# A Review of the Economic Analyses Contained in the DSEIS for Amendment 13

*Prepared for*

**NOAA Fisheries**

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*Prepared by*


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# Contents

# Executive Summary

This review addresses the economic analyses included in Draft Supplemental Environmental Impact Statement for Amendment 13 to the New England Fishery Management Council's Multispecies Fishery Management Plan published on August 21, 2003. The review has been requested by NOAA Fisheries, and begins with a summary of the reviewer's experience and the terms of reference under which the review was conducted. Section 2 begins with a summary of the overall conclusions and then goes on to address the overall soundness of the economic analysis in terms of the models, data and assumptions used to assess the impacts of the alternatives. Section 2 also includes a discussion on how well the DSEIS analysis compares the economics impacts across the various alternatives and ends with a summary of the reviewer's conclusions regarding the economic impacts of the alternatives. Section 3 of the review examines issues believed to be of significance by the reviewer, including a discussion of the DSEIS organization and writing style, and a discussion of the DSEIS Cumulative Affects Analysis.

In general, the economic analysis contained in the DSEIS is sound, and appears to rely on the best scientific information available. The models used appear to have been developed in a way that effectively address the alternatives to which they were applied, and to that end appear to produce reliable results and projections of net benefits, and economic impacts. However, documentation of the economic analysis, and in particular documentation of models, data and assumptions used is inconsistent and difficult to find within the DSEIS. It appears as though the authors, in an attempt to streamline the analysis, and to keep the amount of text facing decision makers to a minimum, sacrificed a more thorough and complete description of their work. While this strategy may be appropriate for readers who are familiar with the models, data, and assumptions used to assess management actions in this fishery, to persons less familiar with the process and the particular fisheries in question, these shortcomings make difficult to be confident in the results of the analysis.

Long-run estimates of community impacts resulting from major rebuilding strategies are not provided in the analysis. Short-run regional impacts including direct, indirect and induced effects, of the major secondary alternative groups are provided. Impacts for several large communities are included in these region estimates. Impacts on smaller communities do not appear to be explicitly provided, but enough information is provided in the document to enable readers to estimate effects.

The comparison of alternatives within the DSEIS is inadequate from a big-picture perspective. The DSEIS does not contain comprehensively specified alternatives that combine rebuilding strategies and particular suites of management measures that could be used to achieve rebuilding while attempting to minimize economic and social disruptions. Because comprehensive alternatives are not specified and are not analyzed, it is generally not possible to fully and reasonably assess the consequences of the different measures. Because of this shortcoming, the DSEIS is critically deficient with respect to CEQ guidelines for NEPA documents that specifically require contrastable and comparable alternatives.

The lack of comprehensive alternatives is clearly due to the excessive number of different and widely varied management actions that are included in the DSEIS. If the analysts had attempted to assess all of the different permutations and combinations of potential management actions included in the DSEIS, literally thousands of different models runs and corresponding result summaries would have been required. While it may be convenient to blame the analysts for a poorly constructed analysis, the process that created the excessive number of options as well as the CEQ guidelines, which require that all reasonable alternatives must be included, are clearly implicated.

# 1 Introduction

This review of economic analyses of related to Amendment 13 to the NEFMC's Multispecies Fishery Management Plan (FMP) has been requested by NOAA Fisheries. The intent is to provide NOAA Fisheries, the NPFMC, the New England fishing industry, and members of the interested public with the an additional perspective from outside the region. Northern Economics, Inc. an economics consulting firm in Anchorage, and in particular Marcus L. Hartley, Vice President and Senior Economist (hereafter referred to as the reviewer) have been contracted to provide one of three external economic reviews. Mr. Hartley has been actively involved in fisheries economics since 1989, when he joined the staff of the North Pacific Fishery Management Council (NPFMC). Mr. Hartley began working for Northern Economics in 1997, after serving as the NPFMC's Senior Economist for three years.[1]

This remainder of this introduction will: 1) discuss the terms of reference under which the review was conducted, 2) provide a guide or roadmap to the body of the review.

## 1.1 Terms of Reference

In order to provide a consistent set of economic reviews to NOAA Fisheries, the structure of this review was specified in the "Terms of Reference," provided to each of the reviewers. The Terms of Reference dictate that this review is to address social and economic issues and analyses contained in the Draft Environmental Impacts Statement (DSEIS).[2] The Terms of Reference specifically indicate that the requirements for the assessment of fisheries regulations are found in several statutes and executive orders including the Magnuson-Stevens Fishery Conservation and Management Act (MSA), Executive Order 12866, (EO-12866), and the National Environment Policy Act (NEPA). Additionally, the terms of reference cite guidelines that are to be followed when preparing FMPs, including its "Guidelines for the Economic Analysis of Fishery Management Actions" (NOAA, 2000). Although not cited specifically in the Terms of Reference, the Council for Environmental Quality (CEQ) has published guidelines for the preparation of NEPA documents[3], and because DSEIS is a NEPA document, it is implied that any fishery DSEIS should also follow the guidance suggested by the CEQ.

In addition to questions of whether the DSEIS follows statutory and agency guidelines, the Terms of Reference state that the review address the following questions:

*A) Are the economic analyses in the DSEIS scientifically sound, based on the following considerations:*

*a. Appropriateness of the data used*

*b. Assumptions made in study design, data collection, and analytical methods*

[1] Mr. Hartley has been the primary author of many of the important economics decision documents used in the North Pacific to manage the federal fisheries in that region, and has also worked on fishery decision documents in the Pacific and Western Pacific regions. Additional information about Mr. Hartley and Northern Economics, Inc. can be found at www.northerneconomics.com.

[2] Notice that the Final Supplemental Environmental Impact Statement (FSEIS) was published in the Federal register on December 29, 2003. The FSEIS contains a preferred alternative that was not included in the DSEIS, additional analyses, and is substantially reorganized. For these reasons this review should not be considered directly applicable to the FSEIS.

[3] 42 USCode, Sec. 1502 from 43 FR 55994, Nov. 29, 1978

c. *Overall approach to analyzing the impacts of each alternative and the economic and statistical methods and models employed in each analysis*

d. *Accuracy, relevance, and applicability of findings of impacts on fishing communities*

e. *Completeness of analyses given the available data, and as compared to other DSEIS for fishery management actions*

B) *To what extent do the results in the DSEIS effectively compare economic impacts, overall and on individual communities*

C) *Give your concise conclusion about the economic impact of the alternatives analyzed in the DSEIS, in terms of gross and net revenues, and employment in the short term, long term, and overall…*

a. *Relative to each other*

b. *Relative to conditions in the year 2002 (the most recent year for which complete economic data are available)*

c. *Relative to economic conditions since 1986 (the first year considered in the analysis)*

d. *On specific ports, gear sectors, shoreside industries and communities*

D) *Does the DSEIS provide information on the likely economic impacts on communities in absolute terms (as opposed to providing comparative analyses) and on allocation consequences of the alternatives? If so, provide a concise summary of your interpretation of this information. If not, would you expect such information based on your knowledge of other DSEIS for fishery management actions?*

The reviewers were provided with documents describing the legal mandates, and were provided access to all relevant documents concerning Amendment 13. In addition, the reviewers visited the New England Fisheries Science Center (NEFSC) Social Science Branch in Woods Hole and had in-depth discussions about the analysis with Branch staff members, members of the NEFSC staff, and members of the public in attendance.

## 1.2 Structure of the Review

While each of the three reviews was conducted independently, the reviewers discussed the DSEIS among themselves and shared their own perspectives and opinions with the others. While there was no attempt to form a consensus, it was agreed that the general structure of the reviews would be comparable. To that end, an outline was developed and agreed upon. Thus, each of the reviews will contain an executive summary, and three sections. Section 1 provides an introduction, Section 2 addresses the primary issues requested in the Terms of Reference, and Section 3 contains additional comments of particular concern to the individual reviewers.

In this particular review, each section and sub-section will begin with a summary of the conclusions drawn and a description of the information that follows. Text and sub-sections that follow the summary will serve primarily as backup documentation or to provide additional details. This style may be somewhat unfamiliar to readers used to a more traditional style that first describes the methods used, presents the background material, and then finishes with conclusions and summaries.

Primary Issues

Section 2 addresses the primary issues contained in the Terms of Reference—specifically the italicized text shown on page 1—and begins with an overview of the conclusions of this review. The section then goes on to address the overall soundness of the economic analysis in terms of the models, data, and assumptions used to assess the impacts of the alternatives included in the DSEIS. Subsection 0 and Subsection 2.4 will address how well the DSEIS analysis compares the different economics impacts that are projected to result from the various alternatives. Section 2.5 discusses the projections of community impacts in the DSEIS and provides suggestions as to how they might be improved. Finally, Section 2 ends with a summary of this reviewer's conclusions regarding the economic impacts of the alternatives (Subsection 2.6), based not only on information in the DSEIS, but also on supplemental information provided by NEFSC and on the reviewer's experience and expertise regarding fishery management issues and impacts.

Other Comments

Section 3 of this review examines issues of importance that are either implied by the Terms of Reference or believed to be of significance by the reviewer. The section contains discussion of the following topics:

- Document Organization and Writing Style
- Cumulative Affects Analysis

# 2 Primary Issues

The section addresses the primary issues in the Terms of Reference and is organized into six sub-sections beginning with an overall summary of findings regarding the economic analysis followed by separate subsections for each of the primary issues.

## 2.1 Summary of Findings

In general, the economic analysis contained in the DSEIS is sound, and appears to rely on the best scientific information available. The models used appear to have been developed in a way that effectively address the alternatives to which they were applied, and to that end appear to produce reliable results and projections of net benefits, and economic impacts. However, documentation of the economic analyses and in particular documentation of models, data and assumptions used are not consistent throughout the document and difficult to find within the DSEIS. It appears as though the authors, in an attempt to streamline the analysis, and to keep the amount of text facing decision makers to a minimum, sacrificed a more thorough and complete description of their work. While this strategy may be appropriate for readers who are familiar with the models, data, and assumptions used to assess management actions in this fishery, to persons less familiar with the process and the particular fisheries in question, these shortcomings make it considerably more difficult to be confident in the results of the analysis. Were it not for the special presentations provided to the reviewers in Wood's Hole on January 9, 2004, and the additional correspondence and personal communications between the analysts and the reviewers, it is unlikely that this review would have reached the same conclusions.

The comparison of alternatives within the DSEIS is inadequate from a big-picture perspective. The DSEIS does not contain fully-specified alternatives that combine rebuilding strategies and particular suites of management measures that could be used to achieve rebuilding while attempting to minimize economic and social disruptions. Because comprehensive alternatives are not specified and are not analyzed, it is generally not possible to fully and reasonably assess the consequences of the different measures. Because of this shortcoming, the DSEIS is critically deficient with respect to CEQ guidelines for NEPA documents that specifically require contrastable and comparable alternatives.[4]

The lack of comprehensive alternatives is clearly due to the excessive number of different and widely varied management actions that are included in the DSEIS. If the analysts had attempted to assess all of the different permutations and combinations of potential management actions included in the DSEIS, literally thousands of different model runs and corresponding result summaries would have been required. While it may be convenient to blame the analysts for a poorly constructed analysis, the process that created the excessive number of options and the same set of CEQ guidelines requiring that all reasonable alternatives must be included[4], are clearly implicated.

## 2.2 Soundness of Economic Analysis

This section examines the analytical tools developed and used in the DSEIS and briefly discussions the application of those tools to the various alternatives under consideration. Our approach in this section is to provide comment on each of the major models that were employed (Section 2.2.1).

Eight distinct economic models were used to assess impacts of the various alternatives including:

1) Net Benefit Model
2) Dockside Demand Model
3) Closed Area Model
4) Revenue Change Model
5) Hard TAC Model
6) Break-Even Model
7) Input/Output (I/O) Model
8) Recreational Fishing Model

Each of these models is described with varying degrees of detail within the DSEIS. Additionally, the reviewers were provided with detailed descriptions of the models during sessions at the Social Science Branch Office in Woods Hole.

Different models are used to assess the impacts of different groups of alternatives. For example the various proposed rebuilding programs for overfished stocks were assessed using the "Net Benefit Model" while the alternatives that would address rebuilding by changing the management regimes were assessed with other models including the closed area, revenue, and I/O models. A primary difference between the net benefit model and the other economic models is the analytical time frame—long-term effects were measured with the net benefit model and short-term effects were projected using the other models.

[4] 42 US Code. Sec. 1502.14 from 43 FR 55994, Nov. 29, 1978

### 2.2.1 Assessment of Economic Models

The following subsections review the different models employed in the DSEIS, the description of the model, and the application of the model in the DSEIS. The review of the economic models evaluates the models with respect to three areas:

1) The description of the model contained in the DSEIS text—does the description allow decision makers and the interested public to understand the basic components of the model and reasonably assess its appropriateness.

2) The appropriateness and completeness of the model as used notwithstanding the description of the model in the text—the information is derived not only from the DSEIS text, but also from presentations made by the authors to the reviewers and in other personal communication between the authors and reviewers.

3) Are there shortcomings in the model that could have been reasonably addressed, or are there components that make the model unnecessarily complex.

#### 2.2.1.1 Net Benefit Model

The net benefit model (NBM) is the primary tool used to project long-term economic effects of the different rebuilding strategies. While the NBM is critical to the overall analysis, its relative importance is not readily apparent. In fact a formal description of the NBM does not appear in the table of contents, nor is there mention of the NBM in sections that purport to describe the analytical approach used in the DSEIS. For example, Section 4.1 entitled "Analytic Approach and Limitations" does not mention the NBM,[5] but describes in detail the Closed Area Model (CAM)—as a primary tool used to analyze both the biological and economic impacts. As discussed in the summary of findings, the lack of a section that comprehensively describes the analytical approach is a major shortcoming of the DSEIS, and the relative obscurity of the description of the NBM is a prime example of this deficiency.

Notwithstanding the fact that a description of the NBM is difficult to find and not discussed in context with other models used in the formal analytical approach sections, the description of the NBM and its use, once it is found in Section 4.4, is very well written. Nearly all of the NBM's components are discussed in a manner that is accessible to decision makers and the description of results is straightforward and informative. Overall, the NBM appears to be a reliable and robust model, and receives high marks. Futhermore, the written description of its use is well done and admirably conveys the projected results of the major rebuilding strategies.

As with all analytical models, the NBM could be improved upon, as could the model description and the methods used to describe results. Several potential areas where the model could be improved are listed below:

- Non-consumptive benefits should be addressed in the NBM. Non-consumptive benefits of rebuilding include benefits received by members of the U.S. public that result from the rebuilding of the stocks and the knowledge that major components of the marine ecosystem are no longer being depleted. Non-consumptive users will receive varying degrees of benefits from the different rebuilding strategies. Furthermore, non-consumptive benefit streams tend to vary inversely from commercial benefits, and therefore will tend to offset costs/benefits of

[5] The NBM is also not mentioned in Appendix XI or Appendix XVI, both of which describe analytical approaches used in the analysis

commercial users. Because non-consumptive benefits are extremely difficult if not impossible to quantify, they should at a minimum be discussed qualitatively.

- Recreational users will also see changes in their benefits streams. Like non-consumptive benefits, recreational benefits are difficult to quantify, but should be discussed qualitatively in any net-benefits discussion.
- The NBM purports to examine both producer and consumer surplus, but only producer surpluses appear to be quantitatively addressed. Except for their mention in the introductory section of the NBM, consumer surpluses do not appear to be explicitly addressed.
- Additional detail on the methods used to incorporate uncertainty should be discussed. Such a discussion could be relegated to an appendix, but should be available to readers seeking additional insights.
- Tables showing the derivation of net present value for each of the alternatives should be developed and highlighted. These tables should include nominal net revenues and discounted net revenues projections for each year (through 2026), nominal and discounted consumer surpluses for each year, as well as cumulative discounted net benefits. Such a table even if it shows only orders of magnitudes will provide reviewers and decision makers a more complete sense of the flow of costs and benefits over time.
- If it were assumed that the distribution of vessels within each vessel class defined in the NBM remains constant with respect to vessel homeports, it would have been possible to estimate order of magnitude long-term community impacts. As it is, no long-term estimates of community impacts are provided in the DSEIS.

#### 2.2.1.2 Dockside Demand Model or Price Model

The genesis of the dockside demand model (DDM) is a "co-integration analysis of dockside prices" conducted by economists at the University of Rhode Island. The co-integration analysis is discussed in detail in Appendix XVI. The DDM builds upon the co-integration analysis and is used to predict prices of various species at different harvest levels for different years within the context of the NBM. The co-integration analysis found that prices of major New England groundfish species generally move together and are highly influenced by the price of Atlantic cod. The analysis also found that prices for Atlantic cod were largely exogenous—determined by outside influences such as global landings of Atlantic cod, markets for groundfish in Europe, exchange rates, etc. The analysis also found that there was a general upward trend in prices over time regardless of quantities landed.

A shortcoming of the co-integration analysis is the apparent exclusion of Pacific cod catches from Alaska. In 2003, over 500 million pounds of Pacific cod were caught in Alaskan waters [NOAA Fisheries–Alaska Region, 2004]—over three times the total projected landings of large mesh species in New England in 2003. Pacific cod is becoming a significant substitute for Atlantic cod for New England, other U.S., and European consumers, hence its importance in price models cannot be ignored.

While the DDM is used in the NBM,[6] the exact specification of the DDM and the price/quantity/year relationships that result are not explicitly discussed in the DSEIS or in the Appendices. The use of the dockside demand model and the resulting price effects within the

[6] It does not appear that the DDM or the co-integration analysis is used in any of the other economic models employed in the DSEIS.

NBM should be more explicitly described in the DSEIS text, ideally in either the discussion of the approach in Section 4.1 or in the discussion of the NBM in Section 4.6. While there is a discussion of model results in Appendix XVI, a table showing the ranges of prices and quantities by year would have been useful to understand the relative importance of this component.

The DSEIS text should also discuss the fact the price changes in response to quantities landed have a directional effect on producer surplus that is opposite of the directional effect on consumer surplus. For example, if prices increase in response to a decrease in landing, the change in producer surplus is less than it would have been if prices had remained constant. At the same time, the price increase means that consumer surplus losses are greater than they would have been had prices remained constant. This is not to say that price effects are not important, rather that their relative importance in a net benefits analysis compared to quantity effects is likely to be small. This is particularly true when the vast majority of producers and the consumers are US residents.[7] These offsetting nature of price changes coupled with the apparently weak correlation between landings and prices, and the fact that price changes are not considered elsewhere in the analysis, appear to make the DDM somewhat of an unnecessary diversion.

#### 2.2.1.3 Closed Area Model

The closed area model (CAM) is used as a primary input into the other economic models that examine short-term effects on vessels and communities of various management measure that are contemplated in response to the proposed rebuilding strategies.

The CAM is the first and only model described in Section 4.1—Analytic Approach and Limitations. The model is introduced with the following text:

> "One of the primary analytic tools used to analyze both biolocial and economic impacts of the proposed alternatives to achieve mortality objectives is the closed area model."

The description of the CAM continues for an additional two pages, and is followed by Section 4.2 that discusses the biological impacts of the rebuilding strategies.[8] Because of its placement and that fact that no other models are described in Section 4.1, it is likely that many readers, reviewers, and decision makers will incorrectly infer that the CAM is the primary analytical tool used in the DSEIS—not only for economic effects but also for biological effects. This is a serious flaw in the DSEIS, and very likely a source of considerable confusion. It appears in fact, that the CAM is not used at all in the estimation of long-term effects of the various rebuilding strategies, nor is the CAM used to address many of the proposed management actions that could mitigate the short-term negative consequences of the rebuilding strategies [Thunberg, 2004].

In spite of the fact that the description of the CAM is inappropriately thrust into limelight by virtue of its inclusion in the sections describing the analytical effects, the CAM appears to be a reasonable model for the uses to which it is applied. While the description of the CAM in the DSEIS is reasonably clear, particularly if the initial description is combined with the description of

[7] Price effects are more important in situations where the majority of products are exported. For example, the vast majority of products produced in the Alaska Pollock or Pacific Whiting fisheries are exported. In those fisheries any price changes that result from management actions would affect US-based producer surplus but would have very little effect on US-based consumer surplus—changes in producer surpluses would not be offset to any significant degree, and thus a price effect model would have a much greater role in estimating net benefits of the management action.

[8] The CAM is also mentioned as the primary economic model (along with the DDM) in Appendix XVI. Again, the fact that other economic models are not mentioned in the appendix leads to the incorrect inference that the CAM is the primary economic tool used in the DSEIS.

the data, and its application in Section 4.4.4, the presentation and discussions provided in Woods Hole on January 9, 2004, significantly enhanced the reviewer's understanding with respect to the model, its use, and the output it generates.

While the CAM is generally an acceptable model, there may be ways that it could be improved upon. One of the potential shortcomings of the model is that it maximizes gross revenues of each individual vessel based on prior activities of that vessel. However, the CAM ignores variable costs, and therefore it is possible that, under various alternative management regimes, the model will predict that vessels fish, even when they are not able to cover operating costs. While vessel-level cost information are not available, cost estimates have been made for classes of similar-sized vessels using similar gears. These cost estimates were incorporated into the NBM discussed earlier. By re-tooling the CAM to maximize net revenues of vessel classes, the CAM may be more robust in its predictions of future vessel behavior under changing conditions. Further, by assuming that the distribution of participation within each vessel class remains constant with respect to homeports, estimates of community impacts need not be sacrificed.[9]

#### 2.2.1.4 Revenue Change Model

The revenue change model (RCM) is clearly and succinctly described in DSEIS Section 4.4.4. However, given that the RCM is the primary tool used to report vessel level impacts of proposed management actions addressing the rebuilding strategies, the RCM is conspicuously absent from the discussions of the analytical approach contained in Section 4.1 and Appendix XVI.

The stated purpose of the RCM is "to provide a comparative assessment of economic impacts across alternatives, as well as an assessment of the distributive effects by gear sector, state, and vessel size class" [DSEIS, p. I-557]. The RCM takes the vessel-level revenue outputs of the CAM, combines it with revenues for the vessel from other non-groundfish trips made in the baseline period,[10] and estimates the proportional change in revenue for that vessel from the baseline.

Overall this approach to estimating short-term revenue effects is reasonable and appropriate for the purposes to which it is used. Further, the consistency with which the RCM reports the distribution of outcomes by grouping vessels over a variety of factors is valuable and enlightening.

While the RCM approach appears to produce reliable results, the fact that all of the alternatives studied, incorporate rebuilding strategies that significantly reduce landings compared to the baseline, all of the model results are negative. While the analysts are careful to point out that the analysis should be used to rank alternatives, the that fact that all of the options are negative, clearly produces a bias against choosing anything but the no-action alternative—an alternative that is legally out of bounds.

Given the caveat that the CAM/RCM outcomes should be used strictly as a tool to rank the alternatives, the "negativity" problem described in the previous paragraph could have been addressed by normalizing the results against the average results of all of the legally viable alternatives.[11] For example, when looking at Alternatives 1A through 1D as in Table 171, the

[9] There are benefits of having vessel level results from the CAM, including the ability to easily describe the distribution of effects within vessel classes as is done in the Revenue Change Model discussed in the next section of this review, as well the ability to easily estimate community impacts discussed in Section 2.2.1.7.

[10] This step relies on the assumption that non-groundfish trips remain constant from the baseline period.

[11] The solutions in this and the following two paragraphs are not intended to suggest that the analysts should hide the fact that the projected the short-term effects create lower revenues than the baseline

analysts could have calculated the average outcome for each vessel over all four of the options. Then, rather than reporting the change of the group against the no-action alternative, the table would report the change of the groups compared to the average of all the alternatives. If this were done in Table 171, Alternatives 1B and 1D would have shown positive outcomes (with 1B slightly higher than 1d) and Alternative 1A and 1C would have shown negative outcomes.

Another approach to address the negativity problem would have explicitly recognized that the no-action alternative was not a legal option, and forego the subtraction of the no-action baseline revenues from the CAM outcomes, and rather than presenting results as a percentage change from the baseline, the results could have been presented as total revenue under the option.

A third solution to the negativity problem would be to run the CAM/RCM for each year through 2026 as was done with the NBM, and show the discounted cumulative change in revenue for each alternative. Notwithstanding the issues of uncertainty and potential biases, it is likely that additional insights into the long-term effects of the management alternatives in response to the rebuilding strategies, could have been achieved had the CAM/RCM approach been carried forward into the future. As it is, the analysis stops with a one-year forecast, that in nearly every case results in a negative outcome compared to the no-action or status quo alternatives. If, as shown by the results of the NBM, the long-term benefits to the producers outweigh the short-run costs even after taking into the account the time-value of money, then an analysis that examines only the short-run will most certainly be biased against any management action.

#### 2.2.1.5 Hard-TAC Model

The hard-TAC model (HTM) was apparently developed to supplement the CAM for a small subset of management alternatives that incorporate fleet-wide total catch quotas (or TACs) for individual species. The stated purpose of the HTM was to simulate the effects of the "race for fish" or "derby style" fisheries that typically occur when fisheries are managed with TACs and individual vessels are not allocated a specific share or individual quota. The HTM was also developed to estimate discards that typically occur when the catch of a particular species approaches the TAC.

To simulate the derby, it was assumed that fisheries for all species began at the beginning of the fishing year and that catch of each TAC species progressed simultaneously at a rate determined by weekly catch rates seen during the baseline period (sorted from high to low). Thus, the HTM produces an estimate of the length of time it might take to attain the TAC of particular species. Iterating the model could then approximate the effects of trip limits that are imposed when the catch of a species approaches its TAC.

While the HTM is clearly described in Appendix XVI as part of the analytical tools used in the DSEIS, it does not appear that the HTM was actually used.[12] The presentations and discussions that took place on January 9, 2004 at Woods Hole revealed that the analysts chose to simulate TACs within the CAM by limiting each vessel to its historical proportion of the catch of each species subject to the TACs. The following subsection discusses this approach and its applications within the DSEIS.

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conditions, rather that some of the negativity that has arisen from the DSEIS could likely have been avoided.

[12] The HTM is included in the description of the analytical approach contained in Appendix XVI, whereas descriptions of NBM, CAM, and RCM are not included. This creates some unnecessary confusion for readers, and decision makers, who may infer that the HTM was a primary analytical tool used throughout the analysis. In fact it appears that the HTM is not actually used to assess impacts of the alternatives.

#### 2.2.1.5.1 Closed Area Model Adaptation for TACs

TACs are included in three of the management alternatives that are proposed to address the rebuilding strategies—TACs are included as a "back-stop" in Alternatives 2 and 3 and as a primary management tool in Alternative 4. Notwithstanding the inclusion of the HTM in the description of analytical approach, the assessment of economic effects of the TAC was accomplished within the CAM by limiting each vessel to its historical proportion of the catch of each species subject to the TACs. The pros and cons of using the HTM or the TAC version of the CAM (TCAM) were presented to the reviewers in Woods Hole, but were not fully described in the DSEIS. According to the analysts, the TCAM was chosen because: 1) of the consistency of the results, 2) the limitations of TCAM were viewed as less significant than limitations of the HTM, and 3) the TCAM was better suited to simulate multiple regulatory instruments. The analysts also recognized that the TCAM was unable to determine fishery season lengths and was unable to estimate effects of trip limits.

#### 2.2.1.5.2 A Critique of the Closed Area Model Adaptation for TACs

Given the history and the relative sophistication of the two models, the analysts' choice to use the TCAM over the HTM was probably prudent. The TCAM could provide an approximation of a hard-TAC system operating with individual quotas, while at the same time providing results that could be compared to the results of other alternatives. However, the alternatives that contain hard TACs do not include measures implementing an individual quota (IQ) system, and as demonstrated in the pollock, sablefish, and halibut fisheries in Alaska, TACs management regimes with IQs are radically different from TAC management regimes without IQs.

With an IQ, the vessel owner is able to optimize his fishing year without regard to the actions of other vessel owners. This is critical if there are seasonal differences in catch rates, flesh quality or ex-vessel values paid for various species. Without an IQ, the vessel owner operating under a multi-species TAC management regime, must optimize over successive but separate time-periods during the year. In other words, the owner must determine which species to target during the first month of the fishing year based on the species that are available to him at that time. Periodically during the year, the vessel owner must re-evaluate which species to target during the current period particularly if a TAC has been met or if the relative profitability of a particular species has changed. In many cases optimization over the shorter time period will result in apparently irrational decisions compared to the decisions that would be made if the owner had an IQ.

As an example, assume the TAC of Species-A is 5,000 tons and that the catch per vessel-day in the spring is 5 tons, and in the fall the catch per vessel-day is 10 tons. Further, assume there are 10 boats in the fishery. If all vessels fish in the spring then each vessel will have to fish for 100 days to catch 500 tons. If all of the vessels delayed fishing until fall, then each vessel will fish for 50 days and catch 500 tons. Clearly the fleet as a whole will be better of fishing in the fall. But because none of the vessels have exclusive rights to the fish, there is no guarantee that the entire TAC will be available in the fall. In fact any individual vessel might be able to increase its relative share of the fishery by starting early compared to the rest of the fleet. In order to prevent other vessels from usurping their share of the fish, and to avoid the possibility of catching nothing, all vessels will fish in the spring, foregoing more profitable fishing in the fall. The problem is compounded in multi-species or multiple-gear fisheries.

Based on the example above, a more appropriate adaptation of the CAM would have been to run the CAM on a month-by-month basis.[13] During Month-1, each vessel chooses a fishing strategy and continues that same strategy for the entire month. At the end of the month, total catch (including incidental catch) of each species over all vessels is summed. If the TAC of any species has been met (or crossed a pre-determined threshold—85 percent of the TAC, for example) then fishing for that particular species is prohibited. After determining which species can be targets in the coming month, the model is re-run with a revised set of constraints. At the end of each month new constraints are added until all TACs or TAC thresholds have been met or the fishing year ends. The outcomes under this successive time period model is likely to be different than a model with IQs in which vessels are assured their share of each TAC. Whether the differences would be significant enough to alter the relative ranking of the alternative under consideration is an empirical question.

While the model described in the previous paragraph may have been appropriate, the time necessary to develop such a model was unlikely available to the DSEIS analysts. Further, since the model described above was never formally published nor was it widely distributed, the DSEIS analysts cannot be faulted for not incorporating it into the CAM.[14]

#### 2.2.1.6 Break-even Model

The break-even model (BEM) was developed to assess management measures that allocate and limit days at sea (DAS) in response to the rebuilding strategies. The BEM is introduced in Section 4.4.5 and the description cover 5 pages of text. As with many other models, the BEM is not mentioned earlier in Section 4.1 or in Appendix XVI both of which purport to describe the analytical approach used for assessing alternatives. The BEM uses cost data for vessel classes to evaluate how many DAS a typical vessel in each class will need to cover non-crew operating costs and fixed costs, as well as the additional DAS needed to provide crewmembers with labor payments at least as high as wage that could be received onshore. Overall, the BEM appears to be a useful tool that can provide significant insight into fishing vessel behavior changes in response to changing DAS restrictions.[15]

#### 2.2.1.7 Input/Output Model

An input/output model is developed and utilized in the DSEIS to project short-term indirect and induced effects of the alternatives at the regional level. While the I/O model is not mentioned in Sections describing the analytical approach (Section 4.1 and Appendix 16) it is clearly and

[13] This type of model was developed by Berman and Hartley [1994] based on prior unpublished work by Arnarson [1990] for use by the North Pacific Fishery Management Council's Comprehensive Rationalization Program (a multi-species IQ program). However, before it could be utilized, the Council abandoned rationalization in favor of license limitation. Although reviewed and approved for use by the Council's SSC, the Berman and Hartley model was never formally published.

[14] A written description of the Berman and Hartley model can be obtained by requesting it from Mr. Hartley directly--(907) 274-5600.

[15] It should be noted that the BEM treats crew payments as variable costs, in direct contradiction to the NBM, which treats crew payments as part of producer surplus. Valid arguments can be made for either assumption—crewmembers do in fact have a profit sharing arrangement with owners, thus it can be argued that crew payments are part of producer surplus. At the same time crew are unlikely to stay with the owner if they receive no compensation at all, and from that perspective crew payments can be viewed as a variable cost. Regardless, the DAS model does a reasonable job estimating impacts of changing DAS restrictions.

succinctly described in Section 4.4.6. The I/O model and its use were also described during the presentations provided to the reviewers in Woods Hole.

The I/O model developed for this analysis appears to appropriately capture not only the indirect and induced effects from changes in fish-harvesting activities, but also the additional marginal direct, indirect and induced effects of seafood dealers and processors while avoiding double counting errors.

Experience with other I/O models used in fishery applications reveals that readers have a difficult time associating the economic term "indirect and induced" effects with real jobs and income in real industry and service sectors. From that perspective the model description could be improved if it provided some examples of effects for highly aggregated sectors. A typical complaint might be, "Yes I read about the I/O model, but I work in the fuel supply business and I want to know how I will be affected." These types of concerns can be addressed by putting more effort into the explanation of the meaning of indirect and induced effects and by providing examples.

Another concern, which has also been voiced with respect to other models, is that because the primary input for the I/O model are direct effects as projected by the RCM, the I/O model suffers from the same perceived negativity problem described in Section 2.2.1.4. Since all alternatives incorporate the rebuilding strategies, all outcomes are negative compared to the baseline conditions. Thus, the perception that all options are negative may obfuscate the finding that some options are less negative than others.

#### 2.2.1.8 Recreational Fishing Model

Short-term net benefits effects (welfare) of the alternatives on recreational fishing—defined to include both anglers and operators of charter operations—are assessed qualitatively based on the assumption that more is better. This methodology is reasonable given that more quantitative methods are very expensive and time consuming and have not been proven to reliably estimate differences in welfare changes across multiple alternatives. Because the welfare estimates are qualitative, it could have been insightful to estimate long-term benefits to recreational fishing with respect the various rebuilding strategies. This shortcoming was mentioned in the discussion of the NBM in Section 2.2.1.1.

Economic Impacts of recreational fishing (direct, indirect, and induced effects) based on spending of recreational fishers are modeled using an I/O output model. The same basic approach as specific in the I/O model discussed in the previous section is used.

As with other short-term models, the comparison of effects to the no-action baseline that incorporates fishing at previous levels, but which is not a legally viable option, tends to disguise the finding that some options are less draconian than others.

## 2.3 Assessment of Alternatives

While technically strong and generally well done, the analysis of alternatives in the DSEIS suffers from three significant problems:

1) the excessive number of alternatives, many of which are serial in nature with outcomes dependent on decisions made on other alternatives
2) the overall approach and organization of the assessment of the alternatives does not allow readers to comprehensively assess any single alternative
3) there is a fundamental mis-specification of the No Action Alternative.

The first problem may be considered outside of the control of the analysts, and therefore criticism of the alternatives that are included is outside the formal scope and terms of reference of this review.[16] However, the overall approach and organization of the assessment, and the proper specification of the No-Action Alternative are clearly within the purview of the analysts.

In spite of the organizational shortcomings and the mis-specification of the No-Action Alternative, the actual analyses of the alternatives are scientifically sound. For diligent and well-organized readers and decision makers, the DSEIS provides enough data to make informed choices on preferred alternatives. The remainder of this section will begin with a discussion of the two major problems of DSEIS that are within the purview of the analysts and the Terms of Reference for this review (Sections 2.3.1 and 2.3.2). The review will then go on to discuss the assessment of the major groupings of alternatives.

### 2.3.1 Overall Approach and Organization of the Assessment of Alternatives

The overall approach and organization of the assessment of alternatives suffers from a lack of cohesiveness, consistency, and structure. This significantly affects the reader's ability to follow the analysis and precludes a systematic comparison of impacts. This subsection is divided into two parts—the first discusses cohesiveness, consistency and structure without regard to the specific alternatives and the second examines the broader structural issues that arise from the nature of the alternatives—the primary rebuilding alternatives which determine the rebuilding path, and the other management alternative which address ways to achieve the path chosen.

#### 2.3.1.1 Basic Structure of the Document

The following is an example of the problem of the lack of a consistent structure in the document:

To understand the effects on various components of the human and marine environments of a 65 percent reduction in Days at Sea (DAS), the reader, following the Table of Contents, would go first to page 288, then page 443 and finally page 746. The reader might miss sections that deal with the 65 percent reduction in DAS because of inconsistent terminology in the Table of Contents and from section to section. Going back through the Table of Contents more carefully, and recognizing that the 65 percent reduction is one of many alternatives to address rebuilding requirements, the imaginative reader might check for more information on pages 374, 728, and 864. Still the reader would not have found the basic economic and social impact discussions, which are addressed on pages 558, 636, 673, and 680 under various labels.

The problem is compounded by the fact that there are no less than four completely different alternatives that are labeled Alternative 1, some of which are no-action alternatives and some of which are not.

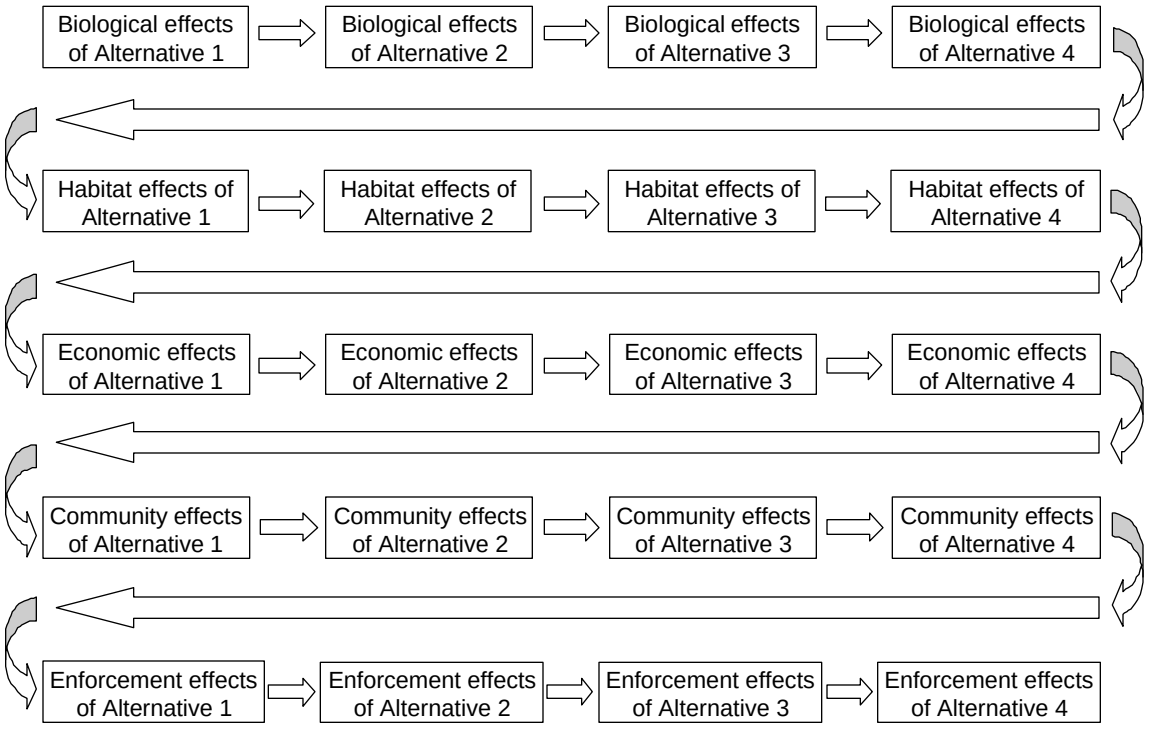
While this labeling and terminology problem is relatively mundane, and could be fixed by a thorough and careful edit of the DSEIS, the problem is significant enough that it makes the document nearly impossible to follow and undoubtedly casts suspicion on any of the analytical findings.

The organizational problems with the DSEIS are more than just a terminology issue. As indicated above the analytical section is organized from the perspective of the different components of the

[16] Additional comments on this critical issue along with other comments that are outside the terms of reference are contained in Section 3.

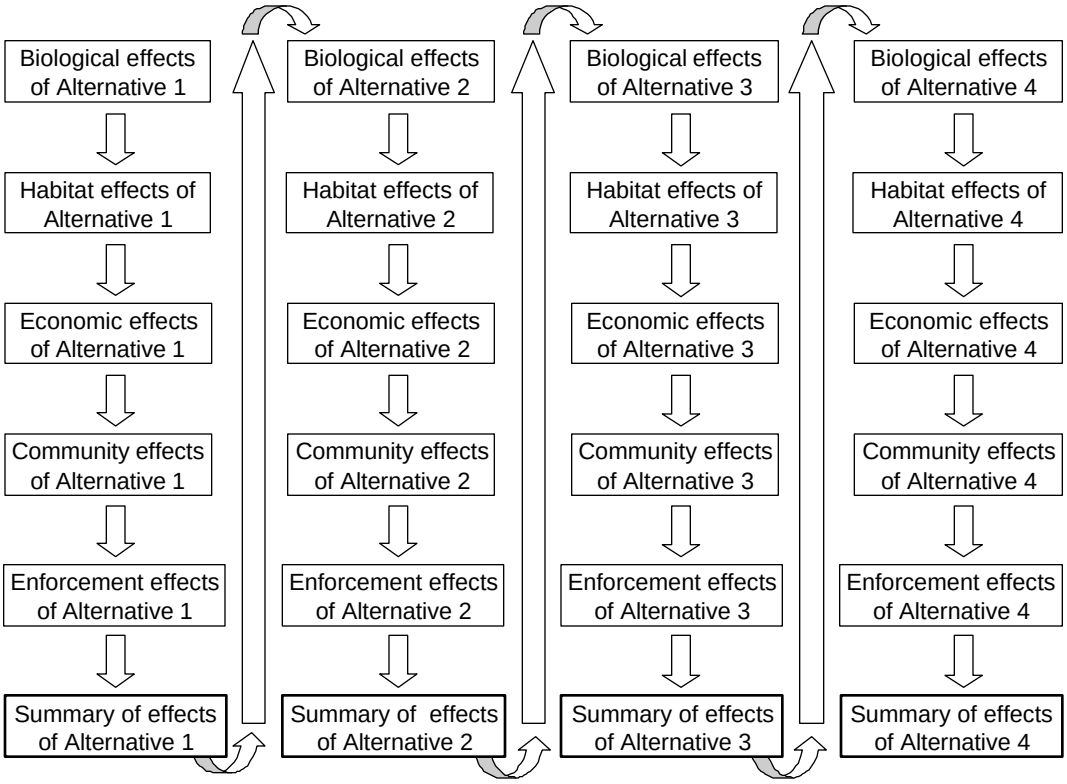
affected environment. Section 4.2 for example focuses on the biological component and looks at all of the alternatives from that perspective. Section 4.3 examines the full suite of alternatives from a habitat perspective while Section 4.4 focuses on economic effects. There is nothing inherently wrong with this approach—it allows readers specifically interested in biological effects the luxury of reviewing all of the biological effects in succession, without having to flip to different sections. However, this row-wise approach does not allow readers interested in a particular alternative to easily understand how all of the environmental components are affected by the alternative, nor does it provide a summary of the effects of the alternative. Figure 1 below demonstrates the row-wise organizational structure of the analysis.

Figure 1. Existing Row-Wise Organizational Structure of the Assessment of the Alternatives




The alternative approach is shown in Figure 2. Because readers and decision makers have many different approaches to gaining an understanding of impacts, the preferred approach should be to provide both a row-wise and a column-wise assessment. Whether the row-wise assessment is first or the column-wise assessment is not important, there should always be a summary of effects that takes a comprehensive look at all affected components.

Figure 2. Column-Wise Assessment of Alternatives with Effects Summary




#### 2.3.1.2 Structure of Primary and Secondary Alternatives

Decision makers managing the New England multi-species groundfish fishery have essentially two major decisions they must make:

1) Choose a rebuilding strategy that will meet legal requirements
2) Adapt the existing management regime to achieve the rebuilding path chosen

The suite of options to adapt the existing regime is clearly dependent on the decision on rebuilding strategies. Therefore, the DSEIS and the assessment of alternative should be clearly structured around this dependency. From this perspective, the options to adapt the existing management regimes should be nested within the different rebuilding strategies. Instead, the DSEIS examines the different rebuilding strategies and then examines the management adaptations independently. Without a nested approach, it is very difficult to understand the interactions between the various management actions and the rebuilding strategies.

It should be noted that adopting a nested approach to structuring the alternatives results in literally thousands of different permutations that could be chosen. Theoretically, the analysts would need to examine each of these combinations to accurately depict the range of potential outcomes. While this is a significant problem, thoughtfully structuring representative alternatives that capture the broad differences among the various options and then conducting sensitivity analyses around major decision points can overcome the issue.

Table 1 on the following page demonstrates hypothetically how representative alternatives might have been structured, and shows which sensitivity analyses would be conducted. While the analysis that might fall out of such a structure would be long and tedious, the structure ensures that reasonable comparisons of outcomes can be developed.

Table 1. An Example of How "Representative Alternatives" Could be Constructed

| | Primary Alternatives | | | |
|---|---|---|---|---|
| | **Representative Alternative 1** | **Representative Alternative 2** | **Representative Alternative 3** | **Representative Alternative 4** |
| Rebuilding Strategies | Accomplish by 2009 with Constant Fishing Mortality | Accomplish by 2009 with Phased Mortality Reduction | Accomplish by 2014 with Constant Fishing Mortality | Accomplish by 2014 with Phased Mortality Reduction |
| | **Secondary Alternatives** | | | |
| Address Rebuilding | Up to 65% Reduction in DAS | Reduce Allocated DAS | Area Management | Hard TAC |
| Sensitivity Analysis | ▪ Reduce Allocated DAS<br>▪ Area Management<br>▪ Hard TAC | ▪ 65% Reduction in DAS<br>▪ Area Management<br>▪ Hard TAC | ▪ 65% Reduction in DAS<br>▪ Reduce Allocated DAS<br>▪ Hard TAC | ▪ 65% Reduction in DAS<br>▪ Reduce Allocated DAS<br>▪ Area Management |
| Control Capacity | Permit Absorption | Permit Transfer | Days-at-Sea Transfer | Freeze on Unused Days-at Sea |
| Sensitivity Analysis | ▪ Permit Transfer<br>▪ Days-at-Sea Transfer<br>▪ Freeze on Unused Days-at Sea<br>▪ Days at Sea Reserve<br>▪ Latent Effort Categorization | ▪ Permit Absorption<br>▪ Days-at-Sea Transfer<br>▪ Freeze on Unused Days-at Sea<br>▪ Days at Sea Reserve<br>▪ Latent Effort Categorization | ▪ Permit Absorption<br>▪ Permit Transfer<br>▪ Freeze on Unused Days-at Sea<br>▪ Days at Sea Reserve<br>▪ Latent Effort Categorization | ▪ Permit Absorption<br>▪ Permit Transfer<br>▪ Days-at-Sea Transfer<br>▪ Days at Sea Reserve<br>▪ Latent Effort Categorization |
| EFH Alternatives | Closed Areas to Protect Hard Bottoms | Habitat Closure Consistent with FW Adjustment 13 | Restrict Rockhopper and Roller Gear | VMS on all Groundfish Vessels |
| Sensitivity Analysis | ▪ No additional actions<br>▪ Habitat Closure Consistent with FW Adjustment 13<br>▪ Expand List of Prohibited Gears<br>▪ Restrict Rockhopper and Roller Gears<br>▪ VMS on all Groundfish Vessels | ▪ No additional actions<br>▪ Closed Areas to Protect Hard Bottoms<br>▪ Expand List of Prohibited Gears<br>▪ Restrict Rockhopper and Roller Gears<br>▪ VMS on all Groundfish Vessels | ▪ No additional actions<br>▪ Closed Areas to Protect Hard Bottoms<br>▪ Habitat Closure Consistent with FW Adjustment 13<br>▪ Expand List of Prohibited Gears<br>▪ VMS on all Groundfish Vessels | ▪ No additional actions<br>▪ Closed Areas to Protect Hard Bottoms<br>▪ Habitat Closure Consistent with FW Adjustment 13<br>▪ Expand List of Prohibited Gears<br>▪ Restrict Rockhopper and Roller Gears |

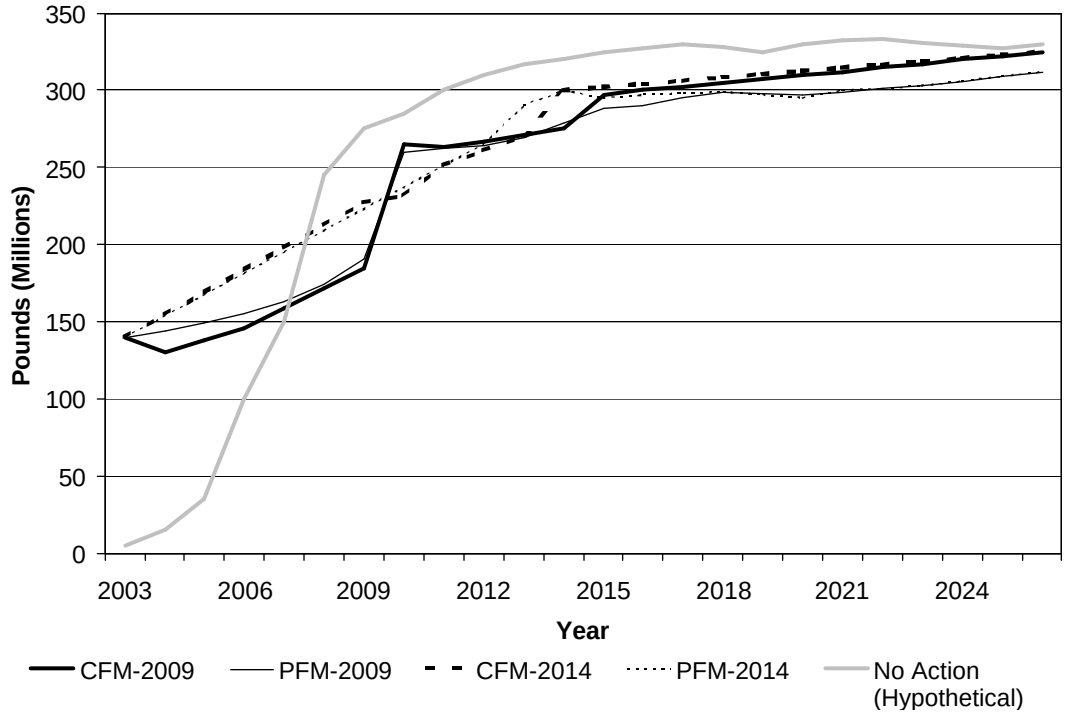
Note: The sensitivity analyses would be conducted in a *ceteris paribus* manner. For example, the sensitivity analysis of options to address rebuilding under Representative 1 would all be examined with rebuilding accomplished by 2009 with constant fishing mortality, permit absorption, and closed areas to protect hard bottoms.

### 2.3.2 The No Action Alternative

From the perspective of this reviewer, the No Action Alternative is mis-specified in the DSEIS. Because the current management regime has been declared "out of compliance", if the Council and NOAA Fisheries take no action to rebuild the overfished stocks, then all fishing under the FMP will be prohibited. From this perspective, short-term direct economic impacts of a properly specified No Action Alternative can be calculated by multiplying the baseline conditions by negative 1. Instead the DSEIS equates the No Action Alternative to the existing conditions, which, as stated above, cannot legally be maintained. Therefore the No Action Alternative (as defined) cannot be considered a reasonable alternative and should not be examined in a NEPA document.[17]

From a biological perspective, a properly specified No Action Alternative would quite likely result in rebuilt stocks much quicker than any of the other rebuilding strategies. Figure 3 reproduces the fishing mortality for four specified rebuilding strategies and adds a purely hypothetical line showing fishing mortality under a properly specified No-Action Alternative. Theoretically, and as is demonstrated by the figure, the long-term discounted economic benefits of a properly specified No-Action Alternative could exceed those of any of the other rebuilding options, particularly if non-use values are incorporated at least qualitatively into the benefits assessment.

Figure 3. Fishing Mortality under Specified Rebuilding Strategies and a Properly Specified No-Action Alternative (Hypothetical)




Notes: CFM=Constant Fishing Mortality
PFM=Phased Fishing Mortality

Source: CFM-2009, PFM-2009, CFM-2014, PFM-2014 are approximated from Figures in Section 4.4.2 of the DSEIS. The No-Action fishing mortality is purely hypothetical

[17] While it could be argued that a No Action Alternative that results in no fishing is also not a reasonable alternative, NEPA requires that a No Action Alternative be included in EIS documents.

The fact that the No Action Alternative is mis-specified, introduces significant negative bias into the analysis. While it is clear that any of the action-based alternatives will result in a reduction in fishing compared to previous years, the reader should regularly be reminded that the alternative to any action—no fishing at all—will be much worse.

### 2.3.3 Other Alternatives

The analyses of all of the other alternatives suffer from the mis-specification of the no-action alternative and the organizational issues discussed above. In spite of these problems, the economic analyses of the rebuilding strategies as well as the analyses of management alternatives to address rebuilding requirements are generally strong. While the analyses of alternatives to control capacity, to minimize adverse effects on essential fish habitat (EFH), and fishery administration measures appear to reasonable, the analyses and impacts are overshadowed by the much greater impacts of the rebuilding strategies and measures to address rebuilding. The effects of capacity measures, EFH measures, and administrative measures would be more properly addressed as separate amendments once the final preferred rebuilding programs are selected.

#### 2.3.3.1 Assessment of Rebuilding Strategies for Overfished Stocks

The economic analysis of rebuilding program for overfished stocks is generally sound. There are some shortcomings that could have been addressed, including:

- A qualitative assessment of non-use benefit streams—these benefits most likely would have been greater for more aggressive rebuilding strategies (2009 v. 2014).
- A qualitative assessment of recreational-use benefits—distinguishing between benefit streams for the various paths would have been difficult.
- An assessment, either qualitative or quantitative, of net benefits gained by processors and dealers—these benefit streams would likely have directly complimented benefit streams of commercial fishers.
- It would have been very useful to project long-term commercial fishing benefits accruing to communities and regions based on an assumption that the distribution of fishing vessels and incomes is unchanged from the baseline. This would have provided some additional assurance to communities that eventually the rebuilding strategies would bring back a reasonable level of fishing activity.
- The cumulative effects section discusses the possibility that short-term declines in fishing due to rebuilding could be devastating to existing fishery-based infrastructure such as processors and dealers, markets and auctions, boat harbors, etc. These effects are properly considered indirect effects of the action and should be addressed along with direct effects.

#### 2.3.3.2 Assessment of Management Alternatives to Address Rebuilding Requirements

The economic analyses of management alternatives to address rebuilding requirements are generally strong and technically sound. The Closed Area Model combined with the Revenue Change Model and the I/O Model appear to be very good tools to assess short-term impacts of fisheries managed under a Days at Sea regime. The economic analyses of these alternatives have the following shortcomings:

- The Closed Area Model as currently configured does not appear to produce realistic results for alternatives moving to a TAC management regime. If the Council's preferred alternative includes a TAC, then efforts should be made to re-tool the model to better simulate conditions generated by the race for fish.
- The analyses in this section could have been more explicit about which rebuilding strategy is assumed. In addition, the analysis could have benefited from a sensitivity analysis of the major rebuilding strategies.
- The analyses in this section could have done more to evaluate long-term consequences, if not quantitatively then qualitatively.
- Several elements of this suite of alternatives are discussed in a separate section of the document beginning on page 728. The authors could have done a better job of integrating these two sections or better explained their reasoning behind the separation.

#### 2.3.3.3 Assessment of Alternatives to Control Capacity

The economic analyses of alternatives to control capacity appear reasonable. However, because of the enormous consequences of the rebuilding strategies as well as the measures to address rebuilding, the significance of the capacity controls measures are overshadowed. In most fisheries, capacity control issues would constitute an entire EIS by themselves. From this perspective it is unlikely that the economic effects of capacity control alternatives have been studied to the extent warranted.

#### 2.3.3.4 Assessment of Alternatives to Minimize Adverse Effects on Essential Fish Habitat

As with the previous group of alternatives the economic analyses of alternatives to minimize adverse effects on Essential Fish Habitat (EFH) appear reasonable. However, the analysis and the impacts are overshadowed by the enormity of the rebuilding program. In most regions, EFH issues would constitute an entire EIS by themselves. From this perspective it is unlikely that the economic effects of EFH alternatives have been studied to the extent warranted.

#### 2.3.3.5 Assessment of Fishery Program Administration Alternatives

The assessment of the fishery program alternatives, is relatively weak compared to the assessment of of rebuilding strategies and management alternative to address rebuilding. Each of the different management options is addressed independently and often only qualitatively, even though many of the options may produce additive impacts. As with the previous two groups of alternatives, it is unlikely that the economic effects of the administrative alternatives have been studied to the extent warranted.

## 2.4 Comparison of Economic Impacts

The comparison of economic impacts of the alternatives is generally deficient because:

1) The alternatives are compared against a mis-specified no-action alternative that cannot legally occur.
2) The number of alternatives included in the analysis is so large and the effects are so widespread that comparisons are impossible to generate.

3) Systematic assessments of the combined effects of fully specified suites of alternatives are not provided (ie. a column-wise assessment as discussed in Figure 2 on page 15, and in Table 1 on page 16).
4) Summary comparisons of direct and indirect effects of the alternatives within each group of actions and across groups of alternatives are not generally provided, and are left to the reader.

## 2.5 Assessment of Community Impacts

The terms of reference ask that the review examine whether community impacts of the alternatives in absolute terms were provided in the DSEIS. As stated in the last bulleted item in Section 2.2.1.1, which describes the Net Benefit Model used to assess the rebuilding strategies, no long-term estimates of community impacts (either relative or absolute) are provided in the DSEIS. It appears that estimates of long-term direct community impacts could have been approximated by assuming the proportion of gross revenues by vessels from various communities remain constant throughout the rebuilding period. Ranges for these order of magnitude estimates could have generated by providing estimates based on the lowest proportion of total revenue experienced by the community since 1986 and the highest proportion. While there is an enormous amount of uncertainty in this relatively simple-minded of projection, it could have provided communities a sense of how they might fare in the future under the various rebuilding strategies.

Estimates of direct community impacts for other secondary groups of alternatives are not readily apparent, but with effort can be calculated from the tables and figures provided in the DSEIS. It is possible to calculate the direct effects on fish harvesting sectors at the 12 regions for the alternatives to address rebuilding programs. For example direct harvester effects on sales in the Gloucester Region of Alternative 1A, as calculated from Table 222 on page I-638, are –$7.6 million, while direct harvest effects in Boston are -$4.2 million. These figures are calculated by adding up the estimates for each of the harvester classes shown in the table. Similar tables are provided for the other alternatives in this group of options. The estimates of direct harvester effects for each region can be compared to the total direct harvester effects for the alternative by summing the direct effects on harvest sectors in the right-most column. The proportion of each region's direct effect will be quite different than each region's share of total direct, indirect, and induced impacts (shown in the bottom row of the table). For example, Boston is estimated to experience 9 percent of the direct short-term harvester effects from Alternative 1A, but over 20 percent of the total effects. Gloucester, on the other hand, is projected to account for over 17 percent of the direct harvester effects, but only 13 percent of the total impacts.

The estimates from these tables can also be compared to estimates of harvester revenues in recent years (provided in the existing conditions found in Volume II) to obtain an approximation of the size of the impacts relative to recent years. For smaller communities within regions, estimates can be calculated by the reader by assuming region-wide effects are distributed proportionally to the each community within the region based on historical revenue shares.

As with the rest of the analysis, the ability to estimate community impacts suffers from the very large number of alternatives included in the amendment package, as well as the structure of the alternatives as analyzed. Section 2.3.1, and in particular Table 1 on page 16 of this review, contain a more complete discussion of ways to analyze complex suites of alternatives. In that example,[18] representative alternatives are specified that explicitly choose one option from all of the different

[18] The alternative specification structure shown in Table 1 is based on alternative structure used in the Alaska Groundfish Fisheries Draft Programmatic Supplemental Environmental Impact Statement, September 2003.

groups of options under consideration. The representative alternatives are then assessed as a whole, with resulting projecting vessel and community level impacts over both the short-term and long-term. In doing so, the analyst must be careful to explicitly state the assumptions used and should warn readers and decision makers about the uncertainty that is inherent in projection cover such a wide variety of changes.

## 2.6 Reviewer's Conclusions Regarding Economic Impacts of Major Rebuilding Options

The Terms of Reference ask that the reviewers include their own conclusions regarding economic impacts of the major rebuilding options. Based on specific argument discussed below, it appears that a 2014 rebuilding schedule using an adaptive fishing mortality strategy would be a superior choice for rebuilding overfished stocks, while Alternative 1B appears to be the superior suite of measures to address rebuilding.

Rebuilding Strategies

The economic analysis of the rebuilding strategies provides sufficient information to make a reasonably informed decision on the strategy that will cause the least economic hardship to the commercial fishing industry and to consumers. Specifically, it can be concluded that adopting the 2014 rebuilding schedule is a superior timeline compared to adopting the more aggressive 2009 rebuilding timeline. Furthermore, it appears that the adaptive fishing mortality strategy is superior to phased and constant mortality strategies.

The addition of non-use benefits could potentially shift the outcome to different conclusion. While the economic analysis does not explicitly examine non-use benefits generated from the different strategies, the following items provide a means to place a relative ranking of alternatives in terms of non-use benefits:

- Significant non-use value is generated by the belief that overfished stocks are being rebuilt
- Non-use value is likely higher for more aggressive strategies compared to less aggressive strategies, but the relative importance of the timelines considered is likely less important than the belief that rebuilding is occurring.
- Non-use value is likely higher for a constant fishing mortality compared to a phased or adaptive strategies because of the regulated nature of the constant rate. But the relative importance to overall value is small compared to the belief the stocks are being rebuilt.

From these perspectives, it appears reasonable to conclude that all of the rebuilding strategies will generate similar magnitudes of non-use benefits, with strategies for 2009 slightly higher than strategies for 2014, and strategies with constant mortality higher than others.

Because the dominant factor in non-use benefits is the belief that overfished stocks are being rebuilt, the relative differences between options combined with the uncertainty surrounding the actual magnitude of non-use benefits lead to the overall conclusion that non-use benefits are unlikely to alter the conclusions found in the quantitative assessment—specifically, that the 2014 adaptive rebuilding strategy is the superior choice.

Measures to Address Rebuilding

Conclusions regarding the measures to address rebuilding are more difficult to reach because of the complexity of the options, the lack of summary comparisons across alternatives, and the difficulties in estimating impacts of alternatives that move to a TAC-based management regime. Based on the latter point alone, Alternative 4 that is explicitly TAC-based, as well as Alternatives 2B and 3 that include TACs as a back-stop, should likely be dropped from serious consideration until additional analysis is completed. This leaves the four variations of Alternative 1 (1A-1D) and Alternative 2A as reasonable choices. As indicated in the table showing revenue changes across different aggregation of the fishing fleet, Alternative 1B appears to be generally superior to 1A, 1C, 1D and 2A.

# 3 Other Comments

This section contains comments that are somewhat outside the terms of reference, but are provided because they directly affect the perceived quality of economic assessment. The first sub-section contains comments on the document organization and writing style and provides a general framework that would make the document more reader-friendly. The section also provides a general framework for cumulative effects analyses, which appears to complies with the CEQ guidelines, but also provides a methodology to address complex step-wise management needs such as those addressed in this DSEIS.

## 3.1 Document Organization and Writing Style

Overall, the text of the DSEIS, regardless of its technical merit, is poorly organized and plagued by inconsistencies and poor use of terminology. Further, the writing style is at times frustrating and difficult to follow. This is particular true of the Executive Summary. While this review recognizes that many authors have contributed to the DSEIS, a document of this length must adhere to strict organizational and editorial protocols. If not, the reader will be constantly confused and frustrated and any useful information contained in the DSEIS may be disregarded.

The document could be significantly improved if Alternative naming and numbering protocols are strictly followed. In this DSEIS for example there are several very different proposals that are referred to as "Alternative 1". It would have been easier to follow if the numbering scheme indicated both the group and the alternative number. For example, the rebuilding strategies could have been labeled Alternatives A-1 through A-6, and the alternatives to address rebuilding could have been numbered Alternatives B-1 through B-4. Similarly, options within alternatives should not simply be called Option 1, Option 2, etc., but should be numbered so that they can be unmistakably identified and show the context in which they occur. For example, **Option B-2.a** would indicate the option of management without a TAC under Alternative 2 of the alternative measures to address rebuilding.

The document could also be significantly improved by providing readers an overview of each section they are about to read. At a minimum, readers should be informed of what is contained in each section, so that they can make a determination of whether they wish to read it. Additionally, it may be useful to place the summary and conclusions at the beginning of the section, and use the remainder of the section to prove the case. In this way if readers choose to believe the authors, they can skip the details and move on. If they wish to be convinced or are interested in the methodologies used then they can read the detail in the text following the summary.

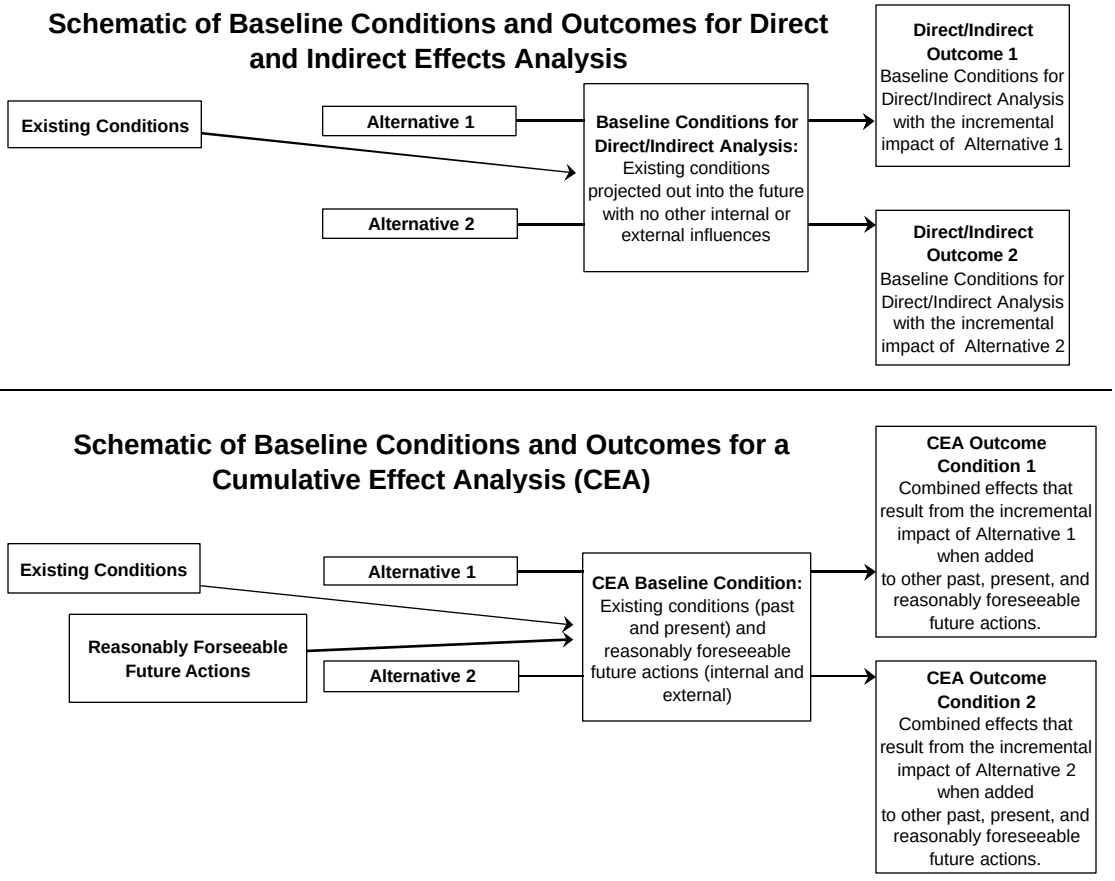
If this editorial methodology is followed, the roadmap and overview of each section is easily constructed by aggregating the roadmaps and overviews of each subsection. Similarly, the roadmap and overview of each chapter can be a condensed version of the roadmaps and overviews of each section. The introduction to the document as well as the executive summary can generally be constructed by aggregating the roadmaps and overviews contained in each chapter.

Finally, the DSEIS suffers because the existing conditions are not summarized prior to the summary of effects. The existing conditions are specified in detail in Volume II of the DSEIS, but it would have been extremely useful to have a succinctly written summary of the conditions of the major environment factors before the analysis of alternatives.

## 3.2 Cumulative Affects Analysis

The cumulative effects analysis (CEA) contained does not appear to meet the standard protocols of this type of analysis. Figure 4 shows the fundamental difference between the two types of effects analyses required in NEPA documents. In general, two distinct analyses should be conducted: 1) an analysis of direct and indirect effects (DIEA), and 2) an analysis of cumulative effects—CEA. The primary differences between the two analyses are the baseline conditions against which the alternatives are assessed.

Figure 4. A Comparison of an Analysis of Direct & Indirect Effects and an Analysis of Cumulative Effects



In the DIEA, the existing conditions are the environmental factors that may be affected by the actions. The existing conditions are then projected into the future without taking into account other internal or external influences to create the DIEA Baseline Conditions. Each alternative is then imposed on those baseline conditions and the incremental effects—both direct and indirect—are reported.

In the CEA, reasonably foreseeable future actions—both internal[19] and external—are added into the mix, and new baseline conditions for the affected environmental factor are projected. If, using a hypothetical example, it is reasonably foreseeable that farm-raised fish will be declared unsafe and illegal to sell in the U.S., then the subsequent price effects on New England groundfish species would be taken into account. After the effects of reasonably foreseeable actions have been taken into the account, the incremental effects of the alternative on the CEA baseline are assessed. These incremental effects (both indirect and direct) become known as the cumulative effects.

By employing the CEA framework described above it may[20] be possible to assess step-wise management programs in which the effects of secondary programs build on initial decisions and amendments. As an example, assume that rather than loading Amendment 13 with the huge array of potential management actions, a series of related amendments are developed in separate NEPA documents—the rebuilding strategies alone would be addressed in a stand-alone EIS as Amendment A, and the related document would be an EIS for Amendment B

The existing conditions and projected baseline conditions for the DIEA of Amendment A would be developed as shown in Figure 4. But because it is foreseeable that the NEFMC would take actions to address the rebuilding strategies, the projected baseline conditions for the CEA would reflect the likely changes to DAS regulations and closed areas that would be the likely outcomes of those future actions—as described in Amendment B. In addition to the effects of foreseeable internal actions, the projected effects of any other foreseeable external actions would be factored into the CEA baseline conditions. Then the CEA for Amendment A would show how the proposed rebuilding strategies are likely to incrementally affect the CEA baseline.

In the meantime, the initial draft of the EIS for management measures to address the rebuilding program could be underway. The existing conditions and the projected baseline conditions for the DIEA in this analysis would be identical to those in the EIS described for Amendment A. The projected incremental direct and indirect effects of the Amendment B alternatives would constitute the DIEA. In general, the DIEA for Amendment B would be similar to the CEA in Amendment A. The Amendment B DIEA would however provide additional details because additional options would be examined. Further, the baseline conditions for the Amendment B DIEA would not include any foreseeable external conditions.

The CEA for Amendment B would not be developed until after a preferred alternative was determined for Amendment A. The baseline conditions for the Amendment B CEA would include projected effects of the preferred alternative from Amendment A as a foreseeable future action along with any other foreseeable internal or external actions. Finally, the CEA for Amendment B would estimate the incremental effects on the environment described in the CEA baseline projection.

While the strategy of separating complex amendment packages into smaller NEPA documents is complex, it may prove to be a better strategy than overloading a single NEPA with an excessive number of alternatives.

[19] Reasonably foreseeable internal actions would not include any of the alternatives under consideration, but would include action and effects of those actions that have already been approved but not yet implemented or, actions that are contemplated and are likely to be approved in the future.

[20] Whether or not the example described here is "acceptable" from a NEPA perspective has not been fully tested, but a similar approach has been submitted for approval to NOAA Fishery in two related Environmental Assessments of management actions dealing with bycatch in the North Pacific.