

MEMORANDUM

DATE: August 15, 2014

TO: New England Fishery Management Council
Mid-Atlantic Fishery Management Council

FROM: Industry-funded Monitoring Plan Development Team/Fishery Management Action Team

SUBJECT: Industry-funded Monitoring Omnibus Amendment Development

1. The PDT/FMAT met via in person on March 7 and August 5, 2014 to continue development of the omnibus amendment to address observer funding issues. The March 7th PDT/FMAT meeting focused on planning the analysis and the PDT reviewed the preliminary results of the analysis at the August 5th meeting, so the meeting reports of these meetings are combined. PDT/FMAT participants at the March 7th meeting included Melissa Hooper, Aja Szumylo, Carrie Nordeen, Katherine Richardson, J. Michael Lanning, (NMFS GARFO), Susan Gardner, Kelly Neville, Andrew Kitts, Kiersten Curti, Susan Wigley, Paul Rago (NMFS NEFSC), Jason Didden(MAFMC), and Lori Steele (NEFMC), and several members of the public. Participants at the August 5th meeting included Carrie Nordeen, Katherine Richardson, J. Michael Lanning, (NMFS GARFO), Andrew Kitts, Kiersten Curti, Susan Wigley, Amy Martins, (NMFS NEFSC), Jason Didden(MAFMC), and Lori Steele (NEFMC), and several members of the public.

2. Prioritization Process and Timeline

At the August 5th meeting, the PDT reviewed several potential schedules for the prioritization process alternatives (Table 1). The IFM Omnibus would create the framework for industry-funded monitoring (IFM) programs for all fisheries for coverage above and beyond SBRM. Under this amendment, the Councils could flesh out those monitoring programs in future actions, but these programs would be contingent upon funding which would be allocated through a prioritization process, on an annual or other time scale, to determine actual seaday allocations for any given year. The sub-options in the document consider different processes for this prioritization, which would follow different schedules. The major components affecting the schedules are:

1. How much discretion does NMFS have? Advice from NE General Counsel is that the more discretion NMFS has, the more likely rulemaking and additional NEPA would be required before the seaday allocation could be put into effect. The formulaic alternatives (2.3-2.5) are not likely to require rulemaking.
2. How much Council and public input is desired? In what forum would the prioritization take place? Hosting public meetings or syncing with Council meetings, as opposed to a formula computed by NMFS, requires a longer process. But more public input reduces need for rulemaking.
3. Does the amount of industry-funded coverage depend on the amount of SBRM coverage in the same fishery? If an IFM program counts SBRM coverage toward the IFM

coverage in a given fishery (e.g., as in sector ASM), then it will be necessary to conduct the IFM prioritization after the SBRM prioritization is complete.

4. When is NMFS's budget to support IFM known? The IFM funding prioritization can't be completed without a budget. The draft timelines are based on a January/February timeline for final budget approval, as that has been the case recently. However, that may differ year to year.
5. How much or what type of information is needed to calculate the IFM coverage? The availability of different types of data would affect when the analysis could begin, and the complexity of the analysis would also affect the timeline. At this time, it is difficult to predict what type of analysis would be needed and how long it would take.
6. What is the "coverage year"? Is the IFM coverage allocated on the fishing year, calendar year, or SBRM year? This would affect when the process needs to be completed by. Because the prioritization process would have to address all fisheries that have an IFM program, it may be necessary for all IFM programs to be on a consistent timeline with each other and with SBRM (April-May).

Alternatives 2.1/2.2 – These alternatives have the advantage of allowing the Councils and NMFS the most discretion over the funding priorities. However, they call for substantial analysis to be prepared by someone (a PDT or NMFS), and for that analysis to be presented at a joint meeting between the Councils, such as an NRCC meeting. These alternatives would also likely require rulemaking because of the potential for very different priorities year to year. After reviewing potential timelines for this alternative, the PDT concluded that the process laid out in these alternatives would be difficult, maybe impossible, to complete within a year and thus could not be done annually. The PDT recommends that this alternative include a schedule based on a 2-3 year cycle, similar to how the Councils set specifications. This would allow the Councils/NRCC and NMFS to go through the prioritization process before NMFS conducts rulemaking, and the rulemaking to be complete before the annual budget/SBRM process begins. This could work if NMFS and the NRCC/Councils agree on a set of priorities that would remain static for 3 years, and that NMFS would use to run a formulaic prioritization on an annual basis to determine final coverage rates based on available funding, without additional rulemaking (similar to SBRM). This would also provide some stability for industry, because they would know if their fishery was first priority and, therefore, more likely to get funding and have IFM in those 2-3 years. However, this would mean that the Councils would be conducting the prioritization well in advance of the specs cycle and would not modify the criteria during a cycle, although the Councils could always do so anyway if new information became available.

Alternatives 2.3/2.4/2.5 – Under these alternatives, the Councils would select a formula in this omnibus amendment that NMFS would use to determine the funding allocation to each IFM program. The formula would be agreed upon and analyzed in this omnibus amendment, so additional rulemaking would not be required. This results in a more streamlined timeline that could be completed on an annual basis and adjust to changes in budget from year to year. However, these alternatives are blunt tools that do not provide NMFS or the Councils any discretion over the funding priorities in a given year.

In order for a monitoring program to be implemented with completion of this action, the Councils/NMFS would have to run the Council's preferred prioritization process as part of the

omnibus rulemaking (AND assuming there is funding). Depending upon which alternative the Councils select and how long it would take, the Councils may want to specify a separate one-time priority list through this amendment that would stand for the first 1-2 years (contingent upon funding), until the prioritization process could be set up and run.

The PDT had some questions for the Observer Committee related to the timing and process for these alternatives:

1. Is the timing and process laid out for the alternatives clear? Are there any modifications or other alternatives that the Committee recommends for consideration?
2. For Alternatives 2.1/2.2, what joint meeting forum does the Committee recommend to consider for the prioritization discussion?
3. Does the Committee inclusion of a separate one-time priorities list in this action for the early years of implementation?

Table 1: Current and potential process schedules

| | | Status Quo (SBRM, etc.) | Alternatives 2.1.-2.2 (discretionary) | Alternatives 2.3-2.5 (formulaic) |
|---------------|--------------------|--|--|--|
| Year 1 | January-April | | Prepare and analyze draft IFM prioritization for Years 2-4 (4 mos) | |
| | April | | NRCC and/or Councils review draft IFM prioritization for Years 2-4 | |
| | May-October | | NMFS conducts proposed and final rulemaking (6 mos) | |
| | October – December | Observer data July Year 0 - June Year 1 is available; work on analysis for SBRM; work on analysis for sector ASM (3 mos?) | Observer data July Year 0 - June Year 1 is available; work on analysis for IFM including coverage and funding needs (3 mos) | Observer data July Year 0 - June Year 1 is available; work on analysis for IFM including coverage and funding needs (3 mos) |
| Year 2 | January-February | Receive Year 2 budget; publish sector ASM coverage rates in proposed rule; determine scallop seaday schedule and compensation rate (1-2 mos?) | Receive Year 2 budget; determine whether funding sufficient; determine final Year 2 coverage rates (2 mos) | Receive Year 2 budget; determine whether funding sufficient; run IFM prioritization (2 mos) |
| | March | Run SBRM | Announce Year 2 | Announce Year 2 |

| | | | | |
|--|-------|--|---|---|
| | | prioritization; publish sector ASM rates in final rule; begin scallop Year 2; roll-out SBRM seadays to providers ASAP (1-2 mos) | coverage rates and roll-out to providers (min 30 days before year start) | coverage rates and roll-out to providers (min 30 days before year start) |
| | April | Begin Year 2 seaday schedule for SBRM | Begin Year 2 for IFM; NMFS briefs Councils on final rates | Begin Year 2 for IFM; NMFS briefs Councils on final rates |
| | May | Begin sector ASM Year 2 | | |

3. Prioritization Criteria

Alternatives 2.1/2.2 include criteria to be used by the PDT/FMAT or NMFS in developing the initial recommendations for funding priorities. These criteria are meant to guide the PDT/NMFS and ensure they examine all the factors that the Councils wish to weigh on the decision. The PDT discussed how the PDT/NMFS would use the criteria in any given year to generate a recommendation. The criteria are quite diverse and it is not clear how the PDT/NMFS is intended to weight fisheries within a criterion or across criteria. For example, if one fishery's objective is to monitor bycatch of an overfished stock, while another fishery's objective is to monitor a recently listed species, which should take priority? In absence of further guidance, this would require the PDT/NMFS to project what value judgments the Councils are likely to make and to reconcile the different concerns of the two Councils in order to generate the initial recommendation. The PDT was concerned that this would be too much to expect of the PDT/NMFS and would require a significant amount of analysis that would extend the process timeline. This wide open process could also result in vastly different recommendations from cycle to cycle, which would be unstable for the industry and may require more public input and be more likely to be litigated. The PDT considered developing a weighting scheme in this omnibus amendment that could provide the PDT/NMFS more guidance in developing their initial recommendation. The PDT found an example of a similar process that the Mid-Atlantic SSC developed to prioritize RSA projects (Attachment 1). Developing a similar weighting scheme in this omnibus would require the Councils to make value judgments now about the different criteria and FMPs, but would save time in the specs cycle process. The Councils could make modifications to the weighting scheme frameworkable.

The PDT was concerned that if the Councils have difficulty agreeing on the weighting scheme, it could delay the omnibus. The PDT considered whether a separate omnibus framework adjustment could be the vehicle for the weighting scheme to be implemented after the omnibus amendment. However, the actual prioritization of funding could not take place until the framework is implemented, so the PDT concluded this would not save time. If the Council specified a one-time priorities list in this omnibus amendment to be effective until the framework

is implemented, this may be more feasible. The PDT plans to investigate this option further and try to develop a weighting scheme to present at the Committee's next meeting.

Specific questions the PDT has for the Committee on this topic:

1. Does the Committee support the list of criteria in Alternatives 2.1 and 2.2? Are there any modifications the Committee recommends?
2. Does the Committee support the idea to try to develop a weighting scheme for prioritizing fisheries?

4. Monitoring Provider Standards

The Omnibus Alternative 2 will lay out a framework for IFM programs moving forward, including general standards for monitoring providers and individual monitors. The SBRM amendment already includes general standards for observers and observer providers. This omnibus amendment would add standards for other types of monitoring programs, such as at-sea monitoring, dockside monitoring, portside sampling, and electronic monitoring (EM). The PDT plans to develop these standards for the Committee's next meeting. The PDT discussed what types of programs and standards to include in the amendment. The observer provider standards are based on national policy and national policies may be developed in the future for EM providers and other types of providers. The PDT discussed that any provider standards developed in this amendment should be consistent with national policy and existing observer service provider standards. Although these types of monitoring programs differ in terms of the types of data they collect, the PDT thought it would be possible to develop some overarching standards for all monitoring programs in this amendment (e.g., conflict of interest, insurance requirements). Later Council frameworks that implement IFM programs for individual fisheries could then add on any specific standards applicable to their individual situation. The PDT thought that EM may be too fluid at this point to develop specific standards, but it may be possible to include EM in some of the general standards.

The PDT noted that there are different educational requirements for groundfish ASMs (high school diploma) and observers (college degree), and that the Councils need to clarify whether the general ASM standards developed in this omnibus would include the college degree requirement or the high school diploma requirement, and if the former, if they would supersede the groundfish ASM standards. Because ASMs collect a simpler dataset than NEFOP observers and only have to have a high school diploma, it was thought they would require less training and could be paid less, which would reduce the costs of the program. However, the National Observer Program conducted a review of ASM and observer performance and found that ASMs have not been a cost savings. In addition, wages are established by the Department of Labor based on the duties and environment of the position, which is not substantially different for ASMs and observers, so observers and ASMs receive the same wages. Providers also take experience into account in setting wages. ASMs are less likely to complete the training program and have a higher attrition rate, requiring them to be more frequently replaced, which increases costs. They also found that ASMs struggle more with the subsampling methods under intense conditions (e.g., high volume catches), resulting in lower data quality. Therefore, NEFSC staff recommends not extending the exemption from the college degree requirement.

The PDT has the following questions for the Committee on this topic:

1. Does the Committee support using the observer service provider requirements from the SBRM amendment to establish consistent requirements for all third party monitoring services (at-sea, dockside, EM)?
2. Does the Committee recommend that the omnibus standards supersede the groundfish ASM standards?

5. Monitoring Costs/Economic Analysis

At the March 5th meeting, the PDT discussed how to approach the economic analysis for the omnibus and individual FMP alternatives. At the August 5th meeting, the PDT received an initial report from the NEFSC and discussed how to proceed. The omnibus alternatives (1 and 2) are all administrative. Since there would be no impacts on the fishing industry until a framework implements a regulation using these administrative requirements, an analysis of impacts can be general at this time. A detailed analysis of impacts will be needed when a framework adjustment is made on a fishery FMP. For Alternative 2.1 and 2.2, it would be helpful to provide information about the level of costs to be borne by NMFS and by the industry so the public and decision makers have a sense of the relative magnitudes of the separate cost responsibilities. While this would not be a formal economic evaluation, it would provide useful information for when a framework proposes a level of observer coverage so there is a clear understanding of how that translates to costs for industry, and for NMFS.

For all of the mackerel and herring coverage options (Herring Alternatives 1-2.4, Mackerel Alternatives 1-2.4) an estimate on the impacts on fishing vessels from paying for increased observer coverage is required. These are the general steps for doing this analysis:

Under each coverage option:

1. Identify the directly regulated vessels
2. Identify trips from the previous year's landings records that would have been eligible for selection under the new proposed coverage.
3. Describe the regulated vessels and eligible trips and, if appropriate, divide them into categories for analyses (large/small vessels, long/short trips, etc)
4. Estimate the number of trips, by category (could do a random selection of trips), that would get observer coverage
5. Calculate the average revenue and average operating costs by vessel category
6. Show to what degree the increased industry-funded observer cost (and so would need a breakdown of observer costs) increases the average operating costs. Report this impact on a per trip basis and on an annual basis.
7. Calculate the cost to both industry and to NMFS of the increased observer coverage, including the average vs. marginal costs.

However, the NEFSC's research into monitoring costs revealed a clarification that needs to be made to the definition of cost responsibility. Specifically, training and debriefing costs need to be separated between the cost of labor and facilities to provide the training/debriefing (NMFS responsibility) and the salary and per diem of the monitors for attending the training/debriefing (not NMFS responsibility). The NEFSC also has costs for maintaining a liaison between the NEFSC, enforcement, the USCG, and the observer providers to address safety and compliance

issues for IFM programs. The PDT has made this clarification to Omnibus Alternative 2. The PDT plans to provide annual totals for each of these items, as well as in terms of cost per seaday. The PDT is still compiling this information, and does not have actual number values to share with the Committee at this time. However, the PDT wanted to prepare the Committee for the eventual results - that the cost per seaday based on Alternative 2, assuming a total seaday cost is ~\$1200, is likely to be ~\$300-500/day for NMFS and \$700-900/day for industry. This is substantially different than the \$325/day industry cost called for in the original herring and mackerel amendments.

Another consideration for this analysis is that infrastructure costs do not increase in seaday increments. At a given certain level of infrastructure, the NEFSC may be able to absorb some additional seadays, up to a point. After that tipping point, another substantial investment of infrastructure would be needed (e.g., a new lease on additional office space, hiring a new staff member, modification to a contract or creation of a new contract). How much additional coverage could be absorbed depends on how close to the tipping point the Observer Program is at any given time. NEFSC staff are looking at the amount of additional seadays they may be able to absorb at current levels, and preliminarily estimated it to be an additional 10% of total seadays. An additional 20% seadays would require additional infrastructure investment.

The NEFSC does not track costs by individual FMP or by the items listed in Alternative #, but the NEFSC is trying to develop annual and seaday cost estimates for each of the items. This may be necessary for the NEFSC to do on a regular basis as part of the analysis for the eventual prioritization process, in order for the prioritization to be scalable. For example, if the NEFSC has \$2M, they need to be able to translate that into seadays in order to determine how much coverage that would provide a given FMP. Estimates would have to be generated for different types of monitoring programs in order to see how far the funding would go in a fishery with observer coverage vs. a fishery with dockside monitoring, which have different per day costs.

6. Observer Coverage Alternatives Analysis

At the March 7th meeting, the PDT developed an approach to the analysis in support of the alternatives for observer coverage in the herring and mackerel fisheries (Herring Alternatives and Mackerel Alternatives 1-2.4). On August 5th, the PDT received a progress report on the analysis.

The PDT has been working on updating the analysis of incidental catch of river herring and shad by different gear types, similar to the analysis conducted for mackerel Amendment 14. Preliminary results are consistent with previous analysis. For river herring species, midwater trawl gear and small mesh bottom trawl gear continue to account for the large majority of incidental catch. For shad species, large mesh gillnets account for the greatest percentage, followed by small mesh bottom trawl gear, and then midwater trawl gear. NEFSC staff are continuing to refine these results and plan to present them at a later date. NEFSC staff are also planning to calculate CVs/confidence intervals for the estimates, and develop curves of the relationship of a given CV/CI to coverage level. The NEFSC is also looking further into which fisheries in the small mesh bottom trawl strata are responsible for the river herring catch. This should assist the PDT in identifying what CV/CI and coverage levels to recommend to the Councils and for which gear types or permit categories in the alternatives.

The PDT has also discussed several other ideas to pursue in the analysis:

- Look at the CV/CI at the catch cap vs. fleet vs. stock level, which can require different sample sizes and lead to vastly different coverage rates.
- Look at what level of precision would provide assurance for monitoring catch caps. The PDT could use the methodology developed in FW 3 for the catch caps to simulate the performance of the estimates under different scenarios.
- Examine changes to CV/CI as a result of coverage on gear types/permit categories under the catch caps vs. gears responsible for the most incidental catch. This would illustrate the value of coverage on different trip types in terms of precision. Modes with high variance, but not necessarily high volume, of discards will tend to be magnet for observer coverage, so it is important to determine what modes to focus coverage on.
- Look at the relationship of precision to cost, and the tradeoffs. What is the marginal value of incremental increases in coverage?
- Determine timeliness of data needed for making determinations if analysis had to be conducted as part of prioritization process.
- Consider whether a single coverage target or complimentary coverage targets for both herring and mackerel fisheries would meet objectives, given the amount of overlap in these fisheries.
- Look at what kind of SBRM coverage herring and mackerel fleets would be likely to get under the SBRM amendment to see if would satisfy some objectives. If so, additional IFM coverage might not be needed, or additional coverage could focus on making up for specific short-falls (e.g., if compliance objective, then maybe EM).
- Consider alternatives that might take advantage of the overlap in the herring and mackerel fisheries for efficiency.

SBRM Coverage

The NEFSC ran the Councils' preferred SBRM amendment prioritization process for the first time to determine 2014 seaday allocations, so the PDT was able to get an idea of the coverage levels herring and mackerel modes might get under the SBRM amendment. Currently, midwater trawl vessels are required to have 100-percent coverage of trips into the groundfish closed areas. The NEFSC typically sets aside a pool of sea days for this coverage based on the anticipated number of closed area trips, prior to conducting the seaday allocation for SBRM. So this coverage is in addition to any seadays the midwater trawl fleets are allocated through the SBRM prioritization process. This has resulted in fairly high overall coverage levels for the herring fishery in recent years. However, this separate closed area seaday allocation is not expected to continue after implementation of the SBRM amendment because the amendment requires that the funding currently used for this purpose be directed exclusively to SBRM. Beginning April 2015, the midwater trawl fleets would only receive coverage allocated through SBRM. This amounted to 45 seadays in 2014 for NE midwater trawl (pilot coverage), and none for MA midwater trawl. The MA midwater trawl mode is filtered out by the "trip filter," because it accounted for less than 1% of total VTR trips and any pilot coverage would have resulted in 100% coverage or more. The NE midwater trawl mode was given only pilot coverage through the prioritization process because it accounts for a small proportion of discards to total catch of herring. Seaday allocations may increase or decrease in future years, depending on discard behavior on these trips, and the results of the prioritization process. However, it appears the Councils cannot rely on increased SBRM coverage to achieve this amendment's objectives.

The PDT wants to highlight to the Committee that the discontinuation of the additional seaday allocation for herring closed area trips under SBRM next year could limit closed area trips by herring midwater trawl vessels. Under Amendment 5, herring midwater trawl vessels are prohibited from fishing in the closed areas without an observer. When the new SBRM goes into effect, this means that herring vessels would only be able to fish in a closed area if they are randomly assigned an observer for SBRM. This also has the potential to bias discard estimates for SBRM, if a large majority of midwater trawl SBRM trips are fished in the closed areas. The PDT intends to address this issue in the document by including this requirement in industry-funded monitoring program described in the Herring Alternatives.

The PDT has struggled with how to approach the analysis for the coverage alternatives – by gear type or permit category or fishery (e.g., “mackerel trip”). The current alternatives adapted from the original amendments are developed around permit categories or a trip definition (e.g., “mackerel trip”), rather than gear type. However, the PDT is using NEFOP observer data from SBRM deployments, so stratifying incidental catch estimates by permit category or an FMP trip definition would violate the randomness of the SBRM sampling scheme and potentially bias estimates. Council staff indicated that the original alternatives were developed around the river herring/shad catch cap definition – because the catch caps apply to the limited access fisheries, the IFM coverage would be targeted at the limited access fisheries. Yet the objectives and performance standard for the coverage is to achieve a certain CV/CI on the estimate of river herring and shad catch. This suggests targeting the coverage at the fleets responsible for the most incidental catch, which may not be the same as the permit category or FMP definitions under the catch cap. The analysis the PDT is developing will help to illustrate the impacts of defining the performance standard in these different ways. It may be possible to develop an alternative that addresses both the cap definition and the objectives for coverage. The PDT is also considering how to specify the coverage target in these alternatives – as a desired CV? A confidence interval? A coverage level? The definition of a desired CV or CI allows for the coverage level to be calculated through the prioritization process, but these concepts can be difficult to understand. The Councils could also specify a target coverage level based on the desired CV or CI that would be maintained in the regulations until modified. However, this would not be robust to changes in incidental catch patterns. The PDT will continue work on the analysis for these alternatives and bring the refined alternatives to the Committee/Councils at a later meeting.

7. Public Comments

- One member of the public commented that the amendment should consider accuracy and observer bias as well as precision. Another member of the public suggested looking at whether certain gear types might have greater impact on accuracy than others, such as high volume gears. The PDT responded that it intends to consider the issue of accuracy in the document, but that it is difficult to quantify. The PDT may be able to use data from the 100% coverage on herring closed area trips to model potential observer effects in fleets with less than 100% coverage.
- Some members of the public emphasized the urgency of completing the action and expressed disappointment that development is not progressing more quickly.

- One member of the public was concerned about fairness, that some vessels may receive “free” coverage from SBRM, while others have to pay for coverage. He emphasized the need to understand these types of interactions between the amendments.
- One commenter suggested that only the alternative for 100% coverage without waivers would meet the Councils’ objectives, because all other alternatives would result in coverage levels that fluctuate based on funding which would not ensure objectives are met.
- One commenter suggested the PDT economic analysis of the alternatives should include potential cost savings that could accrue if the fishery has 100% coverage in terms of efficiencies in notifications and deployments.
- One commenter asked that the analysis of infrastructure costs for NMFS in the document consider whether it would be cheaper to outsource some tasks.
- One commenter emphasized the need for information about the costs for industry as soon as possible so that the industry could better weigh in on the alternatives under consideration. One commenter asked to see analysis of the industry’s ability to pay and believed that industry would not be able to accommodate \$300-800/day for industry. Another commenter suggested that the PDT flag cost drivers for the industry, NMFS, providers so that they can change practices to reduce costs (e.g., lack of notice of trip cancellations).
- One comment suggested that data collection tasks for herring observers could be prioritized to require less training and reduce costs. The Observer Program responded that herring observers are paid the same as other NEFOP observers, even though they have additional high volume sampling training. Another commenter expressed concern that requiring a college degree of at-sea monitors would result in a shortage of qualified applicants. The Observer Program clarified that this has not been an issue.

Draft MAFMC Research Prioritization Process

Under the Magnuson-Stevens Act, each Council is to develop a 5-year Research Plan for submission to and consideration by the National Marine Fisheries Service. A draft 2012-2016 Research plan has been prepared by Council staff and includes dozens of important projects that range from relatively simple short-term single species activities to long-term ecosystem modeling and assessment programs. The Mid Atlantic Council requested the assistance of its Scientific and Statistical Committee to suggest a process to help the Council identify its priorities within the list of proposed research and information needs.

A work group of the SCC met by teleconference on February 8th to discuss the task and suggest preliminary criteria to use in evaluating projects. Those results have been incorporated into a draft prioritization process described below for further consideration by the SSC. Basic assumptions going into the process included that there are more proposed projects than there is funding available, and that not all projects have equal priority for funding. Therefore a process was needed to prioritize the MAFMC research proposals in a way that maximizes net benefits from the available funds.

The process includes six steps outlined in more detail in the following pages:

Step 1: Compare species criteria to species criteria

Step 2: Compare species (vertical) to species criteria (horizontal) in an L-shaped matrix

Step 3: Identify additional criteria against which to evaluate research proposals

Step 4: Assign weights to the importance of criteria by comparing them in an L-shaped matrix

Step 5: Construct the final L-shaped matrix

Step 6: Cost-benefit analysis

Step 1: Compare species criteria to species criteria

(See Step 1 Spreadsheet.xls)

All species are not created equal, and we may want to give deference to research on some species in lieu of others. What criteria would make us prefer one species over another? We identified five species criteria.

Species criteria

1. High commercial value (annual dollar value of fishery)
The higher the dollar value (in the case of a commercial fishery), the more important the species.
2. Recreational value (landings, weight)
The higher number of annual landings or gross weight (in the case of a recreational fishery), the more important the species.
3. The stock is overfished
The more overfished the stock, the more important the species (as it is important for research to be conducted on this stock).

4. Overfishing is occurring on the species
The more overfishing of the stock, the more important the species (as it is important for research to be conducted on this stock).
5. Impact on other species (Ex. Forage fish and choke species)
The more impact a species has on other species (whether positive or negative), the more important the species.

**Remember that each of these species criteria is being judged in reference to which species are the most important from the standpoint of funding research proposals. That means that while overfishing is generally not considered a good thing, the criteria is being applied in the context of giving more deference to funding a fishery where overfishing is occurring.

We do not want to assume that each of the five criteria have equal weights, so we assign weights to the relative importance of these criteria by comparing them pair-wise in an L-shaped matrix. (Step 1 Spreadsheet.xls)

- Reading across the vertical axis, compare each species criteria to those on the horizontal axis (place an “x” in the boxes where the same two criteria are being compared).
- Each time a weight (e.g. 1, 5, 10) is recorded in a row cell, its reciprocal value (e.g. 0.1, 0.2) must be recorded in the corresponding cell.
 - 1 = species criteria equally important
 - 5 = species criterion is more important
 - 10 = species criterion is much more important
 - .2 = species criterion is less important
 - .1 = species criterion is much less important
- Total each horizontal row and convert to a relative decimal value known as the “species criterion weighting.”
- If individual judgments are sought (versus taking a group consensus) these judgments will be compiled group-wide by taking a geometric mean to come up with a final rating which will be used in step 2.

Step 2: Compare species (vertical) to species criteria (horizontal) in an L-shaped matrix

(See Step 2 Spreadsheet.xls)

Each species criterion now has a weighted value. In the context of funding research proposals for MAFMC, how do we determine species importance relative to the species criteria?

- Reading across the vertical axis, compare each species to the species criteria on the horizontal axis. Assign a rating by how much each species is in alignment with the criterion. The maximum number that can be assigned is equal to the species criterion weighting for

that criterion found in step 1 after adding up the group totals. The species will be assigned the full weight if the species perfectly meets the species criterion. The lowest number is 0 (the species does not meet that criterion at all). A table was developed based on facts from the NMFS databases. Recommendations on what percentage of the species criterion weight should be attributed to each species are below:

| Species | Commercial value \$ (2010) | Recreational value (# fish 2010) | Overfished (Stock size relative to biological reference points) | Overfishing (F current/Fmsy) | Spillover? |
|---|----------------------------|----------------------------------|---|------------------------------|------------|
| Bluefish | 1,075,604 | 2,559,736 | 95% | ~0.75 | neither |
| Tilefish | 5,106,306 | ~0 | 104% | ~0.35 | neither |
| Surfclams | 17,718,858 | ~0 | 162% | ~0.20 | neither |
| Ocean quahog | 7,878,102 | ~0 | 162% | ~0.25 | neither |
| Summer flounder | 8,125,838 | 1,225,669 | 100% | ~0.75 | neither |
| Black sea bass | 1,613,590 | 1,317,458 | 111% | ~1.00 | neither |
| Scup | 2,935,522 | 2,735,543 | 202% | ~0.25 | neither |
| Atlantic mackerel | 912,426 | 3,914,000 | midpoint* | 0.50* | forage |
| Butterfish | 329,021 | ~0 | Yes; exact data not available but <50% | 0.50* | choke |
| Illex | 5,676,703 | ~0 | Midpoint* | 0.50* | forage |
| Loligo | 6,088,431 | ~0 | 128% | 0.50* | forage |
| Spiny dogfish | 228,607 | ~0 | 106% | ~0.35 | neither |
| * no data- use midpoint 50% error rate each way | | | | | |

For commercial value:

Surfclams (100% of species criterion weighting)
 Ocean quahog, Tilefish, Summer flounder, Illex, Loligo (75% of species criterion weighting)
 Scup (50% of species criterion weighting)
 Bluefish, Black sea bass, Atlantic mackerel (25% of species criterion weighting)
 Butterfish, Spiny dogfish (0% of species criterion weighting)

For recreational value:

Atlantic mackerel (100% of species criterion weighting)
 Bluefish, Scup (66.67% of species criterion weighting)
 Black sea bass, summer flounder (33.33% of species criterion weighting)
 Tilefish, Surfclams, Ocean quahog, Butterfish, Illex, Loligo, Spiny dogfish (0% of species criterion weighting)

Note the use of “number of fish” for a proxy of recreational importance is imperfect and undervalues species such as summer flounder where low bag limits affect landings. Better proxies such as MRIP data on directed trips were not yet available nor were willingness to pay values for recreational species. We can check sensitivity of this value on the outcome and/or adjust accordingly.

For Overfished:

Normalized cumulative data for overfished (numbers in second column (red) are 1 minus the normalized cumulative data because those species that are overfished should get a greater percentage of the criterion weighting): *=no data so they were assigned the median 50%

| | | | |
|-------------------|----------|----------|--------------------------|
| Bluefish | 0.265605 | 0.734395 | 73% of species criterion |
| Tilefish | 0.338178 | 0.661822 | 66% of species criterion |
| Surfclams | 0.823204 | 0.176796 | 18% of species criterion |
| Ocean Quahog | 0.823204 | 0.176796 | 18% of species criterion |
| Summer flounder | 0.304954 | 0.695046 | 70% of species criterion |
| Black sea bass | 0.399322 | 0.600678 | 60% of species criterion |
| Scup | 0.968222 | 0.031778 | 3% of species criterion |
| Atlantic mackerel | .5* | 0.5 | 50% of species criterion |
| Butterfish | 0.047484 | 0.952516 | 95% of species criterion |
| Illex | .5* | 0.5 | 50% of species criterion |
| Loligo | 0.555333 | 0.444667 | 44% of species criterion |
| Spiny dogfish | 0.355297 | 0.644703 | 64% of species criterion |

Numbers in the second column are the percentages each species will get of the overfished criterion

For Overfishing:

Use the same proportions in above table ($F_{\text{current}}/F_{\text{msy}}$) as the proportions of the species criterion

| | | |
|----------|-------|--------------------------|
| Bluefish | ~0.75 | 75% of species criterion |
| Tilefish | ~0.35 | 35% of species criterion |

| | | |
|-------------------|-------|---------------------------|
| Surfclams | ~0.20 | 20% of species criterion |
| Ocean Quahog | ~0.25 | 25% of species criterion |
| Summer flounder | ~0.75 | 75% of species criterion |
| Black sea bass | ~1.00 | 100% of species criterion |
| Scup | ~0.25 | 25% of species criterion |
| Atlantic mackerel | 0.50* | 50% of species criterion |
| Butterfish | 0.50* | 50% of species criterion |
| Illex | 0.50* | 50% of species criterion |
| Loligo | 0.50* | 50% of species criterion |
| Spiny dogfish | ~0.35 | 35% of species criterion |

For Spillover:

Species that are both choke and forage (100% of species criterion weighting)

Species that are one or the other (50% of species criterion weighting)

Species that are neither (0% of species criterion weighting)

THEN...

- Total each horizontal row and convert to a relative decimal value known as the “species weighting.”
- Now we know the relative importance of each species (in reference to needing research conducted) and can start on the main part of the process for comparing research proposals to criteria.

Step 3: Identify other criteria besides species against which to evaluate research proposals

In the previous steps we’ve already determined why research on one species might be more important to fund than research on another species. In step 3 we need to identify other criteria besides species importance to use in rating research proposals. Based on SSC conference call results and further reflection, we’ve identified a total of eight criteria, including species importance. We can easily add or subtract criteria if these are not to everyone’s liking. We define the meaning of the different criteria below.

1) Species is important

We need to simply evaluate the need to pick research projects benefiting important species compared to the other criteria.

2) Decreases scientific and/or management uncertainty and risk

Species are put into various tiers based on how much information is available. In this way, tier 3 species have a lot of uncertainty, while tier 1 species have the least uncertainty related to their

stock assessments. When addressing this criterion, the ability of a particular project to decrease uncertainty and move the species from a higher tier to a more desirable lower tier should be taken into account. The same process can be used to evaluate the importance of a project to reducing management uncertainty, i.e., it lowers risk to Councils associated with achieving the chosen ACL. If a research project lowers the risk of not achieving the chosen ACL (and the repercussions to the Council and fish stocks that go along with that) by increasing the accuracy of scientific data or creating a new management mechanism that has a higher likelihood of success, then the project is more desirable.

3) Positive social impacts

Social considerations must be taken into account when evaluating any research proposal, as coastal and fishing communities are major stakeholders. These include the research's benefit to these communities, whether it is through increased access to jobs, recreational fishing, artisanal fishing, etc., with a particular emphasis on sustainability.

4) Positive economic impacts

Economic considerations also must be taken into account when evaluating research proposals. This includes the potential the research has for increasing net economic values over time with a particular emphasis on sustainability.

5) Is widely applicable

If a research project contributes results that are widely applicable to the greater understanding of multiple species or attributes it is to be rated highly as "applicable." For instance, if developing a new method for assessing the length at age of a mackerel can be applied to other species, this research will be considered highly applicable. Data collection on a single species may not be considered highly applicable, while analytical and assessment tasks may be more so.

6) Contributes to a better understanding of the big-picture ecosystem

It should be considered whether research projects may be beneficial to the larger ecosystem—not only to a specific species. For example research that helps sustain forage fish would help sustain other fish that eat these fish. Important ecosystem attributes to consider when evaluating research proposals include: bottleneck species, bycatch, and ecosystem indicators. This is similar in concept to criteria 6 but is not identical. Given the special interest in ecosystem based fishery management of the Council we kept this separate.

7) Quick achievement of an outcome

Research projects require different amounts of time before the achievement of an outcome is expected. Some projects may be implemented and expected to achieve an outcome within the year (a one-shot deal), while others may need to be conducted over a much longer period of time with

several trials before results can be conclusive. Projects that are valuable to fisheries management and achieve an outcome quickly should have priority over slower projects.

8) Has elements of applied research (as opposed to basic)

Projects may either be basic or applied. The goal of basic research is to improve scientific understanding, while applied research builds off of basic research and is used to solve practical problems. Applied research is often much easier to implement because it already has tools and technologies available to tackle an issue. Much of the Council's focus is on decisions hinging on applied research so we give deference to applied research.

Step 4: Assign weights to the importance of criteria by comparing them in an L-shaped matrix

(See Step 4 Spreadsheet.xls)

Now that we have our final criteria, through a pair-wise comparison we determine weights for the eight criteria since we do not want assume they are all equally important. The process is similar to Step 1. We can either use a mean of individual judgments or simply accept a group consensus response for the relative importance of different criteria. Our goal in this step is to ask "In the context of funding research proposals for MAFMC, how important each of the eight criteria compared to each other?"

- Reading across the vertical axis, compare each criteria to those on the horizontal axis (place an "x" in the boxes where the same two criteria are being compared).
- Each time a weight (e.g. 1, 5, 10) is recorded in a row cell, its reciprocal value (e.g. .1, .2) must be recorded in the corresponding cell.
 - 1 = species equally important
 - 5 = species is more important
 - 10 = species is much more important
 - .2 = species is less important
 - .1 = species is much less important
- Total each horizontal row and convert to a relative decimal value known as the "criteria weighting."

Step 5: Construct the final L-shaped matrix

(See Step 5 Spreadsheet.xls)

Now the fun part.

Compare, i.e., rate each research proposal (vertical) against the criteria (horizontal) in an L-shaped matrix.

- First we must explain how to evaluate the species criterion. This criterion in the matrix is subdivided into each species. The proportion assigned to each species in step 2 (after group consensus) must be re-proportioned based on the weighted value of species importance from step 4. So if the proportional value for bluefish from step 2 was 0.2 and the value of species importance from step 4 was 0.3 then the final value of importance for bluefish is the product of these two numbers, 0.06. For the purpose of the species columns in this matrix, the research proposal will be rated based on how closely it targets/supports/aligns with one or more species.
- Now for the other criteria. Each criterion has a weighted value. Reading across the vertical axis, compare each research proposal to the criteria on the horizontal axis. Assign a number by how much each research proposal is in alignment with the criterion. The maximum number that can be assigned is equal to the criterion weighted value (that is if the research proposal perfectly meets the criterion). The lowest number is 0 (the research proposal does not meet that criterion at all). Use the scale below:
 - 0% of criterion weighting= doesn't meet criterion at all
 - 25% of criterion weighting = slightly meets criterion
 - 50% of criterion weighting = somewhat meets criterion
 - 75% of criterion weighting = mostly meets criterion
 - 100% of criterion weighting = fully meets criterion
- Total each horizontal row and convert to a relative decimal and then compare. Those research proposals with the highest numbers have the highest amount of benefits to pursuing them.

These relative decimals will be used as the value for benefits for each research proposal, and can be used in step 6.

Step 6: Cost-benefit analysis

- We left out cost as a criterion for a reason. We don't have a total budget constraint and don't have specific costs for each proposal. If we did we could simply convert the cost into a rating score, compute the benefit cost ratio for each proposal, sort them from highest to lowest score and apply the budget constraint. We could also get into optimization and program the frontier of projects that give us the greatest return for our budget.
- For now we can only compare the benefits of a research proposal to some proxy for the cost of the proposal to see which research projects maximize benefits and minimize cost. Each project could be assigned a cost ratings value (e.g., score of 1 = under \$250K, 2 = \$250-500K, etc) by guesstimate/expert knowledge. We know the benefit value from step 5. Create a chart with the research proposals on the vertical axis and "benefit," "cost," "benefit/cost," "cumulative cost" and "cumulative benefit" on the horizontal axis. After dividing benefit by cost, re-rank the options with the highest number at the top of the list and the lowest at the bottom. Then

calculate the cumulative cost and cumulative benefit. This easily shows you where you must cut off the projects based on how much money you have available and the cumulative benefits associated with this set of projects. Thus, you will be able to maximize the benefits for the amount of money you have with which to pursue research projects.

Note: All factors that go into cost must be considered including the cost of labor and equipment. Whether the research would be funded through appropriations or industry (through grant set-aside programs) could be considered either as a criteria in ranking the benefits or as a discounted cost. For example, a project funded by industry would be considered low cost for this purpose (as it wouldn't cost the government money), and thus more desirable if our accounting stance was government dollars.