- Review the work being done elsewhere on ways of assessing the health of an ecosystem and develop relevant indices to help monitor the health of the Alaskan ecosystem.

4.2.2 Long-term

The following are longer-term activities and research that should be carried out as a means of improving the knowledge base.

- The habitat associations of the various species should be determined from the groundfish survey data. The habitat features should include at least temperature, depth and type of habitat. This would help to determine what, if any, feature most affects the distribution of the various fish species.
- Use the above associations and other available information and data to produce Essential Fish Habitat Source documents similar to those produced for some of the fish stocks in the US Northeast.
- The presence of closed areas to trawling offers the potential for research on the influence on trawling on habitat. These should include monitoring of the closed and open areas and comparisons carried out between the two. Experimental field programs should be established to determine the recovery rates of different types of habitat to known trawling.
- Surficial sediment surveys need to be carried out throughout Alaskan waters.
- The influence of habitat on the life history of different species needs to be identified. This should be carried out through observational programs that would include the use of manned and unmanned submersibles.
- More detailed investigations into the fish-habitat associations and requirements is required in regions where there are important small scale (<10 km) variations in habitat structure, especially in the Gulf of Alaska and the Aleutian Islands because of the paucity of information there. The association of the fishing activity with these habitat features must be investigate as well.
- The efforts 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 appears to point to a breakdown in logic and communication.
- Significant investment should be directed toward making the invertebrate data from scientific trawl surveys, fishing vessel logbooks, and any other relevant data available and in electronic format.

- Test the assumption of random spatial distribution of fishing effort using a combination of observer, logbook and VMS data. Show the temporal distribution of fishing effort and discuss possible effects of fishing on the spawning process. It should also examine the time between multiple trawls in relation to the recovery time for the habitat.
- Use the model to determine the time dependent nature of the loss of habitat for each of the species. How long does it take to reach "equilibrium"? Has "equilibrium" been reached? Back-calculate the time to pristine conditions given reasonable assumptions about the fishing effort. How does this compare with when trawling began?
- Provide time series of the stock size of each species relative to its current MSST level.
- Take advantage of existing substrate data to provide a better surficial sediment map on which to apply the model.
- Use the model in hindcast mode to examine past history of trawled areas and to obtain a better understanding of how the existing equilibrium status of populations relates to historical patterns.
- Compare the spatial pattern in the CPUE from the surveys and the commercial fishery to the pattern of fishing effort. Has the CPUE been declining in areas of heaviest fishing and where the habitat has been most affected?
- Integrate the results from on-going research associated with fishing gear effects on the seafloor as much as possible into parameterization and testing of the model, and in the qualitative evaluations of the effects of fishing on EFH of the various managed stocks.
- The rate of destruction of hard corals and sponges should be checked from the groundfish survey data to determine the reliability of I in the habitat reduction model for these habitats.
- Broaden the scope of the evaluators of habitat effects by including the opinions, information and data of stakeholders.
- Explore alternative models that take advantage of existing data on growth, fecundity etc. in different habitat types as an alternative to the MSST analysis. Specifically, a spatially explicit examination of parameters other than population abundance (e.g., growth rates, size at age, fecundity, condition etc.) is preferable. These analyses 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.
- The evaluations of the effects of fishing on habitat need to be reconsidered after the above suggestions are completed. The alternative model results and information from other regions should be taken into account along with the MSST and the model results to assess the possibility of habitat degradation affecting commercial fish stocks. Where the data are unclear, or where habitat reduction is high even if the abundance levels are above MSST, the precautionary approach should be used. This may result in some habitats being classified as potentially impacted by fishing.
- Reduce the total number of species/stocks examined in Appendix B and examine the data rich stocks in greater detail.

considered in relation to the distribution of fishing effort to determine if the patterns of change that are connected with the current patterns of fishing effort. These could then be combined with the model results of habitat loss as well as integrative measures of stock production to address the potential impact of fishing on EFH. 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 had not been 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.

Because of the large uncertainty in our understanding of the processes linking habitat and life history stages of fish, in the habitat reduction model and the factors influencing stock productivity, a precautionary approach needs to be applied to the evaluation of fishing effects on EFH. Research closures or other precautionary management measures should be utilized to protect potential EFH while research is carried out to assess these habitats, their ecological role, and the impacts of fishing.

Although the requirements were to assess the effects of habitat changes due to fishing on both the sustainability of the fishery and the health of the ecosystem, the latter was not addressed in Appendix B. Several marine scientists and organizations are presently struggling with this issue and it is suggested that a review of this work be undertaken along with the development of ecosystem indicators as a first step in assessing the health of the Alaskan ecosystem.

Finally, while Appendix B was generally well written, it occasionally suffers from a lack of information, details or quantification. These need to be corrected in the final version. Some examples include the following. What is the level of loss of habitat that would be considered unacceptable or at least significant enough to warrant concern? What is exactly meant by the term "professional judgment"? Provide justification for the assumptions made.

4.2 Recommendations

4.2.1 Short term

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

- Validate the habitat reduction model in regions or areas where data are available.
- Compare the spatial pattern of length-weight relationships for different species with the fishing effort pattern. If the fish in the heavily fished areas are in poorer condition (less weight for the same length fish) then this might argue for an affect of fishing through habitat degradation.

Many of the leading researchers and several key recent papers in the field of fisheries impacts on habitat were not cited nor are their results incorporated into Appendix B. Also, many of the excellent field research programs on Alaskan regional fishery habitats, including those being conducted by the NMFS, were not cited or acknowledged. Consequently, more information on the roles that biogenic structures on both soft and hard benthic environments in the Alaska region may play in the ecology of commercial species is available than is presented in the DEIS.

The model estimates the percent reduction in habitat due to fishing but does not provide a measure of the effect of habitat destruction on the sustainability of the fish stocks. To assess the latter, evaluators relied heavily upon the population abundance relative to MSST to determine if there has been a measurable effect on the stocks from habitat loss. The assumption was that if habitat loss negatively affected stock productivity, then it would be reflected in the state of the stock relative to MSST. The panel felt this criterion is not an appropriate one because it is largely insensitive to habitat changes. One of the difficulties with this approach is that the variability in abundance of the stock responds to many factors besides habitat changes, including water masses fluctuations, predator and prey fields, and fishing directly. Also, massive and virtually irreversible damage to some habitats (e.g. coral and sponge gardens) may occur before species decline below their MSST or it is detected.

The heavy reliance on the population-based criterion resulted in little attention being paid to the local effects of habitat loss. Even in areas where the model indicated that the habitat was severely reduced, there were no mitigation procedures proposed.

Given the high parameter uncertainties, the assumptions in the model and the dependence of the stock levels relative to MSST to factors besides habitat, the panel concluded that is premature to conclude that there the current level and pattern of fishing activity has minimal or temporary effects on the habitat and 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. This is further emphasized by the over 40% of the evaluations labeled as "Unknown". 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.

Since the use of the abundance of the stock relative to MSST is not considered to be an appropriate measure, 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. Emphasis should be placed on analysis of proximate variables that are immediately reflected in the individual fish (e.g., condition, growth, fecundity, gut fullness). Once these have been assessed one can start to make substantive conclusions about the potential effect of fishing activities on EFH on the capacity of stocks to maintain productivity. Also, spatial patterns in secondary processes (e.g., changes in the distribution of recruits, CPUE) can be be much easier to achieve if there are areas that are *not* currently fished and fishermen are involved in the process. Such an approach has worked successfully in Australia and resulted in a large increase in the proportion of protected marine habitat and therefore a much stronger buffer in the long term for fish production.

The assumptions of random allocation of effort within model blocks needs to be tested in selected sub-regions where the impact of fishing on EFH has been predicted to be significant (e.g., > 20% long term impact) using observer or other fishing effort data.

4. Main Conclusions/Recommendations

4.1 Conclusions

As review panel members, we have been asked to examine and comment on the model and methods described in Appendix B of the DEIS to assess the effects of fishing on habitat. The assessment is restricted to the effects on managed species and their long-term productivity or sustainability as a fishery. The task given to the NMFS scientists was a difficult one because there is a general lack of data and knowledge on both how and when fish use particular habitats and how important habitat is relative to other issues such as environmental conditions, food, predators, etc.

The habitat reduction model in the present DEIS, as acknowledged in the report, suffers from several factors including assumptions of constant fishing pressure and random distribution of fishing effort, coarse resolution of sediment and habitat types, as well as the high uncertainty in the damage done by the trawls, the number of times the trawls touch bottom, and the recovery rate of the habitat. As a result, the model should only be considered an intuition-building tool and the absolute value of the predicted impacts a relative index of the potential impact of fishing activities on EFH. A major criticism is the lack of any attempt to validate the model. The model needs to be tested against observations, using data from Alaskan waters, if available, and other regions such as Georges Bank or the North Sea where major studies of trawling impacts have been undertaken.

The use of additional available data and further analyses could improve the model. These include among others (1) analysis of the spatial and temporal patterns of the fishing effort and their relation to habitat type, (2) back calculations to determine the state of the habitat relative to previous conditions, and (3) better resolution of the surficial sediments, if only in certain areas. However, even if the model were improved by better resolving the model parameters, obtaining finer spatial resolution of the fishing effort and sediments, and accounting for temporal changes, especially in effort, it was felt that the pattern of habitat reduction produced by the model would unlikely be significantly altered from that shown in the present draft of Appendix B. The additional data and analyses should still be used and undertaken to confirm the robustness of the model.

In regards to local habitats the destruction of corals and sponges with their long recovery times are of particular concern. In keeping with the precautionary approach, these should receive special consideration.

Recommendations: Discuss further within Appendix B vulnerable local habitat features and possible connections to those managed species that might tend to aggregate in such habitats.

3.3 TOR 3: What improvements could be made to the model, or to its application?

A number of suggestions have already been made in the form of recommendations in discussions of the previous terms of reference. Some of the more important bear repeating.

Model validation is required with an independent dataset. The data could come from a comparison of trawled and untrawled areas of the EBS or from other areas where long-term impacts of trawling have been studied.

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.

Temporal dependence should be introduced in the fishing impacts. In the present model formulation there is no seasonal time dependency in the fishing effort data, yet the recovery rate parameters are explicitly so. Estimates of the average time interval between overlapping fishing effort relative to the recovery rates of the habitat are needed.

A precautionary approach needs to be applied to the evaluation of fishing effects on EFH. This is especially important given that many of the stock collapses or severe declines around the world could have been avoided or lessened by following a precautionary approach. It is also important given that many of species in Alaskan waters have unknown life history characteristics. In spite of this lack of knowledge these species were not listed as requiring any sort of special concern. The bar seems to be set rather high for "proving" a link between EFH and fish production and the burden of proof is clearly shifted to those who believe EFH is important.

Outside consultation with interested groups is needed to obtain their input, information and data. One mechanism might be a public consultation that embraces fishing groups. Such an approach would serve the dual function of filling some of the gaps in data (particularly as it pertains to habitat) and also help to create a spirit of cooperation with fishermen.

Additional protected areas could be very useful in terms of potentially enhancing adjacent fisheries and ensuring healthy ecosystem functioning. Establishing protected habitat may other sources on this same topic of ecosystem indicators are available on the web. Examples of indicators include biodiversity indices, trophic level changes, condition factors, the demersal to pelagic ratio, habitat complexity, etc. Apex predators have often been considered sensitive to ecosystem health thus marine mammal productivity could perhaps be another potential indicator of ecosystem health.

Recommendations: Review the literature and web-based information to determine the state-of-the-art in regards to assessing the role of the managed fish stocks in a healthy ecosystem. Based on this review, define and generate time series of ecosystem indices for Alaskan waters.

3.2.2. TOR 2b: 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?

It was the unanimous opinion of the panel that adequate consideration was not given to localized habitat impacts in Appendix B. Instead the report focused almost exclusively on population indices, e.g. total abundance relative to MSST. There was little discussion in Appendix B of whether localized habitat was being destroyed at a rate that was unsustainable. In no case was it recommended that specific habitat be protected even where the model indicated substantial local habitat had been lost. The impression was given that these more local effects would be dealt with under Habitat Areas of Particular Concern (HAPC).

It is unclear and was not discussed in Appendix B whether it would be better to concentrate fishing in particular locations and sacrifice some local habitat while protecting other areas, or to spread the effort out as evenly as possible.

Recommendation: Clearly state what the philosophy should be in regards to spatial allocation of fishing effort and its impact on habitat.

In regards to localized habitat impacts, there was no discussion of substructure in the populations. Are there sub-populations of some or all of the species and if so are some of these sub-populations threatened by habitat destruction? For example, Atka mackerel has been suggested as possibly consisting of several sub-populations. This is, in part, because the fishery tends to focus on limited fishing grounds, although genetic studies have not been able to confirm the existence of distinct sub-populations.

Recommendations: (1) Analyze the spatial distribution of CPUE and condition indices to determine if they provide any evidence for localized impacts of fishing. (2) Examine the long-term changes in abundance in relation to habitat types. For example, if there were 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.

3.2.1.5. Corals and Sponges

Corals and sponges are of particular concern because of their long recovery times. The areas of greatest alarm are where the model results indicate a reduction of order 50–100% in the coral habitat.

The recovery rate of sponge habitat may be greatly underestimated, as noted in the comments by Shester and confirmed by studies on the Northwest Shelf of Australia (Sainsbury 1997). Indeed, the recovery times will be species dependent.

> Recommendation: Reassess the recovery times for sponges through a more extensive literature survey and by consultation with those working on sponges and rerun the model if the recovery rates are revised.

Since the fine-scale distribution of fishing effort is not known, the actual impact on corals and sponges may be significantly biased upwards or downwards, depending on whether trawlers avoid or focus effort on those habitats. If fishes aggregate in these sensitive habitats, then fishing effort typically soon follows, facilitated by improvements in fishing technology. The development of rock-hopper gear, GPS, track-plotters, net sondes, etc. enables trawlers to advance continually onto grounds once considered untrawlable.

Levels of coral, sponge and bryozoan by-catch in the Alaskan trawl fisheries, particularly in the Aleutian region, based on observer records are a matter of concern, but these data were not analyzed or incorporated into the model formulation or validation process. Anderson and Clark (2003) show that coral by-catch from new orange roughy fishing grounds declined sharply after the first year of fishing. The continued coral and sponge by-catch from certain segments of the Alaskan trawl fisheries may therefore indicate continued advance of the fleet into previously unfished grounds containing sensitive habitat.

> Recommendation: Analyze catch and effort data, observer by catch data, field studies and consult with the industry to assess the damage done to the long-lived corals and sponges as well as the possible encroachment of fishing trawls into new areas containing corals and sponges. .

3.2.1.6. Healthy Ecosystem

A standard for a "healthy" ecosystem was never addressed in Appendix B. During the presentations, the NMFS team indicated that they were given little guidance on how to address this issue and it appeared that either they did not quite know how to proceed or did not have the time to explore the possibilities.

Measuring the health of an ecosystem is a topic that is presently receiving much attention throughout the marine science community. In Paris during March-April 2004 a major symposium was held entitled Quantitative Ecosystem Indicators for Fisheries Management (http://www.flmnh.ufl.edu/fish/organizations/ssg/ecosymp2004.pdf). Many

These, or other indices, could be used in combination with the results from the habitat reduction model and a population-based criterion to assess habitat effects on fish.

B_{MSY} is the spawning stock size that maximizes production (usually estimated as the equilibrium spawning stock corresponding to the fishing mortality that generates the highest long-term yield). The 10 yr prediction does therefore not contain any additional observations as compared to the assessment of the current stock situation. As apart of a management plan it might be good reasons for including this 10 yr test for classifying the stock, but for evaluating the current production the information is blurred by the assumption about future recruitment. For this purpose B_{MSY} is a better measure than MSST and would be more transparent and consistent among stocks.

3.2.1.3 Species Evaluations

There was general concern that the species evaluations were heavily reliant upon a single or few expert opinions from the NMFS. It is essential that the evaluators of the effects of fishing on EFH for the various species be broadened.

Recommendation: Carry out opinion surveys with stakeholders. (Well-designed, statistically based opinion surveys can be very informative and have been used extensively for fisheries assessment purposes in eastern Canada.) Also, seek the opinion of researchers involved in the various fishing impact studies reviewed in Heifetz (2002, 2003).

Over 40% of the evaluations by species and category (spawning, feeding, growth) were classified as U (unknown), yet there appears to be an implicit assumption throughout that if it is unknown, that there is no effect, or at least nothing needs to be done until more data are available (burden of proof argument). For example, even if one or two of the evaluations are listed as U for a given species, it is often stated that fisheries are unlikely to adversely affect the EFH of the species in question.

3.2.1.4 Precautionary Approach

In recent years, fisheries science has been applying the precautionary approach. That is, in the absence of conclusive proof, one should proceed cautiously. Yet, there is little to no discussion within Appendix B of the precautionary approach with regards to EFH. Since it is likely difficult to detect an influence on the stock until after the habitat is damaged, perhaps even until much of the habitat is destroyed, the use of the precautionary approach is paramount. This is especially true for those habitats with long recovery times, e.g. hard corals and sponges.

Recommendation: Apply the precautionary approach to the evaluation of the effects of fishing on habitat and their subsequent influence on the sustainability of commercial fish stocks especially where the model suggests the habitat is heavily reduced and/or the recovery times are long, as well as where little is known about the role of habitat in the life history stages.

(b) Because the MSST approach works on a population level, it is likely to be an extremely insensitive measure of EFH loss. Moderate effects due to habitat degradation might be difficult to detect due to "noise" from the additional controlling factors discussed above. Also, a decline in stock productivity below MSST due to extensive and irreversible damage to EFH would likely be gradual and only be detectable well after the habitat had been affected, i.e. the lag between cause and effect is probably quite long. The result being that many years of observation would be needed to detect a trend with reasonable statistical significance.

(c) The MSST criterion is poorly matched with the output of the spatially explicit fishing effects model. For example, it provides no information about stock structure, i.e. the number of sub-stocks distributed within the management unit and how they may have changed over time. This can be serious as serial depletion of sub-stocks eventually led to the collapse of several managed stocks in the North Atlantic (Frank and Brickman, 2001).

(d) MSST is an empirically determined threshold and therefore sensitive to the length of the time series. For those long-lived managed species, the time series can be less than one generation (< 30 y). Also, with the addition of new data, the MSST threshold level changes. What are the calculated virgin biomass estimates for some of the species? Consideration should be given to theoretically based thresholds based on life history characteristics.

(e) The corollary of the MSST applied criterion used in the report is that habitat degradation due to fishing is an issue if the stock is below MSST. However, in the case of blue king crab for which the stock was reported to be below MSST, the DEIS stated that the reason for the low stock was not habitat related but due to other factors. While this may be easily justified (but was not in Appendix B), it makes it very unclear as to what conditions will be required before an effect of fishing on habitat will not be classified as MT or U. There is no indication of what other conditions are necessary when the stock is below MSST in order to be interpreted as indicating an effect of habitat reduction on stock sustainability.

(f) MSST is inappropriate with regard to the impact of fishing on sensitive habitats, such as corals and sponges, where any habitat impact is unlikely to be temporary and reductions > 50% cannot be regarded as minimal.

Since the MSST criterion is most often insensitive to habitat changes, then clearly an alternative approach is needed. Ideally, this approach should take advantage of existing data, and preferably a data time series.

<u>Recommendations</u>: Examine data on size-at-age, the size structure of the population, condition (e.g. liver indices), fecundity and gut fullness in a spatially structured format that more closely resembles the design of the habitat model. These types of data are routinely collected during the stock surveys that are conducted by regulatory agencies.

3.2.1 *TOR 2a: Does the DEIS apply an appropriate standard for determining whether fishing alters the capacity of EFH to support managed species either for a sustainable fishery or to contribute to a healthy ecosystem.*

An evaluation was carried out of whether fishing impacted the EFH to such an extent that it influenced the ability to support sustainable fisheries for managed stocks. This evaluation was done on a species by species basis. The process outlined in the DEIS states that they were based on (1) the results from the habitat reduction model; (2) literature and other information on habitat requirements to accomplish successful 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 professional judgment of scientists that manage and study the species of interest. The sustainability criteria used by the scientists was the abundance level relative to the Minimum Stock Size Threshold (MSST). If the stock was above or equal to the MSST, or projected to be above within 10 years, the stock was considered to be in good shape. The MSST was based upon data since the late 1970s. Where MSST could not be estimated, other proxies were used or baring these, the MSST was considered as being unknown.

3.2.1.1. Model application

The habitat reduction model was run for almost all species and the DEIS discusses the results by species. However, the model results appeared to be seldom used in the evaluation, with almost exclusive reliance placed on the abundance level of the stocks relative to MSST.

3.2.1.2. MSST

The panel felt strongly that the MSST was not an appropriate index to evaluate the effects of habitat reduction. Many reasons were given.

(a) MSST is a population measure that embodies and integrates many different processes. Habitat degradation is most often probably a second-order effect, with the abundance of the stock likely responding more to changes in water mass, changes in predator or prey fields, or to direct fishing, including effects on the spawning stock biomass. In regards to environmental conditions, the report notes, and it was further elaborated during the presentations, that Alaskan waters are subject to regime shifts. These shifts occur roughly simultaneous throughout the North Pacific due to changes in large-scale atmospheric forcing. In the late 1970s, there was a shift in the Bering Sea from an invertebrate dominated fishery to an explosion of groundfish. If another major shift occurred such that we were to shift back again to invertebrates and the groundfish abundances decreased, the strict application of the MSST criterion would require that the habitat be protected when in fact they would have played little role in the decline.

3.1.11 Other Issues and Concerns

The model 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.

There was no assessment and little discussion on the effects of fishing on the spawning beds or the spawning aggregations. If trawling, or any other form of fishing, disrupts fish during spawning over extend periods, this would likely cause a reduction in spawning success. Some species have demersal eggs that might be destroyed or buried by contact with fishing gear. The possibility of these effects will depend upon the seasonal distribution of the fishing. These effects are not assessed by the model but should be evaluated.

> Recommendation: Compare seasonal fishing locations with known spawning aggregations, especially for those species that have geographically limited spawning.

During the questioning by the review panel, the NMFS team indicated that other Fisheries Councils are wrestling with these same issues. They further stated that as far as they know, the AFSC is as far along in the development of a fish habitat model, or in fact further ahead, compared to most other councils.

> Recommendations: (1) Describe briefly in the report any other state of the art models and explain why the AFSC selected the one they have. (2) Given that each of the councils are attempting to deal with this issue, the councils should monitor each other's progress and share information on the development of such models, if they are not already doing so.

3.1.12 Conclusion

The habitat reduction model is essentially an intuition-building tool that provides approximate inferences about the potential impact of fishing on EFH. Validation of the model is a high priority through application in Alaskan waters where available data exists and in other regions where more extensive data exists. Many recommendations have been made to improve or better quantify the model or model parameters and these should be undertaken. While the panel recognizes that several of these likely represent minor sources of bias that may not be of great significance to the overall projections from the model, this needs to be confirmed.

3.2 TOR 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?

effort, back calculate the changes in percent of the habitat unaffected by fishing over time. (3) Use the model to predict the possible effects of different fishing efforts on habitat reduction in the future.

3.1.8 Shester Model

The NMFS model estimates habitat reduction due to fishing but does not address the question of what affect this has on fish. G. Shester, in his comments on the DEIS, presented a model that did attempt to do this. He assumed that the estimated reduction in habitat features could be (linearly) translated into a reduced carrying capacity for the fish. He 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. 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. Having said that, the Shester model at least attempts to assess the affects of habitat loss on the fish stocks.

3.1.9 Closed Areas

The areas that have already been closed to trawling could serve as valuable reference sites to parameterize the sensitivity of habitat features to trawling and recovery rates. For example, Stone examines the epibenthic communities inside and outside of two closed areas around Kodiak Island but little, if any of this information was incorporated into Appendix B.

Reference is made to two large area closures in the eastern Bering Sea that were closed to bottom trawling to protect red king crab habitat (see pg. B-20). How was this decision reached? It should be noted that the conclusions on page B-29 that fishing had no or unknown effects on this species are inconsistent with the area closures to protect red king crab.

3.1.10 Habitat Dependency

Habitat dependency of the various managed stocks was generally not quantitatively evaluated. However, the bottom trawl survey database provides the necessary information to conduct such an evaluation, in terms of species distributions and abundances, relative to bottom depth, substrate type, temperature and salinity conditions. There are well-developed methods involving use of survey data to derive cumulative distribution functions of the unweighted and catch weighted sampled habitat (Perry and Smith, 1994; Smith and Page, 1996) and commercial fisheries data (Reynolds, 2003).

Recommendation: Conduct habitat association analyses on fisheries data (both survey and commercial) for the various areas and species.

substrate data to examine the sensitivity of the model to the assumption about lack of substrate complexity/heterogeneity.

Have all avenues been exhausted for surficial sediment data, e.g. from the US Geological Survey? Are there preliminary data that could be used to better resolve the sediment types? Were the data from the paper by McConnaughty and Smith used? Current meter data from models can be used to help refine the sediment information. Was this attempted?

3.1.6 Model Validation

A critical step in the application of any model is its validation against available sources of data. There was no attempt within the DEIS to validate the impact model. There are, however, 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, for example from Georges Bank or the North Sea. Even if the application of the model to other regions might be slightly different from that for Alaska, assessment, analysis and interpretation of the model's application would provide confidence in its validity as a predictive tool. A second source is from NMFS own research in the Alaska Region (Heifetz 2000, 2002, 2003). Some of the work on the impacts of trawling have been published (e.g., McConnaughey et al. 2000) and together with the 2002 and 2003 progress reports of the research program in closed areas of Bristol Bay could have served as a tool for the validation of the modelling approach.

Recommendations: Undertake validation of the model's predictive capabilities by applying it to other regions outside of Alaska and to at least the Bristol Bay region within Alaska.

3.1.7 Model Exploration

The model was not used to explore past conditions or possible future scenarios. These could easily be done with little effort.

The habitat reduction model in Appendix B, it is an equilibrium model, with estimates of H_{equil} being estimated based upon recent fishing effort. The change in habitat is relative to a pristine state, unaffected by trawling and other methods of fishing. However, we know that fishing, including trawling, has been ongoing for some time. Are we near equilibrium for any of the habitat types or are we continuing to lose habitat? The model should be used to back calculate where we might be relative to H_{equil} by using whatever data are available from the past or by making assumptions on the amount of trawling and the impacts of trawling in the past. Where are we relative to pristine conditions, based upon the data and/or reasonable assumptions?

Recommendations: (1) Apply the model as a retrospective tool to determine how far the current environments are from conditions 10-30 years ago. (2) Given the model has a time component (equation 4, appendix B) and there are estimates of past fishing

Jennings and Kaiser), as well as several important studies from the Alaska region (Freese 2004, Krieger 2001, Witherell and Coon 2001, Stone 2004). For example, in the case of hard corals, only one study (Krieger 2001) 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, such as Fossa et al (2002) off Norway, Koslow et al (2001) off Tasmania, and Clark and O'Driscoll (2003). Although not satisfying the criteria applied in the DEIS, they could have been used to address how realistic the value derived from the single study by Krieger was relative to studies where the impact of trawling on coral had been considered.

> Recommendations: Review the papers identified by the panel members and the environmental groups. Where considered relevant, add them to the list of references and discuss their results and implications with regard to impacts of fishing on habitat.

Research on the effects of fishing gear on essential fish habitat, as well as research aimed at defining essential fish habitat has been on-going within the AFSC for several years, (see Heifetz 2002, 2003; Stone 2003). This literature was not cited, however.

> Recommendations: Cite the literature from the AFSC studies. Integrate, where possible, the research results from these studies with the development and testing of the habitat reduction model and the qualitative evaluations of effects on managed species. Where results are not yet forthcoming from these studies, the report should note what research is being carried out.

3.1.5 Surficial Sediment Data

Appendix B concludes that comprehensive substrate datasets do not exist for the study area and that "insufficient amount of data on types, proportion, and distribution of substrates should engender great caution in the application of the analysis results." As a result of the lack of data broad habitat categories were defined: 5 for the EBS region and 3 for each of the GOA and AI regions. In large part, habitat designation closely reflected the bathymetry of a region. In the GOA and AI, the high degree of bathymetric complexity within and among blocks is very likely to be associated with variations in habitat structure.

Finer detail substrate data do exist, however, for the eastern Bering Sea, particularly Bristol Bay and a number of mapping initiatives are underway of major fishing grounds (see Heifetz 2002, 2003) that could have provided high-resolution substrate data for sub-areas of the model domain. Instead, the report adopted the coarsest resolution everywhere.

> Recommendations: Determine if the high-resolution sediment data support the broad scale characterization of habitats. Run the model within the Bristol Bay area (or any other region where there are sufficient data) using coarse versus highly resolved

are relative to some post-impact state, although the truly pristine status of habitats is effectively unknown (e.g. Jackson et al., 2001).

The ρ values were based upon the duration from time of impact to time of recovery however little was said in Appendix B of how the recovery varies in time, i.e. linear, asymptotic, etc. In cases where the recovery is an asymptotic process, the time to full recovery is difficult to ascertain.

> Recommendations: Briefly discuss within the report the temporal changes in the habitat recovery. Explore the possibility of assuming an asymptotic (or sigmoid) recovery in order to obtain a more precise estimate of recovery rate, for example using the time to say 50% recovery.

The model views benthic communities as if they were single populations, for which simple intrinsic rates of mortality and growth (or fishing impact and recovery rate) can be specified. The community is expected to reach equilibrium, given a particular level of fishing. However, benthic communities, even on relatively soft bottoms, are diverse and complex. Studies on Georges Bank have shown that trawling leads not only to reduced benthic biomass and diversity, but a shift in community structure and habitat complexity: from epifauna (e.g. bryozoans, hydroids, worm tubes) that provide complex habitat for shrimps, polychaetes, brittle stars and small fish, to sites dominated by hard-shelled molluscs, scavenging crabs and echinoderms (Collie et al. 1997, 2000). Intensively fished areas are likely to be maintained in a permanently altered state, inhabited by only those organisms adapted to frequent disturbance (de Groot 1984, Jones 1992, Collie et al. 2000). Thus, how were the recovery rates determined? Are they based upon the quality or the quantity of the habitat or both?

3.1.4 Literature Survey

The chosen criterion for selecting literature studies pertinent to the determination of gear impacts, recovery rates and fishing impacts was that the habitat had to be similar in nature to those in the EBS, GOA or AI. This approach is very conservative. Relatively few studies satisfied the criteria and considerable information from Georges Bank, the North Sea and Australia were excluded from the parameter set. 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 reviewed literature appeared in the DEIS (Chapter 3) and was supplied to the panel during the review meeting. It covered many recent papers, but neglected a surprising number of key studies and reviews. Environmental groups present at the review meeting provided the panel with a list of 198 papers on the impacts of fishing that were not cited or utilized in the DEIS. Indeed, many of the leading scientists working in the field were not cited (e.g. Auster, Collie, Dayton, de Groot, Fossa, Gislason, Hall, Hutchings, Vessel speeds tend to be dependent on the target species being sought, yet a single value is given for speed in Table B.2-4. Depending on the composition of the fisheries in various areas, vessel speeds could vary widely.

Recommendation: Construct frequency distributions of vessel speeds for each gear/vessel class combination. Determine what effect this has on the estimates of area swept.

Another key assumption of the model is that fishing effort is constant in time. The effort was calculated from the observer data for 1998 to 2002. The assumption of constant fishing effort was not addressed in the report although 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/histdrawldata.htm). These data should provide not only an indication of changes in fishing intensity within the region but also changes in the spatial patterns of allocation.

Recommendations: The report should contain time series of fishing effort (as far back in time as possible) as well as temporal changes in the spatial pattern of the effort. Explore the effects of non-constant fishing effort on the model results.

3.1.2 Gear effect parameter, q

Estimates of q for bottom trawl gear were determined from the literature. As noted in Appendix B, the uncertainty in these parameter values is high.

The adjustment for multiple contacts (B-12) does not consider the frequency of contact. The frequency relative to the recovery time is the critical consideration.

For scallop trawls and other gear besides bottom trawls the report states that "professional judgment" was used to assess their effect on habitat. It is unclear what this means and hence how reliable the estimates are. The report also indicates that studies on the effects of bottom trawl gear on the habitat that did not meet the necessary criteria were examined for consistency with the excepted studies but there was no indication of what the examination consisted of nor whether these studies were consistent or not with those that met the criteria.

Recommendations: Clarify in the report what is meant by "professional judgment" and note the results of the comparison of the studies that did not meet the criteria with those that did.

3.1.3 Recovery Rate, ρ

The recovery rates, ρ, for the different habitats were also determined from the literature. A reasonable description of the procedure was presented in Appendix B, although again, as acknowledged in the report, these parameters have high uncertainty. Recovery rates

I begin with comments on the model parameters, then comment on validation and model testing and finally provide other related concerns. Recommendations are imbedded into the discussion.

3.1.1 Fishing intensity parameter, f

A key assumption in the application of the model is that of random distribution of fishing effort within each 5 km x 5 km block. It is expected, however, that patchiness in habitat will lead to patchiness in fish concentrations and hence fishing effort. The assumption of random fishing effort was not validated.

> Recommendations: Quantitatively assess the assumption of random fishing effort using the observer database and, for those vessels that did not have observers, use either logbook data or vessel monitoring systems (VMS), if available. Determine the difference in the model results using the observed fishing effort distribution within a block rather than a random distribution.

If the fishing effort were non-random, then a key question would be whether this effort is associated with a specific habitat feature. This is important because if habitat structure within the block were random, non-random fishing would tend to lessen the overall impact since some habitat areas would remain largely unaffected. However, if habitat type and fishing intensity were strongly associated, the impact would be underestimated.

> Recommendation: Using gear effect studies by NMFS, estimate whether 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.

Using the end position to assign a trawl to a particular 5 km x 5 km block underestimates the effects of fishing on habitat due to the non-linearity in the model (as discussed in the comments by J. Tagart). The relative bias will increase with increasing fishing intensity and with decreasing recovery rates.

> Recommendation: Proportionally assign the tows to the different areas under simple assumptions and determine the quantitative difference this would make to the model results.

Observer data forms the primary basis for quantifying the distribution and intensity of fishing effort. Observer coverage was 100% for vessels > 125 ft but was generally less than 30% for vessels < 125 ft. The statement is made in the report that vessels <60 ft in length take less than 1% of the fish so their effect on habitat is considered negligible.

> Recommendations: Map the catch per unit effort (CPUE) of the fishery data by vessel class/gear type combination. Within the report, explicitly state all assumptions regarding the location of unobserved effort.

written reports of each of the panel members; however, it represents the chair's view. The format of this report addresses each term of reference (TOR) in order.

Before presenting our findings, I want to state that the panel all agreed that the NMFS team who prepared Appendix B produced a well-written document with a logical progression of ideas that was easy to follow. It was clear that they had put a tremendous amount of work and thought into the report.

3. Summary of Findings

3.1 TOR 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?

The model, developed by the NMFS and presented in the DEIS, estimates the long-term reduction in habitat due to fishing. It is applied to 3 regions: the Eastern Bering Sea (EBS), Gulf of Alaska (GOA) and Aleutian Islands (AI). The model itself is elegant in its simplicity being a balance between the loss of organisms or structures due to direct effects of fishing gear (I) and the recovery rate of the organisms or habitat structures (ρ). The gear impact (I) is the product of the number of times fishing gear hits bottom (f) times the amount of damage done during each hit (q). The approach is to use the mean or mid-point of the range of values collated from the literature and the lower 25^{th} and upper 75^{th} percentiles of the distribution of the collated data as measures of the uncertainty. The model is applied to a spatially resolved grid of habitats (5 km by 5 km) with a constant fishing effort. The decision to use blocks of 25 km^2 represents a reasonable 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. The model further assumes that within each grid point, the spatial distribution of fishing activity and habitats is random. The steady state solution (i.e., the long-term effect impact or LEI) is estimated for each gear type and habitat category. It represents the percent reduction in the fishing habitat that existed under unfished conditions. The predicted LEIs from the model are scaled versions of the fishing intensity patterns. Consistent with intuition, the model predicts that the long-term impact of trawling is less on organisms or substrate that sustain minimum damage by the direct contact with the gear or have high recovery rates while it is greater for those habitat types that are more heavily impacted by fishing activities and have long recovery times.

The panel felt that the model was well conceived and is useful in providing estimates of the possible effect of fishing on benthic habitat. However, as acknowledged in the DEIS, the parameter estimates are not well resolved and have high uncertainty, due in large part to a paucity of data. Thus the results must be viewed as rough estimates only. In regards to whether the model incorporated the "best available scientific information", the panel concluded that additional information could have been used. There were also concerns about the lack of model validation.

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

Other members of the AFSC and NMFS also attended, some of whom were involved in the preparation of the DEIS. The meeting was opened to the public and although there was no opportunity for public testimony or questioning, members of the public did have a chance to talk with the panel members during the morning and afternoon breaks.

PowerPoint presentations summarizing key aspects of the model and the subsequent evaluation of fishing effects took up the morning. Although there was no formal response to the questions that had been submitted by reviewers prior to the meeting, it was clear that many of the questions had helped to shape the talks that were given. Paper copy summaries of all presentations were supplied to reviewers as well as copies of Section 3.4.3 that was referred to in Appendix B but not previously made available to the panel. The afternoon completed the presentations and was followed by a question and answer period, first on the model and second on the assessment methodology. All members of the review panel had the opportunity to seek clarification on the EFH document and to challenge the authors on aspects of the document and presentation that they felt required closer scrutiny. Although the question period occupied only half a day, there was sufficient time to cover all of the questions raised, and when the question period ended, all members of the review panel felt satisfied that the discussion had been productive and thorough. The review panel greatly appreciated the effort and patience of the NMFS scientists involved.

The following day, June 30, the panel members met in executive session at the Best Western University Towers Hotel to discuss the DEIS and the results from the previous day's meeting. Dr. Drinkwater chaired the session, which went through the each of the review panel's terms of reference. Although the panel had requested that the authors of the report be available to respond to any additional questions, it was not found to be necessary to query them any further. During the course of the session it was clear that there was general agreement by the review panel on the major points related to the terms of reference. The panel disbanded at approximately 15:30 having felt that they had covered all of the major issues.

Upon returning home, each panel member wrote a review, which addressed the terms of reference and related topics. These were submitted to the CIE on or before July 15th. As already stated there was general agreement amongst all of the panel members on the larger issues. This summary report represents many of the panel's findings and the highlights of individual reviewer's comments. It is based upon the discussions and

2.1 Terms of Reference

The panel was asked, in view of the Magnuson-Stevens Act requirements and the EFH regulations, to 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?

2.2 Review Process

The review process contained several steps. First, advance material was provided by CIE through their website, which allowed the panel members to download the relevant documents (see reference list). Reviewers read these documents as well as related papers and reports they felt would be helpful in the review. Upon the request of Dr. Jon Kurland, the panel members provided a list of questions that they wished to see addressed by the authors of the report.

The panel members had an on site visit to the Alaska Fisheries Science Center (AFSC) at the National Marine Fisheries Service Laboratory at 7600 Sandpoint Way in Seattle on June 29. Dr. Jon Kurland chaired the meeting. The agenda for the meeting was:

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 for Alaska 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.

2. Review Panel and its Terms of Reference

In order to provide an independent assessment of the DEIS and its conclusions, NMFS contracted with the Center for Independent Experts (CIE) to conduct a peer review of the evaluation of the technical aspects and assessment methodology used in determining the effects of fishing on Essential Fish Habitat (EFH) in Alaska, which were contained in Appendix B of the DEIS. Given the newness of the model, the importance of this analysis for Alaska's fisheries, and the controversial nature of the subject matter, NMFS determined that an outside peer review would be a prudent step.

The review panel consisted of:

- Dr Asgeir Aglen (Institute of Marine Research, Bergen, Norway)
- Dr Ken Drinkwater (Institute of Marine Research, Bergen, Norway) (Chair)
- Dr Ken Frank (Bedford Institute of Oceanography, Halifax, Canada)
- Dr Tony Koslow (CSIRO Marine Research, Perth, Australia)
- Dr Pierre Pepin (Northwest Atlantic Fisheries Centre, St. Johns, Canada)
- Dr Paul Snelgrove (Memorial University, St. Johns, Canada)
-

with expertise in benthic ecology, fisheries oceanography, fishery biology, fisheries assessment, fishing gear technology and biophysical modeling.

1. 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 for Alaska. 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 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 several input parameters, the results of the model are displayed not only as point estimates but also as a range of percentage habitat reduction.

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 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.

Several short-term suggestions were aimed at improving the quantitative assessment of evaluations; some of the more important recommendations are:

(1) Attempt to validate the habitat reduction model with observations.
(2) Compare the spatial pattern of length-weight relationships for different species with the fishing effort pattern.
(3) Test the assumption of random spatial distribution of fishing effort.
(4) Determine the temporal changes in the affected habitat through model hindcasts.
(5) Provide time series of the stock size of each species relative to its current MSST level.
(6) Improve the surficial sediment map on which to apply the model.
(7) Compare the spatial pattern in the CPUE from the surveys and the commercial fishery to the pattern of fishing effort.
(8) Integrate the results from on-going fishing gear impacts research into the habitat reduction model.
(9) Investigate the rate of destruction of hard corals and sponges from the groundfish survey data.
(10) Broaden the scope of the evaluators of habitat effects by including the opinions, information and data of stakeholders.
(11) Explore spatially explicit models of growth, fecundity, condition etc. in different habitat types.
(12) Use the spatially explicit models along with the habitat reduction model and a population index (e.g. abundance relative to the MSST) to re-assess the possibility of habitat degradation affecting commercial fish stocks.
(13) Use the precautionary approach especially where the data are unclear, where recovery times are long (e.g. for corals and sponges), or where habitat reduction is high even if the abundance levels are above MSST.
(14) Review the work being done elsewhere on ways of assessing the health of an ecosystem and develop relevant indices to help monitor the health of the Alaskan ecosystem.

The following are some longer-term activities and research that should be carried out as a means of improving the knowledge base.

(15) Determine the habitat associations (temperature, depth, type of habitat, etc.) for various species from the groundfish survey data.
(16) Produce Essential Fish Habitat Source documents on at least the major species.
(17) Monitor habitats and fish abundances in the present closed and open areas.
(18) Consider the establishment of new closed areas in regions with high habitat loss.
(19) Establish field programs to measure the recovery rates of different types of habitat.
(20) Carry out surficial sediment surveys.
(21) Establish observational programs to identify the influence of habitat on different life history stages for the major commercial species, especially in the Gulf of Alaska and the Aleutian Islands.
(22) Convert invertebrate data from scientific trawl surveys, fishing vessel logbooks, and any other relevant data available into electronic format.

Executive Summary

The Magnuson-Stevens Fishery Conservation and Management Act requires that every fishery management plan describe and identify Essential Fish Habitat (EFH) for the fishery and minimize to the extent practicable the adverse effects of fishing on EFH. The National Marine Fisheries Service (NMFS) and the North Pacific Fishery Management Council recently developed a draft environmental impact statement (DEIS) that considers the impacts of fishing on EFH for multiple species of managed fish stocks. Appendix B of the DEIS contains the technical details of the evaluation including a habitat reduction model. A review of the model and its application, as well as the assessment of the impacts of fishing on habitat was carried out.

The quantitative model to assess the impact of fishing on different habitat types was dependent upon the number of times the fishing gear impacted the habitat type, the damage done by the gear to the habitat and the recovery rate of the habitat. In addition to the model, the criterion of the abundance relative to Minimum Stock Size Threshold (MSST) was used to assess whether the loss of habitat was affecting the fish productivity by species. Assessment scientists then carried out evaluations on the effects of fishing on spawning and breeding, on feeding, and on growth to maturity for the commercial species. For all species examined the evaluation was either that the effects were minimal or temporary (MT, approximately 58%) or unknown (the remaining 42%).

While the habitat reduction model was considered a reasonable approach, uncertainties in parameter values together with the lack of information on sediments, habitat types, and fishing effort distribution, meant that the model results must be considered as very approximate. Validation of the model using data from Alaskan waters as well as other regions is essential to confirm the usefulness of the model.

The use of the stock abundance relative to MSST to assess the possible influence of habitat degradation on fish stocks was not considered to be appropriate for several reasons, including that habitat effects are only one of many factors that influence the stock abundance, the criterion provides no spatial information, and the expected lag between habitat destruction and detection of its effect on the stock productivity is expected to be long, such that the habitat may be destroyed before mitigation could be implemented.

Since the MSST criterion is not considered to be an appropriate measure, a systematic and quantitative approach to the evaluation of possible impacts of trawling on managed species is proposed. It includes examination of indices that are immediately reflected in the individual fish (e.g., condition, growth, fecundity, gut fullness), consideration of the spatial patterns in, for example, the distribution of recruits and CPUE and their relation to the distribution of fishing effort, the estimated loss of habitat and its rate from the habitat reduction model and then integrative measures, including the history of the stock abundance, recruitment and growth. Finally, a precautionary approach needs to be applied because of the large uncertainties in our knowledge of the links between habitat and the life stages of the various fish species.

AGENDA C-3(a)
OCTOBER 2004

Summary Report

Review on

Evaluation of Fishing Activities That May Adversely Affect Essential Fish Habitat (EFH) in Alaska

Draft of Appendix B

K. Drinkwater

Ole Irgensvei 61,
5019 Bergen, Norway

2. Revised open areas and modifications based on Oceana's April 29th letter to the NPFMC with:
    a. No bycatch caps for corals/sponges, and no TAC reductions for any groundfish;
    b. Including coral/sponge bycatch caps and TAC reductions for Atka mackerel and rockfish TACs.

3. Open areas where the cumulative bottom trawl groundfish catch is greater than or equal to 200 mt, based on observer data for 1991-2003. This option would also remove coral/sponge bycatch caps and TAC reductions for all groundfish.

NMFS has plotted the observer data, relative to the alternative/option #3, as detailed above. The resulting maps are attached as <u>Item C-3(c)</u>. At this meeting, the Council may finalize the boundaries of the open areas for this alternative/option so that staff can complete the analysis prior to final Council action on the EFH EIS, scheduled for February 2005.

AGENDA C-3(b-d)
OCTOBER 2004

MEMORANDUM

TO: Council, SSC and AP Members

FROM: Chris Oliver
Executive Director

ESTIMATED TIME
8 HOURS
(all C-3 items)

DATE: September 27, 2004

SUBJECT: Essential Fish Habitat (EFH)

ACTION REQUIRED

b) Receive Center for Independent Experts (CIE) review.
c) Receive draft comment and response report on EFH EIS.
d) Receive revised Alternative 5b open area boundaries using the 200 mt limit, and take action as necessary.

BACKGROUND

CIE Review

Earlier this year, NMFS contracted with the Center for Independent Experts (based at the University of Miami) to review the effects of fishing analysis contained within the EFH EIS as Appendix B. The CIE report was distributed by mail last month, and has been available on the NMFS Alaska Region web site. A summary of the report is attached as Item C-3(a). Dr. Ken Drinkwater, chair of the CIE review panel, will be in attendance early in the Council meeting to report on the panel's findings. The Council may provide input on revising the EFH EIS analysis to address the CIE findings.

Comment and Response Report

NMFS has drafted responses to public comments on the EFH Draft EIS, and has requested Council input on the draft responses. The report was mailed out last week, and the cover letter from Dr. Balsiger is attached as Item C-3(b). NMFS staff will be on hand to summarize the report.

Alternative 5b areas with 200 mt limit

In June, the Council added several suboptions for the Aleutian Islands portion of Alternative 5b of the EFH EIS. Specifically the options would be as follows:

1. The original Alternative 5b open areas for bottom trawling with coral and sponge bycatch caps and TAC reductions (as currently analyzed in the EFH EIS).

References

Reviewed Documents

Enticknap, B. 2004. Letter providing comments on Draft Environmental Impact Statement for Essential Fish Habitat identification and conservation in Alaska, Submitted on behalf of the Alaska Marine Conservation Council, p. 20.

NMFS. 2004a. Executive Summary of the *Draft Environmental Impact Statement for Essential Fish Habitat Identification and Conservation in Alaska,* 11 p. plus tables and figures

NMFS. 2004b. Appendix B: The evaluation of fishing activities that may adversely affect Essential Fish Habitat. Draft Environmental Impact Statement, 76 p. plus tables and figures

North Pacific Fishery Management Council. 2002. Essential Fish Habitat, p. 6, *In* Draft Minutes of the Scientific Statistical Committee for September 30-October 2, 2002.

North Pacific Fishery Management Council. 2003. Essential Fish Habitat, p. 3-4, *In* Draft Minutes of the Scientific Statistical Committee for December 2-4, 2002.

North Pacific Fishery Management Council. 2003. Essential Fish Habitat, p. 4-6, *In* Draft Minutes of the Scientific Statistical Committee for January 27-29, 2003.

North Pacific Fishery Management Council. 2003. Minutes of the Scientific Statistical Committee, Conference Call for June 26, 2003. 3 p.

North Pacific Fishery Management Council. 2003. Essential Fish Habitat, p. 2-4, *In* Draft Minutes of the Scientific Statistical Committee for March 31-April 2, 2003.

North Pacific Fishery Management Council. 2003. Essential Fish Habitat, p. 1-5, *In* Draft Minutes of the Scientific Statistical Committee for October 6-7, 2003.

Shester, G. 2004. Comments on Alaska Region Essential Fish Habitat Draft Environmental Impact Statement, p. 24.

Tagart, J.V. 2004. Technical Review of Appendix B: The evaluation of fishing activities that may adversely affect Essential Fish Habitat, part of the January 2004 Draft Environmental Impact Statement for Essential Fish Habitat identification and conservation in Alaska, Submitted on behalf of Marine Conservation Alliance, p. 26.

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));

Associated Papers and Documents Read and/or Referenced

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Appendix: Statement of Work

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 Reviewed

I reviewed 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);
- Section 3.4.3 of the DEIS, 20 pages plus 1 table and 5 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/efh.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 Chair

1. The Chair shall moderate the June 29 meeting with the NMFS scientists as well as other meetings the panel may have to conduct its work.

2. The Chair shall compile all of the panelists' input from the meeting and from their review reports to prepare a summary report, and shall provide the summary report to Dr. David Die via e-mail at ddie@rsmas.miami.edu, and to Mr. Manoj Shivlani via email at mshivlani@rsmas.miami.edu. This summary report shall accurately present all the opinions and findings of each individual panelist in an easily read summary, and shall not represent a consensus report. The Chair shall provide the summary report to the CIE no later than July 23, 2004.

3. The Chair shall present the results of the review to the Council and its Advisory Panel and Scientific and Statistical Committee at a meeting on or about October 6, 2004, in Sitka, Alaska.

Signed_________________________________ Date___________

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

AGENDA C-3(b)
OCTOBER 2004

September 23, 2004

Stephanie Madsen, Chair
North Pacific Fishery Management Council
605 West 4th Avenue, Suite 306
Anchorage, Alaska 99501-2252

Dear Ms. Madsen:

Enclosed for Council review please find the National Marine Fisheries Service's (NMFS's) draft responses to public comments on the Draft Environmental Impact Statement for Essential Fish Habitat Identification and Conservation in Alaska (EFH EIS). Please note that some of the draft responses are incomplete and await additional information – most notably the responses that discuss the Council's final action.

NMFS received numerous comments that criticized our evaluation of the effects of fishing on EFH as well as the Council's preliminary preferred alternative for minimizing the effects of fishing on EFH. NMFS also received the reports from the Center for Independent Experts (CIE) panel that reviewed the analysis of the effects of fishing on EFH. (Dr. Ken Drinkwater, the chair of that panel, will present the findings to the Council at the October meeting.) Based on this feedback, NMFS is preparing new information to address many of the CIE recommendations, and we are revising the EIS to explain more clearly the limitations of our analysis and the policy choices that must be made by the Council and NMFS based upon the final EIS.

The most significant decision facing the Council for final action on the EFH EIS is how precautionary to be in light of the available information. The draft EIS found that Council-managed fishing results in persistent reductions in the availability of certain benthic habitat features, including corals and other living structure. The analysis found no indication that these habitat changes alter the overall capacity of EFH to support sustainable fisheries, although considerable scientific uncertainties remain. As NMFS has stated before, even though the available information does not identify adverse effects of fishing that are more than minimal and temporary, that finding does not necessarily mean that no such effects exist.

The Council's existing precautionary management approach includes a variety of measures that protect large areas of habitat and limit harvests to very conservative levels. Given that context, the Council must balance the uncertain effects of fishing-induced habitat disturbance on the productivity of managed species against the tangible costs of new restrictions on fishing. In view of uncertainty, the Council may decide that additional precautionary management measures are warranted.

We look forward to the Council's input on the draft responses to comments, and we remain available to assist you in preparing for final action on the EFH EIS at the February 2005 meeting.

Sincerely,

Donald J. Berg
for James W. Balsiger
Administrator, Alaska Region

Enclosure

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

AGENDA C-3(c)
OCTOBER 2004

September 16, 2004

Stephanie Madsen, Chair
North Pacific Fishery Management Council
605 West 4th Avenue, Suite 306
Anchorage, Alaska 99501-2252

Dear Ms. Madsen:

At the June meeting in Portland, the Council voted to modify the Aleutian Islands portion of Alternative 5B in the Essential Fish Habitat Environmental Impact Statement to have four options, as follows:

1. Original 5B open areas approach for bottom trawling, including coral/sponge bycatch caps and TAC reductions for Pacific cod, Atka mackerel and rockfish;

2. Oceana's proposed modifications to the open areas approach for bottom trawling based on its April 29, 2004 letter to the Council, including coral/sponge bycatch caps and TAC reductions for Atka mackerel and rockfish;

3. Oceana's proposed modifications to the open areas approach for bottom trawling based on its April 29, 2004 letter to the Council, minus the coral/sponge bycatch cap and TAC reductions for Atka mackerel and rockfish;

4. A modified 5B open areas approach for bottom trawling that would incorporate all areas where the cumulative bottom trawl groundfish catch is greater than or equal to 200mt based on observer data from 1991-2003. No coral/sponge bycatch caps or TAC reductions are associated with this option.

The Council requested that staff plot these Alternative 5B options on 1:300,000 scale nautical charts to facilitate public review.

NMFS intended to present a full analysis of all the Alternative 5B options at the October Council meeting. However, while performing the spatial analysis of the 200mt option, we discovered that Council input is necessary to finalize boundaries for this option before we complete the analysis. As you will see on the enclosed maps, the areas with at least 200mt of catch are irregular in shape, so the Council may wish to adjust these areas to facilitate management and enforcement. NMFS will then complete the analysis and present the results for all of the Alternative 5B options at the December meeting.

Enclosed please find two sets of maps covering management areas 541, 542, and 543 in the Aleutian Islands; one showing the modified 5B areas and the other showing the areas with at least 200mt of catch. Both are overlaid on the original 5B areas for comparative purposes. Also enclosed is a single map showing the areas with at least 200mt of catch for all of the Aleutian Islands area.

The maps for the modified 5B reflect the changes sought by Oceana. Oceana provided the map files to NMFS and we made no edits. The modifications result in an approximately 6.5% decrease in areas open to fishing compared to the original 5B, for a total of 31,854 km^2.

The maps for the 200mt option are based on 1991-2003 NORPAC data, non-pelagic trawl (NPT) only, for management areas 541, 542, and 543. The methods and results of this analysis are as follows. Observer data were summed to 6'x6' grids aligned to latitude/longitude. These blocks are each approximately 80 km^2. A total of 1,054 blocks contained some level of catch from 1991-2003, with 348 blocks containing greater than 200mt of groundfish catch. These 348 blocks result in an area of 26,555 km^2 and contain 94.7% of the NPT tows and 97.6% of the total catch. The total area of the 200mt option should not be compared to the total open area of the other 5B options until the Council finalizes the boundaries of the 200mt option. NMFS used NOAA charts 16460, 16480, and 16500 for management area 541 and part of 542, and chart 16012 for the remainder of 542 and 543. Workable electronic versions of charts 16420 and 16440 were not available.

NMFS staff will be available at the October meeting in Sitka to provide any additional information to assist the Council in finalizing the Alternative 5B options.

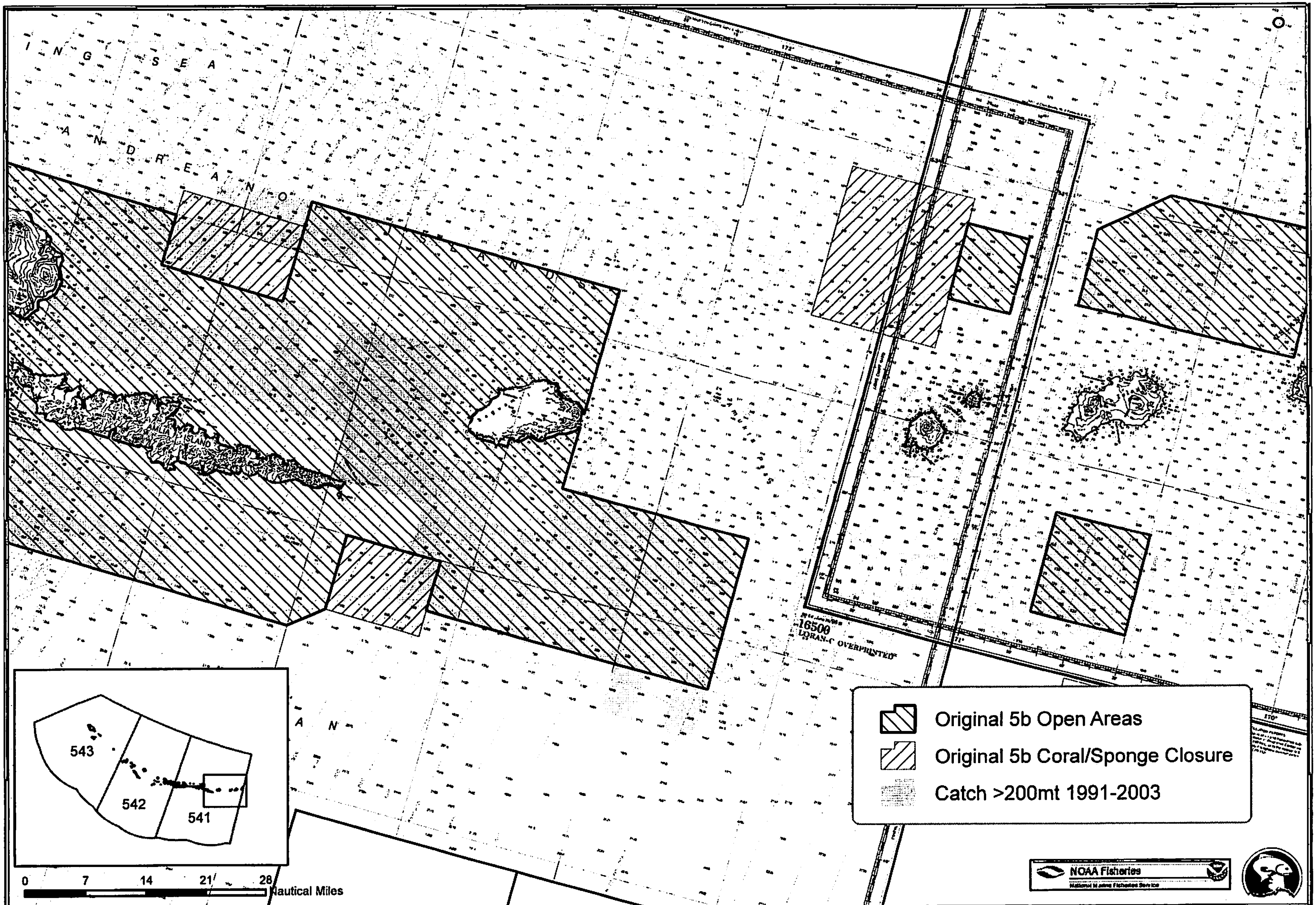
Sincerely,

Donald J. Berg

For James W. Balsiger
Administrator, Alaska Region

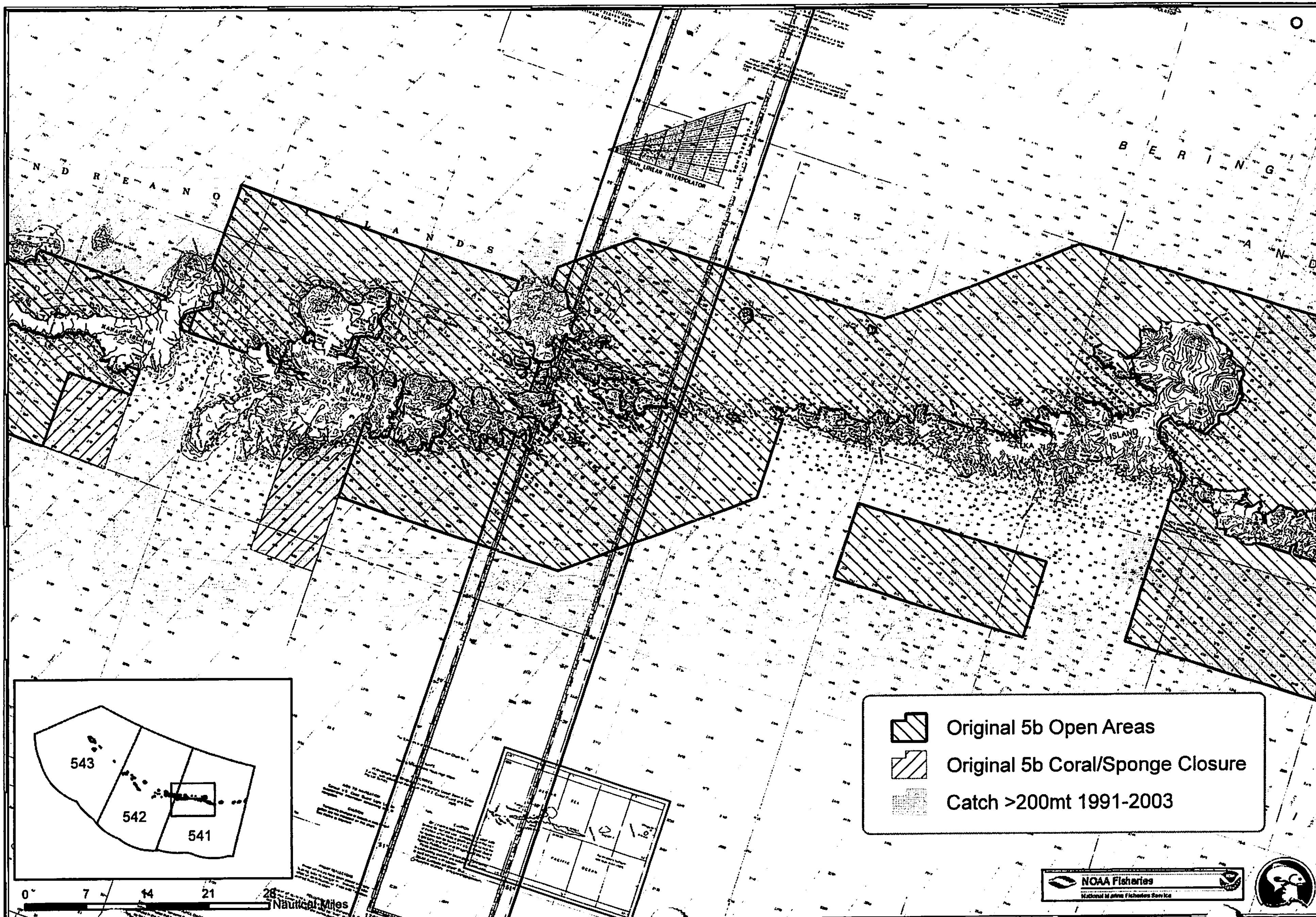
Enclosures

EFH EIS Alternative 5b - 200mt with Original 5b Overlay



**** All areas not EXPLICITLY OPEN in Alternative 5b options are CLOSED to bottom trawling**

EFH EIS Alternative 5b - 200mt with Original 5b Overlay



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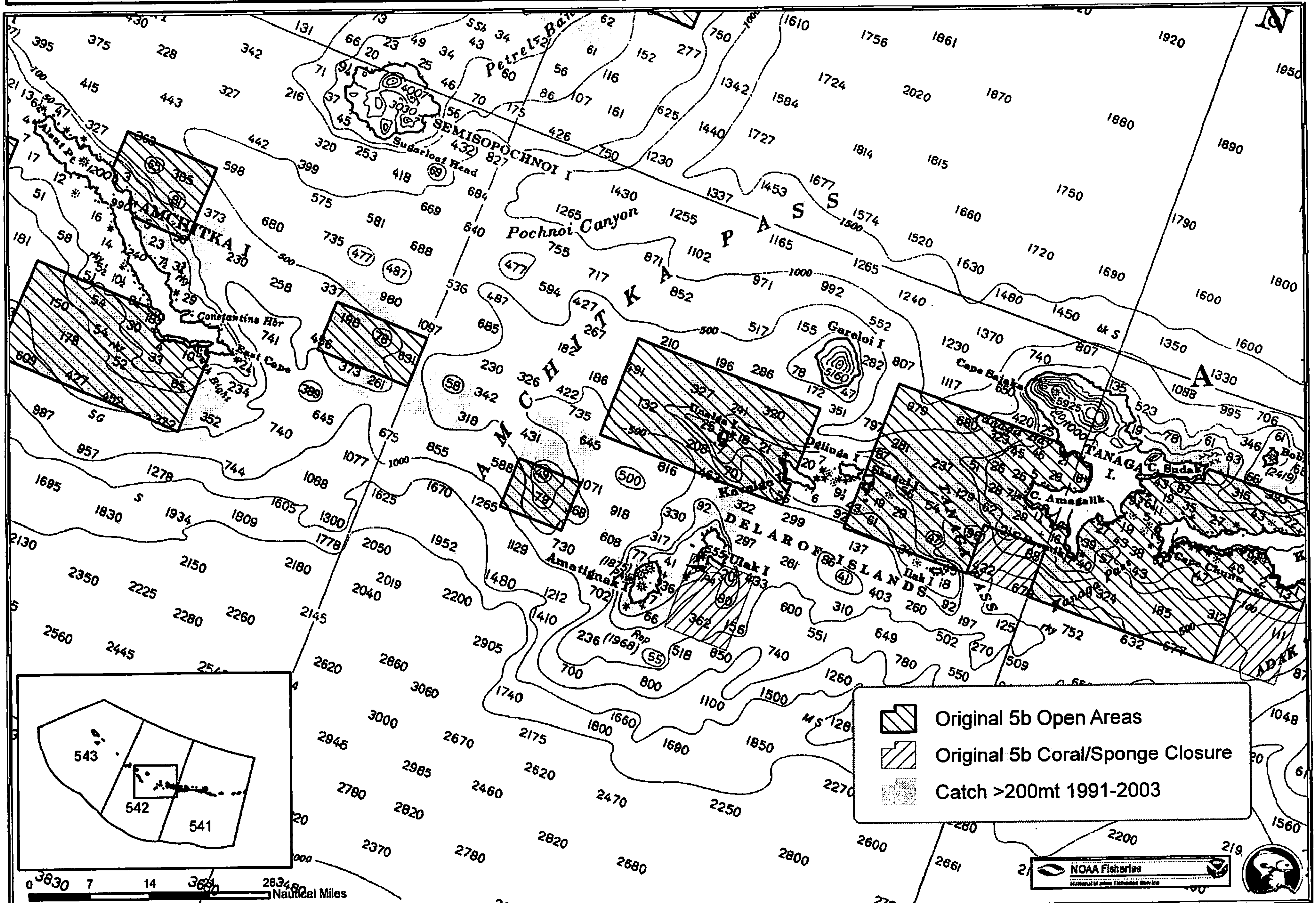
EFH EIS Alternative 5b - 200mt with Original 5b Overlay



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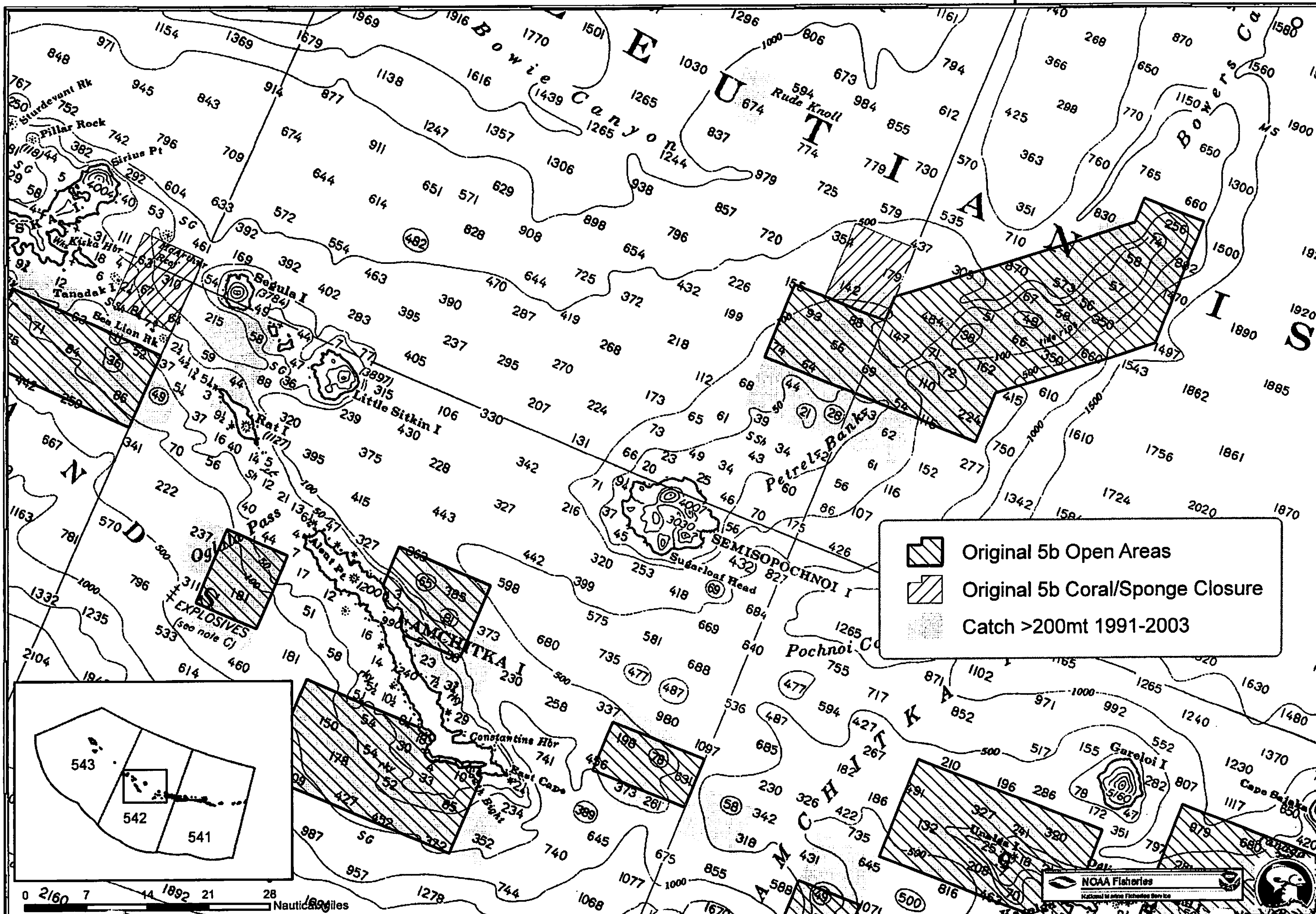
EFH EIS Alternative 5b - 200mt with Original 5b Overlay



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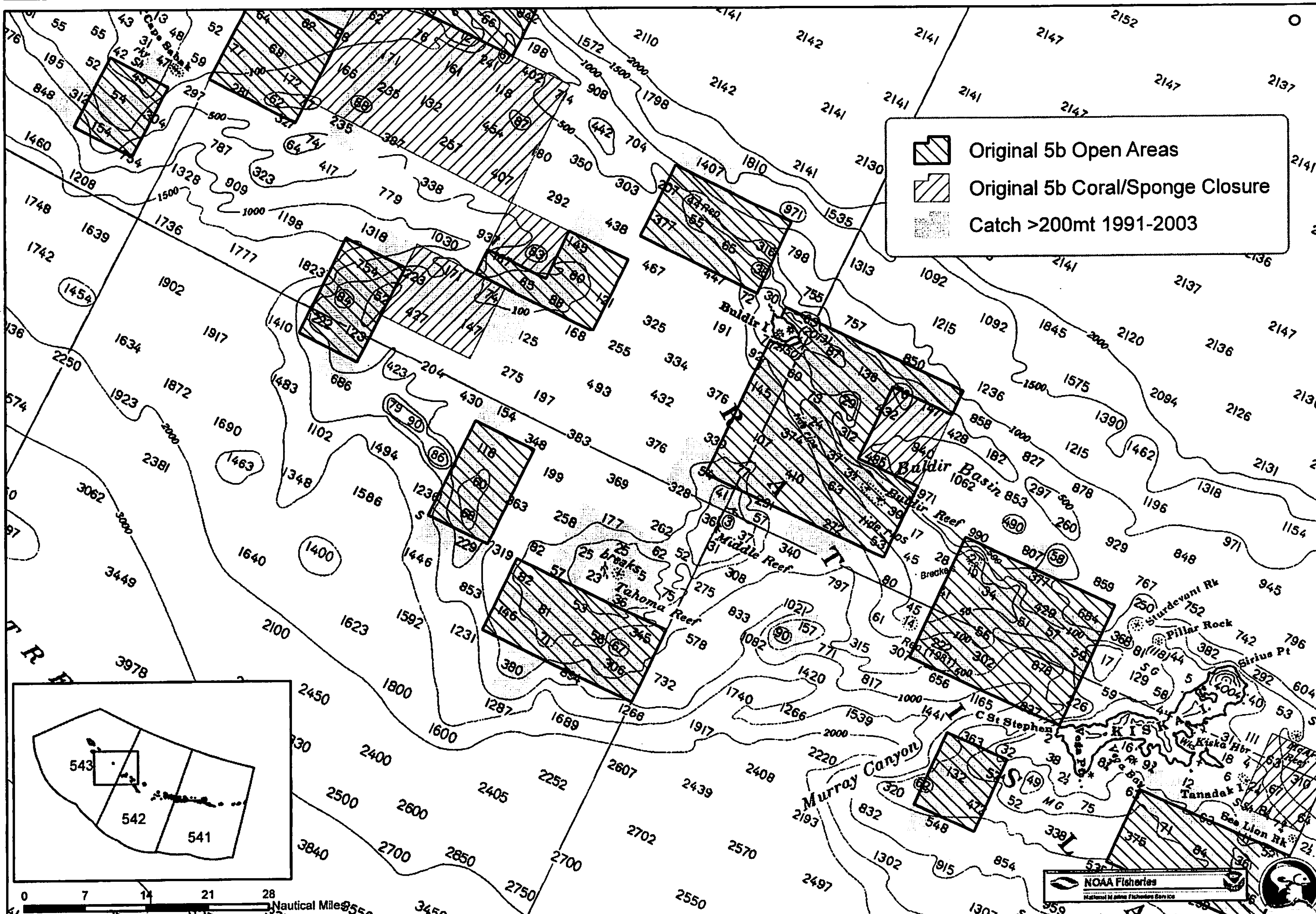
EFH EIS Alternative 5b - 200mt with Original 5b Overlay



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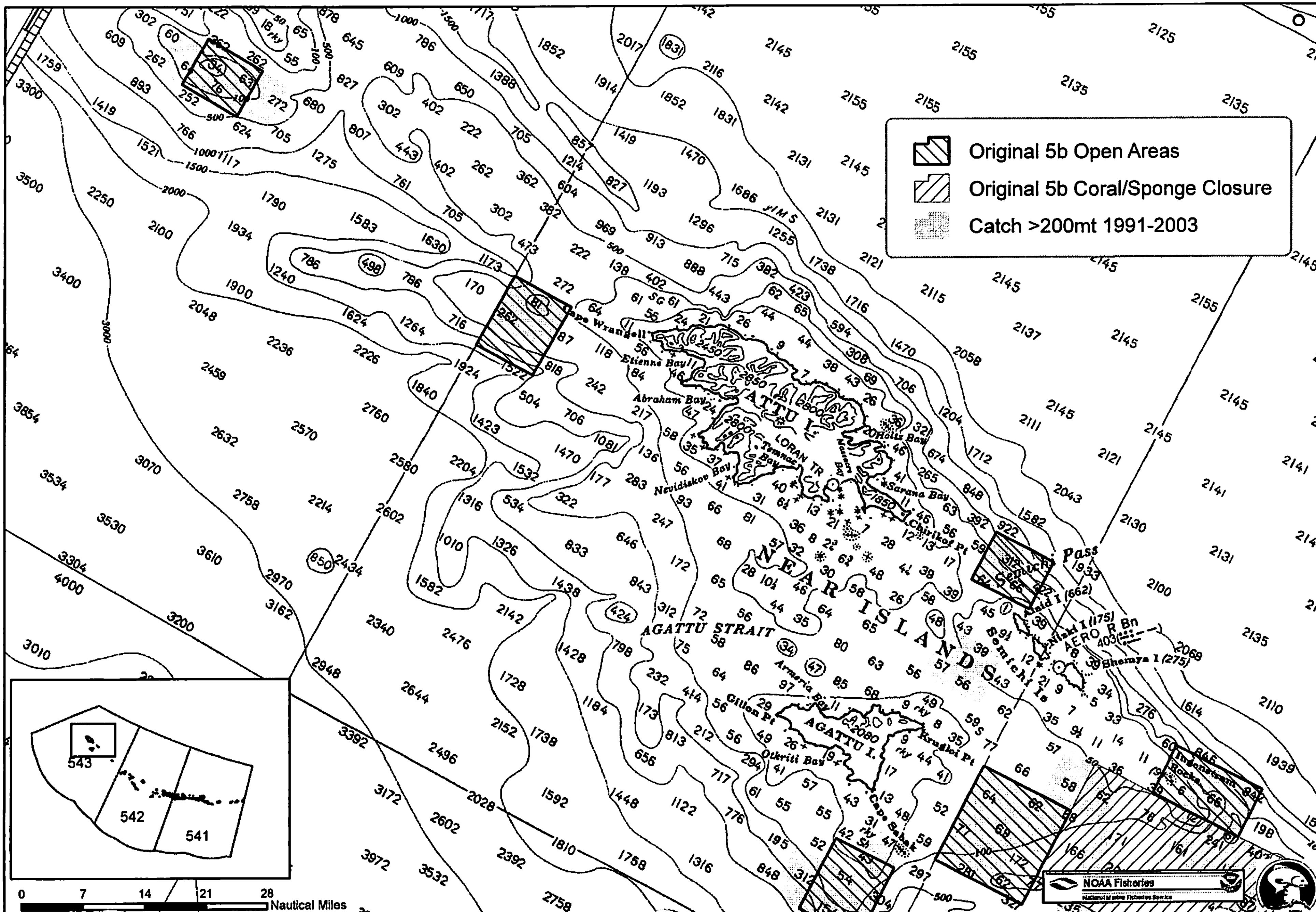
EFH EIS Alternative 5b - 200mt with Original 5b Overlay



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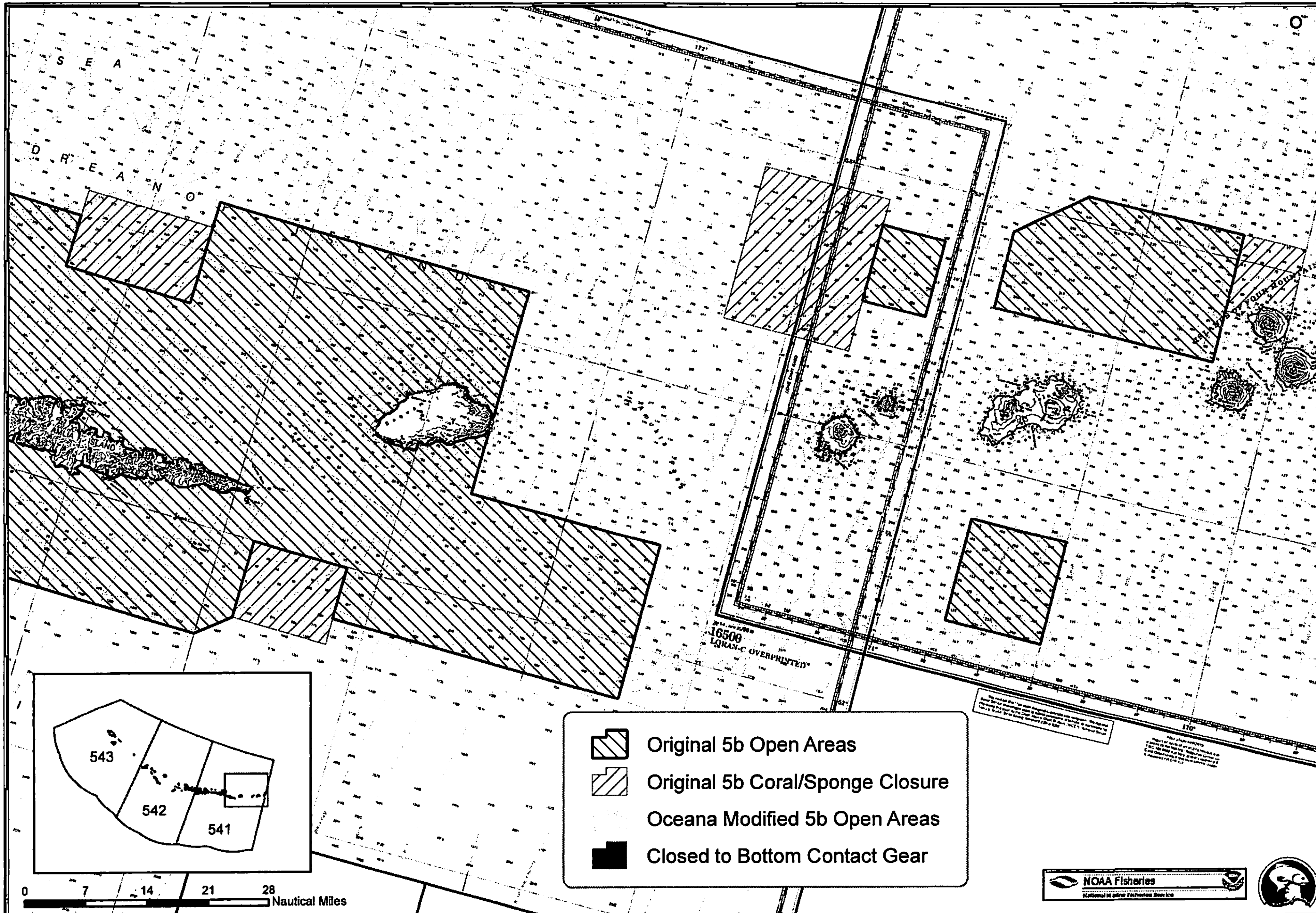
EFH EIS Alternative 5b - Modified with Original 5b Overlay



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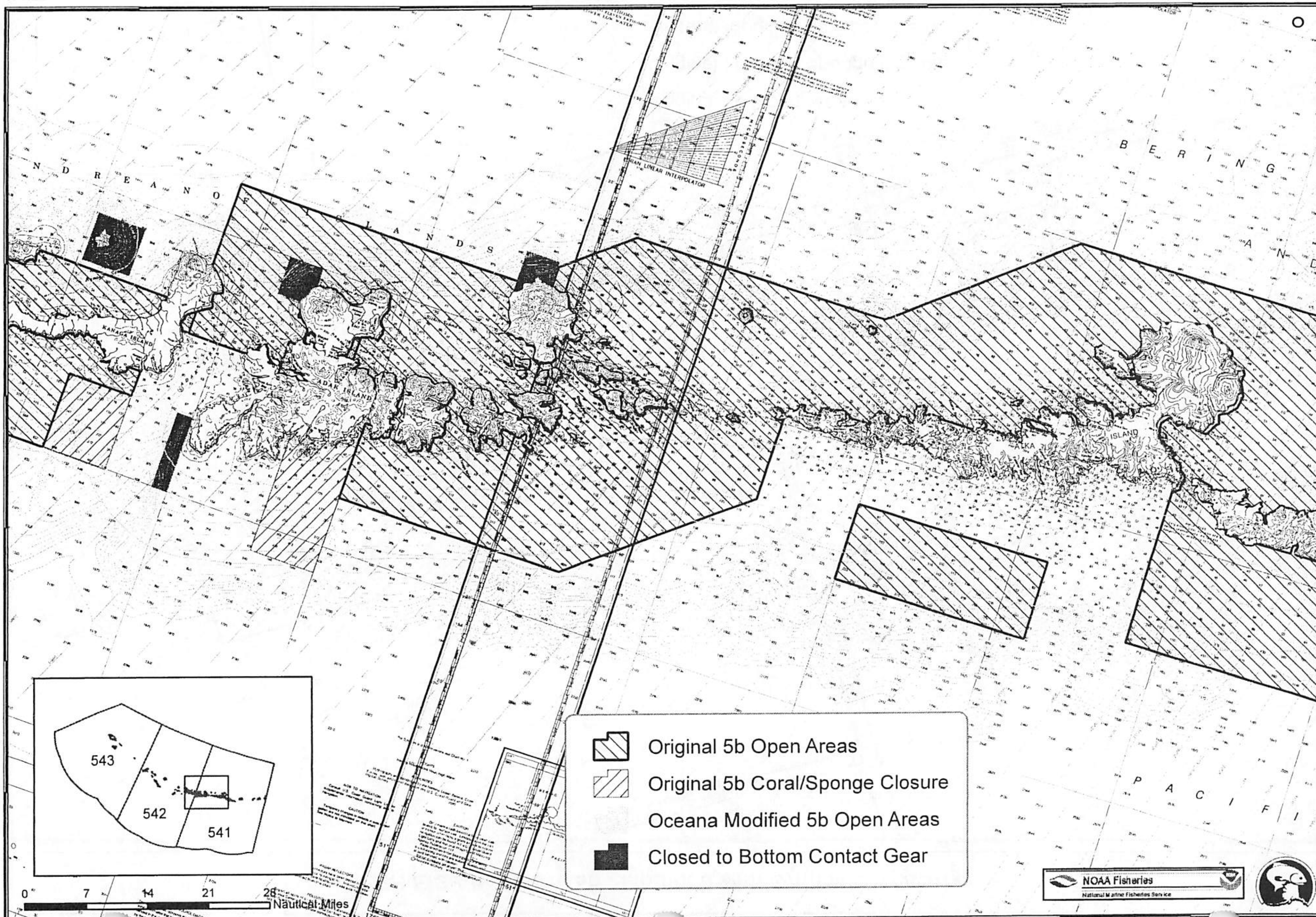
EFH EIS Alternative 5b - Modified with Original 5b Overlay



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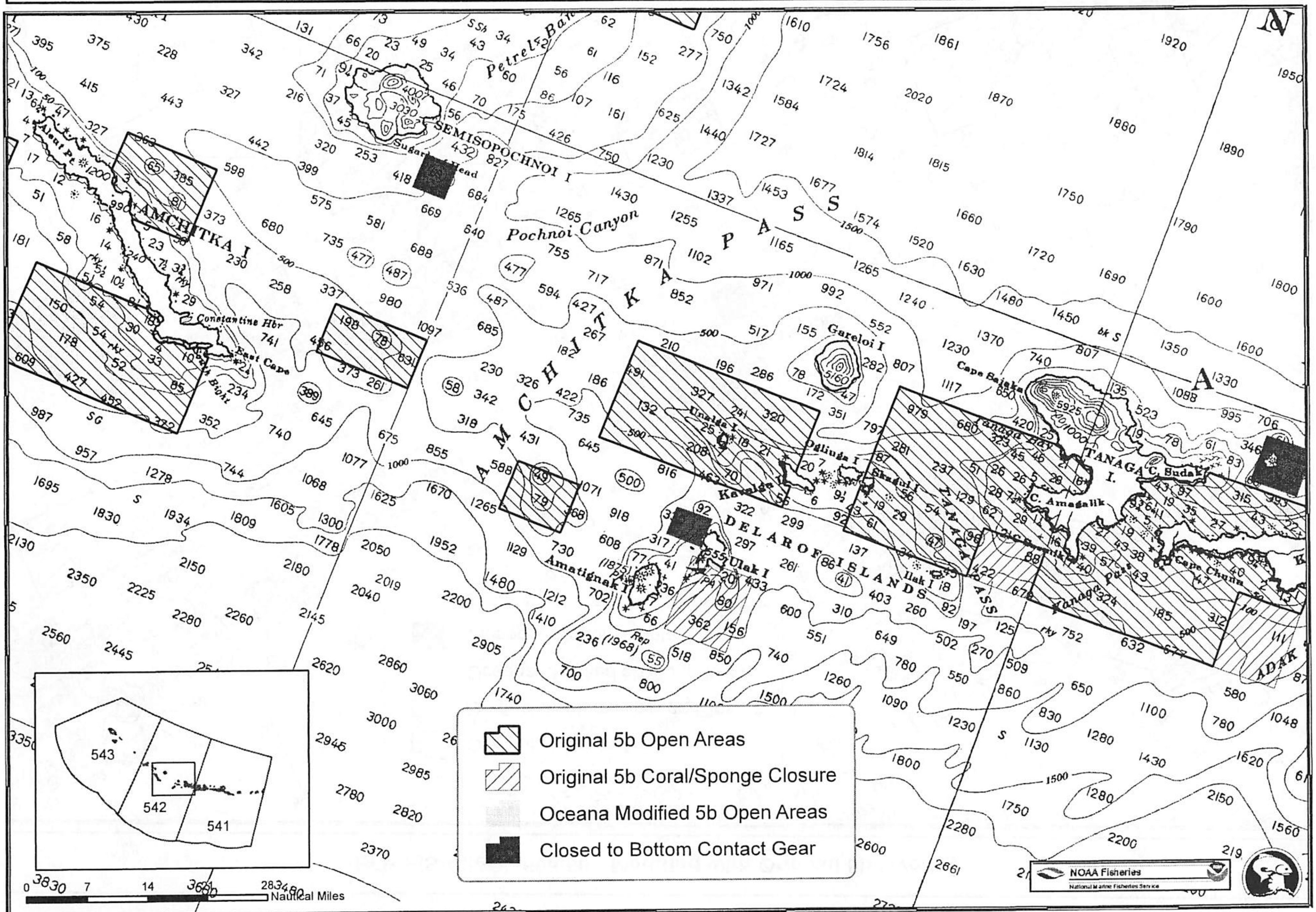
EFH EIS Alternative 5b - Modified with Original 5b Overlay



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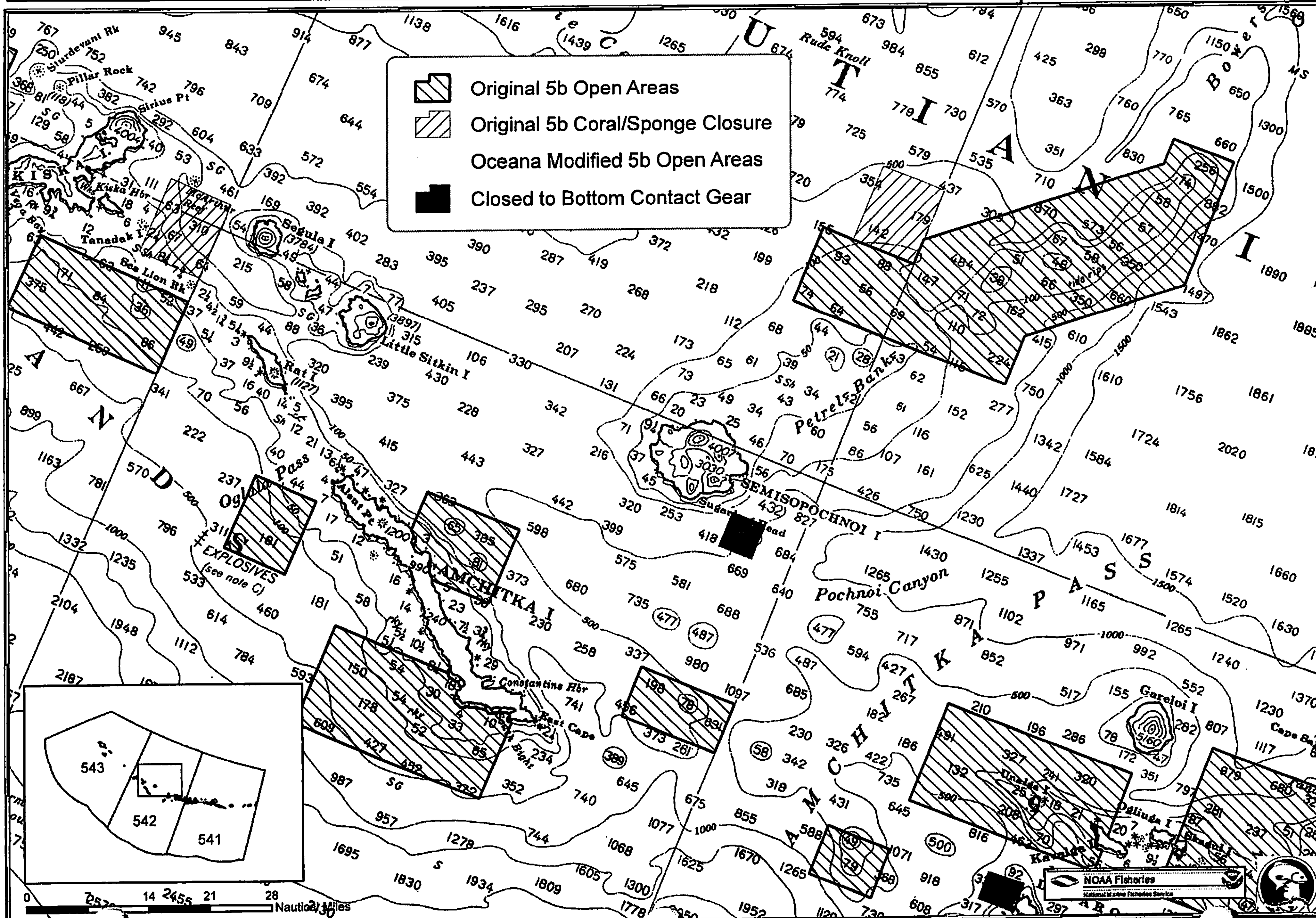
EFH EIS Alternative 5b - Modified with Original 5b Overlay



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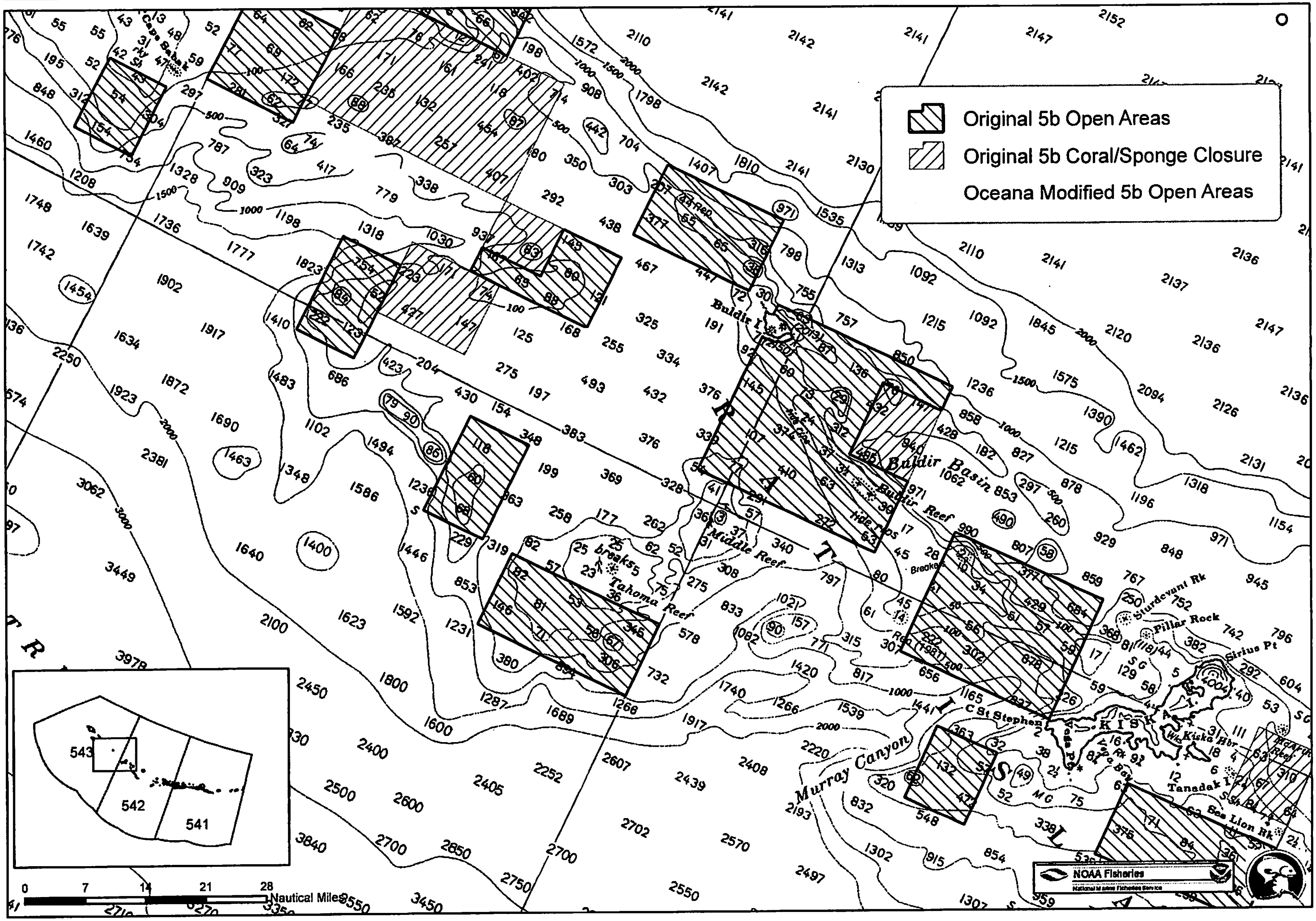
EFH EIS Alternative 5b - Modified with Original 5b Overlay



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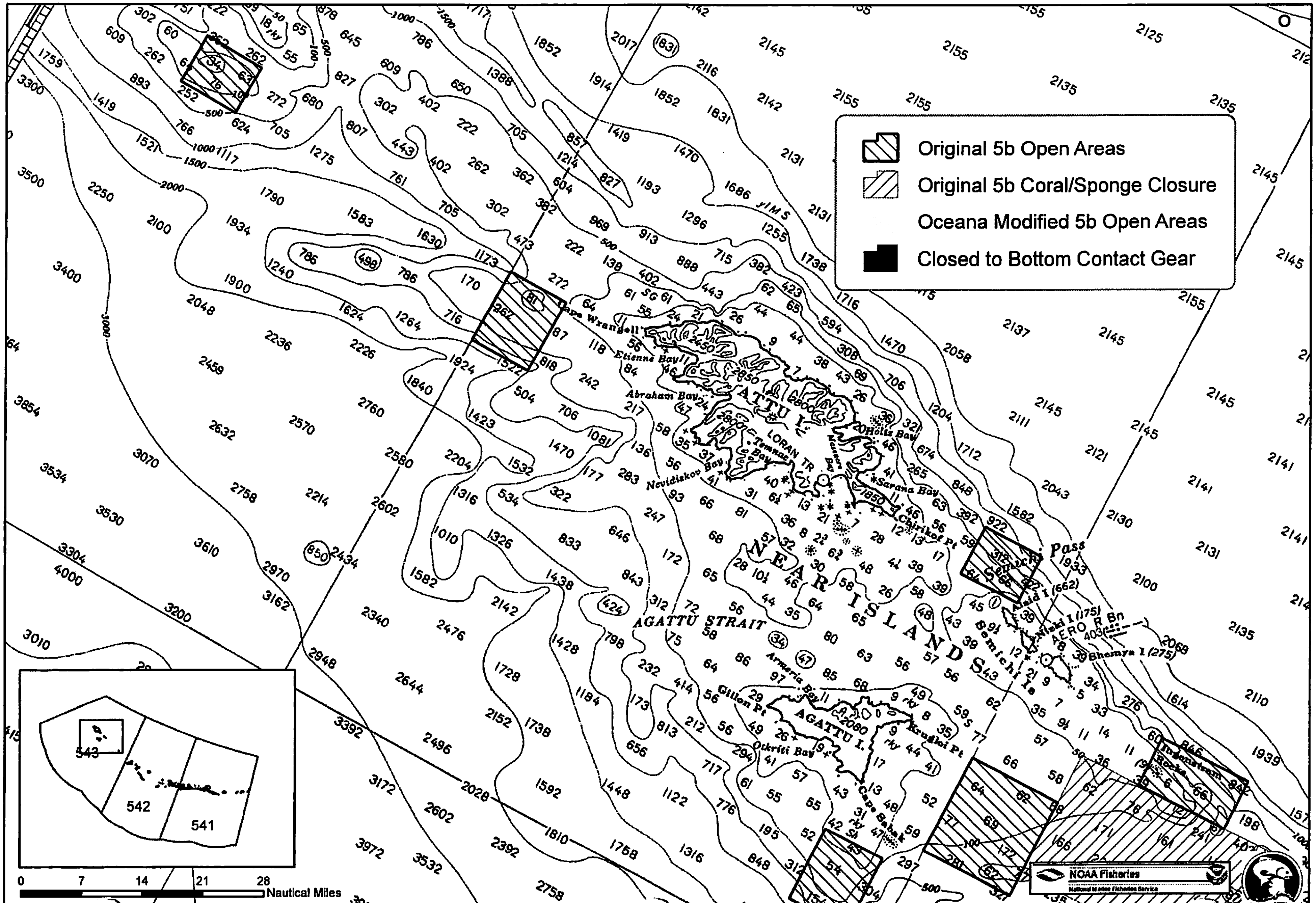
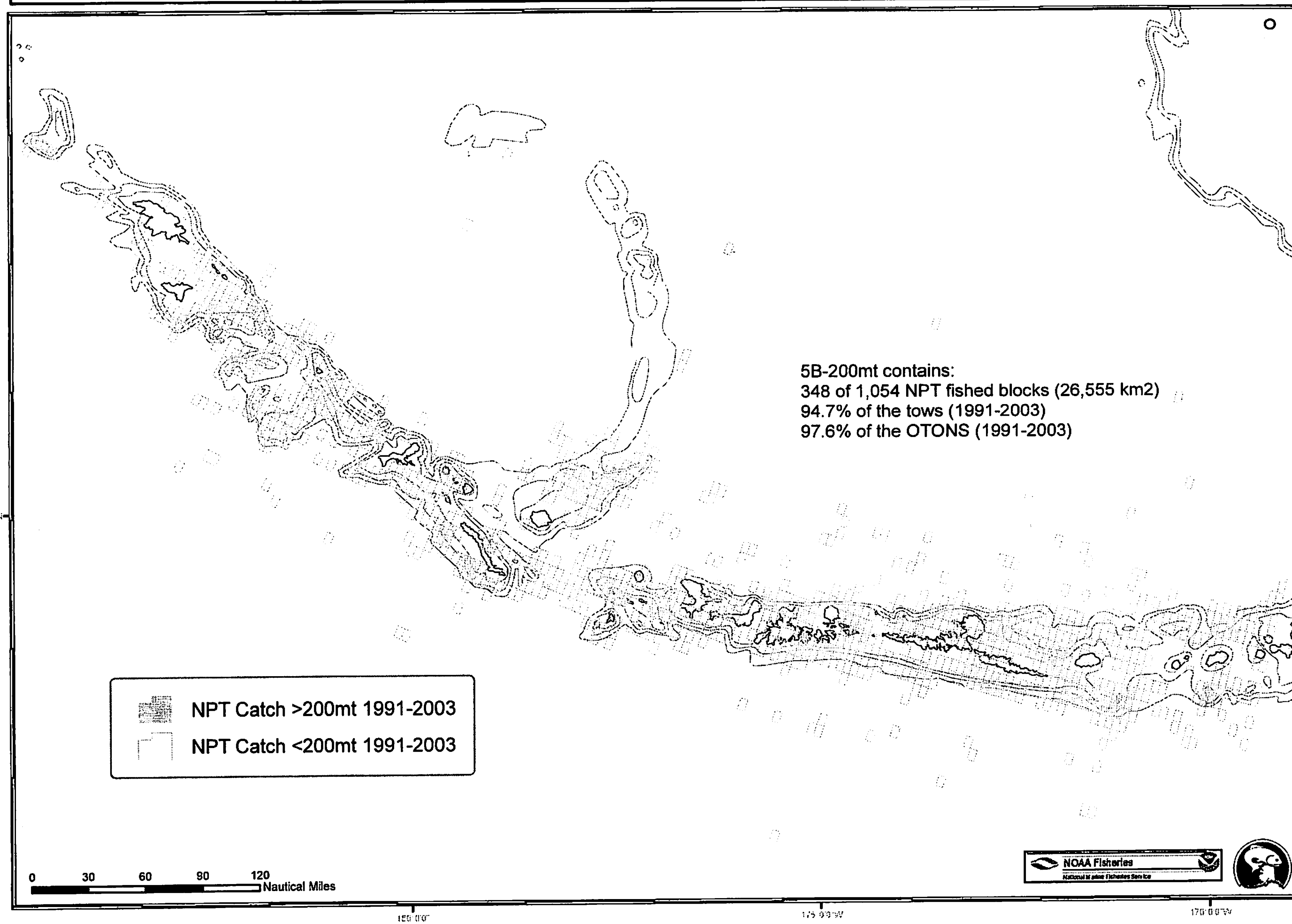
EFH EIS Alternative 5b - Modified with Original 5b Overlay



** All areas not EXPLICITLY OPEN in Alterna... 5b options are CLOSED to bottom trawling

EFH EIS Alternative 5b - >200mt NPT Catch 1991-2003



Public Testimony Sign Up Sheet
Agenda Item C-3 EFH (b-d)

EFH

	NAME (PLEASE PRINT)	AFFILIATION
1	Jon Tillinghast / Rick Harris	Alaska Forest Assn.
2	Keith Simila	US Forest Service
3 6	Ben Enticknap	Alaska Marine Conservation Council
4 6	Heather McCarty	MCA - Marine Cons. Alliance
5 3	Kevin Kennedy	TDX - Corp
6 6	JOHN GAUVIN	GROUNDFISH FORUM
7 (6?)	Jim Ayers	Oceana & Rep The Ocean Conservancy
8 6	Dave Fraser	Aleutian Cod Marketing Association
9 6	Donna Parker	HSCC
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NOTE to persons providing oral or written testimony to the Council: Section 307(1)(I) of the Magnuson-Stevens Fishery Conservation and Management Act prohibits any person " to knowingly and willfully submit to a Council, the Secretary, or the Governor of a State false information (including, but not limited to, false information regarding the capacity and extent to which a United State fish processor, on an annual basis, will process a portion of the optimum yield of a fishery that will be harvested by fishing vessels of the United States) regarding any matter that the Council, Secretary, or Governor is considering in the course of carrying out this Act.

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Jon Kurland
Ken Drinkwater
4:13p 10/6/04

Agenda C-3(b)

*** DRAFT 10/4/04 ***

National Marine Fisheries Service's Technical Response to the Center for Independent Experts' Review of the Evaluation of the Effects of Fishing on Essential Fish Habitat (EFH) in the Draft Environmental Impact Statement for EFH in Alaska

Introduction

The Center for Independent Experts (CIE) completed an independent peer review of the technical aspects and assessment methodology used by the National Marine Fisheries Service (NMFS) to evaluate the effects of fishing on Essential Fish Habitat (EFH) in Alaska. Specifically, the reviewers focused on two broad issues: 1) the fishing effects model used to assess the impact of fishing on different habitat types, and 2) the analytical approach employed to evaluate the effects of fishing on EFH, particularly the use of stock abundance relative to the Minimum Stock Size Threshold (MSST) to assess possible influence of habitat degradation on the productivity of fish stocks. Many of the panel's comments, criticisms, and concerns are provided in the panel chair's summary report and are embodied as a succinct set of short-term and long-term recommendations. The following provides NMFS' responses to many of the technical recommendations raised by the CIE review panel. Where warranted and appropriate, NMFS provides additional points of clarification and proposes additional analyses and activities that it will attempt to complete for inclusion in the final EFH environmental impact statement (EIS). Issues of a policy nature (e.g., the appropriate level of precaution; inclusion of the opinions, information and data of stakeholders; etc.) are outside the scope of this technical response.

Background

The Magnuson-Stevens Fishery Conservation and Management Act requires that every fishery management plan describe and identify 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 assessing 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.

After reviewing 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 specific habitat requirements of managed species. 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 at the population level. In other words, are the fisheries, as they are currently conducted, altering the capacity of EFH to support healthy populations of managed species over the long term? 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 MSST, after at least thirty years of fishing at intensities equal to or higher than 2003 levels. 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 the analysis finds 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. While the DEIS acknowledges effects on habitat due to fishing, it finds that the adverse effects of Council-managed fishing activities on EFH are either minimal or temporary. Under the Magnuson-Stevens Act, the Council must act to minimize adverse effects to EFH that are more than minimal and not temporary in nature. Therefore, these findings suggest that no additional management actions are required pursuant to the EFH regulations.

In order to provide an independent assessment of the evaluation of the effects of fishing on EFH contained in Appendix B of the DEIS, NMFS contracted with the Center for Independent Experts (CIE) to conduct a peer review focused on the technical aspects and assessment methodology. Given the limited review of the model, the importance of this analysis for Alaska's fisheries, and the controversial nature of the subject matter, NMFS determined that an outside peer review would be a prudent step.

The CIE review panel consisted of:

- Dr. Asgeir Aglen (Institute of Marine Research, Bergen, Norway)
- Dr. Ken Drinkwater (Institute of Marine Research, Bergen, Norway) (Chair)
- Dr. Ken Frank (Bedford Institute of Oceanography, Halifax, Canada)
- Dr. Tony Koslow (CSIRO Marine Research, Perth, Australia)
- Dr. Pierre Pepin (Northwest Atlantic Fisheries Centre, St. Johns, Canada)
- Dr. Paul Snelgrove (Memorial University, St. John, Canada)

Members of the panel had expertise in benthic ecology, fisheries oceanography, fishery biology, fisheries assessment, fishing gear technology and biophysical modeling. They were asked, in view of the Magnuson-Stevens Act requirements and the EFH regulations, to 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 should 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 Minimum Stock Size Threshold (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?

On June 29, 2004 the panel met with some of the key NMFS Alaska Fisheries Science Center (AFSC) analysts who were involved in the preparation of the DEIS. The analysts provided presentations summarizing aspects of the fishing effects model and the subsequent analytical approach employed for assessing the effects on EFH and managed species. The panelists had the opportunity to seek clarification on the analysis and to challenge the authors on aspects of the document and presentations that they felt required closer scrutiny. The panel then met in executive session the following day to discuss the review panel's terms of reference. Upon returning home, each panel member wrote a review, which addressed the terms of reference and related topics. The chair provided a summary report, highlighting many of the panel's findings and individual reviewer's comments, as well as offering a number of short-term and long-term recommendations. The background materials used by the CIE panel and the resulting panel reports are available via the internet at http://www.fakr.noaa.gov/habitat/cie/review.htm.

NMFS Technical Response

NMFS appreciates the thorough review conducted by the CIE panel and commends the panelists for synthesizing the many complex issues into comprehensive and perceptive reports. The panelists' reviews focused primarily on two broad issues: 1) the fishing effects model used to assess the impact of fishing on different habitat types, and 2) the analytical approach employed to evaluate the effects of fishing on EFH, particularly the use of stock abundance relative to MSST to assess possible influence of habitat degradation on the productivity of fish stocks. Many of the panel's comments, criticisms, and concerns are provided in the panel chair's summary report and are embodied as a succinct set of short-term and long-term recommendations. The short-term recommendations are aimed at improving the quantitative assessment within the time frame in which NMFS is required to publish a completed environmental impact statement. From a practical standpoint, this requires that any additional activities will need to be completed by early January 2005. The longer-term recommendations are directed at activities and research that the panel believes should be carried out as a means of improving our knowledge base of the subject matter.

This report provides NMFS' responses to many of the technical recommendations raised by the CIE review panel. Where warranted and appropriate, NMFS proposes additional analyses and activities that it will attempt to complete for inclusion in the final EFH EIS. Issues of a policy nature (e.g., the appropriate level of precaution; inclusion of the opinions, information and data of stakeholders; etc.) are considered outside the scope of this technical response. Specifically, this report addresses those short-term technical recommendations that can be divided into the two broad issues identified above (i.e., *Issues Related to the Fishing Effects Model, and Issues Related to Impact Evaluations and the Role of MSST*). NMFS agrees that all of the longer-term activities and research proffered by the review panel are excellent avenues to pursue, however, NMFS offers no direct response in this report.

Issues Related to the Fishing Effects Model

The panel concluded that the model was well conceived and a reasonable approach for providing estimates of the possible effect of fishing on benthic habitat. However, as acknowledged in the DEIS, the panel felt that the parameter estimates were not well resolved and had high uncertainty, due in large part to a paucity of data. Therefore, they felt that the results must be viewed as rough estimates only. In regards to whether the model incorporated the "best available scientific information," the panel concluded that additional information could have been used. The panel also had concerns about the lack of model validation. The following provides some general comments concerning the model and its limitations, plus responses to the specific model related recommendations proposed by the panel.

The primary purpose of modeling the effects of fishing on habitat features was to provide experts for each fish species a consistent image of the distribution and relative magnitude of those effects, incorporating the available information relevant to Alaska fisheries. This stage of the analysis embodied the risk assessment recommended in Chapter 5 of the National Academy of Science review of the Effects of Trawling and Dredging on Seafloor Habitat (NAS 2002), synthesizing available data and technical studies to describe the nature, severity and distribution of the risk to features of the habitat relevant to the marine fish populations of Alaska. Such a quantitative approach was preferable to more qualitative methods involving subjective scoring of factors. This approach made the assumptions explicit, and preserved the detail of higher quality data (fishing distribution). The panel comments on the model clearly supported this approach. Furthermore, the Council and its Scientific and Statistical Committee concluded that this model incorporates the best available scientific information and provides a good approach to understanding the impacts of fishing activities on habitat.

Other than a single parameter for recovery rate, the model did not incorporate a wide range of non-fishing factors that affect the abundance and distribution of habitat features. Therefore, it projected outcomes assuming fishing effects are a principal driver of feature distribution. While this was considered useful for considering how fishing could influence EFH, it was almost certainly inadequate as a full model of the dynamics of habitat features (nor was it ever intended as such). Actual changes in the distribution and abundance of habitat features may be influenced more by other factors that are not included in the fishing effects model.

The greatest challenge in implementing the model was paucity of information on many of the needed parameters and a lack of field measurements for model validation. As the panel noted, this degraded the model results to the status of "rough estimates" of the primary effects on habitat features. These uncertainties, however, reflect the state of knowledge in this area and were acknowledged and described in the DEIS. The panel proposes a range of auxiliary analyses that could clarify the significance of different assumptions and data quality issues. NMFS responds to these recommended analyses below. Even though the proposed analyses are good ideas, NMFS concurs with the panel's conclusion that, "even if the model were improved by better resolving the model parameters, obtaining finer spatial resolution of the fishing effort and sediments, and accounting for temporal changes, especially in effort, it was felt that the pattern of habitat reduction produced by the model would unlikely be significantly altered from that shown in the present draft of Appendix B."

NMFS Response to Model Specific Recommendations

Panel Recommendation: Attempt to validate the habitat reduction model with observations. The panel suggests undertaking validation of the model's predictive capabilities by applying it to other regions outside of Alaska and to at least the Bristol Bay region where they believed such data exists. They recommended using gear effect studies by NMFS to estimate whether 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.

NMFS Response: Comparing estimates from the model with actual field measurements of the same parameters would provide an independent assessment of potential biases. However, few existing data sets allow such comparisons. Three studies in Alaska, McConnaughey et al. (2000), part of Eloise Brown's thesis (Brown 2003) and a study led by AFSC researcher Bob Stone near Kodiak Island provide comparisons of benthos densities on both sides of trawl closure boundaries. The ratios of densities in fished and unfished areas could be related to model projections based on the fishing history of the area. The required fishing data have not yet been examined sufficiently to see if they would support useful comparisons, particularly whether projected difference in abundances would be large enough.

NMFS determined that implementing the model with data from outside of Alaska for validation purposes was not feasible. Assembling and understanding the necessary data would introduce considerable risk of conceptual errors. NMFS will review the available data from the above Alaska studies to determine whether they would be useful for validation of the effects model.

Panel Recommendation: Test the assumption of random spatial distribution of fishing effort. The panel recommends quantitatively assessing the assumption of random fishing effort within each 5 km x 5 km block using the observer database and, for those vessels that did not have observers, use either logbook data or vessel monitoring systems (VMS), if available. Determine the difference in the model results using the observed fishing effort distribution within a block rather than a random distribution.

NMFS Response: Such a comparison was presented in Rose and Jorgensen (in press) for the Atka mackerel fishery and could be done for other fisheries. As acknowledged in the DEIS, distributions are likely to be more contagious than the random assumption applied in the model. Documenting the variability of this effect between fisheries is a useful direction for further research, but the recommended tests are not likely to result in significant changes to the model's portrayal of the distribution and relative magnitude of fishing effects. The tests would only allow a more explicit qualitative description of the potential error. NMFS recognizes that small-scale fishing distribution studies need to be part of its ongoing research.

Panel Recommendation: Determine the temporal changes in the affected habitat through model hindcasts. The panel recommends that the DEIS should display time series of fishing effort (as far back in time as possible) as well as temporal changes in the spatial pattern of the effort, and should explore the effects of non-constant fishing effort on the model results. Specifically, (1) apply the model as a retrospective tool to determine how far the current environments are from conditions 10-30 years ago; (2) given the model has a time component (equation 4, appendix B) and there are estimates of past fishing effort, back calculate the changes in percent of the habitat unaffected by fishing over time; and (3) use the model to predict the possible effects of different fishing efforts on habitat reduction in the future.

NMFS Response: A time series of fishing effort would be an informative addition to the analysis, particularly in evaluating what changes in habitat features the model would have estimated. Such a complete time series has not been compiled and several aspects of existing data will limit the analysis, particularly increasingly sparse observer coverage going back before 1985 and the lack of coverage of the early domestic fleet during parts of the late 1980s. NMFS will assemble a time series of trawl effort distribution off of Alaska and include it in the final EFH EIS. The data limitations mentioned above and the need to provide a succinct and accessible presentation will limit the temporal and spatial resolution of this series. Comparison of effort patterns to model results likely will be limited to qualitative assessments.

Panel Recommendation: Improve the surficial sediment map on which to apply the model. The panel recommends that NMFS determine if the high-resolution sediment data support the broad scale characterization of habitats. Run the model within the Bristol Bay area (or any other region where there are sufficient data) using coarse versus highly resolved substrate data to examine the sensitivity of the model to the assumption about lack of substrate complexity/heterogeneity.

NMFS Response: The habitat map of the Bering Sea was based on the data assembled and described in Smith and McConnaughey (1999). Very few blocks would actually change designation between the three substrate types (sand, sand/mud and mud) if a higher spatial resolution were used. The number of substrate types is more limited by the ability to estimate separate model parameters between types than by the available habitat data. The number of studies associated with each substrate is quite small and in most cases more detailed information on the type of substrate in a study location is not available. Implementing this recommendation is not likely to affect the EIS analyses, but NMFS recognizes that continued habitat mapping is and will remain a high priority for ongoing habitat research.

Panel Recommendation: Integrate the results from on-going fishing gear impacts research into the habitat reduction model. The panel suggests reviewing specific papers identified by the panel members and environmental groups. Where considered relevant, add them to the list of references and discuss their results and implications with regard to impacts of fishing on habitat. Furthermore, cite the literature from the AFSC studies. Integrate, where possible, the research results from these studies with the development and testing of the habitat reduction model and the qualitative evaluations of effects on managed species. Where results are not yet forthcoming from these studies, note what research is being carried out.

NMFS Response: A detailed discussion relating the output of the model to the broader literature on fishing effects was not an area of emphasis in Appendix B. A review of the literature was included in Section 3 of the EIS, which emphasized ecosystems and fishing gears relevant to Alaska fisheries. Appendix B documents estimates of sensitivity parameters from relevant studies that provided sufficient quantitative information on changes in habitat features due to fishing and the amount of fishing effort that caused those changes. The model was run in early 2003, precluding use of any more recent data. To improve the documentation of the fishing effects evaluation, NMFS will examine existing literature, including that cited by the reviewers and more recent data from Alaska studies, particularly for information that conflicts with or supports model results.

Panel Recommendation: Investigate the rate of destruction of hard corals and sponges from the groundfish survey data. The panel suggests analyzing catch and effort data, observer bycatch data, field studies and industry information to assess the damage done to long-lived corals and sponges as well as the possible encroachment of fishing trawls into new areas containing corals and sponges.

NMFS Response: NMFS analysts used the effect and recovery model to evaluate the effects of fishing on corals and sponges. This model predicts an estimate of the proportional reduction in a habitat feature (e.g., corals or sponges), relative to an unfished state, if a fishery were continued at current intensity or distribution. NMFS determined that the model was the best tool available for the assessment. The model considers the intensity of fishing effort, sensitivity of habitat features, recovery rates of habitat features, and distribution of fishing effort, including a range of plausible values for sensitivity and recovery rates of corals and sponges. The observer data provide estimates of the bycatch of corals and sponges, but they are not particularly useful for analyzing fishing impacts. These data are useful for documenting that corals and sponges are taken incidentally in various fisheries, but they provide neither a quantitative estimate of the relative abundance and distribution of corals and sponges, nor the proportional reduction in coral and sponge habitat relative to unfished levels. Therefore, NMFS determined that incorporating coral and sponge bycatch information into the fishing effects model is not appropriate.

The EFH EIS considered the effects of fishing on animals that provide living structure, as well as three other categories of habitat features considered potentially important to managed fish species. Particularly long-lived animals that provide habitat structure were considered separately as the hard coral feature. The effects of fishing model estimated the persistent effects on these features to the smallest spatial scale that was feasible. As envisioned by the EFH regulations, the analysis focused on the extent to which fishing affects the capacity of EFH to support managed species, as evidenced by the ability of a species to support a sustainable fishery and the species' contribution to a healthy ecosystem. The areas used by each species and their habitat needs were provided in the EFH descriptions and supporting information in Appendices D and F. An expert on each managed species or species groups reviewed these and other available sources of information to clarify the specific types and distribution of habitat features used in spawning, feeding, and growth to maturity. They then evaluated whether the habitat effects of fishing would affect EFH in a way that was more than minimal and temporary. None of the evaluators found habitat effects that exceeded this threshold.

Issues Related to Impact Evaluations and the Role of MSST

The panel concluded that the use of stock abundance relative to MSST to assess the influence of habitat degradation on fish stocks is not an appropriate measure because it is largely insensitive to habitat changes. Furthermore, the panel concluded that habitat effects are only one of many factors that influence the stock abundance, the criterion provides no spatial information, and the expected lag between habitat destruction and detection of its effects on the stock productivity is expected to be long, such that the habitat may be destroyed before mitigation could be implemented.

NMFS scientists agree with the panel's conclusion that only considering stock abundance relative to MSST does not provide a sufficiently sensitive or detailed analysis of the influence of habitat degradation on the productivity of fish stocks. However, the Appendix B evaluations of habitat effects were not limited to an assessment of stock status relative to MSST. In addition to considering the habitat needs of each species relative to the results of the habitat model, each evaluator had a full set of more detailed information on stock status. In retrospect, these results, which were included by reference to the programmatic EIS for the groundfish fisheries, should have been more thoroughly described and incorporated into Appendix B.

As discussed in greater detail below, growth, recruitment and distribution of fish are sensitive indicators to change, so NMFS used a retrospective type analysis to assess the influence of habitat degradation on the productivity of managed fish species. Moreover, stock abundance relative to MSST was not the only criterion NMFS used for evaluating the impacts of fishing on EFH. The following provides a more detailed explanation/rationale of the analytical approach employed by NMFS analysts for assessing the effects on EFH and managed species.

The functional relationship between habitat and fish productivity or fish distribution is not known for most target species in Alaska. In the absence of direct functional relationships, NMFS stock assessment scientists based their evaluations on a review of temporal trends in abundance, temporal trends in recruitment, and spatial and temporal trends in distribution relative to available information regarding spatial or temporal trends in habitat impacts. NMFS analysts examined the available data to determine whether fish population trends varied in response to fishery impacts on habitat. They utilized indices of past, present and future stock status to evaluate the sustainability of managed fish species given current levels of habitat impact. This type of approach is commonly used in retrospective analysis of impacts of climate or oceanographic factors on the distribution or production of marine fish (Francis et al 1998, Anderson and Piatt 1999, Hunt et al. 2001). For the DEIS, the retrospective analyses searched for evidence that habitat impacts influence the productivity of managed species. The conceptual foundation for this technique is that if fish populations were tightly coupled to habitat, and the habitat was severely degraded, then impact of degraded habitat condition would be detectable at the population level.

The past and present status of the stock was evaluated using survey, fishery and stock assessment information. Most assessment authors include plots of catch distribution and survey biomass in their annual stock assessments. Time series of recruitment, spawning biomass, and total biomass were available for species that are assessed using age- or size-based statistical age structured models. Forecasts of future stock status were conducted to assess the possibility that recent events may be detrimental to stock production. For longer lived species, forecast models are needed because impacts on reproductive success could take several years to appear at the population level. NMFS stock assessment scientists who conducted the Appendix B analysis knew the time series of reproductive success (recruitment), growth, or the abundance of young fish and had ready access to forecast models to assess future spawning biomass levels and determine whether the stock is likely to fall below its MSST in 10 years (overfished) or 12 years (approaching overfished).

The Appendix B analysis uses MSST to assess whether the current status of habitat is sufficient to sustain managed fish species, not to evaluate habitat health. The long-term effect index (LEI) maps from the fishing effects model identify the impacts to habitat. The MSST test evaluates whether the current stock condition is capable of rebuilding to Bmsy or a proxy (B35%) in 10 years if the stock is fished at a level greater than status quo Fmsy or F35%. Several indicators of stock status could have been considered for this analysis. NMFS selected MSST because it has been accepted by the North Pacific Fishery Management Council and NMFS as a reasonable process of evaluating the status of a stock (see more detailed description of the harvest guidelines in Appendix A). The Bmsy or B35% is an integral part of the test, as it is the target level for rebuilding over a 10 year time horizon. An advantage of the biomass forecasts is that they provide an estimate of the range of likely biomass levels into the next decade.

NMFS analysts evaluated available information to assess whether fish populations vary as a function of habitat condition. The first part of this analysis involved determining whether there was evidence of a functional relationship between spatial or temporal trends in habitat impact and the spatial distribution or temporal trends in fish production. Stock assessment authors reviewed time series of production indices and maps of fish distribution to assess whether there were trends in the population that raised concerns. If a decline in recruitment or growth coincided with an increase in habitat impact, or if shifts in distribution coincided with maps of high habitat impact, the authors were encouraged to identify potential links in their evaluations. Authors were not encouraged to raise concerns based solely on evidence of a declining population trend; a link to spatial or temporal trends in habitat impacts was required. The authors were cautioned to differentiate between shifts due to targeted fishing or incidental catch and shifts potentially caused by a change in habitat. The results showed no indication that current levels of habitat impact negatively affect the ability of the stocks to support sustainable fisheries for many target species.

NMFS Response to Impact Evaluation Specific Recommendations

Panel Recommendation: Compare the spatial pattern of length-weight relationships for different species with the fishing effort pattern. The panel felt that if the fish in heavily fished areas are in poorer condition (less weight for the same length fish) then this might argue for an effect of fishing through habitat degradation.

NMFS Response: NMFS analysts will attempt to estimate length-weight anomalies by substrate type for target species that exhibit a broad spatial distribution in the GOA and EBS. Examples might include sablefish (Gulf of Alaska, Bering Sea and Aleutian Islands combined), pollock by region, Pacific cod by region, arrowtooth flounder by region, and rock sole by region. NMFS resource assessment surveys collect age structures and individual weights on a length stratified basis over broad geographic areas. Therefore, post stratification of length-weight would not be recommended unless the stratification scheme selected was consistent with the original strata used by the surveys.

Panel Recommendation: Provide time series of stock size of each species relative to its current MSST level.

NMFS Response: NMFS agrees that the analysis could be improved by a more systematic representation of the available information for each species. The past and present status of the stock was evaluated using survey, fishery, and stock assessment information. Most assessment authors include plots of catch distribution and survey biomass in their annual stock assessments. Time series of recruitment, spawning biomass, and total biomass were available for species that are assessed using age- or size-based statistical age structured models. In some cases, authors had information on interannual variations in size-at-age or weight-at-age by area. This information should have been included in the DEIS to provide a more complete source of information for the reader. The final EIS will include information on spatial distributions, recruitment trends and biomass relative to biological reference points.

Panel Recommendation: Compare the spatial pattern in the CPUE from the surveys and commercial fishery to the pattern of fishing effort. The panel questions if CPUE has been declining in areas of heaviest fishing and where the habitat has been most affected.

NMFS Response: NMFS plans to conduct a CPUE analysis for target species. The available data will be partitioned into size bins (e.g., adult, sub-adult, juvenile, or some reasonable grouping). The fishery and survey CPUE data will then be plotted by year and checked for evidence of serial depletion. The fishery data will be partitioned by gear type and season at a minimum. The fishery data may need to be linked with regulatory factors that could explain shifts in distribution including: shifts in annual quotas, time/area closures, and gear allocations. The analysts will then attempt to differentiate between situations where shifts in distribution are linked to regions of high LEI and situations where shifts do not appear to be linked to LEIs. Specifically, the analysts will search for regions where fish were historically abundant and where LEIs were high and the fish no longer reside.

Readers should be cognizant of a number of caveats regarding time trends in the spatial distribution of CPUE:

- Annual plots of spatial distributions of survey CPUE have been completed for many target groundfish species. These plots reveal niche partitioning by species across broad regions and some evidence of shifts in distribution in response to anomalous oceanographic conditions (e.g., the 1999 expansion of the cold pool in the EBS). The interpretation of spatial patterns of abundance will need to address the expected home range of the species, the sensitivity of the species to anomalous ocean conditions, and the nature of the changes in response to environmental conditions. Varying levels of information of this type are available for target groundfish species. Because of a lack of detailed information on a small scale for many species, results may be difficult to interpret.

- The habitat model only represents recent effort distributions. This impedes the analyst's ability to evaluate time trends in spatial distribution relative to time trends in habitat impact. Potential solutions to this problem would be to run the habitat model for earlier time periods or to produce effort maps for earlier years. Several issues complicate these solutions. First, the spatial resolution of effort data is much coarser in the earlier years (half degree by one degree latitude and longitude blocks). Second, vessel standardization has not been completed. The percentage of observed hauls was low in the early years and during the transition period between foreign and domestic fisheries.

- The habitat model represents the recent distribution of effort, therefore the impacts of recent shifts in effort may not be realized in long-lived species.

Panel Recommendation: Explore spatially explicit models of growth, fecundity, condition etc. in different habitat types. The panel suggests exploring alternative models that take advantage of existing data on growth, fecundity, etc. in different habitat types as an alternative to the MSST analysis. Specifically, they recommend a spatially explicit examination of parameters other than population abundance (e.g., growth rates, size at age, fecundity, condition, etc). The panel acknowledges that these analyses may not be possible for all stocks and populations but the development of detailed case studies which cover a representative range of life histories (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.

NMFS Response: NMFS will attempt to compare growth patterns of northern rockfish, Pacific ocean perch, and Atka mackerel in the Western (light impact on coral see Fig B.2-6c), Central (more impact on coral), and Eastern (more impact on coral) Aleutian Islands. The analysis will consider size and weight at age by statistical area and growth trajectories by sub-region for all three species. If the data are available, the analysts will also compare growth patterns of northern rockfish, POP, sablefish, pollock, Pacific cod, flathead sole and arrowtooth flounder in the Western (moderate impact on coral see Fig B.2-6a, b), Central (heavy impact on coral) and Eastern (very little impact on coral) regions of the Gulf of Alaska. The analysts will consider size and weight at age by statistical area and growth trajectories by sub-region.

NMFS analysts will also attempt to examine spatial trends in diet composition and fullness of some target groundfish species that consume epifauna by size bin (adult, sub-adult, juvenile, or some reasonable grouping) across regions of high, medium, and low LEI areas for benthic infauna and epifauna. This analysis will likely be done for the eastern Bering Sea shelf flatfish species for which food habits data are available.

Readers should be cognizant of a number of caveats regarding the growth data, food habits information, and LEIs:

<u>Caveats regarding the growth data</u>

- In the early years, sample weights were collected intermittently using triple beam balance scales. Weight measurements taken using triple beam scales may have been more uncertain because measurements were potentially influenced by the ships motion. To account for this potential problem, RACE survey scientists did not collect weights during rough seas. In recent years, all fish sampled for otoliths are weighed using a motion compensated digital scale. The biggest advantages of the electronic scales are that far more fish can be weighed within the allotted time with much greater precision in the weight reading. The magnitude of the uncertainty associated with use of different scales is difficult to quantify.

- During surveys, age structures were collected on a length stratified basis. Post stratification of weight at age or length at age data would not be recommended unless the stratification scheme selected was consistent with the original strata used by the survey.

- When fish are spatially stratified at different ages, interpreting area specific growth anomalies could be difficult, particularly for stocks that exhibit exceptionally strong year classes.

- Seasonal differences in size or weight are well known and documented. If fishery data is included in the analysis, the data should be partitioned seasonally.

- Evidence of density dependent growth effects have been documented for some flatfish. Interpretation of time trends in growth of these species should address the potential impact of increased abundance on competition for limited prey.

Caveats regarding the food habits information

- Interpreting spatial indices of diet composition can be difficult because food habits of individual fish are highly variable within regions, prey distribution and abundance may be influenced by oceanographic features such as frontal zones, and the annual distribution of sampling may be coarse.

- Indices of gut fullness are influenced by several factors including time of day, prey type, and temperature. In addition, undetected regurgitation of stomach contents occurs and may increase with depth.

- Food habits of most fish shift with age. Some effort to partition the data into juvenile, sub-adult and adult may be required.

Caveats regarding the LEIs

- LEIs for coral in the Gulf of Alaska and Aleutian Islands do not account for the depth distribution of deepwater corals or the probability of encountering corals.

- LEIs for benthic infauna or benthic epifauna were not tested against observed information from food habits data or surveys. Predictions of long term effects may not be consistent with observed trends in the encounter of epifaunal organisms.

Panel Recommendation: Use the spatially explicit models along with the habitat reduction model and a population index (e.g. abundance relative to the MSST) to re-assess the possibility of habitat degradation affecting commercial fish stocks. The panel further suggests that the alternative model results and information from other regions should be taken into account along with the MSST and the model results to assess the possibility of habitat degradation affecting commercial fish stocks. Where the data are unclear, or where habitat reduction is high even if the abundance levels are above MSST, the precautionary approach should be used. This may result in some habitats being classified as potentially impacted by fishing.

NMFS Response: The stock assessment community is actively researching techniques to formally incorporate environmental forcing into stock assessments. The steps required to complete this task typically adhere to the following sequence:

- Researchers conduct retrospective analyses to identify evidence of environmental forcing on some aspect of the population (e.g. distribution, growth, reproductive success). Statistical inference is typically applied to evaluate hypotheses.
- Researchers implement process oriented studies to verify potential linkages revealed by retrospective analyses.
- Functional relationships between environmental forcing and population dynamics are derived from the combination of retrospective studies and process oriented research.
- Stock assessments are conducted with and without the environmental covariates to measure improvement of model estimates to observations to evaluate the relative

importance of the environmental factor in predicting future abundance.

Evaluating the impact of environmental forcing on fish production is an important first step towards evaluating the role of habitat. Often, habitat considerations are linked. For example, temperature preference is known to affect the distribution of many fish species and is obviously an important determinant of habitat quality. Given an adequate preferred temperature regime, a next level of habitat quality might be based on biological and/or physical features. Current research on the role of habitat on fish production occurs primarily via retrospective analyses. NMFS scientists are continually gathering information to evaluate potential linkages between habitat quantity and quality and future fish production. Much of this information is presented in the EFH EIS. Modeling fish production as a function of spatial and temporal habitat impacts requires a large number of assumptions that are difficult to support given historical information. Stock assessments are typically highly imprecise endeavors, even for species for which large amounts of data are collected (e.g., EBS pollock). Disentangling a population response between fishing, environmental conditions, and habitat measures (which are typically lacking) is difficult without a large number of questionable assumptions.

Panel Recommendation: Review the work being done elsewhere on ways of assessing the health of an ecosystem and develop relevant indices to help monitor the health of the Alaskan ecosystem. The panel recommends that NMFS review the literature and web-based information to determine the state-of-the-art in regards to assessing the role of the managed fish stocks in a healthy ecosystem. Based on this review, define and generate time series of ecosystem indices for Alaskan waters.

NMFS Response: The definition of EFH does not directly address maintenance of a healthy ecosystem; rather it requires that EFH includes the habitat necessary to support the role of each managed fish species in a healthy ecosystem. While the literature on assessing the health of an ecosystem is a complex and growing field, developing a measure of the role(s) of an individual species in a healthy ecosystem has not received as much attention. NMFS scientists continually review the literature and participate in international efforts to determine the state-of-the-art with regard to species-specific, community, and ecosytem-level indicators of healthy ecosystems. Each year, an Ecosystems Considerations chapter of the Stock Assessment and Fishery Evauation (SAFE) report is compiled which contains time series of ecosystem indices for Alaskan waters. The final EFH EIS will include a reference to the Ecosystem Considerations chapter and other species SAFE chapters that provide abundance indices of living substrates, selected nontarget species, starfish, and forage fish (components of EFH).

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Acronyms

ABC	Acceptable Biological Catch
AFSC	Alaska Fisheries Science Center
CIE	Center for Independent Experts
CPUE	Catch Per Unit of Effort
DEIS	Draft Environmental Impact Statement
EBS	Eastern Bering Sea
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
GOA	Gulf of Alaska
HAPC	Habitat Areas of Particular Concern
INPFC	International North Pacific Fisheries Commission
LEI	Long-term Effect Index
MSST	Minimum Stock Size Threshold
MSY	Maximum Sustainable Yield
NMFS	National Marine Fisheries Service
OFL	Overfishing Level
POP	Pacific Ocean Perch
PSEIS	Programmatic Supplemental Environmental Impact Statement
RACE	Resource Assessment and Conservation Engineering
SAFE	Stock Assessment and Fishery Evaluation
SPR	Spawning Per Recruit
VMS	Vessel Monitoring System

Appendix A. Additional information related to harvest control rules and MSST.

Harvest Control Rules and MSST

Because the panelists had many comments questioning the inclusion of MSST as an element for evaluating present sustainability of managed fisheries, the following is provided to clarify the purpose of the status determinations. Analysts considered the results of the forecasts as one of several criteria used for determining impact rankings.

Harvests of BSAI and GOA Groundfish stocks are limited by a number of stringent management measures. For a given stock or stock complex (except for the GOA "other species" complex, which is managed using slightly different rules), the total allowable catch (TAC) is always set less than or equal to the acceptable biological catch (ABC), which is always set less than or equal to the maximum permissible ABC (maxABC), which is always set substantially below the overfishing level (OFL), except in the limiting case where OFL is zero, in which case maxABC, ABC, and TAC are also zero.

The maxABC and OFL are prescribed by formulae called harvest control rules. Six pairs ("tiers") of maxABC and OFL control rules are specified by the BSAI and GOA Groundfish FMPs, corresponding to six levels of data availability. The parameters ("reference points") used in the tier system vary from tier to tier, but a common theme throughout the system is that the maxABC control rule is always proportionally less than the OFL control rule, except in the limiting case where OFL is zero, in which case maxABC is also zero.

Presently, nearly all major stocks and stock complexes are managed under Tier 3. The level of data availability corresponding to Tier 3 is such that reliable estimates of MSY-related reference points do not exist. Instead, reference points in the Tier 3 control rules are based on relative spawning per recruit (SPR). Relative SPR is the ratio between lifetime egg production of two hypothetical cohorts, one of which is fished and one of which is not. The cohort that is fished produces fewer eggs over the course of its lifetime than the cohort that is not, because the process of fishing removes some fish from the cohort and these removed fish are no longer able to contribute to egg production. Thus, relative SPR is a number that ranges between 0 (obtained in the case of extremely intense fishing) and 1 (obtained in the case of no fishing), and is often displayed as a percentage. For example, $F_{35\%}$ is the fishing mortality rate that reduces the lifetime egg production of a cohort to 35% of what it would be in the absence of fishing, $F_{40\%}$ is the fishing mortality rate that reduces the lifetime egg production of a cohort to 40% of what it would be in the absence of fishing, and so forth. For a given stock, $F_{35\%}$ will always be higher than $F_{40\%}$, because more fishing is required to reduce lifetime egg production to 35% of the unfished level than is required to reduce lifetime egg production to 40% of the unfished level. In terms of biomass, SPR-based reference points represent the long-term average biomass that would result if the average strength of future cohorts were equal to the historic average and all future cohorts were fished at the corresponding SPR-based fishing mortality rate. For example, $B_{35\%}$ represents the long-term average biomass that would result if the average strength of future cohorts were equal to the historic average and all future cohorts were fished at $F_{35\%}$.

The control rules for Tier 3 are shown in Figure 1. In Tier 3, the proxies for B_{MSY} and F_{MSY} are $B_{35\%}$ and $F_{35\%}$, respectively. Note that the fishing mortality rate corresponding to OFL can never exceed $F_{35\%}$ and the fishing mortality rate corresponding to maxABC can never exceed $F_{40\%}$. In the event that stock size declines below $B_{40\%}$, both the OFL and maxABC fishing mortality rates decline linearly with stock size. These mandated reductions in fishing mortality begin as soon as a stock declines below $B_{40\%}$, well before the stock reaches its MSY proxy level of $B_{35\%}$. In the unlikely event that a stock falls to a size less than 5% of its MSY proxy level, both OFL and maxABC (and therefore ABC and TAC) are set equal to zero. As Figure 1 implies, the fishing mortality rates corresponding to all ABCs and TACs are less than the MSY proxy fishing mortality rate of $F_{35\%}$. Operationally, many Tier 3 stocks are harvested at rates that are only small fractions of $F_{35\%}$, even though their biomass levels are well above $B_{40\%}$.

In the terminology of the National Standard Guidelines, the fishing mortality rate corresponding to OFL represents the "maximum fishing mortality threshold" (MFMT). The MFMT plays a key role in determining the minimum stock size threshold (MSST), which is defined in the National Standard Guidelines (§600.310(d)(2)(ii)) as follows:

"To the extent possible, the stock size threshold should equal whichever of the following is greater: one-half the MSY stock size, or the minimum stock size at which rebuilding to the MSY level would be expected to occur within 10 years if the stock or stock complex were exploited at the maximum fishing mortality threshold specified under paragraph (d)(2)(ii) of this section."

In light of the CIE panel's concerns for being more precautionary, it bears repeating that the MSST does not represent the point at which fishing mortality rates begin to be reduced. In Tier 3, the point at which fishing mortality rates begin to be reduced is $B_{40\%}$, well above the MSY proxy stock size of $B_{35\%}$ and far above MSST. MSST represents the point at which the reductions in fishing mortality already mandated by the tier system are required to be reexamined and adjusted if they are found to result in an insufficient rate of rebuilding.

The DEIS used MSST to represent the lower bound of the range of sustainability. A stock is determined to be above its MSST only if it is above the biomass that produces MSY (Bmsy) or is expected to rebuild to Bmsy within 10 years. To ensure that the test for recovery errs on the conservative side, rebuilding rates are computed using the assumption that the stock will be harvested at the overfishing level throughout the rebuilding period, although actual harvesting rates in the BSAI and GOA groundfish fisheries invariably are much lower. Assessing stock status relative to MSST ensures that the stock is either above or reasonably close to the MSY level, so this test is more rigorous than a test for "sustainability" per se.

The Appendix B analysis assessed whether the effects of fishing alter the ability of a stock to sustain itself above MSST (i.e., not whether the stock is currently below MSST). The answer to that question would be yes if there are downward trends in the stock status sufficient to drive the population below its MSST, and if those trends are related to poor recruitment. Such trends should be evident long before the stock reaches its MSST. Hence, considering the ability of a stock to remain above MSST is not an insensitive measure of the response of the stock to habitat perturbations. NMFS did not identify any such downward trends in stock status that could reasonably be attributed to habitat factors.

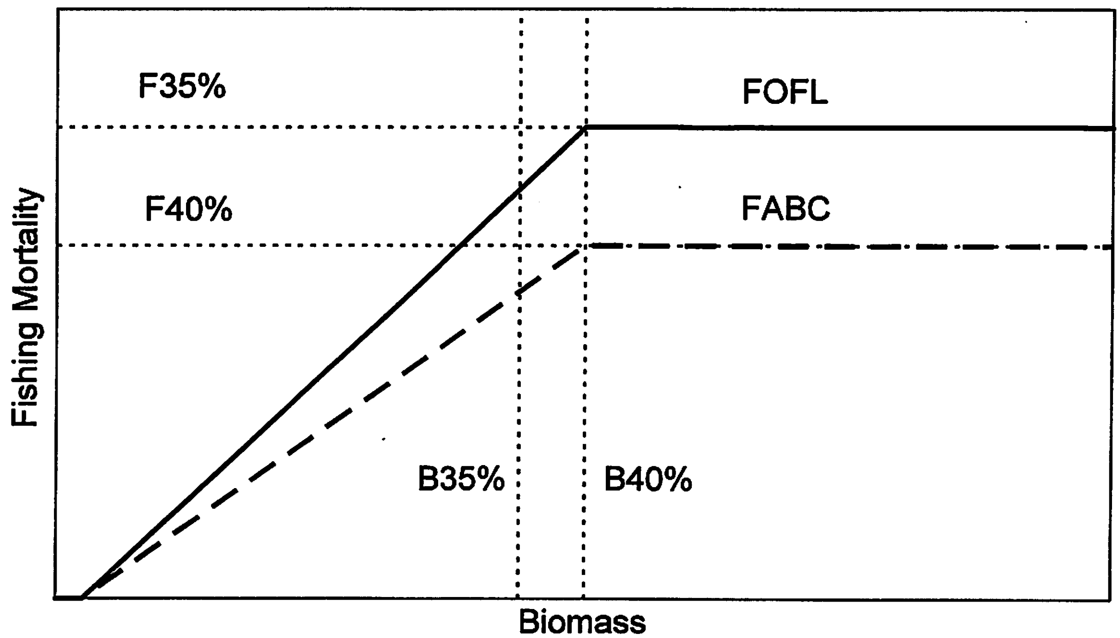

Figure 1. Tier 3 harvest control rules. The fishing mortality rate corresponding to OFL is shown by the solid segmented line and the fishing mortality rate corresponding to maxABC is shown by the dashed segmented line.

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ESSENTIAL FISH HABITAT TESTIMONY

NORTH PACIFIC FISHERY MANAGEMENT COUNCIL

October 8, 2004

Keith Simila, USDA Forest Service, Alaska Region

The Forest Service generally concurs with the concerns raised by Sealaska and the Alaska Forestry Association.

We have three primary issues I'd like to raise to you today.

1. **The implementation of more stringent conservation measures than what are already provided for in the forest plans and through existing federal and state regulations.**
2. **Inadequacies in the NEPA process used to identify and display the effects of the conservation measures for EFH on affected land owners.**
3. **The improper use of an EIS to effectively promulgate regulations.**

Land Management Plans are the means the Forest Service uses to insure conservation strategies are implemented for management actions such as timber harvest and road construction and the construction and use of LTFs.

The Tongass National Forest, for example, has implement the most scientifically based conservation strategy of any National Forest. This was done in recognition of the potential for impacts to fisheries resources from management actions anticipated in the plan. The plan took 10 years and cost $35 million and NMFS cooperated in the development of the conservation measures taken in the plans to insure protection of water quality and essential fish habitat.

The Forest Service adheres to Best Management Practices to protect resources, we provide exceptionally high standards for riparian management, LTF siting, road construction timing and fish passage, and we maintain a highly qualified staff of fish biologists, foresters and engineers to insure we follow our own guidelines to protect fish habitat. The National Forests in Alaska continue to provide healthy spawning and rearing habitats for some of the worlds greatest salmon fisheries and we are confident that this habitat will be maintained.

We understand that NMFS takes existing conservation strategies, BMP's and standards and guidelines into account. The EIS as proposed in Appendix G identifies additional conservation measures that appear to "raise the bar" on those fully developed in the land management planning process, and through the regulatory processes of other agencies that address the implementation of the Clean Water Act and other laws.

The effects of the measures listed in Appendix G should have been brought into the main body of the EIS and the resultant impacts on the land owners displayed. Relegating the implementation of the conservation measures to an appendix enabled this to slip below the radar screen of FS management. We believe the NEPA process was not adequately followed and should be remedied.

The EIS is introducing a new regulatory process and measures on upland and tidal areas that rightfully fall within the jurisdiction of EPA and the State of Alaska in their role of implementing the Clean Water Act. Essential Fish Habitat conservation strategies listed for management actions empowers NFMS to provide their own version of how the CWA should be implemented, supplementing the extensive regulatory vehicles already in place to accomplish CWA and other goals.

For example: Log transfer facility conservation measures citied in Appendix G do not mention existing EPA and Alaska DEC regulations that apply in the zone of deposit that are designed to protect water quality and remediate impared water bodies. The measures required as part of NPDES permits or remediation plans should suffice to protect Clean Water – yet NFMS recommends more stringent guidelines to address CWA concerns.

Using the EIS to implement new conservation measures on affected land owners that have significant regulatory effect appears improper. The conservation measures listed should go through a formal rule-making process as other regulatory agencies have done in order to insure the effects are fully vetted with the best science and address actual instead of potential problems and identify where existing conservation strategies are not working and where they need to be supplemented.

In summary, our recommendation is that Appendix G be eliminated from the EIS document itself. That a formal rule-making process be used instead to promulgate regulations that work in a more collaborative way with the affected land management agencies and regulatory agencies.

Thank you.

John Tellinghast AK Forestry assn.
Ron Wolfe Sealaska Corp.

Appendix G: Discussion of "Silviculture/Timber Harvest"

Potential Adverse Impacts

EIS Allegation	*EIS' Alleged Support for Allegation*	*Actual State of Scientific Knowledge*	*Proposed Alternate Language*
1. *"In Southeast Alaska, logging is considered the largest threat to anadromous fish habitat."* p. 3-40.	None. It is unclear who "considers" logging to be the "largest threat."	*"Pacific salmon are generally in good health in southeastern Alaska…In contrast to the Pacific Northwest and California,…we found no evidence of widespread loss of spawning aggregate in southeastern Alaska."* American Fisheries Society (1996).	Delete sentence.
2. *"Although current forest management practices are designed to avoid or minimize adverse effects to fish habitat, the harvest and cultivation of timber and other forestry products are major activities that can have both short- and long-term impacts throughout many coastal watersheds and estuaries if management practices are not fully implemented or effective."*	No support is offered for the suggestion that perhaps BMPs are not being implemented or are not effective.	All available scientific studies suggest that BMP's are effective. For example, with modern buffers zones: • Anadromous streams are given complete shade protection. Schult and McGreer (2001); Murphy (1995); Konopacky (1996); and • 82%--93% of all large woody debris is retained. Murphy (1995); Martin and Grotefelt (2001).	Although current forest management practices are designed to avoid or minimize adverse effects to fish habitat, the harvest and cultivation of timber and other forestry products are major activities that can have both short- and long-term impacts throughout many coastal watersheds and estuaries if management practices are not fully implemented or effective. However, and although individual unlawful acts do occur, there is no evidence that these BMPs are not being implemented on either public or private land in Alaska. Nor is there any available scientific evidence that current BMPs are not effective in protecting essential fish habitat.
3. *"Logging roads can destabilize slopes*	There is no study cited in support of any of the EIS' allegations regarding mass movement of soils. Further, the EIS	In a study before imposition of modern BMPs, only 8.5% of all landslides caused in Tongass were from forested	Improperly engineered ~~L~~logging roads can destabilize slopes and increase erosion and sedimentation (See Road Building and Maintenance, Section 2.3).

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and increase erosion and sedimentation (See Road Building and Maintenance, Section 2.3). Two major types of erosion occur: mass wasting and surface erosion. Mass movement of soils, commonly referred to as landslides or debris slides, is associated with timber harvest and road building on high hazard soils and unstable slopes. Both frequency and size of debris slides are increased when logging roads are built on, or timber is harvested from, these unstable land forms. The result is increased erosion and sediment deposition in downslope waterways."	does not discuss the effect of modern BMPs on reducing mass wasting from harvesting and road building.	areas, and were generally confined to slopes with specific risk characteristics (Swanston & Marion [1991]; Perkins [1999]). Only 3.4% of all landslides from recently-logged areas delivered any sediments to anadromous streams Perkins [1999]). Under federal and state BMPs, hazardous slopes must either be avoided altogether, or site-specific hazard management plans must be developed.	Two major types of erosion could occur: mass wasting and surface erosion. Mass movement of soils, commonly referred to as landslides or debris slides, ~~is associated~~can occur with timber harvest and road building on high hazard soils and unstable slopes. ~~Both~~ There is inconclusive empirical evidence indicating whether, or to what extent, the frequency and size of debris slides are increased when logging roads are built on, or timber is harvested from, these unstable land forms. In some cases, ~~T~~the result of mass soil movement could be~~is~~ increased erosion and sediment deposition in downslope waterways. However, studies performed in the early 1990's, even before institution of modern BMPs, found that only 3.4% of landslides that did occur in recently-logged areas reached anadromous streams, and that there were no channel responses in association with logging-related landslides. (Perkins 1999; (Swanston and Marrion 1991). Moreover, under federal and state BMPs, hazardous slopes must either be avoided altogether, or site-specific hazard management plans must be developed.
4. *"Erosion from roadways is most severe when poor construction practices are employed that do not include properly located, sized, and installed culverts; proper ditching; and ditch blocker water bars (Furniss et al. 1991.)"*	The Furniss study cited in the EIS relied on studies that were conducted before imposition of modern BMPs._Furniss himself concluded that potential impacts caused by roads can be greatly reduced by adoption of BMPs designed to protect fish habitat.	New BMPs contain detailed road and culvert design standards. 11 AAC 95.285 –320. These standards are designed to avoid all the specific inadequacies listed in the EIS. Recent studies indicate that, where sedimentation from modern road construction did occur, it migrated less	Erosion from roadways ~~is most severe~~can occur when poor construction practices are employed that do not include properly located, sized, and installed culverts; proper ditching; and ditch blocker water bars (Furniss et al. 1991.)). However, recent studies found that sediment transport distances

		than 200 feet, and only minimal amounts of sediment were delivered to waterways from this distance (Schult and McGreer [2001]).	from roads constructed under modern BMPs were generally less than 200 feet, and that only minimal amounts of sediment could travel that far (Schult and McGreer 2001). In this regard, road construction is generally prohibited within riparian areas (except for stream crossings).
5. *"Stream crossings (bridges and culverts) on forest roads are often inadequately designed, installed, and maintained, and they frequently result in full or partial barriers to both the upstream and downsteam migration of adult and juvenile fish. Perched and undersized culverts can accelerate stream flows to the point that these structures become velocity barriers for migrating fish. Blocked culverts result from installation of undersized culverts or inadequate maintenance to remove debris. Blocked culverts can result in displacement of the stream from the downstream channel to the roadway or roadside ditch, resulting in dewatering of the downstream channel and increased erosion of the roadway. Culverts and bridges deteriorate structurally over time. Failure to replace or remove them at the end of their useful life may cause partial or total blockage of fish passage. Caution should be used, however, when removing culverts. Channel incision can often occur downstream of a culvert and generally moves upstream. An existing culvert can act as a grade*	No study is cited for the proposition that stream crossings are "often inadequate[]" or "frequently result" in barriers to fish passage. Nor does the EIS take into account the effect of modern BMPs on avoiding the problems discussed in the text.	The specific culvert problems noted in the EIS (such as undersizing, perching, and failure to remove the culvert at the time of road closing) are now prohibited by modern BMPs (11 AAC 95.300-305 and 320).	With regard to ~~S~~stream crossings, ~~(bridges and culverts) on forest roads are often inadequately designed, installed, and maintained, and they frequently result in full or partial barriers to both the upstream and downsteam migration of adult and juvenile fish. Perched~~ perched and undersized culverts can accelerate stream flows to the point that these structures become velocity barriers for migrating fish. However, perched culverts are prohibited under modern BMPs, and all culverts are now subject to sizing requirements designed to assure passage of both fish and significant flood events. Blocked culverts could result from installation of undersized culverts or inadequate maintenance to remove debris. Blocked culverts can result in displacement of the stream from the downstream channel to the roadway or roadside ditch, resulting in dewatering of the downstream channel and increased erosion of the roadway. However, under modern BMPs culverts must be properly sized and maintained. Culverts and bridges deteriorate structurally over time. Failure to replace or remove them at the end of their useful life may cause partial or total blockage of fish passage.

control, halting the upstream progression of a headcut and causing further channel regrade (Castro 2003). The unchecked upstream progression of a headcut can cause further damage to EFH."			However, modern BMPs require removal of culverts upon road closure, unless regulators determine that other measures are warranted. In this regard, ~~C~~caution should be used~~, however,~~ when removing culverts. Channel incision can often occur downstream of a culvert and generally moves upstream. An existing culvert can act as a grade control, halting the upstream progression of a headcut and causing further channel regrade (Castro 2003). The unchecked upstream progression of a headcut can cause further damage to EFH.
6a. *"Removing streamside vegetation increases the amount of solar radiation reaching the stream and can result in warmer water temperatures, especially in small, shallow streams of low velocity. In southeast Alaska, Meehan et al. (1969) found that maximum temperature in logged streams without riparian buffers exceeded that of unlogged streams by up to 5°C, but did not reach lethal temperatures. However ,the increased water temperatures often exceeded optimum temperatures for pink and chum salmon (Reiser and Bjornn 1979). Logged streams have been associated with higher water temperatures, lower baseflows and higher peak flows, and low oxygen levels that have resulted in significant mortalities of pink and chum salmon*	EIS cites two studies: • (Flanders and Cariello [2000]) which deals only with effectiveness of stream crossings. Study doesn't mention oxygen or temperature; and • Meehan (1969). EIS states that Meehan found logging-induced temperature increases up to 5°C, when, in fact, study found no temperature increases "due to logging" greater than 2.2°C (see Table 17). Further, Meehan investigated streams that did not have today's shade-protecting buffer zones.	Even before imposition of new BMPs, temperature increases were never a significant issue in Southeast Alaska because of cooler ambient temperatures, and temperature changes did not result in fish mortality. Meehan (1969); Meehan (1970); Beschta (1987); Pentac (1991). Contrary to the EIS' allegation, no study has ever found a causal relationship between logging and lower dissolved oxygen levels causing a fish mortality in Southeast Alaska. Pentac (1991). With buffers now mandatory along anadromous streams, streams are given complete shade protection. Schult and McGreer (2001); Murphy (1995); Konopacky (1996). According to scientists, "adherence to Alaska's forest practices ruels will prevent adverse impacts of harvest activities on DO	Removing streamside vegetation without providing a shading buffer increases the amount of solar radiation reaching the stream and can result in warmer water temperatures, especially in small, shallow streams of low velocity. In southeast Alaska, Meehan et al. (1969) found that maximum temperature in logged streams without riparian buffers exceeded that of unlogged streams by ~~up to 5~~a maximum of 2.3°C~~,~~.The highest such temperature recorded was 16.01°C, which is ~~but did~~ not a ~~reach~~ lethal temperatures. ~~However ,the increased water temperatures often exceeded optimum temperatures for pink and chum salmon (Reiser and Bjornn 1979). Logged streams have been associated with higher water temperatures, lower baseflows and higher peak flows, and low oxygen levels that have resulted in~~

(Flanders and Cariello 2000). In cold climates, the removal of riparian vegetation can result in lower water temperatures during winter, increasing the formation of ice and damaging and delaying the development of incubating fish eggs and alevins".		concentrations in streams." Shult and McGreer (2001).	~~significant mortalities of pink and chum salmon (Flanders and Cariello 2000).~~ No scientific study has ever documented a fish kill in Southeast Alaska attributable to either logging-induced temperature increases or logging-induced declines in low oxygen levels (Pentac Environmental (1991); Schult and McGreer (2001); (Meehan 1969); (Beschta et al 1987)). Moroever, current federal and state BMPs require retention of shading buffers along all anadromous streams, which scientists believe will prevent any adverse impacts from temperature change or dissolved oxygen decreases (Shult and McGreer (2001)). In cold climates, the removal of riparian vegetation can result in lower water temperatures during winter, increasing the formation of ice and damaging and delaying the development of incubating fish eggs and alevins.
6b. In its Response to Comments, NMFS states that prespawner mortality "*generally is the result of streams lacking protective riparian buffers*."	NMFS cites no authority for this proposition.	No scientific study supports this proposition. To the contrary, a comprehensive 1991 study by the Alaska Working Group on Cooperative Forestry Fishery Research (of which NMFS was part) found that prespawner mortality was caused by too many fish congregated in too little water—two variables not influenced by logging.	Delete this allegation.
7. *"By removing vegetation, timber harvest reduces transpiration losses from the landscape and decreases the absorbtive capacity of the groundwater.*	The EIS cites no study in support of this proposition.	Summer low flows typically increase after timber harvest. This has a positive ecological effect by increasing summer rearing habitat for juvenile salmon. Timber harvest can affect peak flows, but the existence and the magnitude of	By removing vegetation, timber harvest reduces transpiration losses from the landscape and decreases the absorbtive capacity of the groundwater. These changes result in increased water yields during low flow summer periods.

These changes result in increased surface runoff during periods of high precipitation and decreased base flows during dry periods."		the effect is highly site-specific. McGreer (2000).	(McGreer [2000]) Increased flow during low-flow periods can have a beneficial impact on essential fish habitat by improving summer rearing habitat.~~surface runoff during periods of high precipitation and decreased base flows during dry periods.~~ Timber harvest has the potential to affect flow during peak periods; however, this effect is highly variable, and its impact on essential fish habitat is undetermined.
8. *"Reduced soil strength results in destabilized slopes and increased sediment and debris input to streams (Swanston 1974). Sediment deposition in streams can reduce benthic community production (Culp and Davis 1983), cause mortality of incubating salmon eggs and alevins, and reduce the amount of habitat available for juvenile salmon (Heifitz et al. 1996). Cumulative sedimentation from logging activities can significantly reduce the egg-to-fry survival of coho and chum salmon (Cederholm and Reid 1987; Myren and Ellis, 1984)."*	Only two of the referenced studies (Culp and Davies; Cederholm and Reid) actually address the effects of sediment on aquatic biota, and both were done before modern BMPs. The other two studies involve fish habitat in winter (Heifitz) and summer low flows in streams (Myren and Ellis). The narrative ignores the effective of the now-mandatory buffer zones along all anadromous streams.	Today's mandatory buffer zones are effective in preventing sedimentation to streams (Spence et al. [1996]; Hicks et al. [1991]; Heifitz et al. [1986]). With the filtering effects of modern buffers, anadromous stream sedimentation from nearby timber harvest is no longer a significant problem. Shult and McGreer (2001).	Without the now-mandatory anadromous stream buffers and stream stabilization standards for all streams, ~~R~~reduced soil strength could result~~s~~ in destabilized slopes and increased sediment and debris input to streams (Swanston 1974~~).~~ ~~-~~), which could ~~Sediment deposition in streams can~~ reduce benthic community production (Culp and Davis 1983), cause mortality of incubating salmon eggs and alevins, and reduce the amount of habitat available for juvenile salmon ~~(Heifitz et al. 1996). Cumulative sedimentation from logging activities can significantly reduce the egg-to-fry survival of coho and chum salmon~~ (Cederholm and Reid 1987). The filtering effects of currently-required buffer zones renders these impacts unlikely (Schult and McGreer 2001).
9. *"Reductions in the supply of LWD also result when old growth forests are removed, with resulting loss of habitat*	EIS relies on a 16-year old study that does not take modern buffer zones into account.	Alaska Forest Practices Act's buffers result in retention of 82%--93% of LWD. Murphy (1995); Martin and Grotefelt (2001).	Finally, available evidence indicates that the anadromous stream buffers required by federal and state law will provide an adequate ~~Reductions in the~~ supply of LWD, thereby retaining the

complexity that is critically important for successful salmonid spawning and rearing (Bisson et al. 1988)."			~~also result when old growth forests are removed, with resulting loss of~~ habitat complexity that is critically important for successful salmonid spawning and rearing ~~(Bisson et al. 1988)~~ (Martin and Groenfendt (2001); Murphy (1995); Martin et al. (1998)).
10. *"Timber harvest removes the dominant vegetation, converts mature and old-growth upland and riparian forests to tree stands or forests of early seral stage, reduces permeability of soils and increases the area of impervious surfaces, increases sedimentation from surface runoff and mass wasting processes, results in altered hydrologic regimes, and impairs fish passage through inadequate design, construction, and/or maintenance of stream crossings. Deforestation associated with timber harvest can alter or impair instream habitat structure and watershed function. Timber harvest may result in inadequate or excessive surface and stream flows, increased stream bank and stream bed erosion, loss of complex instream habitats, sedimentation of riparian habitat, and increased surface runoff with associated contaminants (e.g., herbicides, fertilizers, fine sediments). Hydrologic characteristics, (e.g., water temperature, annual hydrograph) change, and greater variation in stream discharge is associated with timber harvest. Alterations in the supply of LWD and sediment can have negative*	These paragraphs merely repeat the individual allegations concerning forestry discussed above. They serve no independent purpose here. The editorial changes needed with respect to each individual allegation are discussed above. If this text were retained, it too would require the same editing that its counterpart text received in ##1-9, above.	See the discussion with respect to each individual allegation, above.	Delete these two paragraphs.

effects on the formation and persistence of instream habitat features. Excess debris in the form of small wood and silt can smother benthic habitat and reduce dissolved oxygen levels."			

Recommended Conservation Measures

Measure	*Discussion*	*Proposed Alternate Language*
Recommended Conservation Measure #1. *"Implement Best Management Practices (BMPs) for impacts affecting particular habitats and resulting from specific types of silviculture-related activities provided in the "Additional Resources" section."*	NMFS has indicated that it does intend to recommend BMPs that differ from those currently imposed by the Forest Service and the State of Alaska. The "Additional Resources" bibliography is a nine-page, single-spaced list of often lengthy reports and other documents. Using this bibliography as a source of additional BMPs is contrary to NMFS' assurances, it would create confusion because of the sheer mass of material referenced, and it would provide no sideboards to NMFS' conservation recommendations.	Implement Best Management Practices (BMPs) for impacts affecting particular habitats and resulting from specific types of silviculture-related activities provided in the Tongass Land Management Plan, the Chugach Land and Resources Management Plan, other current federal land management rules, and the State of Alaska's Forest Resources and Practices Act~~"Additional Resources" section~~.
Recommended Conservation Measure #2. *"Avoid timber operations to the extent practicable near streams with EFH. For the Alaska region, see the following links: Fish: Forest-Wide Standards and Guides: http://www.fs.fed.us/r10/TLMP/F_PLAN/FPCCHAP4.PDF; http://www.or.blm.gov/ForestPlan/newsandga.pdf ; http://www.dnr.state.ak.us/forestry/pdfs/forpracregs.pdf."*	NMFS has indicated that it does intend to recommend BMPs that differ from those currently imposed by the Forest Service and the State of Alaska. This recommendation should make it clear that it is not intended as a source of additional BMPs, beyond those already required by federal or state law.	Avoid timber operations ~~to the extent practicable~~ near streams with EFH to the extent required by the Tongass Land Management Plan, the Chugach Land and Resources Management Plan, other current federal land management rules, and the State of Alaska's Forest Resources and Practices Act. For the Alaska region, see the following links: Fish: Forest-Wide Standards and Guides: http://www.fs.fed.us/r10/TLMP/F_PLAN/FPCCHAP4.PDF; http://www.or.blm.gov/ForestPlan/newsandga.pdf; http://www.dnr.state.ak.us/forestry/pdfs/forpracregs.pdf.
Recommended Conservation Measure #3 *"Avoid timber operations to the extent practicable in wetlands contiguous with anadromous streams. See the following links: Wetlands: Forest-Wide Standards and Guides: http://www.fs.fed.us/r10/TLMP/F_PLAN/FPCCHAP4.PDF"*	NMFS has indicated that it does intend to recommend BMPs that differ from those currently imposed by the Forest Service and the State of Alaska. The State of Alaska does not require buffers adjacent to wetlands above the mean higher high water mark of anadromous streams.	Avoid timber operations ~~to the extent practicable~~ in wetlands contiguous with anadromous streams to the extent required by the Tongass Land Management Plan, the Chugach Land and Resources Management Plan, other current federal land management rules, and the State of Alaska's Forest Resources and Practices Act. See the following links: Wetlands: Forest-Wide Standards and Guides: http://www.fs.fed.us/r10/TLMP/F_PLAN/FPCCHAP4.PDF

Recommended Conservation Measure #4 *"Avoid timber operations to the extent practicable near estuary and beach habitats. See the following links: Beach and Estuary Fringe: Forest-Wide Standards and Guides http://www.fs.fed.us/r10/TLMP/F_PLAN/FPCCHAP4.PDF"*	NMFS has indicated that it does intend to recommend BMPs that differ from those currently imposed by the Forest Service and the State of Alaska. The State of Alaska does not require buffers adjacent to estuaries above the mean higher high water mark of anadromous streams, nor does it require buffers along beaches. Moreover, there is no scientific support for requiring beach buffers in order to protect essential fish habitat. Beach buffers are required under federal rules for aesthetic purposes, which are beyond the scope of the EFH program.	Delete this measure
Recommended Conservation Measure #5. *"Maintain riparian buffers along all streams. In the Alaska region, buffer width is site-specific and dependent on use by anadromous fish and stream process type. Stream process groups are described in the following link: http://www.fs.fed.us/r10/TLMP/F_PLAN/APPEND_D.PDF. Standards and guidelines for riparian buffers for the Alaska region are described in the following links. Riparian Forest-Wide Standards and Guides: htttp://www.fs.fed.us/r10/TLMP/F_PLAN/FPCHAP4.PDF and http://www.fs.fed.us/r10/chugach/forest_plan/forest_plan_web.pdf; FPRA riparian buffer regulations can be found at http://www.dnr.state.ak.us/forestry/pdfs/fprachrt.pdf"*	NMFS has indicated that it does intend to recommend BMPs that differ from those currently imposed by the Forest Service and the State of Alaska. The State of Alaska does not require buffers along all streams, because an inter-agency scientific task force found that requiring buffer zones along non-anadromous streams was not needed to protect fishery resources.	Maintain riparian buffers along all streams to the extent required by the Tongass Land Management Plan, the Chugach Land and Resources Management Plan, other current federal land management rules, and the State of Alaska's Forest Resources and Practices Act. On federal land ~~I~~in the Alaska region, buffer width is site-specific and dependent on use by anadromous fish and stream process type. Stream process groups are described in the following link: http://www.fs.fed.us/r10/TLMP/F_PLAN/APPEND_D.PDF. Standards and guidelines for riparian buffers for federal land in the Alaska region are described in the following links. Riparian Forest-Wide Standards and Guides: htttp://www.fs.fed.us/r10/TLMP/F_PLAN/FPCHAP4.PDF and http://www.fs.fed.us/r10/chugach/forest_plan/forest_plan_web.pdf; FPRA riparian buffer ~~regulations~~ regulations for private and state-owned land in Alaska can be found at http://www.dnr.state.ak.us/forestry/pdfs/fprachrt.pdf
Recommended Conservation Measure #6 *"Incorporate watershed analysis into timber and*	NMFS has indicated that it does intend to recommend	To the extent required by the Tongass Land

silviculture projects. Particular attention should be given to the cumulative effects of past, present, and future timber sales within the watershed. See the following link on watershed analysis: http://www.fs.fed.us/r10/TLMP/F_PLAN/APPEND_J.PDF"	BMPs that differ from those currently imposed by the Forest Service and the State of Alaska. The State of Alaska does not require incorporation of watershed planning into timber projects on private land.	Management Plan, the Chugach Land and Resources Management Plan, other current federal land management rules, and the State of Alaska's Forest Resources and Practices Act, ~~I~~incorporate watershed analysis into timber and silviculture projects. Particular attention should be given to the cumulative effects of past, present, and future timber sales within the watershed. For federal lands in Alaska, ~~S~~see the following link on watershed analysis: http://www.fs.fed.us/r10/TLMP/F_PLAN/APPEND_J.PDF
Recommended Conservation Measure #8 *"For forest roads, see Section 2.3, Road Building and Maintenance. For the Alaska region, also see the following links: 1) transportation: forest-wide standards and guides http://www.fs.fed.us/r10/TLMP/F_PLAN/FPCHAP4.PDF and 2) soils and water: forest-wide standards and guides: http://www.fs.fed.us/r10/TLMP/F_PLAN/FPCHAP4.PDF; http://www.fs.fed.us/r10/chugach/forest_plan/forest_plan_web.pdf; http://www.dnr.state.ak.us/forestry/pdfs/forpracregs.pdf"*	NMFS has indicated that it does intend to recommend BMPs that differ from those currently imposed by the Forest Service and the State of Alaska. Some of the provisions of Section 2.3 conflict with existing BMPs, including the provision in Section 2.3 that requires all culverts to pass the 100-year flood. Since all existing forest road BMPs are already incorporated into the EIS' recommended conservation measures by virtue of Measure #7 ("Follow BMPs"), this measure is redundant, and will, because of the conflicts discussed above, create confusion.	Delete this measure.

John Tellinghast AK Forestry Assn,
Ron Wolfe, Sealaska Corp.

Appendix G: Discussion of "Log Transfer Facilities/In-water Log Storage"

Potential Adverse Impacts

EIS Allegation	*EIS' Alleged Support for Allegation*	*Actual State of Scientific Knowledge*	*Proposed Alternate Language*
1. *"Log handling and storage can result in water quality degradation and modification to habitat."*	No support is cited for this proposition. Statement gives no indication of the location or magnitude of the "degradation" or "modification." "Water quality degradation" implies degradation to the water column, for which there is no scientific support.	There is no evidence of marine LTF bark accumulations causing water quality degradation in the water surrounding the bark pile (*see #5, below*). The only water quality violations that have been detected occured in the intersticial waters within the bark pile itself, which is not used by fish species. *Id.* Older LTFs (those built before imposition of the EPA permit requirement in 1985) averaged 1.96 acres of continuous bark accumulation (Schultz and Berg [1976]). Post-1985 LTFs, built under the Alaska Timber Task Force LTF guidelines, averaged only .7 acres of continuous coverage (EPA [1996]). Continuous bark accumulations taper off quickly to discontinuous coverage with natural species characteristics (Sempert [2000]). Discontinuous coverage of up to 40% can be beneficial to the natural benthic community (Kathman et al. [1984]; Jacobs [2000]). *See also* ADEC LTF Adjudication, Hearing Officer Decision (2002). *"The discharge of bark and wood*	Log handling and storage can result in ~~water quality degradation and~~ localized modification to benthic habitat and water quality degradation within the intersticial waters of continuous bark accumulations that may be deposited on the ocean floor.

		debris at LTFs sited and operated in conformity with [current] permits will have limited and localized impacts on the benthic environment within a Project Area, but will have no discernible effect on the benthic environment as a whole in the geographic area covered by the General Permits." ADEC LTF Adjudication, Hearing Officer Decision (2002).	
2. *"The physical adverse impacts of these structures are similar in many ways to those of floating docks and other 'over-water' structures (Section 4.6).*	No support is cited for this proposition.	The only available study on impacts of shading on a marine LTF (Levy et al. [1982]) shows no material difference in abundance or growth of salmonids feeding in the log rafting area (Jacobs [2000]). The LTF permits prohibit most log storage in waters shallower than 40 feet.	Delete this sentence.
3. *"EFH may also be physically impacted by activities associated with LTFs. Bark and wood debris may impact EFH as a result of the abrasion of log surfaces from transfer equipment."*	No support is cited for the proposition that bark accumulations "impact EFH."	No water quality violations have been documented in the water around a marine LTF bark pile (*see section #5, below*). *"No adverse effects on fisheries have been reported* [from a marine LTF bark accumulation]*."* Tetra Tech (1996).	~~EFH~~ Benthic communities may also be physically impacted by activities associated with LTFs. Bark and wood debris may ~~impact EFH~~cause localized impacts to benthic communities as a result of the abrasion of log surfaces from transfer equipment.
4. *"Accumulation of bark debris in shallow and deep water environments*	No support is cited for the proposition that localized reductions of epibenthos in a bark pile "can ultimately impact various stages of groundfish."	There is no scientific support for the theory that an LTF bark pile leads to any reduction in the health or abundance of groundfish populations (McCrone [2000]; Jacobs [2000]).	Accumulation of bark debris in shallow and deep water environments has resulted in locally decreased epifaunal macrobenthos richness and

has resulted in locally decreased epifaunal macrobenthos richness and abundance (Kirkpatrick et al. 1998, Jackson 1986), which can ultimately impact various life stages of groundfish."		*"No adverse effects on fisheries have been reported* [from a marine LTF bark accumulation]." Tetra Tech (1996); ADEC LTF Adjudication, Hearing Officer Decision (2002).	abundance (Kirkpatrick et al. 1998, Jackson 1986)~~, which can ultimately impact various life stages of groundfish~~.
5. *"Log storage may also result in a significant release of soluble, organic compounds. Log storage may affect groundfish by significantly increasing oxygen demand within the area of accumulation (Pacific Northwest Pollution Control Council [PNPCC] 1971). High oxygen demand can lead to an anaerobic zone where toxic sulfide compounds are generated, particularly in brackish and marine waters. Leaching of soluble organic compounds also leads to cumulative oxygen demand and reduced visibility. Reduced oxygen levels, anaerobic conditions, and the presence of toxic sulfide compounds are presumed to lead to reduced groundfish species and their forage base. Anaerobic areas reduce available habitat."*	Cites only a 33-year-old literature search of anecdotal information (PNPCC 1971) which concludes that "data from field investigations which clearly define the impact of leachates on water quality are not available." No support is sited for the "presumption" that "groundfish species and their forage base" are being harmed by LTF bark accumulations.	*"No adverse effects on fisheries have been reported* [from a marine LTF bark accumulation]." Tetra Tech (1996). LTF bark accumulations have no material effect on the surrounding waters' "visibility." Tetra Tech 1996. No violation of dissolved oxygen standards has ever been detected in marine water surrounding an LTF bark pile—even in waters a mere 10 cm. from the top of the bark pile; the only violations found being in the intersticials waters *inside* a bark pile. Pease (1974); O'Clair (1988); Conlan & Ellis (1979); Alaska Timber Task Force (1985); United States Department of Justice/EPA (2000). *"Violations of Alaska's water quality standards for dissolved oxygen...at an LTF are unlikely to occur in the water column outside of an area of continuous coverage by bark and woody debris..."* LTF Adjudication, Hearing Officer Decision (2002). . No toxic concentrations of any substance have ever been detected in the water column surrounding an LTF bark pile, even in waters directly above	There is no evidence that ~~L~~log storage ~~may also~~ results in ~~a~~ the ~~significant~~ release of soluble, organic compounds into the surrounding marine water column; however, these compounds may be present in the intersticial waters inside the bark pile. Nor is there any evidence that ~~L~~log storage ~~may~~ affects groundfish by ~~significantly~~ increasing oxygen demand within the water column. High oxygen demand can, however, also occur in the intersticial waters within a bark pile. This, in turn, can -lead to an anaerobic zone where toxic sulfide compounds are generated. However, no violation of a water quality standard for sulfides or other toxic substances has ever been detected in the ~~, particularly in brackish and~~ marine waters surrounding an LTF bark accumulation. ~~Leaching of soluble organic compounds also leads to cumulative oxygen demand and reduced visibility.~~ Reduced oxygen levels, anaerobic conditions, and the presence of toxic sulfide compounds in the intersticial waters have never been found to have any effect on

		the bark pile. Pentac (1997); Conlan & Ellis (1979); O'Clair (1988); Tetra Tech (1996). *"The proposition that bark and wood debris produce toxic substances during decomposition [even] at Ward Cove...is unsound."* U.S. Dept. of Justice/EPA (2000). *"There are no documented field studies showing toxic concentrations of ammonia, sulfides or phenols in the water column at an LTF with bark and wood debris solely from LTF activities."* LTF Adjudication, Hearing Officer Decision (2002).	~~are presumed to lead to reduced~~ groundfish species and their forage base. ~~Anaerobic areas reduce available habitat.~~
6. *"In addition, soils at onshore facilities where logs are decked are often contaminated with gasoline, diesel fuel, solvents, etc., from trucks and heavy equipment. These contaminants can leach into nearshore EFH."*	No studies are cited demonstrating that leaching of hydrocarbons has occurred or is occurring at LTFs.	Leaching of hydrocarbons into waters of the United States is prohibited by both state and federal law.	In addition, soils at onshore facilities where logs are decked are often contaminated with gasoline, diesel fuel, solvents, etc., from trucks and heavy equipment. <u>Leaching of</u> ~~T~~<u>t</u>hese contaminants ~~can leach~~ into nearshore EFH <u>is prohibited by state and federal law</u>.

Recommended Conservation Measures

Measure	*Discussion*	*Proposed Alternate Language*
Recommended Conservation Measure #1 *"Storage and handling of logs should be restricted or eliminated from waters where state and federal water quality standards cannot be met at all times."*	NMFS has indicated this it is not its intent to impose standards different than the State of Alaska's water quality standards. The State of Alaska allows a zone of deposit in which water quality criteria can be exceeded. The measure, as written, is ambiguous as to whether the measure is intended to recognize this zone of deposit.	Storage and handling of logs should be restricted or eliminated from waters where state and federal water quality ~~standards~~ criteria cannot be met at all times outside of an authorized zone of deposit.
Recommended Conservation Measure #3. *"Storage of logs should not take place where they will ground at any time or shade aquatic vegetation."*	NMFS has indicated that it does not intend to impose requirements beyond the Alaska Timber Task Force LTF guidelines. The ATTF Guidelines do not require log storage to not "shade aquatic vegetation." Such a requirement is vague and overbroad, and taken literally could prohibit all log storage. Instead, the ATTF Guidelines impose a siting rule that log storage should be conducted in waters at least 40 feet deep. According to the ATTF, this rule will "protect [aquatic vegetation]...from...shading by log rafts." Under the EPA general permits for Alaska LTFs, this standard applies to all LTFs that received a U.S. Army Corps of Engineers' permit before October 22, 1985—a grandfather clause that recognizes that some older LTFs, whose storage areas were sited before adoption of the ATTF Guidelines, cannot feasibly comply with this siting guideline.	Storage of logs should not take place where they will ground at any time ~~or shade aquatic vegetation~~. Log storage at LTFs that received a U.S. Army Corps of Engineers permit on or after October 22, 1985 should be conducted in waters that are at least 40 feet deep at mean lower low water.
Recommended Conservation Measure #4 *"Avoid siting log storage areas and LTFs in sensitive habitats and areas important for specified species."*	NMFS has indicated that it does not intend to impose requirements beyond the Alaska Timber Task Force LTF guidelines. The ATTF Guidelines do prohibit LTF and log storage siting in a list of sensitive habitats. This measure, as written, is ambiguous as to whether it intends to adopt the ATTF list, or leave it to NMFS to define a different	Avoid siting log storage areas and LTFs in sensitive habitats and areas important for specified species, as required by the Alaska Timber Task Force guidelines.

	universe of "sensitive habitats" later. The ambiguity is especially acute given the use of the phrase "important for specified species," since that phrase is not used in the ATTF guidelines.	

Kevin Kennedy HO
10-9-04 C-3(b-d)

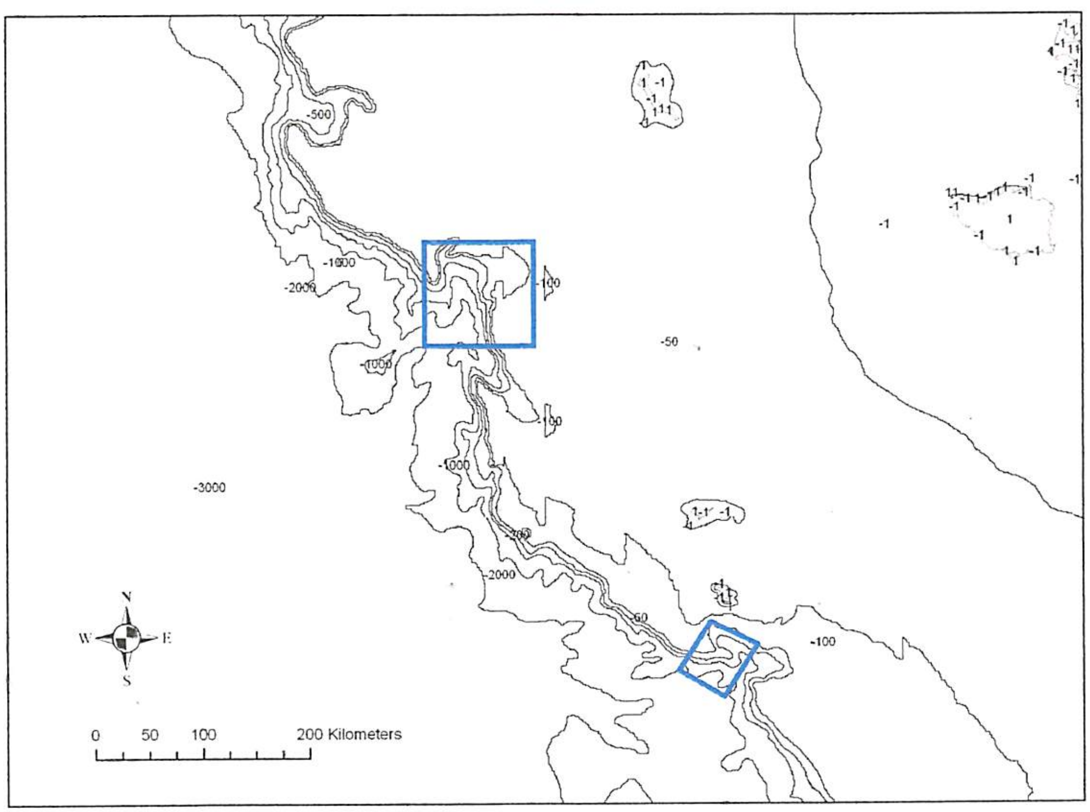
HAPC Alternative

Name of Proposer: TDX Corporation

Zhemchug and Pribilof Canyon

Zhemchug Canyon
Alternatives for analysis
Option #1: No action
Option #2: Prohibit bottom-tending mobile gear, including pelagic gear that contacts the bottom
Option #3: Prohibit all bottom-contact commercial fishing gear

Pribilof Canyon
Alternatives for analysis
Option #1: No action
Option #2: Prohibit bottom-tending mobile gear, including pelagic gear that contacts the bottom
Option #3: Prohibit all bottom-contact commercial fishing gear



AGENDA C-3(b)
SUPPLEMENTAL
OCTOBER 2004

HO/ 10-9-04
11:19 am

Alaska Marine Conservation Council

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September 28, 2004

Stephanie Madsen, Chair
North Pacific Fishery Management Council
605 W. 4th Avenue, Suite 306
Anchorage, AK 99501-2252

RECEIVED
SEP 28 2004
N.P.F.M.C.

Dr. James Balsiger
Regional Director
NMFS Alaska Region
PO Box 21668
Juneau, AK 99802-1668

RE: Agenda Item C-3: Essential Fish Habitat

Dear Dr. Balsiger and Ms. Madsen:

The Alaska Marine Conservation Council commends the National Marine Fisheries Service for initiating an independent scientific review of Appendix B of the Essential Fish Habitat Environmental Impact Statement (EFH EIS), an evaluation of fishing activities that may adversely affect essential fish habitat. The recent report by the U.S. Commission on Ocean Policy stressed the need for independent review of NMFS and Regional Fishery Management Council science. The NMFS decision to have an independent review demonstrates their commitment to ensuring that the best science is used in the fishery management process.

> Independent review is the hallmark of the scientific process, providing assurance that appropriate procedures for data collection and analysis have been used. Typically such reviews are conducted by scientists with expertise similar to those who have done the work; thus the process is called peer review… To ensure that these reviews are independent, a significant proportion of the reviewers should come from outside the region and be selected by a group such as the Center for Independent Experts.[1]

As the National Marine Fisheries Service moves forward with finalizing the EFH EIS, the analysis in Appendix B must first be revised based on the findings of the Center for Independent Experts (CIE). The CIE review of the NMFS analysis found significant flaws in the draft document that must be addressed in the final version of the EIS. As it stands now, Appendix B is critically flawed and the conclusions drawn from it may have dangerous consequence for the health of Alaska's marine ecosystem and sustainable fisheries. Dr. Paul Snelgrove of the independent review team warned that the primary conclusion drawn from

[1] U.S. Commission On Ocean Policy. An Ocean Blueprint for the 21st Century. Chapter 19, pg 235.

this analysis, "that current fishing activities are having no effect on EFH is premature at best, and potentially dangerous for the long-term sustainability of Alaskan fisheries."[2]

This letter focuses on just four of the key findings of the review conducted by the Center for Independent Experts. The CIE review of Appendix B found that 1) the use of minimum stock size threshold (MSST) as an evaluation tool "was not considered to be appropriate," 2) the analysis failed to adequately address localized impacts, 3) the analysis failed to incorporate the best available scientific information, and 4) the analysis did not incorporate a measure of precaution.

1) Minimum Stock Size Threshold

The mathematical model used to determine the long-term effects on habitat (the habitat reduction model) was not the only information used to determine whether or not fishing impacts are more than minimal and not temporary in nature. The analysis relied heavily on the status of individual stocks in relation to their Minimum Stock Size Threshold, or overfishing level, to determine any adverse impacts to essential fish habitat. The CIE noted, "the model [habitat reduction model] results appeared seldom used in the evaluation, with almost exclusive reliance placed on the abundance of stocks relative to MSST."[3] The CIE took a resounding opposition to the MSST evaluation saying:

> The use of the stock abundance relative to MSST to assess the possible influence of habitat degradation on fish stocks was not considered to be appropriate for several reasons, including that habitat effects are only one of many factors that influence the stock abundance, the criterion provides no spatial information, and the expected lag between habitat destruction and detection of its effect on the stock productivity is expected to be long, such that the habitat may be destroyed before mitigation could be implemented.[4]
>
> ...
>
> The very nature of EFH, and its importance to multiple life stages and activities renders MSST a very insensitive measure of the ramifications of EFH loss because MSST operates on a spatial scale that is unlikely to respond in the short term to local habitat effects. It is this delayed response in MSST that suggests its use as a primary diagnostic tool is the antithesis of any precautionary approach.[5]

The use of MSST as a tool to evaluate the effects of fishing on habitat is a product of the Council and NMFS efforts to link production rates of individual species to habitat type. The Council's problem statement for EFH states, "The intent of the Council is for those FMP species where data are available, habitat measures should be applied to minimize the effects of fishing on habitat essential to continued productivity of the managed species."[6]

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[2] Dr. P. Snelgrove. July 2004. Review of the National Marine Fisheries Service and the North Pacific Fishery Management Council Draft EIS with respect to Essential Fish Habitat: Evaluation of Fishing Activities that May Adversely Affect Essential Fish Habitat, at 3.
[3] Dr. K. Drinkwater. July 2004. Summary Report, at 16.
[4] Ibid at 2.
[5] Dr. P. Snelgrove, *supra note* 2, at 2.
[6] Draft EFH EIS. January 2004, at 1-3.

Yet the EFH final rule does not require such a high, unattainable measure for determining adverse impacts. In the preamble to the rule, NMFS states, "It is not appropriate to require definitive proof of a link between fishing impacts to EFH and reduced stock productivity before Councils can take action to minimize adverse fishing impacts to EFH to the extent practicable. Such a requirement would raise the threshold for action above that set by the Magnuson-Stevens Act." [7]

The data linking production rates of managed species to habitat is considered by NMFS as "level 4" data.[8] In the Alaska region, only level 2 data and in a few instances, level 3 data are available for managed species. At level 2, quantitative data (i.e. density or relative abundance) are available for the habitats occupied by a species or life stage. **The best available science suggests that the degree to which the habitat is utilized by a managed species, is indicative of its habitat value.** In **no** instance do we have level 4 data in which "essential habitats are those necessary to maintain fish production consistent with a sustainable fishery and the managed species contribution to a healthy ecosystem."[9]

The Council's Scientific and Statistical Committee (SSC) has notified the Council that establishing links between stock productivity and habitat is virtually impossible at this time simply because the current level of scientific information is not available (i.e. we have level 2 information but not level 4 information).

> Some have argued that sustained productivity of Alaskan groundfish fisheries does not prove evidence of loss of productivity from habitat damage. On the other hand, linkages between habitat and productivity of FMP species are virtually impossible to establish experimentally. Based on the NRC [National Research Council] trawling effects report and other reviews, the presumption is that mobile-bottom contact gear affects habitat.[10]

The SSC reiterated this concern in March 2004, stating:

> The SSC notes that it may not be possible to motivate the protection of rare and fragile habitats (e.g. habitat found on seamounts and coral gardens) solely on the basis of their linkage to the productivity of managed species.
>
> ...
>
> The SSC believes that this is a very high standard of evidence and may not be consistent with [the] Council's precautionary approach. The SSC recognizes that there are high costs and a long time frame required to achieve a scientifically credible understanding between these habitats and fish productivity.[11]

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[7] EFH Final Rule – response to comments, January 17, 2002, pg 2354.
[8] EFH Final Rule 50 CFR § 600.815 (a)(iii)(4)
[9] Ibid.
[10] NPFMC SSC, January 2003. Draft Minutes, at 5.
[11] NPFMC SSC, March 2004. Draft Minutes, at 5.

Recommendation #1: *"The remedy seems clearly to replace the MSST criterion with consideration of fishery impacts on the EFH itself as the primary criterion."*[12]

Since the best available science suggests that "the degree to which the habitat is utilized is assumed to be indicative of its habitat value" [13], it is appropriate to consider fishing impacts on the habitat itself as the primary criterion. The evaluation of fishing on essential fish habitat should be conducted without the MSST evaluation. Instead, the analysis should more accurately reflect guidance from the SSC, the CIE review, and the EFH Final Rule, which describes how to proceed with the level of data currently available.

2) Localized Impacts

The EFH Final Rule clearly defines adverse impacts to essential fish habitat and the scale at which they occur. The final rule states, "adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may **include site-specific** or habitat wide-impacts, including individual, cumulative, or synergistic consequences of actions."[14] Despite the clear statement that adverse impacts can be site-specific, the evaluation of fishing activities in Appendix B did not consider impacts at a site-specific scale. The CIE panel stated:

> It was the unanimous opinion of the panel that adequate consideration was not given to localized habitat impacts in Appendix B. Instead the report focused almost exclusively on population indices, e.g. total abundance relative to MSST. There was little discussion in Appendix B of whether localized habitat was being destroyed at a rate that was unsustainable. In no case was it recommended that specific habitat be protected even where the model indicated substantial local habitat had been lost.[15]

Site-specific impacts in the North Pacific are evident from the bycatch of habitat forming marine life such as corals, sponges and sea whips.[16] "Levels of coral, sponge and bryozoan bycatch in the Alaskan trawl fisheries, particularly in the Aleutian region, based on observer records are a matter of concern, but these data were not analyzed or incorporated into the model formulation or validation process."[17] The CIE panel also noted that impacts to spawning aggregations, a site-specific impact, need consideration in the anlaysis. "There was no assessment and little discussion on the effects of fishing on the spawning beds or the spawning aggregations."[18] A prime example is that there was no consideration in the draft EFH EIS of areas determined to be the "primary broodstock habitat" for mature female red king crab, north of Unimak Island.[19]

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[12] Dr. J. Anthony Koslow. July 2004. Report of the Center for Independent Experts, at 9.
[13] EFH Final Rule 50 CFR § 600.815 (a)(iii)(2)
[14] Ibid at § 600.810 (a)
[15] Dr. K. Drinkwater. Summary Report, at 20.
[16] NMFS, Alaska Groundfish Fisheries Final Programmatic Supplemental Environmental Impact Statement, at A-T-535.
[17] Dr. K. Drinkwater, Summary Report, at 15.
[18] Ibid at 20
[19] Armstrong, D. A., Wainwright, T. C., Jensen, G. C., Dinnel, P. A., and Andersen, H. B. 1993. Taking refuge from bycatch issues: Red king crab (*Paralithodes camtschaticus*) and trawl fisheries in the eastern

Recommendation #2: Examine the long-term changes in abundance of fish and crab in relation to habitat types at a localized scale. Discuss in appendix B, vulnerable habitat features and connections to managed species that aggregate in such habitats. Also, the analysis should use spatially explicit models to investigate the rate of destruction of hard corals and sponges.

3) Best Available Scientific Information

NMFS is always required to use the best available science. National Standard 2 of the Magnuson Stevens Act states, "Conservation and management measures shall be based upon the best scientific information available." The reviewers found that the NMFS analysis failed to incorporate much scientific information, including some of the agency's own research here in Alaska.

"The reviewed literature appeared in the DEIS (Chapter 3) and was supplied to the panel during the review meeting. It covered many recent papers, but neglected a surprising number of key studies and reviews."[20]

...

"I conclude that the DEIS does not incorporate the best available scientific information and does not provide an adequate basis for understanding the impacts of fishing on essential fish habitat in Alaska."[21]

As previously mentioned, scientific research conducted by Alaska Fisheries Science Center scientists and documented by other researchers, describe the importance of a habitat area north of Unimak Island to mature female red king crab. [22] Yet in the review of fishing activities that may adversely affect Bristol Bay red king crab, this information was summarily ignored.

Recommendation #3: Scientific information pertinent to understanding fishery impacts on habitat, habitat use by fish and crab species, and the benefits of protected areas that was brought forth by the CIE panel and in public comments, must be reviewed and incorporated into the EFH EIS.

4) Precautionary Approach

The precautionary approach is a cornerstone of modern fisheries management. Yet the NMFS evaluation of the effects of fishing on essential fish habitat has been labeled as "the antithesis of any precautionary approach." The draft EFH EIS lays the entire burden of proof on the public and science to prove an adverse effect to the "continued productivity of the

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Bering Sea. Canadian Journal of Fisheries and Aquatic Sciences. 50(9): 1993-2000. AND, Dew, C.B., and R.A. McConnaughey. (submitted for publication) Did Bottom Trawling in Bristol Bay's Red King Crab Brood-Stock Refuge Contribute to the Collapse of Alaska's Most Valuable Fishery?

[20] Dr. K. Drinkwater, Summary Report, at 11.

[21] Dr. J. Anthony Koslow, *supra note* 12, at 7.

[22] Armstrong et al. and Dew et al., *supra note* 19.

managed species" before conservation measures are applied. This was done despite being advised by the SSC and the public that current levels of scientific information cannot achieve a scientifically credible understanding of productivity and habitat. Yet vast amounts of scientific information suggest that a link between habitat and managed species exist. Even the U.S. Congress understands this link, stating:

> One of the greatest long-term threats to the viability of commercial and recreational fisheries is the continuing loss of marine, estuarine, and other aquatic habitats. Habitat considerations should receive increased attention for the conservation and management of fishery resources of the United States.[23]

The precautionary approach needs to be applied not only at a management level, but within the Essential Fish Habitat EIS as well. NMFS has structured their analysis in a highly un-precautionary way, which led to the conclusion in Appendix B that no managed fishery is having an impact on habitat that is more than minimal and not temporary in nature.

Recommendation #4: The Alaska Marine Conservation Council concurs with the CIE review that, "Finally a precautionary approach needs to be applied because of the large uncertainties in our knowledge of the links between habitat and the life stages of the various fish species." The CIE recommended to, "Use the precautionary approach especially where the data are unclear, where recovery times are long (e.g. for corals and sponges), or where habitat reduction is high even if the abundance levels are above MSST."[24]

The Alaska Marine Conservation Council appreciates the hard work by the Center for Independent Experts review panel. Now, NMFS and the Council must ensure that the appropriate steps are taken to fix the fishing affects analysis in the final EFH EIS. The analysis must evaluate fishing activities on EFH itself (not rely on the MSST evaluation), address localized impacts, use the best scientific information available, and incorporate the precautionary approach.

Sincerely,

Ben Enticknap
Fishery Project Coordinator

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[23] 16 U.S.C. § 1801(a)(9)
[24] Dr. K. Drinkwater, Summary Report, pgs 2-3.