Center for Independent Experts (CIE) Review of the National Marine Fisheries Service's Evaluation of the Effects of Fishing on Essential Fish Habitat in Alaska

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Executive summary

The model developed by the National Marine Fisheries Service (NMFS) to assess the effects of fishing on essential fish habitats in Alaska is a simple yet elegant representation of the balance between loss due to direct effects of fishing gear and the ability of organisms and structures to recover over time. It should be considered an intuition building tool, and the absolute value of the predicted impacts should only be considered as a first order relative indices of the potential impact of fishing activities on essential fish habitat (EFH) and its capacity to maintain stock productivity in the long term. Although every attempt was made to use realistic measures of the direct impact of trawls and the ability of different classes of benthos to recover from those impacts, the end result is that all model calculations effectively present a scaling of the spatial pattern in fishing activity within the eastern Bering Sea (EBS), Gulf of Alaska (GOA), and Aleutian Islands (AI).

The current version of the DEIS does not provide strong evidence that the model predictions of long term impacts of fishing activity on EFH was applied in a systematic and quantitative manner to basic biological knowledge of the managed species and stocks in the three regions of interest. The approach appears to have been more qualitative, relying heavily on expert knowledge and the current state of the stock relative to MSST. However, MSST may not be responsive enough to changes in environmental and stock status because of the heavily reliance on past information in the analytical assessments, as well as in the medium term projections.

Appendix B of the DEIS provides very little information about the potential for localized habitat impacts that may indicate a reduction of the capacity of EFH to support managed species. In order to demonstrate that the spatial pattern of fishing effort has not had a localized impact, NMFS must provide analyses that investigate whether there are localized differences in life history characteristics (i.e., spawning/breeding, adult growth/feeding, and growth to maturity. This requires a spatial mapping of such first order effects that would show whether the distribution of the characters among individuals (e.g., weight at length, fecundity, gut fullness, etc.) exhibit regional differences that are not potentially consistent with the hypothesis of an impact due to changes in EFH capacity to support managed species.

Improvements to the model include validation of its ability to provide long and short term predictions of the effect of fishing on EFH, the inclusion of a greater range of data on

potential recovery rates of benthic organisms and structures, and the evaluation of the effects of areas closures on demersal habitats.

Given the analyses presented in the DEIS on the impact of fishing activities on EFH, I believe it is premature to conclude that the current level and pattern of fishing activity has minimal or temporary effects on the capacity of managed species to remain about a threshold biomass levels that would ensure long term productivity and sustainable fishing of the stocks in the EBS, GOA and AI.

Background

The Magnuson-Stevens Fishery Conservation and Management Act requires that every fishery management plan describe and identify Essential Fish Habitat (EFH) for the fishery, minimize to the extent practicable the adverse effects of fishing on EFH, and identify other measures to promote the conservation and enhancement of EFH. NMFS and the North Pacific Fishery Management Council recently developed a draft environmental impact statement (DEIS) to consider the impacts of incorporating new EFH provisions into the Council's fishery management plans. The DEIS evaluates three actions: (1) describing and identifying EFH for fisheries managed by the Council; (2) adopting an approach for the Council to identify Habitat Areas of Particular Concern within EFH; and (3) minimizing to the extent practicable the adverse effects of Council-managed fishing on EFH. Most of the controversy surrounding the level of protection needed for EFH concerns the effects of fishing on sea floor habitats. Substantial differences of opinion exist as to the extent and significance of habitat alteration caused by bottom trawling and other fishing activities. Although an increasing body of scientific literature discusses the effects of fishing on habitat, there is no consensus within the scientific community on an appropriate methodology for analyzing potential adverse effects.

The national EFH regulations (50 CFR 600.815(a)(2)) require an evaluation of the effects of fishing on EFH, and this evaluation appears in Appendix B to the DEIS. The evaluation has two components: a quantitative mathematical model to show the expected long term effects of fishing on habitat, and a qualitative assessment of how those changes affect fish stocks. The model estimates the proportional reductions in habitat features relative to an unfished state, assuming that fishing will continue at the current intensity and distribution until the alterations to habitat and the recovery of disturbed habitat reach equilibrium. The model provides a tool for bringing together all available information on the effects of fishing on habitat, such as fishing gear types and sizes used in Alaska fisheries, fishing intensity information from observer data, and gear impacts and recovery rates for different habitat types. Due to the uncertainty regarding some input parameters (e.g., recovery rates of different habitat types), the results of the model are displayed as point estimates as well as a range of potential effects.

After considering the available tools and methodologies for assessing effects of fishing on habitat, the Council and its Scientific and Statistical Committee concluded that the model incorporates the best available scientific information and provides a good approach to understanding the impacts of fishing activities on habitat. Nevertheless, the model and its application have many limitations. Both the developing state of this new model and the limited quality of available data to estimate input parameters prevent drawing a complete picture of the effects of fishing on EFH. The model incorporates a number of assumptions about habitat effect rates, habitat recovery rates, habitat distribution, and habitat use by managed species. The quantitative outputs of the analysis may convey an impression of rigor and precision, but the results actually are subject to considerable uncertainty.

One major limitation of the model is that it does not consider the habitat requirements of managed species or the distribution of their use of habitat features. Therefore, DEIS analysts were asked to use the model output to address whether continued fishing at the current rate and intensity is likely to alter the ability of a managed species to sustain itself over the long term. In other words, are the fisheries, as they are currently conducted, affecting habitat that is essential to the welfare of each managed species? To help answer that question, the analysts considered available information about the habitats used by managed species. The analysts also considered the ability of each stock to stay above its minimum stock size threshold (MSST), after at least thirty years of fishing at equal or higher intensities. MSST is the level below which a stock is in jeopardy of not being able to produce its maximum sustainable yield on a continuing basis.

The DEIS analysis concludes that despite persistent disturbance to certain habitats, the effects on EFH are minimal because there is no indication that continued fishing activities at the current rate and intensity would alter the capacity of EFH to support healthy populations of managed species over the long term. The DEIS finds that no Council-managed fishing activities have more than minimal and temporary adverse effects on EFH, which is the regulatory standard requiring action to minimize adverse effects under the Magnuson-Stevens Act. Additionally, the analysis concludes that all fishing activities combined have minimal, but not necessarily temporary, effects on EFH. These findings suggest that no additional management actions are required pursuant to the EFH regulations.

Questions to be Answered

Given the context of the Magnuson-Stevens Act requirements and the EFH regulations, the CIE reviewers shall address the following issues:

1. Does the model incorporate the best available scientific information and provide a reasonable approach to understanding the effects of fishing on habitat in Alaska?

2. Does the DEIS Appendix B analysis provide a reasonable approach for identifying whether any Council-managed fishing activities adversely affect EFH in a manner that is more than minimal and not temporary in nature? (For purposes of this question, the terms “temporary” and “minimal” should be interpreted consistent with

the preamble to the EFH regulations: "Temporary impacts are those that are limited in duration and that allow the particular environment to recover without measurable impact. Minimal impacts are those that may result in relatively small changes in the affected environment and insignificant changes in ecological functions.") To answer this question, the panel shall address at least the following issues:

a. Does the DEIS Appendix B analysis apply an appropriate standard (including the consideration of stock status relative to MSST) for determining whether fishing alters the capacity of EFH to support managed species, a sustainable fishery, and the managed species' contribution to a healthy ecosystem?

b. Does the DEIS Appendix B analysis give appropriate consideration to localized habitat impacts that may reduce the capacity of EFH to support managed species in a given area, even if those impacts do not affect a species at the level of an entire stock or population?

3. What if any improvements should NMFS consider making to the model, or to its application in the context of the DEIS, given the limited data available to use for input parameters?

Description of review activities

Materials

The CIE panel shall review the following materials:

- The Executive Summary from the *Draft Environmental Impact Statement for Essential Fish Habitat Identification and Conservation in Alaska* (11 pages plus tables and figures);
- The evaluation of fishing activities that may adversely affect EFH (Appendix B to the DEIS; 76 pages plus tables and figures);
- EFH sections of the minutes of the Council's Scientific and Statistical Committee meetings in October 2002, December 2002, February 2003, April 2003, June 2003, and October 2003 (each is approximately 2 pages);
- Section 303(a)(7) of the Magnuson-Stevens Act;
- Pertinent excerpts from the NMFS regulations for EFH (50 CFR 600.10 and 600.815(a)(2)) and the associated preamble (67 FR 2354-2355);
- Pertinent excerpts from the Magnuson-Stevens Act National Standard 1 Guidelines (50 CFR 600.310(d)); and
- Selected public comments on the DEIS that are pertinent to Appendix B, including criticisms of the analytical approach (comments to be selected by NMFS after the close of the public comment period on April 15, 2004).

Panelists were asked to refer to the following website to access all background material:

http://www.fakr.noaa.gov/habitat/cie/review.htm

Workshop with NMFS personnel

The panel attended in person and participated in a one-day meeting with the scientists who developed the fishing-effects model and the analytical approach used to evaluate the effects of fishing in the DEIS. The meeting was held at the Alaska Fisheries Science Center in Seattle on June 29, 2004. The meeting was open to the public, but there was no opportunity for public testimony, although members of the public did have a chance to talk with the panel members during the morning and afternoon breaks. The lead authors of the model, Dr. Jeffrey Fujioka and Dr. Craig Rose, provided an overview of the model, how it was developed, how it was refined in response to comments from the Council's Scientific and Statistical Committee and other reviewers, and how it was used in the DEIS. The panel questioned Dr. Fujioka and Dr. Rose, as well as Dr. Anne Hollowed, who assisted in designing the analytical approach used to evaluate the effects of fishing in the DEIS.

The agenda for the meeting was:

1. Welcome and introductions (Jon Kurland)
2. Panel chair's opening remarks (Dr. Ken Drinkwater)
3. Scope and schedule for the CIE review (Jon Kurland)
4. Background behind the EFH Environmental Impact Statement (Jon Kurland)
5. Fishing effects model (Dr. Jeff Fujioka and Dr. Craig Rose)
    - Development and evolution of the model
    - Application of the model to the EFH EIS
6. Analytical approach for assessing the effects on EFH and managed species (Dr. Craig Rose and Dr. Anne Hollowed)
7. Discussion and question from the CIE panel

Executive meeting

The panel meet in executive session at the Best Western University Tower Hotel on June 30, 2004 to discuss the information presented during the Workshop with NMFS personnel, and to identify any unanswered questions.

Summary of findings

DEIS review

1. Does the model incorporate the best available scientific information and provide a reasonable approach to understanding the effects of fishing on habitat in Alaska?

Model structure and assumptions

The model developed and presented in the DEIS is designed as a tool to investigate the long term impact of fishing activity on the productivity of benthic organisms in three (3) regions of interest: the Eastern Bering Sea (EBS), Gulf of Alaska (GOA) and Aleutian Islands (AI). The model itself is elegant in its simplicity as the overall structure is based on the balance between the loss of organisms or structures caused by direct effects of fishing gear(s) and the recovery rate of the organisms or structures within each of the five classes described in the DEIS. As a result, there are two key parameters that must be applied in order to estimate the effects of fishing on essential fish habitat: recovery rates and the impacts of different gears. The model is designed to be applied to a spatially resolved grid of habitats for which there is knowledge of the intensity of fishing effort over the period of 1998-2002. Based on the simple structure of the model, NMFS scientists calculated the steady state solution (i.e., the long term impact) using parameter estimates for each gear and organism category. The model is designed only to address direct impacts of fishing gear, the removal or death of organisms or habitat structures through direct interactions with the gear, and does not consider possible indirect effects such as perturbations to food availability or productivity for the benthos or changes in fish behaviour due to disturbance in habitat status. Application of the model assumes that within each grid point, the spatial distribution of fishing activity and habitats within each block is random.

Model Parameterization – Recovery times

Parameterization of recovery times for the different classes of benthic organisms and structures was based on collation of information from the scientific peer reviewed literature and local expertise, to a lesser degree. Because of the limited knowledge of the exact recovery rates for the three major regions of interest under consideration in the DEIS, the approach taken by NMFS was to base the primary conclusions of the application on the mean or mid point of the range of values collated from the literature as well as to perform the calculations of long term impacts based on the lower 25th and upper 75th percentiles of the distribution of the collated data.

The approach taken for the inclusion of literature information into the parameter data set can be considered as a very conservative one. The selection of information required that the habitat in which the study had been conducted had to be very similar in nature of those in the EBS, GOA or AI. Because studies of the impact of fishing in northern regions are limited in extent, this resulted in relatively few studies satisfying the criteria. As a result, considerable information from George’s Bank, the North Sea and Australia were excluded from the parameter set, particularly in the case of infauna and epifauna, which may represent important food sources for managed species or their prey. Although consultations were held with regional experts to determine whether the parameter values were reasonable for the region, it should be noted that all consulted experts were associates of NMFS.

Whether the net consequences of increasing the breadth of information collated from previous studies on the overall estimates of the impact of fishing would have lead to an increase or decrease in the estimated impact of fishing activity on EFH is unclear. However, the additional information would have lead to a more broadly based range of outcomes that would have lessened the overall uncertainty about the calculations general applicability. The latter is an important component of considerations under a precautionary approach to the determination of the overall impacts of fishing activity on essential fish habitat.

Parameterization – Impacts of fishing gears

The section dealing with parameterization of the impact of a single passage of fishing gear on infauna, epifauna, living structures, hard corals and non-living structures was similar in nature of the section dealing with parameterization of recovery rates. The information represents a collation of data from the peer reviewed scientific literature. As with recovery rates, NMFS scientists were selective in their choice of which studies to include. In this particular instance, the rationale for selection was to ensure that parameterization was highly quantitative, whereby the number of passes by fishing gear in “controlled” conditions could be clearly identified from each report. In this section of the DEIS, the approach is generally a valid one aimed at reducing the uncertainty associated with experimental design from previous studies.

As with the parameterization of recovery rates, the overall number of studies used to determine the breadth of gear impact was relatively limited, largely because of the selection criteria identified by NMFS scientists. However in the case of hard corals, only one study was found which satisfied the criteria set by NMFS scientists. Although the impact observed in that study was substantial, other sources of information could have been used to build a more extensive data set that would have provided greater confidence in the rate of impact. For example, the study by Fossa et al (2002) off Norway or that of Koslow et al (2001) off Tasmania, as well as the work of Clark and O’Driscoll (2003) could have been used to provide some substantiation of the parameter values used in the analysis. Although the data from the latter studies might not have satisfied the criteria applied in the DEIS, they could have been used to address how realistic the value derived from the single study by Krieger (2001) was relative to studies where the impact of trawling on coral had been considered.

Model validation

A critical step in the application of any model is its validation against available sources of data, whether they be from the region of interest or from other areas where similar processes and impacts may have taken place. There was no attempt within the DEIS to demonstrate that the impact model used to project the potential significance of trawl impacts in the EBS, GOA and AI would have produced accurate predictions. This represents a significant shortcoming of the information presented in the DEIS. This is a particular concern given the simplicity of the model, which does not require extensive or complex observational sets to provide the necessary input data and parameters from which validation could be assessed. The key question is how well the model would have predicted the short and long term impacts of trawling on diverse classes of benthos given knowledge of the loss and recovery rates.

There are two obvious sources of information with which the model could have been validated. The first comes from published studies which have attempted to assess the impacts of trawling on local ecosystems. One example of this comes from Georges Bank, an area for which there is extensive documentation in papers by J.S. Collie (University of Rhode Island) and collaborators from which data could have been gathered to provide an overall assessment of the general accuracy of the model. Even though the overall application of the model could have been different from the application presented in the DEIS (e.g., in terms of spatial resolution or habitat types), or that some of the assumptions of the model may have been violated, NMFS could have provided some assessment, analysis and interpretation of the model's application as a means to provide confidence in its validity as a predictive tool.

A second source of information to validate the model's accuracy is from NMFS own research in the Alaska Region (Heifetz 2000, 2002, 2003). Although some of the work on the impacts of trawling have been published (e.g., McConnaughey et al. 2000), the 2002 and 2003 progress reports of the research program on the "Effects of fishing activities on benthic habitat" detailed short-term studies in closed areas of Bristol Bay (e.g., Trawl impact studies in the Eastern Bering Sea – PI McConnaughey, RA) that could have served as a tool for the validation of the modelling approach taken in the DEIS. The 2003 progress report also outlines the efforts of McConnaughey in assessing the long-term effects of bottom trawling by contrasting the mean sizes and biomass of 16 invertebrate taxa in heavily trawled (HT) and untrawled (UT) straddling the crab and areas Crab and Halibut Protection Zone 1. Despite the limitations of research that may not be completed to the Principal Investigator's satisfaction, the inclusion of those data would have provided another means by which NMFS could have provided evidence of the model's general validity.

<u>Model application to study area – input data</u>

There are two key elements in the application of the model, beyond the parameter values: designation and description of habitat types and estimates of fishing intensity. In the application of the model, NMFS cited the paucity of data on habitat characteristics, particularly in the GOA and AI, for the broad characterisation of habitats into five (5) areas for the EBS and three (3) for each of the GOA and AI regions. In large part, habitat designation closely reflected the bathymetry of a region. Fishing intensity was based on data collected from the groundfish observer program, tallied for 5 x 5 km blocks for the period of 1998-2002, to represent the current level of fishing. The decision to use blocks of 25 km^2 represents a good compromise to investigate the local scale of the impact of fishing while providing enough resolution over the large scale of the regions of interest to identify the general patterns of fishing intensity.

A key assumption in the application of the model is that of random distribution of fishing effort and habitat within each block. When applied over large areas with limited habitat diversity, this model assumption may be realistic and variations in conditions at the sub-grid scale (i.e., the variation in habitat structure within each block) may not have a significant impact on the overall impact of fishing on essential fish habitat. Such areas would consist of the broad shelf in the EBS where bathymetry changes little over long distances. However, even within such large regions, there is the potential for significant intermediate scale patchiness (i.e., at scales of several blocks, 10s of km), which could affect the overall estimate of the impacts of fishing by altering the relative proportion of habitats with each region of interest. Heifetz (2002, 2003) outlines results of preliminary studies aimed at characterizing habitat complexity at a finer resolution than used in the DEIS. It would have been useful to reference some of this material as a means to support the broadscale characterization of habitats and to present some information of the expected scale of variability within the broad categories used in the DEIS. Such information could lend support to the validity of the estimates or to point to potential sources of bias and uncertainty.

The most serious source of uncertainty in habitat designation and description is in the areas of the GOA and the AI. In these areas, the high degree of bathymetric complexity within and among blocks is very likely to be associated with variations in habitat structure. Changes from soft to hard bottom features are known to occur in areas of bathymetric complexity and these areas are also the most likely to harbour hard and soft corals, which would be heavily impacted by direct contact with fishing gear and which also have the longest recovery times. In these areas, any knowledge of habitat complexity at the sub-grid scale could have been beneficial to the evaluation of the impacts of fishing. The progress reports (Heifetz 2002, 2003) give evidence that some information, albeit preliminary, is available from NMFS' own research efforts. The most critical aspect of this information is an attempt to assess the assumption of random distributions of habitat and fishing intensity within each block. During the workshop meeting of 29 June 2004, the review panel was presented with some information on the atka mackerel fishery in the Aleutian Islands which indicates that fishing activity may not have been random within blocks. The key question to address is whether this lack of randomness in fishing intensity is also associated with a specific habitat feature. If habitat structure within the block is random, the overall impact of non-random fishing would be to lessen the overall impact because some areas of habitat would remain largely unaffected. However, if habitat type and fishing intensity are strongly associated, the overall impact would be underestimated using the current model application. In the DEIS, the assumptions of randomness in habitat and fishing intensity in the different areas was not verified. Given even preliminary results from the NMFS studies on the effects of fishing gear on seafloor habitats, the analysis should be able to make interpretative comments about whether current estimates of the potential impacts of fishing on essential fish habitats represent conservative (i.e., overestimates) or optimistic (i.e., underestimates) projections of the impacts of fishing in the different regions and general habitat designations.

In his commentary of the DEIS, Taggart suggested that allocation of effort to the end point block of each tow could lead to an underestimate of the impact of trawling. This is essentially true because of the non-linear nature of the model. The relative bias will increase with increasing fishing intensity, particularly at intermediate levels, and with decreasing recovery rates. However, I believe that the overall source of uncertainty associated with this procedure in the application of the model to the overall predictions of impact on EFH may be relatively unimportant, at least in a qualitative sense. The model is essentially an intuition building tool which provides order of magnitude inferences about the potential impact of fishing on EFH. All the figures presented in Appendix B of the DEIS are essentially scaled views of the distribution of fishing intensity, with the scaling dependent on recovery rates and direct loss due to interaction with the various gear types. The model predictions are a guide that indicates that the long term impact of trawling is anticipated to be less on organisms that can survive the direct contact with the gear and that have high recovery rates, while the converse is likely to be true for those habitat types that are more heavily impacted by fishing activities and have long recovery times. The nature of the impact on managed species can only determined through detailed analysis of the localised first order responses of those species using the spatially explicit projections of the potential impact on EFH (see question 2). So, minor sources of bias may not be of great significance to the overall projections from the model.

Model application – backward and forward projections

Application of the model has relied on highly resolved spatial information of fishing intensity based on recent (1998-2002) observer information which supplies 100% on vessels greater 125 feet and ~ 1/5-1/3 coverage on smaller vessels. Application of the model has investigated the long-term impact of fishing, which measures the overall steady-state loss of habitat given intensity and recovery rates of the different categories of benthic habitats. However, one question that was never addressed is what is the expected current state of the benthic habitats given NMFS knowledge of the overall fishing intensity that has been carried out in the region in the last decades. Since the simple model applied to make the projections has a time component in its formulation (equation 4, appendix B), it would be possible to apply the model as a retrospective tool to determine how far the current environment is from conditions 20-30 years ago.

There appears to be considerable information on overall fishing effort over the past decades from the historical database of trawl data for the Bering Sea (www.afsc.noaa.gov/race/groundfish/habitat/hist_drawldata.htm) which should provide some indication of the overall intensity of fishing within the region and possibly of the changes in spatial patterns of allocation. Although the backward projections would require some assumptions about the overall efficiency of gear types and possibly in the spatial allocation of effort because of gaps in the data, the estimates should provide a general perspective of how far the current environment may be from the earlier state of the environment given the assumption that current levels of productivity had persisted throughout the period. The importance of backward projections could be most significant in trying to evaluate the overall impact of trawling on managed species. For instance, if the current state of essential habitats is far removed from conditions three decades ago, then the relative health of the managed species could be contrasted directly with those conditions to determine whether the long term impacts have in fact had measurable effects on the overall ability of the populations to maintain their productivity.

Alternate model – Shester

In one of the selected commentaries of the DEIS provided to the review panel, Dr. G. Shester proposes a quantitative model of the effects of habitats impacts on fishery productivity through a carrying capacity mechanism. As a panel member, I feel it is important to comment on the suitability of this proposal as a possible alternative to that currently proposed by NMFS.

The model by Shester is based on the simple concept of logistic growth and density dependence. In the proposal, Shester presents an argument that the impact of fishing effects on fish habitats, beyond the direct catch, could modify the overall carrying capacity of the systems through a reduction proportional to fishing effort. Although the concept is an interesting one, the characterization of "environmental carrying capacity", and any possible anthropogenic or environmental modifications, has been nearly impossible to carry out in practice. As a theoretical construct, the proposal has some merit, but the application of Shester's model to the questions being addressed by the DEIS appears impracticable. Shester argues that habitat quality could be determined by the relative densities of fish associated with each habitat type. However, this neglects any consideration that different species may show long term changes in distribution that may be determined by factors other than the benthic habitat or that changes in habitat occupation may not be proportional to overall population abundance among different species. For the method to be applicable, habitat quality would have to be defined independently of fish density. There would have to be an attempt to provide measures of the impact of trawling on the state of the environment or of the fish, since Shester's formulation would be unlikely to differentiate between the direct removal of the fish and the indirect one through changes in carrying capacity.

2. Evaluation of impact of fishing on managed populations

   A) Does the DEIS Appendix B analysis apply an appropriate standard (including the consideration of stock status relative to MSST) for determining whether fishing alters the capacity of EFH to support managed species, a sustainable fishery, and the managed species' contribution to a healthy ecosystem?

The evaluation process outlined in the DEIS states that recommendations were based on: [1] the results of the fishing effects analysis; [2] literature and other sources of knowledge regarding what each species requires to accomplish spawning, breeding and growth to maturity; [3] knowledge of the responses of the recruitment, biomass and growth of the species during periods with similar fishing intensities; and [4] the knowledge and professional judgement of scientists that manage and study the species of interest. The ability of the species to maintain populations above Minimum Stock Size Threshold

(MSST) was selected to represent the ability of the species to support a sustainable fishery. In each assessment presented in the DEIS, NMFS scientists outlined the basic biological knowledge concerning each species or stock based on the scientific literature, whether based on studies conducted within the Alaska region or other regions. Whenever possible, local knowledge was emphasised in an attempt to highlight the potential significance of impacts on EFH.

As currently presented in the DEIS, the evaluation process and the results of the EFH impacts analysis from the model appear to be separate. Although the information was provided to those carrying out the evaluation process, there is no clear description of how the results of the quantitative model were applied in a systematic manner to the qualitative conclusions from the evaluation process for all species and stocks. Model development yielded information on the spatial pattern of fishing impacts and an average measure over the entire range of a habitat type pertinent to the different regions of interest. There are few instances in the description of habitat connections in the DEIS were there is clear evidence that NMFS used both aspects of the model output to derive the inferences about the evaluation of effects. Although in several cases there was a clear consideration that one life stage or another was generally not within the region of significant predicted impact, in no instances did the DEIS outline quantitative measures that could give an indication of the degree of overlap between fishing activity and the various life stages or age classes. There also appears to have been limited consideration as to the potential importance of variations in life history (spawning/breeding, feeding, and growth to maturity) on the potential impacts of trawling on EFH. For example, at the workshop of June 29, 2004, the panel was presented with preliminary information about the drift patterns of arrowtooth flounder in the EBS during different environmental regimes (1980-1989 versus 1990-1997) by Dr. Anne Hollowed. The drift projections showed that during the earlier period, eggs and larvae would be advected toward coastal nursery areas that are little affected by fishing activities, whereas in the 1990-97 period, during a period of decline in recruitment, advection could have resulted in settlement further offshore, close to an area of where the EFH impact model predicted a long-term impact of 5.1-25% on the infauna prey on which the juveniles rely on for growth to maturity (Section B.3.3.7). However, this information, albeit preliminary, was not considered in making the assessment and the overall conclusion of minimal or temporary impact on spawning, adult feeding or juvenile survival and growth to maturity. Therefore, it is clear that the effect of variations in environmental conditions and that of trawling activities could have a synergistic effect on population processes. Although it is currently unclear in the case of arrowtooth flounder in the EBS whether the environmental and fishery processes do have a significant interaction, the lack of any consideration given to the possible spatial variations in interactions may be an indication that the results of the modelling work was not incorporated into knowledge of the species in a systematic manner. Consequently, it is unclear to me how NMFS could reach objective conclusions across a wide range of species when there is limited evidence in Appendix B of the DEIS for a systematic and consistent approach across all species and stocks.

There is an inherent difficulty in evaluating the impact of fishing activities on EFH and how it may impact on a population's ability to recover from a period of decline, poor recruitment or decreased growth. In order to detect cumulative effects of impacts on EFH, the measure of a stock's status should show rapid response to changes in stock or environmental conditions. The approach to use the ability of the species to maintain populations above MSST, based on key considerations of [1] past and present trends in distribution, recruitment, and biomass, and [2] projected stock status (workshop presentation 29 June 2004), relies heavily on the use of the results of analytical assessment models. In both instances, the estimates and projections of recruitment and biomass generally rely on analytical models that make use of indices of abundance from both commercial and scientific sources. Such models are heavily influenced by data obtained in years prior to the current assessment. As a result, estimation errors are not independent of one another over time (because successive assessments use the same data, along with incremental new information). For example, Walters and Maguire (1996) argue that persistent over-estimation of stock size contributed to the demise of the northern cod stock. There is a good possibility that such a persistent pattern of inaccuracy also occurred in the assessment of other stocks off Newfoundland since most of the groundfish stocks collapsed at the same time as northern cod. Because most assessment methods rely heavily on past information, estimation of stock status (numbers and biomass) will show long term variations that smooth out short-term (e.g., inter-annual) variability in the indices that contribute to the estimation process. Therefore, such indices are unlikely to show rapid responses to changes in environmental status (including EFH) unless the impact is persistent relative to the generation time of the stock under consideration. Only estimates of recruitment from analytical are likely to show reasonably rapid responses to environmental status. As a result, it is likely to be difficult to detect the cumulative impact of environmental or man-made effects on population state using measurements based on such analytical approaches.

Stock projections rely entirely on past information, which assumes that the combination of fishery, environment and population status will recur. The procedure outlined in the workshop (29 June 2004) indicates that projections were driven by randomization methods based on time series of year-class strength (without a stock/recruitment relationship), biomass estimates and projected catches from management advice. An example was provided based on 13 populations from the Eastern Bering Sea and/or Aleutian Islands to illustrate the process and the projections. Most stocks presented as an example showed the end point of a period of medium term (i.e., 5-10 years) decline in biomass (with the exception of walleye pollock (EBS) and Pacific ocean perch (EBS/AI)) with most flatfish stocks indicating an overall lower recruitment in the last decade relative to the long-term time series. Yet in virtually all instances, the stock projections indicate that the stocks would rebuild to levels above MSST over the next decade, on average. Although the lower limit of the confidence intervals was generally below MSST, the average long term projections was interpreted as indicating that stock productivity was not significantly affected by possible impacts of trawling on EFH. *The contrast between the recent trends in stock biomass and recruitment with the simulated projections could not have been greater*. Many of the stocks show long term cycles, with an increase in biomass during the 1960s to early 1980s, while the current state of most populations suggests a decline in stock status. As a result, projections are likely to be greatly influenced by data from the period of increasing stock biomass while the current information suggests a possible decline in productivity. There is a possibility that changes in stock productivity may be related to long term changes in environmental conditions. In the example given for arrowtooth flounder, there is evidence that environmental variations associated with the Arctic Oscillation could contribute to the decrease in recruitment. However, it is also not possible to exclude the possible impact of cumulative impacts of trawling or interaction with environmental conditions on EFH on the recruitment pattern. Because the factors that determine recruitment patterns are unknown, it would appear that conclusions based on projections that rely heavily on the assumption that past environmental and population states will recur could be overly optimistic. Rather than using the entire time series of data, stock projections would be more precautionary if they were based on the most recent decade of information since that is the most current knowledge of the state of the environment.

It is clear that considerable effort has been applied to ensure that scientific expertise was included in making recommendations about the potential impact of fishing effects on EFH for managed species. However, it is difficult as an external reviewer to rate the reliability in the instances where judgement or opinion came into play in determining the overall significance of the impacts of trawling and to what degree uncertainties in knowledge were applied in a precautionary manner. For example, the section dealing with light dusky rockfish (pages B-55 and B-56) states that the effect of fishing on their habitat is either unknown or negligible. How does one arrive at such contrasting conclusions when the basic knowledge of the habitat requirements for the species are at best classified as very poorly known? Although it is necessary to rely on expertise in making assessments when information is limited, there must be a procedure in place to ensure consistency in approach. I view this as particularly significant in the light of issues raised in answer to question 2B whereby first order effects (e.g., growth, condition, fecundity) would provide information that could be assessed objectively.

In conclusion, the current DEIS does not provide strong evidence that the model predictions of long term impacts of fishing activity on EFH was applied in a systematic and quantitative manner to basic biological knowledge of the managed species and stocks in the three regions of interest. The approach appears to have been more qualitative, relying heavily on expert knowledge and the current state of the stock relative to MSST. However, MSST may not be responsive enough to changes in environmental and stock status because of the heavily reliance on past information in the analytical assessments, as well as in the medium term projections.

B) Does the DEIS Appendix B analysis give appropriate consideration to localized habitat impacts that may reduce the capacity of EFH to support managed species in a given area, even if those impacts do not affect a species at the level of an entire stock or population?

Appendix B of the DEIS provides very little information about the potential for localized habitat impacts that may indicate a reduction of the capacity of EFH to support managed species. In order to demonstrate that the spatial pattern of fishing effort has not had a localized impact, NMFS must provide analyses that investigate whether there are localized differences in life history characteristics (i.e., spawning/breeding, adult growth/feeding, and growth to maturity. This requires a spatial mapping of such first order effects that would show whether the distribution of the characters among individuals (e.g., weight at length, fecundity, gut fullness, etc.) exhibit regional differences that are not potentially consistent with the hypothesis of an impact due to changes in EFH capacity to support managed species. No such analysis was presented in appendix B. The analysis of the general distribution of fish in relation to trawl impacts appears to be based on the broad geographic distribution of species, whereby the average impact predicted by the model is applied to the area where 75 or 95 percent of the population is distributed. I previously referred to this point in 2A, where I mentioned the lack of an apparent systematic approach in the use of the model projections and the evaluation of effects on individual species.

The most basic approach to assess if there is a localised impact on productivity of managed species would be to determine if there were spatial patterns in individual condition (e.g., residuals from a general length-weight relationship) and if this pattern was in any way consistent with the model's projections of the impact of trawling on EFH. Length and weight data are routinely collected as part of assessment surveys and these should be accessible for the dominant managed species. If there is an impact of trawling on the local environment's ability to sustain production, one would expect that areas of predicted high trawl impacts would be associated with reduced condition. The basic biological characteristics of a species would come into the interpretation of such an analysis. Clearly, species which depend more heavily on infauna for feeding would likely show the closest association of condition with areas of high impacts on infauna if there is a significant impact of trawling on benthic productivity. Other factors to be investigated could include length-at-age and fecundity if such information were available.

Further analysis of secondary effects of fishing on EFH could include the long term changes in research vessel estimates of abundance in relation to habitat impacts. If there is a strong requirement by a species for habitat structures that could be impacted by trawling (e.g., corals), one would expect the greatest changes in abundance estimates from standardized trawls to occur in such habitats. Such analyses could also point to the potential loss of sub-stock complexes within each stocks range. Although there may be sufficient mixing within a region to prevent genetic differentiation on the long term (i.e., many generations), there could easily be gradual loss of sub-components of the population due to prolonged effects of directed fishing effort or impacts on EFH. The gradual loss of stock components could lead to a potential for a decline in growth as population density declines. Such losses may not be detected by population indices based on integrated analyses of stock abundance since the losses of population complexes are likely to occur along the margins of the distribution (e.g., Frank and Brickman 2000). Analyses based on catches (i.e., abundance estimates) rather than life history characters should be interpreted with some caution as variations in catchability by either commercial or scientific trawls may change in unexpected manners from year-to-year. Further caution should be exercised if the estimates of abundance are based on age-structured model projections, as discussed in 2A. It is clear that for some species there will be considerable year-to-year variation in the distribution within the regions of interest. However, variability does not preclude comparison of patterns of impact and biological characters. In addition, because of the very nature of marine ecosystems, where many variables show large scale correlation, there might also be environmental covariates that could show a pattern consistent with spatial patterns in life history characters and distribution patterns. However, even if there were confounding factors at play, the lack of an ability to determine the ultimate cause of spatial differences in condition would suggest that caution should be exercised in reaching conclusions about the potential effects of trawling on EFH.

3. What, if any, improvements should NMFS consider making to the model, or to its application in the context of the DEIS, given the limited data available to use for input parameters?

I consider there are two classes of improvements that can be made to the application of the model in context of the DEIS. The first are short term (i.e., that can be accomplished within the timeframe facing NMFS for publication of the DEIS):

[1] Application of the model should attempt to provide a broader breadth in parameter estimates, particularly as they relate to recovery rates of benthos from which a more realistic range of impacts can be estimated. In several cases, there were so few estimates available that considerable uncertainty in the range of impacts remains. Effort should be directed more toward those benthos classes with intermediate recovery rates. Species with recovery rates in the extremes (e.g., corals) are unlikely to recover within reasonable timeframes.

[2] The model should be validated with an independent data set. The data could come from a comparison of trawled and untrawled areas of the EBS, where a number of long term area closures could provide a base for comparison. Alternatively, the data could come from other areas where long term impacts of trawling have been studied (e.g., North Sea, Georges Bank).

[3] The model should be applied in backward projections of EFH status to assess the current state of the regions of interest (EBS, GOA, AI) relative to projected conditions from 10-30 years before present. Although there are likely to be gaps in the database on the distribution of fishing effort relative to the more recent observed coverage, long term backward projections could be informative in reaching conclusions about the ability of the Alaska ecosystems to maintain productive capacity of managed species.

[4] Greater effort should be directed toward determining whether the assumptions of random allocation of effort within model blocks are being satisfied. It is clearly impossible to carry out such analyses throughout the entire EBS, GOA and AI regions. However, selected subregions, where the impact of fishing on EFH has been predicted to be significant (e.g., > 20% long term impact) could be studied in greater

detail. The effort would be most important in areas of the Aleutian Islands and the Gulf of Alaska where the greatest uncertainty in knowledge of the spatial structure of the habitats occurs. If the effect is not randomly distributed, the precautionary approach would dictate that one assume that fishers are targeting a particular habitat type, which would result in higher overall impacts within the regions.
[5] There has to be a systematic and quantitative approach to the evaluation of possible impacts of trawling on managed species that must focus more on the potential for localized impacts predicted from the model. There is a wide range of methods used in the analysis of spatial variability and correspondence between factors. Work by researchers dealing with landscape ecology have provided a wide range of approaches that could be applied to the underlying issue of the DEIS. Emphasis should be placed on analysis of proximate variables that are immediately reflected in the individual fish (e.g., condition, growth, fecundity) that could reflect the immediate impact of trawling on EFH. Second, changes in spatial distribution and/or recruitment patterns over time, based on research vessel surveys, should be investigated to determine if there is indication of a systematic reduction in habitat availability, particularly for habitat types where the predicted impact of trawling is greatest (e.g., GOA and AI). Only after these two elements have been considered could measures of a species capacity to remain above MSST be used as an indicator of the potential cumulative impact on the population. In the latter case, it is important to consider the history of the stock and how it has responded to changes in management practices aimed at ensuring stable biomass levels above threshold levels. If the response has not been as anticipated, particularly if management measures have proven to be less effective, then it may not be possible to exclude the cumulative impact of trawling on EFH as a possible cause for the reduced response even if other environmental factors may appear to be at play.

The second class of improvements involve long term efforts:

[1] Fish-habitat associations and requirements, particularly in regions where there are important small scale (<10 km) variations in habitat structure, and their association with fishing activity, must be investigate more fully. If fishers are directing their efforts on specific habitat types, the current model is likely to underestimate the potential impact of those activities on both habitats and managed species. Particular attention should be paid to the Gulf of Alaska and the Aleutian Islands because of the paucity of information across these bathymetrically complex regions.
[2] The efforts surrounding the subject of the DEIS on EFH should be closely linked with research and management efforts dealing with habitats of particular concern (HAPC). Scientifically the two subject areas cannot be viewed in isolation and the lack of inclusion of information that was clearly available within NMFS indicates a breakdown in logic and communication.
[3] During the workshop of June 29, 2004, we were informed that an extensive base of invertebrate data from scientific trawl catches was largely inaccessible in electronic format. Significant investment should be directed toward making such data available as they could prove essential in establishing long term changes in EFH throughout the Alaska region.

Conclusions and recommendations

The model applied in this analysis should be considered an intuition building tool and the absolute value of the predicted impacts should only be considered as first order relative indices of the potential impact of fishing activities on EFH and its capacity to maintain stock productivity in the long term. Although every attempt was made to use realistic measures of the direct impact of trawls and the ability of different classes of benthos to recover from those impacts, the end result is that all model calculations effectively present a scaling of the spatial pattern in fishing activity within the EBS, GOA and AI. The model is a guide that indicates that the long term impact of trawling is anticipated to be less on organisms that can survive the direct contact with the gear and that have high recovery rates while the converse is likely to be true for those habitat types that are more heavily impacted by fishing activities. As a result, the absolute values of the predicted impact, integrated over wide regions cannot be viewed as an appropriate measure of the true impact in gauging the evaluation of effects on the various managed stocks, as it appears to have been used in the DEIS section of Appendix B dealing with the evaluation of impact on managed species. It is only after more detailed analysis of the spatial distribution (i.e., localized) of first order effects (i.e., impact on individual characters such as weight at length, growth, fecundity, gut fullness) have been assessed can one start to make substantive conclusions about the potential effect of fishing activities on EFH on the capacity of stocks to maintain productivity. After this, spatial patterns in secondary processes (e.g., changes in the distribution of recruits, CPUE) can then be considered in relation to the distribution of fishing effort to see if there patterns of change that are consistent with the current patterns of fishing effort. Only after it has been possible to reject the association with fishing activity with spatial patterns in first and second order population responses would it be possible to use integrative measures of stock production to address the potential impact of fishing impacts on EFH.

Given the analyses presented in the DEIS on the impact of fishing activities on EFH, I believe it is premature to conclude that the current level and pattern of fishing activity has minimal or temporary effects on the capacity of managed species to remain about a threshold biomass levels that would ensure long term productivity and sustainable fishing of the stocks in the EBS, GOA and AI. The conclusions of the report are also at odds with the overall conclusions of the NRC (2002) report on the effects of trawling and dredging on seafloor habitat. Therefore, NMFS should provide a detailed discussion of the reasons for these differences of opinion once further analyses (see below) have been carried out.

Within the timeframe in which NMFS is required to publish a completed EIS, the following activities that will provide a stronger basis for conclusions about the potential impact of fishing on EFH can be undertaken and completed:

- The model’s ability to predict long term impacts of fishing should be validated against an independent data set;

- The model should be applied in backward projections of EFH status to assess the current state of the regions of interest (EBS, GOA, AI) relative to projected conditions from 10-30 years before present. Although there are likely to be gaps in the database on the distribution of fishing effort relative to the more recent observed coverage, long term backward projections could be informative in reaching conclusions about the ability of the Alaska ecosystems to maintain productive capacity of managed species;
- An objective evaluation of the patterns of fishing in a subset of critical areas (i.e., moderate impact or greater) of the five habitat types identified for the EBS and the three habitat types identified for both of the GOA and AI should be carried out to verify that the assumption of randomness within analytical blocks is satisfied. Departure from randomness could indicate that fishing may be directed onto specific habitat types not resolved by the scale of the analytical grids;
- Application of the model predictions, including the importance of localized effects, should follow a more systematic approach in the evaluation of potential impacts on stocks;
- The evaluation of effects of fishing on the capacity of species to maintain biomass levels that can ensure sustainable exploitation must be based on more in-depth analysis of first and second order effects, as outlined in the previous sections. The analysis may not be possible for all stocks and populations but the development of detailed case studies which cover a representative range of life histories (e.g., spawning patterns, level of parental care, feeding habitats, migratory requirements, taxonomic categories, etc.) would provide a more comprehensive evaluation of the potential impacts of fishing on EFH based on past patterns in fishing activity.

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Appendices

APPENDIX I: Bibliography of materials provided

Executive summary of the draft environmental impact statement for essential fish habitat identification and conservation in Alaska. United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service Alaska, 11pp.

Evaluation of fishing activities that may adversely affect essential fish habitat, appendix B. National Marine Fisheries Service, vi + 76 pp plus tables and figures.

North Pacific Fishery Management Council. Minutes, Scientific Statistical Committee September 20-October 2, 2002.

North Pacific Fishery Management Council. Minutes, Scientific Statistical Committee December 2-December 4, 2002.

North Pacific Fishery Management Council. Minutes, Scientific Statistical Committee January 27-29, 2002.

North Pacific Fishery Management Council. Minutes, Scientific Statistical Committee March 31-April 2, 2003.

North Pacific Fishery Management Council. Minutes, Scientific Statistical Committee Conference Call, June 26, 2003.

North Pacific Fishery Management Council. Minutes, Scientific Statistical Committee October 6-7, 2003.

Section 303(a)(7) of the Magnuson-Stevens Act;

Pertinent excerpts from the NMFS regulations for EFH (50 CFR 600.10 and 600.815(a)(2)) and the associated preamble (67 FR 2354-2355);

Pertinent excerpts from the Magnuson-Stevens Act National Standard 1 Guidelines (50 CFR 600.310(d))

Shester, G. Comments on Alaska region essential fish habitat draft environmental impact statement. 24pp

Taggart, J.V. Technical review of appendix B: evaluation of fishing activities that may adversely affect essential fish habitat. 26pp.

Enticknap, B. Comment on draft environmental impact statement for essential fish habitat identification and conservation in Alaska. 20pp.

Fujioka J. Summary slides of powerpoint presentation “Habitat reduction and recovery: a model to assess effects of fishing on habitat reduction” .

Rose, C. Summary slides of powerpoint presentation “Evaluation of fishing activities that may adversely affect essential fish habitat”.

Hollowed, A. Summary slides of powerpoint presentation “Evaluation of effects on managed species”.

Draft Essential Fish Habitat Environmental Impact Statement – January 2004. Pages 3-148 to 3-167; Table 3.4-35; Figures 3.4-1 to 3.4-5.

APPENDIX II: Statement of work

Consulting Agreement between the University of Miami and Dr. Pierre Pepin

Background

The Magnuson-Stevens Fishery Conservation and Management Act requires that every fishery management plan describe and identify Essential Fish Habitat (EFH) for the fishery, minimize to the extent practicable the adverse effects of fishing on EFH, and identify other measures to promote the conservation and enhancement of EFH. NMFS and the North Pacific Fishery Management Council recently developed a draft environmental impact statement (DEIS) to consider the impacts of incorporating new EFH provisions into the Council's fishery management plans. The DEIS evaluates three actions: (1) describing and identifying EFH for fisheries managed by the Council; (2) adopting an approach for the Council to identify Habitat Areas of Particular Concern within EFH; and (3) minimizing to the extent practicable the adverse effects of Council-managed fishing on EFH. Most of the controversy surrounding the level of protection needed for EFH concerns the effects of fishing on sea floor habitats. Substantial differences of opinion exist as to the extent and significance of habitat alteration caused by bottom trawling and other fishing activities. Although an increasing body of scientific literature discusses the effects of fishing on habitat, there is no consensus within the scientific community on an appropriate methodology for analyzing potential adverse effects.

The national EFH regulations (50 CFR 600.815(a)(2)) require an evaluation of the effects of fishing on EFH, and this evaluation appears in Appendix B to the DEIS. The evaluation has two components: a quantitative mathematical model to show the expected long term effects of fishing on habitat, and a qualitative assessment of how those changes affect fish stocks. The model estimates the proportional reductions in habitat features relative to an unfished state, assuming that fishing will continue at the current intensity and distribution until the alterations to habitat and the recovery of disturbed habitat reach equilibrium. The model provides a tool for bringing together all available information on the effects of fishing on habitat, such as fishing gear types and sizes used in Alaska fisheries, fishing intensity information from observer data, and gear impacts and recovery rates for different habitat types. Due to the uncertainty regarding some input parameters (e.g., recovery rates of different habitat types), the results of the model are displayed as point estimates as well as a range of potential effects.

After considering the available tools and methodologies for assessing effects of fishing on habitat, the Council and its Scientific and Statistical Committee concluded that the model incorporates the best available scientific information and provides a good approach to understanding the impacts of fishing activities on habitat. Nevertheless, the model and its application have many limitations. Both the developing state of this new model and the limited quality of available data to estimate input parameters prevent drawing a complete picture of the effects of fishing on EFH. The model incorporates a number of assumptions about habitat effect rates, habitat recovery rates, habitat distribution, and habitat use by managed species. The quantitative outputs of the analysis may convey an impression of rigor and precision, but the results actually are subject to considerable uncertainty.

One major limitation of the model is that it does not consider the habitat requirements of managed species or the distribution of their use of habitat features. Therefore, DEIS analysts were asked to use the model output to address whether continued fishing at the current rate and intensity is likely to alter the ability of a managed species to sustain itself over the long term. In other words, are the fisheries, as they are currently conducted, affecting habitat that is essential to the welfare of each managed species? To help answer that question, the analysts considered available information about the habitats used by managed species. The analysts also considered the ability of each stock to stay above its minimum stock size threshold (MSST), after at least thirty years of fishing at equal or higher intensities. MSST is the level below which a stock is in jeopardy of not being able to produce its maximum sustainable yield on a continuing basis.

The DEIS analysis concludes that despite persistent disturbance to certain habitats, the effects on EFH are minimal because there is no indication that continued fishing activities at the current rate and intensity would alter the capacity of EFH to support healthy populations of managed species over the long term. The DEIS finds that no Council-managed fishing activities have more than minimal and temporary adverse effects on EFH, which is the regulatory standard requiring action to minimize adverse effects under the Magnuson-Stevens Act. Additionally, the analysis concludes that all fishing activities combined have minimal, but not necessarily temporary, effects on EFH. These findings suggest that no additional management actions are required pursuant to the EFH regulations.

Expertise Needed for the Review

The review panel shall comprise six individuals. Panelists shall have expertise in benthic ecology, fishery biology, fishing gear technology, ecological modeling, and/or closely related disciplines.

Information to be Reviewed

The CIE panel shall review the following materials:

- The Executive Summary from the *Draft Environmental Impact Statement for Essential Fish Habitat Identification and Conservation in Alaska* (11 pages plus tables and figures);

- The evaluation of fishing activities that may adversely affect EFH (Appendix B to the DEIS; 76 pages plus tables and figures);
- EFH sections of the minutes of the Council's Scientific and Statistical Committee meetings in October 2002, December 2002, February 2003, April 2003, June 2003, and October 2003 (each is approximately 2 pages);
- Section 303(a)(7) of the Magnuson-Stevens Act;
- Pertinent excerpts from the NMFS regulations for EFH (50 CFR 600.10 and 600.815(a)(2)) and the associated preamble (67 FR 2354-2355);
- Pertinent excerpts from the Magnuson-Stevens Act National Standard 1 Guidelines (50 CFR 600.310(d)); and
- Selected public comments on the DEIS that are pertinent to Appendix B, including criticisms of the analytical approach (comments to be selected by NMFS after the close of the public comment period on April 15, 2004).

Panelists should refer to the following website to access all background material.

http://www.fakr.noaa.gov/habitat/cie/review.htm

Questions to be Answered

Given the context of the Magnuson-Stevens Act requirements and the EFH regulations, the CIE reviewers shall address the following issues:

1. Does the model incorporate the best available scientific information and provide a reasonable approach to understanding the effects of fishing on habitat in Alaska?

2. Does the DEIS Appendix B analysis provide a reasonable approach for identifying whether any Council-managed fishing activities adversely affect EFH in a manner that is more than minimal and not temporary in nature? (For purposes of this question, the terms "temporary" and "minimal" should be interpreted consistent with the preamble to the EFH regulations: "Temporary impacts are those that are limited in duration and that allow the particular environment to recover without measurable impact. Minimal impacts are those that may result in relatively small changes in the affected environment and insignificant changes in ecological functions.") To answer this question, the panel shall address at least the following issues:

    a. Does the DEIS Appendix B analysis apply an appropriate standard (including the consideration of stock status relative to MSST) for determining whether fishing alters the capacity of EFH to support managed species, a sustainable fishery, and the managed species' contribution to a healthy ecosystem?

    b. Does the DEIS Appendix B analysis give appropriate consideration to localized habitat impacts that may reduce the capacity of EFH to support managed species in a given area, even if those impacts do not affect a species at the level of an entire stock or population?

3. What if any improvements should NMFS consider making to the model, or to its application in the context of the DEIS, given the limited data available to use for input parameters?

Review Process, Deliverables, and Schedule

The review panel shall consist of six members, one of whom shall serve as the Chair, as specified below.

Duties of the Panelists

1. Each panelist shall attend in person and participate in a one-day meeting with the scientists who developed the fishing-effects model and the analytical approach used to evaluate the effects of fishing in the DEIS. The meeting will be held at the Alaska Fisheries Science Center in Seattle on June 29, 2004. The meeting will be open to the public to attend, but there will be no opportunity for public testimony. The lead authors of the model, Dr. Jeffrey Fujioka and Dr. Craig Rose, will provide an overview of the model, how it was developed, how it was refined in response to comments from the Council's Scientific and Statistical Committee and other reviewers, and how it was used in the DEIS. The panel will have an opportunity to question Dr. Fujioka and Dr. Rose, as well as Dr. Anne Hollowed, who assisted in designing the analytical approach used to evaluate the effects of fishing in the DEIS. The panel shall meet in executive session at the Alaska Fisheries Science Center on June 30, 2004 to discuss the information presented, and to identify any unanswered questions.

2. Prior to the meeting, each panelist shall review the materials specified above. Panelists may submit written questions via e-mail to Jon Kurland (Jon.Kurland@noaa.gov), with copies to the Contracting Officer's Technical Representative (COTR), Stephen Brown (Stephen.K.Brown@noaa.gov), and to the CIE manager, Manoj Shivlani (mshivlani@rsmas.miami.edu) at least two weeks before the meeting to ensure topics of particular interest will be covered during the presentation.

3. Each panelist shall deliver an individual final written report containing answers to the questions posed above and any recommendations. These individual reports shall be submitted the Chair and to Dr. David Die of the University of Miami via e-mail at ddie@rsmas.miami.edu, and to Mr. Manoj Shivlani via email at mshivlani@rsmas.miami.edu no later than July 15, 2004. The reports shall include the following sections: executive summary, background, description of review activities, summary of findings, conclusions/recommendations, bibliography of any materials relied upon by the panel, and a copy of this statement of work. Please refer to the

following website for additional information on report generation:
http://www.rsmas.miami.edu/groups/cimas/Report_Standard_Format.html.