industry would violate the Anti-Deficiency Act. Therefore, based on this analysis, there is no current legal mechanism to allow cost-sharing of monitoring costs between NMFS and the industry.

Throughout the development of Amendment 14, NMFS advised the Council that Amendment 14 must identify a funding source for increased observer coverage because NMFS's annual appropriations for observer coverage are not guaranteed. Some commenters asserted that the $325 per day industry contribution was not a limit, but a target, and that the Council intended the industry to pay whatever is necessary to ensure 100-percent observer coverage. NMFS disagrees, and does not believe the amendment specifies that the industry would pay all the monitoring costs associated with 100-percent observer coverage, nor does the amendment analyze the economic impacts of the industry paying all the monitoring costs. The FEIS for Amendment 14 analyzes the industry paying $325 per day, and the DEIS analyzes the cost of vessels paying $800 per day (estimated sum of observer monitoring costs), but it does not analyze a range of that would approximate total monitoring costs. Budget uncertainties prevent NMFS from being able to commit to paying for increased observer coverage in the mackerel fishery. Requiring NMFS to pay for 100-percent observer coverage would amount to an unfunded mandate. Because Amendment 14 does not identify a funding source to cover the costs of increased observer coverage, the measure is not sufficiently developed to approve at this time. Therefore, NMFS had to disapprove the 100-percent observer coverage requirement. With the disapproval of this measure, this action maintains the existing observer coverage levels and full Federal funding for observer coverage the mackerel fishery.

In 2013, a working group was formed to identify a workable, legal mechanism to allow for industry-funded observer coverage in the herring fishery, including staff from the New England and Mid-Atlantic Councils and NMFS. To further explore the legal issues surrounding industry-funded observer coverage, NMFS formed a working group of Greater Atlantic Regional Fisheries Office, NEFSC, General Counsel, and Headquarters staff. The NMFS working group is currently exploring possibilities.

In the November 7, 2013, partial approval letter to the Council, NMFS offered to be the technical lead on an omnibus amendment to establish an administrative mechanism to allow for industry-funded

observer coverage in New England and Mid-Atlantic FMPs. At its October 2013 meeting, the Council considered NMFS's offer and encouraged NMFS to begin development of the omnibus amendment. NMFS expects to present a preliminary range of alternatives for the omnibus amendment to the New England and Mid-Atlantic Councils in early 2014.

Additionally, other measures implemented in this action help improve monitoring in the mackerel fishery. These measures include the requirement for vessels to contact NMFS at least 48 hr in advance of a fishing trip to facilitate the placement of observers, observer sample station and reasonable assistance requirements to improve an observer's ability collect quality data in a safe and efficient manner, and the slippage prohibition and the sampling requirements for midwater trawl vessels fishing in groundfish closed areas to minimize the discarding of unsampled catch.

The same measure that would have required increased observer coverage, coupled with a $325 contribution by the industry, would have also required that: (1) The Council would re-evaluate the increased observer coverage level 2 yr after implementation; and (2) observer service provider requirements for the Atlantic sea scallop fishery would apply to observer service providers for the mackerel fishery. NMFS believes these additional measures are inseparable from the 100-percent observer coverage requirement; therefore, NMFS also disapproved these measures. With the disapproval of these measures, this action maintains the existing SBRM-based observer coverage provisions for the mackerel fishery.

Appendix 2 – Monitor and Service Provider Requirements

The following sections are based on the existing regulations for monitoring service providers. This appendix includes minor revisions that NEFOP staff made to the existing regulations. Omnibus Alternative 2 would apply these revised requirements to all new industry-funded monitoring programs in the New England and Mid-Atlantic FMPs.

§ 648.11 At-sea sea sampler/observer coverage.

(g)(5)(3) Vessel owners shall pay observer service providers for observer services within 45 days of the end of a fishing trip on which an observer deployed.

(h) Observer service provider approval and responsibilities—(1) General. An entity seeking to provide observer services must apply for and obtain approval from NMFS following submission of a complete application. A list of approved observer service providers shall be distributed to vessel owners and shall be posted on the NMFS Fisheries Sampling Branch (FSB) website at: www.nefsc.noaa.gov/femad/fsb/.

(2) [Reserved]

(3) Contents of application. An application to become an approved observer service provider shall contain the following:

(i) Identification of the management, organizational structure, and ownership structure of the applicant's business, including identification by name and general function of all controlling management interests in the company, including but not limited to owners, board members, officers, authorized agents, and staff. If the applicant is a corporation, the articles of incorporation must be provided. If the applicant is a partnership, the partnership agreement must be provided.

(ii) The permanent mailing address, phone and fax numbers where the owner(s) can be contacted for official correspondence, and the current physical location, business mailing address, business telephone and fax numbers, and business email address for each office.

(iii) A statement, signed under penalty of perjury, from each owner or owners, board members, and officers, if a corporation, that they are free from a conflict of interest as described under paragraph (h)(6) of this section.

(iv) A statement, signed under penalty of perjury, from each owner or owners, board members, and officers, if a corporation, describing any criminal conviction(s), Federal contract(s) they have had and the performance rating they received on the contracts, and previous decertification action(s) while working as an observer or observer service provider.

(v) A description of any prior experience the applicant may have in placing individuals in remote field and/or marine work environments. This includes, but is not limited to, recruiting, hiring, deployment, and personnel administration.

(vi) A description of the applicant's ability to carry out the responsibilities and duties of a fishery observer services provider as set out under paragraph (h)(5) of this section, and the arrangements to be used.

(vii) Evidence of holding adequate insurance to cover injury, liability, and accidental death for observers during their period of employment (including during training). Workers' Compensation and Maritime Employer's Liability insurance must be provided to cover the observer, vessel owner, and observer provider. The minimum coverage required is $5 million (unless otherwise specified on the NMFS/FSB website at: www.nefsc.noaa.gov/femad/fsb/). Observer service providers shall provide copies of the insurance policies to observers to display to the vessel owner, operator, or vessel manager, when requested.

(viii) Proof that its observers, whether contracted or employed by the service provider, are compensated with salaries that meet or exceed the U.S. Department of Labor (DOL) guidelines for observers. Observers shall be compensated as Fair Labor Standards Act (FLSA) non-exempt employees. Observer providers shall provide any other benefits and personnel services in accordance with the terms of each observer's contract or employment status.

(ix) The names of its fully equipped, NMFS/FSB certified, observers on staff or a list of its training candidates (with resumes) and a request for an appropriate NMFS/FSB Observer Training class. All observer training classes have a minimum class size of eight individuals, which may be split among multiple vendors requesting training. Requests for training classes with fewer than eight individuals will be delayed until further requests make up the full training class size.

(x) An Emergency Action Plan (EAP) describing its response to an “at sea” emergency with an observer, including, but not limited to, personal injury, death, harassment, or intimidation. The observer provider shall develop and NMFS shall approve an Emergency Action Plan that details contractor response to emergencies involving observers or vessel personnel. The EAP shall include communications protocol and appropriate contact information in an emergency.

(4) Application evaluation. (i) NMFS shall review and evaluate each application submitted under paragraph (h)(3) of this section. Issuance of approval as an observer provider shall be based on completeness of the application, and a determination by NMFS of the applicant's ability to perform the duties and responsibilities of a fishery observer service provider, as demonstrated in the application information. A decision to approve or deny an application shall be made by NMFS within 15 business days of receipt of the application by NMFS.

(ii) If NMFS approves the application, the observer service provider's name will be added to the list of approved observer service providers found on the NMFS/ FSB website specified in paragraph (h)(1) of this section, and in any outreach information to the industry. Approved observer service providers shall be notified in writing and provided with any information pertinent to its participation in the fishery observer program.

(iii) An application shall be denied if NMFS determines that the information provided in the application is not complete or the evaluation criteria are not met. NMFS shall notify the applicant in writing of any deficiencies in the application or information submitted in support of the application. An applicant who receives a denial of his or her application may present additional information to rectify the deficiencies specified in the written denial, provided such information is submitted to NMFS within 30 days of the applicant's receipt of the denial notification from NMFS. In the absence of additional information, and after 30 days from an applicant's receipt of a denial, an observer provider is required to resubmit an application containing all of the information required under the application process specified in paragraph (h)(3) of this section to be re-considered for being added to the list of approved observer service providers.

(5) Responsibilities of observer service providers. (i) An observer service provider must provide observers certified by NMFS/FSB pursuant to paragraph (i) of this section for deployment in a fishery when contacted and contracted by the owner, operator, or vessel manager of a fishing vessel, unless the observer service provider refuses to deploy an observer on a requesting vessel for any of the reasons specified at paragraph (h)(5)(viii) of this section.

(ii) An observer service provider must provide to each of its observers:

(A) All necessary transportation, lodging costs and support with arrangements and logistics of travel for observers to and from the initial location of deployment, to all subsequent vessel assignments, to any debriefing locations, and for appearances in Court for observer-related trials as necessary;

(B) Lodging, per diem, and any other services necessary for observers assigned to a fishing vessel or to attend an appropriate NMFS/FSB observer training class;

(C) The required observer equipment, in accordance with equipment requirements listed on the NMFS/FSB website specified in paragraph (h)(1) of this section, prior to any deployment and/or prior to NMFS observer certification training; and

(D) Individually assigned communication equipment, in working order, such as a mobile phone, for all necessary communication. An observer service provider may alternatively compensate observers for the use of the observer's personal mobile phone, or other device, for communications made in support of, or necessary for, the observer's duties.

(iii) Observer deployment logistics. Each approved observer service provider must assign an available certified observer to a vessel upon request. Each approved observer service provider must be accessible 24 hours per day, 7 days per week, to enable an owner, operator, or manager of a vessel to secure observer coverage when requested. The telephone system must be monitored a minimum of four times daily to ensure rapid response to industry requests. Observer service providers approved under paragraph (h) of this section are required to report observer

deployments to NMFS daily for the purpose of determining whether the predetermined coverage levels are being achieved in the appropriate fishery.

(iv) Observer deployment limitations. (A) A candidate observer's first several deployments and the resulting data shall be immediately edited and approved after each trip by NMFS/FSB prior to any further deployments by that observer. If data quality is considered acceptable, the observer would be certified. Refer to the NMFS/FSB website for program-specific observer training certifications, http://www.nefsc.noaa.gov/fsb.

(v) Communications with observers. An observer service provider must have an employee responsible for observer activities on call 24 hours a day to handle emergencies involving observers or problems concerning observer logistics, whenever observers are at sea, stationed shoreside, in transit, or in port awaiting vessel assignment.

(vi) Observer training requirements. A request for a NMFS/FSB Observer Training class must be submitted to NMFS/FSB 45 calendar days in advance of the requested training. The following information must be submitted to NMFS/FSB at least 15 business days prior to the beginning of the proposed training: A list of observer candidates; observer candidate resumes, cover letters and academic transcripts; and a statement signed by the candidate, under penalty of perjury, that discloses the candidate's criminal convictions, if any. A medical report certified by a physician for each candidate is required 7 business days prior to the first day of training. CPR/First Aid certificates and a final list of training candidates with observer candidate contact information (email, phone, number, mailing address and emergency contact information) are due 7 business days prior to the first day of training. NMFS may reject a candidate for training if the candidate does not meet the minimum qualification requirements as outlined by NMFS/FSB minimum eligibility standards for observers as described on the NMFS/FSB website.

(vii) Reports—(A) Observer deployment reports. The observer service provider must report to NMFS/FSB when, where, to whom, and to what vessel an observer has been deployed, as soon as possible, and according to requirements outlined on the NMFS/FSB website. .The Observer deployment report must be available and accessible to NMFS electronically 24 hours a day, 7 days a week. The observer service provider must ensure that the observer reports back to NMFS its required electronic data, as described in the NMFS/FSB observer training. Electronic data submission will be outlined in observer training and may include accessing government websites via personal computers/devices or submitting data through government issued electronics. The observer service provider shall provide the raw (unedited) data collected by the observer to NMFS at the specified time per program; refer to the NMFS/FSB website for program specific observer training certifications, http://www.nefsc.noaa.gov/fsb.

(B) Safety refusals. The observer service provider must report to NMFS any trip that has been refused due to safety issues, e.g., failure to hold a valid USCG Commercial Fishing Vessel Safety

Examination Decal or to meet the safety requirements of the observer's pre-trip vessel safety checklist, within 12 hours of the refusal(C) Biological samples. The observer service provider must ensure that biological samples, including whole marine mammals, sea turtles, and sea birds, are stored/handled properly and transported to NMFS within 7 days of landing. If transport to NMFS/FSB Observer Training Facility is not immediately available then whole animals requiring freezing shall be received by the nearest NMFS freezer facility within twenty four (24) hours of vessel landing. NMFS freezer locations and availability can be found at http://www.nefsc.noaa.gov/fsb/memos/2012/Freezer%20List%2007-2012.pdf

(D) Observer debriefing. The observer service provider must ensure that the observer remains available to NMFS, either in-person or via phone, at NMFS' discretion, including NMFS Office for Law Enforcement, for debriefing for at least 2 weeks following any observed trip. If requested by NMFS, an observer that is at sea during the 2-week period must contact NMFS upon his or her return. Observer service providers must pay for travel and land hours for any requested debriefings.

(E) Observer availability report. The observer service provider must report to NMFS any occurrence of inability to respond to an industry request for observer coverage due to the lack of available observers by 5 p.m., Eastern Time, of any day on which the provider is unable to respond to an industry request for observer coverage.

(F) Incident reports. The observer service provider must report possible observer harassment, discrimination, concerns about vessel safety or marine casualty, or observer illness or injury; and any information, allegations, or reports regarding observer conflict of interest or breach of the standards of behavior, to NMFS/ FSB within 12 hours of the event or within 12 hours of learning of the event. See FSB website for all incident reporting procedures, timelines and requirements. http://www.nefsc.noaa.gov/fsb/forms/.

(G) Observer status report. The observer service provider must provide NMFS/FSB with an updated list of contact information for all observers that includes the observer identification number, observer's name, mailing address, email address, phone numbers, homeports or fisheries/trip types assigned, and must include whether or not the observer is “in service,” indicating when the observer has requested leave and/or is not currently working for an industry funded program. Any observer not working for 30 days will be placed on Leave of Absence (LOA) status (or as specified by NMFS/FSB according to most recent Information Technology Security Guidelines on the FSB website). Observers on LOA for 90 days or more will need to conduct an exit interview with NMFS/FSB, return any NMFS/FSB issued gear and Common Access Card (CAC), unless alternative arrangements are approved by NMFS/FSB. NMFS/FSB requires 2 week notification of when an observer is leaving the program so that an exit interview may be arranged and gear returned.

(H) Vessel contract. The observer service provider must submit to NMFS/FSB, if requested, a copy of each type of signed and valid contract (including all attachments, appendices, addendums, and

exhibits incorporated into the contract) between the observer provider and those entities requiring observer services.

(I) Observer contract. The observer service provider must submit to NMFS/FSB, if requested, a copy of each type of signed and valid contract (including all attachments, appendices, addendums, and exhibits incorporated into the contract) between the observer provider and specific observers.

(J) Additional information. The observer service provider must submit to NMFS/FSB, if requested, copies of any information developed and/or used by the observer provider and distributed to vessels or observers, such as informational pamphlets, payment notification, description of observer duties, etc.

(viii) Refusal to deploy an observer. (A) An observer service provider may refuse to deploy an observer on a requesting fishing vessel if the observer service provider does not have an available observer within the required time(see website for information on requirements for notifications and waivers for each fishery http://www.nefsc.noaa.gov/fsb/notification.html), and must report all refusals to NMFS/FSB.

(B) An observer service provider may refuse to deploy an observer on a requesting fishing vessel if the observer service provider has determined that the requesting vessel is inadequate or unsafe pursuant to the reasons described at §600.746, and a vessel may not legally sail if the safety deficiency is not fixed.

(C) The observer service provider may refuse to deploy an observer on a fishing vessel that is otherwise eligible to carry an observer for any other reason, including failure to pay for previous observer deployments, provided the observer service provider has received prior written confirmation from NMFS authorizing such refusal.

(6) Limitations on conflict of interest. An observer service provider:

(i) Must not have a direct or indirect interest in a fishery managed under Federal regulations, including, but not limited to, a fishing vessel, fish dealer, and/or fishery advocacy group; (other than providing observer services)

(ii) Must assign observers without regard to any preference by representatives of vessels other than when an observer will be deployed for the trip that was selected for coverage; and

(iii) Must not solicit or accept, directly or indirectly, any gratuity, gift, favor, entertainment, loan, or anything of monetary value from anyone who conducts fishing or fishing related activities that are regulated by NMFS, or who has interests that may be substantially affected by the performance or nonperformance of the official duties of observer providers.

(7) Removal of observer service provider from the list of approved observer service providers. An observer service provider that fails to meet the requirements, conditions, and responsibilities specified in paragraphs (h)(5) and (6) of this section shall be notified by NMFS, in writing, that it is subject to removal from the list of approved observer service providers. Such notification shall specify the reasons for the pending removal. An observer service provider that has received notification that it is subject to removal from the list of approved observer service providers may submit written information to rebut the reasons for removal from the list. Such rebuttal must be submitted within 30 days of notification received by the observer service provider that the observer service provider is subject to removal and must be accompanied by written evidence rebutting the basis for removal. NMFS shall review information rebutting the pending removal and shall notify the observer service provider within 15 days of receipt of the rebuttal whether or not the removal is warranted. If no response to a pending removal is received by NMFS, the observer service provider shall be automatically removed from the list of approved observer service providers. The decision to remove the observer service provider from the list, either after reviewing a rebuttal, or if no rebuttal is submitted, shall be the final decision of NMFS and the Department of Commerce. Removal from the list of approved observer service providers does not necessarily prevent such observer service provider from obtaining an approval in the future if a new application is submitted that demonstrates that the reasons for removal are remedied. Certified observers under contract with an observer service provider that has been removed from the list of approved service providers must complete their assigned duties for any fishing trips on which the observers are deployed at the time the observer service provider is removed from the list of approved observer service providers. An observer service provider removed from the list of approved observer service providers is responsible for providing NMFS with the information required in paragraph (h)(5)(vii) of this section following completion of the trip. NMFS may consider, but is not limited to, the following in determining if an observer service provider may remain on the list of approved observer service providers:

(i) Failure to meet the requirements, conditions, and responsibilities of observer service providers specified in paragraphs (h)(5) and (h)(6) of this section;

(ii) Evidence of conflict of interest as defined under paragraph (h)(6) of this section;

(iii) Evidence of criminal convictions related to:

(A) Embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property; or

(B) The commission of any other crimes of dishonesty, as defined by state law or Federal law, that would seriously and directly affect the fitness of an applicant in providing observer services under this section;

(iv) Unsatisfactory performance ratings on any Federal contracts held by the applicant; and

(v) Evidence of any history of decertification as either an observer or observer provider.

(i) Observer certification. (1) To be certified, employees or sub-contractors operating as observers for observer service providers approved under paragraph (h) of this section must meet NMFS/FSB certification requirements, refer to the program specific observer training certifications on the website at: http://www.nefsc.noaa.gov/fsb.

(2) Observer training. In order to be deployed on any fishing vessel, a candidate observer must have passed an appropriate NMFS/FSB Observer Training course. and must maintain all NMFS/FSB program standards and policies, refer to website for program standards, http://www.nefsc.noaa.gov/fsb If a candidate fails training, the candidate and observer service provider shall be notified immediately by NMFS/FSB. Observer training shall include an observer training trip, as part of the observer's training, aboard a fishing vessel with a trainer. Refer to the NMFS/FSB website for the required number of program-specific observer training certification trips for full certification following an observer training, http://www.nefsc.noaa.gov/fsb.

(3) Observer requirements. All observers must:

(i) Have a valid NMFS/FSB fisheries observer certification pursuant to paragraph (i)(1) of this section;

(ii) Be physically and mentally capable of carrying out the responsibilities of an observer on board fishing vessels, pursuant to standards established by NMFS. Such standards are available from NMFS/FSB website specified in paragraph (h)(1) of this section and shall be provided to each approved observer service provider;

(iii) Have successfully completed all NMFS-required training and briefings for observers before deployment, pursuant to paragraph (i)(2) of this section; and

(iv) Hold a current Red Cross (or equivalence) CPR/First Aid certification.

(v) Accurately record their sampling data, write complete reports, and report accurately any observations relevant to conservation of marine resources or their environment.

(4) Probation and decertification. NMFS may review observer certifications and issue observer certification probation and/or decertification as described in NMFS policy found on the NMFS/ FSB website specified in paragraph (h)(1) of this section.

(5) Issuance of decertification. Upon determination that decertification is warranted under paragraph (i)(4) of this section, NMFS shall issue a written decision to decertify the observer to the observer and approved observer service providers via certified mail at the observer's most current address provided to NMFS. The decision shall identify whether a certification is revoked and shall identify the specific reasons for the action taken. Decertification is effective immediately as of the

date of issuance, unless the decertification official notes a compelling reason for maintaining certification for a specified period and under specified conditions. Decertification is the final decision of NMFS and the Department of Commerce and may not be appealed.

2015
Standardized Bycatch Reporting Methodology
Annual Discard Report with Observer Sea Day Allocation

by

Northeast Fisheries Science Center
NOAA Fisheries
166 Water Street
Woods Hole, MA 02543

and

Greater Atlantic Regional Fisheries Office
NOAA Fisheries
55 Great Republic Drive
Gloucester, MA 01930

May 13, 2015

Introduction

The Standardized Bycatch Reporting Methodology (SBRM) Omnibus Amendment was implemented on 27 February 2008 (NMFS 2008, NEFMC 2007) and later vacated by the US District Court for the District of Columbia and remanded back to National Marine Fisheries Service (NMFS) on 15 September 2011 due to a deficiency associated with the prioritization process, an element of the amendment. On 29 December 2011, NMFS removed the regulations implementing the SBRM (NMFS 2011). A revised SBRM Omnibus Amendment (NEFMC 2015), hereafter referred to as the 2015 SBRM amendment, was approved on 13 March 2015 and a final rule is pending.

The 2015 SBRM amendment requires an annual discard report utilizing information obtained from the Northeast Fisheries Observer Program[1] (NEFOP) for 14 federally managed species and sea turtles (Table 1). Specifically, the SBRM annual discard report requirements include: "*…summaries of the trips observed, fishing modes in the relevant time period, funding issues and other related issues and developments, and projections of coverage across fisheries for upcoming time period. More detailed information would be provided in tables and figures that addressed: The number of observer trips and sea days scheduled that were accomplished for each fishing mode and quarter, as well as the number of trips and sea days of industry activity; the kept weight from unobserved quarters and statistical areas summarized by fishing mode; the amount kept and estimated discards of each species by fishing mode; and the relationship between sample size and precision for relevant fishing modes." (NEFMC 2015, pages 237-238).*

This document contains a compilation of the information to meet the 2015 SBRM annual discard report requirements. For fish and invertebrate species groups, several of the required annual discard report elements can be found in Wigley et al. 2015, along with a description of the data sources, methods, results, and discussion. Similarly, for sea turtles, further information can be found in Murray 2012, 2013, and in review. This document also presents the number of sea days needed to monitor the 15 species groups, the funding available for observer coverage, and the numbers of sea days allocated by fleet[2] (where a fleet represents gear type, access area, trip category, region, and mesh group combinations) for the April 2015 through March 2016 period.

Summary of Observer Coverage

A total of 3,508 trips (10,800 days) was observed during the July 2013 through July 2014 time period. When these trips were stratified by fleet and quarter, some trips were partitioned between fleets resulting in 3,729 trips (11,335 days). See Tables 2 and 3 in Wigley et al. 2015 for a summary of the number of observed trips and industry trips by fleet and calendar quarter and a summary of the number of observed sea days and industry sea days by fleet and calendar quarter, respectively. There were 56 fleets uniquely identified in the July 2013 through June 2014 data. Based upon the industry activity during this time period, the Mid-Atlantic (MA) and New England (NE) twin trawl

---

[1] Further information on the Northeast Fisheries Science Center's Northeast Fisheries Observer Program is available at http://www.nefsc.noaa.gov/fsb/

[2] Fleets are synonymous with "fishing modes".

fleets (Rows 13 and 14, respectively) and the NE haddock separator trawl small mesh exempted fleet (Row 56) were added to the collection of fleets analyzed.

A spatial and temporal analysis of the kept weight of all species from statistical areas and calendar quarter was conducted. Over all fleets, 52% of kept weight of all species occurred in statistical areas and calendar quarters that had observer coverage. For a summary of the percentage of kept weight with observer coverage by fleet for the July 2013 through June 2014 time period, see Table 4 in Wigley et al. 2015.

Summary of Discard Estimates

For fish/invertebrate species, the total catch, kept, and estimated discards (in live weight) and their associated coefficient of variation (CV) were derived for fleets using data collected during the July 2013 through June 2014 time period (Wigley et al. 2015). Based upon that discard estimation analysis, an estimated 64,795 mt (142,848,902 pounds) of federally regulated species were discarded (Table 2). Fleet abbreviations used in this report are described in Appendix Table 1. See Table 5A and 5B in Wigley et al. 2015 for summaries by fleet and SBRM species group and by fleet and individual species that compose these 14 species groups, respectively.

The most recent average annual estimates of sea turtle interactions in U.S. Mid-Atlantic commercial fisheries are listed in Table 3. Estimates are summarized by gear type, and estimates with associated CVs allocated across managed fish species can be found in the references cited. The CVs around the estimates allocated across managed fish species were used to estimate coverage needs in 2015, per methods used in Murray (2012).

Summary of Sea Days Needed

For fish/invertebrate species groups, the number of sea days needed to achieve a 30% CV of total discards for each species group was derived for 56 fleets by using data collected during July 2013 through June 2014 (Wigley et al. 2015). Based on that sample size analysis, a total of 11,204 sea days is needed for the 14 fish and invertebrate species groups. Table 4 presents the number of sea days needed for each of the 14 species groups, number of pilot coverage days, and number of minimum pilot days. Total number of sea days needed for fish/invertebrate groups for each fleet is also given in Table 5 (Step 1).

The use of pilot coverage in the sample size analysis may result in too much coverage in cases where little or no observer coverage may actually be needed, when effort changed sharply between years, or when the fleet effort comprises only a few trips. For example, there are 12 fleets for which there were fewer than 3 Vessel Trip Report (VTR) trips per quarter for at least 1 quarter (Rows 10, 13-17, 22, 26, 30, 32, 40, and 43; Appendix Table 2). To allocate sea days based on pilot coverage to these fleets for these quarters would result in coverage rates exceeding 100%. Additionally, there are several fleets for which activity is greater than 3 VTR trips per quarter, but overall trip activity is low (e.g., Rows 9, 12, 21, 31, 39, and 46; Appendix Table 2). To allocate sea days based on pilot coverage to these fleets would result in coverage rates that generally exceed those derived from observer data. For fleets with low quarterly trip activity, there are 2 scenarios: (1) fleets for which

significant activity occurs in other quarters (e.g., Rows 19, 30, and 43; Appendix Table 2); and (2) fleets for which overall activity is low (e.g., Rows 9, 10, 12-17, 22, 26, 40, and 56; Appendix Table 2). In the first scenario, the use of pilot coverage is warranted for these fleets. In the second scenario, pilot coverage is not warranted.

A refinement to the sample size analysis was developed in 2014 to address the potential for excessive observer coverage created by using a pilot coverage policy for fleets with overall low activity. Pilot coverage had been designed to provide the minimum number of trips sufficient to compute the variance of discard estimates and subsequently the derivation of sea days needed. The number of sea days per quarter could not be reduced further without omitting the fleet from the sample size analysis. A standardized approach, similar to the 2 filters used in the importance filter (Wigley et al. 2007), was employed to remove fleets with overall low trip activity. This approach hereafter is referred to as the trip filter. In the trip filter, the percentage of VTR trips for a fleet was derived by dividing the number of VTR trips in a fleet by the total number of VTR trips across all fleets. The fleets were then ranked (smallest to largest) by the percentage of trips in a fleet and the cumulative percentage for each fleet was then derived. A cut point of 1% was selected to remove fleets that contained the lowest cumulative 1% of the total trips. Thus the trip filter excludes those fleets, which in aggregate, constitute less than 1% of all commercial fishing activity. Fleets which constitute the upper cumulative 99% of all trips remain in the analysis.

Before the trip filter was applied, trips associated with the MA shrimp trawl fleet (Row 19) were partition into two groups: trips fishing in Pamlico Sound and trips fishing in ocean waters. This partitioning was needed because the Southeast Region has mandatory observer coverage of the southeastern shrimp fishery and allocates observer coverage to trips fishing in Pamlico Sound (Scott-Denton 2012). Of the 405 trips in the MA Shrimp trawl fleet (Appendix Table 2, Row 19), 12 trips occurred in ocean waters. The total number of trips for the MA shrimp trawl fleet (Row 19) was adjusted from 405 trips to 12 trips before the trip filter was applied. When the trip filter was applied, 21 of the 56 fleets were removed (Rows 9, 10, 12-17, 19, 21, 22, 26, 31, 32, 39, 40, 46, 49, 50, 52, and 56; Appendix Table 2; Table 5, Step 2) . For the remaining 35 fleets (28 agency-funded and 7 industry- funded fleets), a total of 10,365 sea days is needed for the 14 fish/invertebrate species groups (Table 5; Step 2). It is useful to note that the trip filter does not remove sea days associated with fleets that have discards determined to be important. Implications of the trip filter are discussed later.

For loggerhead turtles, the numbers of sea days needed to achieve a 30% CV of turtle discards were estimated by fishery, defined as a managed fish or invertebrate species landed on vessels using bottom otter trawl, sink gillnet, or scallop dredge gear in the Mid-Atlantic region (see Murray 2012, and Murray 2013). The maximum amount of projected coverage across all the fisheries was considered the desired level of sampling to monitor turtle discards for that gear type. Roughly 3,300 days are needed across bottom trawl fisheries (Murray in review, and sea day estimation methods in Murray 2012), roughly 2,600 days are needed across sink gillnet fisheries (based on CVs in Murray 2013 and sea day estimation methods in Murray 2012), and approximately 1,300 days are needed in the scallop dredge fishery, based on loggerhead bycatch precision levels after chain mats were implemented in the fishery (Murray 2012). Estimates of sea day needs for turtles are revised when new bycatch estimates are published for a particular gear type (approximately every 5 years).

Recent estimates of loggerhead interactions (i.e., "takes") and coverage needs in the scallop dredge fishery are currently being evaluated. Since May 2013, the use of turtle deflector dredges (TDDs) with chain mats have been required on scallop dredges in times and areas where loggerheads are known to be most common. These modifications are intended to reduce those interactions in which animals are landed or observed from the deck, although other "unobservable" interactions may still be occurring (i.e., those in which animals escape from the gear or come in contact with the gear but are not captured and brought to the surface where they can be observed; Warden and Murray 2011). Owing to the fairly recent implementation of TDDs and the possibility of large interannual availability of turtles to scallop fishing areas, more time is needed to confirm the apparent effectiveness of TDDs and chain mats in eliminating observable interactions. Therefore, in 2015 observers will continue to be used to monitor the dredge fleets for turtle interactions. However, further work is being conducted to examine the utility of observers for monitoring turtle interactions in these fleets, particularly if it becomes clear that all or most of the interactions are "unobservable." If additional filters are applied in future cases where turtle interactions are successfully eliminated or become unobservable, coverage levels in the affected fleet will be driven by other species groups.

Sea day requirements for non-loggerhead turtle species (i.e., greens, Kemp's ridleys, and leatherbacks) are not currently estimated because too few have been observed to estimate total bycatch and CVs for these species (Murray 2012). Because observers document all protected species interactions on trips, monitoring of other turtles species will still occur via days intended to monitor fish or loggerheads.

The numbers of sea days needed to achieve a 30% CV associated with the Mid-Atlantic[3] turtle gear types and fish/invertebrate fleets are given below and in Table 5, Steps 2 and 3.

Turtle Gear Types and Fish/Invertebrate Fleets	**Sea Days Needed**	
	Loggerhead Turtles	**Fish/Invertebrate Species Groups**
MA Otter Trawl, MA Scallop Trawl, MA Ruhle Trawl, and MA Haddock Separator Trawl Rows 5, 6, 9-12, and 15	3,309	1,323
MA Gillnet Rows 23-25	2,593	147
MA Scallop Dredge Rows 31, 33, 35, and 37	1,293	304

[3] In the sea turtle sample size analysis, Mid -Atlantic refers to areas fished west of 70^{o}W. In the fish/invertebrate sample size analysis, Mid-Atlantic refers to region based on port of departure from Connecticut and southward. Although it is recognized that port of departure may differ from the area fished, an odds ratio analysis conducted to evaluate broad-scale spatial coherence indicated a strong relationship between area fished (statistical area) and port of departure (region). Based upon this analysis, the "Mid-Atlantic" stratifications used in the 2 analyses were considered similar.

The numbers of sea days needed for the combined fish/invertebrate and turtle species groups were derived as followed:

- If the sum of the sea days needed for fish/invertebrate species groups of the corresponding fish/invertebrate fleets exceeded the sea days needed for the turtle gear type, then the sea days needed for fish/invertebrate was used.

- If the number of sea days needed for turtles for the gear type exceeded the sum of the sea days needed for fish/invertebrate groups of the corresponding fish/invertebrate fleets, then the sea days needed for turtles were distributed according to the proportion of VTR sea days[4] corresponding to fish/invertebrate fleets (Table 5; Steps 4a - 4c). The number of VTR sea days by fleet is taken from Table 3 in Wigley et al. 2015 and reflects industry activity during the July 2013 through June 2014 time period.

A total of 15,786 sea days is needed for fish/invertebrates and loggerhead turtles (COMBINED; Table 5; Step 5) during the April 2015 through March 2016 period. Of the 15,786 sea days, 13,630 sea days are needed for agency-funded fleets and 2,156 sea days are needed for industry-funded fleets (Table 5, Step 6).

Summary of Funding available for the April 2015 through March 2016 period

The funds available to the NEFSC's Northeast Fisheries Sampling Branch in fiscal year (FY) 2015 are estimated to provide support for 9,415 days and 1,850 days are carried over (i.e., bought ahead) from FY2014 funds for a total of 11,265 (9,415 + 1,850) days for the April 2015 through March 2016 time period. Based upon an observer set-aside compensation rate analysis for the Industry Funded Scallop program, there is industry funding for 2,512 days. Hence, 13,777 (11,265 + 2,512) days are available for observer coverage during April 2015 through March 2016.

Below is a summary of the 2 funding source categories: agency- funded and industry-funded. Within the agency-funded category, there are 6 sub-categories: Atlantic Coast, National Catch Share Program, National Observer Program, Northeast Fisheries Observers, Marine Mammal Protection Act, and Reducing Bycatch.

- **Agency-funded**: The funding sources for the 11,265 agency-funded sea days include: Atlantic Coast (1,152 days), Northeast Fisheries Observers (3,827 days), National Observer Program (2,310 days and 1,465 days), Reducing Bycatch (73 days), and 650 carryover/bought ahead days collectively fund the sea days for prioritization (9,477 days; Table 5, Step 7); National Catch Share Program funds support the infrastructure (data processing and training) and the FY2014 National Observer Program funding (remaining in At-Sea Monitoring [ASM] contracts) collectively fund the sea days for At-Sea Monitoring (1,100 days; Table 5, Step 7); and Marine Mammal Protection Act (MMPA; 588 days) and

[4] The use of VTR sea days represents a refinement to the sea day allocation methods used in 2012, 2013, 2014, and those described in the 2015 SBRM Omnibus Amendment. This refinement results in the sea days needed to monitor turtles to be distributed among fish/invertebrate fleets based on industry activity. Additionally, this refinement preserves the number of TURS days within each turtle gear type group. These two features were not present in the previous method in which the numbers of day needed for fish/invertebrates were used.

FY14 carryover/bought ahead (100 days) collectively fund the sea days to monitor protected species (688 days; Table 5, Step 7).

- 688 agency-funded days are applicable to protected species[5] only.

  The 688 MMPA days are associated with trips having sampling protocols that are specific to protected species (marine mammals, sea turtles, Endangered Species Act [ESA] listed fish species) and are not applicable for non-ESA listed fish and invertebrates. Owing to the extra demands of monitoring protected species, information on finfish and shellfish is not collected on these trips. However, these days will provide observer coverage for sea turtles and ESA-listed fish species above that which is allocated.

- 10,577 (11,265 - 688) agency-funded days are applicable for all species.

  - 9,477 days are subject to the prioritization process across all fleets. The prioritization approach is described in the next section and given in Table 6.
  - 1,100 days are associated with At-Sea Monitoring and have been provisionally allocated among fleets associated with New England groundfish based on previous year industry activity. Actual allocation will be based on industry activity during April 2015 through March 2016.
  - No sea days have been set aside to support the training of new observers or as discovery days to address emerging questions of scientific and management interest as the year progresses.

- Projected costs (i.e., an estimated rate that includes fixed and variable costs for operations, training, and data processing infrastructure and at-sea costs based on realized cost in FY14): $1227 for NEFOP days ($712 for the costs associated with the sea days and $515) and $1241 for ASM days ($711 for the sea day portion and $530 from the infrastructure).

- **Industry-funded**: The number of industry-funded sea days available for scallop fleets is determined by taking 1 percent of the total acceptable biological catch/annual catch limit set for the year. The Industry Funded Scallop (IFS) program allows the vessels an increase in landings to help defray the costs of carrying an observer (i.e., the compensation rate). The sale of the additional scallops allocated to each boat supplies the funding for the at-sea costs of observer coverage. Based upon projected landings and expected prices, the IFS program generates funds in support of discard monitoring of the scallop fleets. A compensation rate analysis was undertaken to support observer coverage of the 12 industry-funded scallop fleets (Rows 9-12 and 31-38; Table 5).

[5] In this document, protected species refers to marine mammals, sea turtles, and ESA-listed fish.

- Based upon the compensation rate analysis, a total of 2,512 sea days can be funded: 1,346 days for Open areas, 1,149 days for Mid-Atlantic Access Areas, 10 days for Closed Area II (CAII), and 7 days in the Nantucket Lightship Access Area (NLAA).
    - The industry-funded schedule runs March through February, a 12-month period that is shifted 1 month from the NEFOP sea day schedule of April to March.
    - Bulletins describing the 2015 set-aside compensation rate calculations and scallop management measures are available at:

      http://www.greateratlantic.fisheries.noaa.gov/nr/2015/April/15scalobsercomratephl.pdf

      http://www.greateratlantic.fisheries.noaa.gov/nr/2015/February/15scalfy2015measuresphl.pdf
- Of the 1,346 days for the Open areas, there are 193 days for Limited Access General Category fleets (Rows 11, 35, and 36; Table 7) and 1,153 days for Limited Access fleets (Rows 12, 37, and 38; Table 7).
- Coverage of the 12 fleets depends on industry activity among these fleets during April 2015 through March 2016; the sea days represent the maximum coverage (i.e., caps).
- Projected costs: the cost to industry for at-sea portion is $675/day for industry-funded fleets. Additional agency funds are needed for training and certification of observers and data processing.

Below is a summary of sea days based on the agency budget and the compensation rate analysis, by funding source for April 2015 through March 2016.

Funding Source	**Sea Days**
Agency-funded Total	**11,265**
Agency-funded applicable to all species (prioritized days)	9,477
Agency-funded applicable to all species (non-prioritized days)	1,100
Agency-funded applicable to protected species only (non-prioritized days)	688
Industry-funded Total applicable to all species	**2,512**
Total	**13,777**

Prioritization Trigger and Details of the Allocation of Sea Days to Fleets

Within the agency-funded fleets and prioritization-applicable funding, a funding shortfall of 4,153 (13,630 – 9,477) days is expected (Table 5). The 2015 funding shortfall triggers the SBRM prioritization approach; the prioritization approach is utilized with a portion of the agency funds.

The following describes the steps taken to allocate the 13,777 funded sea days to 41 fleets (Tables 5, 6, and 7).

Step 1. Derive the number of sea days needed for the 14 fish/invertebrate species groups (see Wigley et al. 2015, same method as Wigley et al. 2014; Table 5).

Step 2. Apply the trip filter and remove sea days from fleets that comprise 1% or less of the cumulative percentage of trips across all fleets. A total of 10,365 days is needed across 35 fleets (28 agency-funded fleets and 7 industry-funded fleets; Table 5).

Step 3. Derive the number of sea days needed for sea turtles (see Murray 2012, 2013, in review; Table 5).

Step 4. To support the penultimate prioritization approach, derive the number of sea days needed for loggerhead turtles for each of the fish/invertebrate fleets associated with the turtle gear type group (Table 5).

a. Summarize the number of VTR sea days corresponding to each fish/invertebrate fleet (see Table 3 in Wigley et al. 2015). The VTR sea days are zero for the fish/invertebrate fleets that have been filtered out via the trip filter.

b. Derive the percentage of VTR sea days for each fish/invertebrate fleet within a turtle gear type group. For each fish/invertebrate fleet associated with a turtle gear type, divide the VTR sea days by the sum of the VTR sea days for the gear type group.

c. Derive the number of sea days needed for loggerhead turtles by fish/invertebrate fleet. Multiply the number of turtle sea days needed for the gear type by the percentage of VTR sea days for each fish/invertebrate fleet within the turtle gear type group.

Step 5. Derive the number of sea days needed for fish/invertebrates and turtles COMBINED; select the largest of the 2 sea days (i.e., sea days needed for the 14 fish/invertebrate species groups with the trip filter applied [Step 2] and sea days needed for loggerhead turtles [Step 4c]) within the fleet.

A total of 15,786 days is needed to achieve a 30% CV on the discards of the 15 species groups in 2015; Table 5).

Step 6. Partition fleets into funding source categories and sum the number of sea days needed, by funding source.

There were 13,630 days and 2,156 days needed to achieve a 30% CV for the 15 species groups for agency-funded and industry-funded fleets, respectively (Table 5).

Step 7. Obtain funded sea days, by funding source category. For agency-funded sea days, calculate the number of sea days applicable to the prioritization process (prioritized versus non-prioritized days).

There are 9,477 agency-funded days applicable to the prioritization process (Table 5).

Step 8. Evaluate needed sea days versus funded sea days for each funding category and calculate shortfall or surplus sea days associated with the prioritization process.

A shortfall of 4,153 days is expected for agency-funded fleets (Table 5).

Step 9. Apply the penultimate approach algorithm to allocate sea days to fleets for agency-funded days that are applicable to prioritization process.

As described in the 2015 SBRM Amendment, the number of agency-funded sea days applicable to the prioritization process is assigned to each fleet (fishing mode) after sequentially removing the sea days needed for the species group/fleet with the highest sea day difference between adjacent species groups within a fleet until the sea day shortfall is removed.

The following describes the steps taken to assign the agency-funded sea days applicable to the prioritization process using the penultimate approach (Table 6).

Step 9.1. For each agency-funded fleet where sea days are needed, list the sea days needed for the 15 species groups (fish/invertebrates and loggerhead turtles) in descending order within a fleet (Table 6). Use the minimum pilot days (Table 4) as the minimum sea days needed for fleets that are not filtered out via the trip filter.

Step 9.2. Calculate the differences in sea days between adjacent species groups within each agency-funded fleet (Table 6).

Step 9.3. Within the resulting matrix of sea day differences (Step 9.2), identify the largest difference and remove the sea days associated with the species group accounting for this difference (Table 6).

Repeat this process for the next largest difference, with the constraint that the differences are taken in penultimate order (from left to right in the matrix) within a fleet, until the cumulative reduction of sea days equals the sea day shortfall (Step 8). If the reduction in sea days using the next largest (penultimate) value is greater than the shortfall, reduce the number of sea days only enough to remove the shortfall.

The 2015 sea day shortfall is 4,153 days. The 4,647 days (red deepsea crab [RCRAB] in Row 8; Tables 4 and 6) associated with the largest sea day difference (3,916 days) between adjacent species groups is removed first (Table 6). The penultimate value in Row 8 is associated with Fluke-scup-black sea bass (731 days; Tables 4 and 6). The 1,577 days (loggerhead turtle [TURS] in Row 5; Tables 5 and 6) are associated with the next largest sea day difference (1,021 days) between adjacent species groups. Removing 1,577 days associated with TURS would remove more sea days than needed to reach the shortfall amount of

4,153 days (Table 6). Thus, only 237 of the 1,021 sea day difference between adjacent species groups (1,577 days for TURS and 566 days for squid-butterfish-mackerel [SBM]) are needed (Table 6). The penultimate value for Row 5 becomes 1,340 (1,577 – 237) days for TURS.

Step 9.4. After the removal of sea days within a fleet (Step 9.3), the remaining highest sea days (i.e., the penultimate or the left -hand-most value in Step 9.1) becomes the "PRIORITIZED" sea days required for that fleet.

The 9,477 prioritized sea days provide observer coverage to all 28 agency-funded fleets. There are 26 fleets for which no reduction in sea days occurred and there are 2 fleets (Rows 5 and 8) for which the numbers of sea days allocated are less than the days needed to achieve a 30% CV. The prioritized sea days for Row 5 become 1,340 days and the prioritized sea days for Row 8 become 731 days (Table 6). For Row 5, all fish/invertebrate species groups have an expected CV of 30% or less; however, the CV for TURS in the MA otter trawl gear type group is expected to exceed 30%. For Row 8, the CV for the RCRAB species group is expected to exceed 30% while all other species groups within this fleet have an expected CV of 30% or less.

Step 9.5. Identify fleets that cannot be covered by NEFOP this year.

In 2015, there are no practical limitations that prevent the NEFOP from covering these fleets. The sea days in Step 9.5 equal the sea days in Step 9.4 (Table 7).

Step 10. Allocate agency-funded non-prioritized sea days: ASM and MMPA days.

There are 1,788 agency-funded days that are not applicable to the prioritization process (non-prioritized days: 1,100 ASM days and 688 MMPA days; Table 7).

The 1,100 ASM sea days will be assigned to trips via the Pre-Trip Notification System (PTNS; Palmer et al. 2013). This means that the observer coverage within each of these fleets will depend upon industry activity during the April 2015 through March 2016 period. The ASM sea days have been proportionally allocated based on previous year industry activity, and thus the allocation presented in this report should be considered provisional (Table 7).

The 688 MMPA sea days, all assumed to have limited sampling protocols, are allocated to a row designated as "MMPA coverage" and will be associated with the NE and MA gillnet fleets (Rows 23-28; Table 7).

Step 11. Allocate industry- funded days. The sea days for the industry-funded fleets are assigned to trips via the call-in system[6]. Similar to the ASM non-prioritized sea days, the sea day

[6] For more information on the call-in system for the industry-funded scallop program, see http://www.nefsc.noaa.gov/fsb/scallop/Industry_Scallop_Call_in_Guide.pdf

coverage for industry-funded fleets will depend on industry activity during the April 2015 through March 2016 period and will be capped as described above. The 2,512 industry-funded sea days have not been allocated to individual fish/invertebrate fleets, but rather to groups of fish/invertebrate fleets that correspond to the stratification used in compensation rate analysis: Mid-Atlantic access area fleets (Rows 9, 10, 31, and 33; Table 7); Open areas fleets (Rows 11, 35 and 36 for Limited Access General Category fleets and Rows 12, 37, and 38 for Limited Access; Table 7); and New England access area fleets (Rows 32 and 34; Table 7). The allocated sea days represent the maximum coverage (i.e., caps).

Industry-funded sea days are expected to meet or exceed the SBRM required sea days for each fleet group corresponding to the stratification used in the compensation rate analysis except for New England access areas (Table 7). The 2015 sea day analyses estimated a total of 121 days needed for the New England access areas (Rows 32 and 34) for the upcoming year based on the July 2013 through June 2014 data; however, the New England access areas are closed for 2015 and fishing activity will not be allowed in these access areas after April 2015. Hence only a portion of the 121 days will be required for this group to cover 2014 compensation fishing trips. It was estimated that a total of 17 days would provide sufficient coverage between the beginning of the sea day schedule (April 2015) and the implementation of the 2015 scallop regulations.

Step 12. The sea days allocated for the April 2015 – March 2016 (TOTAL) is the sum of the prioritized days (Step 9.5), non-prioritized days (Step 10), and industry-funded days (Step 11). A total of 13,777 days is allocated across 41 fleets (Table 7).

The agency-funded fleets with an * or ** (Table 7) indicate that some or all of the observer coverage will be assigned via the PTNS or the scallop call-in program. This means that some or all of the observer coverage within each of these fleets will depend upon industry activity during the April 2015 through March 2016 period. The sea days for agency-funded fleets have been proportionally allocated based on previous year industry activity, and thus should be considered provisional. All other fleets will have sea days assigned to trips via the NEFOP sea day schedule.

Discussion

Although the trip filter removes the fleets with overall low activity from the sample size analysis, some of these fleets may have observer coverage assigned via the PTNS or the call-in program. For example, 5 of the 21 fleets that are removed by the trip filter are scallop fleets (Rows 9, 10, 12, 31, and 32) that have a call-in program such that coverage could be assigned based on industry activity. Similarly, those fleets associated with groundfish (e.g., Row 17) could be assigned observer coverage via the PTNS, depending upon industry activity. Because the sea days needed for these fleets have been excluded, the needed sea days may be slightly underestimated. However, it is important to note that these fleets have very low trip activity and the activity is expected to remain low. As a practical matter, fleets with low trip activity within a quarter or overall are very difficult to “find” unless they are part of PTNS or a call-in program. Attempts to assign observers can be inefficient since the probability of randomly finding such trips at a specific port or time period will be very low. Such fleets fall below practical detection limits.

The sample size analysis conducted by Wigley et al. (2015) derived the expected precision (CV) of the discard estimates for various species groups over a range of sample sizes for each of the species groups that were not filtered out by the importance filter (see Table 7 and Figure 3 in Wigley et al. 2015). Deriving the expected CV assumes the variance of the discard estimate is constant over a range of sample sizes (number of trips). For fish/invertebrates, the following example illustrates that although the sea days needed may be greater than the total allocated sea days, this does not imply that the expected precision for *all* fish/invertebrate species groups will exceed 30% CV. In the NE large mesh otter trawl fleet, a total of 1,390 days (Table 7, Step 12, Row 8) has been allocated for which 4,647 days (Table 7, Step 5, Row 8) are needed for a 30% CV for the 14 fish/invertebrate species groups. The expected CV for RCRAB is approximately 59% and all other fish/invertebrate species groups have an expected CV of 30% or less with 1,390 days allocated to this fleet (Figure 1). For loggerhead turtles, 3,309 days are needed in Mid-Atlantic otter trawl fleets for a 30% CV. With 2,977 days allocated to Mid-Atlantic otter trawl fleets (Table 7, Step 12, Rows 5 and 6), the expected CV increases to roughly 32% (Figure 2). As IFS days will provide additional coverage for turtles in MA scallop trawl fleets, the expected CV may be slightly lower.

The NY Department of Environmental Conservation has secured funding through the Atlantic Coast Cooperative Statistical Program (ACCSP) to support observer coverage (approximately 880 days) for otter trawl, gillnet, and pot/trap fleets in the Mid-Atlantic region. These sea days will provide observer coverage for all species above that allocated in this report.

References

Murray KT In review. The importance of place and operational fishing factors in estimating and reducing loggerhead (*Caretta caretta*) interactions in U.S. bottom trawl gear. *Fish. Res.*

Murray KT. 2013. Estimated Loggerhead and Unidentified Hard-shelled Turtle Interactions in Mid-Atlantic Gillnet Gear, 2007-2011. NOAA Tech Memo NMFS-NE-225. 20 p. Available online at: http://www.nefsc.noaa.gov/publications/tm/tm225/

Murray KT. 2012. Estimating observer sea day requirements in the Mid-Atlantic region to monitor loggerhead sea turtle (*Caretta caretta*) interactions. US Dept Commer, Northeast Fish Sci Cent Ref Doc 12-26; 10 p. Available online at: http://www.nefsc.noaa.gov/publications/crd/crd1226/

Murray KT. 2011. Interactions between sea turtles and dredge gear in the U.S. sea scallop (*Placopecten magellanicus*) fishery, 2001-2008. *Fish. Res.* 107:137-146.

National Marine Fisheries Service (NMFS). 2011. Fisheries of the Northeastern United States; Removal of Standardized Bycatch Reporting Methodology Regulations. Federal Register, Vol. 76, No. 250, Thursday, December 29, 2011. p. 81844 – 81850. http://www.gpo.gov/fdsys/pkg/FR-2011-12-29/pdf/2011-33302.pdf

National Marine Fisheries Service (NMFS). 2008. Magnuson-Stevens Fishery Conservation and Management Act Provisions; Fisheries of the Northeastern United States; Northeast Region Standardized Bycatch Reporting Methodology Omnibus Amendment. Federal Register, Vol. 73, No. 18, Monday, January 28, 2008. p. 4736-4758. Available on-line at: https://federalregister.gov/a/E8-1436

New England Fishery Management Council (NEFMC), Mid-Atlantic Fishery Management Council and National Marine Fisheries Service. 2015. Standardized Bycatch Reporting Methodology: An Omnibus Amendment to the Fishery Management Plans of the New England and Mid-Atlantic Fishery Management Councils. November 2014. 348 p. Available on-line at: http://www.greateratlantic.fisheries.noaa.gov/regs/2015/January/15SBRMOmnibusPR.html

New England Fishery Management Council (NEFMC), Mid-Atlantic Fishery Management Council and National Marine Fisheries Service. 2007. Northeast Region Standardized Bycatch Reporting Methodology: An Omnibus Amendment to the Fishery Management Plans of the New England and Mid-Atlantic Fishery Management Councils. June 2007. 642 p. Available on-line at: http://www.nefmc.org/issues/sbrm/index.html

Palmer MC, Hersey P, Marotta H, Shield G, Cierpich, SB. 2013. The design, implementation and performance of an observer pre-trip notification system (PTNS) for the northeast United States groundfish fishery. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 82 p. Available online at: http://www.nefsc.noaa.gov/publications/crd/crd1321/

Scott-Denton E, Cryer PF, Duffy MR, Gocke JP, Harrelson MR, Kinsella DL, Nance JM, Pulver JR, Smith RC, Williams JA. 2012. Characterization of the U.S. Gulf of Mexico and South Atlantic penaeid and rock shrimp fisheries based on observer data. *Marine Fisheries Review*, 74(4): 1-27. Available at: http://spo.nmfs.noaa.gov/mfr744/mfr744.html

Warden ML, Murray KT. 2011. Reframing protected species interactions in commercial fishing gear: moving toward estimating the unobservable. *Fish. Res.*110: 387-390.

Wigley SE, Blaylock J, Rago PJ, Shield G. 2014 discard estimation, precision, and sample size analyses for 14 federally managed species in the waters off the northeastern United States. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 157 p. Available online at: http://www.nefsc.noaa.gov/publications/crd/crd1405/

Wigley SE, Rago PJ, Sosebee KA, Palka DL. 2007. The Analytic Component to the Standardized Bycatch Reporting Methodology Omnibus Amendment: Sampling Design, and Estimation of Precision and Accuracy (2nd Edition). US Dep. Commer., Northeast Fish. Sci. Cent. Ref. Doc. 07-09; 156 p. Available online at: http://www.nefsc.noaa.gov/publications/crd/crd0709/

Wigley SE, Tholke C, Blaylock J, Rago PJ, Shield G. 2015. 2015 discard estimation, precision, and sample size analyses for 14 federally managed species in the waters off the northeastern United States. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 15-04; 162 p. Available online at: http://www.nefsc.noaa.gov/publications/crd/crd1504/

Table 1. A list of the 14 fish and invertebrate species groups and 1 species of sea turtles (in bold), with species group abbreviations in parentheses and scientific names in italics, and the species that compose these groups, corresponding to the 13 federal fishery management plans implements in the waters off the northeastern United States.

ATLANTIC SALMON (SAL)	*Salmo salar*
BLUEFISH (BLUE)	*Pomatomus saltatrix*
FLUKE - SCUP - BLACK SEA BASS (FSB)	
Black sea bass	*Centropristis striata*
Fluke	*Paralichthys dentatus*
Scup	*Stenotomus chrysops*
HERRING, ATLANTIC (HERR)	*Clupea harengus*
LARGE MESH GROUNDFISH (GFL)	
American plaice	*Hippoglossoides platessoides*
Atlantic cod	*Gadus morhua*
Atlantic halibut	*Hippoglossus hippoglossus*
Atlantic wolffish	*Anarhichas lupus*
Haddock	*Melanogrammus aeglefinus*
Ocean pout	*Zoarces americanus*
Pollock	*Pollachius virens*
Redfish	*Sebastes fasciatus*
White hake	*Urophycis tenuis*
Windowpane flounder	*Scophthalmus aquosus*
Winter flounder	*Pseudopleuronectes americanus*
Witch flounder	*Glyptocephalus cynoglossus*
Yellowtail flounder	*Limanda ferruginea*
MONKFISH (MONK)	*Lophius americanus*
RED DEEPSEA CRAB (RCRAB)[7]	*Chaceon quinquedens*
SEA SCALLOP (SCAL)	*Placopecten magellanicus*
SKATE COMPLEX (SKATE)[8]	*Rajidae*
Barndoor skate	*Dipturus laevis*
Clearnose skate	*Raja eglanteria*
Little skate	*Leucoraja erinacea*
Rosette skate	*Leucoraja garmani*
Smooth skate	*Malacoraja senta*
Thorny skate	*Amblyraja radiata*
Winter skate	*Leucoraja ocellata*
SMALL MESH GROUNDFISH (GFS)	
Offshore hake	*Merluccius albidus*
Red hake	*Urophycis chuss*
Silver hake	*Merluccius bilinearis*
SPINY DOGFISH (DOG)	*Squalus acanthias*
SQUID[9] **- BUTTERFISH - MACKEREL (SBM)**	
Atlantic mackerel	*Scomber scombrus*
Butterfish	*Peprilus triacanthus*
Northern shortfin squid	*Illex illecebrosus*
Longfin inshore squid	*Doryteuthis (Amerigo) pealeii*
SURFCLAM - OCEAN QUAHOG (SCOQ)	
Surfclam	*Spisula solidissima*
Ocean quahog	*Artica islandica*
TILEFISH (TILE)	*Lopholatilus chamaeleonticeps*
LOGGERHEAD TURTLE (TURS)	*Caretta caretta*

[7] Red deepsea crab was referred to as red crab in previous documents.

[8] Skate complex comprises 7 species as well as skate, unknown.

[9] Squid, unclassified is included in this species group. In this document, longfin inshore squid is referred to as longfin squid. Longfin inshore squid and northern shortfin squid are also known as Loligo squid and Illex squid, respectively.

Table 2. Total catch (live lb), Vessel Trip Report landings (kept; live lb), estimated discards (live lb), associated coefficient of standard error of the estimated discards (SE; live lb) for 14 SBRM species groups combined, by fleet, based on July 2013 thro shading indicates fleets not considered or with no Northeast Fisheries Observer Program trips in the annual analysis. These C annual sample size analysis. Blank CV indicates either no discards or discards equals 0. "P" indicates fleets with "pilot" design
Taken from Table 5C in Wigley et al. 2015.

Species: 14 SBRM SPECIES GROUPS COMBINED

Fleet Row	Gear Type	Access Area	Trip Category	Region	Mesh Group	Total	Kept	Discarded	CV	
1	Longline	OPEN	all	MA	all	1,711,479	1,711,479			
2	Longline	OPEN	all	NE	all	1,490,357	1,298,479	191,878	0.348	
3	Hand Line	OPEN	all	MA	all	296,320	296,320	0		
4	Hand Line	OPEN	all	NE	all	1,177,906	936,874	241,032	0.496	
5	Otter Trawl	OPEN	all	MA	sm	47,393,001	31,649,299	15,743,702	0.099	1,
6	Otter Trawl	OPEN	all	MA	lg	36,769,493	13,561,150	23,208,344	0.111	2,
7	Otter Trawl	OPEN	all	NE	sm	61,106,617	54,835,765	6,270,852	0.135	
8	Otter Trawl	OPEN	all	NE	lg	105,280,035	57,234,642	48,045,393	0.069	3,
11	Scallop Trawl	OPEN	GEN	MA	all	1,966,509	996,246	970,264	0.174	
12	Scallop Trawl	OPEN	LIM	MA	all	658,754	658,754			
13	Otter Trawl, Twin	OPEN	all	MA	all	1,260,016	1,148,765	111,251	0.000	
16	Otter Trawl, Ruhle	OPEN	all	NE	sm	1,103,933	902,390	201,543	0.035	
17	Otter Trawl, Ruhle	OPEN	all	NE	lg	119,838	72,306	47,532	0.000	
18	Otter Trawl, Haddock Separator	OPEN	all	NE	lg	3,132,468	2,412,967	719,501	0.189	
19	Shrimp Trawl	OPEN	all	MA	all	8,386	8,386			
20	Shrimp Trawl	OPEN	all	NE	all	369,649	369,649			
22	Floating Trap	OPEN	all	NE	all	18,352	18,352			
23	Sink, Anchor, Drift Gillnet	OPEN	all	MA	sm	1,384,925	1,352,331	32,594	1.830	
24	Sink, Anchor, Drift Gillnet	OPEN	all	MA	lg	4,173,630	3,912,719	260,911	0.500	
25	Sink, Anchor, Drift Gillnet	OPEN	all	MA	xlg	7,708,472	6,823,553	884,919	0.196	
26	Sink, Anchor, Drift Gillnet	OPEN	all	NE	sm	376	376			
27	Sink, Anchor, Drift Gillnet	OPEN	all	NE	lg	11,628,459	7,956,540	3,671,919	0.077	
28	Sink, Anchor, Drift Gillnet	OPEN	all	NE	xlg	17,943,981	15,175,147	2,768,834	0.080	
29	Purse Seine	OPEN	all	MA	all	0	0			
30	Purse Seine	OPEN	all	NE	all	48,513,940	48,499,422	14,518	0.512	
31	Scallop Dredge	AA	GEN	MA	all	375,290	360,682	14,608	0.559	
32	Scallop Dredge	AA	GEN	NE	all	468,359	449,517	18,842	0.560	
33	Scallop Dredge	AA	LIM	MA	all	17,830,225	15,570,539	2,259,686	0.246	

Table 2, continued. Total catch (live lb), Vessel Trip Report landings (kept; live lb), estimated discards (live lb), associated co and standard error of the estimated discards (SE; live lb) for 14 SBRM species groups combined, by fleet, based on July 2013 Dark shading indicates fleets not considered or with no Northeast Fisheries Observer Program trips in the annual analysis. The the annual sample size analysis. Blank CV indicates either no discards or discards equals 0. "P" indicates fleets with "pilot" de
Taken from Table 5C in Wigley et al. 2015.

Species: 14 SBRM SPECIES GROUPS COMBINED

Fleet Row	Gear Type	Access Area	Trip Category	Region	Mesh Group	Total	Kept	Discarded	CV	
34	Scallop Dredge	AA	LIM	NE	all	34,703,924	31,504,235	3,199,689	0.135	
35	Scallop Dredge	OPEN	GEN	MA	all	11,935,749	9,888,426	2,047,323	0.099	
36	Scallop Dredge	OPEN	GEN	NE	all	9,881,711	8,982,229	899,483	0.122	
37	Scallop Dredge	OPEN	LIM	MA	all	60,751,142	55,320,621	5,430,521	0.081	
38	Scallop Dredge	OPEN	LIM	NE	all	192,744,890	167,907,405	24,837,485	0.059	1,
39	Danish Seine	OPEN	all	MA	all	0	0			
40	Mid-water Paired & Single Trawl	OPEN	all	MA	all	3,172,468	3,163,000	9,468	0.000	
41	Mid-water Paired & Single Trawl	OPEN	all	NE	all	148,097,047	148,023,920	73,127	0.403	
42	Pots and Traps, Fish	OPEN	all	MA	all	478,506	366,848	111,657	0.215	
43	Pots and Traps, Fish	OPEN	all	NE	all	319,991	319,991			
44	Pots and Traps, Conch	OPEN	all	MA	all	5,475	3,346	2,129	0.145	
45	Pots and Traps, Conch	OPEN	all	NE	all	42,794	0	42,794	0.000	
46	Pots and Traps, Hagfish	OPEN	all	NE	all	0	0			
47	Pots and Traps, Lobster	OPEN	all	MA	all	272,646	140,018	132,628	0.169	
48	Pots and Traps, Lobster	OPEN	all	NE	all	342,744	25,205	317,539	0.990	
49	Pots and Traps, Crab	OPEN	all	MA	all	176,310	176,310			
50	Pots and Traps, Crab	OPEN	all	NE	all	2,202,976	2,201,739	1,237	0.000	
51	Beam Trawl	OPEN	all	MA	all	675,527	675,527			
53	Dredge, Other	OPEN	all	MA	all	0	0			
54	Ocean Quahog/Surfclam Dredge	OPEN	all	MA	all	256,367,297	256,367,297			
55	Ocean Quahog/Surfclam Dredge	OPEN	all	NE	all	215,812,072	215,812,072			
56	Otter Trawl, Haddock Separator	OPEN	all	NE	sm	267,724	202,022	65,702	0.044	
	Confidential fleets					271,892	271,892			
	Other fleets					2,284,907	2,284,907			
					TOTAL	1,314,698,562	1,171,849,660	142,848,902	0.034	4,

Table 3. The most recent average annual estimates of sea turtle interactions and their associated coefficient of variation (CV) in commercial fisheries.

Fishery	Estimate	CV	Years Included	Species	Referen
Bottom trawl, for fish and scallops	231	0.13	01 Jan 2009-2013	Loggerhead	Murray (
Sea Scallop Dredge	95	0.18	26 Sep 2006-2008	Loggerhead	Murray 2
Sea Scallop Dredge	125	0.15	26 Sep 2006-2008	Hard-shelled	Murray 2
Sink Gillnet	89	0.26	01 Jan 2007-2001	Loggerhead	Murray 2
Sink Gillnet	95	0.21	01 Jan 2007-2011	Hard-shelled	Murray 2

Table 4. The number of sea days needed to achieve a 30% coefficient of variation of the discard estimate for each of the 14 fish groups, the number of pilot sea days, the number of minimum pilot sea days, and the maximum number of sea days needed for Needed) for fish and invertebrate species groups based on July 2013 through June 2014 data. Bold red font indicates basis for fl fleets with "pilot" designation. Species group abbreviations are given in Table 1. *Taken from Table 6 in Wigley et al. 2015.*

Row	Fleet Gear Type	Access Area	Trip Category	Region	Mesh Group	BLUE	HERR	SAL	RCRAB	SCAL	SBM	MONK	GFL	GFS	SKATE	DOG	FSB	SCOQ
1	Longline	OPEN	all	MA	all	85	85	85	85	85	85	85	85	85	85	85	85	85
2	Longline	OPEN	all	NE	all	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Hand Line	OPEN	all	MA	all	70	70	70	70	70	70	70	70	70	70	70	70	70
4	Hand Line	OPEN	all	NE	all	0	0	0	0	0	0	0	**48**	0	0	0	0	0
5	Otter Trawl	OPEN	all	MA	sm	0	0	0	0	0	**556**	0	336	531	294	402	493	0
6	Otter Trawl	OPEN	all	MA	lg	0	0	0	0	0	0	**744**	72	0	89	220	210	0
7	Otter Trawl	OPEN	all	NE	sm	0	0	0	0	0	**1,311**	0	313	460	0	571	720	0
8	Otter Trawl	OPEN	all	NE	lg	0	0	0	**4,647**	0	0	228	349	231	316	192	731	0
9	Scallop Trawl	AA	GEN	MA	all	6	6	6	6	6	6	6	6	6	6	6	6	6
10	Scallop Trawl	AA	LIM	MA	all	42	42	42	42	42	42	42	42	42	42	42	42	42
11	Scallop Trawl	OPEN	GEN	MA	all	0	0	0	0	0	0	0	0	0	0	0	0	0
12	Scallop Trawl	OPEN	LIM	MA	all	72	72	72	72	72	72	72	72	72	72	72	72	72
13	Otter Trawl, Twin	OPEN	all	MA	all	60	60	60	60	60	60	60	60	60	60	60	60	60
14	Otter Trawl, Twin	OPEN	all	NE	all	85	85	85	85	85	85	85	85	85	85	85	85	85
15	Otter Trawl, Ruhle	OPEN	all	MA	lg	27	27	27	27	27	27	27	27	27	27	27	27	27
16	Otter Trawl, Ruhle	OPEN	all	NE	sm	48	48	48	48	48	48	48	48	48	48	48	48	48
17	Otter Trawl, Ruhle	OPEN	all	NE	lg	68	68	68	68	68	68	68	68	68	68	68	68	68
18	Otter Trawl, Haddock Separator	OPEN	all	NE	lg	0	0	0	0	0	0	0	0	0	0	**302**	0	0
19	Shrimp Trawl	OPEN	all	MA	all	65	65	65	65	65	65	65	65	65	65	65	65	65
20	Shrimp Trawl	OPEN	all	NE	all	9	9	9	9	9	9	9	9	9	9	9	9	9
21	Floating Trap	OPEN	all	MA	all	9	9	9	9	9	9	9	9	9	9	9	9	9
22	Floating Trap	OPEN	all	NE	all	21	21	21	21	21	21	21	21	21	21	21	21	21
23	Sink, Anchor, Drift Gillnet	OPEN	all	MA	sm	0	0	0	0	0	0	0	0	0	0	0	0	0
24	Sink, Anchor, Drift Gillnet	OPEN	all	MA	lg	0	0	0	0	0	0	0	0	0	0	0	0	0
25	Sink, Anchor, Drift Gillnet	OPEN	all	MA	xlg	0	0	0	0	0	0	**122**	0	0	0	0	0	0
26	Sink, Anchor, Drift Gillnet	OPEN	all	NE	sm	9	9	9	9	9	9	9	9	9	9	9	9	9
27	Sink, Anchor, Drift Gillnet	OPEN	all	NE	lg	0	0	0	0	0	0	0	0	0	0	**103**	0	0
28	Sink, Anchor, Drift Gillnet	OPEN	all	NE	xlg	0	0	0	0	0	0	152	0	0	73	**240**	0	0
29	Purse Seine	OPEN	all	MA	all	6	6	6	6	6	6	6	6	6	6	6	6	6
30	Purse Seine	OPEN	all	NE	all	0	0	0	0	0	0	0	0	0	0	0	0	0
31	Scallop Dredge	AA	GEN	MA	all	27	27	27	27	27	27	27	27	27	27	27	27	27
32	Scallop Dredge	AA	GEN	NE	all	0	0	0	0	0	0	0	0	0	0	0	0	0
33	Scallop Dredge	AA	LIM	MA	all	0	0	0	0	0	0	**153**	0	0	0	0	0	0
34	Scallop Dredge	AA	LIM	NE	all	0	0	0	0	0	0	65	0	0	**121**	0	0	0
35	Scallop Dredge	OPEN	GEN	MA	all	0	0	0	0	0	0	0	0	0	**28**	0	0	0
36	Scallop Dredge	OPEN	GEN	NE	all	0	0	0	0	0	0	0	0	0	0	0	0	0
37	Scallop Dredge	OPEN	LIM	MA	all	0	0	0	0	0	0	**123**	0	0	51	0	0	0
38	Scallop Dredge	OPEN	LIM	NE	all	0	0	0	0	0	0	176	155	**630**	84	0	207	0
39	Danish Seine	OPEN	all	MA	all	6	6	6	6	6	6	6	6	6	6	6	6	6
40	Mid-water Paired & Single Trawl	OPEN	all	MA	all	32	32	32	32	32	32	32	32	32	32	32	32	32
41	Mid-water Paired & Single Trawl	OPEN	all	NE	all	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 4 continued. The number of sea days needed to achieve a 30% coefficient of variation of the discard estimate for each of species groups, the number of pilot sea days, the number of minimum pilot sea days, and the maximum number of sea days nee Days Needed) for fish and invertebrate species groups based on July 2013 through June 2014 data. Bold red font indicates basis indicates fleets with “pilot” designation. Species group abbreviations are given in Table 1. *Taken from Table 6 in Wigley et al. 2*

Row	Fleet Gear Type	Access Area	Trip Category	Region	Mesh Group	BLUE	HERR	SAL	RCRAB	SCAL	SBM	MONK	GFL	GFS	SKATE	DOG	FSB	SCOQ
42	Pots and Traps, Fish	OPEN	all	MA	all	22	22	22	22	22	22	22	22	22	22	22	22	22
43	Pots and Traps, Fish	OPEN	all	NE	all	42	42	42	42	42	42	42	42	42	42	42	42	42
44	Pots and Traps, Conch	OPEN	all	MA	all	28	28	28	28	28	28	28	28	28	28	28	28	28
45	Pots and Traps, Conch	OPEN	all	NE	all	22	22	22	22	22	22	22	22	22	22	22	22	22
46	Pots and Traps, Hagfish	OPEN	all	NE	all	83	83	83	83	83	83	83	83	83	83	83	83	83
47	Pots and Traps, Lobster	OPEN	all	MA	all	47	47	47	47	47	47	47	47	47	47	47	47	47
48	Pots and Traps, Lobster	OPEN	all	NE	all	0	0	0	0	0	0	0	**572**	0	0	0	0	0
49	Pots and Traps, Crab	OPEN	all	MA	all	29	29	29	29	29	29	29	29	29	29	29	29	29
50	Pots and Traps, Crab	OPEN	all	NE	all	83	83	83	83	83	83	83	83	83	83	83	83	83
51	Beam Trawl	OPEN	all	MA	all	35	35	35	35	35	35	35	35	35	35	35	35	35
52	Beam Trawl	OPEN	all	NE	all	11	11	11	11	11	11	11	11	11	11	11	11	11
53	Dredge, Other	OPEN	all	MA	all	11	11	11	11	11	11	11	11	11	11	11	11	11
54	Ocean Quahog/Surfclam Dredge	OPEN	all	MA	all	75	75	75	75	75	75	75	75	75	75	75	75	75
55	Ocean Quahog/Surfclam Dredge	OPEN	all	NE	all	65	65	65	65	65	65	65	65	65	65	65	65	65
56	Otter Trawl, Haddock Separator	OPEN	all	NE	sm	0	0	0	0	0	0	0	0	0	0	0	0	0
					Totals	**1,300**	**1,300**	**1,300**	**5,947**	**1,300**	**3,167**	**3,063**	**3,145**	**3,152**	**2,356**	**3,330**	**3,661**	**1,300**

Table 5. The number of sea days needed to monitor fish/invertebrates (FISH), loggerhead turtles (TURS), combined species groups (COMBINED) by fleet (Steps 1 through 6), and the number of funded sea days for April 2015 through March 2016 (Step 7) and the differences between needed and funded days (Step 8).

	Fleet					Step 1	Step 2	Step 3	Step 4a	Step 4b	Step 4c	Step 5
Row	Gear Type	Access Area	Trip Cat.	Region	Mesh	2015 Sea Days Needed FISH	2015 Sea Days Needed FISH **FILTERED**	2015 Sea Days Needed for TURS	Vessel Trip Report Sea Days	% Vessel Trip Report Sea Days	TURS Sea Days by FISH fleet	2015 Sea Days Needed COMBINED
1	Longline	OPEN	all	MA	all	85	85		1,303			85
2	Longline	OPEN	all	NE	all	14	14		540			14
3	Hand Line	OPEN	all	MA	all	70	70		3,395			70
4	Hand Line	OPEN	all	NE	all	48	48		2,385			48
5	Otter Trawl	OPEN	all	MA	sm	556	556	3,309	8,824	0.477	1,577	1,577
6	Otter Trawl	OPEN	all	MA	lg	744	744		9,156	0.495	1,636	1,636
7	Otter Trawl	OPEN	all	NE	sm	1311	1,311		9,318			1,311
8	Otter Trawl	OPEN	all	NE	lg	4647	4,647		18,811			4,647
9	Scallop Trawl	AA	GEN	MA	all	6	0		0	0.000	0	0
10	Scallop Trawl	AA	LIM	MA	all	42	0		0	0.000	0	0
11	Scallop Trawl	OPEN	GEN	MA	all	23	23		535	0.029	96	96
12	Scallop Trawl	OPEN	LIM	MA	all	72	0		0	0.000	0	0
13	Otter Trawl , Twin	OPEN	all	MA	all	60	0		0			0
14	Otter Trawl , Twin	OPEN	all	NE	all	85	0		0			0
15	Otter Trawl, Ruhle	OPEN	all	MA	lg	27	0		0	0.000	0	0
16	Otter Trawl, Ruhle	OPEN	all	NE	sm	48	0		0			0
17	Otter Trawl, Ruhle	OPEN	all	NE	lg	68	0		0			0
18	Otter Trawl, Haddock Separator	OPEN	all	NE	lg	302	302		990			302
19	Shrimp Trawl	OPEN	all	MA	all	65	0		0			0
20	Shrimp Trawl	OPEN	all	NE	all	9	9		135			9
21	Floating Trap	OPEN	all	MA	all	9	0		0			0
22	Floating Trap	OPEN	all	NE	all	21	0		0			0
23	Sink, Anchor, Drift Gillnet	OPEN	all	MA	sm	12	12		1,994	0.302	784	784
24	Sink, Anchor, Drift Gillnet	OPEN	all	MA	lg	13	13	2,593	2,120	0.322	834	834
25	Sink, Anchor, Drift Gillnet	OPEN	all	MA	xlg	122	122		2,478	0.376	975	975
26	Sink, Anchor, Drift Gillnet	OPEN	all	NE	sm	9	0		0			0
27	Sink, Anchor, Drift Gillnet	OPEN	all	NE	lg	103	103		5,391			103
28	Sink, Anchor, Drift Gillnet	OPEN	all	NE	xlg	240	240		4,366			240
29	Purse Seine	OPEN	all	MA	all	6	6		231			6
30	Purse Seine	OPEN	all	NE	all	31	31		618			31
31	Scallop Dredge	AA	GEN	MA	all	27	0		0	0.000	0	0
32	Scallop Dredge	AA	GEN	NE	all	31	0		0			0
33	Scallop Dredge	AA	LIM	MA	all	153	153	1,293	1,580	0.167	216	216
34	Scallop Dredge	AA	LIM	NE	all	121	121		2,579			121
35	Scallop Dredge	OPEN	GEN	MA	all	28	28		3,816	0.404	522	522
36	Scallop Dredge	OPEN	GEN	NE	all	16	16		4,662			16
37	Scallop Dredge	OPEN	LIM	MA	all	123	123		4,053	0.429	555	555
38	Scallop Dredge	OPEN	LIM	NE	all	630	630		10,301			630
39	Danish Seine	OPEN	all	MA	all	6	0		0			0
40	Mid-water Paired & Single Trawl	OPEN	all	MA	all	32	0		0			0
41	Mid-water Paired & Single Trawl	OPEN	all	NE	all	39	39		1,426			39
42	Pots and Traps, Fish	OPEN	all	MA	all	22	22		1,005			22
43	Pots and Traps, Fish	OPEN	all	NE	all	42	42		956			42
44	Pots and Traps, Conch	OPEN	all	MA	all	28	28		1,341			28
45	Pots and Traps, Conch	OPEN	all	NE	all	22	22		1,122			22
46	Pots and Traps, Hagfish	OPEN	all	NE	all	83	0		0			0
47	Pots and Traps, Lobster	OPEN	all	MA	all	47	47		2,270			47
48	Pots and Traps, Lobster	OPEN	all	NE	all	572	572		34,395			572
49	Pots and Traps, Crab	OPEN	all	MA	all	29	0		0			0
50	Pots and Traps, Crab	OPEN	all	NE	all	83	0		0			0
51	Beam Trawl	OPEN	all	MA	all	35	35		324			35
52	Beam Trawl	OPEN	all	NE	all	11	0		0			0
53	Dredge, Other	OPEN	all	MA	all	11	11		308			11
54	Ocean Quahog/Surfclam Dredge	OPEN	all	MA	all	75	75		3,735			75
55	Ocean Quahog/Surfclam Dredge	OPEN	all	NE	all	65	65		3,230			65
56	Otter Trawl, Haddock Separator	OPEN	all	NE	sm	25	0		0			0
					Total	**11,204**	**10,365**	**7,195**	**149,693**			**15,786**

Step 6	Agency Fleets (Sea Days Needed)	**9,932**	**9,271**	**13,630**
	Industry Fleets (Sea Days Needed)	**1,272**	**1,094**	**2,156**
Step 7	Agency Fleets (Sea Days Funded)	Prioritized		**9,477**
	Agency Fleets (Sea Days Funded)	Non-prioritized (ASM)		**1,100**
	Agency Fleets (Sea Days Funded)	Non-prioritized (MMPA)		**688**
	Industry Fleets (Sea Days Funded)			**2,512**
Step 8	Agency Fleet Difference	SHORTFALL		**-4,153**
	Industry Fleet Difference	SURPLUS		**356**

Turtle Gear Types							
MA Trawl	1,470	1,323	**3,309**	18,515		3,309	3,309
MA Gillnet	147	147	**2,593**	6,592		2,593	2,593
MA Dredge	331	304	**1,293**	9,449		1,293	1,293

KEY: Agency funded fleets	Industry funded fleets

Table 6. The 2015 sea days needed (COMBINED; Step 5) and the information used in the penultimate approach to prioritize funded days that are applicable to the prioritization process (Steps 9.1 through 9.5).

	Fleet					Step 5	Step 9.1								Step 9.2								Step 9.3		Step 9.4	St
Row	Gear Type	Access Area	Trip Cat.	Region	Mesh	2015 Sea Days Needed COMBINED	Penultimate sea days needed for the 15 species groups, in descending order with minimum pilot coverage as minimum for fleet								Sea day differences between adjacent species groups within a row (red font indicated values used in Step 9.3)								Sea day differences, in descending order with fleet constraint	Cumulative reduction of sea days	2015 Sea Days PRIORITIZED (Penultimate)	Se PRI (Pen
1	Longline	OPEN	all	MA	all	85	85								0								3,916	3,916	85	
2	Longline	OPEN	all	NE	all	14	14								0								237 of 1,021	4,153	14	
3	Hand Line	OPEN	all	MA	all	70	14								56										70	
4	Hand Line	OPEN	all	NE	all	48	13								35										48	
5	Otter Trawl	OPEN	all	MA	sm	1,577	556	531	493	402	336	294	32		1,021	25	38	91	66	42	262	32			1,340	
6	Otter Trawl	OPEN	all	MA	g	1,636	744	220	210	89	72	29			892	524	10	121	17	43	29				1,636	
7	Otter Trawl	OPEN	all	NE	sm	1,311	720	571	460	313	34	34			591	149	111	147	279	0					1,311	
8	Otter Trawl	OPEN	all	NE	g	4,647	731	349	316	231	228	192	35		3,916	382	33	85	3	36	157	35			731	
9	Scallop Trawl	AA	GEN	MA	all	0																				
10	Scallop Trawl	AA	LIM	MA	all	0																				
11	Scallop Trawl	OPEN	GEN	MA	all	96																				
12	Scallop Trawl	OPEN	LIM	MA	all	0																				
13	Otter Trawl , Twin	OPEN	all	MA	all	0																			0	
14	Otter Trawl , Twin	OPEN	all	NE	all	0																			0	
15	Otter Trawl, Ruhle	OPEN	all	MA	g	0																			0	
16	Otter Trawl, Ruhle	OPEN	all	NE	sm	0																			0	
17	Otter Trawl, Ruhle	OPEN	all	NE	g	0																			0	
18	Otter Trawl, Haddock Separator	OPEN	all	NE	g	302	94								208										302	
19	Shrimp Trawl	OPEN	all	MA	all	0																			0	
20	Shrimp Trawl	OPEN	all	NE	all	9	9								0										9	
21	Floating Trap	OPEN	all	MA	all	0																			0	
22	Floating Trap	OPEN	all	NE	all	0																			0	
23	Sink, Anchor, Drift Gillnet	OPEN	all	MA	sm	784	12								772										784	
24	Sink, Anchor, Drift Gillnet	OPEN	all	MA	g	834	13								821										834	
25	Sink, Anchor, Drift Gillnet	OPEN	all	MA	dg	975	122	14							853	108									975	
26	Sink, Anchor, Drift Gillnet	OPEN	all	NE	sm	0																			0	
27	Sink, Anchor, Drift Gillnet	OPEN	all	NE	g	103	19								84	19									103	
28	Sink, Anchor, Drift Gillnet	OPEN	all	NE	dg	240	152	73	19						88	79	54								240	
29	Purse Seine	OPEN	all	MA	all	6	6								0										6	
30	Purse Seine	OPEN	all	NE	all	31	31								0										31	
31	Scallop Dredge	AA	GEN	MA	all	0																				
32	Scallop Dredge	AA	GEN	NE	all	0																				
33	Scallop Dredge	AA	LIM	MA	all	216																				
34	Scallop Dredge	AA	LIM	NE	all	121																				
35	Scallop Dredge	OPEN	GEN	MA	all	522																				
36	Scallop Dredge	OPEN	GEN	NE	all	16																				
37	Scallop Dredge	OPEN	LIM	MA	all	555																				
38	Scallop Dredge	OPEN	LIM	NE	all	630																				
39	Danish Seine	OPEN	all	MA	all	0																			0	
40	Mid-water Paired & Single Trawl	OPEN	all	MA	all	0																			0	
41	Mid-water Paired & Single Trawl	OPEN	all	NE	all	39	39								0										39	
42	Pots and Traps, Fish	OPEN	all	MA	all	22	13								9	13									22	
43	Pots and Traps, Fish	OPEN	all	NE	all	42	30								12	30									42	
44	Pots and Traps, Conch	OPEN	all	MA	all	28	15								13	15									28	
45	Pots and Traps, Conch	OPEN	all	NE	all	22	9								13	9									22	
46	Pots and Traps, Hagfish	OPEN	all	NE	all	0																			0	
47	Pots and Traps, Lobster	OPEN	all	MA	all	47	17								30	17									47	
48	Pots and Traps, Lobster	OPEN	all	NE	all	572	18								554										572	
49	Pots and Traps, Crab	OPEN	all	MA	all	0																			0	
50	Pots and Traps, Crab	OPEN	all	NE	all	0																			0	
51	Beam Trawl	OPEN	all	MA	all	35	35																		35	
52	Beam Trawl	OPEN	all	NE	all	0																			0	
53	Dredge, Other	OPEN	all	MA	all	11	10								1	10									11	
54	Ocean Quahog/Surfclam Dredge	OPEN	all	MA	all	75	24								51	24									75	
55	Ocean Quahog/Surfclam Dredge	OPEN	all	NE	all	65	14								51	14									65	
56	Otter Trawl, Haddock Separator	OPEN	all	NE	sm	0																			0	
					Total	15,786																			9,477	

Step 6	Agency Fleets (Sea Days Needed)	13,630	
	Industry Fleets (Sea Days Needed)	3,155	
Step 7	Agency Fleets (Sea Days Funded)	9,477	Prioritized days
	Agency Fleets (Sea Days Funded)	1,100	Non-prioritized days (ASM)
	Agency Fleets (Sea Days Funded)	688	Non-prioritized days (MMPA)
	Industry Fleets (Sea Days Funded)	2,512	Industy-funded scallop days
Step 8	Agency Fleet Difference	-4,153	
	Industry Fleet Difference	356	

Turtle Gear Types	MA Trawl	3,309
	MA Gillnet	2,593
	MA Dredge	1,293

KEY: Agency funded fleets | Industry funded fleets

Fleets with reduction in sea days

Table 7. The number of sea days needed to monitor the combined species groups (COMBINED; Step 5), prioritized days (Step 9.5), non-prioritized days (At-Sea Monitoring [ASM] and protected species [MMPA]; Step 10), industry-funded days (Step 11), and the 2015 observer sea days allocated for April 2015 through March 2016 (Step 12), by fleet. Note: * indicates all coverage is dependent on industry activity; ** indicates some coverage is dependent on industry activity; *** indicates coverage for protected species bycatch.

	Fleet					Step 5	Step 9.5	Step 10	Step 11	Step 12	
Row	Gear Type	Access Area	Trip Cat.	Region	Mesh	2015 Sea Days Needed COMBINED	2015 Sea Days PRIORITIZED (Penultimate)	2015 Sea Days non-prioritized (ASM, MMPA)	2015 Industry-funded Sea Days	Sea Days Allocated for April 2015 - March 2016 (TOTAL)	Comments
1	Longline	OPEN	all	MA	all	85	85	0		85	Fish stock assessment support
2	Longline	OPEN	all	NE	all	14	14	29		43	Fish stock assessment support *
3	Hand Line	OPEN	all	MA	all	70	70	1		71	Fish stock assessment support **
4	Hand Line	OPEN	all	NE	all	48	48	17		65	Fish stock assessment support **
5	Otter Trawl	OPEN	all	MA	sm	1,577	1,340	0		1,340	Fish stock assessment and turtle bycatch support
6	Otter Trawl	OPEN	all	MA	lg	1,636	1,636	1		1,637	Fish stock assessment and turtle bycatch support **
7	Otter Trawl	OPEN	all	NE	sm	1,311	1,311	1		1,312	Fish stock assessment support **
8	Otter Trawl	OPEN	all	NE	lg	4,647	731	659		1,390	Fish stock assessment support **
9	Scallop Trawl	AA	GEN	MA	all	0					Industry funded* (see Row 33)
10	Scallop Trawl	AA	LIM	MA	all	0					Industry funded * (see Row 33)
11	Scallop Trawl	OPEN	GEN	MA	all	96					Industry funded * (see Row 36)
12	Scallop Trawl	OPEN	LIM	MA	all	0					Industry funded * (see Row 38)
13	Otter Trawl , Twin	OPEN	all	MA	all	0	0	0		0	
14	Otter Trawl , Twin	OPEN	all	NE	all	0	0	0		0	
15	Otter Trawl, Ruhle	OPEN	all	MA	lg	0	0	0		0	
16	Otter Trawl, Ruhle	OPEN	all	NE	sm	0	0	0		0	
17	Otter Trawl, Ruhle	OPEN	all	NE	lg	0	0	4		4	Fish stock assessment support *
18	Otter Trawl, Haddock Separator	OPEN	all	NE	lg	302	302	0		302	Fish stock assessment support*
19	Shrimp Trawl	OPEN	all	MA	all	0	0	0		0	
20	Shrimp Trawl	OPEN	all	NE	all	9	9	0		9	Fish stock assessment support
21	Floating Trap	OPEN	all	MA	all	0	0	0		0	
22	Floating Trap	OPEN	all	NE	all	0	0	0		0	
23	Sink, Anchor, Drift Gillnet	OPEN	all	MA	sm	784	784	0		784	Fish stock assessment and turtle bycatch support
24	Sink, Anchor, Drift Gillnet	OPEN	all	MA	lg	834	834	0		834	Fish stock assessment and turtle bycatch support
25	Sink, Anchor, Drift Gillnet	OPEN	all	MA	xlg	975	975	0		975	Fish stock assessment support *
26	Sink, Anchor, Drift Gillnet	OPEN	all	NE	sm	0	0	0		0	
27	Sink, Anchor, Drift Gillnet	OPEN	all	NE	lg	103	103	237		340	Fish stock assessment support **
28	Sink, Anchor, Drift Gillnet	OPEN	all	NE	xlg	240	240	151		391	Fish stock assessment support**
29	Purse Seine	OPEN	all	MA	all	6	6	0		6	Fish stock assessment support
30	Purse Seine	OPEN	all	NE	all	31	31	0		31	Fish stock assessment support
31	Scallop Dredge	AA	GEN	MA	all	0					Industry funded * (see Row 33)
32	Scallop Dredge	AA	GEN	NE	all	0					Industry funded * (see Row 34)
33	Scallop Dredge	AA	LIM	MA	all	216			1,149	1,149	Industry funded * (Rows 9, 10, 31, & 33)
34	Scallop Dredge	AA	LIM	NE	all	121			17	17	Industry funded * (Rows 32 & 34)
35	Scallop Dredge	OPEN	GEN	MA	all	522					Industry funded * (see Row 36)
36	Scallop Dredge	OPEN	GEN	NE	all	16			193	193	Industry funded * (Rows 11, 35, & 36)
37	Scallop Dredge	OPEN	LIM	MA	all	555					Industry funded * (see Row 38)
38	Scallop Dredge	OPEN	LIM	NE	all	630			1,153	1,153	Industry funded * (Rows 12, 37, & 38)
39	Danish Seine	OPEN	all	MA	all	0	0	0		0	
40	Mid-water Paired & Single Trawl	OPEN	all	MA	all	0	0	0		0	
41	Mid-water Paired & Single Trawl	OPEN	all	NE	all	39	39	0		39	Fish stock assessment support
42	Pots and Traps, Fish	OPEN	all	MA	all	22	22	0		22	Fish stock assessment support
43	Pots and Traps, Fish	OPEN	all	NE	all	42	42	0		42	Fish stock assessment support
44	Pots and Traps, Conch	OPEN	all	MA	all	28	28	0		28	Fish stock assessment support
45	Pots and Traps, Conch	OPEN	all	NE	all	22	22	0		22	Fish stock assessment support
46	Pots and Traps, Hagfish	OPEN	all	NE	all	0	0	0		0	
47	Pots and Traps, Lobster	OPEN	all	MA	all	47	47	0		47	Fish stock assessment support
48	Pots and Traps, Lobster	OPEN	all	NE	all	572	572	0		572	Fish stock assessment support
49	Pots and Traps, Crab	OPEN	all	MA	all	0	0	0		0	
50	Pots and Traps, Crab	OPEN	all	NE	all	0	0	0		0	
51	Beam Trawl	OPEN	all	MA	all	35	35	0		35	Fish stock assessment support
52	Beam Trawl	OPEN	all	NE	all	0	0	0		0	
53	Dredge, Other	OPEN	all	MA	all	11	11	0		11	Fish stock assessment support
54	Ocean Quahog/Surfclam Dredge	OPEN	all	MA	all	75	75	0		75	Fish stock assessment support
55	Ocean Quahog/Surfclam Dredge	OPEN	all	NE	all	65	65	0		65	Fish stock assessment support
56	Otter Trawl, Haddock Separator	OPEN	all	NE	sm	0	0	0		0	
	MMPA coverage							688		688	Coverage associated with Rows 23-28***
					Total	15,786	9,477	1,788	2,512	13,777	

Step 6	Agency Fleets (Sea Days Needed)	13,630	
	Industry Fleets (Sea Days Needed)	2,156	
Step 7	Agency Fleets (Sea Days Funded)	9,477	Prioritized days
	Agency Fleets (Sea Days Funded)	1,100	Non-prioritized days (ASM)
	Agency Fleets (Sea Days Funded)	688	Non-prioritized days (MMPA)
	Industry Fleets (Sea Days Funded)	2,512	Industy-funded scallop days
Step 8	Agency Fleet Difference	-4,153	
	Industry Fleet Difference	356	

Turtle Gear Types	
MA Trawl	3,309
MA Gillnet	2,593
MA Dredge	1,293

KEY: Agency funded fleets | Industry funded fleets

Fleets with reduction in sea days

Appendix Table 1. Stratification abbreviations used for 2015 fleets.

Abbreviation	Definition
MA	Mid-Atlantic ports (CT and southward)
NE	New England ports (RI and northward)
sm	Small mesh (less than 5.50 in)
lg	Large mesh (mesh from 5.50 to 7.99 in for gillnet; 5.50 in and greater for otter trawl)
xlg	Extra large mesh (8 in and greater)
LIM	Limited access category
GEN	General category
OPEN	Non-access area
AA	Access area

Appendix Table 2. The number of Vessel Trip Reports (VTR) trips, by fleet and calendar quarter (Q) during July 2013 through June 2014. "P" indicates fleets with "pilot" designation. The percentage and cumulative percentage for each fleet, when fleets are ranked from smallest to largest, are also presented. The shaded cells represent the fleets containing the lowest cumulative 1% of all trips. Note: the total number of VTR trips in MA shrimp trawl fleet (Row 19) was adjusted from 405 trips to 12 trips before the trip filter was applied.

Fleet						VTR TRIPS					
Row	Gear Type	Access Area	Trip Category	Region	Mesh Group	Q3	Q4	Q1	Q2	TOTAL	Pilot
1	Longline	OPEN	all	MA	all	62	26	37	69	**194**	P
2	Longline	OPEN	all	NE	all	203	160	56	73	**492**	
3	Hand Line	OPEN	all	MA	all	1,562	722	70	754	**3,108**	P
4	Hand Line	OPEN	all	NE	all	1,377	377	6	435	**2,195**	
5	Otter Trawl	OPEN	all	MA	sm	1,472	900	394	1,073	**3,839**	
6	Otter Trawl	OPEN	all	MA	lg	1,625	733	810	1,015	**4,183**	
7	Otter Trawl	OPEN	all	NE	sm	1,386	745	420	1,037	**3,588**	
8	Otter Trawl	OPEN	all	NE	lg	2,127	1,523	1,348	1,667	**6,665**	
9	Scallop Trawl	AA	GEN	MA	all	.	.	.	13	**13**	P
10	Scallop Trawl	AA	LIM	MA	all	.	1	2	.	**3**	P
11	Scallop Trawl	OPEN	GEN	MA	all	119	20	6	134	**279**	
12	Scallop Trawl	OPEN	LIM	MA	all	10	4	5	6	**25**	P
13	Otter Trawl, Twin	OPEN	all	MA	all	2	9	9	29	**49**	P
14	Otter Trawl, Twin	OPEN	all	NE	all	5	6	6	2	**19**	P
15	Otter Trawl, Ruhle	OPEN	all	MA	lg	6	.	2	.	**8**	P
16	Otter Trawl, Ruhle	OPEN	all	NE	sm	1	.	14	3	**18**	P
17	Otter Trawl, Ruhle	OPEN	all	NE	lg	2	.	1	6	**9**	P
18	Otter Trawl, Haddock Separator	OPEN	all	NE	lg	14	25	12	73	**124**	
19	Shrimp Trawl	OPEN	all	MA	all	249	152	4	.	**405**	P
20	Shrimp Trawl	OPEN	all	NE	all	78	4	.	49	**131**	P
21	Floating Trap	OPEN	all	MA	all	42	5	.	38	**85**	P
22	Floating Trap	OPEN	all	NE	all	9	.	.	1	**10**	P
23	Sink, Anchor, Drift Gillnet	OPEN	all	MA	sm	663	452	363	460	**1,938**	
24	Sink, Anchor, Drift Gillnet	OPEN	all	MA	lg	534	720	308	453	**2,015**	
25	Sink, Anchor, Drift Gillnet	OPEN	all	MA	xlg	98	714	244	1,064	**2,120**	
26	Sink, Anchor, Drift Gillnet	OPEN	all	NE	sm	1	3	.	1	**5**	P
27	Sink, Anchor, Drift Gillnet	OPEN	all	NE	lg	1,546	990	257	828	**3,621**	
28	Sink, Anchor, Drift Gillnet	OPEN	all	NE	xlg	1,194	556	252	931	**2,933**	
29	Purse Seine	OPEN	all	MA	all	105	.	.	124	**229**	P
30	Purse Seine	OPEN	all	NE	all	218	39	2	37	**296**	
31	Scallop Dredge	AA	GEN	MA	all	9	13	8	37	**67**	P
32	Scallop Dredge	AA	GEN	NE	all	59	6	2	4	**71**	
33	Scallop Dredge	AA	LIM	MA	all	92	25	23	60	**200**	
34	Scallop Dredge	AA	LIM	NE	all	168	83	18	59	**328**	
35	Scallop Dredge	OPEN	GEN	MA	all	703	391	349	783	**2,226**	
36	Scallop Dredge	OPEN	GEN	NE	all	866	669	1,090	972	**3,597**	
37	Scallop Dredge	OPEN	LIM	MA	all	115	54	59	221	**449**	
38	Scallop Dredge	OPEN	LIM	NE	all	353	93	171	426	**1,043**	
39	Danish Seine	OPEN	all	MA	all	24	.	.	61	**85**	P
40	Mid-water Paired & Single Trawl	OPEN	all	MA	all	1	.	12	.	**13**	P
41	Mid-water Paired & Single Trawl	OPEN	all	NE	all	127	112	140	60	**439**	
42	Pots and Traps, Fish	OPEN	all	MA	all	387	253	61	270	**971**	P
43	Pots and Traps, Fish	OPEN	all	NE	all	707	112	1	103	**923**	P
44	Pots and Traps, Conch	OPEN	all	MA	all	225	528	96	258	**1,107**	P
45	Pots and Traps, Conch	OPEN	all	NE	all	401	362	.	356	**1,119**	P
46	Pots and Traps, Hagfish	OPEN	all	NE	all	17	14	4	12	**47**	P
47	Pots and Traps, Lobster	OPEN	all	MA	all	800	398	93	401	**1,692**	P
48	Pots and Traps, Lobster	OPEN	all	NE	all	11,982	7,823	1,773	4,590	**26,168**	
49	Pots and Traps, Crab	OPEN	all	MA	all	10	5	6	33	**54**	P
50	Pots and Traps, Crab	OPEN	all	NE	all	14	17	27	23	**81**	P
51	Beam Trawl	OPEN	all	MA	all	36	28	11	39	**114**	P
52	Beam Trawl	OPEN	all	NE	all	30	5	.	12	**47**	P
53	Dredge, Other	OPEN	all	MA	all	.	41	183	64	**288**	P
54	Ocean Quahog/Surfclam Dredge	OPEN	all	MA	all	506	365	454	499	**1,824**	P
55	Ocean Quahog/Surfclam Dredge	OPEN	all	NE	all	823	571	563	769	**2,726**	P
56	Otter Trawl, Haddock Separator	OPEN	all	NE	sm	.	.	.	6	**6**	
					Total	33,165	20,854	9,772	20,493	**84,284**	

Row	VTR Trips	% of Trips	VTR TRIPS Cum %
10	3	<0.1%	0.0%
26	5	<0.1%	0.0%
56	6	<0.1%	0.0%
15	8	<0.1%	0.0%
17	9	<0.1%	0.0%
22	10	<0.1%	0.0%
19	12	<0.1%	0.1%
9	13	<0.1%	0.1%
40	13	<0.1%	0.1%
16	18	<0.1%	0.1%
14	19	<0.1%	0.1%
12	25	<0.1%	0.2%
46	47	0.1%	0.2%
52	47	0.1%	0.3%
13	49	0.1%	0.3%
49	54	0.1%	0.4%
31	67	0.1%	0.5%
32	71	0.1%	0.6%
50	81	0.1%	0.7%
21	85	0.1%	0.8%
39	85	0.1%	0.9%
51	114	0.1%	1.0%
18	124	0.1%	1.2%
20	131	0.2%	1.3%
1	194	0.2%	1.5%
33	200	0.2%	1.8%
29	229	0.3%	2.0%
11	279	0.3%	2.4%
53	288	0.3%	2.7%
30	296	0.4%	3.1%
34	328	0.4%	3.5%
41	439	0.5%	4.0%
37	449	0.5%	4.5%
2	492	0.6%	5.1%
43	923	1.1%	6.2%
42	971	1.2%	7.4%
38	1,043	1.2%	8.6%
44	1,107	1.3%	9.9%
45	1,119	1.3%	11.3%
47	1,692	2.0%	13.3%
54	1,824	2.2%	15.5%
23	1,938	2.3%	17.8%
24	2,015	2.4%	20.2%
25	2,120	2.5%	22.7%
4	2,195	2.6%	25.3%
35	2,226	2.7%	28.0%
55	2,726	3.2%	31.2%
28	2,933	3.5%	34.7%
3	3,108	3.7%	38.4%
7	3,588	4.3%	42.7%
36	3,597	4.3%	47.0%
27	3,621	4.3%	51.3%
5	3,839	4.6%	55.9%
6	4,183	5.0%	60.9%
8	6,665	7.9%	68.8%
48	26,168	31.2%	100.0%
	83,891		

Row	VTR TRIPS Cum %
1	1.5%
2	5.1%
3	38.4%
4	25.3%
5	55.9%
6	60.9%
7	42.7%
8	68.8%
9	0.1%
10	0.0%
11	2.4%
12	0.2%
13	0.3%
14	0.1%
15	0.0%
16	0.1%
17	0.0%
18	1.2%
19	0.1%
20	1.3%
21	0.8%
22	0.0%
23	17.8%
24	20.2%
25	22.7%
26	0.0%
27	51.3%
28	34.7%
29	2.0%
30	3.1%
31	0.5%
32	0.6%
33	1.8%
34	3.5%
35	28.0%
36	47.0%
37	4.5%
38	8.6%
39	0.9%
40	0.1%
41	4.0%
42	7.4%
43	6.2%
44	9.9%
45	11.3%
46	0.2%
47	13.3%
48	100.0%
49	0.4%
50	0.7%
51	1.0%
52	0.3%
53	2.7%
54	15.5%
55	31.2%
56	0.0%

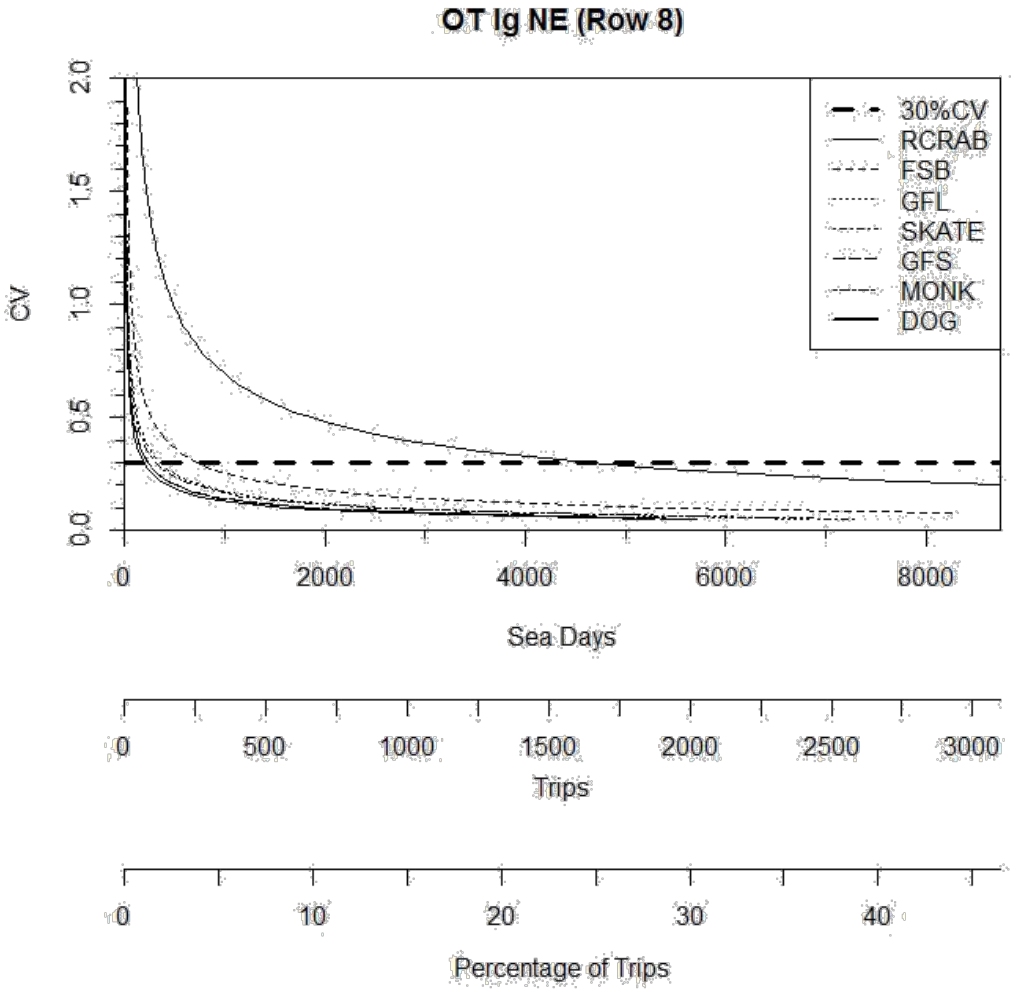


Figure 1. Results from the 2015 sample size analysis conducted for the New England large mesh otter trawl fleet (Row 8). The curves represent the relationship between the coefficient of variance (CV) and the sample size (sea days, trips, and percent of trips) for each of the species groups that were not filtered out. The horizontal dashed line is the 30% CV. For species group abbreviations, see Table 1. *Taken from Figure 3 in Wigley et al. 2015.*

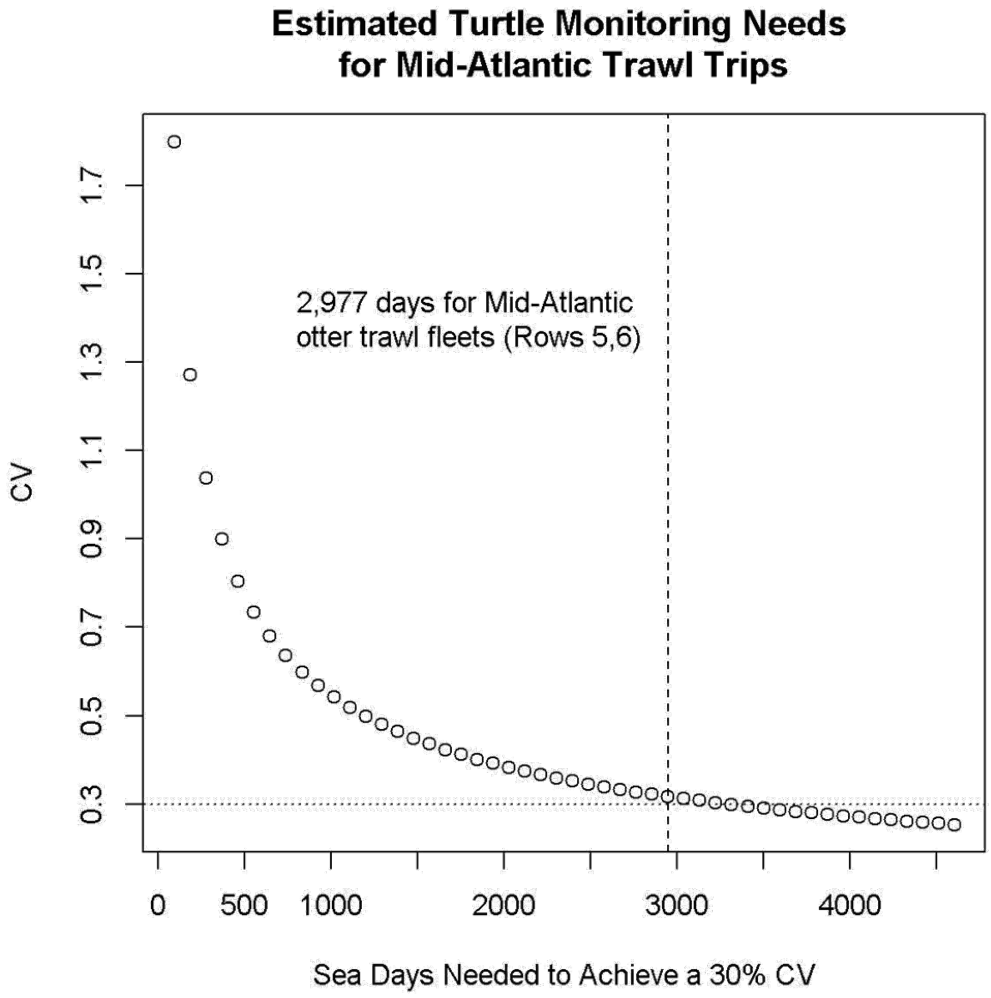


Figure 2. Expected CVs for estimates of turtle interactions in Mid-Atlantic otter trawl fleets under the observer sea day allocation for 2015. Vertical dashed line indicates the number of sea day needs for fish/invertebrates and turtles combined.

Northeast Fisheries Science Center Reference Document 16-03

2016 Discard Estimation, Precision, and Sample Size Analyses for 14 Federally Managed Species Groups in the Waters off the Northeastern United States

by SE Wigley, C Tholke, and G Shield

Northeast Fisheries Science Center Reference Document 16-03

2016 Discard Estimation, Precision, and Sample Size Analyses for 14 Federally Managed Species Groups in the Waters off the Northeastern United States

by SE Wigley[1], C Tholke[2], and G Shield[1]

[1]NOAA Fisheries, Northeast Fisheries Science Center, 166 Water Street, Woods Hole, MA 02543

[2]Integrated Statistics,16 Sumner Street, Woods Hole, MA 02543

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts
April 2016

Northeast Fisheries Science Center Reference Documents

This series is a secondary scientific series designed to assure the long-term documentation and to enable the timely transmission of research results by Center and/or non-Center researchers, where such results bear upon the research mission of the Center (see the outside back cover for the mission statement). These documents receive internal scientific review, and most receive copy editing. The National Marine Fisheries Service does not endorse any proprietary material, process, or product mentioned in these documents.

All documents issued in this series since April 2001, and several documents issued prior to that date, have been copublished in both paper and electronic versions. To access the electronic version of a document in this series, go to *http://www.nefsc.noaa.gov/nefsc/publications/*. The electronic version is available in PDF format to permit printing of a paper copy directly from the Internet. If you do not have Internet access, or if a desired document is one of the pre-April 2001 documents available only in the paper version, you can obtain a paper copy by contacting the senior Center author of the desired document. Refer to the title page of the document for the senior Center author's name and mailing address. If there is no Center author, or if there is corporate (*i.e.*, non-individualized) authorship, then contact the Center's Woods Hole Laboratory Library (166 Water St., Woods Hole, MA 02543-1026).

Information Quality Act Compliance: In accordance with section 515 of Public Law 106-554, the Northeast Fisheries Science Center completed both technical and policy reviews for this report. These predissemination reviews are on file at the NEFSC Editorial Office.

This document may be cited as:

Wigley SE, Tholke C, Shield G. 2016. 2016 Discard estimation, precision, and sample size analyses for 14 federally managed species groups in the waters off the northeastern United States. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 16-03; 168 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://www.nefsc.noaa.gov/publications/

TABLE OF CONTENTS

List of Tables i
List of Figures ii
List of Appendix Tables ii
List of Acronyms and Abbreviations iv
Executive Summary 1
Introduction 1
Methods 2
Data Sources 2
Discard Estimation 4
Discard Reasons 5
Sample Size Analysis 5
Results 7
Discussion 10
Acknowledgements 12
References Cited 13
Appendix: Equations used in discard estimation and sample size analysis 162

LIST OF TABLES

Table 1. List of the 14 fish and invertebrate species groups, with species group abbreviations in parentheses and scientific names in italics, and the species that compose these groups, corresponding to the 13 federal fishery management plans implemented in the waters off the northeastern Unites States 16

Table 2. Number of Northeast Fisheries Observer Program and Vessel Trip Report trips, by fleet and calendar quarter, based on July 2014 through June 2015 data. 17

Table 3. Number of Northeast Fisheries Observer Program and Vessel Trip Report sea days, by fleet and calendar quarter, based on July 2014 through June 2015 data. 19

Table 4. Vessel Trip Report kept weight of all species, percentage of kept weight of all species across all fleets, kept weight of all species with Northeast Fisheries Observer Program coverage from statistical areas and quarters with at least 1 observed trip and at least 3 observed trips in the fleet and quarter, and percentage of kept weight of all species with observer coverage, by fleet, based on July 2014 through June 2015 data. 21

Table 5A. Total catch, Vessel Trip Report landings, estimated discards, associated coefficient of variation, and standard error of the estimated discards for 14 fish and invertebrate species groups, by fleet, based on July 2014 through June 2015 data. 23

Table 5B. Total catch, Vessel Trip Report landings, estimated discards, associated coefficient of variation, and standard error of the estimated discards for 23 individual species that compose the 14 species groups, by fleet, based on July 2014 through June 2015 data.……..…..…….51

Table 5C. Total catch, Vessel Trip Report landings, estimated discards, associated coefficient of variation, and standard error of the estimated discards for the 14 species groups combined, by fleet, based on July 2014 through June 2015 data……..…...97

Table 6. The number of sea days needed to achieve a 30% coefficient of variation of the discard estimate for each the 14 fish and invertebrate species groups, the number of pilot sea days, the number of minimum pilot sea days, and the maximum number of sea days needed for each fleet for fish and invertebrate species groups, based on July 2014 through June 2015 data..…….. 99

Table 7. Number of sea days, trips, and percentage of trips needed to achieve a 30% coefficient of variation of the discard estimate, by fleet and species group, based on July 2014 through June 2015 data. ……..……..……101

LIST OF FIGURES

Figure 1A. Percentage of Vessel Trip Report landings and estimated discards and the percentage of estimated discards by fleet for each of the 14 species groups, based on July 2014 through June 2015 data. ……..…….....103

Figure 1B. Percentage of Vessel Trip Report landings and estimated discards and the percentage of estimated discards by fleet for the 23 individual species that compose the 14 species groups, based on July 2014 through June 2015 data. … ……...……...…...110

Figure 2. Percentage of Vessel Trip Report landings and estimated discards and the percentage of estimated discards by species groups for the 30 nonpilot fleets, based on July 2014 through June 2015 data…… ……...……..……122

Figure 3. Results from the 2016 sample size analysis conducted for selected fleets. ……....137

LIST OF APPENDIX TABLES

Appendix Table 1. The number of fleets used in analyses and reported in the tables of this report.……..…….145

Appendix Table 2. Discard reason categories used in Appendix Tables 3A and 3B and the associated discard fish dispositions. ……...……..…..146

Appendix Table 3A. Estimated discards and percentage by discard reason category for 14 species groups, based on July 2014 through June 2015 data. ……..……...….……..147

Appendix Table 3B. Estimated discards and percentage by discard reason category for 23 individual species that compose the 14 species groups, based on July 2014 through June 2015 data …...…… ……..….152

Appendix Table 4. Fleet abbreviations used in Figures 1A, 1B, 2, and 3…….…….…....160

LIST OF ACRONYMS AND ABBREVIATIONS

AA = Access area
ASM = At-Sea Monitoring Program
ASMFC = Atlantic States Marine Fisheries Commission
CV = coefficient of variation
d/k = discard/kept
FED = finfish excluder device
FMP = fishery management plan
GEN = General category
lg = large mesh
LIM = Limited access category
MA = Mid-Atlantic
MRIP = Marine Recreational Information Program
NE = New England
NEFOP = Northeast Fisheries Observer Program
NEFSC = Northeast Fisheries Science Center
NMFS = National Marine Fisheries Service
OPEN = Nonaccess area
SBRM = Standardized Bycatch Reporting Methodology
SE = standard error of the estimate
sm = small mesh
VTR = Vessel Trip Report
xlg = extra large mesh

EXECUTIVE SUMMARY

This report describes the analyses associated with the discard estimation of 14 federally managed fish and invertebrate species groups during the July 2014 through June 2015 time period and the expected coverage needed by at-sea observers for northeastern US fisheries for the April 2016 through March 2017 period using the Standardized Bycatch Reporting Methodology.

An estimated 57,063 mt (125,803,405 lb) of federally regulated species were discarded during the July 2014 through June 2015 time period. The predominant species groups discarded were skates (Rajidae*)* and spiny dogfish (*Squalus acanthias*). Across all species groups examined, "No Market" was the reason reported for the majority of discards. Analyses also revealed that for fleets with observer coverage, the coverage within a fleet corresponded with the spatial and temporal patterns of fishing activity in terms of kept weight of all species. The discards reported in this document may not necessarily correspond directly with the discard estimates derived for individual stock assessments because of differences in stratification and data. Hence, the discard estimates are not definitive, but indicative of where discarding occurred among commercial fleets and for which species groups.

The sea days needed to achieve a precision-based performance standard (30% coefficient of variation of the discard estimate) were estimated to be 10,746 sea days for the 14 fish and invertebrate species groups across 57 fleets. The sea day analyses used a standardized protocol to account for the importance of the discarded species relative to the amount of discards by each fleet and total fishing mortality.

INTRODUCTION

The Standardized Bycatch Reporting Methodology (SBRM) Omnibus Amendment (NEFMC 2007; NMFS 2008) was vacated by the US District Court of the District of Columbia on 15 September 2011 because of a deficiency associated with the prioritization process, an element of the amendment. The regulations implementing the SBRM were removed by the National Marine Fisheries Service (NMFS) on 29 December 2011 (NMFS 2011). A revised SBRM Omnibus Amendment was approved on 13 March 2015 and the final rule became effective 30 July 2015 (NEFMC 2015). This report provides some of the information required by the annual discard report specified in the SBRM amendment.

The SBRM discard estimation methods described in Wigley et al. 2007 are still applicable. The analyses conducted for 2016 are similar to those conducted in 2015 (Wigley et al. 2015) in which the sample size analyses are based on the assumption that the pattern of fishing activity observed in the prior year will be similar to that in the upcoming year.

This document presents the estimated discards and associated precision as well as the number of sea days needed to obtain a 30% coefficient of variation (CV) on the discard estimates for the 14 species groups associated with federal fishery management plans (FMPs) in northeastern US fleets[1]. Additionally, discard reasons associated with the discarded species are

[1] "Fleet" is synonymous with "fishing mode."

summarized. This document differs from SBRM documents prior to 2012 in that this document does not include a sea day prioritization[2] and does not contain information about sea turtles.

METHODS

Data Sources

The data sets used include July 2014 through June 2015 data from the Northeast Fisheries Observer Program[3] (NEFOP) database, the Vessel Trip Report (VTR; including logbooks from the surfclam [*Spisula solidissima*] and ocean quahog [*Arctica islandica*] fishery) database, the Northeast Fisheries Science Center (NEFSC) commercial landings database, and the National Oceanic and Atmospheric Administration Marine Recreational Information Program (MRIP) database.

The NEFOP is a comprehensive, multipurpose program that collects a broad range of data including information on all species, by disposition (retained and discarded), that are encountered during a fishing trip as well as gear characteristics data, economic information, and biological samples (NEFOP 2013). The NEFOP employs trained sea-going observers and monitors to collect these data. Fish and invertebrate species are recorded by weight. Conversion factors were applied to convert any dressed weight data to live[4] weight equivalents.

For this analysis, only observed hauls from NEFOP trips with a "complete" sampling protocol were used. A "complete" sampling protocol includes obtaining species weights for both kept and discarded portions of all species in the catch. NEFOP training trips have been included in the analysis. Aborted trips and "set only" trips were excluded from the analysis along with trips fishing in statistical areas associated with the Southeast Region (statistical area $\geq$ "700"), trips landing outside the Greater Atlantic Region (e.g., trips landing in Canada), and "carrier" trips (*fleet_type* = "050"; no fishing effort occurred on these trips). Hauls with no catch reported, species hail weight with discard reason "039" ("previously discarded"), and catch of nonliving matter (such as debris, shells, etc.; these items would not be kept and sold) were also excluded for the analysis. Additionally, there were 3 observed tuna purse seine trips; and 1 observed MA crab dredge for which there were no corresponding VTR trips for the gear type and 1 observed Mid-Atlantic other dredge trip, 1 observed Mid-Atlantic limited access scallop trawl trip, 1 observed New England small mesh haddock separator trawl trip, and 1 observed Mid-Atlantic large mesh Ruhle trawl trip with no corresponding VTR trips for the calendar quarter; consequently these 8 observed trips were removed from the analysis.

---

[2] The observer sea day allocation documents are available online at: http://www.nefsc.noaa.gov/femad/fsb/SBRM/

[3] There were 1,406 At-Sea Monitoring Program (ASM) trips associated with New England hand line, longline, otter trawl, Ruhle trawl, and gillnet fleets in the July 2014 through June 2015 data. A comparison of discard rates derived from observer and at-sea monitor data in 2014 and 2015 revealed there were generally similar discard rates between the 2 data collection programs for the 18 fish species and 5 gear types (longline, large mesh otter trawl, large mesh Ruhle trawl, large mesh gillnet, and extra large mesh gillnet) where at-sea monitor data exist, hence NEFOP and ASM data were pooled. See Northeast Fisheries Observer Program (2013) for more information on ASM. The Atlantic States Marine Fisheries Commission (ASMFC) funded 65 otter trawl trips (66 trips when stratified by gear type and mesh size) in the July 2014 through June 2015 data. A comparison of discard rates derived from NEFOP-allocated and ASMFC-allocated trips revealed there were generally similar discard rates for the 3 fleets where ASMFC-allocated trips exist (Mid-Atlantic small mesh otter trawl fleet [49 trips], Mid-Atlantic large mesh otter trawl fleet [1 trip], and New England small mesh otter trawl fleet [16 trips]); hence, these data have been pooled.

[4] In this document, "live" is equivalent to "round" grade (i.e., includes the weight of the shell for shellfish).

The same broad stratification scheme used in previous SBRM analyses was employed in this analysis, in which trips were partitioned into nonoverlapping fleets by using 5 classification variables: geographic region, gear type, mesh, access area, and trip category. Calendar quarter was used in the analyses and was based on landed date to capture seasonal variations in fishing activity and discard rates. Two broad geographical regions were defined: New England (NE) and Mid-Atlantic (MA) based on port of departure[5]; ports in states from Maine to Rhode Island constituted the NE region, and ports in states from Connecticut to northern North Carolina (35^{o} N) constituted the MA region. Gear type was based on Northeast gear codes (*negear)*. Some gear codes were combined: sink, anchored, and drift gillnets, and single and paired mid-water trawls. Trips for which gear was unknown were excluded. Mesh size groups were formed for otter trawl and gillnet gear types. For otter trawls, 2 mesh groups were formed: small (mesh less than 5.50 in) and large (5.50 in mesh and greater). For gillnets, 3 mesh groups were formed: small (mesh less than 5.50 in), large (mesh from 5.50 to 7.99 in), and extra large (mesh 8.00 in and greater). Two access area categories were formed: access area (AA) and open (OPEN). The sea scallop fishery was divided into general (GEN) and limited (LIM) category trips. All other fisheries were combined into a category called "all." In the data set analyzed, there were also trips associated with 2 exempted fisheries where 100% monitoring coverage was required for trips. The exempted trips using a haddock separator trawl with small mesh have been grouped together to form the NE small mesh haddock separator trawl fleet (Row 18), and the exempted trips using a mid-water trawl fishing in the groundfish access area have been grouped together to form the NE AA mid-water trawl fleet (Row 57).

Stratification abbreviations used are given below.

Abbreviation	Definition
MA	Mid-Atlantic ports (CT and southward)
NE	New England ports (RI and northward)
sm	Small mesh (less than 5.50 in)
lg	Large mesh (from 5.50 to 7.99 in for gillnet; 5.50 in and greater for otter trawl)
xlg	Extra large mesh (8.00 in and greater)
LIM	Limited access category
GEN	General category
OPEN	Nonaccess area
AA	Access area

The VTR data are used as a basis for defining the sampling frame, since all federally permitted vessels are required to file a VTR for each fishing trip except those vessels that hold only a federal commercial lobster permit (See NMFS-Greater Atlantic Regional Fisheries Office http://www.greateratlantic.fisheries.noaa.gov/aps/evtr/doc/vtr_inst.pdf for guidance). These self-reported data[6] constitute the basis of the fishing activity of the commercial fleets. While dealer data are the preferred data to use because of more accurate weights, VTR data are used as a

[5] Wigley et al. (2007) found that the majority (over 93%) of 2004 observed trips both originated and fished in the same region and exhibited the same general pattern as in the VTR data. An updated analysis using July 2007 through June 2011 data found similar results (Wigley et al. 2012a).

[6] See Wigley et al. 2007 for more details on self-reported VTR data.

surrogate because dealer data do not contain mesh size and area fished information. The VTR data were thus used to expand the NEFOP discard ratios to total discards. For this analysis, the commercial federal VTR trips were used. Conversion factors were applied to convert various units of measure to pounds and all weight to live weight. VTR trip data were grouped into fleets as defined above. Trips participating in the US/Canada access area and other special access programs could not be identified in the VTR data. These trips were grouped by the other stratification variables and were not partitioned separately.

The VTR trips associated with the MA shrimp trawl fleet (Row 20) were partitioned into 2 groups: trips fishing in Pamlico Sound and trips fishing in ocean waters. Partitioning was needed because the Southeast Region has mandatory observer coverage of the southeastern shrimp fishery and allocates observer coverage to trips fishing in Pamlico Sound (Scott-Denton et al. 2012). MA shrimp trawl trips fishing in Pamlico Sound have been removed from these analyses, while trips fishing in ocean waters have been retained.

The clam fishery has a logbook system separate from the VTR logbook. The commercial clam logbook data were used to augment the VTR data for the clam dredge fishery. The commercial and recreational landings (in live weight) for the federally managed species were used only in sample size analysis.

A list of the 14 federally managed fish and invertebrate species groups analyzed and the individual species that compose each species groups is given in Table 1. Summaries of the data used, in terms of number of trips and number of sea days, by fleet, calendar quarter, and data source (NEFOP and VTR), are given in Tables 2 and 3, respectively.

The spatial and temporal patterns of observer coverage within a fleet were evaluated. Rather than using number of trips (a trip-based metric), the kept weight of all species reported in the VTR was used. The "kept weight with observer coverage" was derived as the kept weight of all species reported in the VTR summed by fleet, statistical area, and quarter, where at least 1 observed trip occurred in the fleet-quarter-statistical area cell and at least 3 observed trips[7] occurred in the fleet-quarter stratum. The "kept weight" was derived as the kept weight of all species reported in the VTR summed over all statistical areas and quarters within a fleet. The percentages of "kept weight with observer coverage" were calculated by dividing the "kept weight with observer coverage" by the "kept weight." These percentages were derived for the 57 fleets (reported as 53 individual fleets and 4 confidential fleets combined into "Confidential fleets"), "Other minor fleets," and all fleets combined. Additionally, as a relative measure of fleet activity among all fleets, the percentage of "kept weight" was derived by dividing the "kept weight" by the sum of the "kept weight" across all fleets.

Discard Estimation

Total discards of each of the 14 federally managed species groups were estimated for the July 2014 through June 2015 time period by using a combined discard/kept (d/k) ratio estimator (Cochran 1963), where d = discarded pounds of a given species group, and k = the kept pounds of all species (i.e., any species retained during the trip). Total discards (in weight) were derived by multiplying the estimated discard rate of each fleet by the corresponding fleet landings in the VTR database and then summing over fleets. In this analysis, no survival ratios were applied to discard estimates.

Simple imputation methods were used to fill quarterly cells for which there were fewer than 3 observed trips. Data from adjoining strata were pooled to impute estimates for cells with

[7] The 3 trips for fleet-quarter correspond with a minimum threshold for allocating observer coverage.

0, 1, or 2 trips. In this imputation only the temporal stratification (calendar quarter) was relaxed to an annual aggregation even though seasonal variation can occur for some species. This simple imputation could not be applied to fleets where observer coverage was low or missing throughout the year (i.e., too few data to support the simple imputation approach). In these cases, imputed values were not used, and the fleet was designated as a fleet in need of pilot coverage[8]. If some data were available, then discard estimates were derived, but these results were not used in sample size analyses.

The variances and standard errors (SE) of the discard estimates were also derived. In this document, CV is defined as the ratio of the standard error of the total discards divided by the total discards. The appendix presents the equations used in the analysis.

For each species/species group and fleet, the landings from the VTR and clam logbook are presented to provide perspective for the discard estimates.

Discard Reasons

For each species group and fleet, the fish dispositions associated with discarding (as reported by the at-sea observer) have been grouped into the following 6 discard reason categories: no market, regulation (size), regulation (quota), regulation (other), poor quality, and other. The discard reason categories and the associated fish dispositions are summarized in Appendix Table 2. The discard reasons "No Market" and "Poor Quality" are considered economic discards and not regulatory discards.

The observed (nonextrapolated) discards associated with each of the 6 discard reason categories were summed for each species group/species for the fleets where discards could be estimated. For individual fleets, the percentage of observed discards by discard reason category was derived by dividing the sum of the observed discards for each discard reason category by the sum of the total observed discards for each species group/species and fleet. The discard reason category percentages were taken from the observed discard reason category percentages. For each fleet that composes the "Other fleets filtered out" (an aggregated fleet that represents fleets where the variance of the discard estimate was not used in the annual sample size analysis), the observed discard reason category percentages were then multiplied by the total estimated (extrapolated) discards for each species group/species to derive the estimated discards by discard reason category. The total estimated discards by discard reason category were summed over the fleets that compose the fleet aggregation for each species group/species. The estimated discard reason category percentage was derived by dividing the estimated discards for each discard reason category by the sum of the total estimated discards for each species group/species and fleet. In other words, the "Other fleets filtered out" represents the weighted percentage where the weighting factor was the fleet extrapolated discards.

Sample Size Analysis

A sample size analysis (also referred to as sea day analysis) was conducted to estimate the number of baseline trips and sea days needed to monitor the 14 federally managed species groups in each fleet. As described in Wigley et al. 2007 (and given in the Appendix), the number of trips and sea days needed to achieve a given precision level was based on the variance of the

[8] Pilot coverage is defined as a minimum level of observer coverage necessary to acquire bycatch information with which to calculate variance estimates that can then be used to further define the level of sampling needed (NMFS 2004).

total discard estimate for a species group, with the assumption that the pattern of fishing activity observed in the prior year would be similar to that in the upcoming year. Sample sizes (trips and sea days) associated with the precision standard for discard estimates (30% CV) were derived. The sample size analysis was performed by using trips as the sampling unit and then converting the number of trips to sea days by multiplying by the weighted mean VTR trip length, where the weighting factor was the quarterly number of VTR trips that occurred during July 2014 through June 2015 time period. The percentage of trips was derived by dividing the number of trips needed by the number of VTR trips that occurred in the fleet. When total discards could not be estimated because of little or no observer coverage (no data), or when total discards were zero (no variance), the sample size (number of trips) was determined by using a pilot coverage level set to 2% of the quarterly VTR trips that occurred in a fleet, with a minimum of 3 trips per quarter (12 trips per year) and a maximum of 100 trips per quarter (400 trips per year). The 2% pilot coverage was the same as was used in previous sea day analyses. In this analysis, to avoid assigning more coverage than could be attained, a refinement was made to pilot coverage: if less than 3 VTR trips occurred in a fleet and quarter, then pilot coverage was set to zero. The quarterly trips were then multiplied by the quarterly mean VTR trip length to derive quarterly sea days. The quarterly trips and quarterly sea days were then summed for annual number of trips and sea days. It is recognized that pilot coverage may still result in too much coverage in cases where little or no observer coverage may actually be needed, when effort changes sharply between years, or when the fleet comprises a low number of trips on an annual basis. A trip filter is subsequently applied during the sea day allocation[9]. Some fleet/species combinations contribute very little to the total fishing mortality or discard of the species but may require significant resources to characterize the precision of the estimate. For example, a high variance estimate for a rare event within a fleet would require high levels of sampling, even though the total discard in that fleet was unimportant with respect to either the total discard or total fishing mortality of the resource. To address this, importance filters were used to provide a standardized protocol to further refine the number of baseline sea days based on: (a) the importance of the discarded species relative to the total amount of discards by a fleet, and (b) the total fishing mortality due to discards.

The 2016 baseline sea days were filtered by using a 95% cut-point in the discard filter and a 98% cut-point for the total mortality filter due to discards. In other words, estimates of sea day coverage for a given species or species group were derived for those fleets where discards constituted 95% of the discard mortality and catch constituted 98% of the total fishing mortality.

To determine the number of sea days (referred to as the “2016 sea days needed”) and trips needed to achieve a 30% CV on the estimates of discards for each of the 14 species groups within a fleet, the maximum number of sea days for the 14 species groups (i.e., the maximum number of sea days in a row) was used. This approach ensures that all species groups will have a 30% CV or less. In the event that sea days for each species group within a fleet were filtered out, then the number of sea days for the fleet was based on minimum pilot days to maintain monitoring coverage for that fleet. Minimum pilot coverage represents a minimum threshold for the allocation of sea days and is defined as 3 trips per quarter for each quarter where industry activity was 3 trips or greater. The quarterly number of trips is multiplied by the quarterly mean VTR trip length and then summed over quarters to derive the annual minimum pilot days for the fleet. If the fleet was designated as a pilot fleet, then pilot sea days were used. These fleets are

[9] A description of the trip filter can be found in the sea day allocation documents from 2014 onward; see http://www.nefsc.noaa.gov/femad/fsb/SBRM/ .

indicated with a “P.” The fleets with sufficient data to estimate sample size are referred to as nonpilot fleets.

RESULTS

There were 57 fleets uniquely identified in the July 2014 through June 2015 data (Tables 2 and 3; Appendix Table 1). Based upon the industry activity during this time period, the NE mid-water trawl AA fleet (Row 57) was added to the collection of fleets analyzed (fleets that have not been included in previous analyses are indicated with a “+” in Tables 2 and 3). The other minor fleets not uniquely identified in this analysis were aggregated into a single fleet labeled “Other minor fleets.” Because of confidentiality rules, the landings and discards associated with 4 unique fleets (MA AA LIM scallop trawl [Row 10], NE twin trawl [Row 14], MA large mesh Ruhle trawl [Row 15], and NE small mesh haddock separator trawl [Row 18]) in Tables 2 and 3 were aggregated into a single fleet labeled “Confidential fleets” for reporting purposes in Tables 4 and 5. Hence, the fleet row numbers within Tables 2, 3, and 6 are sequential, while the fleet row numbers in Tables 4, 5, and 7 are ordered, but there are gaps in the row numbers.

Of the 57 fleets examined, 27 fleets had little or no observer data: 10 fleets had sparse observer data across all quarters, while 17 fleets were missing observer data in all quarterly cells. The fleets with no observer coverage were primarily pot and trap fisheries targeting particular species (e.g., red deepsea crab [*Chaceon quinquedens*], whelk also known as conch [*Busycon carica*, *Busycotypus canaliculatus*], shrimp [*Pandalus borealis*], and hagfish [Myxinidae]). No discard estimation was performed for the 17 fleets with no observer coverage, and they were designated as fleets in need of pilot coverage (Tables 2 and 3; Appendix Table 1). The 10 fleets with sparse observer coverage were also designated as fleets in need of pilot coverage for the sample size analysis; however, discard estimation was performed with the sparse observer data. For the 30 remaining fleets (designated as nonpilot fleets; Rows 1, 2, 4-8, 11, 13, 18, 19, 24-26, 28, 29, 31, 32, 34-39, 42, 43, 46, 48, 49, and 57), estimates of discards and their associated variance were derived and used to determine the sample sizes needed for a 30% CV. Of the 30 fleets, there were 12 fleets (Rows 1, 2, 4, 11, 13, 18, 31, 32, 34, 43, 46, and 48) where the simple imputation was applied (Tables 2 and 3).

Thus, for the discard estimation and precision analysis, 17 fleets had no discard estimation, and 40 fleets had discards estimated. For the sample size analysis, 30 fleets had sample sizes derived from the discard variances, and 27 fleets had sample sizes based upon pilot coverage.

A total of 4,023 trips (11,726 days) was observed during the July 2014 through July 2015 period. When these trips were stratified, some trips were partitioned between strata, resulting in 4,410 trips (12,723 days; Tables 2 and 3) in the NEFOP data set.

In terms of number of trips, the percentages of observed trips varied by fleet and calendar quarter. On an annual basis, for the 40 fleets with some observer coverage, the percentage of observed trips by fleet ranged between 0.2% (MA hand line, Row 3; Table 2) to 100% (NE small mesh haddock separator trawl fleet [Row 18] and NE AA mid-water trawl fleet [Row 57]; Table 2). It is unexpected to have coverage percentages at 100%; however, these 2 fleets are

composed of the exempt fisheries trips for which 100% monitoring was required[10]. For the 30 nonpilot fleets (excluding the 2 exempted fleets [Rows 18 and 57]), the percentage of observed trips ranged between 0.4% (NE lobster pot, Row 49) and 22.6% (NE large mesh gillnet fleet, Row 28). Over all fleets, the percentage of observed trips was 5.5% (Table 2). The percentage of observer days (Table 3) was generally similar to the percentage of observed trips.

In terms of kept weight of all species, the percentage of observer coverage over all fleets was 56% (Table 4). For the 30 nonpilot fleets, the percentage of observer coverage ranged between 4% and 100% with an average of 77% (Table 4). Twenty-three of the 30 fleets had a percentage greater than or equal to 67% with an average of 89%. This finding indicates that the majority of kept weight within the fleet was associated with statistical areas and quarters with observer coverage. Additionally, these 23 fleets composed 63% of the total kept weight across all fleets. The kept weight of all species was considered a surrogate for fishing effort; hence, observer coverage occurred spatially and temporally where the majority of fishing effort occurred at the statistical area and quarter year scales.

The landings associated with the combined fleet "Other minor fleets" contributed 0.3% of the total landings across all fleets (Table 4); thus, the 57 uniquely identified fleets account for almost all of the total VTR landings.

Annual VTR landings for all fleets and estimated discards (live weight, in pounds) with associated precision (CV and SE) for 38 individual fleets (Rows 1-9, 11, 13, 16, 17, 19, 20, 24-26, 28, 29, 31-39, 41-46, 48, 49, and 57[11]) and 2 combined fleets ("Confidential fleets" and "Other minor fleets" [with landings only]) are summarized for each of the 14 species groups, the individual species that composed those species groups, and the 14 species groups combined (Tables 5A, 5B, and 5C; Figures 1A and 1B). There were 15 fleets (Rows 12, 21-23, 27, 30, 40, 47, and 50-56) as well as the "Other minor fleets" that have no discard estimation because of the lack of NEFOP coverage. Fleets with no discard estimation have dark shade in Tables 5A and 5B. In Table 5A, the CVs associated with the cells (species group and fleet) that were not used in the sample size analysis (i.e., cells filtered out via the importance filter) are indicated in light shading. Precision of discards of individual species (Table 5B) and 14 species group combined (Table 5C) were not used in the sample size analysis.

Based upon this analysis, 57,063 mt (125,803,405 lb; live weight) of discards for the 14 species groups occurred during the July 2014 through June 2015 period (Table 5C). The majority (76%) of the discards comprises 2 species groups: skates (Rajidae; 64%) and spiny dogfish (*Squalus acanthias*; 12%); the remaining SBRM species groups each accounted for less than or equal to 7% (Table 5A).

The percentage of discards to total catch varied among the 14 species groups (Table 5A; Figure 1A) and individual species (Table 5B; Figure 1B). There was 1 species group (SAL) with zero discards (this species group is not presented in Figure 1A); 3 species groups (SCOQ, HERR, and TILE) where discards were less than 1% of total catch; 4 species groups (SCAL, BLUE, SBM, and RCRAB) where percentages of discards ranged between 1% and 10% of total catch; 4 species groups (FSB, GFL, GFS, and MONK) where discards ranged between 11% and 25% of total catch; and 2 species groups (DOG and SKATE) where discards were greater than

[10] For further information see: https://www.gpo.gov/fdsys/pkg/FR-2015-04-08/html/2015-08056.htm and http://federalregister.gov/r/0648-AY47

[11] Discards were estimated rather than summed for the NE AA mid-water trawl exempted fleet (Row 57) and NE small mesh haddock separator trawl exempted fleet (Row 18) because unobserved hauls occurred on observed trips in these fleets.

26% of total catch. The species groups with the highest percentage of total discards relative to total catch were: skates (72%), spiny dogfish (47%), and monkfish (*Lophius americanus*; 22%; Figure 1A). For individual species (Table 5B; Figure 1B), most notable are the high percentages of discards to total catch for Atlantic wolffish *(Anarhichas lupus*; >99%), ocean pout (*Zoarces americanus*; >99%), and windowpane flounder (*Scophthalmus aquosus*; >99%) because of the no possession regulations for these 3 individual species, and for Atlantic halibut (*Hippoglossus hippoglossus*; 66%) because of a 1 fish per trip regulation. Offshore hake (*Merluccius albidus*; 88%) had a high percentage of discards to total catch because of economic reasons (no market). The NE large mesh otter trawl fleet (Row 8) had the highest estimated discards of SBRM species (Table 5C).

The reasons for discarding varied among the 14 species groups (Appendix Table 3A) and individual species (Appendix Table 3B). Overall, for the 14 species groups, the majority (82%) of discards were attributed to "No Market." "Regulation" (size, quota, and other), "Poor Quality," and "Other" contributed 14%, 2%, and 2%, respectively (Appendix Table 3A).

The percentages of discards to total catch by fleet were also summarized for the 30 nonpilot fleets (Figure 2). Discards of 1 or more of the 14 species groups that were filtered out via the importance filter have been aggregated into a species group labeled "Other SBRM." Discards of nonfederally managed species have been aggregated into a species group labeled "Non-SBRM." The percentages of discards to total catch varied by fleet (Figure 2). There were 3 fleets (Rows 31, 42, and 57) where discards were less than 1% of the total catch in the fleet; 4 fleets (Rows 2, 4, 25, and 34) where the percentages of discards ranged between 1% and 10%; 11 fleets (Rows 1, 7, 18, 24, 26, 29, 32, 35, 37, 39, and 48) where the percentages of discards ranged between 11% and 25% of total catch; 9 fleets (Rows 5, 8, 19, 28, 36, 38, 43, 46, and 49) where the percentages of discards ranged between 26% and 50% of the total catch; and 3 fleets (Rows 6, 11, and 13) where discards were greater than 50% of the total catch (Figure 2).

The number of species groups discarded within a fleet also varied among fleets. The majority of fleets (21 of the 30 fleets) comprised 2 or 3 discarded species groups. For 8 of these fleets (Rows 2, 4, 11, 18, 25, 26, 32, and 34), the "Other SBRM" species group comprised the majority of the discards. This finding indicates that the majority of discards for those 8 fleets were filtered out via the importance filter. There were 10 fleets (Rows 1, 31, 36, 37, 42, 43, 46, 48, 49, and 57) for which the "Non-SBRM" species group comprised the majority of the discards. There were another 3 fleets where 2 of the 3 discarded species groups were "Other SBRM" and "Non-SBRM," and the third represented the majority of the discards: Row 13 (skate; 75%) and Rows 24 and 28 (spiny dogfish; 50% and 71% respectively; Figure 2). The remaining fleets (9 of the 30 fleets) had between 4 and 9 discarded species groups. The skate species group comprised the majority of the discards in 4 of these fleets (Rows 6, 8, 19, and 29) while the "Non-SBRM" group comprised the plurality of the discards in 4 fleets (Rows 5, 35, 38, and 39), and there was 1 fleet (Row 7) for which small mesh groundfish (GFS) comprised the plurality of discards. The dominant "Non-SBRM" species in the scallop dredge fleets (Rows 32-39) were: sand dollar (Clypeasteroida), sponge (Porifera), starfish (Asteroidea) and Jonah crab (*Cancer borealis*). "Fish, not known" was the dominant "Non-SBRM" species in the NE purse seine fleet and the MA and NE mid-water trawl fleets (Rows 31, 41, and 42, respectively). American lobster (*Homarus americanus*) and Jonah crab were the dominant "Non-SBRM" species in the MA and NE lobster pot fleets (Rows 48 and 49, respectively; Figure 2).

The precision of the discard estimates varied by species group and fleet (Table 5A). Of the 14 species groups, 10 species groups (BLUE, FSB, GFL, MONK, RCRAB, SCAL, SKATE,

GFS, DOG, and SBM) had an overall CV that was less than 30%, and 3 species groups (HERR, SCOQ, and TILE) had an overall CV that was greater than 30% and 1 species group (SAL) had zero discards and consequently no CV. The discards of 4 species groups (BLUE, HERR, SCOQ, and TILE) were filtered out in all fleets; this finding indicates that the discards of these species groups were a minor component of the total catch of these species (Table 5A; Figure 1A). The precision of the discard estimates for individual species are given in Table 5B; these precision estimates were not used in the sample size analysis.

The number of sea days needed for each species group and fleet, as well as the number of pilot coverage days, minimum pilot coverage days, and the sea days needed for the fleet (referred to as "2016 Sea Days Needed"), are summarized in Table 6. A total of 10,746 days are needed for the 57 fleets. As mentioned previously, 27 fleets had insufficient observer information to estimate discards, and the sea days for these fleets were based on pilot coverage. The number of sea days needed for fleets with the pilot coverage designation was 808 days (8% of 10,746 days; Table 6). Of these 27 fleets, there were 2 fleets (Rows 10 and 15) where industry activity was so low that pilot coverage was zero (Tables 2 and 6). There are 15 fleets for which the sea days for all species groups were filtered out via the importance filter, and minimum pilot coverage days were used to maintain some coverage (Rows 1, 2, 4, 11, 18, 25, 26, 31, 32, 37, 43, 46, 48, 49, and 57; Table 6). There was a total of 300 sea days associated with the fleets with minimum pilot coverage (3% of 10,746 days; Table 6). The sea days needed for the remaining 15 fleets (9,638 days, representing 90% of the total sea days needed) were derived by using the variance of the discard estimate (Tables 6). Of the 9,638 days, 3,531 days (37%) were associated with 1 fleet (NE large mesh otter trawl [Row 8]; Table 6).

The sample size (in terms of number of sea days, number of trips, and percentage of trips based on the July 2014 through June 2015 VTR trips) needed to achieve a 30% CV of the discard estimate in 15 fleets is given in Table 7. The relationship between sample size and precision, over a range of sample sizes, is shown in Figure 3 for species groups and fleets. If the precision standard (30% CV) was relaxed for the red crab species group in 1 fleet (Row 8), resulting in the penultimate (next largest) value being used in the fleet (e.g., 760 days rather than 3,531 days for Row 8), then the total number of sea days needed across the 57 fleets would be 7,975 days (a 26% decrease from the 10,746 days). When the penultimate value is used, the expected achieved precision of red crab discards in Row 8 would be about 72% CV (Figure 3).

DISCUSSION

A broad stratification was used to support the deployment of observers on commercial fishing trips among various fleets by using attributes known prior to the trip departure. As discussed in previous discard estimation analyses (Wigley et al. 2007, 2011), species-specific stock assessment discard estimation may differ from this report because of differences in stratification and data used (calendar year versus 12-month [July through June] time period; area fished versus region [port of departure]; gear groupings; discard mortality assumptions; and VTR landings versus dealer landings). Region, based on port of departure, was used for the deployment of observers. It is recognized that area fished would provide a better stratification for discard estimation. It is expected, however, that, when uncertainty in the estimates is taken into account, estimates would be in the same order of magnitude. The discard estimates presented here are not definitive estimates but rather are indicative of where discarding occurred among the

commercial fleets for the 14 federally managed species groups.

No survival ratios were applied to the discard estimates; we do not account for potential survival of organisms returned to the water. When comparing discard estimates from this study with those from stock assessments, it is useful to note that survival ratios are applied in stock assessments for Georges Bank and Gulf of Maine stocks of Atlantic cod (*Gadus morhua*), Atlantic sea scallop (*Placopecten magellanicus*), skates, spiny dogfish, fluke (*Paralichthys dentatus*), southern New England/Mid-Atlantic and Gulf of Maine stocks of winter flounder (*Pseudopleuronectes americanus*), and southern New England/Mid-Atlantic yellowtail flounder (*Limanda ferruginea*).

These analyses have used VTR data. Dealer (*CFDERSyyyy*) data do not contain mesh or area fished information until the trip-based allocation is performed (Wigley et al. 2008). The trip-based allocation of dealer (*CFDETT/SyyyyAA*) data is conducted annually and was not available when this analysis was initiated. Given that the VTR landings estimates are usually less (VTR reports the good faith hails) than the dealer records for a given fleet, the corresponding estimates of discards will also be underestimated. The magnitude of the underestimation will vary by fleet and year.

It is important to note the discard estimates provided in this analysis appropriately reflect the underlying data used (e.g., the VTR data used to raise the discard ratios to total discards and the observed trips used to derive the discard ratios were from the same VTR-based sampling frame). It is inappropriate to extrapolate beyond the sampling frame used unless it can be shown that the trips with no VTR reporting requirements have the same landings and discard characteristics as the trips with VTR reporting requirements.

In 2014, the northern shrimp fishery was closed and remained closed through 2015. As in years past, the VTR trips associated with NE shrimp trawl fleet (Row 21; Tables 2 and 3) were investigated. These trips used 2 inch mesh, and most trips reported catching small mesh groundfish and/or herring while a few trips reported catching squid. The northern shrimp fishery requires a finfish excluder device (FED); however, other small mesh exempted fisheries do not require a FED. Currently, there is no data element within the VTR database that indicates whether or not a FED or other bycatch reduction device was used. Based upon previous investigations, the captains of the vessels participating in the small mesh exempted fisheries indicated that a FED was not used. An additional data element within the VTR database is needed to distinguish trips using a FED from those that are not.

The analysis conducted for the spatial and temporal observer coverage used live weight. As a result, fleets using scallop dredge and clam dredge targeting species with shells have higher kept weight percentage than other fleets because of the use of “live” weight rather than “landed meat” weight. However, the use of live weight does not distort the observed percentage (spatial or temporal pattern) within a fleet. It is important to remember that percent observer coverage is an indicator of where observed kept weight (or trips) occurred relative to unobserved kept weight (or trips). The percentage observed should not be confused with the precision of the discard estimate, which is the metric used to describe discard variability and to determine the sample size needed for monitoring purposes.

The refinement to pilot coverage made in this analysis (pilot coverage was applied only when there were at least 3 VTR trips in a fleet and calendar quarter) reduced the pilot coverage in 11 of the 27 pilot fleets (Rows 10, 12, 14, 15, 16, 23, 27, 41, 44, 50, and 53; Table 2) where there were 1 or 2 VTR trips within a fleet and calendar quarter and prevented pilot coverage from exceeding industry activity. The refinement also resulted in no coverage for fleets with low

overall trip activity: MA AA LIM scallop trawl fleet (Row 10) and MA large mesh Ruhle trawl fleet (Row 15; Table 6). Each of these fleets had only 2 VTR trips during the July 2014 through June 2015 time period (Table 2).

There is 1 fleet with high sea day requirements (>2,000 sea days). The high monitoring coverage for NE large mesh otter trawl fleet (Row 8; Table 6) was because of high variability of red deepsea crab discards. In this analysis, as well as in previous analyses (NEFSC 2011a, 2011b; Wigley et al. 2011, 2012b, 2013, 2014, 2015), the high variability arose from observing some trips that were fishing in deep-water portions of statistical areas as well as observing the same trips or other trips that were fishing in shallower portions of the same statistical areas. Red deepsea crabs were encountered during trips fishing in deep water. Although the discard reason reported for this fleet was "No Market" (Appendix Table 3A), these vessels do not generally have permits to land red deepsea crabs, thus the red deepsea crabs must be discarded. Currently, the analysis does not stratify fleets further to account for depth because statistical area is the finest spatial resolution that defines a subtrip within the VTR (a subtrip within the VTR is a unique gear, mesh, and statistical area).

Fish may be discarded for economic reasons (e.g., "No Market" or "Poor Quality") or for regulatory reasons (size, quota, or other). When considering mechanisms to reduce discards, it may be useful to know why discarding is occurring.

It is important to note that large discard percentages may be associated with a small quantity of discards. Additionally, it is important to note that for many species, the discards are associated with fleets that have been filtered out by the importance filter. Observers classify the discards by fish disposition based upon the NEFOP protocol (NEFOP 2013) in which the observer asks the captain/crew why species are being discarded. Thus, these data should be considered a form of self-reported data, and as such, these data are difficult to verify and should be interpreted cautiously.

This analysis does not address the coverage needed for individual sectors or multiple stock components of a species. The analytical basis for the allocation of future sea day coverage in this analysis is a specified level of precision (i.e., 30% CV), and an expectation that the pattern of fishing activity observed in the prior year will be similar to that in the upcoming year.

ACKNOWLEDGEMENTS

We thank all the NEFOP observers and at-sea monitors for their diligent efforts to collect the data used in this report. We thank our reviewers for their helpful comments on this report. Lastly, we thank recently retired Paul Rago for developing many of the methods used in the SBRM analyses.

REFERENCES CITED

Cochran WL. 1963. Sampling techniques. J. Wiley and Sons. New York.

National Marine Fisheries Service (NMFS). 2004. Evaluating bycatch: a national approach to standardized bycatch monitoring programs. US Dep. Comm., NOAA Tech. Memo. NMFS-F/SPO-66, 108 p. Available online at: http://spo.nmfs.noaa.gov/tm/tm66.pdf

National Marine Fisheries Service (NMFS). 2008. Magnuson-Stevens Fishery Conservation and Management Act Provisions; Fisheries of the Northeastern United States; Northeast Region Standardized Bycatch Reporting Methodology Omnibus Amendment. Federal Register, Vol. 73, No. 18, Monday, January 28, 2008. p. 4736-4758. Available online at: https://federalregister.gov/a/E8-1436

National Marine Fisheries Service (NMFS). 2011. Fisheries of the Northeastern United States; Removal of Standardized Bycatch Reporting Methodology Regulations. Federal Register, Vol. 76, No. 250, Thursday, December 29, 2011. p. 81844 – 81850. http://www.gpo.gov/fdsys/pkg/FR-2011-12-29/pdf/2011-33302.pdf

New England Fishery Management Council (NEFMC), Mid-Atlantic Fishery Management Council, National Marine Fisheries Service. 2007. Northeast Region Standardized Bycatch Reporting Methodology: An Omnibus Amendment to the Fishery Management Plans of the Mid-Atlantic and New England Regional Fishery Management Councils. June 2007. 642 p. Available online at: http://www.nefmc.org/issues/sbrm/index.html

New England Fishery Management Council (NEFMC), Mid-Atlantic Fishery Management Council, National Marine Fisheries Service. 2015. Standardized Bycatch Reporting Methodology: An Omnibus Amendment to the Fishery Management Plans of the New England and Mid-Atlantic Regional Fishery Management Councils. March 2015. 361 p. Available online at: http://www.greateratlantic.fisheries.noaa.gov/regs/2015/June/15SBRMOmnibusAmend.html

Northeast Fisheries Science Center (NEFSC). 2011a. Standardized Bycatch Report Methodology Annual Discard Report 2011 (Section 1 and 2). Internal document presented to the NEFMC and MAFMC. 1135 p. Available online at: http://www.nefsc.noaa.gov/fsb/SBRM/

Northeast Fisheries Science Center (NEFSC). 2011b. Standardized Bycatch Report Methodology Sea Day Analysis and Prioritization 2011. Internal document presented to the NEFMC and MAFMC on January 25, 2011. 25 p. Available online at: http://www.nefsc.noaa.gov/fsb/SBRM/2011/2011-SBRM-Sea-Day-Analysis-Prioritization.pdf

Northeast Fisheries Observer Program (NEFOP). 2013. Fisheries Observer Program Manual 2013. Northeast Fisheries Science Center, Woods Hole, MA 02543. 426 p. Available on-line at: http://www.nefsc.noaa.gov/fsb/manuals/2013/NEFSC_Observer_Program_Manual.pdf

Scott-Denton E, Cryer PF, Duffy MR, Gocke JP, Harrelson MR, Kinsella DL, Nance JM, Pulver JR, Smith RC, Williams JA. 2012. Characterization of the U.S. Gulf of Mexico and South Atlantic penaeid and rock shrimp fisheries based on observer data. Marine Fisheries Review, 74(4): 1-27. Available at: http://spo.nmfs.noaa.gov/mfr744/mfr744.html

Wigley SE, Blaylock J, Rago PJ, Murray KT, Nies TA, Seagraves RJ, Potts D, Drew K. 2012a. Standardized Bycatch Reporting Methodology 3-year Review Report 2011- Part 2. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 12-27; 226 p. Available at: http://www.nefsc.noaa.gov/publications/crd/crd1227/

Wigley SE, Blaylock J, Rago PJ, Shield G. 2012b. 2012 Discard estimation, precision, and sample size analyses for 14 federally managed species groups in the northeast region. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 12-17; 146 p. Available at: http://www.nefsc.noaa.gov/publications/crd/crd1217/

Wigley SE, Blaylock J, Rago PJ, Shield G. 2013. 2013 Discard estimation, precision, and sample size analyses for 14 federally managed species groups in the northeast region. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 13-15; 150 p. Available at: http://www.nefsc.noaa.gov/publications/crd/crd1315/

Wigley SE, Blaylock J, Rago PJ, Shield G. 2014. 2014 Discard estimation, precision, and sample size analyses for 14 federally managed species groups in the waters off the Northeastern United States. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 14-05; 157 p. Available at: http://www.nefsc.noaa.gov/publications/crd/crd1405/

Wigley SE, Blaylock J, Rago PJ, Tang J, Haas HL, Shield G. 2011. Standardized Bycatch Reporting Methodology 3-year Review Report 2011- Part 1. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 11-09; 285 p. Available at: http://www.nefsc.noaa.gov/publications/crd/crd1109/

Wigley SE, Tholke C, Blaylock J, Rago PJ, Shield G. 2015. 2015 Discard estimation, precision, and sample size analyses for 14 federally managed species groups in the waters off the northeastern United States. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 15-04; 162 p. doi: 10.7289/V5DN431K. Available at: http://www.nefsc.noaa.gov/publications/crd/crd1504/

Wigley SE, Hersey P, Palmer JE. 2008. A description of the allocation procedure applied to the 1994 to 2007 commercial landings data. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 08-18; 61 p. Available at: http://www.nefsc.noaa.gov/publications/crd/crd0818/crd0818.pdf

Wigley SE, PJ Rago, KA Sosebee, DL Palka. 2007. The analytic component to the Standardized Bycatch Reporting Methodology Omnibus Amendment: sampling design and estimation of precision and accuracy (2nd edition). U.S. Dep. Commer, Northeast Fish. Sci. Cent. Ref. Doc. 07-09; 156 p. Available online: http://www.nefsc.noaa.gov/publications/crd/crd0709/index.htm

Omnibus Industry-Funded Monitoring (IFM) Amendment

Amendment 7 to the Atlantic Herring FMP

DRAFT

Options Under Consideration

to Establish IFM in the Atlantic Herring Fishery

(Coverage Targets, Program Requirements, Sea Day Costs)

Lori Steele, NEFMC Staff, Herring Plan Development Team (PDT) Chairman
Industry-Funded Monitoring FMAT

DATE: 8/7/15 for Draft Omnibus IFM Amendment/EA

Intentionally Blank

TABLE OF CONTENTS

1.0 SUMMARY OF HERRING IFM OPTIONS UNDER CONSIDERATION 1

2.0 WHAT IS A SEA DAY COST? 2

2.1 What Drives Sea Day Costs Up? 3

2.2 How Can Sea Day Costs be Reduced? 5

3.0 ELEMENTS OF HERRING OPTIONS UNDER CONSIDERATION 10

3.1 Sampling Objectives, Sampling Design, Data Collected 10

3.2 Service Provider Requirements 18

3.3 Observer Training, Certification, and Sampling Equipment 21

3.4 Pre-Trip Notification, Debriefing, and Data Management 25

3.5 Summary: Comparison of Herring OBS and ASM Options 28

4.0 ESTIMATED SEA DAY COSTS FOR THE HERRING ASM OPTIONS 29

LIST OF TABLES

Table 1 Summary Discussion – How to Reduce Sea Day Costs 6
Table 2 Types of Information/Data That Can Improve Predictability of the Fishery 9
Table 3 NEFOP Generic Haul Log (Example) 12
Table 4 NEFOP Discard Log (Example) 13
Table 5 Monitoring Approaches for the Atlantic Herring Fishery Based on Data Needs 15
Table 6 Monitoring Approaches for the Atlantic Mackerel Fishery Based on Data Needs 16
Table 7 Herring IFM Options: Sampling Objectives, Sampling Design, Data Collected 17
Table 8 Herring IFM Options: Service Provider Requirements 20
Table 9 Herring IFM Options: Observer Training and Certification 24
Table 10 Herring IFM Options: Observer Equipment 24
Table 11 Herring IFM Options: Logistics (Notification), Debriefing, and Data Management 27
Table 12 Qualitative Comparison of Options for Industry-Funded Monitoring in the Atlantic Herring Fishery (Herring OBS Options vs. Herring ASM Options) 28

1.0 SUMMARY OF HERRING IFM OPTIONS UNDER CONSIDERATION

The options under consideration to establish industry-funded monitoring (IFM) in the Atlantic herring fishery are described in detail in the Draft omnibus IFM amendment. The options under consideration are grouped into two categories: (1) options for industry-funded observer coverage (herring OBS options, HER OBS); and (2) options for industry-funded at-sea monitoring (herring ASM options, HER ASM). The primary difference between these options is that the herring OBS options require comprehensive sampling (catch and bycatch) to provide data that is consistent with NEFOP observer data collected to meet the requirements of the standardized bycatch reporting methodology (SBRM). The herring ASM options require comprehensive sampling of bycatch only, i.e., any catch that is not retained on board the vessel for any reason, including full and partial slippage events, operational discards, and catch that is sorted on board the vessel and then discarded. The industry (vessels/vessel owners) would pay for at-sea monitors to collect bycatch data, while NEFOP observers would continue to be deployed to collect observer data on herring vessels to meet SBRM requirements. The details of the industry-funded herring OBS and ASM options under consideration are discussed in the following subsections of this document.

The intent of considering two different kinds of industry-funded monitoring programs for the Atlantic herring fishery is to address specific monitoring needs identified by the Council while providing a basis for understanding and comparing the costs of the monitoring program, particularly those which will be borne by the fishing industry. This approach also provides a mechanism to consider options that may reduce costs for the industry. For comparison purposes, information about the current multispecies (groundfish) at-sea monitoring program (GF ASM) for sector vessels is provided throughout this document as well. Since the sea day costs of the GF ASM program are better understood and current estimates of these costs are available, the sea day costs of a herring ASM program can be estimated based on a comparison to the groundfish ASM program, with particular consideration of the factors that can drive sea day costs up (see Section 2.1, p. 3).

Under the herring OBS options, vessels would be required to hire/pay sea day costs for NMFS-approved observers on some number of trips (based on coverage targets) above those on which vessels are required to carry an observer deployed through the standardized bycatch reporting methodology (SBRM). The industry-funded observers would require NEFOP certification to collect observer data, including a high-volume certification, and they would collect comprehensive catch/bycatch data consistent with NEFOP protocols for observer data collected under the SBRM. Under the herring ASM options, vessels would be required to hire/pay sea day costs for NMFS-approved at-sea monitors on trips (based on coverage targets) other than those on which vessels are required to carry an observer deployed through the SBRM. The industry-funded at-sea monitors would require NEFOP certification for the herring ASM program (HER ASM), and they would collect bycatch (discard) data consistent with NEFOP protocols.

Each set of options for IFM in the Atlantic herring fishery includes sub-options to consider allowances for waivers in the event that an observer or at-sea monitor cannot be provided for a fishing trip (to allow the vessel to fish). Additional sub-options are under consideration to exempt wing vessels (in a pair trawl operation) that do not take on fish from requirements to carry observers/monitors under the industry-funded monitoring program. These vessels would be required to notify NMFS ahead of time (through the pre-trip call-in and/or VMS) and would be prohibited from fishing for or possessing herring on exempted trips.

Some of the herring IFM options under consideration in the IFM amendment would apply to all Category A/B Atlantic herring vessels (single and paired midwater trawl, purse seine, small mesh bottom trawl) on trips declared into the herring fishery, while other options would apply only to midwater trawl vessels (single and paired, all permit categories). The options that apply only to midwater trawl vessels are based on SBRM fleet divisions (gear type and area).

2.0 WHAT IS A SEA DAY COST?

For the purposes of this discussion document, the *sea day cost* is amount that the participants in the fishery (vessels/vessel owners) pay to service provider companies for deploying an observer/at-sea monitor for a fishing trip to meet the requirements of an industry-funded monitoring program. As described in the Draft omnibus IFM amendment, the *sea day cost* incurred by the industry generally includes travel and salary for observer training, deployment and debriefing; service provider overhead and project management costs; special equipment costs; and other expenses determined by the service provider to meet the monitoring program requirements. Sea day costs are usually estimated based on a 24-hour day but can be billed based on full days, partial days, or hours. In many cases, vessel owners will enter into contracts with service providers to negotiate and secure a specific sea day cost for an agreed-upon number of sea days. Vessels may enter into contracts with multiple service providers to meet the monitoring requirements for a fishery. There are several elements of a sea day cost that can be negotiated through these contracts.

In an industry-funded monitoring program, a primary component of a *sea day cost* (sometimes upwards of 50% of the sea day cost) is **labor**, i.e., wages/salary for observers, which can be estimated by the service provider based on the anticipated number of days per month that each observer will work in the monitoring program. **Insurance** is another significant component of the sea day cost, the annual cost of which (per observer) is spread across the estimated number of sea days. Additional costs related to observer **training** (daily stipend, travel, and lodging), employee **benefits** (health insurance, vacation), and project management and **overhead** (staff, offices) are estimated for the year and then distributed across the estimated number of sea days for the monitoring program.*

**Insurance and workers compensation expenses are higher in the Northeast Region than in west coast fisheries.*

There are currently no industry-funded monitoring programs in the Greater Atlantic Region that include contracts between service provider companies and fishing industry participants. Until now, all contracts for observer coverage and at-sea monitoring have been entered into by the Federal government and service providers, administered by NMFS/NEFOP. The contract for NEFOP observer coverage under the SBRM requirements is signed for five years with one provider (currently MRAG Americas). Until recently, the Federal government has been covering industry sea day costs in the groundfish at-sea monitoring program through contracts with three service providers. Later in 2015, when groundfish sectors will become responsible for paying their at-sea monitoring sea day costs, there will be an opportunity for sector vessels to enter into contracts with provider companies to negotiate sea day costs. There is likely to be some reduction in sea day costs that will result from "privatizing" contracts and eliminating the Federal government as a party entering into the contract (see following discussion). Several industry-funded monitoring programs in U.S. west coast fisheries use vessel/provider contracts; reviewing these programs is helpful to understand the factors that drive sea day costs up and the ways that the monitoring program can be structured to reduce these costs (see Section **Error! Reference**

ource not found. of this document for more information about industry-funded monitoring programs in other U.S. fisheries).

Sea day costs are determined by individual service providers based on their overhead and the estimated costs associated with deploying their employees as observers in the monitoring program. There are many elements of the sea day cost that will be unique to individual service provider companies and cannot be predicted or estimated with any certainty. In addition, sea day costs can be variable, and service providers can bid different sea day costs to different vessels under the same monitoring program, depending on the details of the individual contracts. Ultimately, it will be up to the participants in the fishing industry to negotiate sea day costs with service providers in contracts designed to better meet their individual needs. To the extent that vessels that fish out of the same ports can work together to negotiate costs with service provider companies, there may be savings by reducing observer travel costs and offering more days in total for the providers to distribute overhead costs. In addition, there may be opportunities for the industry to reduce their sea day costs by allowing some costs (travel, meals, cancellations) to be negotiated in the contracts with service providers.

A large part of the sea day cost is determined by service providers based on predictions/assumptions of how vessels participating in the monitoring program will operate over the course of a fishing year and how the fishery will respond. If service providers have adequate information to accurately predict their overhead and related costs, then they can increase their efficiency and transfer these cost savings to the industry.

2.1 WHAT DRIVES SEA DAY COSTS UP?

There are several factors that can significantly affect sea day costs in any industry-funded monitoring program. During the development of this discussion document, representatives from the NEFOP, service provider companies in the northeast U.S., and representatives from U.S. west coast service provider companies identified the following factors that most commonly increase sea day costs. In an effort to reduce sea day costs, the elements of the herring ASM options under consideration (described in Section 3.0 of this document) specifically address the following factors, to the extent possible. *Discussion of each of these factors with respect to the herring ASM options is provided below in italics.*

- **Requirements for New Data Collection/New Equipment.** New or different sampling protocols require modifications to observer training, which could increase training costs for both the government and service providers. If new or different sampling equipment is required to meet the monitoring program needs, the expense of the additional equipment will be incurred by the service provider. In addition, re-designing existing observer databases to incorporate new data introduces a significant administrative expense.

  The herring ASM options build on existing observer data collection protocols and do not require the collection of new/different data and/or new/additional sampling equipment. The protocols for the herring ASM options focus on the sampling of bycatch and is based on existing protocols for sampling bycatch and completing a NEFOP discard log for observed herring trips (see Section 3.1 for more information).

- **SCA and FLSA Requirements.** Requirements associated with the Service Contract Act (SCA) and Fair Labor Standards Act (FLSA) apply to any contracts in which the Federal government is involved. There is likely to a reduction in sea day cost associated with eliminating any legal requirements that

apply specifically to contracts involving the Federal government. However, service provider companies would still be subject to FLSA requirements and other applicable labor laws.

The SCA applies to every contract entered into by the United States (government) or the District of Columbia. Contractors and subcontractors performing on these Federal contracts must observe minimum wage standards (based on the prevailing wage for a locality, as determined by the Department of Labor) as well as safety and health standards, and they must maintain certain records. The SCA requires that every employee working under the contract must be paid not less than the monetary wages, and must be furnished fringe benefits, which are determined based on locality. Fringe benefits include paid holiday leave, vacation time, and minimum requirements for health and welfare (80/20 compensation for health insurance). Because contracts in the Atlantic herring industry-funded monitoring program will be between service providers and participants in the fishing industry, it will not be necessary for these contracts to meet the requirements of the SCA.

However, even without the SCA requirements, service provider companies will still be required to pay employees not less than the federal minimum wage provided in the Fair Labor Standards Act (FLSA). The FLSA establishes minimum wage, overtime pay, recordkeeping, and youth employment standards affecting employees *in the private sector as well as in Federal, State, and local governments.* Covered non-exempt workers are entitled to a minimum wage of not less than $7.25 per hour effective July 24, 2009. Overtime pay at a rate not less than one and one-half times the regular rate of pay is required after 40 hours of work in a workweek.

According to a report published by MRAG Americas (June 2012), Northern Economics (2011) estimated that the SCA and FLSA requirements are likely to add $50-$100 to the sea day cost for an industry-funded monitoring program. However, eliminating SCA requirements by privatizing contracts in this region is not likely to decrease sea day costs by as much as $100 for two reasons: (1) FLSA requirements for minimum wage and overtime would still apply to vessel/provider contracts; and (2) employees working for companies currently providing observer coverage and at-sea monitoring services in this region have been working (some for many years) under government contracts, which are consistent with SCA requirements for wages and fringe benefits. It may be very difficult for service providers in this region to change the wage and benefit structure they offer to their employees, many of whom have been working in observer and ASM programs in this region for several years. Therefore, the reduction in sea day cost that can be expected from the privatization of contracts cannot be estimated with certainty but is likely to be on the lower end of the range predicted in the MRAG Report.

**This savings is not reflected in the current estimate of sea day costs for the groundfish ASM program.*

- **Ability to Predict the Fishery.** Sea day costs will likely be higher if service providers cannot predict how the fishery will operate (numbers of vessels/trips, length of trips, seasonality and spatial distribution of trips) in order to accurately estimate costs (administrative, overhead, communications, logistics) associated with deploying observers to meet the needs of the monitoring program. Predictability increases efficiency and therefore reduces costs. With limited information to predict the fishery, service providers are more likely to over-estimate costs associated with travel and observer deployment to ensure that they cover their costs.

  The Atlantic herring fishery is a small group of vessels that fish in a relatively predictable manner. Ultimately, in order to reduce costs, it will be up to industry participants to provide as much detail as

possible about their fishing patterns to the service providers when they negotiate contracts for sea days.

- **Complicated Logistics (Vessel Selection and Observer Deployment).** The more infrastructure necessary to efficiently deploy observers to meet the needs of the monitoring program (field offices, coordinators, communications networks), then the higher the sea day costs will be. If pre-trip notification systems need to be expanded to determine observer/monitor deployment, this will likely increase costs.

  The existing pre-trip notification system (PTNS) can be utilized for vessel selection under the herring ASM options. The coverage targets are relatively simple and should not create overhead/staff costs associated with vessel selection/notification and observer deployment. In addition, travel costs associated with deploying observers on Category A/B herring vessels may be less than those for other IFM programs. The Atlantic herring fishery operates with a relatively small number of boats in a limited geographical area (versus the area covered by west coast fisheries), so observers can reach a number of deployment ports across several states more easily (ex., driving vs. flying).

2.2 HOW CAN SEA DAY COSTS BE REDUCED?

Table 1 summarizes the ways that sea day costs can be in an industry-funded monitoring program. The discussion provided in Table 1 was generated from information provided by NEFOP personnel, observers, and representatives from service providers in the northeast and U.S. west coast. To the extent that the issues identified in Table 1 can be addressed through the management measures that establish/implement the IFM program, sea day costs borne by the fishing industry can be reduced.

Table 1 Summary Discussion – How to Reduce Sea Day Costs

How to Reduce Sea Day Costs	Discussion/Rationale
Build from existing observer sampling protocols; do not require new/different data to be collected	• Collecting data in a new/different way will require modifications to existing observer sampling protocols and training procedures, new/revised manuals/logs, possibly new/additional sampling equipment, and database design or restructure; this could increase administrative and training costs
Eliminate SCA and related regulatory requirements for Federal contracts	• Federal requirements for wage structure/overtime/paid holidays/vacation are not necessary for contracts between vessels/providers; without specifically implementing these requirements as part of the IFM regulations, wage structure and benefits for employees would be determined by individual service provider companies; MRAG report (June 2012) estimates that eliminating these requirements may reduce costs by $50-$100 per sea day; • FLSA and other Federal labor laws would still apply to service provider companies; however, eliminating the SCA requirements from IFM regulations is likely to result in some reduction in sea day cost; • Not likely to result in $100 per sea day cost savings in this region due to existing pay structure/benefits for observers required by Federal contracts; • *Needs NOAA GC Input**
"Grandfather in" current service providers approved for NEFOP observer coverage and GF ASM programs – approve these providers immediately for Herring ASM program	• Reduces expense of applying/re-approving service provider companies already approved for other programs in the region; observers/monitors for approved service providers would still need NEFOP certification for Herring ASM program; • Allows herring vessels to select from multiple service providers when program is established; increases negotiating opportunities for vessels at onset of program by creating competition between companies; • Provides opportunity for existing service providers in GF ASM program to offer more work days to their observers (could reduce staff/overhead expenses for both programs)
Allow cross-certification of NEFOP and GF ASM observers for HER ASM program; combine/overlap training and recertification whenever possible	• Cross-training and applying training courses to multiple certification reduces training costs (travel, hotel, per diem for service providers); • Reduces equipment costs for service providers – no need to purchase duplicative equipment • As previously noted, this may reduce overhead costs for GF ASM service providers by providing their observers with a greater number of days to work (improving ability for service providers to retain full-time employees)

Table 1 continued. Summary Discussion – How to Reduce Sea Day Costs

How to Reduce Sea Day Costs	Discussion/Rationale
Provide detailed information about fishing patterns for vessels participating in the industry-funded monitoring program	• Allows providers to more accurately estimate manpower/resources needed, logistics, overhead, and travel costs - reduces need for providers to over-estimate these costs to cover expenses that cannot be predicted prior to the start of the year; • Increases predictability of fishery for observer/monitor deployment; • Increases efficiency for service providers
Minimize observer deployment logistics	• Simplifying the selection process for vessels/trips that require industry-funded observers/monitors reduces costs for service providers because vessel selection/notification would not require additional staff or resources; • Pre-trip notification and selection for Herring ASM options could be built into existing herring PTNS; 100% coverage target options (and 50% coverage target options) eliminate need for service provider to develop a plan to meet specified coverage targets for the monitoring program;
Allow industry to negotiate less significant costs with providers	• Structure the provisions in the industry-funded monitoring program to allow the industry to negotiate as many minor costs as possible with service providers, to better meet their individual vessel needs circumstances; • These may include costs for trip cancellations and no-shows, meal reimbursements, partial day/hourly billing (see below), land-hour rates (if necessary), or other costs
Encourage service providers/industry to negotiate billing by partial days (versus 24 hour days)	• Sea scallop regulations 648.11(g)(5)(i)(A)(2) state that "For the purposes of determining a daily rate…a service provider may charge a vessel owner for not more than the time an observer boards a vessel until the vessel disembarks (dock to dock), where a day is defined as a 24-hour period, and portions of other days would be pro-rated at an hourly charge." • Industry participants should be aware that this can be negotiated in contracts with providers; may be opportunity to reduce sea day costs for some vessels depending on fishing operations; • Consideration should be given to the possibility of land hour time for observers/monitors, which may be necessary if days are billed partially or by the hour
Allow observers to be deployed on the same vessel for more than two consecutive multi-day trips, and more than twice in any given month for multi-day deployments	• Prohibited in current regulations for industry-funded observer coverage (Herring OBS options), implemented in SBRM amendment • Increases flexibility and reduces travel costs for service providers; appears to be consistent with regulations for Groundfish ASM

Table 1 continued. Summary Discussion – How to Reduce Sea Day Costs

How to Reduce Sea Day Costs	Discussion/Rationale
Encourage vessels in close proximity to negotiate contracts together so that they can utilize the same observers and minimize travel expenses	• Industry can reduce costs by collaborating with vessels that fish from same ports and/or during same seasons to reduce travel and related costs for observers/monitors
Streamline debriefing and re-certification requirements	• Reduces costs to service providers (travel/per diem)
Insurance	• There may be ways to reduce/streamline insurance requirements to reduce costs for providers. To the extent that duplicative or redundant insurance requirements can be eliminated, costs can be reduced. This issue requires further investigation.
Combine the IFM programs for herring and mackerel fisheries	• Would reduce complexity (PTNS, deployment, travel) and increase efficiency for service providers; increases number of sea days for amortizing travel/training expenses over the year; • Could increase the total number of work days available for ASM-certified observers/monitors and may reduce staff/overhead costs for service providers • The New England and Mid-Atlantic Councils should consider this further when the goals/objectives for IFM programs in the Atlantic herring and mackerel fisheries are more clearly articulated.

As noted in Table 1, one way to reduce sea day costs is to provide service provider companies with accurate, detailed information about the fishery characteristics to better predict how vessels participating in the industry-funded monitoring program will operate over the course of the upcoming year. This allows providers to more accurately estimate the staff, resources, and overhead that will be needed to meet their contractual requirements. This information also helps service providers predict any travel expenses they may incur, therefore reducing the need to over-estimate these costs to cover expenses that cannot be anticipated ahead of time. Table 2 describes the types of fishery data that can help to better predict how vessels in the fishery will operate over the upcoming fishing year. Ultimately, in order to reduce sea day costs, it will be up to industry participants to provide as much detail as possible about their fishing patterns to the service providers when they negotiate contracts for sea days.

Table 2 Types of Information/Data That Can Improve Predictability of the Fishery

<table>
<tr><td>Number of vessels and trips by gear type, area, and month</td><td rowspan="7">This information helps service providers estimate:
No. of observers are needed for the monitoring program
Number of days per month observers may work
Staff/overhead to deploy observers and maintain communications
Travel expenses and other logistics</td></tr>
<tr><td>Length of vessels, other vessel characteristics</td></tr>
<tr><td>Length of fishing trips</td></tr>
<tr><td>Percentage/proportion of back-to-back trips</td></tr>
<tr><td>Port sailed/port landed; geographical extent of fishing
Proportion of trips with different port sail/land</td></tr>
<tr><td>Total ports sailed from (by month or season)</td></tr>
<tr><td>How many boats will be out fishing at any given time?</td></tr>
<tr><td>Number of hauls per trip (per day)</td><td>This helps to determine minimum number of hours of work per sea day; some service providers may pay their observers differently, depending on the work schedule at sea.</td></tr>
</table>

3.0 ELEMENTS OF HERRING OPTIONS UNDER CONSIDERATION

The following subsections describe the elements of the options under consideration in the IFM amendment to establish industry-funded monitoring (IFM) in the Atlantic herring fishery, including the options for industry-funded observer coverage (Herring OBS) and the options for industry-funded at-sea monitoring (Herring ASM). The primary focus of the discussion in this document is regarding the details of the herring ASM options, which were added to the IFM amendment by the New England Council in January 2015. (The Mid-Atlantic Council added similar options for industry-funded monitoring in the Atlantic mackerel fishery.)

To the extent possible, the herring ASM options were developed based on the current multispecies (groundfish) at-sea monitoring (GF ASM) program for sectors. However, the elements of the herring ASM options have been designed with a more explicit intent of reducing sea day costs (borne by the fishing industry) to the extent possible. For comparison purposes, and for a better understanding of the factors that can increase sea day costs, the elements of the Groundfish ASM program are discussed throughout the following subsections. Since the sea day costs of the GF ASM program are currently better understood and recent estimates of these costs are available, the sea day costs of a herring ASM program can be estimated based on a comparison to the Groundfish ASM program.

In addition to the coverage targets specified within each option (see Draft IFM Amendment), the elements of the options for industry-funded monitoring in the Atlantic herring fishery include the sampling objectives, sampling design, data to be collected, service provider requirements, training and certification requirements, sampling equipment, logistics (trip notification) and related provisions, debriefing, and data management.

Under all of the herring at-sea monitoring options (HER ASM), to reduce sea day costs for vessels that are subject to the industry-funded monitoring requirements, the following provisions would apply:

- Existing service providers approved for observer coverage (NEFOP) and groundfish at-sea monitoring (GF ASM) would be "grandfathered in" as approved service providers for Herring ASM (observers working for these companies would still require certification for Herring ASM – see Section 3.2 for more information). Re-approval of the Herring ASM service providers after Year 1 would be consistent with the process for re-approving Groundfish ASM service providers.
- Cross-certification of observers from NEFOP and GF ASM programs would be allowed to certify observers for Herring ASM (see Section 3.2 for more information). Any training that is completed for a NEFOP and/or GF ASM certification could be applied to a Herring ASM certification during the same year. Training, certification, debriefing, and re-certification would be streamlined and combined with the NEFOP and GF ASM programs to the extent possible.

3.1 SAMPLING OBJECTIVES, SAMPLING DESIGN, DATA COLLECTED

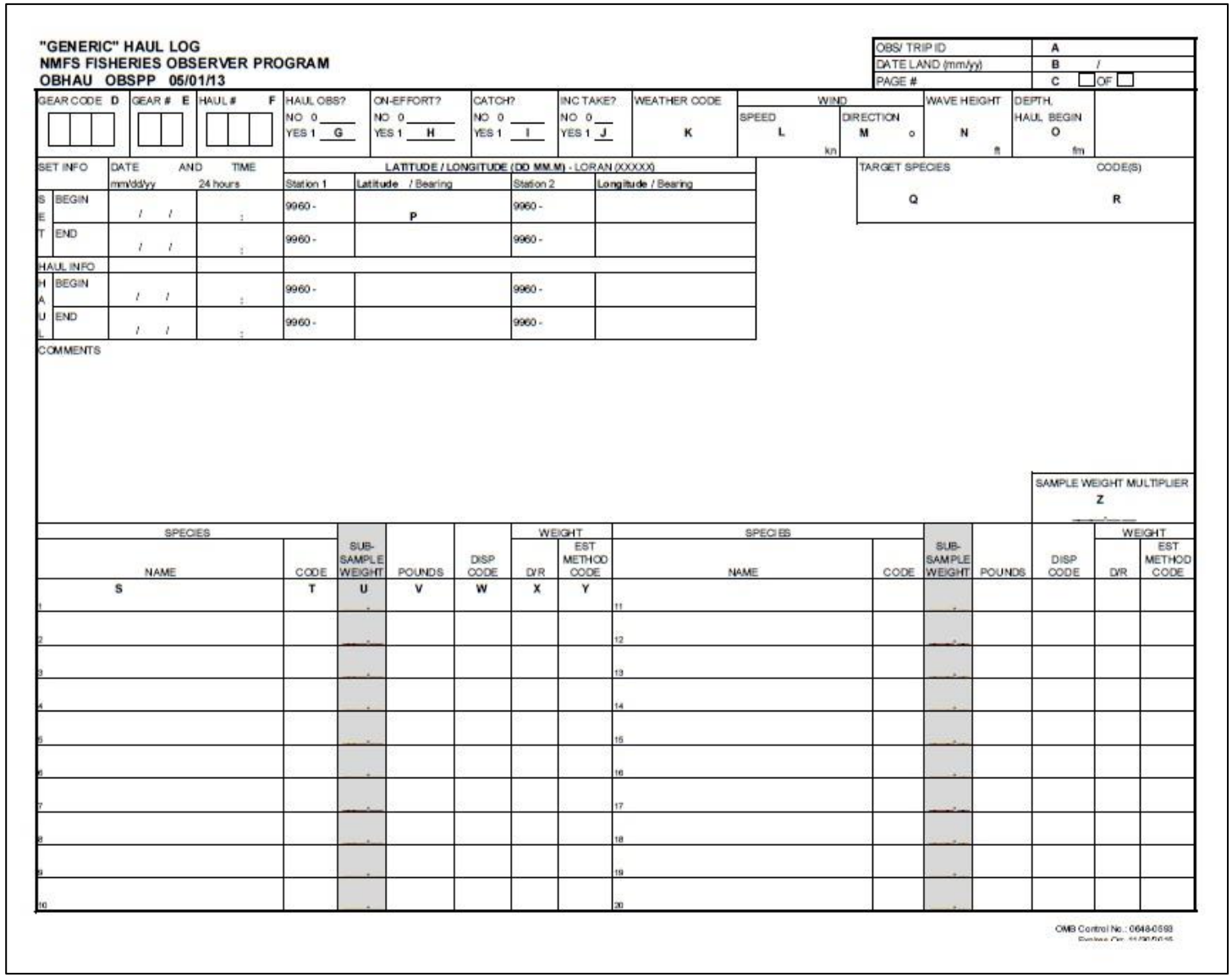
The herring OBS options under consideration in the IFM amendment focus on the collection of comprehensive catch and bycatch data, along with other environmental and economic information, consistent with the NEFOP sampling protocols for high-volume fisheries. The herring ASM options focus on the collection of bycatch data, including documentation of full and partial slippage events,

operational discards, and catch that is discarded after being brought on board the vessel, i.e., any catch that is not kept/landed by the vessel. The intent of focusing the herring ASM options on the collection of bycatch (discard) data only is to reduce some of the training and equipment expenses associated with the monitoring program, thereby reducing sea day costs for the industry. The herring ASM options also represent one component of a comprehensive long-term catch monitoring program for the Atlantic herring fishery, which will also incorporate portside sampling and electronic monitoring (EM).

There would be no new or different data collection requirements under the herring ASM options; rather, the ASM options would require that a subset of the catch data that is currently collected by NEFOP observers on a limited number of herring trips (determined by the SBRM) be collected on more trips,. i.e., trips with an industry-funded at-sea monitor. The sampling protocols for the ASM options would be developed by NEFOP based on information needed to document catch that is not kept/landed by the vessels, including slippage events and operational discards. In order to streamline training and equipment costs, the bycatch data (data elements and sampling protocols) collected by herring at-sea monitors would be consistent with bycatch data collected by groundfish at-sea monitors.

In general, data elements collected under the Herring ASM options would be identified based on existing NEFOP haul logs and the NEFOP discard log that was developed in 2010 specifically for vessels that pump fish. Table 3 represents a generic NEFOP haul log, and Table 4 represents a NEFOP discard log, which was developed by the NEFOP in 2010 specifically to meet the monitoring needs of the herring fishery. The discard log is currently required to be completed by observers on all hauls in which fish are pumped, as well as any significant discard events on vessels that do not pump fish. Under the herring ASM options, the discard log would be required to be completed by at-sea monitors on all observer hauls, regardless of gear type or fishing method. Basing the Herring ASM sampling design on the NEFOP discard log allows data collected by herring at-sea monitors to be compared to observer data since the discard log was created in 2010.

Table 3 NEFOP Generic Haul Log (Example)



"GENERIC" HAUL LOG
NMFS FISHERIES OBSERVER PROGRAM
OBHAU OBSPP 05/01/13

OBS/ TRIP ID	A
DATE LAND (mm/yy)	B /
PAGE #	C ☐ OF ☐

GEAR CODE D	GEAR # E	HAUL # F	HAUL OBS?	ON-EFFORT?	CATCH?	INC TAKE?	WEATHER CODE	WIND SPEED L	WIND DIRECTION M	WAVE HEIGHT N	DEPTH, HAUL BEGIN O
			NO 0 / YES 1 G	NO 0 / YES 1 H	NO 0 / YES 1 I	NO 0 / YES 1 J	K	kn	o	ft	fm

SET INFO	DATE mm/dd/yy	AND TIME 24 hours	LATITUDE / LONGITUDE (DD MM.M) - LORAN (XXXXX) Station 1	Latitude / Bearing	Station 2	Longitude / Bearing
S E T BEGIN	/ /	:	9960 -	P	9960 -	
T END	/ /	:	9960 -		9960 -	
HAUL INFO						
H A U L BEGIN	/ /	:	9960 -		9960 -	
L END	/ /	:	9960 -		9960 -	

TARGET SPECIES Q	CODE(S) R

COMMENTS

SAMPLE WEIGHT MULTIPLIER Z

SPECIES NAME S	CODE T	SUB-SAMPLE WEIGHT U	POUNDS V	DISP CODE W	WEIGHT D/R X	WEIGHT EST METHOD CODE Y	SPECIES NAME	CODE	SUB-SAMPLE WEIGHT	POUNDS	DISP CODE	WEIGHT D/R	WEIGHT EST METHOD CODE
1							11						
2							12						
3							13						
4							14						
5							15						
6							16						
7							17						
8							18						
9							19						
10							20						

OMB Control No.: 0648-0593

Table 4 NEFOP Discard Log (Example)

DISCARD LOG
NMFS FISHERIES OBSERVER PROGRAM
OBPDQ 05/01/13

OBS/ TRIP ID	
DATE LAND (mm/yy)	/
PAGE #	☐ OF ☐

GEAR CODE | **GEAR #** | **HAUL #**

Were there discards for this tow?
__ No (0)
__ Yes (1)
__ Unknown (9)

When the pumping/hauling process was complete were you able to see the contents of the codend/ bunt?
__ No (0)
__ Yes, all contents seen on deck (1)
__ Yes, all/some contents seen in water (2)

Why was the catch discarded on this haul? *(CHECK ALL THAT APPLY)*
☐ Unknown (0) (comment)
☐ Market (1)
☐ Regulations (2)
☐ Quality (4)
☐ Not brought onboard (5)
☐ Other (9) (comment)
☐ Not applicable

Who estimated the weight of the discarded catch?
__ Observer (1)
__ Captain (2)
__ Combination (8)
__ Not applicable

Was any of the catch pumped to another vessel?
__ No (0)
__ Yes (1)
__ Unknown (9)

Was there an observer onboard the other vessel? If yes, provide the Tripid and Haul Number.
__ No (0)
__ Yes (1)
__ Unknown (9)
TRIPID: _____
HAUL #: _____

Check off the discard event. *(CHECK ALL THAT APPLY)*
☐ Unknown (0) (comment)
☐ Operational discards (1)
☐ Tow was partially released (2)
☐ Tow was fully released (3)
☐ Discarded after being brought onboard (4)
☐ Other (9) (comment)
☐ Not applicable

REASONS NOT BROUGHT ONBOARD: Describe any reasons why the catch could not be pumped/hauled onboard.

CATCH COMPOSITION OF DISCARDED CATCH: Describe the catch composition of the discarded catch and how those determinations were made.

CHALLENGES OBSERVING THIS HAUL: Describe any challenges that occurred with observing this haul:

OMB Control No.: 0648-0593
Expires on: 11/30/2015

Different kinds of reporting and/or monitoring can provide different kinds of information with varying levels of verification, as illustrated for the Atlantic herring and mackerel fisheries in Table 5 and Table 6. These tables were developed by the IFM FMAT based on similar tables provided in the 2013 Fisheries Monitoring Roadmap Report (Lowman et al, 2013).

For landings, vessel trip reporting and dealer landings reporting provide dual records of reported landings with the general location coming from the vessel trip report. If specific location of catch is important, VMS, observers, and monitors can provide independent verification of location. Portside sampling can provide independent verification of total landings amounts but no information on location of catch. If small amounts of incidentally-caught species are typically mixed in and retained with the target species, portside sampling may be the best way to estimate/document those landings.

For discards (of targeted or incidental species), vessel trip reporting provides reported discards, but independent verification of discards is often desired. Observers and monitors can provide detailed location-specific discard information, though monitors may or may not collect species composition and may limit their data collection to confirming retention and generally documenting discarding frequency. Cameras (electronic monitoring) can also confirm retention. If retention is confirmed (by whatever means), then portside monitoring can provide full catch verification. Affidavits of discard/slippage events can provide details of why discard/slippage events occur. If retention is not confirmed, then portside sampling can provide independent verification of landings composition but uncertainty regarding discards will persist (assuming observer coverage is not complete).

Biological information (age/length data) must generally be collected by observers/monitors at sea or dockside samplers/port agents on land.

Depending on the level of detail desired for tracking landings and/or discards, some combination of the above monitoring and reporting requirements should address Council needs (the costs of the various requirements are described in Section 4.0 of this document). If independent verifications of both landings and discards are desired, then having either a high level of observer/monitor coverage that subsamples catch or verification of retention (by monitors or cameras) coupled with portside sampling should address that objective.

Table 5 Monitoring Approaches for the Atlantic Herring Fishery Based on Data Needs

		Self-Reporting			Independent monitoring					
Data Need		Vessel	Dealer	Affidavits	VMS	NEFOP Observers	Cameras	Portside	At-sea monitors	At-sea monitors
									With sampling for species comp	w/o sampling for species comp
Total herring catch accounting [ACL monitoring]	Verifying retained	Vessels report by species	Dealer reports by species		Can verify location fishing activity	Verifying location of fishing activity	Not quantifying, but confirming retention	Not useful for vessels fishing in more than one area	Verifying location of fishing activity	Not quantifying, but confirming retention
	Quantifying discards	Vessels report by species			Can verify location fishing activity	Species composition data Estimates amount of discards	Not quantifying, but confirming retention		Species composition data	Not quantifying, but confirming retention
Non-target catch accounting	Haddock catch cap monitoring [ACL monitoring]	Used for total retained		Can help with details of why slippage occurs	Can verify location fishing activity	Species composition data Estimates amount of discards	Not quantifying, but confirming retention	Not useful for vessels fishing in more than one area	Species comp and estimates of discarded catch	Not quantifying, but confirming retention
	River herring and shad catch cap monitoring	Used for total retained		Can help with details of why slippage occurs	Can verify location fishing activity	Species composition data Estimates amount of discards	Not quantifying, but confirming retention	Not useful for vessels fishing in more than one area	Species comp and estimates of discarded catch	Not quantifying, but confirming retention
Scientific information	Stock assessments for herring	VTR only				Collect age, length data		Collect age, length data	Collect age, length data for discards only	
	Stock assessments for non-target species	VTR only				Collect age, length data		Collect age, length data	Collect age, length data for discards only	
	Spawning information					Collect age, length data		Collect age, length data	Collect age, length data for discards only	

Table 6 Monitoring Approaches for the Atlantic Mackerel Fishery Based on Data Needs

		Self-Reporting			Independent monitoring					
Data Need		**Vessel**	**Dealer**	**Affidavits**	**VMS**	**NEFOP Observers**	**Cameras**	**Portside**	**At-sea monitors**	**At-sea monitors**
									With sampling for species comp	Without sampling for species comp
Total mackerel catch accounting [ACL monitoring]	Verifying retained	Vessels report by species	Dealer reports by species		Can verify location fishing activity	Verifying location of fishing activity	Not quantifying, but confirming retention	Not useful for vessels fishing in more than one area	Verifying location of fishing activity	Not quantifying, but confirming retention
	Quantifying discards	Vessels report by species			Can verify location fishing activity	Species comp data Estimates amount of discards	Not quantifying, but confirming retention		Species comp data	Not quantifying, but confirming retention
Non-target catch accounting	River herring and shad catch cap monitoring	Used for total retained		Can help with details of why slippage occurs	Can verify location fishing activity	Species comp data Estimates amount of discards	Not quantifying, but confirming retention	Not useful for vessels fishing in more than one area	Species comp and estimates of discarded catch	Not quantifying, but confirming retention
Scientific information	Stock assessments for mackerel	VTR only				Collect age, length data		Collect age, length data	Collect age, length data for discards only	
	Stock assessments for non-target species	VTR only				Collect age, length data		Collect age, length data	Collect age, length data for discards only	

Table 7 summarizes the sampling objectives, the primary elements of the sampling design, and the data to be collected under the options for industry-funded monitoring in the Atlantic herring fishery (herring OBS and herring ASM options – see description of options in the Draft IFM Amendment); the elements of the current groundfish ASM program are also provided in the table for comparison purposes. Under all of the options, the details of the sampling protocols and logs to be completed would be determined by NEFOP upon implementation of the IFM amendment.

Table 7 Herring IFM Options: Sampling Objectives, Sampling Design, Data Collected

	Industry-Funded Observer Coverage Options (OBS)	***NE GROUNDFISH ASM PROGRAM***	**Industry-Funded Herring ASM Options (Herring ASM)**
Sampling Objectives	SBRM, MMPA, MSA, ESA Stock Assessment, Discard Estimation	MSA Catch monitoring; discard estimation	*Bycatch documentation* - catch that is not kept/landed on Herring Category A/B herring vessels, including full and partial slippage events and operational discards; also including catch that may be brought aboard, sorted, and then discarded *Elements of data collection based on GF ASM; Herring ASM program is intended to complement portside sampling/EM for comprehensive catch monitoring program (landings + discards)*
Sampling Design	Comprehensive catch and bycatch data collection program; protected species documentation; biological sampling; environmental parameters; economic information	Catch monitoring to ensure that ACLs are not exceeded; data on catch composition to estimate total discards by sectors and common pool vessels, by gear type and stock area	Sampling protocols based on NEFOP Haul Log ("modified" - discards); Discard Log; Documentation of bycatch (discards); Protected species interactions; *(in addition to pre-trip safety checklist and other logs/reports as determined by NEFOP)*
Data Collected	Comprehensive catch/bycatch catch/bycatch; biological samples; protected species; fishery information; environmental parameters	Catch/Bycatch	Catch not brought on board the vessel for any reason; Slippage events; Operational discards; Discards brought on board *No subsampling for kept catch estimation*

**The elements of the Groundfish ASM program are provided in the table above for comparison purposes.*

3.2 SERVICE PROVIDER REQUIREMENTS

Under the herring OBS options, the requirements for approving service providers and certifying observers for observer coverage (HER OBS) are proposed to be consistent with those implemented recently through the SBRM amendment (CFR 648.11(h)). Under the herring ASM options, the requirements for approving service providers and certifying observers for the herring at-sea monitoring program (HER ASM) are proposed to be consistent with those for the groundfish sector ASM program, implemented through Amendment 16 to the Multispecies FMP (CFR 648.47(b)(4) and (b)(5)). This approach is consistent with the January 2015 Council motion regarding the addition of the Herring ASM options.

Appendix I of this document provides a detailed comparison of the service provider regulatory requirements for approval/certification under the herring observer coverage options (HER OBS) and the herring at-sea monitoring options (HER ASM). As previously noted, the HER ASM service provider requirements are based on the current requirements for the groundfish ASM program. The major elements of the options as well as the differences between the herring OBS options and herring ASM options are discussed below.

Under the Herring OBS Options:

- Service provider requirements for industry-funded observer coverage would be consistent with those recently implemented through the SBRM amendment (CFR 648.11(h), Table 8, see details in Appendix I).
- Certified observers would be required to qualify/receive and additional NEFOP high-volume certification to work on herring OBS trips. MRAG Americas is currently the only service provider with high-volume certified observers because this is the company that has the existing (five-year) contract with NMFS for observer coverage under the SBRM amendment. Under the herring OBS options, additional service provider companies would need to apply and be approved by NMFS for observer coverage and train/certify their observers through NEFOP for observer coverage in high-volume fisheries.

Under the Herring ASM Options:

- Service provider requirements for industry-funded herring at-sea monitoring would be consistent with those for the multispecies (groundfish) sector at-sea monitoring program, implemented in Amendment 16 to the Northeast Multispecies FMP (CFR 648.47(b)(4) and (b)(5), Table 8, see details in Appendix I).
- Existing service providers approved for observer coverage and the groundfish ASM program would be "grandfathered in," i.e., automatically approved for the herring ASM program, when the omnibus IFM amendment becomes effective. This increases negotiating opportunities for participants in the fishery by providing competition between companies at the onset of the industry-funded monitoring program (versus having only one service provider available at the program onset).

- Observers working for HER ASM-approved service providers would be required to obtain a Herring ASM certification before being deployed for at-sea monitoring trips on herring vessels. Re-approval of the herring ASM service providers after Year 1 would be consistent with the process for re-approving groundfish ASM service providers.
- Cross-certification for existing providers/observers across multiple monitoring programs would be allowed and encouraged to minimize additional training for a HER ASM certification. Observers employed by the service provider companies that are approved for NEFOP observer coverage and/or groundfish ASM could apply their training for these certifications to a herring ASM certification during the same year. An abbreviated herring ASM training program would be developed to certify new (HER ASM only) observers who are not already certified/certifying for observer coverage or groundfish ASM. This is discussed more in Section 3.3 of this document.
- Provisions for re-certification of herring ASM observers would be consistent with those for Groundfish ASM, but the time needed for re-certification would likely be shorter (see Section 3.3).

The primary differences between the service provider requirements proposed under the HER OBS options and the HER ASM options is that there is no requirement for observers to have a college degree for HER ASM, and there is no prohibition on deploying observers on back-to-back multi-day trips or multiple multi-day trips on the same vessel in the same month (Table 8). Eliminating the college degree requirement and prohibition on multiple trips should reduce sea day costs by increasing the potential pool of observers for-hire and reducing logistics and travel expenses associated with deploying observers on multiple fishing trips. However, concerns about observer retention and data quality have been expressed regarding the elimination of the college degree requirement; these concerns should be considered carefully under the HER ASM options.

Another difference between the options is that the regulations regarding service provider approval and responsibilities under the herring ASM options do not include requirements for service providers to meet SCA/FLSA and Department of Labor (DOL) wage/overtime standards. While it is expected that service provider companies will continue to adhere to DOL and other applicable Federal labor laws, the proposed regulations for the HER ASM options would not further address these requirements, which is also consistent with the current service provider requirements for the Groundfish ASM program. As previously discussed (see Sections 2.1 and 2.2), there is likely to be a sea day cost savings by eliminating these requirements.

Table 8 Herring IFM Options: Service Provider Requirements

	Industry-Funded Observer Coverage Options (HER OBS)	*NE GROUNDFISH ASM PROGRAM*	Industry-Funded Herring ASM Options (HER ASM)
Service Provider Requirements	***Implemented through SBRM Amendment***	***Implemented through Am 16 Multispecies FMP***	***Same as Groundfish ASM Program***
	CFR 648.11(h) Observer Service Provider Approval/Responsibilities	CFR 648.47(b)(4) and (b)(5)	*No requirement for providers to meet SCA/FLSA/DOL wage/overtime standards*
	Bachelor's Degree required	High School Diploma or equivalency	*High School Diploma or equivalency*
		No prohibition on observer deployment on back-to-back trips or multiple multi-day trips	*No prohibition on observer deployment on back-to-back trips or multiple multi-day trips*
Current NMFS-Approved Providers	MRAG Americas	MRAG Americas East West Technical Services AIS, Inc. ACD USA Ltd.* Fathom Research, LLC*	MRAG Americas East West Technical Services AIS, Inc. ACD USA Ltd.* Fathom Research, LLC*

**Service provider companies with an asterisk by their names have been approved for Groundfish ASM but are not currently providing sea day coverage.*

The elements of the Groundfish ASM program are provided in the table above for comparison purposes.

3.3 OBSERVER TRAINING, CERTIFICATION, AND SAMPLING EQUIPMENT

General provisions related to observer training, certification, and sampling equipment under the herring OBS and ASM options are summarized in Table 9 and Table 10. Training and certification of industry-funded observers under the HER OBS and HER ASM options would be administered/managed through NEFOP, consistent with training and certification for the groundfish ASM program (GF ASM). Approved service providers for would be responsible for covering the costs associated with providing their employees with a daily stipend, meals, hotel/lodging, and covering other related expenses associated with attending training/certification courses at NEFOP (Falmouth, MA). This can include lodging, meals, and a daily stipend over weekends if training courses more than one week.

Cross-certification of observers and carryover of overlapping training/equipment from NEFOP and GF ASM programs would be allowed to certify observers under the herring ASM options. Any training courses that are completed for a NEFOP observer coverage certification and/or GF ASM certification could be applied to a herring ASM certification during the same year. Training, certification, debriefing, and re-certification would be streamlined (ex., provided remotely) and combined with the NEFOP and GF ASM programs to the extent possible. Because the herring ASM program focuses only on the collection of discard data on Category A/B herring vessels, training requirements and equipment needs for a HER ASM only certification (observers not certified for other programs) would be less than those for the industry-funded observer coverage (OBS options) or the GF ASM program. Therefore, the costs paid by service providers to certify observers for the HER ASM program are expected to be less than those for observer coverage (OBS options) and the GF ASM program, which is likely to reduce the sea day costs for the HER ASM options. Any newly-approved service providers that do not have observers currently certified for either NEFOP observer coverage or GF ASM would incur the largest training/certification/equipment costs under the HER ASM options.

Under the Herring OBS Options:

- Observers (employed by approved service providers) would need to attend 15 training days to obtain a NEFOP certification for observer coverage (Table 9). Newly certified observers would be required to work four training trips, including one trip with a veteran observer. Additional experience (sea days) is necessary prior to qualifying for a high-volume certification, which would then require one additional training day.
- Current GF ASM-certified observers could obtain a NEFOP certification for observer coverage under the Herring OBS options with additional training days and a high-volume certification.

Under the Herring ASM Options:

- Any training that is completed for a NEFOP observer coverage and/or GF ASM certification by observers working for approved service providers could be applied to a HER ASM certification during the same year. Observers already certified for NEFOP and/or GF ASM would not require training trips with a veteran observer to certify for HER ASM. This should significantly reduce costs for existing service providers that may want to "dual certify" their observers for multiple monitoring programs, including herring ASM. Many costs associated with training/certifying observers under the herring ASM options would be incurred only by service provider companies that are certifying their observers for HER ASM only.
- Current NEFOP-certified observers with high-volume certification would not require additional training days to certify for HER ASM, but would likely require some overview/instruction regarding the protocols for HER ASM trips (possibly conducted remotely/online).
- Current groundfish ASM-certified observer would likely require 1-2 additional training days to learn more about herring fishing operations (midwater trawl, purse seine, and small mesh bottom trawl gear) and sampling protocols in high-volume fisheries. Based on cost information provided by service provider companies (*see below), the cost of certifying GF ASM observers for HER ASM would be about $320-$640 (1-2 training days), or about 10-20% of the cost of certifying observers for the GF ASM program (11 training days).
- New observers certifying for HER ASM-only (employed by approved service providers) would likely require 4-5 training days, which includes two days of safety training plus 2-3 days or training for the HER ASM program (herring fishing operations, sampling protocols, data entry, species identification). To obtain a HER ASM certification, new observers would be required to work four training trips, including one trip with a veteran observer. Based on the cost information provided by service provider companies (*see below), the cost of certifying new observers for HER ASM only would be about $1,500-$2,000 per observer (4-5 training days), or about 50% of the cost of certifying observers for the GF ASM program (11 training days).
- Annual recertification would be required for the HER ASM program, but the recertification process could likely be reduced to one day. The GF ASM program recertification currently lasts three days. The costs to service providers for recertifying observers under the herring ASM options, therefore, is expected to be 1/3 of the cost for recertifying observers for Groundfish ASM. To the extent possible, the recertification courses for these programs would be combined and/or provided remotely.

**The cost for training/certifying one observer for the Groundfish ASM program is estimated by service providers to be $3,000-$4,000 (personal communication). This includes travel, meals, lodging, and a daily stipend for 11 training days at the NEFOP training center in Falmouth, MA. This results in an average estimate of about $320 per training day per observer.*

Under the herring ASM options, expenses for sampling equipment would be shared between the Federal government and the service providers in a manner that is similar to the current groundfish ASM program. Because of the focus on bycatch/discards only, less sampling equipment would likely be needed for the herring ASM options versus the herring OBS options (Table 10). Personal safety equipment (immersion suit, inflatable vest, etc.) would continue to be paid for by the service providers; existing observers certified observer coverage and the GF ASM program already possess personal safety equipment and would not need to purchase it again to certify for HER ASM. Other personal issue and off-the-shelf gear such as small scales, gloves, bags, measuring tapes, knives, clipboards, etc. would be covered by the service provider. Additional costs for this equipment would be incurred primarily by newly-approved service providers that do not have observers currently certified for either NEFOP observer coverage or GF ASM. Special prints, special electronics, and not-off-the-shelf gear would continue to be funded by the Federal government, although the availability of future funding is unknown. This includes manuals, field guides, tablets, logs, laptops, and other electronics. The costs of any sampling equipment not provided by the Federal government must be covered by the service providers and is therefore transferred to the industry in the sea day cost.

Overall, because of the need for less sampling equipment and the ability for current NEFOP and GF ASM observers to utilize existing equipment for a herring ASM program, the equipment costs associated with the herring ASM options are expected to be less than those for the herring OBS options. The equipment costs for the herring ASM options will also be lower for service providers with observers who are already certified for groundfish ASM.*

**Information provided by NMFS indicates that the estimated sea day cost incurred by the service provider for equipment in the Groundfish ASM program is $17.50 per observer (based on the observer working 150 sea days in a year).*

Table 9 Herring IFM Options: Observer Training and Certification

	Industry-Funded Observer Coverage Options (OBS)	*NE GROUNDFISH ASM PROGRAM*	Industry-Funded Herring ASM Options (Herring ASM)
Training and Certification	15 days (3 working weeks) comprehensive training, plus high-volume certification for qualified observers (one extra day); **Current Groundfish ASM-certified Observers** - can certify for OBS with additional training days and high-volume certificaiton	11 days (covers multiple gear types - gillnet, longline, otter trawl, handline - catch estimation procedures, protected species)	**NEFOP-Certified Observers with Current High-Volume Certification** - no extra training days, but possibly some instruction on protocols for ASM trips; **GF ASM-Certified Observers** - 1-2 training days for herring/high-volume; **New HER ASM Observers** - 4-5 training days for HER ASM only certification (2 days safety, plus herring/high-volume training); *Providers pay for travel/lodging, and daily pay to observers for attending training;* *Est. provider cost for Gfish ASM training (11 days) - $3000-$4000 per observer ($325/day)*
Training Courses			
Certification/Shadow Trips	Yes, 4 trips incl. 1 with trainer	Yes, 4 trips incl. 1 with trainer	Not required for existing NEFOP and GF ASM-certified observers (already certified); New HER ASM only observers - one shadow trip with trainer; first four trips would be training trips
Re-certification	No	Yes, Annual	Yes, annual - one day (Gfish ASM - 3 days; cost reduced by 2/3)
Safety Refresher (two days)	Yes, every 18 months	Yes, every 18 months	Yes; cross-certify; additional cost only for HER ASM-only observers
CPR/First Aid Certification	Annual	Annual	Annual; cross-certify; additional cost only for HER ASM-only observers

Table 10 Herring IFM Options: Observer Equipment

	Industry-Funded Observer Coverage Options (Herring OBS)	*NE GROUNDFISH ASM PROGRAM*	Industry-Funded Herring ASM Options (Herring ASM)
Equipment	Comprehensive - 83 items	Limited - 44 items	Limited - Similar to Groundfish ASM; any equipment necessary for discard sampling/documentation
Personal Safety Equipment- Immersion suit, PLB, Inflattable Vest	Yes	Yes, covered by provider	Yes, covered by provider; Equipment for NEFOP and GFASM can be used; Additional cost only for HER ASM-only observers
Personal Issue and Off-the-Shelf Gear	*(baskets, small scales, gloves, bags, measuring tapes, disposable cameras, knives, clipboards)*	Yes, covered by provider	Yes, covered by provider; Est. total cost for new observer ($2,600 amortized for life of equipment); Est. sea day cost (service provider) per observer (150 days) - $17.50
Special Prints, Electronics, Not Off-the-Shelf Gear	*(manuals, guides, Marel scales, tablets, logs, electronics)*	Yes, covered by NMFS	Yes, covered by NMFS; *future funding unknown*

The elements of the Groundfish ASM program are provided in the tables above for comparison purposes.

3.4 PRE-TRIP NOTIFICATION, DEBRIEFING, AND DATA MANAGEMENT

Provisions related to vessel selection (through pre-trip call-in/notification), debriefing, and data management for the herring OBS and ASM options are summarized in Table 11. Under all of the herring OBS and ASM options, vessel selection/notification for industry-funded coverage would occur through the existing pre-trip call-in system for Atlantic herring vessels (Amendment 5). The Atlantic herring notification process differs from the Groundfish Pre-Trip Notification System.

The existing notification system for observer deployment on Atlantic herring vessels requires all limited access herring vessels (as well as Category D vessels fishing with midwater trawl gear in Areas 1A, 1B, and/or 3) and all Atlantic herring carrier vessels to notify NMFS/NEFOP at least 48 or 72 hours (depending on permit category) prior to the beginning of any trip where the vessel may harvest, possess, or land Atlantic herring. Vessels/representatives must provide information including the vessel name, permit number/permit category, contact person name and contact phone number, date sail, time sail, port of departure, gear type, and area intending to fish (i.e., herring management area, closed area, etc., consistent with regulatory requirements), as well as target species (target species is helpful to identify directed herring versus directed mackerel trips). Notification is through a telephone number. Vessels can provide pre-trip notification for multiple trips at one time. If a trip is cancelled, a vessel representative must notify NMFS of the cancelled trip, even if the vessel is not selected to carry an observer. All waivers or observer selection notices for observer coverage are issued to the vessel by VMS so as to have on-board verification of the waiver or selection.

The existing pre-trip notification system (PTNS) for observer deployment on groundfish and longfin vessels requires all vessels fishing on PTNS-eligible groundfish trips or PTNS-eligible longfin trips to notify NMFS/NEFOP at least 48 hours prior to the beginning of any trip. Groundfish sector vessels with category A, C, D, E, F, and HA multispecies permits must notify for all multispecies trips. Common pool vessels with categories A, D, E, and F permits, as well as those fishing monkfish or multispecies using A DAS must notify for their groundfish trips. Vessels with a longfin/butterfish moratorium (SMB 1) permit must notify for all trips on which they plan on landing greater than 2500 pounds of longfin squid. Vessels/representatives must provide information including the vessel name, permit number, contact person name and contact phone number, date sail, time sail, port of departure, estimated length of trip, gear type, and area intending to fish. There are several methods available for the pre-trip notification: internet, email, and telephone. Vessels can provide pre-trip notification for multiple trips at one time and may enter their own trips directly into the PTNS without contacting FSB staff. Trips are entered into the PTNS and go through a programmed algorithm to determine which trips get selected for observer coverage. Trips are cancelled by FSB staff based on automated sail reports. All waivers or observer selection notices for observer coverage are issued to the vessel via VMS so as to have on-board verification of the waiver or selection. The PTNS system in all its complexity requires a full time contractor to oversee the system on a daily basis. The NEFOP also contracts with an afterhours phone service to provide access 24 hours a day, 7 days a week to allow for notifications or troubleshooting.

Under the Herring OBS and ASM Options, vessels would be notified via VMS if they are selected for industry-funded coverage. The 100% coverage target options simplify vessel selection, as all vessels that are not selected for observer coverage under the SBRM provisions would be required to obtain an industry-funded observer employed by one of the service providers approved for the monitoring program.

Debriefing is an important component of any monitoring program, as it helps to resolve data issues expeditiously and ultimately enhances data quality. It also provides an opportunity to review observer performance and address any problems with data collection and data entry. Provisions for debriefing under the Herring ASM options would be consistent with those for the Groundfish ASM program. To the extent possible, debriefing will be streamlined (for example, conducted remotely) to reduce travel and other related costs. The most successful debriefings are conducted soon after the vessel lands and after the preliminary data are uploaded to the NEFOP program. Preliminary data can be reviewed by staff and follow-up questions answered in a timely manner. Information is then edited near real-time and is therefore more accurate. Sampling in the high volume fisheries can be challenging and direct communication with observers after trips land is key to understanding the data, especially slippage information.

Responsibilities and provisions for **data management** under the Herring ASM options would be the same as those for observer data and data collected for Groundfish ASM. The NEFOP would manage the data. A summary of preliminary data would be uploaded electronically, by observers and reviewed by the NEFOP staff. Once verified the data are available for use by GARFO and other end users. Data are stored in master tables in the Observer database, and fully audited data are available 90 days after date landed.

Table 11 Herring IFM Options: Logistics (Notification), Debriefing, and Data Management

	Industry-Funded Observer Coverage Options (HER OBS)	*NE GROUNDFISH ASM PROGRAM*	Industry-Funded Herring ASM Options (HER ASM)
Logistics and Related Provisions	PTNS	Gfish PTNS	Build into existing pre-trip notification system for Herring A/B vessels (different from GFish) *No need to develop strategy for vessel selection under 100% coverage options (or possibly 50%)*
Debriefing	Yes	Yes	Yes; Pre-trip and post-trip briefing important for discard logs; *Streamline/combine debriefing to the extent possible*
Data Management	NEFSC/NEFOP	NEFSC/NEFOP	Data submitted to NEFOP for use by all users (NEFSC, GARFO, NEFMC) under a separate program code
	Upload OB PRELIM record 48 hours from landing	Upload OB PRELIM record 48 hours from landing	OBPRELIM upload - a) Delivery of paper log data shall be received within 5 calendar days (120 hours) of the vessel landing (b) Delivery of electronic data shall be received within 2 calendar days (48 hours) of the vessel landing
	Paper logs due 5-7 business days	Paper logs due 5-7 business days	Paper logs due 5-7 business days

**The elements of the Groundfish ASM program are provided in the table above for comparison purposes.*

3.5 SUMMARY: COMPARISON OF HERRING OBS AND ASM OPTIONS

Table 12 provides a qualitative comparison of some of the pros/cons associated with the options under consideration in the IFM amendment to establish industry-funded monitoring in the Atlantic herring fishery.

Table 12 Qualitative Comparison of Options for Industry-Funded Monitoring in the Atlantic Herring Fishery (Herring OBS Options vs. Herring ASM Options)

	Pros	**Cons**
Observer Coverage Options (HER OBS)	Comprehensive catch sampling (kept and discarded)	Higher sea day cost
	Biological samples collected	Limited ability to reduce industry/sea day costs
	More applications/uses for data (stock assessment, catch monitoring, etc.)	Industry-funded observer data not collected consistently with SBRM strata (gear type, area) not utilized for bycatch estimation and stock assessment
		Limited to only one service provider at onset of industry-fund program; higher costs for other providers to certify observers
	Pros	**Cons**
At-Sea Monitoring Options (HER ASM)	Reduces sea day costs for industry	Discard data only; more limited applications of data
	Builds on existing discard data collected by observers (provides basis for comparison to observer data)	Loss of opportunity to collect other important data while paying for an observer
	Focuses on at-sea component of comprehensive long-term catch monitoring program that will likely include portside sampling and EM	
	Multiple service providers available at onset of industry-funded program; increases flexibility and negotiating ability for industry; competition reduces costs	
	Discard data collected by at-sea monitors can help to inform decisions about maximized retention provisions for the portside sampling/EM components of the IFM program	

4.0 ESTIMATED SEA DAY COSTS FOR THE HERRING ASM OPTIONS

For the purposes of the omnibus IFM Amendment, an estimate of the sea day cost that may be expected under the Herring ASM options will be developed by the IFM FMAT based on estimates of sea day costs for NEFOP observer coverage (currently estimated at $806 in the Draft IFM Amendment) and the Groundfish ASM program. This sea day cost can be used in the economic analysis for a comparison of the impacts of the Herring ASM options to the Herring OBS options.

Intentionally Blank

Omnibus Industry-Funded Monitoring (IFM) Amendment

Amendment 7 to the Atlantic Herring FMP

DRAFT APPENDIX I:
SERVICE PROVIDER REQUIREMENTS

Proposed Regulations for Herring Industry-Funded Observer Coverage (OBS) and Herring Industry-Funded At-Sea Monitoring (ASM)

Regulations for Service Provider Approval

	Industry-Funded Observer Coverage (OBS) Options Service Provider Requirements *Consistent with SBRM Amendment*	**Proposed Atlantic Herring At-Sea Monitoring (ASM) Service Provider Requirements** *Consistent with NE Groundfish ASM Requirements*
At-Sea Sampler/Observer Coverage (CFR 648.11) **CFR 648.11(h) Observer Service Provider Approval/Responsibilities**		**Independent Third-Party Monitoring Provider Standards** **CFR 648.47(b)(4) and (b)(5)**
3. Contents of Application	*Corporate structure, contact information, confict-of-interest and other statements*	*Same requirements (b)(4)*
	Summary of prior experience, monitoring services provided	*Same requirements (b)(4)*
	Proof of Insurance - Workers Compensation and Maritime Employer's Liability Insurance $5M min)	*Addressed in i(G) Evidence of adequate insurance to cover in jury, liability, and accidental death*
	Proof that salaries meet/exceed DOL Guidelines, compensation for FLSA non-exempt employees, information about benefits and personnel services provided	*Addressed in (b)(4)(i)(H) Proof of benefits and personnel services, but no reference to DOL Guidelines or FLSA requirements*
	Names of NMFS-certified observers and trainees	*Addressed in (b)(4)(i)(I) Proof that monitors have passed adequate training course to the extent not funded by NMFS, consistent with NEFOP*
	Emergency Action Plan	*(b)(4)(i)(J) Same*
		(b)(4)(i)(K) Evidence that the company is in good financial standing

Regulations for Service Provider Responsibilities

	Industry-Funded Observer Coverage (OBS) Options Service Provider Requirements *Consistent with SBRM Amendment*	Proposed Atlantic Herring At-Sea Monitoring (ASM) Service Provider Requirements *Consistent with NE Groundfish ASM Requirements*
At-Sea Sampler/Observer Coverage (CFR 648.11) **CFR 648.11(h) Observer Service Provider Approval/Responsibilities**		**Independent Third-Party Monitoring Provider Standards** **CFR 648.47(b)(4) and (b)(5)**
5. Responsibilities of Observer Service Providers	*Provide observers with transportation to initial location of deployment, subsequent vessel assignments, and debriefing locations*	*(b)(4)(ii)(A) Must establish and carry out a comprehensive plan to deploy NMFS-certified at-sea monitors, or other at-sea monitoring mechanism (ex., NMFS-approved EM equipment) to meet specified coverage levels;* *(b)(4)(ii)(A)(1)-(A)(6) include specific requirements for groundfish sector monitoring*
	Lodging, per diem, and any other services for observers to attend training classes	
	Required observer equipment prior to training or deployment	*Addressed in (b)(4)(ii)(J); and* *(b)(5)(i) - providers are responsible for cost of gear to the extent not funded by NMFS*
	Individually-assigned communication equipment (cell phones, other devices)	
iii. Logistics	*Must be able to deploy observers based on comprehensive plan (24/7) with phone system to secure coverage, must access all ports, report deployments to NMFS, fair/equitable assignment of observers*	*Addressed in (b)(4)(ii)(A)*
iv. Limitations	*Review/edit/approve data from first four deployments by candidate observer before certifying*	
	Observers cannot be deployed on the same vessel for more than two consecutive multi-day trips; observers cannot be deployed on the same vessel more than twice in any given month for multi-day deployments	*Not addressed in Groundfish ASM Provider Requirements*
v. Communications with Observers	*Must have employee on call 24/7 to handle issues*	
vi. Observer Training Requirements	*Must submit information about trainees at least 7 days prior to training*	
vii. Reports	*Observer deployment reports w/in 24 hours; reports back in OBSCON data w/in 24 hours of landing; raw data w/in four days of landing*	
	Safety refusals within 24 hours; Return biological samples within 7 days; Debriefing availability for up to 2 weeks following trip; Observer availbaility report to NMFS by 5 p.m.; other reports (harassment, discrimination, injury, etc.) within 24 hours of event	*(b)(4)(ii)(B) Monitors must remain available to NMFS for debriefing at least two weeks following trip; (b)(4)(ii)(C) similar requirements for other reports in this section*
	Requirements for observer status reports, vessel contracts, observer contracts and additional information that may be distributed to vessels	*(b)(4)(ii)(D) contracts and (b)(4)(ii)(E) other paperwork distributed to vessels*
viii. Refusal to Deploy Observer	*If provider does not have observer available within 48 hours of request; if the vessel is determined unsafe; other reasons including failure to pay for previous deployments (if authorized in writing by NMFS)*	*(b)(4)(ii)(F); also includes refusal for inadequate notice for departure or landing*
6. Limitations on Conflict of Interest	*No direct/indirect interest in fishery/vessels/dealers/research/advocacy; must assign observers without preference; must not soliciy or accept gifts, favors, loans, etc.*	*Addressed in (b)(4)(ii)(G)*
7. Removal of Service Provider	*Process for removal if provider does not meet requirements/conditions of service, conflict of interest, criminal convictions, embezzlement, theft, etc., crimes of dishonesty, unsatisfactory performance ratings on Federal contracts, evidence of de-certification*	*(b)(4)(ii)(I) A means to protect the confidentiality and privacy of data submitted by vessels, as required under the MSA*

Regulations for Observer Certification

	Industry-Funded Observer Coverage (OBS) Options **Service Provider Requirements** *Consistent with SBRM Amendment*	**Proposed Atlantic Herring At-Sea Monitoring (ASM)** **Service Provider Requirements** *Consistent with NE Groundfish ASM Requirements*
648.11(i) Observer Certification		**Independent Third-Party Monitoring Provider Standards**
(1) Eligibility Standards	*Observers must meet NMFS National Minimum Eligibility Standards (National Observer Program), Provided Below*	**CFR 648.47(b)(4) and (b)(5)**
Education/Experience	*Unless waived by the RA, must possess Bachelor's Degree with a major in one of the sciences; must have had at least one undergad course on math/stats; must have experience with data entry on computers; these requirements can be waived by RA or NEFSC Directors if skills have been acquired through alternative training program (observing fishing activities, research cruises, marine mammal data recording, collecting biological samples, entering data, completing NMFS biological training program*	*(b)(4)(iii)(A) High school diploma or legal equivalent*
Training Requirement	*Must pass tests 80% or greater for program; must complete acknowledgement of risk*	*(b)(4)(iii)(B) Successful completion of NMFS-required training and briefings before deployment*
Conflict of Interest	*No direct financial interest, ownership, etc. in catching, taking, harvesting, processing fish; may not solicit or accept gifts; may not observe on vessels previously employed in another capacity; must not work for other vessels/processors while hired as observer*	*Addressed in (b)(4)(ii)(G)*
Physical/Mental Confition	*Documentation of physician certification within 12 months of completing training*	*Addressed in (b)(4)(iii)(C)*
Communication Skills	*Must be able to communicate verbally and written in English*	
Citizenship/Ability to Work Legally in US	*Must be a U.S. citizen, non-citizen with green card, TN authorization, H1 visa, or valid work visa, and social security card*	
(2) Observer Training	*Must pass NMFS/NEFOP course(s); one training trip with another observer; data from first four trips reviewed/approved for certification*	*Addresssed in (b)(4)(iii)(B)*
(3) Observer Requirements	*Must be NMFS/NEFOP certified; completed all required training and briefings for observers*	
	Physically and mentally capable fo carrying out responsibilities	
	Red Cross/CPR certification	*Addressed in (b)(4)(iii)(D)*
	Must accurately record sampling data, write complete reports, report observations accurately	
(4) and (5) Probation/Decertification	*Process for NMFS to review certifications and written issuance of de-certification*	
	Automatic background check when observers are issued a "CAC" card	*(b)(4)(iii)(E) Absence of fisheries-related convictions, based upon a thorough background check*
		(b)(4)(iii)(F) Independence from fishing-related parties
		(b)(5)(ii) includes requirements for groundfish vessel selection protocols

Appendix 6 – Monitoring Cost Estimates for the Industry-Funded Monitoring Omnibus Amendment

NMFS Costs for NEFOP-level observers, at-sea monitors and dockside monitors. Based on fiscal year 2013 expenses, Table 1 shows the level of costs required to support the deployment of all Northeast Region at-sea monitoring programs, including NEFOP observers, and groundfish at-sea monitors, and the scallop industry-funded monitoring program. These are presented as annual costs because while some components can be scaled up proportional to an increase in the total number of sea days, many cannot be scaled proportionally. For example, an increase in observer days would increase the number of hours needed to process data and that need could be met by hiring additional data processing personnel (proportional to the increased need). However, the facilities (particularly office space) needed to accommodate the additional data processing personnel is not proportionally scalable. The approximately $5 million of NMFS costs, detailed below, supported 10,666 sea days in FY 2013, but could support about a maximum of 15,000 sea days per year. The currently leased facilities could accommodate additional personnel to support an additional 2,000 sea days. However, beyond that, new facilities cost would have to be incurred. Facility costs cannot be obtained in small increments, so if sea days beyond 17,000 are considered, new facilities would have to be obtained so that there is sufficient capacity to cover the upper end of any anticipated increase. NMFS costs for dockside monitoring programs are likely similar to the costs described in this annual estimate.

The operational costs are presented as a single figure and are not broken out by each of the three components because there is some overlap, particularly when allocating employees' time over these activities.

TABLE 1. NMFS COST RESPONSIBILITIES FOR MONITORING

NMFS Cost Responsibilities		Annual Cost (FY2013) for all Programs (NEFOP, ASM, and industry funded scallops)
Training and Data Processing Costs	The labor and facilities costs associated with training and debriefing of monitors	$805,700
	Data processing	$2,057,100
Operational Costs	Certification of monitoring providers and individual monitors; performance monitoring to maintain certifications	$2,244,700
	Developing and executing vessel selection	
	Costs associated with liaison activities between service providers, NMFS, Councils, sectors and other partners	
Total		$5,107,500

The groundfish electronic monitoring cost comparison report estimates NMFS costs for the groundfish at-sea monitoring program for fiscal year 2014 costs. In fiscal year 2014, NMFS spent an estimated

$531,953 on training, $626,043 on data processing, and $719,548 on program management for the groundfish at-sea monitoring program for a total cost of $1,877,544 (Table 2). This total cost is divided by the number of at-sea monitor sea days accomplished in 2014 (3,541 days) to get a per sea day administrative costs of $530 (Table 2).

TABLE 1: ANNUAL AT-SEA MONITORING COSTS FOR NOAA FISHERIES

	Estimated Cost	
Program Component	**Total**	**Per Sea Day**
Training	$531,953	$150
Data Processing	$626,043	$177
Program Management	$719,548	$203
Total	$1,877,544	$530

NMFS cost responsibilities for electronic monitoring. In this section, we estimate NMFS costs for administering the example EM programs for groundfish sectors (audit approach) and the midwater trawl fleet (optimized/full retention approach) based on the roles and responsibilities described above. The reader should note that generalized descriptions for industry costs for electronic monitoring programs presented in this section were derived separately and differently than the NMFS costs presented here.

Many of the costs to NMFS for administering the example EM program would be driven by the scale of the program and the level of participation, although these costs do not necessarily increase linearly with the amount of sea days. Thus, we present a range of potential NMFS costs from overseeing an audit approach EM program for a single hypothetical sector (20 vessels) to a program for the entire active groundfish fleet (400 vessels), and for an optimized/full retention approach EM program for an example midwater trawl fleet (9 vessels). We based NMFS costs for the EM program on costs the Northeast Fishery Observer Program incurred for administering programs with similar roles and responsibilities and from the New England EM Project (Archipelago, 2014). These are rough estimates of NMFS potential costs and, unlike the NEFOP-level observer/at-sea monitoring program costs presented in the section above, may not reflect efficiencies or economies of scale that are possible in a mature program. NMFS would also have other incremental costs for enforcement and use of the data for management, which were not estimated here in order to be consistent with the estimates of the NEFOP-level observer/at-sea monitoring program.

In Table 3, training costs include labor and costs of licenses for any proprietary EM review software. The number of annual trainings that would need to be held and, hence, the number of trainers, would depend on the number of EM reviewers employed by the service providers, which would depend on the number and activity levels of vessels using EM in the fishery. For the audit model, training costs do not increase linearly. Although the number of participants increases by a factor of 20 when scaling up from 20 vessels to a fleet-wide program, the training costs increase by a factor of 8. This type of relationship makes it difficult to estimate costs at a unit that is easily multiplied (e.g., sea day cost). For the optimized/full retention model, although the example fleet includes only 9 midwater trawlers, there is a

large amount of video footage to be reviewed, due to a high number of assumed trips (500) and the assumed rate of video review (100 percent) used in the analysis. This much video footage may require a larger cadre of EM reviewers than the number of vessels might indicate, also increasing demand for training and certifications and NMFS's training costs.

NMFS may also have some costs for reviewing and approving individual Vessel Monitoring Plans (VMPs), which are each vessels individualized plans for equipment specifications, installation, and catch handling, and inspecting equipment installation on the vessel. Annual labor and travel associated with this activity is estimated at $15,500 for 9 vessels, $31,000 for 20 vessels and $232,500-$310,000 for 400 vessels.

For the audit model, NMFS costs for auditing the service provider's review of logbooks were estimated to be $46,795 for 20 vessels and $432,405-$525,905 for 400 vessels (Table 3), assuming NOAA Fisheries audits 5 percent of trips. These costs include staff time and licenses for proprietary EM review software. Use of open source software would negate the cost of software licenses in this category. For the optimized full retention model, the staff time and equipment costs to conduct periodic video reviews to audit the service providers are estimated at $26,295, assuming 5 percent of trips are audited.

Program management cost is labor for a program manager, which is necessary to administer the new program, liaise with the service providers, vessel, and enforcement, and coordinate staff. Program management cost is estimated at $86,000 annually, irrespective of the number of vessels participating in the program.

Not included in these cost estimates is the cost of storing any EM data submitted by the service providers or sectors. NMFS data storage costs would be driven by record-keeping and security requirements for EM data, which NMFS is still working to determine. Alternately, NMFS may be able to get remote access to EM data and video stored by the provider, and reduce or eliminate its data storage costs (Van Oyen, pers. comm., 2014).

TABLE 3: NMFS COST RESPONSIBILITIES FOR ELECTRONIC MONITORING PROGRAMS

	Estimated NMFS Cost Responsibilities for Audit and Optimized/Full Retention EM program models		
	Audit Model		**Optimized/Full Retention Model**
Program Component	**20 vessels**	**400 vessels**	**9 vessels**
EM Reviewer Training	$25,000	$187,500 - $250,000	$12,500
VMP Approval, Inspections	$31,000	$232,500 - $310,000	$15,500

EM Review Audit	$46,795	$423,405 - $525,905	$26,295
Program Management	$86,000	$86,000	$86,000
Total	$188,795	$929,405 - $1,171,905	$140,295

Industry Costs for NEFOP-level observers and FMP-specific at-sea monitors. The industry cost responsibilities are presented as costs per sea day because these costs are, for the most part, proportionally scalable to the number of sea days. These per day costs by cost component are shown in the tables below. This per day cost estimate does not include "Other costs of the provider to meet performance standards laid out by a fishery management plan" because those costs will not be known until the details are made explicit in subsequent management plans. These costs are based on the period from October 2012 through May 2014 and are averaged across the three service providers.

TABLE 4. INDUSTRY COST RESPONSIBILITIES FOR NEFOP AND AT-SEA MONITORING

Industry Cost Responsibilities	**NEFOP-level observer cost per observed sea day (FY2013)**	**Fishery Specific At-sea monitoring cost per sea day**
Costs to the provider for deployments and sampling (e.g., travel and salary for observer deployments and debriefing)	Sea day charges paid to providers: $640/day Travel: $71/day Meals: $22/day Other non-sea day charges: $12/day	Sea day charge paid to providers: $561/day Travel: $67/day Meals: $18/day Other non-sea day charges: $14/day
Equipment, as specified by NMFS, to the extent not provided by NMFS	$11/day	
Costs to the provider for observer time and travel to a scheduled deployment that doesn't sail and was not canceled by the vessel prior to the sail time.	$1/day	
Provider overhead and project management costs not included in sea day charges above (e.g., per diem costs for trainees)	Training: $61/day	Training: $50/day
Other costs of the provider to meet performance standards laid out by a fishery management plan	TBD – won't know these costs until an industry funded observer coverage program is implemented in a fishery	TBD – won't know these costs until an industry funded observer coverage program is implemented in a fishery
Total (not including other costs)	$818/day	$710/day

Additional estimates for industry contributions for NEFOP-level observer coverage and the groundfish at-sea monitoring program were provided in the Fisheries Monitoring Roadmap (Lowman et al., 2013).

This report based the estimated costs on the 2011 fiscal year. For 2011, the industry cost for NEFOP-level coverage was estimated at $917 per sea day, and the industry cost groundfish at-sea monitoring was estimated at $847 per sea day. These additional estimates are provided to highlight the inter-annual variability in the sea day estimate for NMFS and industry costs, as outlined in the introduction (Section 1.0).

Industry cost responsibilities for dockside monitoring. The industry costs of a dockside monitoring program are generally broken into several components: Program management and overhead costs of the provider company; travel costs for the monitor to travel from home or office to offload port, for non-principle ports; and hourly salary for the monitor, including, in some instances, waiting time at the dock.

A number of example industry costs for dockside monitoring are presented below. Dockside monitoring costs can be represented in three ways: 1) as a cost per sea day; 2) as a cost per landing event; and 3) as a cost per pound landed. The paragraphs below will discuss the different available estimates of dockside monitoring costs using each of these representations, and the pros and cons of each representation.

- Cost per sea day – This document uses a cost estimate of $106 per sea day based on publicized estimates for other dockside monitoring programs. In particular, the estimate is influenced by the industry costs for the NE Multispecies dockside monitoring program. The Fisheries Monitoring Roadmap (Lowman et al., 2013) provides per sea day rates of $51 and $82 for dockside monitoring for the British Columbia Hook and Line Groundfish fishery and the Pacific Groundfish (non-whiting) IFQ fishery, respectively. The “cost per sea day” representation makes the cost of dockside monitoring easy to compare against industry costs for at-sea and electronic monitoring. However, this representation of dockside monitoring costs implies that costs scale linearly with trip length, which does not accurately represent dockside monitoring costs. For example, if we assume the cost for monitoring is $106 per sea day, then a 3 day trip would cost $318 and 10 day trip would cost $1,060 to monitor. However, a 10-day trip could come back with its hold only half full with fish, or a 3-day trip could come back with a full hold. In this example, the 3-day trip with the full hold would actually cost more to monitor than the 10-day trip.
- Cost per landing event - The average cost per landing event for the NE Multispecies groundfish dockside monitoring program ranged from $36.87-$212.32 for all sectors. Though this range is a more accurate representation of costs than the cost per sea day representations, it is not easy to compare against industry costs for at-sea and electronic monitoring.
- Cost per pound of fish landed – The analysis assumes the cost per pound landed for each specific FMP is the most accurate way to represent the potential industry costs for monitoring. The average cost per pound of groundfish landed for the NE Multispecies groundfish dockside monitoring program range ranged from $0.006-$0.12 per pound for all sectors. The average cost per pound landed and per trip is inversely related to the average pounds landed – that is, larger trips are less expensive to monitor, by pound, than smaller trips. This was due to several

factors, including that larger trips typically landed in a principle port (no roving monitor required and, depending on the location, no travel costs) and much of the cost of providing a monitor is fixed, due to the logistics of having monitors present while vessels land their catch (e.g., insurance, administrative costs). The analysis uses estimated a cost of $0.002 per pound of herring landed, based on state dockside monitoring programs for herring, to analyze the economic impacts of Herring Alternative 2.3 and 2.4 and Mackerel Alternative 2.3 and 2.4.

Industry cost responsibilities for electronic monitoring. Portions of the discussion that follows were originally included in the March 2015 version of the Environmental Assessment for the Omnibus Standardized Bycatch Reporting Methodology Amendment. The description of costs and costs responsibilities below is generalized to encompass a range of potential program designs.

The economic impacts associated with the alternative to implement an electronic video monitoring program for one or more fisheries in the Greater Atlantic Region are derived directly from the expected costs to purchase, install, and maintain the electronic monitoring systems. Industry would be required to purchase, install, and maintain the electronic monitoring equipment aboard their vessels.

Based on cost estimates as of May 2006, it is likely that the cost to purchase a complete electronic video monitoring system would be approximately $7,200 per vessel (Archipelago Marine Research, Ltd. 2006).[1, 2] Installation costs are highly variable and depend upon the size of the vessel, the number of cameras to be installed, and other complicating factors such as the need to retrofit the vessel to support the installation of the equipment. Kinsolving (2006) estimates installation costs as ranging from $650 to $4,225 per vessel, based on a service rate of $65 per hour and the installation time ranging from 10 hours to as many as 65 hours per vessel, depending on the aforementioned complexity. In addition to the cost to purchase and install a system, it is expected that an annual registration fee would be required by the contractor providing the equipment and this is estimated to be approximately $600 per year. Maintenance costs would be expected to vary, but for the purposes of analysis, Kinsolving's (2006) estimate of $975 per year is used. The total first year costs would be approximately $10,200 per vessel, with continuing costs of approximately $1,600 per vessel per year for the second year and beyond (see **Error! Reference source not found.**).

[1] Archipelago Marine Research, Ltd. (2006), identifies the costs to purchase, install, and maintain a complete electronic monitoring system. While this fee schedule is focused on the British Columbia groundfish longline fisheries, the costs identified are presumed to be transferable to other fisheries. Published costs in Canadian dollars were converted to U.S. dollars based on the published exchange rate for September 7, 2006.

[2] Kinsolving (2006) also provides estimates of the cost to purchase a complete electronic monitoring system, ranging from $4,250, if off-the-shelf components are used, to $8,000 if a package system is purchased from an approved contractor. For the purposes of this analysis, the costs published by Archipelago Marine Research, Ltd. (2006), were used to simplify the analysis and to clearly identify the source of the costs used.

TABLE 5. ESTIMATED COSTS PER FISHING VESSEL TO PURCHASE, INSTALL, AND MAINTAIN AN ELECTRONIC VIDEO MONITORING SYSTEM (ARCHIPELAGO MARINE RESEARCH, LTD. 2006; KINSOLVING 2006).

	Year 1 (per vessel)	Year 2+ (per vessel)
Equipment purchase	$7,194	N/A
Installation costs (average)	$2,438	N/A
Annual program registration fee	$608	$608
Annual maintenance	N/A	$975
Total	**$10,240**	**$1,583**

The information presented above and in **Error! Reference source not found.** provide an estimate of the per vessel costs of implementing an industry-funded electronic monitoring requirement. The next step is to estimate the number of affected vessels within the fisheries for which this alternative would be considered.

The costs discussed above address only the purchase, installation, and annual maintenance of the electronic video monitoring systems, but do not address the costs associated with extracting the data from the video recording systems, or storing, maintaining, editing, and reviewing the data.

Agency or contractor personnel would be required to obtain the video data from fishing vessels (either through dockside extraction or a mail-in hard drive exchange program), to review the video footage in order to document discard events, to oversee and perform quality control on the extracted data, and to archive and maintain the data. Video reviewing and data archiving equipment would also be required. Kinsolving (2006) estimates that data storage systems would be required to support approximately 20 terabytes of data per year, but this was an estimate solely for the Pacific rockfish pilot program, which has a fleet of approximately 25 vessels (consolidating to 18 active vessels) that make an average of seven fishing trips per year, with trips averaging 3 days each. Therefore, extrapolating to determine the data storage needs were this program implemented in the Greater Atlantic Region would most likely be orders of magnitude greater.

Potential Industry Cost Saving with Electronic Monitoring and Portside Monitoring. For both electronic monitoring and portside monitoring it is difficult to predict whether and/or how costs may change if industry is contracting directly with providers (versus the federal government contracting with providers). General program overhead/management is a substantial part of the costs and it is difficult to know whether these costs will be reduced when industry is contracting with providers, and if so how much. Based on the amount of coverage/monitoring several potential cost savings have been identified however, as described below. It is also important to remember that all of these cost figures (including the original values) are estimates, and may be higher or lower than actual costs once implemented.

Electronic Monitoring

Based on "A Cost Comparison of At-Sea Observers and Electronic Monitoring fora Hypothetical Midwater Trawl Herring/Mackerel Fishery."
https://www.greateratlantic.fisheries.noaa.gov/stories/2015/september/em_cost_assessment_for_gar_herring_150904_v6.pdf

100% recording, 100% Review: ***$325***

Haulback Recording Only, 100% Review: $***248*** - Reduction: $78 of the $160 data services cost (49%). [(325 – (.49*160)) = (325 – 78) = $248]. $82 of data services costs remaining.

Haulback Recording Only, 50% Review: ***$218*** - $61 is the cost for haulback review, so if only half of the trips are reviewed, this would save about another $30. [(248 – (61/2)) = (248 – 30.5) = $218]

Field Services are $78/day, and "Field services costs are largely driven by the frequency of hard drive retrievals from the vessel, and the associated travel and labor costs." "Repair and technical support needs also drive field services costs." However, the document also states that repair and technical support costs were low because it was believed that minor problems could be addressed during data retrieval. If 25% of costs were repair and technical support but this amount doubled due to additional single purpose technical support trips, an overall 40% savings from mailing hard drives appears reasonable. 40% of $78 = $31. Saving $31 would reduce the overall cost to around ***$187*** per seaday. [(218 – 31) = $187]

Portside Monitoring

The Portside Monitoring cost estimate is $5.12/mt, but this includes administration costs that have been borne by the State of Massachusetts, and could be paid for by NMFS (subject to funds being available to run such a program). For NEFOP observers, the administrative cost for NMFS is approximately 37% ($479 NMFS cost $818 at-sea industry cost - http://s3.amazonaws.com/nefmc.org/150929-NEFMC-Meeting-Presentation-without-notes.pdf, slide 32). If one assumes that 25% or 33% of these costs would not be directed at vessels (conservatively less than 37%), the cost for vessels per mt would be $3.84/mt and $3.41/mt respectively.

If only 50% of trips were sampled, while any particular trip might still have to pay $3.84/mt or $3.41/mt, over the course of a year it should reduce average costs to $1.92/mt or $1.71/mt. The table below describes the total costs for trips landing different amounts of fish, and daily costs assuming a 3-day trip.

	25% Admin		33% Admin	
Full Cost	$5.12	Per day cost	$5.12	Per day cost
Cost less Admin	$3.84	with 3/day	$3.41	with 3/day
50% Coverage	$1.92	trip	$1.71	trip
100 mt trip cost	$192	$64	$171	$57
200 mt trip cost	$384	$128	$341	$114
300 mt trip cost	$576	$192	$512	$171
400 mt trip cost	$768	$256	$683	$228

Table 6 summarizes the ways that sea day costs can be minimized reduced in an industry-funded monitoring program. The discussion provided in Table 6 was generated from information provided by NEFOP personnel, observers, and representatives from service providers in the northeast and west coast. To the extent that the issues identified in Table 6 can be addressed through the management

measures that establish/implement the IFM program, sea day costs borne by the fishing industry can be reduced.

TABLE 6 SUMMARY DISCUSSION – HOW TO REDUCE SEA DAY COSTS

How to Reduce Sea Day Costs	Discussion/Rationale
Build from existing observer sampling protocols; do not require new/different data to be collected	• Collecting data in a new/different way will require modifications to existing observer sampling protocols and training procedures, new/revised manuals/logs, possibly new/additional sampling equipment, and database design or restructure; this could increase administrative and training costs
Eliminate SCA and related regulatory requirements for Federal contracts	• Federal requirements for wage structure/overtime/paid holidays/vacation are not necessary for contracts between vessels/providers; without specifically implementing these requirements as part of the IFM regulations, wage structure and benefits for employees would be determined by individual service provider companies; MRAG report (June 2012) estimates that eliminating these requirements may reduce costs by $50-$100 per sea day; • FLSA and other Federal labor laws would still apply to service provider companies; however, eliminating the SCA requirements from IFM regulations is likely to result in some reduction in sea day cost; • Not likely to result in $100 per sea day cost savings in this region due to existing pay structure/benefits for observers required by Federal contracts
"Grandfather in" current service providers approved for NEFOP observer coverage and GF ASM programs – approve these providers immediately for any new, fishery-specific ASM program	• Reduces expense of applying/re-approving service provider companies already approved for other programs in the region; observers/monitors for approved service providers would still need to be certified for existing monitoring programs to participate as fishery-specific at-sea monitors; • Allows vessels to select from multiple service providers when program is established; increases negotiating opportunities for vessels at onset of program by creating competition between companies; • Provides opportunity for existing service providers to offer more work days to their observers (could reduce staff/overhead expenses for both programs)
Allow cross-certification of NEFOP and GF ASM observers for new, fishery-specific ASM programs; combine/overlap training and recertification whenever possible	• Cross-training and applying training courses to multiple certifications reduces training costs (travel, hotel, per diem for service providers); • Reduces equipment costs for service providers – no need to purchase duplicative equipment • As previously noted, this may reduce overhead costs for service providers by providing their observers with a greater number of days to work (improving ability for service providers to retain full-time employees)

Table 6 continued. Summary Discussion – How to Reduce Sea Day Costs

How to Reduce Sea Day Costs	Discussion/Rationale
Provide detailed information about fishing patterns for vessels participating in the industry-funded monitoring program	• Allows providers to more accurately estimate manpower/resources needed, logistics, overhead, and travel costs - reduces need for providers to over-estimate these costs to cover expenses that cannot be predicted prior to the start of the year; • Increases predictability of fishery for observer/monitor deployment; • Increases efficiency for service providers
Minimize observer deployment logistics	• Simplifying the selection process for vessels/trips that require industry-funded observers/monitors reduces costs for service providers because vessel selection/notification would not require additional staff or resources
Allow industry to negotiate less significant costs with providers	• Structure the provisions in the industry-funded monitoring program to allow the industry to negotiate as many minor costs as possible with service providers, to better meet their individual vessel needs circumstances; • These may include costs for trip cancellations and no-shows, meal reimbursements, partial day/hourly billing (see below), land-hour rates (if necessary), or other costs
Encourage service providers/industry to negotiate billing by partial days (versus 24 hour days)	• Sea scallop regulations 648.11(g)(5)(i)(A)(2) state that "For the purposes of determining a daily rate…a service provider may charge a vessel owner for not more than the time an observer boards a vessel until the vessel disembarks (dock to dock), where a day is defined as a 24-hour period, and portions of other days would be pro-rated at an hourly charge." • Industry participants should be aware that this can be negotiated in contracts with providers; may be an opportunity to reduce sea day costs for some vessels depending on fishing operations; • Consideration should be given to the possibility of land hour time for observers/monitors, which may be necessary if days are billed partially or by the hour
Allow observers to be deployed on the same vessel for more than two consecutive multi-day trips, and more than twice in any given month for multi-day deployments	• Prohibited in current regulations for industry-funded observer coverage, implemented in SBRM amendment • Increases flexibility and reduces travel costs for service providers; appears to be consistent with regulations for Groundfish ASM

Table 6 continued. Summary Discussion – How to Reduce Sea Day Costs

How to Reduce Sea Day Costs	Discussion/Rationale
Encourage vessels in close proximity to negotiate contracts together so that they can utilize the same observers and minimize travel expenses	• Industry can reduce costs by collaborating with vessels that fish from same ports and/or during same seasons to reduce travel and related costs for observers/monitors
Streamline debriefing and re-certification requirements	• Reduces costs to service providers (travel/per diem)
Insurance	• There may be ways to reduce/streamline insurance requirements to reduce costs for providers. To the extent that duplicative or redundant insurance requirements can be eliminated, costs can be reduced. This issue requires further investigation.
Combine the IFM programs for multiple fisheries, when appropriate	• Would reduce complexity (PTNS, deployment, travel) and increase efficiency for service providers; increases number of sea days for amortizing travel/training expenses over the year; • Could increase the total number of work days available for ASM-certified observers/monitors and may reduce staff/overhead costs for service providers

Cost drivers for electronic monitoring. There are a number of variables in the design of an electronic monitoring program. The text below briefly summarizes some of the program specifications related to data submission, video review, video audit, and data storage that can reduce the industry contribution for electronic monitoring programs.

Data Submission

- Allow the hard drives that store EM footage to be submitted by mail, rather than requiring them to be retrieved by a technician.
- For fisheries that have dockside monitoring programs in addition to EM, consider having dockside monitor retrieve/transmit hard drives.

Video Review

- Design a random sampling program to select trips or portions of trips (i.e., around haulback on herring and mackerel trips) from which video would be reviewed.
- For audit approaches, specify an assumed discard rate in lieu of additional video review in the instances where the EM validation fails.
- Documentation of discards at the species level, including identifying and counting the fish and measuring the length of the fish, for only a few species of interest (e.g., only species in the NE multispecies complex on groundfish trips).
- Software solutions may be able to automate review of portions of video footage.

Data storage

- Allow video data to be stored in the “cloud” (as permitted within security and data confidentiality regulations).
- Determine the lowest possible frame rate and image resolution necessary to document the activity of interest for the EM program. Slow activities such as identifying large objects in a pile of fish being sorted, requires more frames per second. The higher the frame rate, the more likely it is that the camera will capture detailed information. Similarly, identifying fish to species requires higher resolution than verifying when fishing gear is deployed. Higher frame rate and resolution results in larger video files and requires additional storage requirements.

Mid-Atlantic Fishery Management Council
800 North State Street, Suite 201, Dover, DE 19901-3910
Phone: 320-674-2331 | FAX: 320-674-5399 | www.mafmc.org
Richard B. Robins, Jr., Chairman | Lee G. Anderson, Vice Chairman | Christopher M. Moore, Ph.D., Executive Director

March 24, 2015

Dear _____,

As you are most likely aware, the National Marine Fisheries Service in conjunction with both the New England and Mid-Atlantic Fisheries Management Councils is developing an omnibus action that would allow the Councils to implement industry-funded monitoring within their respective jurisdictions. The Amendment will also consider specific coverage levels for the Atlantic mackerel and Atlantic herring fisheries. Please see http://www.mafmc.org/actions/observer-funding-omnibus for further information.

Preliminary analyses of economic factors related to the alternatives currently being considered for the herring and mackerel fisheries have highlighted the need for more detailed information about the cost of fishing in these two fisheries. It is important that the degree to which the cost of industry-funded coverage reduces the profitability of fishing for different types of vessels be understood and described in the Environmental Assessment. The current analyses use fishing cost information collected by the Northeast Fisheries Observer Program but the type of costs collected and the coverage on herring and mackerel vessels are limited.

Thank you for agreeing to fill this information gap by completing the attached survey. This survey is being administered by the MAFMC. The survey will ask you a number of questions about your annual fishing costs. Responses to the survey are completely confidential, as required by law. Once you complete the survey please return it using the enclosed stamped envelope. The survey should take no longer than one hour to complete. Responses to the survey are voluntary, but by completing it, you will be helping the Councils understand how the policies currently being considered affect you.

If you have any questions about how to complete the survey please contact Jason Didden (302-526-5254 or jdidden@mafmc.org). Thank you in advance for your participation!

Sincerely,

Christopher M. Moore, Ph.D., *Executive Director MAFMC*

Completed surveys should be mailed to:

Jason Didden
Mid-Atlantic Fishery Management Council
800 North State Street, Suite 201
Dover, DE 19901-3910

Herring and Mackerel Vessel Annual Cost Survey for 2014

Thank you very much for participating in this important survey!

The questions in this survey relate to the following vessel only:
[**Vessel name**]
Coast Guard Documentation or State Registration Number: **[12345678]**

Your responses and participation in this survey are
CONFIDENTIAL

Photo credit: Lisa Colburn, NOAA Fisheries

Completed surveys should be mailed to:
Jason Didden
Mid-Atlantic Fishery Management Council
800 North State Street, Suite 201
Dover, DE 19901-3910

General Instructions:

- **This survey is about your costs in 2014 for the vessel identified in this survey.** In your answers, include combined costs for all state and/or federal fisheries for this vessel in 2014, including costs incurred while the vessel was inactive.

Please note that all responses are completely confidential.

Section A: Vessel Information

This section is only about the vessel identified in this survey. **All costs requested are for 2014.**

1. Ownership type for this vessel (*check one*):

- ☐ Sole proprietorship
- ☐ General partnership
- ☐ Limited partnership
- ☐ C Corporation
- ☐ S Corporation
- ☐ Limited Liability Company (LLC)
- ☐ Other _____

2. Number of owners, including yourself: _____

3. Was this vessel acquired from a previous owner or was it bought new (*check one*)?

- ☐ Acquired from a previous owner
- ☐ Purchased New

4. In what calendar year did you become the owner of the vessel? _____

5. What port did this vessel operate from most of the time during 2014?

_____

Section B: Repair/Maintenance/Upgrade/Improvements Costs

6a. Was this vessel hauled out in 2014 for any reason? (Possible reasons include regular repair and maintenance, emergency haul-out, long term storage, etc.)

- ☐ Yes
- ☐ No [please go to 6c]

6b. What were the haul-out costs in 2014, including taking the vessel out of the water and any transportation? *(Do not include any repair/maintenance costs – we'll ask you for them in question 7.)*

Haul out cost in 2014: $ _____

6c. How often do you usually haul-out this vessel?

- ☐ Every year
- ☐ Every other year
- ☐ Every ____years
- ☐ Every ____months
- ☐ Other (please describe) _____

7. What were your repair/maintenance and upgrade/improvement costs for this vessel in 2014? Include the cost of any tools and equipment you may have purchased. If you did not have any expenses in 2014, then check $0.

We know that these kinds of costs may vary significantly year to year. However, ***this survey is about 2014 expenses only.***

$ _____ ☐ $0

If you are able to provide a breakdown of these total repair/maintenance and upgrade/improvement costs, please do so in the following table. Otherwise, skip to question #8.

7.	***Do not include vessel haul-out costs reported above in question 6b.***
Expense Category	**Repair/Maintenance/Upgrades/Improvements, 2014**
Propulsion Engine (such as engine, drive train, exhaust/cooling systems)	$_____ ☐ $0 **Description:**
Deck Equipment/ Other Machinery (such as winches, haulers, generators, hydraulics, compressors, reels, pumps)	$_____ ☐ $0 **Description:**
Hull (such as frame, deck, wheelhouse, keel, steering, rigging, fish holds, fuel tanks)	$_____ ☐ $0 **Description:**
Fishing Gear (such as codends, nets/panels, dredges, buoys, highfliers, doors, pots/traps, cables)	$_____ ☐ $0 **Describe Upgrade/Improvement:**

7.	***Do not include vessel haul-out costs reported above in question 6b.***
Expense Category	**Repair/Maintenance/Upgrades/Improvements, 2014**
Wheelhouse and Electronics (such as Radar, GPS, VMS, sounder, radio, depth/temperature/net sensors)	$_____ ☐ $0 **Describe Upgrade/Improvement:**
Processing/ Refrigeration (such as RSW, packaging equipment, icemaker)	$_____ ☐ $0 **Describe Upgrade/Improvement:**
Safety Equipment (such as EPIRB, rafts, fire extinguishers, flares, survival suits)	$_____ ☐ $0 **Describe Upgrade/Improvement:**
Other Repair/maintenance or upgrade/improvement:	$_____ ☐ $0 **Describe Upgrade/Improvement:**

Section C: Vessel Related Costs

8. For each expense category listed in the table below, ***please enter the total amount spent in 2014 for this vessel (and average per day cost for crew and hired captain)***. If you did not have an expense in 2014, then check $0.

Mooring/Dockage Fees for this vessel in 2014 (including upkeep expenses): $_____ ☐ $0	**Permit and/or License fees** for this vessel in 2014: $_____ ☐ $0
Vessel insurance premium in 2014 for this vessel (premium paid for either hull or P & I insurance): $_____ *Number of months insured:* _____ ☐ $0	**Quota or DAS lease payments** in 2014 for this vessel (if non-monetary payments were used to obtain quota or DAS, please estimate the value of those non-monetary payments): $_____ ☐ $0
Total payments to crew and hired captain in 2014 for this vessel only: Crew: Annual $_____ Avg per day $_____ Hired Cpt: Annual $_____ Avg per day $_____ (**Do not include** what you earn when you are the captain) ☐ $0	**Crew benefits** for this vessel in 2014 (the cost to you, as the vessel owner, for providing retirement benefits; health, life, or disability insurance premiums; and unemployment insurance for your crew and hired captain): $_____ ☐ $0
Vessel Activity/Quota Monitoring Cost for this vessel in 2014 (such as observer or dockside monitoring cost):	**Other costs** for this vessel in 2014: *Describe*: _____

$_____	$_____
☐ $0	☐ $0

Section D: Operating Costs

9. For each expense category listed in the table below, *please enter the total amount spent in 2014 for this vessel, including all payments made by you and/or the crew. Also please enter the average cost per day.*

- If nothing was spent in a category, please check $0.
- *We are aware that these kinds of costs may vary significantly from year to year.* ***Please bear in mind that this survey is about 2014 expenses only.***

Fuel/oil/filter for this vessel in 2014: Annual $_____ Avg per day $_____ ☐ $0 ☐ I Don't Know	**Food and Drinking Water** for this vessel in 2014: Annual $_____ Avg per day $_____ ☐ $0 ☐ I Don't Know
Ice for this vessel in 2014: Annual $_____ Avg per day $_____ ☐ $0 ☐ I Don't Know	**Carrier vessel fees** for this vessel in 2014: Annual $_____ Avg per day $_____ ☐ $0 ☐ I Don't Know
Fresh Water for use in this vessel in 2014: Annual $_____ Avg per day $_____ ☐ $0 ☐ I Don't Know	**Communication Costs** for this vessel in 2014 (such as cell phones, radio, VMS etc.): *Do not include office phone use.* Annual $_____ Avg per day $_____ ☐ $0 ☐ I Don't Know
General Fishing Supplies for this vessel in 2014 (such as knives, picks, hooks, boxes, bags, ties, lobster bands, rags, tape, links/rings, lines/twine, etc.): Annual $_____ Avg per day $_____ ☐ $0 ☐ I Don't Know	**General Crew Supplies** for this vessel in 2014 (such as gloves, boot liners and foul-weather gear): Annual $_____ Avg per day $_____ ☐ $0 ☐ I Don't Know
Catch Handling Costs for this vessel in 2014 (such as auction, lumping, pumping,	**Other Costs** for this vessel in 2014: *Describe*:_____

grading, shipping and sales rep): Annual $_____ Avg per day $_____ ☐ $0 ☐ I Don't Know	 Annual $_____ Avg per day $_____ ☐ $0 ☐ I Don't Know

Section E: Typical Crew Payment System

10a. Did you hire a captain for the majority of this vessel's trips in 2014, or were you the captain for most trips?

- ☐ Mostly Owner-operated
- ☐ Mostly Hired Captain
- ☐ Other _____

10b. On average, how many crew were on this vessel when it went out in 2014? DO NOT COUNT YOURSELF OR THE CAPTAIN.

_____ Average number of crew members, not including you or the captain, in 2014

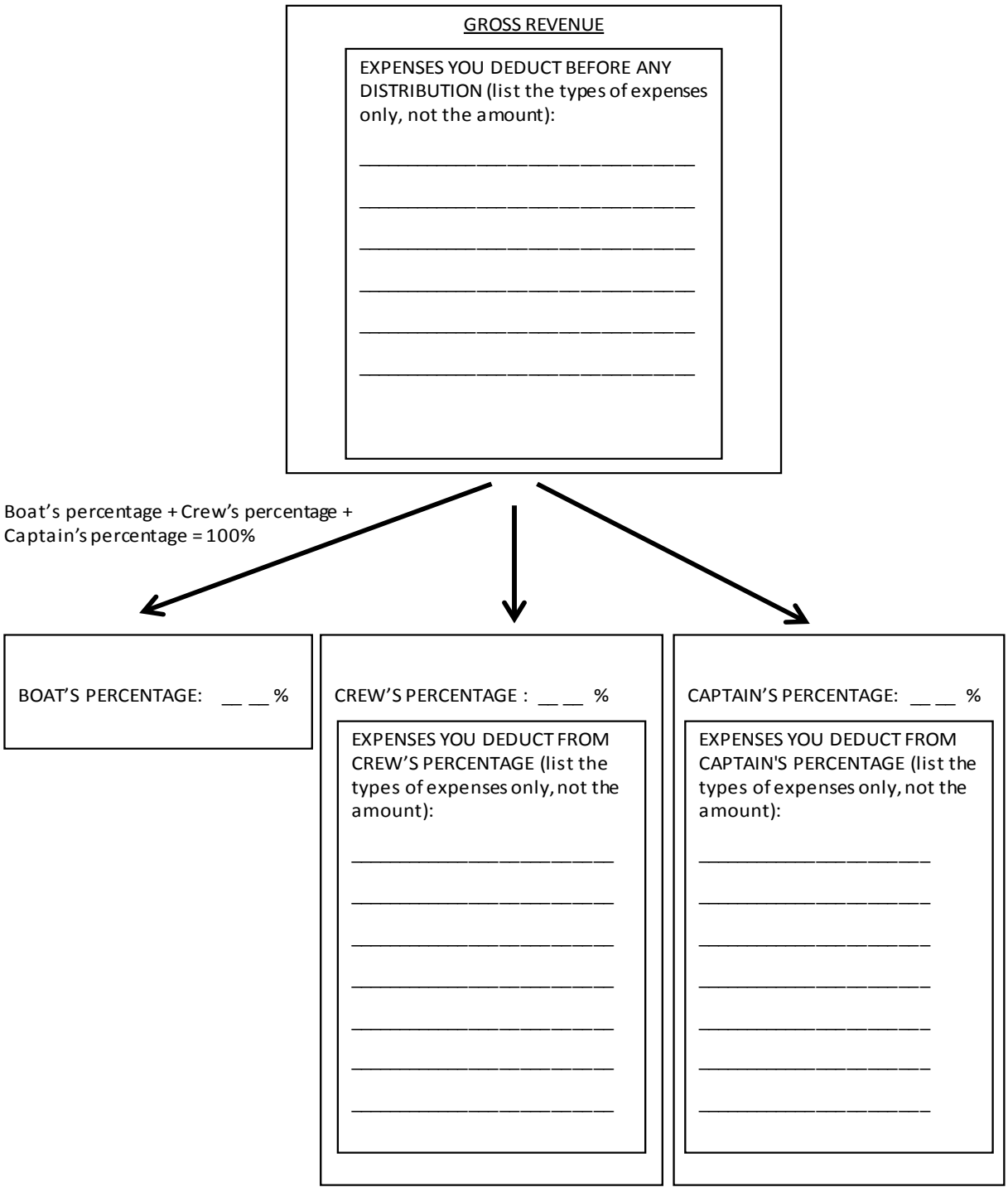
- **If you answered 0 (you had no crew in 2014), SKIP TO QUESTION 11**
- **If your answer was > 0 (you had crew in 2014), please CONTINUE WITH QUESTION 10c**

10c. Please use the diagram on the next page to list the types of expenses that were normally taken out of gross revenue, crew's share, and captain's share in 2014.

You do not need to list the dollar amounts. Just list the *types* of expenses deducted (for example: "fuel" "ice" "food").

Diagram is on the next page

NOTE: If the diagram below is not appropriate for your settlement system, please describe your system on the next page.



If the diagram displayed on the previous page is not appropriate for your crew payment, then please describe your crew payment system in the space below:

10d. Please list the *types* (not the cost) of items crew members purchase for themselves.

Examples include: “food on day boats”, “foul weather gear”, “gloves”, etc.
(These expenses would NOT be included in the diagram above.)

_____ _____

_____ _____

_____ _____

Section F: Overall Business Cost

11a. Including the vessel listed in this survey, how many vessels did your fishing business operate or maintain in 2014?

_____vessel(s) operated or maintained in 2014

11b. For each expense category listed below, please enter the amount spent for either all your vessels or just this vessel in 2014. Indicate by checking the appropriate box.
If you did not spend anything on that expense category in 2014, please check $0.

Workshop/Storage Expenses for 2014 (such as gear shed rental and workshop expense): $_____ ☐ $0 ☐ for all vessels ☐ for this vessel only	**Office Expenses** for 2014 (such as office supplies, office rental, home office, office utilities (such as electric, heat, etc.), postage photocopying, computer and office phone use, excluding **communication costs**): $_____ ☐ $0 ☐ for all vessels ☐ for this vessel only
Business Vehicle Usage Costs for 2014 (for fishing business related purposes only; such as number of miles the vehicle was used for business multiplied by a standard mileage rate): $_____ ☐ $0 ☐ for all vessels ☐ for this vessel only	**Business Travel Costs** for 2014 (such as cost of lodging, travel, and transportation for business associated travel **excluding business vehicle costs**): $_____ ☐ $0 ☐ for all vessels ☐ for this vessel only
Association Fees Paid in 2014 (such as co-operative, fishing organization, sector fees and union dues): $_____ ☐ $0 ☐ for all vessels ☐ for this vessel only	**Professional Fees Paid** in 2014 (such as settlement, accounting, and legal fees): $_____ ☐ $0 ☐ for all vessels ☐ for this vessel only
Principal Paid on Business Loans for 2014 (enter only payments made, ***not*** amount owed): $_____ ☐ $0 ☐ for all vessels ☐ for this vessel only	**Interest Paid on Business Loans** for 2014: $_____ ☐ $0 ☐ for all vessels ☐ for this vessel only
Taxes paid (income, property, etc.) for 2014: $_____ ☐ $0 ☐ for all vessels ☐ for this vessel only	**Non-Crew Labor Services** for 2014 (such as night watchman, shore engineer, and office secretary): $_____ *Describe:* _____

☐ $0 ☐ for all vessels ☐ for this vessel only

Section G: Other Costs and Earnings

12. Did you have any other costs in 2014 that we have not asked about in this survey? If so, please list them below. (Please do not report your personal costs).

Other costs for the identified vessel only:

Cost	Description of other annual costs incurred in 2014
$ _____	_____
$ _____	_____

Other costs for your entire business:

Cost	Description of other annual costs incurred in 2014
$ _____	_____
$ _____	_____

13. Please record the total gross revenue from all activities generated by this vessel in 2014. *(Note: Although we collect revenue information from the dealer reporting system, this question is for cross-checking our record in order to improve our overall data quality.)* **:**

Gross revenue from commercial trips: $_____
Gross revenue from non-commercial trips (e.g. charter trips): $_____
☐ $0 (this vessel was inactive during 2014)

15. In the following table, Please record the number of days this vessel spent in each fishery in 2014. Be as specific as possible in the fishery description noting things such as gear type, target species, fishing region, etc.

Fishery Description (gear/species/region)	Number of Days in 2014

Thank you for your response! Please use the space below for comments.

APPENDIX 8 -- ATLANTIC HERRING ALTERNATIVE ECONOMIC IMPACTS ON HERRING FISHING BUSINESSES

Impact Analysis Methods

Four types of industry-funded monitoring for the herring fishery are being considered: Northeast Fisheries Observer Program (NEFOP) level observer, at-sea monitor (ASM), Electronic Monitoring (EM), and portside sampling (PS) coverage. NEFOP-level and at-sea monitoring coverage would function independently, but EM and portside are intended to be used together.

MONITORING COSTS TO INDUSTRY

Types of Monitoring	NEFOP-Level Observer	At-Sea Monitor	Electronic Monitoring	Portside Sampling
Industry Cost Responsibility	$818 per seaday	$710 per seaday	Year 1: $15,000 one-time set up cost then $325 (also $187) per seaday Year 2: $325 (also $187) per seaday	$0.0023 per lb ($5.12 per mt) and at $0.00174 per lb ($3.84 per mt)

Trips that occurred in 2014 were used to estimate the likely future impacts of the herring alternatives. This is the most recent year for which data is available and 2014 activity should represent what is likely to occur in future years in terms of the vessels participating in the fishery, the condition of the stock, the regulatory environment, and fishing methods. Each alternative has different criteria for defining which types of trips would be monitored (based on permit type, gear used, etc.). Trips from 2014 that met these criteria were evaluated in terms of how the monitoring costs impacted annual returns to owner (see below for description of how return-to-owner (RTO) was calculated). If an alternative specified 100% coverage, then the monitoring costs that would have been paid for all trips occurring in 2014 were calculated and assessed in terms of impacts to RTO. For alternatives that have options with less than 100% coverage, trips from the pool of 2014 trips were randomly selected until the coverage target was met. This was repeated 1,000 times for each trip selection simulation. Mean annual ASM/NEFOP costs per vessel are then calculated from the simulated trip selections.

Vessels were assigned a major gear type based on the gear that earned the greatest revenue (from all species landed) among the trips selected for evaluation (according to the criteria in the alternative). It is not necessarily the major gear for the year for a particular vessel.

In the tables, any information that pertains to amounts of revenue from various species and numbers of days at sea and trips are for the trips that met the criteria under each of the alternatives only, not for the year.

Return-to-Owner

A previous analysis of economic impacts of herring and mackerel coverage target alternatives was based on trip cost data collected by the NEFOP and showed the economic impact of the alternatives on vessel net revenues (gross revenues less trip costs). Because NEFOP only collects a limited amount of cost data, industry participants expressed concern that net revenue estimates used in the previous economic analysis underestimated vessel costs. In response, Jason Didden, staff of the Mid-Atlantic Council, offered to survey herring and mackerel vessels to collect more detailed cost information.

The survey requested information from vessel owners on total trip costs in 2014. The cost survey collected information on variable trip costs, the cost of repairs/maintenance/upgrades/haulout, fixed costs, and payments to crew. These data were used to update the impact analyses. If the vessel owner completed a survey then that vessel's actual costs were used in the analysis. Otherwise, respondent data were used to project costs on other vessels that did not provide a survey response. To do this, responses from the surveys were categorized by the annual primary species caught based on value. Two categories were used: herring/mackerel vessels and squid vessels. For each of these vessel types, costs were assigned into one of four categories: variable costs, crew share, repair/maint/upgrades/haulout, and fixed costs. Average percentages of annual gross revenue by cost category and vessel type were used to estimate costs for vessels that did not have survey data. See table below for cost category descriptions and average percentages of gross revenue.

Surveys were sent to approximately 18 vessel owners (representing about 26 vessels) in the herring and/or mackerel fisheries. Surveys were sent in May 2015 and information was submitted for 16 of the 26 vessels.

Cost category	Description	Average percent of gross revenue	
		Herring/ mackerel vessels	Squid vessels
Variable costs	Annual fuel, oil, food, water, ice, carrier vessel, communication, fishing supplies, crew supplies, and catch handling costs	25%	35%
Crew share	Total annual payments to crew	28%	26%
Repair/ maintenance/ upgrades/ haulout (RMUH)	Annual cost of repairs to engines, deck equipment, machinery, hull, fishing gear, electronics, processing equipment, refrigeration, and safety equipment. Includes haulout costs. Because these costs vary considerably from year to year and upgrade costs were combined with repair/maintenance costs, half of these costs were amortized over 7 years.	13%	11%
Fixed costs	Annual mooring/dockage, permits/licenses, insurance, quota/DAS lease, crew benefits, vessel monitoring, workshop/storage, office, vehicle, travel, association, professional, interest, taxes, and non-crew labor costs. Note: principal payments on business loans are not included in fixed costs.	19%	21%
Return to Owner (RTO)	Gross revenue less variable, crew share, RMUH, and fixed costs	15%	7%

Major Findings

Across the vessel types examined, the paired MWT vessels have the highest monitoring costs as a percentage of RTO. This is due to the fact that these vessels have, on average, more sea days that would have monitoring costs than the other vessel types.

There are differences among vessel types in terms of the sources of revenue that would be used to pay for monitoring costs. For example, for SMBT vessels, half of their revenue comes from herring and the other half from other species. What this means is that for monitoring that is required for the herring fishery, other non-herring sources of revenue must be used to cover the herring related costs. A metric for evaluating these differences is monitoring cost as a percent of herring revenue. For SMBT monitoring costs as a percent of herring revenue are higher than for other vessel types.

Exempting trips less than 25 mt of herring (Herring Alternative 2 Sub-Option 5) from industry-funded monitoring costs reduces the monitoring cost substantially in many cases. The degree of saving varies by gear type. Using Alternative 2.1

as an example, aggregate NEFOP costs decline by 48% for purse seine vessels ($320k to $166k). For paired midwater trawl vessels, the percentage difference (20%; $673k to $541k) is not as great.

For midwater trawl vessels, selecting Herring Alternatives 2.3 or 2.4 rather than Herring Alternative 2.2 results in about a 60% cost saving for paired midwater vessels in Year 2 and beyond and about a 45% cost saving for single midwater trawl vessels.

Selecting Herring Alternative 2.5 rather than Herring Alternative 2.1 reduces total industry monitoring costs from $811k to $75k – a 91% reduction.

Reducing EM costs from $325 to $187 per day and only monitoring half of the portside sampling trips at a rate of $3.84 per mt, as opposed to all trips at $5.12 per mt, reduces total monitoring costs by 51% for paired MWT vessels ($457,595 to $222,958) in year 2. For single MWT vessels, costs are reduced by 54% ($134,165 to $61,067).

Herring Alternative 2.1

Per Vessel	Paired MWT		Purse Seine		Single MWT		SMBT	
	Average	Stnd Dev	Average	Stnd Dev	Average	Stnd Dev	Average	Stnd Dev
Annual Gross Revenue	$1,338,354	$704,254	$1,364,372	$920,296	$1,026,390	$1,179,521	$1,875,233	$1,505,034
Annual Variable Costs	$318,252	$167,769	$330,865	$233,767	$284,996	$267,061	$594,112	$412,374
Annual Crew Share	$410,406	$213,633	$358,167	$270,086	$292,093	$332,733	$519,728	$451,846
Annual Repair/Maint/Upgrade/Haulout	$177,888	$98,231	$182,172	$119,312	$120,240	$101,172	$149,714	$94,073
Annual Fixed Costs	$268,728	$172,799	$251,988	$177,397	$187,892	$200,926	$467,553	$476,899
Annual Return-to-owner	$163,080	$89,827	$241,180	$162,152	$141,169	$362,448	$144,125	$113,903
Annual Cost of NEFOP	$84,150	$37,945	$45,700	$28,075	$23,077	$13,108	$17,380	$14,134
NEFOP as pct of RTO (median)	44.7%		13.9%		24.4%		11.5%	
post-NEFOP RTO	$78,930	$77,928	$195,480	$159,212	$118,091	$352,542	$126,745	$110,764
Percent of Revenue from Herring	91.2%	9.5%	100.0%	0.0%	81.9%	17.0%	52.4%	42.0%
Percent of Revenue from Mackerel	13.9%	8.2%			19.4%	17.0%	2.6%	4.1%
Percent of Revenue from Squids							44.3%	39.7%
Percent of Revenue from Other Species	0.1%	0.1%			7.7%	17.0%	21.5%	17.9%
Average Number of Days at Sea	103	47	56	34	28	16	21	17
Average Number of Trips	34	16	64	37	22	20	11	16

Herring Alternative 2.1

Fleet Level	Paired MWT	Purse Seine	Single MWT	SMBT
Number of Vessels	8	7	6	9
Total Days at Sea	825	392	170	192
Total Number of Trips	275	451	129	103
Total Herring Revenue	$9,409,389	$11,042,232	$3,842,873	$1,483,242
Total Mackerel Revenue	$1,155,588	$225	$570,246	$97,806
Total Squid Revenue				$529,723
Total Other Species Revenue	$5,906		$50,399	$485,180
Total Revenue	$10,570,883	$11,042,457	$4,463,518	$2,595,951
Total NEFOP Cost	$673,200	$319,902	$138,463	$156,420
NEFOP as pct of Total Revenue	6.4%	2.9%	3.1%	6.0%
NEFOP as pct of Herring Revenue	7.2%	2.9%	3.6%	10.5%

Herring Alternative 2.1 – Sub Option 5

Per Vessel	Paired MWT		Purse Seine		Single MWT		SMBT	
	Average	Stnd Dev	Average	Stnd Dev	Average	Stnd Dev	Average	Stnd Dev
Annual Gross Revenue	$1,338,354	$704,254	$1,364,372	$920,296	$1,026,390	$1,179,521	$2,057,720	$1,835,879
Annual Variable Costs	$318,252	$167,769	$330,865	$233,767	$284,996	$267,061	$626,872	$501,818
Annual Crew Share	$410,406	$213,633	$358,167	$270,086	$292,093	$332,733	$583,258	$550,531
Annual Repair/Maint/Upgrade/Haulout	$177,888	$98,231	$182,172	$119,312	$120,240	$101,172	$141,508	$110,893
Annual Fixed Costs	$268,728	$172,799	$251,988	$177,397	$187,892	$200,926	$542,753	$581,061
Annual Return-to-owner	$163,080	$89,827	$241,180	$162,152	$141,169	$362,448	$163,329	$137,021
Annual Cost of NEFOP	$67,626	$36,730	$23,759	$13,141	$15,756	$13,934	$15,975	$12,682
NEFOP as pct of RTO (median)	42.2%		10.4%		5.8%		14.2%	
post-NEFOP RTO	$95,454	$72,095	$217,421	$153,564	$125,412	$351,076	$147,354	$135,976
Percent of Revenue from Herring	94.9%	6.3%	100.0%	0.0%	88.0%	15.0%	88.5%	17.9%
Percent of Revenue from Mackerel	8.1%	6.1%			19.5%	17.1%	2.1%	1.3%
Percent of Revenue from Squids							12.2%	8.5%
Percent of Revenue from Other Species	0.0%	0.1%			0.4%	0.5%	20.3%	12.5%
Average Number of Days at Sea	83	45	29	16	19	17	20	16
Average Number of Trips	28	15	46	29	12	15	10	12

Herring Alternative 2.1 – Sub Option 5

Fleet Level	Paired MWT	Purse Seine	Single MWT	SMBT
Number of Vessels	8	7	6	6
Total Days at Sea	663	204	116	117
Total Number of Trips	221	320	73	59
Total Herring Revenue	$9,152,836	$10,263,855	$3,606,269	$1,352,045
Total Mackerel Revenue	$657,345	$225	$570,246	$28,633
Total Squid Revenue				$171,323
Total Other Species Revenue	$4,109		$2,721	$237,472
Total Revenue	$9,814,290	$10,264,080	$4,179,236	$1,789,473

Total NEFOP Cost	$541,008	$166,313	$94,538	$95,852
NEFOP as pct of Total Revenue	5.5%	1.6%	2.3%	5.4%
NEFOP as pct of Herring Revenue	5.9%	1.6%	2.6%	7.1%

Herring Alternative 2.2 & 2.3 (100%) – ASM Coverage Only

Per Vessel	**Paired MWT**		**Purse Seine**		**Single MWT**		**SMBT**	
	Average	Stnd Dev	Average	Stnd Dev	Average	Stnd Dev	Average	Stnd Dev
Annual Gross Revenue	$1,338,354	$704,254	$1,364,372	$920,296	$1,026,390	$1,179,521	$1,875,233	$1,505,034
Annual Variable Costs	$318,252	$167,769	$330,865	$233,767	$284,996	$267,061	$594,112	$412,374
Annual Crew Share	$410,406	$213,633	$358,167	$270,086	$292,093	$332,733	$519,728	$451,846
Annual Repair/Maint/Upgrade/Haulout	$177,888	$98,231	$182,172	$119,312	$120,240	$101,172	$149,714	$94,073
Annual Fixed Costs	$268,728	$172,799	$251,988	$177,397	$187,892	$200,926	$467,553	$476,899
Annual Return-to-owner	$163,080	$89,827	$241,180	$162,152	$141,169	$362,448	$144,125	$113,903
Annual Cost of ASM	$73,219	$33,016	$39,764	$24,428	$20,079	$11,405	$15,122	$12,298
ASM as pct of RTO (median)	38.9%		12.1%		21.3%		10.0%	
post-ASM RTO	$89,862	$78,545	$201,417	$159,318	$121,089	$353,817	$129,003	$111,075
Percent of Revenue from Herring	91.2%	9.5%	100.0%	0.0%	81.9%	17.0%	52.4%	42.0%
Percent of Revenue from Mackerel	13.9%	8.2%	0.0%		19.4%	17.0%	2.6%	4.1%
Percent of Revenue from Squids							44.3%	39.7%
Percent of Revenue from Other Species	0.1%	0.1%			7.7%	17.0%	21.5%	17.9%
Average Number of Days at Sea	103	47	56	34	28	16	21	17
Average Number of Trips	34	16	64	37	22	20	11	16

Herring Alternative 2.2 & 2.3 (100%) – ASM Coverage Only

Fleet Level	**Paired MWT**	**Purse Seine**	**Single MWT**	**SMBT**
Number of Vessels	8	7	6	9
Total Days at Sea	825	392	170	192

Total Number of Trips	275	451	129	103
Total Herring Revenue	$9,409,389	$11,042,232	$3,842,873	$1,483,242
Total Mackerel Revenue	$1,155,588	$225	$570,246	$97,806
Total Squid Revenue				$529,723
Total Other Species Revenue	$5,906		$50,399	$485,180
Total Revenue	$10,570,883	$11,042,457	$4,463,518	$2,595,951
Total ASM Cost	$585,750	$278,346	$120,477	$136,100
ASM as pct of Total Revenue	5.5%	2.5%	2.7%	5.2%
ASM as pct of Herring Revenue	6.2%	2.5%	3.1%	9.2%

Herring Alternative 2.2 & 2.3 – Sub Option 5 (100%) – ASM Coverage Only

Per Vessel	Paired MWT		Purse Seine		Single MWT		SMBT	
	Average	Stnd Dev	Average	Stnd Dev	Average	Stnd Dev	Average	Stnd Dev
Annual Gross Revenue	$1,338,354	$704,254	$1,364,372	$920,296	$1,026,390	$1,179,521	$2,057,720	$1,835,879
Annual Variable Costs	$318,252	$167,769	$330,865	$233,767	$284,996	$267,061	$626,872	$501,818
Annual Crew Share	$410,406	$213,633	$358,167	$270,086	$292,093	$332,733	$583,258	$550,531
Annual Repair/Maint/Upgrade/Haulout	$177,888	$98,231	$182,172	$119,312	$120,240	$101,172	$141,508	$110,893
Annual Fixed Costs	$268,728	$172,799	$251,988	$177,397	$187,892	$200,926	$542,753	$581,061
Annual Return-to-owner	$163,080	$89,827	$241,180	$162,152	$141,169	$362,448	$163,329	$137,021
Annual Cost of ASM	$58,841	$31,959	$20,673	$11,434	$13,710	$12,124	$13,900	$11,034
ASM as pct of RTO (median)	36.7%		9.1%		5.1%		12.3%	
post-ASM RTO	$104,239	$73,608	$220,508	$154,643	$127,459	$352,543	$149,429	$136,046
Percent of Revenue from Herring	94.9%	6.3%	100.0%	0.0%	88.0%	15.0%	88.5%	17.9%
Percent of Revenue from Mackerel	8.1%	6.1%	0.0%		19.5%	17.1%	2.1%	1.3%
Percent of Revenue from Squids							12.2%	8.5%
Percent of Revenue from Other Species	0.0%	0.1%			0.4%	0.5%	20.3%	12.5%
Average Number of Days at Sea	83	45	29	16	19	17	20	16
Average Number of Trips	28	15	46	29	12	15	10	12

Herring Alternative 2.2 & 2.3 – Sub Option 5 (100%) – ASM Coverage Only

Fleet Level	Paired MWT	Purse Seine	Single MWT	SMBT
Number of Vessels	8	7	6	6
Total Days at Sea	663	204	116	117
Total Number of Trips	221	320	73	59
Total Herring Revenue	$9,152,836	$10,263,855	$3,606,269	$1,352,045
Total Mackerel Revenue	$657,345	$225	$570,246	$28,633
Total Squid Revenue				$171,323
Total Other Species Revenue	$4,109		$2,721	$237,472
Total Revenue	$9,814,290	$10,264,080	$4,179,236	$1,789,473

Total ASM Cost	$470,730	$144,709	$82,257	$83,400
ASM as pct of Total Revenue	4.8%	1.4%	2.0%	4.7%
ASM as pct of Herring Revenue	5.1%	1.4%	2.3%	6.2%

Herring Alternative 2.2 & 2.3 (75%) – ASM Coverage Only

Per Vessel	Paired MWT		Purse Seine		Single MWT		SMBT	
	Average	Stnd Dev	Average	Stnd Dev	Average	Stnd Dev	Average	Stnd Dev
Annual Return-to-owner	$163,080	$89,827	$241,180	$162,152	$141,169	$362,448	$144,125	$113,903
Annual Cost of ASM	$54,936	$24,736	$29,898	$18,339	$15,021	$8,472	$11,709	$9,100
ASM as pct of RTO (median)	29.7%		9.1%		15.9%		7.5%	
post-ASM RTO	$108,144	$80,253	$211,282	$159,725	$126,148	$356,073	$132,416	$111,831
Percent of Revenue from Herring	91.3%	9.4%	100.0%	0.0%	82.5%	16.2%	52.7%	42.0%
Percent of Revenue from Mackerel	13.8%	8.0%	0.0%		19.3%	16.7%	2.6%	4.0%
Percent of Revenue from Squids							44.3%	39.8%
Percent of Revenue from Other Species	0.1%	0.1%			7.5%	16.5%	22.6%	19.1%
Average Number of Days at Sea	77	35	42	26	21	12	16	13

Herring Alternative 2.2 & 2.3 (75%) – ASM Coverage Only

Fleet Level	Paired MWT	Purse Seine	Single MWT	SMBT
Number of Vessels	8	7	6	9
Total Days at Sea	619	295	127	148
Total Herring Revenue	$7,069,090	$8,301,401	$2,870,099	$1,106,513
Total Mackerel Revenue	$865,766	$225	$436,137	$73,907
Total Squid Revenue				$440,897
Total Other Species Revenue	$4,749		$39,714	$385,635
Total Revenue	$7,939,606	$8,301,626	$3,345,950	$2,006,952
Total ASM Cost	$439,489	$209,288	$90,126	$105,382
ASM as pct of Total Revenue	5.5%	2.5%	2.7%	5.3%
ASM as pct of Herring Revenue	6.2%	2.5%	3.1%	9.5%

Herring Alternative 2.2 & 2.3 – Sub Option 5 (75%) – ASM Coverage Only

Per Vessel	Paired MWT		Purse Seine		Single MWT		SMBT	
	Average	Stnd Dev	Average	Stnd Dev	Average	Stnd Dev	Average	Stnd Dev
Annual Return-to-owner	$163,080	$89,827	$241,180	$162,152	$141,169	$362,448	$163,329	$137,021
Annual Cost of ASM	$44,198	$23,997	$15,571	$8,472	$10,298	$9,099	$10,474	$8,230
ASM as pct of RTO (median)	28.2%		6.8%		3.8%		9.4%	
post-ASM RTO	$118,882	$76,712	$225,610	$156,562	$130,870	$354,992	$152,855	$136,065
Percent of Revenue from Herring	94.9%	6.2%	100.0%	0.0%	88.1%	14.8%	89.2%	16.8%
Percent of Revenue from Mackerel	8.7%	6.0%	0.0%		19.4%	17.0%	2.2%	1.1%
Percent of Revenue from Squids							11.8%	8.4%
Percent of Revenue from Other Species	0.0%	0.1%			0.5%	0.8%	19.6%	11.3%
Average Number of Days at Sea	62	34	22	12	15	13	15	12

Herring Alternative 2.2 & 2.3 – Sub Option 5 (75%) – ASM Coverage Only

Fleet Level	Paired MWT	Purse Seine	Single MWT	SMBT
Number of Vessels	8	7	6	6
Total Days at Sea	498	154	87	89
Total Herring Revenue	$6,874,690	$7,702,188	$2,712,401	$1,024,121
Total Mackerel Revenue	$526,863	$225	$433,487	$21,556
Total Squid Revenue				$130,869
Total Other Species Revenue	$3,148		$2,345	$190,706
Total Revenue	$7,404,700	$7,702,413	$3,148,233	$1,367,252
Total ASM Cost	$353,586	$108,996	$61,791	$62,845
ASM as pct of Total Revenue	4.8%	1.4%	2.0%	4.6%
ASM as pct of Herring Revenue	5.1%	1.4%	2.3%	6.1%

Herring Alternative 2.2 & 2.3 (50%) – ASM Coverage Only

Per Vessel	Paired MWT		Purse Seine		Single MWT		SMBT	
	Average	Stnd Dev	Average	Stnd Dev	Average	Stnd Dev	Average	Stnd Dev
Annual Return-to-owner	$163,080	$163,080	$241,180	$241,180	$141,169	$141,169	$144,125	$144,125
Annual Cost of ASM	$36,875	$16,417	$19,846	$12,053	$10,145	$5,662	$8,483	$6,375
ASM as pct of RTO (median)	20.4%		6.0%		10.5%		5.4%	
post-ASM RTO	$126,205	$82,980	$221,334	$160,394	$131,024	$358,152	$135,643	$112,417
Percent of Revenue from Herring	91.4%	9.3%	100.0%	0.0%	83.3%	15.4%	53.6%	42.2%
Percent of Revenue from Mackerel	14.1%	8.0%	0.0%		19.1%	16.2%	2.9%	4.4%
Percent of Revenue from Squids							44.5%	39.8%
Percent of Revenue from Other Species	0.1%	0.2%			8.2%	17.9%	24.7%	21.7%
Average Number of Days at Sea	52	23	28	17	14	8	12	9

Herring Alternative 2.2 & 2.3 (50%) – ASM Coverage Only

Fleet Level	Paired MWT	Purse Seine	Single MWT	SMBT
Number of Vessels	8	7	6	9
Total Days at Sea	415	196	86	108
Total Herring Revenue	4,732,456	5,510,474	1,943,001	748,019
Total Mackerel Revenue	591,520	225	310,908	56,804
Total Squid Revenue				369,787
Total Other Species Revenue	3,503		33,722	312,508
Total Revenue	5,327,480	5,510,699	2,287,630	1,487,117
Total ASM Cost	$294,999	$138,922	$60,867	$76,346
ASM as pct of Total Revenue	5.5%	2.5%	2.7%	5.1%
ASM as pct of Herring Revenue	6.2%	2.5%	3.1%	10.2%

Herring Alternative 2.2 & 2.3 – Sub Option 5 (50%) – ASM Coverage Only

Per Vessel	Paired MWT		Purse Seine		Single MWT		SMBT	
	Average	Stnd Dev	Average	Stnd Dev	Average	Stnd Dev	Average	Stnd Dev
Annual Return-to-owner	$163,080	$89,827	$241,180	$162,152	$141,169	$362,448	$163,329	$137,021
Annual Cost of ASM	$29,489	$15,844	$10,464	$5,525	$6,999	$6,001	$7,247	$5,562
ASM as pct of RTO (median)	18.9%		4.5%		2.5%		6.4%	
post-ASM RTO	$133,591	$80,718	$230,716	$158,500	$134,170	$357,624	$156,082	$136,133
Percent of Revenue from Herring	95.0%	6.2%	100.0%	0.0%	88.5%	14.0%	90.2%	15.2%
Percent of Revenue from Mackerel	10.3%	6.6%	0.0%		19.3%	16.4%	2.7%	0.6%
Percent of Revenue from Squids							11.2%	7.8%
Percent of Revenue from Other Species	0.0%	0.1%			0.8%	1.3%	20.1%	9.6%
Average Number of Days at Sea	42	22	15	8	10	8	10	8

Herring Alternative 2.2 & 2.3 – Sub Option 5 (50%) – ASM Coverage Only

Fleet Level	Paired MWT	Purse Seine	Single MWT	SMBT
Number of Vessels	8	7	6	6
Total Days at Sea	332	103	59	61
Total Herring Revenue	$4,580,747	$5,158,742	$1,820,329	$708,574
Total Mackerel Revenue	$417,898	$225	$310,536	$15,657
Total Squid Revenue				$95,931
Total Other Species Revenue	$2,109		$2,117	$159,514
Total Revenue	$5,000,754	$5,158,967	$2,132,982	$979,676
Total ASM Cost	$235,915	$73,250	$41,994	$43,482
ASM as pct of Total Revenue	4.7%	1.4%	2.0%	4.4%
ASM as pct of Herring Revenue	5.2%	1.4%	2.3%	6.1%

Herring Alternative 2.2 & 2.3 (25%) – ASM Coverage Only

Per Vessel	Paired MWT		Purse Seine		Single MWT		SMBT	
	Average	Stnd Dev	Average	Stnd Dev	Average	Stnd Dev	Average	Stnd Dev
Annual Return-to-owner	$163,080	$89,827	$241,180	$162,152	$141,169	$362,448	$144,125	$113,903
Annual Cost of ASM	$18,578	$7,854	$10,041	$5,914	$5,498	$2,600	$5,642	$4,539
ASM as pct of RTO (median)	10.1%		3.0%		5.6%		3.5%	
post-ASM RTO	$144,503	$86,107	$231,139	$161,277	$135,671	$360,600	$138,483	$112,951
Percent of Revenue from Herring	91.8%	9.0%	100.0%	0.0%	85.0%	13.7%	55.0%	42.1%
Percent of Revenue from Mackerel	16.3%	8.9%	0.1%		20.0%	15.2%	3.1%	4.4%
Percent of Revenue from Squids							44.6%	39.8%
Percent of Revenue from Other Species	0.2%	0.4%			9.0%	19.4%	27.6%	26.7%
Average Number of Days at Sea	26	11	14	8	8	4	8	6

Herring Alternative 2.2 & 2.3 (25%) – ASM Coverage Only

Fleet Level	Paired MWT	Purse Seine	Single MWT	SMBT
Number of Vessels	8	7	6	9
Total Days at Sea	209	99	46	72
Total Herring Revenue	$2,394,688	$2,774,156	$981,948	$448,402
Total Mackerel Revenue	$357,710	$225	$213,945	$39,547
Total Squid Revenue				$305,034
Total Other Species Revenue	$2,470		$28,154	$249,797
Total Revenue	$2,754,868	$2,774,381	$1,224,046	$1,042,780
Total ASM Cost	$148,622	$70,288	$32,987	$50,782
ASM as pct of Total Revenue	5.4%	2.5%	2.7%	4.9%
ASM as pct of Herring Revenue	6.2%	2.5%	3.4%	11.3%

Herring Alternative 2.2 & 2.3 – Sub Option 5 (25%) – ASM Coverage Only

Per Vessel	Paired MWT		Purse Seine		Single MWT		SMBT	
	Average	Stnd Dev	Average	Stnd Dev	Average	Stnd Dev	Average	Stnd Dev
Annual Return-to-owner	$163,080	$89,827	$241,180	$162,152	$141,169	$362,448	$163,329	$137,021
Annual Cost of ASM	$14,949	$7,649	$5,370	$2,578	$3,994	$2,978	$4,560	$3,380
ASM as pct of RTO (median)	9.6%		2.2%		1.4%		3.8%	
post-ASM RTO	$148,131	$85,224	$235,811	$160,535	$137,175	$360,395	$158,769	$136,042
Percent of Revenue from Herring	95.4%	5.8%	100.0%	0.0%	89.3%	12.8%	90.9%	14.1%
Percent of Revenue from Mackerel	15.5%	9.9%	0.1%		20.1%	15.6%	3.1%	0.1%
Percent of Revenue from Squids							11.0%	7.2%
Percent of Revenue from Other Species	0.0%	0.1%			1.3%	2.0%	21.7%	8.6%
Average Number of Days at Sea	21	11	8	4	6	4	6	5

Herring Alternative 2.2 & 2.3 – Sub Option 5 (25%) – ASM Coverage Only

Fleet Level	Paired MWT	Purse Seine	Single MWT	SMBT
Number of Vessels	8	7	6	6
Total Days at Sea	168	53	34	39
Total Herring Revenue	$2,317,299	$2,591,280	$940,773	$452,532
Total Mackerel Revenue	$336,069	$225	$205,825	$10,562
Total Squid Revenue				$68,202
Total Other Species Revenue	$1,128		$1,920	$135,106
Total Revenue	$2,654,496	$2,591,505	$1,148,518	$666,402
Total ASM Cost	$119,591	$37,587	$23,964	$27,358
ASM as pct of Total Revenue	4.5%	1.5%	2.1%	4.1%
ASM as pct of Herring Revenue	5.2%	1.5%	2.5%	6.0%

Herring Alternative 2.3 and 2.4 (100% EM at $325 per day, 100% PS at $5.12 per mt)

Per Vessel	Paired MWT		Single MWT	
	Average	Stnd Dev	Average	Stnd Dev
Annual Gross Revenue	$1,338,354	$704,254	$912,105	$1,024,851
Annual Variable Costs	$318,252	$167,769	$264,620	$232,352
Annual Crew Share	$410,406	$213,633	$239,242	$297,854
Annual Repair/Maint/Haulout	$177,888	$98,231	$110,742	$90,131
Annual Fixed Costs	$268,728	$172,799	$163,296	$175,943
Annual Return-to-owner	$163,080	$89,827	$134,205	$310,157
Annual Cost of EM - year 1	$48,516	$15,113	$22,300	$5,316
Annual Cost of EM - year 2	$33,516	$15,113	$7,300	$5,316
Annual Cost of PS	$23,684	$15,503	$9,471	$16,229
Total Monitoring Costs as pct of RTO - year 1 (median)	42.2%		37.3%	
Total Monitoring Costs as pct of RTO - year 2 (median)	29.1%		12.8%	
Post-monitoring RTO -- year 1	$90,881	$74,211	$102,434	$292,275
Post-monitoring RTO -- year 2	$105,881	$74,211	$117,434	$292,275
Percent of Revenue from Herring	91.2%	9.5%	86.0%	16.3%
Percent of Revenue from Mackerel	13.9%	8.2%	15.5%	17.1%
Percent of Revenue from Squids			2.9%	
Percent of Revenue from Other Species	0.1%	0.1%	6.4%	15.5%
Average Number of Days at Sea	103	47	23	17
Average Number of Trips	34	16	18	18

Herring Alternative 2.3 and 2.4 (100% EM at $187 per day, 50% PS at $3.84 per mt)

Per Vessel	Paired MWT		Single MWT	
	Average	Stnd Dev	Average	Stnd Dev
Annual Return-to-owner	$163,080	$89,827	$134,205	$310,157
Annual Cost of EM - year 1	$34,284	$8,696	$19,200	$3,059
Annual Cost of EM - year 2	$19,284	$8,696	$4,200	$3,059
Annual Cost of PS	$8,585	$5,620	$3,433	$5,883
Total Monitoring Costs as pct of RTO - year 1 (median)	25.1%		26.7%	
Total Monitoring Costs as pct of RTO - year 2 (median)	14.4%		6.9%	
Post-monitoring RTO -- year 1	$120,211	$82,109	$111,572	$302,913
Post-monitoring RTO -- year 2	$135,211	$82,109	$126,572	$302,913

Herring Alternative 2.3 and 2.4(100% EM at $325 per day, 100% PS at $5.12 per mt)

Fleet Level	Paired MWT	Single MWT
Number of Vessels	8	8
Total Days at Sea	825	180
Total Number of Trips	275	140
Total Herring Revenue	$9,409,389	$3,873,778
Total Mackerel Revenue	$1,155,588	$570,248
Total Squid Revenue		$441
Total Other Species Revenue	$5,906	$50,421
Total Revenue	$10,570,883	$4,494,888
Total EM Cost - year 1	$388,125	$178,398
Total EM Cost - year 2	$268,125	$58,398
Total PS Cost	$189,470	$75,767
Total Monitoring Costs - year 1	$577,595	$254,165
Total Monitoring Costs - year 2	$457,595	$134,165
Monitoring Costs as pct of Total Revenue -- year 1	5.5%	5.7%
Monitoring Costs as pct of Total Revenue -- year 2	4.3%	3.0%

Monitoring Costs as pct of Herring Revenue -- year 1	6.1%	6.6%
Monitoring Costs as pct of Herring Revenue -- year 2	4.9%	3.5%

Herring Alternative 2.3 and 2.4 (100% EM at $187 per day, 50% PS at $3.84 per mt)

Fleet Level	Paired MWT	Single MWT
Number of Vessels	8	8
Total Days at Sea	825	180
Total Number of Trips	275	140
Total Herring Revenue	$9,409,389	$3,873,778
Total Mackerel Revenue	$1,155,588	$570,248
Total Squid Revenue		$441
Total Other Species Revenue	$5,906	$50,421
Total Revenue	$10,570,883	$4,494,888
Total EM Cost - year 1	$274,275	$153,601
Total EM Cost - year 2	$154,275	$33,601
Total PS Cost	$68,683	$27,465
Total Monitoring Costs - year 1	$342,958	$181,067
Total Monitoring Costs - year 2	$222,958	$61,067
Monitoring Costs as pct of Total Revenue -- year 1	3.2%	4.0%
Monitoring Costs as pct of Total Revenue -- year 2	2.1%	1.4%
Monitoring Costs as pct of Herring Revenue -- year 1	3.6%	4.7%
Monitoring Costs as pct of Herring Revenue -- year 2	2.4%	1.6%

Herring Alternative 2.3 and 2.4 – Sub Option 5 (100% EM at $325 per day, 100% PS at $5.12 per mt)

Per Vessel	Paired MWT		Single MWT	
	Average	Stnd Dev	Average	Stnd Dev
Annual Gross Revenue	$1,338,354	$704,254	$990,082	$1,081,027
Annual Variable Costs	$318,252	$167,769	$284,110	$243,803
Annual Crew Share	$410,406	$213,633	$259,816	$315,519
Annual Repair/Maint/Haulout	$177,888	$98,231	$120,806	$92,369
Annual Fixed Costs	$268,728	$172,799	$175,636	$186,264
Annual Return-to-owner	$163,080	$89,827	$149,714	$331,640
Annual Cost of EM - year 1	$41,934	$14,629	$20,425	$5,543
Annual Cost of EM - year 2	$26,934	$14,629	$5,425	$5,543
Annual Cost of PS	$22,205	$15,461	$9,943	$17,483
Total Monitoring Costs as pct of RTO - year 1 (median)	40.1%		19.5%	
Total Monitoring Costs as pct of RTO - year 2 (median)	27.5%		4.9%	
Post-monitoring RTO -- year 1	$98,941	$73,425	$119,346	$312,177
Post-monitoring RTO -- year 2	$113,941	$73,425	$134,346	$312,177
Percent of Revenue from Herring	94.9%	6.3%	89.7%	14.4%
Percent of Revenue from Mackerel	8.1%	6.1%	19.5%	17.1%
Percent of Revenue from Squids				
Percent of Revenue from Other Species	0.0%	0.1%	0.4%	0.5%
Average Number of Days at Sea	83	45	17	17
Average Number of Trips	28	15	11	15

Herring Alternative 2.3 and 2.4 – Sub Option 5 (100% EM at $187 per day, 50% PS at $3.84 per mt)

Per Vessel	Paired MWT		Single MWT	
	Average	Stnd Dev	Average	Stnd Dev
Annual Return-to-owner	$163,080	$89,827	$149,714	$331,640
Annual Cost of EM - year 1	$30,498	$8,417	$18,122	$3,189
Annual Cost of EM - year 2	$15,498	$8,417	$3,122	$3,189
Annual Cost of PS	$8,049	$5,605	$3,604	$6,338
Total Monitoring Costs as pct of RTO - year 1 (median)	24.2%		16.9%	
Total Monitoring Costs as pct of RTO - year 2 (median)	13.3%		2.4%	
Post-monitoring RTO -- year 1	$124,533	$81,356	$127,988	$323,695
Post-monitoring RTO -- year 2	$139,533	$81,356	$142,988	$323,695

Herring Alternative 2.3 and 2.4 – Sub Option 5 (100% EM at $325 per day, 100% PS at $5.12 per mt)

Fleet Level	Paired MWT	Single MWT
Number of Vessels	8	7
Total Days at Sea	663	117
Total Number of Trips	221	75
Total Herring Revenue	$9,152,836	$3,618,705
Total Mackerel Revenue	$657,345	$570,246
Total Squid Revenue		
Total Other Species Revenue	$4,109	$2,721
Total Revenue	$9,814,290	$4,191,672
Total EM Cost - year 1	$335,475	$142,978
Total EM Cost - year 2	$215,475	$37,978
Total PS Cost	$177,642	$69,602
Total Monitoring Costs - year 1	$513,117	$212,580
Total Monitoring Costs - year 2	$393,117	$107,580
Monitoring Costs as pct of Total Revenue -- year 1	5.2%	5.1%
Monitoring Costs as pct of Total Revenue -- year 2	4.0%	2.6%

Monitoring Costs as pct of Herring Revenue -- year 1	5.6%	5.9%
Monitoring Costs as pct of Herring Revenue -- year 2	4.3%	3.0%

Herring Alternative 2.3 and 2.4 – Sub Option 5 (100% EM at $187 per day, 50% PS at $3.84 per mt)

Fleet Level	Paired MWT	Single MWT
Number of Vessels	8	7
Total Days at Sea	663	117
Total Number of Trips	221	75
Total Herring Revenue	$9,152,836	$3,618,705
Total Mackerel Revenue	$657,345	$570,246
Total Squid Revenue		
Total Other Species Revenue	$4,109	$2,721
Total Revenue	$9,814,290	$4,191,672
Total EM Cost - year 1	$243,981	$126,852
Total EM Cost - year 2	$123,981	$21,852
Total PS Cost	$64,395	$25,231
Total Monitoring Costs - year 1	$308,376	$152,083
Total Monitoring Costs - year 2	$188,376	$47,083
Monitoring Costs as pct of Total Revenue -- year 1	3.1%	3.6%
Monitoring Costs as pct of Total Revenue -- year 2	1.9%	1.1%
Monitoring Costs as pct of Herring Revenue -- year 1	3.4%	4.2%
Monitoring Costs as pct of Herring Revenue -- year 2	2.1%	1.3%

Herring Alternative 2.5

Per Vessel	Average	Stnd Dev
Annual Gross Revenue	$1,752,994	$822,480
Annual Variable Costs	$409,945	$181,028
Annual Crew Share	$527,920	$227,404
Annual Repair/Maint/Upgrade/Haulout	$208,650	$73,627
Annual Fixed Costs	$340,386	$171,281
Annual Return-to-owner	$266,094	$239,382
Annual Cost of NEFOP	$9,353	$7,604
NEFOP as pct of RTO (median)	4.0%	
post-NEFOP RTO	$256,740	$244,116
Percent of Revenue from Herring	99.9%	0.4%
Percent of Revenue from Mackerel		
Percent of Revenue from Squids		
Percent of Revenue from Other Species	0.2%	0.4%
Average Number of Days at Sea	11	9
Average Number of Trips	4	3

Fleet Level	
Number of Vessels	8
Total Days at Sea	92
Total Number of Trips	33
Total Herring Revenue	$1,437,094
Total Mackerel Revenue	
Total Squid Revenue	
Total Other Species Revenue	$1,170
Total Revenue	$1,438,264
Total NEFOP Cost	$74,827
NEFOP as pct of Total Revenue	5.2%
NEFOP as pct of Herring Revenue	5.2%

Herring Alternative 2.5 – Sub Option 5

Per Vessel	Average	Stnd Dev
Annual Gross Revenue	$1,752,994	$822,480
Annual Variable Costs	$409,945	$181,028
Annual Crew Share	$527,920	$227,404
Annual Repair/Maint/Upgrade/Haulout	$208,650	$73,627
Annual Fixed Costs	$340,386	$171,281
Annual Return-to-owner	$266,094	$239,382
Annual Cost of NEFOP	$6,293	$3,131
NEFOP as pct of RTO (median)	3.7%	
post-NEFOP RTO	$259,800	$241,604
Percent of Revenue from Herring	100.0%	0.0%
Percent of Revenue from Mackerel		
Percent of Revenue from Squids		
Percent of Revenue from Other Species	0.0%	0.0%
Average Number of Days at Sea	8	4
Average Number of Trips	3	1

Fleet Level	
Number of Vessels	8
Total Days at Sea	62
Total Number of Trips	23
Total Herring Revenue	$1,379,191
Total Mackerel Revenue	
Total Squid Revenue	
Total Other Species Revenue	
Total Revenue	$1,379,191
Total NEFOP Cost	$50,347
NEFOP as pct of Total Revenue	3.7%
NEFOP as pct of Herring Revenue	3.7%

Herring Alternative 2.6

Analyses are not yet complete for this alternative. Alternative 2.6 applies the same criteria as found in Alternatives 2.2, 2.3, and 2.4 but only for vessels that fish in groundfish closed areas. However, in order to provide a means for obtaining a reasonably reliable estimate of the impacts of Alternative 2.6, the following two tables are provided. The first table shows the major differences between Alternatives 2.1 and 2.5 at 100% coverage for trips with > 1 lb of herring landed (the second table shows the differences for trips > 25 mt – Sub-Option 5). These two alternatives are identical except that Alternative 2.5 applies only to vessels that fish in groundfish closed areas and applies to MWT vessels with category A through E herring permits whereas Alternative 2.1 applies to vessel with category A and B permits only. Therefore, these differences can be used to estimate the impacts of Alternative 2.6.

Trips with Herring Landings > 1 lb (includes all gear types)

	Herring Alternative 2.1	Herring Alternative 2.5	Herring Alternative 2.5 as a Percent of Alternative 2.1	
Number of Vessels	30	8	26.7%	
Total Days at Sea	1,579	92	5.8%	
Number of Trips	958	33	3.4%	
Total Revenue	$28,672,809	$1,438,264	5.0%	Use this for estimating portside sampling costs for Alternative 2.6
Total NEFOP Cost	$1,287,985	$74,827	5.8%	Use this for estimating EM and ASM costs for Alternative 2.6

Trips with Herring Landings > 25 mt (Sub-Option 5) (includes all gear types)

	Herring Alternative 2.1	Herring Alternative 2.5	Herring Alternative 2.5 as a Percent of Alternative 2.1	
Number of Vessels	27	8	29.6%	
Total Days at Sea	1,100	62	5.6%	
Number of Trips	673	23	3.4%	
Total Revenue	$246,047,079	$1,379,191	5.6%	Use this for estimating portside sampling costs for Alternative 2.6
Total NEFOP Cost	$897,711	$50,347	5.6%	Use this for estimating EM and ASM costs for Alternative 2.6

Appendix 9 - ATLANTIC MACKEREL ALTERNATIVE ECONOMIC IMPACTS ON MACKEREL FISHING BUSINESSES

Impact Analysis Methods

Four types of industry-funded monitoring for the mackerel fishery are being considered: Northeast Fisheries Observer Program (NEFOP) level observer, at-sea monitor (ASM), Electronic Monitoring (EM), and portside sampling (PS) coverage. NEFOP-level and at-sea monitoring coverage would function independently, but EM and portside are intended to be used together.

MONITORING COSTS TO INDUSTRY

Types of Monitoring	NEFOP-Level Observer	At-Sea Monitor	Electronic Monitoring	Portside Sampling
Industry Cost Responsibility	$818 per seaday	$710 per seaday	Year 1: $15,000 one-time set up cost then $325 (and $187) per seaday Year 2: $325 (and $187) per seaday	$0.0023 per lb ($5.12 per mt) and at $0.00174 per lb ($3.84 per mt)

Trips that occurred in 2014 were used to estimate the likely future impacts of the mackerel alternatives. This is the most recent year for which data is available and 2014 activity should represent what is likely to occur in future years in terms of the vessels participating in the fishery, the condition of the stock, the regulatory environment, and fishing methods. Each alternative has different criteria for defining which types of trips would be monitored (based on permit type, gear used, etc.). Trips from 2014 that met these criteria were evaluated in terms of how the monitoring costs impacted annual returns to owner (see below for description of how return-to-owner (RTO) was calculated). If an alternative specified 100% coverage, then the monitoring costs that would have been paid for all trips occurring in 2014 were calculated and assessed in terms of impacts to RTO. For alternatives that have options with less than 100% coverage, trips from the pool of 2014 trips were randomly selected until the coverage target was met. This was repeated 1,000 times for each trip selection simulation.

Mean annual ASM/NEFOP costs per vessel are then calculated from the simulated trip selections.

Vessels were assigned a major gear type based on the gear that earned the greatest revenue (from all species landed) among the trips selected for evaluation (according to the criteria in the alternative). It is not necessarily the major gear for the year for a particular vessel.

In the tables, any information that pertains to amounts of revenue from various species and numbers of days at sea and trips are for the trips that met the criteria under each of the alternatives only, not for the year.

Return-to-Owner

A previous analysis of economic impacts of herring and mackerel coverage target alternatives was based on trip cost data collected by the NEFOP and showed the economic impact of the alternatives on vessel net revenues (gross revenues less trip costs). Because NEFOP only collects a limited amount of cost data, industry participants expressed concern that net revenue estimates used in the previous economic analysis underestimated vessel costs. In response, Jason Didden, staff of the Mid-Atlantic Council, offered to survey herring and mackerel vessels to collect more detailed cost information.

The survey requested information from vessel owners on total trip costs in 2014. The cost survey collected information on variable trip costs, the cost of repairs/maintenance/upgrades/haulout, fixed costs, and payments to crew. These data were used to update the impact analyses. If the vessel owner completed a survey then that vessel's actual costs were used in the analysis. Otherwise, respondent data were used to project costs on other vessels that did not provide a survey response. To do this, responses from the surveys were categorized by the annual primary species caught based on value. Two categories were used: herring/mackerel vessels and squid vessels. For each of these vessel types, costs were assigned into one of four categories: variable costs, crew share, repair/maint/upgrades/haulout, and fixed costs. Average percentages of annual gross revenue by cost category and vessel type were used to estimate costs for vessels that did not have survey data. See table below for cost category descriptions and average percentages of gross revenue.

Surveys were sent to approximately 18 vessel owners (representing about 26 vessels) in the herring and/or mackerel fisheries. Surveys were sent in May 2015 and information was submitted for 16 of the 26 vessels.

Cost category	Description	Average percent of gross revenue	
		Herring/ mackerel vessels	Squid vessels
Variable costs	Annual fuel, oil, food, water, ice, carrier vessel, communication, fishing supplies, crew supplies, and catch handling costs	25%	35%
Crew share	Total annual payments to crew	28%	26%
Repair/ maintenance/ upgrades/ haulout (RMUH)	Annual cost of repairs to engines, deck equipment, machinery, hull, fishing gear, electronics, processing equipment, refrigeration, and safety equipment. Includes haulout costs. Because these costs vary considerably from year to year and upgrade costs were combined with repair/maintenance costs, half of these costs were amortized over 7 years.	13%	11%
Fixed costs	Annual mooring/dockage, permits/licenses, insurance, quota/DAS lease, crew benefits, vessel monitoring, workshop/storage, office, vehicle, travel, association, professional, interest, taxes, and non-crew labor costs. Note: principal payments on business loans are not included in fixed costs.	19%	21%
Return to Owner (RTO)	Gross revenue less variable, crew share, RMUH, and fixed costs	15%	7%

Major Findings

There were two vessel types examined for economic impacts from the mackerel alternatives: paired MWT vessels and a second category that combines single MWT & SMBT vessels (these vessel types are combined for data confidentially reasons). Among the two vessels types evaluated, average per vessel monitoring costs as a percentage of RTO are similar across all scenarios within alternatives 2.1 and 2.2. The average number of monitored seadays per vessel are also similar.

For alternative 2.3 average per vessel monitoring costs as a percent of RTO for single MWT vessels and paired MWT vessels are similar (around 3% to 4%). For these vessel types, only EM and PS monitoring costs apply. SMBT would not have EM/PS costs but would have ASM costs. The impact of these ASM costs on RTO cannot be reported for data confidentiality reasons. For MWT vessels, alternative 2.4 has identical impacts to alternative 2.3.

For the vessels impacted by the mackerel alternatives, mackerel revenue comprises a smaller portion of total revenue than does herring as a percent of total revenue under the herring alternatives. That is, revenue from species that are not the focus of the alternative (non-mackerel species in this case) contributes more significantly to covering mackerel-based monitoring costs than do non-herring species under the herring alternatives. Across all mackerel alternatives, the average percent mackerel revenue never exceeds 75%.

The average percent revenue from mackerel for single MWT vessels are about 20 percentage points lower than paired MWT vessels indicating that single MWT vessels must rely more heavily on non-mackerel revenue in order to cover mackerel-based monitoring requirements.

Exempting trips less than 25 mt from monitoring requirements reduces the cost by about 30% in alternatives 2.1 and 2.2 and by about 23% in alternatives 2.3 and 2.4.

Using EM and PS monitoring in place of ASM on MWT vessels results in no change in monitoring costs in year 1 for paired MWT vessels but a 14% cost saving in year 2. For single MWT and SMBT vessels combined, costs increase by 13% in year 1 and 7% in year 2.

There is significant crossover of vessels impacted by both the herring alternatives and the mackerel alternatives. For example, all of the vessels impacted by mackerel alternative 2.1 are also impacted by herring alternative 2.1.

Reducing EM costs from $325 to $187 per day and only monitoring half of the portside sampling trips at a rate of $3.84 per mt, as opposed to all trips at $5.12 per mt, reduces total monitoring costs by 52% for paired MWT vessels ($45,812 to $21,796) in year 2. For single MWT vessels, costs are reduced by 55% ($34,421 to $15,364).

Mackerel Alternative 2.1 (100%)

Per Vessel	Paired MWT		Single MWT & SMBT	
	Average	Stnd Dev	Average	Stnd Dev
Annual Gross Revenue	$1,698,295	$243,698	$2,179,669	$1,819,008
Annual Variable Costs	$402,791	$65,429	$625,479	$482,473
Annual Crew Share	$523,079	$43,947	$613,595	$544,347
Annual Repair/Maint/Haulout	$225,981	$46,751	$156,964	$110,071
Annual Fixed Costs	$341,930	$124,936	$537,927	$540,915
Annual Return-to-owner	$204,514	$52,550	$245,704	$291,036
Annual Cost of NEFOP	$10,200	$6,273	$11,275	$9,460
NEFOP as pct of RTO (median)	5.1%		11.9%	
post-NEFOP RTO	$194,314	$48,697	$234,429	$292,923
Percent of Revenue from Herring	35.7%	36.4%	45.7%	34.2%
Percent of Revenue from Mackerel	64.1%	36.4%	34.9%	21.1%
Percent of Revenue from Squids			9.9%	13.1%
Percent of Revenue from Other Species	0.2%	0.2%	38.2%	44.6%
Average Number of Days at Sea	13	8	14	12
Average Number of Trips	4	3	3	2

Mackerel Alternative 2.1 (100%)

Fleet Level	Paired MWT	Single MWT & SMBT
Number of Vessels	6	7
Total Days at Sea	75	97
Total Number of Trips	25	21
Total Herring Revenue	$275,720	$688,416
Total Mackerel Revenue	$1,184,211	$850,276
Total Squid Revenue		$93,069
Total Other Species Revenue	$2,895	$749,911
Total Revenue	$1,462,826	$2,381,672
Total NEFOP Cost	$61,200	$78,926
NEFOP as pct of Total Revenue	4.2%	3.3%
NEFOP as pct of Mackerel Revenue	5.2%	9.3%

Mackerel Alternative 2.1—Sub Option 6 (100%)

Per Vessel	Paired MWT		Single MWT & SMBT	
	Average	Stnd Dev	Average	Stnd Dev
Annual Gross Revenue	$1,706,040	$271,636	$2,574,720	$2,082,561
Annual Variable Costs	$402,170	$73,132	$684,427	$578,997
Annual Crew Share	$524,828	$48,900	$743,633	$611,125
Annual Repair/Maint/Upgrade/Haulout	$220,871	$50,362	$180,777	$128,395
Annual Fixed Costs	$345,165	$139,401	$661,531	$612,688
Annual Return-to-owner	$213,005	$53,954	$304,352	$333,578
Annual Cost of NEFOP	$8,813	$3,713	$10,451	$6,260
NEFOP as pct of RTO (median)	4.3%		6.9%	
post-NEFOP RTO	$204,193	$51,645	$293,901	$336,095
Percent of Revenue from Herring	25.7%	33.5%	34.5%	29.9%
Percent of Revenue from Mackerel	74.2%	33.5%	45.9%	20.0%
Percent of Revenue from Squids			0.5%	0.2%
Percent of Revenue from Other Species	0.2%	0.3%	46.4%	53.7%
Average Number of Days at Sea	11	5	13	8
Average Number of Trips	4	2	3	2

Mackerel Alternative 2.1—Sub Option 6 (100%)

Fleet Level	Paired MWT	Single MWT & SMBT
Number of Vessels	5	5
Total Days at Sea	54	64
Total Number of Trips	18	15
Total Herring Revenue	$206,648	$463,726
Total Mackerel Revenue	$1,132,514	$808,274
Total Squid Revenue		$4,216
Total Other Species Revenue	$2,268	$674,817
Total Revenue	$1,341,430	$1,951,033
Total NEFOP Cost	$44,064	$52,257
NEFOP as pct of Total Revenue	3.3%	2.7%
NEFOP as pct of Mackerel Revenue	3.9%	6.5%

Mackerel Alternative 2.1 SMBT Tier 2 (50%)

No landings of mackerel > 20,000 lbs by SMBT with tier 2 permits.

Mackerel Alternative 2.1 SMBT Tier 3 (25%)

No landings of mackerel > 20,000 lbs by SMBT with tier 3 permits.

Mackerel Alternative 2.2 & 2.3 (100%) – Observer Coverage Only

Per Vessel	Paired MWT		Single MWT & SMBT	
	Average	Stnd Dev	Average	Stnd Dev
Annual Gross Revenue	$1,698,295	$243,698	$2,179,669	$1,819,008
Annual Variable Costs	$402,791	$65,429	$625,479	$482,473
Annual Crew Share	$523,079	$43,947	$613,595	$544,347
Annual Repair/Maint/Haulout	$225,981	$46,751	$156,964	$110,071
Annual Fixed Costs	$341,930	$124,936	$537,927	$540,915
Annual Return-to-owner	$204,514	$52,550	$245,704	$291,036
Annual Cost of ASM	$8,875	$5,458	$9,810	$8,231
ASM as pct of RTO (median)	4.4%		10.3%	
post-ASM RTO	$195,639	$49,169	$235,894	$292,661
Percent of Revenue from Herring	35.7%	36.4%	45.7%	34.2%
Percent of Revenue from Mackerel	64.1%	36.4%	34.9%	21.1%
Percent of Revenue from Squids			9.9%	13.1%
Percent of Revenue from Other Species	0.2%	0.2%	38.2%	44.6%
Average Number of Days at Sea	13	8	14	12
Average Number of Trips	4	3	3	2

Mackerel Alternative 2.2 & 2.3 (100%) – Observer Coverage Only

Fleet Level	Paired MWT	Single MWT & SMBT
Number of Vessels	6	7
Total Days at Sea	75	97
Total Number of Trips	25	21
Total Herring Revenue	$275,720	$688,416
Total Mackerel Revenue	$1,184,211	$850,276
Total Squid Revenue		$93,069
Total Other Species Revenue	$2,895	$749,911
Total Revenue	$1,462,826	$2,381,672
Total ASM Cost	$53,250	$68,673
ASM as pct of Total Revenue	3.6%	2.9%
ASM as pct of Mackerel Revenue	4.5%	8.1%

Mackerel Alternative 2.2 & 2.3 – Sub Option 6 (100%) – Observer Coverage Only

Per Vessel	Paired MWT		Single MWT & SMBT	
	Average	Stnd Dev	Average	Stnd Dev
Annual Gross Revenue	$1,706,040	$271,636	$2,574,720	$2,082,561
Annual Variable Costs	$402,170	$73,132	$684,427	$578,997
Annual Crew Share	$524,828	$48,900	$743,633	$611,125
Annual Repair/Maint/Upgrade/Haulout	$220,871	$50,362	$180,777	$128,395
Annual Fixed Costs	$345,165	$139,401	$661,531	$612,688
Annual Return-to-owner	$213,005	$53,954	$304,352	$333,578
Annual Cost of ASM	$7,668	$3,230	$9,094	$5,447
ASM as pct of RTO (median)	3.7%		6.0%	
post-ASM RTO	$205,337	$51,935	$295,258	$335,762
Percent of Revenue from Herring	25.7%	33.5%	34.5%	29.9%
Percent of Revenue from Mackerel	74.2%	33.5%	45.9%	20.0%
Percent of Revenue from Squids			0.5%	0.2%
Percent of Revenue from Other Species	0.2%	0.3%	46.4%	53.7%
Average Number of Days at Sea	11	5	13	8
Average Number of Trips	4	2	3	2

Mackerel Alternative 2.2 & 2.3 – Sub Option 6 (100%) – Observer Coverage Only

Fleet Level	Paired MWT	Single MWT & SMBT
Number of Vessels	5	5
Total Days at Sea	54	64
Total Number of Trips	18	15
Total Herring Revenue	$206,648	$463,726
Total Mackerel Revenue	$1,132,514	$808,274
Total Squid Revenue		$4,216
Total Other Species Revenue	$2,268	$674,817
Total Revenue	$1,341,430	$1,951,033
Total ASM Cost	$38,340	$45,468
ASM as pct of Total Revenue	2.9%	2.3%
ASM as pct of Mackerel Revenue	3.4%	5.6%

Mackerel Alternative 2.2 & 2.3 (75%) – Observer Coverage Only

Per Vessel	Paired MWT		Single MWT & SMBT	
	Average	Stnd Dev	Average	Stnd Dev
Annual Return-to-owner	$204,514	$52,550	$245,704	$291,036
Annual Cost of ASM	$6,948	$3,895	$7,820	$6,393
ASM as pct of RTO (median)	3.3%		7.9%	
post-ASM RTO	$197,566	$50,098	$235,667	$293,747
Percent of Revenue from Herring	35.6%	36.5%	46.4%	33.5%
Percent of Revenue from Mackerel	64.3%	36.4%	34.7%	20.3%
Percent of Revenue from Squids			9.8%	12.8%
Percent of Revenue from Other Species	0.2%	0.2%	38.5%	44.8%
Average Number of Days at Sea	10	5	11	9

Mackerel Alternative 2.2 & 2.3 (75%) – Observer Coverage Only

Fleet Level	Paired MWT	Single MWT & SMBT
Number of Vessels	6	7
Total Days at Sea	59	77
Total Herring Revenue	$226,568	$551,463
Total Mackerel Revenue	$908,886	$665,280
Total Squid Revenue		$73,534
Total Other Species Revenue	$2,207	$608,770
Total Revenue	$1,137,660	$1,899,047
Total ASM Cost	$41,688	$54,743
ASM as pct of Total Revenue	3.7%	2.9%
ASM as pct of Mackerel Revenue	4.6%	8.2%

Mackerel Alternative 2.2 & 2.3 – Sub Option 6 (75%) – Observer Coverage Only

Per Vessel	Paired MWT		Single MWT & SMBT	
	Average	Stnd Dev	Average	Stnd Dev
Annual Return-to-owner	$213,005	$53,954	$304,352	$333,578
Annual Cost of ASM	$5,883	$2,198	$7,549	$4,555
ASM as pct of RTO (median)	2.8%		6.0%	
post-ASM RTO	$207,122	$52,560	$296,804	$335,418
Percent of Revenue from Herring	25.5%	33.5%	35.2%	29.8%
Percent of Revenue from Mackerel	74.4%	33.5%	45.4%	19.3%
Percent of Revenue from Squids			0.5%	0.2%
Percent of Revenue from Other Species	0.2%	0.3%	46.4%	53.6%
Average Number of Days at Sea	8	3	11	6

Mackerel Alternative 2.2 & 2.3 – Sub Option 6 (75%) – Observer Coverage Only

Fleet Level	Paired MWT	Single MWT & SMBT
Number of Vessels	5	5
Total Days at Sea	41	53
Total Herring Revenue	$170,203	$355,677
Total Mackerel Revenue	$856,097	$646,053
Total Squid Revenue		$3,571
Total Other Species Revenue	$1,715	$592,459
Total Revenue	$1,028,016	$1,597,761
Total ASM Cost	$29,417	$37,743
ASM as pct of Total Revenue	2.9%	2.4%
ASM as pct of Mackerel Revenue	3.4%	5.8%

Mackerel Alternative 2.2 & 2.3 (50%) – Observer Coverage Only

Per Vessel	Paired MWT		Single MWT & SMBT	
	Average	Stnd Dev	Average	Stnd Dev
Annual Return-to-owner	$204,514	$52,550	$245,704	$291,036
Annual Cost of ASM	$4,887	$2,259	$6,085	$4,983
ASM as pct of RTO (median)	2.3%		5.2%	
post-ASM RTO	$199,626	$51,095	$235,205	$294,885
Percent of Revenue from Herring	35.5%	36.5%	47.2%	32.8%
Percent of Revenue from Mackerel	64.5%	36.5%	34.3%	19.9%
Percent of Revenue from Squids			10.5%	13.9%
Percent of Revenue from Other Species	0.3%	0.2%	38.0%	44.2%
Average Number of Days at Sea	7	3	9	7

Mackerel Alternative 2.2 & 2.3 (50%) – Observer Coverage Only

Fleet Level	Paired MWT	Single MWT & SMBT
Number of Vessels	6	7
Total Days at Sea	41	60
Total Herring Revenue	$178,570	$414,792
Total Mackerel Revenue	$615,357	$496,422
Total Squid Revenue		$63,321
Total Other Species Revenue	$1,619	$493,004
Total Revenue	$795,546	$1,467,538
Total ASM Cost	$29,324	$42,593
ASM as pct of Total Revenue	3.7%	2.9%
ASM as pct of Mackerel Revenue	4.8%	8.6%

Mackerel Alternative 2.2 & 2.3 – Sub Option 6 (50%) – Observer Coverage Only

Per Vessel	Paired MWT		Single MWT & SMBT	
	Average	Stnd Dev	Average	Stnd Dev
Annual Return-to-owner	$213,005	$53,954	$304,352	$333,578
Annual Cost of ASM	$4,306	$1,290	$6,243	$4,059
ASM as pct of RTO (median)	2.0%		5.3%	
post-ASM RTO	$208,699	$53,155	$298,109	$335,109
Percent of Revenue from Herring	25.3%	33.5%	35.8%	29.6%
Percent of Revenue from Mackerel	74.6%	33.5%	44.9%	18.4%
Percent of Revenue from Squids			0.5%	0.2%
Percent of Revenue from Other Species	0.2%	0.3%	46.5%	53.5%
Average Number of Days at Sea	6	2	9	6

Mackerel Alternative 2.2 & 2.3 – Sub Option 6 (50%) – Observer Coverage Only

Fleet Level	Paired MWT	Single MWT & SMBT
Number of Vessels	5	5
Total Days at Sea	30	44
Total Herring Revenue	$137,598	$251,128
Total Mackerel Revenue	$611,182	$503,343
Total Squid Revenue		$3,049
Total Other Species Revenue	$1,308	$526,287
Total Revenue	$750,088	$1,283,807
Total ASM Cost	$21,532	$31,214
ASM as pct of Total Revenue	2.9%	2.4%
ASM as pct of Mackerel Revenue	3.5%	6.2%

Mackerel Alternative 2.2 & 2.3 (25%) – Observer Coverage Only

Per Vessel	Paired MWT		Single MWT & SMBT	
	Average	Stnd Dev	Average	Stnd Dev
Annual Return-to-owner	$204,514	$52,550	$245,704	$291,036
Annual Cost of ASM	$3,254	$919	$4,784	$4,175
ASM as pct of RTO (median)	1.4%		3.1%	
post-ASM RTO	$201,259	$51,951	$234,577	$295,890
Percent of Revenue from Herring	35.6%	36.4%	47.8%	32.1%
Percent of Revenue from Mackerel	64.7%	36.6%	33.9%	19.5%
Percent of Revenue from Squids			11.4%	15.1%
Percent of Revenue from Other Species	0.4%	0.4%	37.4%	43.4%
Average Number of Days at Sea	5	1	7	6

Mackerel Alternative 2.2 & 2.3 (25%) – Observer Coverage Only

Fleet Level	Paired MWT	Single MWT & SMBT
Number of Vessels	6	7
Total Days at Sea	28	47
Total Herring Revenue	$139,888	$303,922
Total Mackerel Revenue	$379,697	$373,750
Total Squid Revenue		$58,335
Total Other Species Revenue	$1,204	$417,124
Total Revenue	$520,789	$1,153,130
Total ASM Cost	$19,526	$33,485
ASM as pct of Total Revenue	3.7%	2.9%
ASM as pct of Mackerel Revenue	5.1%	9.0%

Mackerel Alternative 2.2 & 2.3 (25%) – Sub Option 6 – Observer Coverage Only

Per Vessel	Paired MWT		Single MWT & SMBT	
	Average	Stnd Dev	Average	Stnd Dev
Annual Return-to-owner	$213,005	$53,954	$304,352	$333,578
Annual Cost of ASM	$3,025	$539	$5,250	$4,103
ASM as pct of RTO (median)	1.4%		3.1%	
post-ASM RTO	$209,980	$53,618	$299,102	$334,697
Percent of Revenue from Herring	25.4%	33.3%	35.9%	28.8%
Percent of Revenue from Mackerel	74.5%	33.3%	44.7%	17.4%
Percent of Revenue from Squids			0.5%	0.2%
Percent of Revenue from Other Species	0.2%	0.3%	46.6%	53.2%
Average Number of Days at Sea	4	1	7	6

Mackerel Alternative 2.2 & 2.3 (25%) – Sub Option 6 – Observer Coverage Only

Fleet Level	Paired MWT	Single MWT & SMBT
Number of Vessels	5	5
Total Days at Sea	21	37
Total Herring Revenue	$113,686	$159,358
Total Mackerel Revenue	$415,938	$395,969
Total Squid Revenue		$2,788
Total Other Species Revenue	$966	$491,517
Total Revenue	$530,590	$1,049,632
Total ASM Cost	$15,125	$26,249
ASM as pct of Total Revenue	2.9%	2.5%
ASM as pct of Mackerel Revenue	3.6%	6.6%

Mackerel Alternative 2.3 and 2.4 (100% EM at $325 per day, 100% PS at $5.12 per mt)

Per Vessel	Paired MWT		Single MWT	
	Average	Stnd Dev	Average	Stnd Dev
Annual Gross Revenue	$1,698,295	$243,698	$1,485,691	$1,330,496
Annual Variable Costs	$402,791	$65,429	$412,835	$315,928
Annual Crew Share	$523,079	$43,947	$404,789	$380,374
Annual Repair/Maint/Haulout	$225,981	$46,751	$121,326	$90,037
Annual Fixed Costs	$341,930	$124,936	$264,343	$225,873
Annual Return-to-owner	$204,514	$52,550	$282,398	$369,292
Annual Cost of EM - year 1	$19,063	$2,498	$18,390	$3,453
Annual Cost of EM - year 2	$4,063	$2,498	$3,390	$3,453
Annual Cost of PS	$3,573	$2,502	$5,215	$3,503
Total Monitoring Costs as pct of RTO - year 1 (median)	10.7%		22.6%	
Total Monitoring Costs as pct of RTO - year 2 (median)	3.8%		8.3%	
Post-monitoring RTO -- year 1	$181,879	$48,953	$258,793	$371,663
Post-monitoring RTO -- year 2	$196,879	$48,953	$273,793	$371,663
Percent of Revenue from Herring	35.7%	36.4%	59.5%	27.7%
Percent of Revenue from Mackerel	64.1%	36.4%	40.4%	27.7%
Percent of Revenue from Squids				
Percent of Revenue from Other Species	0.2%	0.2%	0.2%	0.3%
Average Number of Days at Sea	13	8	10	11
Average Number of Trips	4	3	4	2

Mackerel Alternative 2.3 and 2.4 (100% EM at $187 per day, 50% PS at $3.84 per mt)

Per Vessel	Paired MWT		Single MWT	
	Average	Stnd Dev	Average	Stnd Dev
Annual Return-to-owner	$204,514	$52,550	$282,398	$369,292
Annual Cost of EM - year 1	$17,338	$1,438	$16,951	$1,987
Annual Cost of EM - year 2	$2,338	$1,438	$1,951	$1,987
Annual Cost of PS	$1,295	$907	$1,891	$1,270
Total Monitoring Costs as pct of RTO - year 1 (median)	9.1%		18.3%	
Total Monitoring Costs as pct of RTO - year 2 (median)	1.8%		3.8%	
Post-monitoring RTO -- year 1	$185,881	$50,885	$263,557	$370,534
Post-monitoring RTO -- year 2	$200,881	$50,885	$278,557	$370,534

Mackerel Alternative 2.3 and 2.4 (100% EM at $325 per day, 100% PS at $5.12 per mt)

Fleet Level	Paired MWT	Single MWT
Number of Vessels	6	4
Total Days at Sea	75	42
Total Number of Trips	25	16
Total Herring Revenue	$275,720	$624,837
Total Mackerel Revenue	$1,184,211	$579,021
Total Squid Revenue		
Total Other Species Revenue	$2,895	$1,908
Total Revenue	$1,462,826	$1,205,766
Total EM Cost - year 1	$114,375	$73,560
Total EM Cost - year 2	$24,375	$13,560
Total PS Cost	$21,437	$20,861
Total Monitoring Costs - year 1	$135,812	$94,421
Total Monitoring Costs - year 2	$45,812	$34,421
Monitoring Costs as pct of Total Revenue -- year 1	9.3%	7.8%
Monitoring Costs as pct of Total Revenue -- year 2	3.1%	2.9%
Monitoring Costs as pct of Herring Revenue -- year 1	49.3%	15.1%
Monitoring Costs as pct of Herring Revenue -- year 2	16.6%	5.5%

Mackerel Alternative 2.3 and 2.4 (100% ASM, 100% EM at $187 per day, 50% PS at $3.84 per mt)

Fleet Level	Paired MWT	Single MWT
Number of Vessels	6	4
Total Days at Sea	75	42
Total Number of Trips	25	16
Total Herring Revenue	$275,720	$624,837
Total Mackerel Revenue	$1,184,211	$579,021
Total Squid Revenue		
Total Other Species Revenue	$2,895	$1,908
Total Revenue	$1,462,826	$1,205,766
Total EM Cost - year 1	$104,025	$67,802
Total EM Cost - year 2	$14,025	$7,802
Total PS Cost	$7,771	$7,562
Total Monitoring Costs - year 1	$111,796	$75,364
Total Monitoring Costs - year 2	$21,796	$15,364
Monitoring Costs as pct of Total Revenue -- year 1	7.6%	6.3%
Monitoring Costs as pct of Total Revenue -- year 2	1.5%	1.3%
Monitoring Costs as pct of Herring Revenue -- year 1	40.5%	12.1%
Monitoring Costs as pct of Herring Revenue -- year 2	7.9%	2.5%

Mackerel Alternative 2.3 and 2.4 – Sub Option 6 (100% EM at $325 per day, 100% PS at $5.12 per mt)

Per Vessel	Paired MWT		Single MWT	
	Average	Stnd Dev	Average	Stnd Dev
Annual Gross Revenue	$1,706,040	$271,636	$1,376,004	$1,756,198
Annual Variable Costs	$402,170	$73,132	$312,090	$384,064
Annual Crew Share	$524,828	$48,900	$389,054	$498,240
Annual Repair/Maint/Haulout	$220,871	$50,362	$117,170	$122,329
Annual Fixed Costs	$345,165	$139,401	$242,444	$300,940
Annual Return-to-owner	$213,005	$53,954	$315,247	$451,458
Annual Cost of EM - year 1	$18,510	$1,479	$17,929	$1,880
Annual Cost of EM - year 2	$3,510	$1,479	$2,929	$1,880
Annual Cost of PS	$3,870	$1,757	$5,778	$3,172
Total Monitoring Costs as pct of RTO - year 1 (median)	10.1%		35.1%	
Total Monitoring Costs as pct of RTO - year 2 (median)	3.7%		16.4%	
Post-monitoring RTO -- year 1	$190,626	$51,550	$291,539	$454,111
Post-monitoring RTO -- year 2	$205,626	$51,550	$306,539	$454,111
Percent of Revenue from Herring	25.7%	33.5%	45.9%	23.5%
Percent of Revenue from Mackerel	74.2%	33.5%	53.9%	23.7%
Percent of Revenue from Squids				
Percent of Revenue from Other Species	0.2%	0.3%	0.2%	0.2%
Average Number of Days at Sea	11	5	9	6
Average Number of Trips	4	2	4	2

Mackerel Alternative 2.3 and 2.4 – Sub Option 6 (100% EM at $187 per day, 50% PS at $3.84 per mt)

Per Vessel	Paired MWT		Single MWT	
	Average	Stnd Dev	Average	Stnd Dev
Annual Return-to-owner	$213,005	$53,954	$315,247	$451,458
Annual Cost of EM - year 1	$17,020	$851	$16,685	$1,082
Annual Cost of EM - year 2	$2,020	$851	$1,685	$1,082
Annual Cost of PS	$1,403	$637	$2,095	$1,150
Total Monitoring Costs as pct of RTO - year 1 (median)	8.2%		25.7%	
Total Monitoring Costs as pct of RTO - year 2 (median)	1.6%		7.0%	
Post-monitoring RTO -- year 1	$194,583	$52,875	$296,467	$452,817
Post-monitoring RTO -- year 2	$209,583	$52,875	$311,467	$452,817

Mackerel Alternative 2.3 – Sub Option 6 (100% ASM, 100% EM at $325 per day, 100% PS at $5.12 per mt)

Fleet Level	Paired MWT	Single MWT
Number of Vessels	5	3
Total Days at Sea	54	27
Total Number of Trips	18	12
Total Herring Revenue	$206,648	$462,831
Total Mackerel Revenue	$1,132,514	$556,663
Total Squid Revenue		
Total Other Species Revenue	$2,268	$1,908
Total Revenue	$1,341,430	$1,021,402
Total EM Cost - year 1	$92,550	$53,788
Total EM Cost - year 2	$17,550	$8,788
Total PS Cost	$19,348	$17,334
Total Monitoring Costs - year 1	$111,898	$71,122
Total Monitoring Costs - year 2	$36,898	$26,122
Monitoring Costs as pct of Total Revenue -- year 1	8.3%	7.0%
Monitoring Costs as pct of Total Revenue -- year 2	2.8%	2.6%
Monitoring Costs as pct of Herring Revenue -- year 1	54.1%	15.4%
Monitoring Costs as pct of Herring Revenue -- year 2	17.9%	5.6%

Mackerel Alternative 2.3 and 2.4 – Sub Option 6 (100% EM at $187 per day, 50% PS at $3.84 per mt)

Fleet Level	Paired MWT	Single MWT
Number of Vessels	5	3
Total Days at Sea	54	27
Total Number of Trips	18	12
Total Herring Revenue	$206,648	$462,831
Total Mackerel Revenue	$1,132,514	$556,663
Total Squid Revenue		
Total Other Species Revenue	$2,268	$1,908
Total Revenue	$1,341,430	$1,021,402
Total EM Cost - year 1	$85,098	$50,056
Total EM Cost - year 2	$10,098	$5,056
Total PS Cost	$7,014	$6,284
Total Monitoring Costs - year 1	$92,112	$56,340
Total Monitoring Costs - year 2	$17,112	$11,340
Monitoring Costs as pct of Total Revenue -- year 1	6.9%	5.5%
Monitoring Costs as pct of Total Revenue -- year 2	1.3%	1.1%
Monitoring Costs as pct of Herring Revenue -- year 1	44.6%	12.2%
Monitoring Costs as pct of Herring Revenue -- year 2	8.3%	2.5%