Guidance on Cumulative Effects Analysis in Environmental Assessments and Environmental Impact Statements

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ABSTRACT

This guidance document provides a summary of how to plan and conduct cumulative effects analysis/assessment (CEA) studies for environmental impact statements (EISs) and environmental assessments (EAs). The NOAA Fisheries Service-related CEA process incorporates CEQ's 11-step CEA approach and includes two components – Scoping and Baseline, and Impact Analysis. Each component is comprised of requisite building blocks. For example, Scoping and Baseline integrates affected environment information with effects information from other non-fishing and fishing actions to define the CEA baseline. The impact analysis component integrates the CEA baseline findings with the direct and indirect impacts of alternatives to determine cumulative effects. The identified cumulative effects are then evaluated relative to their significance, and potential follow-on activities such as monitoring and adaptive management can be considered. Practical approaches are described for each building block and information is included on the development of matrix tables which can be used to summarize the findings. To support this CEA process, case law was reviewed to determine the compatibility of the process with Court decisions. The case law review focused on three precedent-setting cases (one on connected actions and two on reasonably foreseeable future actions), a comprehensive review of 25 appellate-level CEA cases, and a review of 32 cases related to incomplete and unavailable information. In summary, the CEA process described herein is consistent with NEPA regulations, is compatible with the CEQ's 11-step CEA approach, and is in consonance with relevant case law.

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Purpose of this Guidance

Cumulative effects analysis/assessment (CEA) is a relatively new topical issue which is being addressed in National Environmental Policy Act (NEPA) compliance documents. The term "cumulative impacts" was originally introduced in early 1970s guidelines promulgated by the Council on Environmental Quality (CEQ); and a definition was incorporated in the CEQ's NEPA regulations published in 1979 (Council on Environmental Quality, 1986). In the 1980s and early 1990s, some attention was given to CEA in environmental impact statements (EISs) and environmental assessments (EAs); however, the extent of coverage was widely varied, primarily because no specific implementing process had been promulgated. In 1997, the CEQ issued a guidance report, also referred to as a handbook, which described an 11-step CEA process (Council on Environmental Quality, 1997). The availability of this process, as well as increasing litigation related to the inadequacy of CEA within EISs and EAs, quickly prompted Federal agencies, including the National Oceanic and Atmospheric Administration (NOAA) Fisheries Service, to give increased attention to this topic.

Cumulative Impacts result from the incremental effects of an action when considered together with other past, present, and reasonably forseeable future actions regardless of who takes the other action.

Numerous scientific and policy challenges were soon recognized regarding the inclusion of CEA within NEPA compliance documents. One example of such a challenge is the context problem of considering the impacts of an FMP (Fishery Management Plan) comprised of multiple fishery management measures within the same spatial areas where other FMPs exist. Another key challenge is accounting for the dynamic nature of target fish species life histories within an FMP; for example, there may be seasonal movement patterns occuring over large spatial areas. Further, the effects of gear types for one fishery may disturb the essential fish habitat (EFH) for the target species of other concurrent managed species. Uncertainties also exist relative to combining effects on common resources; that is, are the effects additive or non-additive?

Despite the challenges noted above, the body of knowledge related to cumulative effects on marine fisheries has expanded over the last decade; thus, a more defined process for CEA can be articulated. In recognition of this enhanced knowledge base, the purpose of this guidance document is to describe a practical and cost-effective CEA process for inclusion in EISs and EAs. The results of this process may be included in the final part of environmental consequences sections within EISs or EAs or as a separate cumulative effects sub-section. This guidance document is focused on conducting CEAs for fishery management applications in the Northeast Region (Region) of NOAA Fisheries Service.

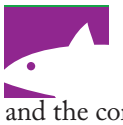
Following this brief introductory section, this guidance document includes a section on the requirements of the NEPA regulations which are related to CEAs. Three features include pertinent definitions of terms and related requirements, the need for quality information, and assessment of the significance of cumulative effects.

An integrated approach for conducting CEAs comprises the third and most important section. The approach, which is derived from the CEQ's 11-step process, is based on a model for developing the "CEA Baseline" and then analyzing the incremental effects of the preferred and other alternatives. Depending on the significance of the cumulative effects, follow-up activities related to monitoring and adaptive management may be needed. Accordingly, the third section includes several subsections which address features of this fishery-related CEA approach.

The remaining two sections focus on the presentation of CEA findings in EISs or EAs, and relevant case law. The conclusions from this guidance document are then articulated, and the utilized references are cited. Finally, five appendices are included. Appendix A provides a summary of CEQ's 11-step CEA process, while Appendix B includes some U.S. Environmental Protection Agency (USEPA) review questions related to direct, indirect, and cumulative effects of FMPs and their amendments. Appendix C includes examples of matrix tables which can be used for summarizing and communicating CEA information in EISs and EAs. Appendix D provides some case studies of how CEA has been applied in both EIS and EAs. Appendix E summarizes three emerging topics which may need increased attention in

future CEAs. Finally, Appendix F provides a checklist for completing cumulative impact assessments.

Requirements of NEPA regulations for addressing cumulative effects



This section highlights selected requirements related to cumulative effects as contained in the NEPA regulations of CEQ and the corollary regulations of NOAA. Specific subsections are included on the types of effects to be addressed in NEPA compliance documents; information quality relative to both Affected Environment and Environmental Consequences sections of EISs and EAs; and significance determinations for direct, indirect, and cumulative effects.

Types of Effects

Several regulatory definitions and content requirements for EISs (or EAs) are related to the environmental consequences. Two key definitions, which are included in the CEQ's NEPA regulations, include (Council on Environmental Quality, 1986):

- **Direct and Indirect Effects or Impacts (Section 1508.8)**
  Effects include direct effects which are caused by the action and occur at the same time and place. In contrast, indirect effects are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable. Indirect effects may include effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems. Effects and impacts can be considered as synonymous terms. Effects may be ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also those result from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the overall effect will be beneficial.

- **Cumulative Effects/Impacts (Section 1508.7)**
  This term refers to the impact on the environment which results from the incremental effects of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

Documentation and Content

As appropriate, both EISs and EAs are required to address direct, indirect, and cumulative effects. The brief requirement related to EAs is included in Section 1508.9(b) – "An EA shall include brief discussions of the need for the proposal, of alternatives as required by section 102(2) (E) of NEPA, of the environmental impacts (effects) of the proposed action and alternatives, and a listing of agencies and persons consulted (Council on Environmental Quality, 1986)." More detailed requirements are stipulated for the technical requirements of EISs in Sections 1502.16 and 1502.14 (Council on Environmental Quality, 1986):

- **Environmental Consequences (Section 1502.16)**
  This section forms the scientific and analytic basis for the comparisons under Sec. 1502.14. The discussion will include the environmental impacts of the alternatives including the proposed action, any adverse environmental effects which cannot be avoided should the proposal be implemented, the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented. As appropriate, the section shall include discussions of:

(a) Direct effects and their significance (infers the consideration of cumulative effects as per Section 1508.25 (Scope)).

(b) Indirect effects and their significance (infers the consideration of cumulative effects as per Section 1508.25 (Scope)).

(c) Possible conflicts between the proposed action and the objectives of Federal, regional, state and local (and in the case of a reservation, Indian tribe) land use plans, policies and controls for the area concerned.

(d) The environmental effects of alternatives including the proposed action.

(e) Energy requirements and conservation potential of various alternatives and mitigation measures.

(f) Natural or depletable resource requirements and conservation potential of various alternatives and mitigation measures.

(g) Urban quality, historic and cultural resources, and the design of the built environment, including the reuse and conservation potential of various alternatives and mitigation measures.

(h) Means to mitigate adverse environmental impacts.

- **Section 1502.14 – Alternatives Including the Proposed Action:**

  This section is the heart of the environmental impact statement. Based on the information and analysis presented in the sections on the Affected Environment (Section 1502.15) and the Environmental Consequences (Section 1502.16), it should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decisionmaker and the public. (Note that the term environmental impact infers the identification and evaluation of direct, indirect, and cumulative impacts.) Section 1502.14 also addresses the evaluation of reasonable alternatives, the elimination of other alternatives, the inclusion of a "no action" (status quo) alternative, and the agency's identification of a preferred alternative.

The NEPA regulations of NOAA also reference the above definitions and concepts from CEQ's regulations and the "40 Most Frequently Asked Questions" support and expand upon these concepts (Council on Environmental Quality, 1981 and 1986). In addition, CEQ's NEPA regulations highlight the importance of scientific accuracy in the prediction of direct, indirect, and cumulative effects. Further, documentation of utilized methods and models is required. Specifically, these requirements are found as follows in the CEQ's NEPA regulations (Council on Environmental Quality, 1986) – Section 1502.24 – Methodology and Scientific Accuracy: Agencies shall insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements. They shall identify any methodologies used and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the statement. An agency may place discussion of methodology in an appendix.

Information Quality

Under the Information Quality Act (Section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (Public Law 106-554)), all NEPA documents that are disseminated to the public must address the utility, integrity, and objectivity of the information included in the document and used as the basis for making decisions regarding the proposed action, as required to complete the pre-dissemination review. Therefore, any data used in the cumulative effects analyses, including those contained in the Affected Environment and the Environmental Consequences sections of EISs and EAs, should use the "best scientific information available." In addition to the Magnuson-Stevens Fishery Conservation and Management Act (MSA), this concept has also been incorporated in the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA). Section 301 of the MSA, as amended, identifies the ten national standards for fishery conservation and management, with National Standard No. 2 stating that "… conservation and management measures shall be based upon the best scientific information available" (National Marine Fisheries Service, January 12, 2007, p. 58).

The CEQ regulations also acknowledge that the information which may be needed for describing the Affected Environment (implicit) and for determining Environmental Consequences (explicit) may be incomplete or unavailable. Accordingly, the regulations include a four-step procedure which all agencies should follow. The procedure is focused on significant adverse effects; however, by inference this includes the baseline conditions (often described in the affected environment section) serving as the reference for assessing the significance of the adverse effects. The procedure is in Section 1502.22 (Council on Environmental Quality, 1986):

> "When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an EIS and there is incomplete or

unavailable information, the agency shall always make clear that such information is lacking. (a) If the incomplete information relevant to reasonably foreseeable significant adverse impacts is essential to a reasoned choice among alternatives and the overall costs of obtaining it are not exorbitant, the agency shall include the information in the EIS. (b) If the information relevant to reasonably foreseeable significant adverse impacts cannot be obtained because the overall costs of obtaining it are exorbitant or the means to obtain it are not known, the agency shall include within the EIS:

(1) a statement that such information is incomplete or unavailable;
(2) a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment;
(3) a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment, and
(4) the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community. For the purposes of this section, "reasonably foreseeable" includes impacts which have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason."

The above four-step procedure, which was promulgated in 1986, has been found to be useful in addressing this information topic. Further, as summarized in the subsequent review of case law, agency adherence to the procedure has been upheld in the Supreme Court, and Appellate and District Court levels of the Federal system.

Significance Determination for Effects

Cumulative effects addressed in an EIS or EA must be assessed relative to their significance in addition to the direct and indirect effects. This assessment (interpretation) is particularly important relative to the effects identified within an EA. By definition, none of the effects on the human environment in an EA should be significant; however, this outcome could be achieved by mitigating the effects which would otherwise be significant. For EISs, mitigation measures are routinely incorporated within management measures to reduce adverse (and significant) effects to a non-significant level. Accordingly, the terms "significantly" and "mitigation" are important definitions in the CEQ's NEPA regulations (Council on Environmental Quality, 1986).

Significantly requires considerations of both context and intensity. **Context** *means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality.* **Intensity** *refers to the severity of impact.*

Significantly, as defined in Section 1508.27, requires considerations of both context and intensity. Context means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant. Intensity refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. The reader is referred to Section 1508.27 for the list of the 10 factors considered in evaluating intensity.

The specific NEPA regulations for NOAA Fisheries Service in NOAA Administrative Order 216-6 (National Oceanic and Atmospheric Administration (NAO), 1999) also include an eleventh item for the CEQ's intensity definition related to the introduction or spread of a non-indigenous species. Further, Section 6.02 of the NAO includes specific guidance on the significance of fishery management actions. This guidance expands the definition above (Section 1508.27) and includes an additional nine factors (some of the listed items are similar to the intensity factors from Section 1508.27). The reader is encouraged to read Section 6.02 to review these factors.

Mitigation includes avoiding the impact altogether

by not taking a certain action or parts of an action; minimizing impacts by limiting the degree or magnitude of the action and its implementation; rectifying the impact by repairing, rehabilitating, or restoring the affected environment; reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; or compensating for the impact by replacing or providing substitute resources or environments.

To summarize both the CEQ's definition of significantly as well as NOAA's guidelines, it should be noted that both can be utilized for determining the significance of cumulative effects associated with marine fisheries management. Further, NMFS finding of no signifiicant impact (FONSI) Guidance in NMFS Instruction 30-124-1, dated July 22, 2005, provides a series of 16 questions for fishery management actions (14 for non-fishery actions) based on CEQ and NAO 216-6 Sections 6.01 and 6.02 factors that must be addressed in the FONSI. While only two factors specifically address cumulative effects, the consideration of cumulative effects is implicit in all the questions listed.

Approach for conducting a cumulative effects assessment

As mentioned above, in 1997, CEQ published an 11-step CEA process for use by Federal agencies in their NEPA compliance documents (Council on Environmental Quality, 1997). These steps are listed in Table 1 below and are further explained in Appendix A. The first four numbered steps are related to scoping (establishing the study boundaries relative to effects, space, time, and effects contributions from other actions). Steps 5 through 7 relate to describing the Affected Environment from an historical reference point to the current condition. The concept of addressing environmental sustainability was also introduced in Step 5. Finally, Steps 8 through 11 include determining the cumulative environmental consequences and considering the need for potential follow-on activities related to mitigation, monitoring, and the use of adaptive management to address uncertainties in current and future cumulative effects. Appendix A herein contains a summary of the features of the 11 steps and how they are related to each other. Further,

Table 1. CEQ Steps for Cumulatve Effects Analysis in EAs and EISs (from CEQ 1997)

EA/EIS Components	CEA Steps
Scoping	1. Identify the significant, or potentially significant, cumulative impacts issues associated with the proposed action and define the assessment goals. 2. Establish the geographic scope for the analysis. 3. Establish the time frame for the analysis. 4. Identify other past, present, and reasonably foreseeable actions affecting the resources, ecosystems, and human communities of concern.
Describing the Affected Environment	5. Characterize the resources, ecosystems, and human communities identified in scoping in terms of their response to change and capacity to withstand adverse impacts. 6. Characterize the natural and human factors that adversely affect these resources, ecosystems, and human communities and their relation to safety or security thresholds established through regulations. 7. Define a baseline condition for the resources, ecosystems, and human communities.
Determining the Envrionmental Consequences	8. Identify the important cause-and-effect relationships between human activities and resources, ecosystems, and human communities. 9. Determine the magnitude and significance of cumulative impacts. 10. Modify or add alternatives to avoid, minimize, or mitigate adverse significant cumulative impacts arising from Federal activities, and identify opportunities to work with others to avoid, minimize, or mitigate adverse effects caused by non-Federal activities. 11. Monitor cumulative impacts of the selected alternative and apply adaptive management.

potential methods for usage throughout the process are also noted in Appendix A. Finally, the presentation of the 11 numbered steps infers a linear process. However, this is not necessarily the best conceptual approach when considering the need for iterations and multiple relationships between certain steps. Accordingly, the first subsection herein describes an alternative model for use in CEA studies related to marine fisheries. The following subsections then relate to features within the model; they include identifying direct/indirect impacts of the action on selected Valued Ecosystem Components (VECs), describing conditions and trends for the selected VECs, identifying other contributing actions, connecting the incremental impacts with the CEA baseline, and evaluating the resulting cumulative effects.

Model for CEA Baseline and Impact Analyses

NOAA Fisheries Service has developed a rearranged approach for conducting CEAs; however, it should be noted that all 11 of the CEQ's steps are incorporated. The rearranged approach is shown in Figure 1 (Tomey, et al., 2006). Rather than a strictly linear process, two additive equations are shown, one for Scoping and Baseline and the other for Impact Analysis. In addition, boxes are shown in Figure 1, and they can be conceptualized as building blocks for CEA.

The terminology used in Figure 1 relates to the CEQ's 11-step process as follows:

- **Scoping and Baseline** – reflects the Scoping phase (Steps 1-4), the Description of the Affected Environment phase (Steps 5-7), and Step 8 of the Determining Environmental Consequences phase of CEQ's process.

- **Existing Conditions/Status/Trends of Each Resource** - is captured in the Affected Environment Section of the EA or EIS and reflects Steps 5-7 of CEQ's process; the term VEC can be substituted for the term "resource." The term VEC denotes a Valued Ecosystem Component, which is important to the decisions related to fisheries management. (Note: this box can be considered to be a building block.)

- **Past/Present/Reasonably Foreseeable Non-Fishing Actions, and Past/Present/Reasonable Foreseeable Fishing Actions** – these two boxes are reflective of Step 4 (other actions) and Step 8 (cause-and-effects linkages) in CEQ's process. The output of both boxes (building blocks) should be expressed in relation to effects on the conditions and trends of the VECs and their indicators.

- **CEA Baseline** – reflects the outputs of Steps 1-8 in the CEQ process. It should be noted that the CEA Baseline does not refer to the traditional use of the term "baseline" for impact studies (could be termed the Environmental Impact Assessment (EIA) process Baseline). The EIA Baseline typically focuses on current (existing) conditions for the VECs as well as projections of future changes in these conditions if the "no project" or "no-action" (status quo) alternative is chosen.

- **Impact Analysis** – reflects Steps 9-11 of the Determining Environmental Consequences phase of CEQ's process.

- **CEA Baseline** – same as described above; it is the output of Scoping and Baseline. Direct/Indirect Impacts of Alternatives – reflects the results of Step 1 of the CEQ's process. This step focuses on cumulative effects issues of concern, and identifying the direct/indirect effects of the preferred and other alternatives represents a beginning point for the study. Further, from the anticipated direct/indirect effects of this building block, the VECs to be utilized can be selected, and their spatial and temporal boundaries can be specified. (Steps 2 and 3 of CEQ's process).

- **Cumulative Effect** – reflects Step 9 (magnitude and significance of cumulative effects) and Steps 10 and 11 (mitigation, monitoring, and adaptive management) of CEQ's process.

In terms of a time-sequence of activities in a CEA study, the following boxes should be addressed:

- **Step A** – Identify the direct/indirect impacts of the preferred and other alternatives. These impacts can be referred to as incremental impacts. Then, based on these anticipated impacts, identify the spatial and temporal boundaries for the study, and select pertinent VECs and their indicators. Finally, prepare a summary table reflecting the impacts on the selected VECs Table 2 (and

Table C-2 in Appendix C) provide examples of such a table (tables developed by NMFS NEPA staff).

- **Step B** – Assemble historical and current information on the status and trends of the VECs and their indicators and then summarize and assess these conditions in the Affected Environment section. A tabular approach could be used to summarize the findings, as exemplified in Table 3 below (see page 10).

- **Step C** – Identify other past, present, and reasonably future actions which would be expected to have been, are now, or will be, contributing their impacts on the selected VECs. A convenient way to divide these other actions is by "fishing related" and "non-fishing related" actions. Summary tables for expressing the effects of these two categories of actions should also be assembled. Tables 4 and 5 (excerpted from Tables C-3 and C-4 in Appendix C) are on fishing related actions, while Table 6 (excerpted from Table C-5) is for non-fishing related actions.

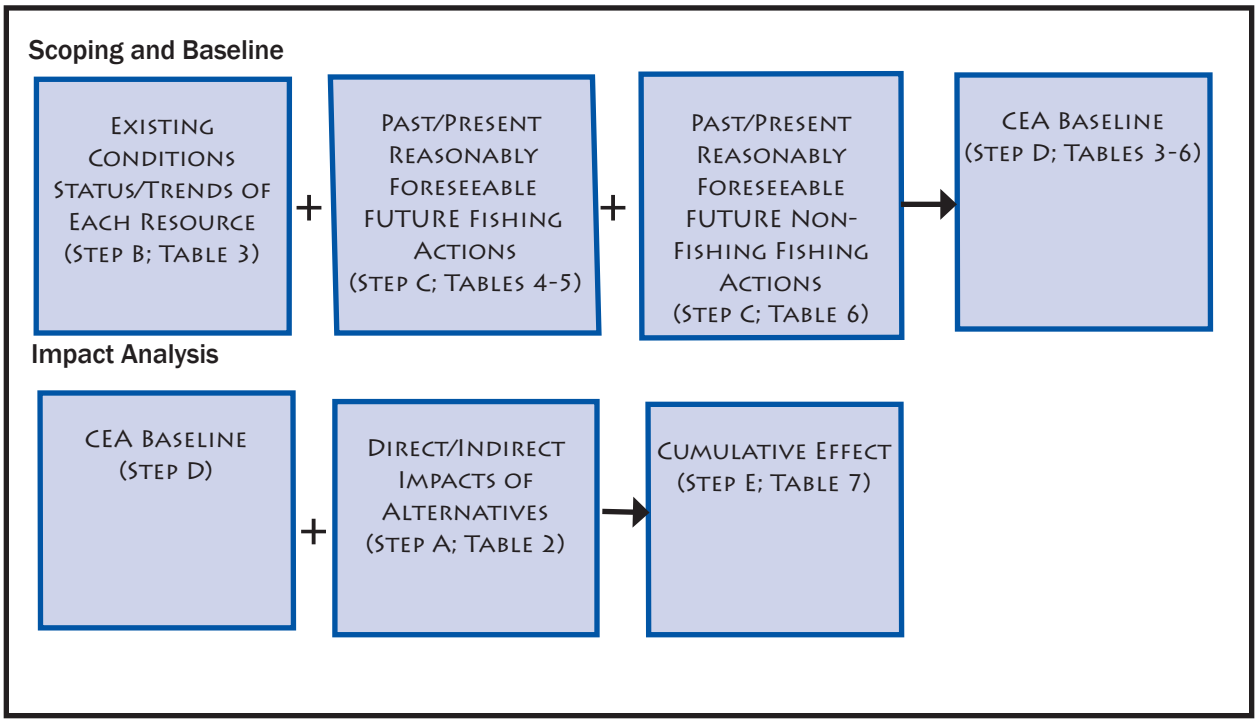
- **Step D** – Describe the CEA Baseline by considering each VEC in relation to its temporal conditions and the effects of other actions on each VEC. The sum effects of Tables 3 through 6 (C-3 through C-5 in Appendix C) comprise the CEA Baseline impacts for each VEC. The net sum of the Baseline impacts can be summarized in Table 7 and/or in a separate table.

- **Step E** – Consider the incremental impacts of the preferred and other alternatives on each VEC and indicator (Table 2 and C-2 in Appendix C); then aggregate this information with the impacts of other actions (Tables 4-6 below, and Tables C-3 through C-5 in Appendix C) and the existing conditions (Table 3) to evaluate the sum cumulative effects in Table 7 (excerpted from Table C-6 in Appendix C).

- **Step F** – Develop monitoring and adaptive management plans as appropriate.

To illustrate how these steps can be applied in a variety of NEPA documents, Appendix D exhibits case studies of a recent region-specific EA and EIS as examples of how to apply this CEA guidance in real situations. The EA example dealt with low/minor

Figure 1. CEA Model for Baseline and Impact Analysis



impact projects, while the EIS example was associated with moderate/major impact projects. Several other NEPA documents also are cited as examples used in a variety of regional regulatory actions. The reader is encouraged to review these documents and compare how the assessments were applied relative to the steps outlined below.

Step A - Direct/Indirect Impacts of the Action on Selected VECs

The above definition of cumulative effects includes several features which need to be included within a systematic approach for identifying and assessing cumulative effects associated with EISs (or EAs). One feature is the need to identify the incremental impact(s) of the action. This phrase refers to the action; however, implicit in the word "action" is the need to identify the impacts of the original proposed action, the alternatives to this action, and the ultimately identified preferred alternative. Further, the word "impact(s)" denotes both direct and indirect impacts, with the two terms also defined above. In addition, impacts also infer spatial considerations; that is, where within a specific spatial area defined for the EIS will such direct and indirect impacts take place? A temporal feature is also inferred from impacts. For example, the impacts resulting from the preferred alternative and the other alternatives which were evaluated would be expected to start upon implementation and to extend for some time into the future. The future time period would be related to the period over which the management measures outlined in the preferred and other alternatives would be utilized as well as accounting for some time beyond this period to allow for natural ecosystem recovery processes to take place.

Selecting VECs for Analysis

Another inference from the word impacts is that they can occur on a broad spectrum of marine resources and ecosystems, as well as on fishery-related companies, ports, and their associated human communities. The term VEC, as defined above, can be used to depict important environmental features which would be subject to the direct/indirect effects of the preferred and other alternatives. Accordingly, an early activity in CEA should be focused on the selection of pertinent VECs, and indicators thereof, which would be subject to the direct/indirect effects. This early selection is also important in relation to the Affected Environment section of the related EIS or EA (see Canter 2008 for further guidance on the Affected Environment section). More specifically, the information in the Affected Environment section could be structured around the selected VECs. Examples of potential VECs used in the Northeast Region include, but are not limited to:

- The **managed or protected (e.g., target) species** (could include one species for a species-specific action or multiple species in a multi-species action) -- The managed species could refer to either those subjected to previous management activities or to those to be addressed for the first time. The proposed action would be expected to have direct/indirect effects on the managed species within the defined spatial and temporal boundaries for the study. Such features could also cause direct/indirect effects on the habitat requirements (e.g., essential fish habitat – EFH and critical habitat units) for the managed or protected species.

- **Other species** within the defined spatial boundary for the EIS (or EA) -- These other species could also be subject to effects from the proposed action or from state-directed management programs through bycatch, for example. Conversely, they may not be managed under any Federal or state program. However, the connection to the managed or protected species being subjected to an EIS is that pertinent features therein could cause direct/ indirect effects on these other species, or on the habitat requirements (e.g., EFH and critical habitat units) of these species.

- The required **habitat** (e.g., EFH and critical habitat units) for the species addressed by the proposed action and, as appropriate, the habitat for the other species VEC -- In general, species have different habitat requirements for different phases of their life cycle. Further, considerable information is known about the effects of different gear types and fishing practices on a variety of types of habitat. As noted above, the direct/ indirect effects of pertinent features of the proposed action could occur on both habitats of the subject species and of other fish species.

- **Protected species** which occur in the defined study area for the proposed action and which could be subject to direct/indirect effects from the proposed activities -- The protected species VEC

encompasses whales, dolphins, turtles, and bird species subject to varying levels of protection under either the auspices of the threatened and endangered species designations within the ESA or the classification schemes within the MMPA. It also includes designated critical habitat for any ESA-listed species. It is important to note that the occurrence of protected species in the study area is not the primary reason for a protected species VEC; rather, it is the actual or anticipated connections resulting from the direct/indirect effects of the proposed action and related management measures that should be emphasized in the related EIS.

- **Human communities** and businesses that have specific interrelationships with the proposed action -- This social and economic VEC can be depicted via other terms, such and ports and communities and the fishing industry. In this regard, this VEC is primarily related to both social and socioeconomic effects.

Following the selection of the pertinent VECs for a NEPA compliance document, consideration should be given to potential indicators for each VEC. In this case, the term indicator denotes a single parameter (or even a composite of several parameters) which is indicative of the conditions of the VEC, including its sustainability (Canter, 1996, pp. 122-123). Indicators for each VEC can be used as the basis for describing the historical and current conditions for the VECs in the Affected Environment sections in EISs or EAs. Additional information on the use of VECs and indicators as the basis for describing the Affected Environment is available elsewhere (Canter, 2008). Further, indicators can be used in the Environmental Consequences sections to depict anticipated changes in their conditions resulting from direct and indirect effects of the preferred and other alternatives, as well as the contributed changes from other actions (both fishing related and non-fishing related actions) within the defined geographical study boundaries and the identified temporal boundaries (past, present, and future).

Appendix C contains selected tables that have been developed by NMFS NEPA staff. These tables will be utilized as examples of information and data presentations associated with CEAs. Specifically, Table C-1 in Appendix C displays a structured approach for VECs, actions affecting the VECs, potential cumulative effects resulting from all actions, and possible generic indicators. The two right-hand columns could both be considered as indicator columns (the penultimate one relates to changes in the conditions of the VEC and the last one identifies composite indicators for the VEC changes). Further, the two right-hand columns could be utilized for organizing information and describing the historical and current conditions for each VEC in the Affected Environment section of a specific EIS or EA.

As mentioned above, Appendix D includes and references case studies which provide useful examples of utilized VECs and indicators within Environmental Consequences sections in EAs and EISs. It should be noted that in most of the referenced cases cited in Appendix D, the NEPA document addressed the selected VECs in both the Affected Environment section and in the Environmental Consequences section. This approach provided both an internal consistency and the demonstration of connections between the proposed measures and their effects, and attendant changes in the conditions of the VECs.

As stated above, the incremental impacts of the

Table 2. Summary of Direct/Indirect Impacts of Alternatives

	Target Species	Non-Target Species
Fishery Managment Alternative		
No Action Alternative (Alternative 1)	Status Quo – As described in the Affected Environment Section of the EIS; Latest stock assessment indicates stock will not rebuild for 15 years	Status Quo -- As described in the Affected Environment Section of the EIS
Alternative 2 Lower TAC by an additional 15%	Positive – Would reduce fishing mortality by reducing catches by 15%; Rebuilding goals will be met in 10 years	Positive – Would reduce bycatch of species B by 10%

Table 3. Example Template Table for Summarizing Affected Environment Conditions/Status/Trends of each VEC

Affected Resource of Concern	Historical Conditions	Current Conditions	Possible Future Conditions	Implications of Conditions Relative to Past, Current, and Future Sustainability of the VEC
Target Species	In each cell, include summary description and/or quantitative information, and discuss the implications			
Non-Target Species				

preferred and other alternatives include both direct and indirect effects. Such effects have been traditionally identified in EISs and EAs prepared within the Northeast Region of NMFS. Reviews of historical EISs or EAs prepared for the managed species which are currently being subjected to the NEPA compliance documentation can be productive. Further, Appendix B herein includes a series of review questions related to the Environmental Consequences sections of FMP-based EISs. The questions are primarily focused on identifying and addressing the direct and indirect effects of various management measures on specific VECs (U.S. Environmental Protection Agency, 2005, pp. 78-80). Appendix B also includes five general review areas and questions related to CEA (U.S. Environmental Protection Agency, May, 1999). While the questions are broadly stated, their consideration could also benefit the identification of direct and indirect effects of the preferred and other alternatives.

The direct/indirect effects of the proposed action and alternatives can be displayed in a table to summarize the impacts for each VEC. Table 2 is excerpted from Table C-2 in Appendix C. Table 2 exhibits the impacts of the Target and Non-Target Species VECs while Table C-2 shows examples for more VECs and a larger array of alternatives.

Step B - Existing Conditions/Status/Trends for the Selected VECs (Related to Affected Environment Section)

Historical and current conditions for each VEC would typically be addressed in Affected Environment sections of EISs and EAs (Canter, 2008). Further, CEA studies should also include temporal trends in the conditions for each VEC. This subsection represents an important building block in the CEA Model described above. The reader is again referred to the case studies described in Appendix D for examples demonstrating how topical information was used and presented in the the Affected Environment section.

As with direct and indirect effects, it is important to adequately summarize the conditions for each of the selected VECs, and their indicators, in the Affected Environment Section of an EA or EIS. It would be useful to summarize at the end of the Affected Environment section (or under each topic) the resultant conditions of each VEC that would be pertinent to the CEA that could be brought forward for use in the CEA Section. A useful approach would be to include a summary table supported by narrative descriptions of the included information. To illustrate, Table 3 can be used.

To relate this building block in the CEA Model to CEQ's 11-step CEA process, this building block represents the accomplishment of Steps 5 to 7.

Step C and Step D - Other Past, Present, and Reasonably Foreseeable Future Actions (Includes FMP/ESA/MMPA Actions and Non-Fishing Actions) and the Description of the CEA Baseline

As previously noted, the definition of cumulative effects is "…when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person

undertakes such other actions." Inferred by this definition is that the effects of such other actions on the selected VECs should be identified and then combined with the incremental effects (i.e., direct/indirect effects) of the proposed action. The combination of such effects could be additive, synergistic, or countervailing. The other actions could encompass a variety of proponents and they should be considered relative to a study-specific time horizon (past, present, and future).

The following approach can be taken to comply with the definition:

- Identify other actions within the spatial boundaries of the impact study which could contribute effects to the selected VECs.

- Classify the other actions as appropriate. For FMP-related actions, a fundamental grouping could be fishing actions and non-fishing actions. The former grouping should include, as appropriate, the original FMP and any subsequent amendments, other FMPs and their amendments, actions related to protected species that could have arisen from meeting various requirements of the ESA or MMPA, and actions related to the EFH requirements within the MSA. Information sources for past, present, and future Federal actions include historical and current EISs or EAs from the Region, as well as contacts with relevant divisions (Sustainable Fisheries, Habitat Conservation, and Protected Resources). Information sources for non-Federal fishing actions could include state agencies involved in state-managed coastal and marine fisheries, fisheries commissions, state and regional coastal zone commissions, as well as several Federal and state agencies with responsibilities for permit programs. Examples of such permitting agencies include the U.S. Army Corps of Engineers, the USEPA, state water quality or water resources agencies, and coastal zone commissions.

- Once other actions are classified, they can also be grouped by their temporal characteristics (past, present, and future actions). In fact, this type of information can be collected for fishing actions via Regional contacts within NMFS, contacts with the Fishery Management Councils, and contacts with state or commission programs. Information sources for non-fishing actions would be the same as noted above.

- A special type of action is called reasonably foreseeable future action (RFFAs). The key question is … what makes a potential future action reasonably foreseeable? A review of 40 court cases wherein reasonably foreseeable was an issue provided instruction on how to answer this question (Rumrill and Canter, 1997). Specifically, one answer is that the identified future action must be within an overall approved plan or a separately approved plan. Another answer was that the future action was beyond mere speculation (this means that some planning has been accomplished, and there is a reasonable likelihood of occurrence). The same information sources as noted above could be utilized to identify RFFAs for both fishing actions and non-fishing actions.

- Another special issue related to other actions is associated with the extent of analysis that might be required. In June 2005, CEQ issued guidance on the consideration of past actions in cumulative effects analysis (Connaughton, 2005). This guidance addressed the extent to which information should be assembled on past actions which have contributed to cumulative effects on specific VECs. The guidance suggests that a key question is related to whether or not specific information on the effects of past actions will inform the current decision. If the answer is yes, a more thorough analysis would be required. If the answer is no, only summary information would be needed.

Following the initial identification and classification of other actions, attention must be directed toward the effects of these actions on the selected VECs. If no information is available to suggest that they would have effects, then it is possible to eliminate other actions from further analysis. Information from other EISs and EAs on fishing actions could be used to delineate potential effects on selected VECs.

In addition, for fishing effects on habitat and EFH assessments, a National Research Council book (Committee on Ecosystem Effects of Fishing, 2002) has useful information on general effects. Further, a comprehensive report on this subject was released in 2004 (Stevenson, et al., 2004), which also has useful information on the effects of gear types on EFH.

Non-Fishing Effects

Relative to "non-fishing activities," NOAA Fisheries Service has produced a summary report which includes generic information on the impacts of non-fishing activities on EFH (Hanson, et al., 2003). This report could be a useful information source for CEAs conducted in the Northeast Region and information provided in this section is drawn primarily from this source. Key definitions and concepts for EFH were included in the 1996 MSA, and extended as part of the 2007 reauthorization of the MSA. Two key definitions related to these impacts are as follows:

- EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (National Marine Fisheries Service, January 12, 2007). Waters include aquatic areas and their associated physical, chemical, and biological properties. Substrate includes sediment underlying the waters. Necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem. Spawning, breeding, feeding, or growth to maturity covers all habitat types utilized by a species throughout its life cycle (Office of Habitat Conservation, 1999).

- Adverse effect means any impact that reduces quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH 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 (U.S. Department of Commerce, 2007).

Non-fishing activities associated with terrestrial or aquatic environments in nearby riverine, estuarine, and marine ecosystems can contribute to cumulative effects on the quality or quantity of EFH. Compiled effects information from numerous USEPA, USFWS, and NOAA Fisheries Service reports, along with peer-reviewed literature, was assembled by Hanson, et al. (2003) as a reference document on typical adverse impacts on EFH, and potential conservation measures which could be used to mitigate such measures. The non-fishing activities addressed included the following:

- Upland activities – nonpoint source pollution (agricultural/nursery runoff, silviculture/timber harvest, and pesticide application), urban and suburban development, and road building and maintenance.

- Riverine activities – mining (mineral mining and sand and gravel mining), debris removal (organic debris and inorganic debris), dam operation, and commercial and domestic water use.

- Estuarine activities – dredging, disposal/landfills (disposal of dredged material and fill material), vessel operations (including waterborne transportation and navigation), introduction of exotic species, pile installation and removal (pile driving and pile removal), overwater structures, flood control and shoreline protection, water control structures, log transfer facilities and in-water log storage, installation of linear crossings (utility lines, cables, and pipelines), and commercial utilization of habitat.

- Coastal and marine activities – point source discharges, fish processing wastes (shoreside and vessel operation), water intake structures and discharge plumes, oil and gas operations (exploration, development, and production), habitat restoration and enhancement, and marine mining.

The information in the report could be utilized to construct impact matrices and develop collaborative mitigation strategies for reducing the contributions of non-fishing activities to cumulative effects on EFH thereby enhancing the sustainability of managed fisheries resources and protected species. Further, it should be recognized that other non-fishing actions may need to be addressed. Examples include beach renourishment, harbor dredging, liquefied natural gas terminals, climate change, lobster shell disease, wind farms, and shipping and transport.

In addition, a comprehensive discussion of non-fishing, anthropogenic activities that may adversely impact EFH and other coastal fishery habitat in the northeast United States was provided by Johnson et al. (2008). This report characterizes existing scientific information regarding human-induced impacts to coastal fishery habitat; provides best management practices and conservation measures that can be

implemented to avoid or minimize adverse impacts to EFH and other coastal fishery habitat; provides a comprehensive reference document for use by Federal and state marine resource managers, permitting agencies, professionals engaged in marine habitat assessment activities, the regulated community, and the public; and enables the best scientific information to be available for use in making sound decisions with respect to project planning, environmental assessment, and permitting. The report is organized by activities that may potentially impact EFH and other fishery habitat occurring in northeastern US riverine, estuarine/coastal, and marine/offshore areas. Major activities that were identified as impacting these three habitat areas include: 1) coastal development; 2) energy-related activities; 3) alteration of freshwater systems; 4) marine transportation; 5) offshore dredging and disposal; 6) physical and chemical effects of water intake and discharge facilities; 7) agriculture and silviculture; 8) introduced/nuisance species and aquaculture; and 9) global effects and other impacts.

Following the identification of pertinent other actions, as well as the effects they could contribute to the selected VECs, it is necessary to demonstrate their connections to the VECs or selected indicators. One method for doing so is via the use of a matrix table. Tables C-3 through C-5 in Appendix C provide examples of the construction of such tables and of the type of information which should be included therein. Excerpts of these tables are provided below in Tables 4-6. The complete example tables are found in Appendix C. The titles of Tables 4, 5 and 6 are self-explanatory.

It should be noted that these three tables include impacts described in relation to characteristics such as low positive, positive, neutral, low negative, and negative impacts. Each of these terms should be clearly defined and the rationale utilized should be delineated. Further, each table includes a net impact summary for each selected VEC. As noted above, these tables would represent key building blocks for defining CEA Baseline (see Figure 1 above). Finally, these types of tables could be utilized in either EISs or EAs.

As mentioned above, these tables can be applied in a variety of NEPA documents. Appendix D exhibits case studies of a region-specific EA and EIS as other examples of how to apply these tables in real situations.

To relate these two building blocks in the CEA Model to CEQ's 11-step CEA process, it is noted that they represent the accomplishment of Steps 4 and 8.

Table 4. Example Display of Impacts of Past and Present Fishing Actions on Resources (VECs) Identified for FMP or Other Management Action (excerpted from Table C-3)

Action	Description	Target Species	Protected Species (Seabird, Sea Turtles, Seals and Dolphins)
Management Action # 1 Implementation of FMP (1991)	• Implemented limited access fishing permits; • established a Total Allowable Catch (TAC) quota	• **Positive** -- Reduced fishing mortality by a reduction in catches by 20%	• **Positive** – Reduction in fishing effort resulted in fewer interactions with sea turtles, seals, and dolphins; neutral on seabirds
Management Action # 2 (1995)	• Lowered TAC by an additional 15%	• **Positive** - Reduced fishing mortality by a reduction in catches by 15%	• **Positive** – Reduced fishing effort results in fewer interactions with sea turtles, seals, and dolphins; neutral on seabirds
Net Impact Summary		• **Positive – Reduction in catches has increased stock biomass**	• **Positive – Reduction of interactions has reduced potential for injuries or mortality for sea turtles and marine mammals; neutral on seabirds**

Table 5. Example Display of Impacts of Reasonably Foreseeable Future Fishing Actions on Resources (VECs) Identified for FMP or Other Management Action (excerpted from Table C-4).

Action	Description	Target Species	Protected Species (Seabird, Sea Turtles, Seals and Dolphins)
Fishery Management Action # 4	• Would establish closed areas to protect spawning habitat	• **Positive** – Proposed closure expected to increase spawning success	• **Positive** – Closure area would reduce interaction with 2 species of dolphin that occur in closed area
ESA Management Action	• Proposed gear requirement to reduce endangered seabird interaction	• **Neutral** – Proposed gear would not change catches of target species	• **Positive**- New gear would reduce entrapment of endangered seabird species and other seabird species
Net Impact Summary		• **Positive – Fishery Management Action # 4 would likely continue to improve stock biomass**	• **Positive – Proposed gear restrictions in ESA Action would reduce interactions with the endangered seabird species and other seabird species; fishery and MMPA area closures would reduce interactions with sea turtles and marine mammals; 2 species of dolphins would particularly benefit**

Table 6. Example Display of Impacts of Past, Present, and Reasonably Foreseeable Future Non-Fishing Actions on Resources (VECs) Identified for FMP or Other Management Action (excerpted from Table C-5)

Action	Description	Target Species	Protected Species (Seabird, Sea Turtles, Seals and Dolphins)
Vessel Operations, Marine Transportation	• Expansion of port facilities, vessel operations and recreational marinas	• No Impact at site	• **Negative at Site** – inshore species impacted by reduced water quality and haul out activity
Beach Nourishment; Dredge and Fill Activities; Offshore Mining	• Placement of sand to nourish beach, fill shorelines. Offshore mining of sand for beaches	• **Negative at Site –** Entrainment, sedimentation and turbidity impacts to fish in area in and around dredge borrow or disposal site; • May displace fish, remove benthic prey, and increase mortality of early life stages	• **Negative at Site –** Dredge and mining activity increases noise and reduces water quality; turtles susceptible to impacts from beach nourishment
Net Impact Summary		• **Low Negative overall –** Potentially negative impacts in the area immediately around the site; minor overall adverse effects to target species since the localized nature of the sites results in a limited exposure to the largely unaffected offshore population	• **Low Negative overall –** Potentially negative impacts in the area immediately around the site; minor overall adverse effects to protected species since the localized nature of the sites results in a limited exposure to the largely unaffected offshore population

Step E - Impact Analysis – Connecting the Incremental Impacts with the CEA Baseline

As shown in Figure 1, impact analysis involves connecting the direct and indirect impacts (incremental impacts) of the preferred and other alternatives with the CEA Baseline. At this point in the CEA study, each of the building blocks comprising the CEA Baseline should have been completed, as would the building block on direct/indirect impacts. Further, each building block should have been structured around the selected VECs and their related indicators. Accordingly, the connections can be demonstrated via the development of a summary matrix table for each VEC.

Table 7 (from Table C-6 in Appendix C) is an example of a summary table for one VEC – managed (target) species. Example management alternatives and additional mitigation measures are shown in the first column. The second column summarizes the incremental impacts of what will become the preferred action and its alternatives. Note that this information should come from Table C-2, as well as the narrative discussion of the direct and indirect effects. The third column is developed from the Affected Environment section; if a summary matrix table had been prepared at the end of this section, its contents could be utilized. The fourth through the sixth columns represent the impacts on the selected VEC that would occur from other actions (past, present, and future fishing actions; as well as past, present, and future non-fishing actions). Finally, the seventh column reflects the cumulative effects on this VEC. Again, explanations should be provided for the impact terminology (positive, negative, etc.) used in this matrix table (Table 7).

In a structure similar to that for Table C-6, additional summary tables could be constructed for the other VECs utilized in the CEA study. Examples of tables which could be utilized for other VECs include non-target species, protected species, physical environment and EFH, and fishing businesses and communities.

To summarize the approach for the cumulative effects building block in Figure 1, the first part consists of combining information from Steps 1 to 9 in the CEQ's 11-step process. The second part relates to the evaluation of the findings within this building block.

The simple matrix approach for integrating cumulative effects information, as described above, represents one approach for CEA. This approach is derived from the boxes and concepts depicted in Figure 1. This approach does provide a documentable process and is indicative that a hard look was taken relative to cumulative effects within an EIS. Conversely, for EAs, a more simplified process might be useful. Simplifications could result from the appropriate identification of fewer direct and indirect effects from the alternatives, fewer VECs, fewer other actions, and fewer cumulative effects. In fact, descriptive narrative could be used in EAs in lieu of a tabular and narrative approach. The reader is encouraged to review Appendix D and the referenced documents therein for examples that exhibit differences between EAs and EISs. For example, the EA example in Appendix D includes a narrative approach to analyzing and presenting the CEA rather than using the series of tables that was described above.

Finally, there are other ways to address cumulative effects rather than the building block approach of Figure 1 and the use of matrix tables. For example, some NOAA Fisheries Service Regional Offices directly address the 11-steps of CEQ's process and provide narrative descriptions of the CEA. Additional information on other examples can be procured from internet searching of NEPA compliance documents produced by other Regional Offices.

Step F - Cumulative Effects Evaluation (Significance, Monitoring, and Adaptive Management)

The final feature of a CEA study involves the evaluation of the cumulative effects (the last box shown in Figure 1). Evaluation encompasses the determination of the significance of the identified cumulative effects. Criteria for such determinations are described in the earlier NEPA regulations section; such criteria are from CEQ (40 CFR 1508.27) and NOAA (Section 6.02 of NAO 216-6). Several of the latter criteria appropriately emphasize the consideration of sustainability of VECs. Step 9 (b) in CEQ's 11-step process highlights significance determinations.

Steps 10 and 11 of CEQ's process emphasize mitigation, monitoring, and adaptive management. Mitigation of significant negative (adverse) cumulative effects may need to be considered in EISs (Step 10). In many cases, management measures incorporated within the alternatives are already providing mitigation choices. Further, it may be appropriate to extend mitigation beyond the incremental impacts of the preferred and other alternatives. Such extensions could encompass both intra-agency collaboration

Table 7. Example Table for Summary of Cumulative Impacts on the Target Species VEC (Excerpted from Table C-6)

Alternatives	Direct and Indirect Impacts of Proposed Action Information here will come from TABLE 2 and Environmental Consequences Section of EIS	Existing Conditions/ Trends Of Affected Resource Summary Cell info from TABLE 3 and Affected Environment Section of EIS	Past to Present Fishing Actions From Summary Cell info from TABLE 4 and Affected Environment Section of EIS	Impacts from Reasonably Foreseeable Future (RFFA) Fishing Actions From Summary Cell info from TABLE 5 and narrative from Cumulative Effects Section of EIS	Impacts from Past, Present and Reasonably Foreseeable Future Non-Fishing Actions Summary info from TABLE 6 and narrative from Affected Environment and/ or Cumulative Effects Section of EIS	Cumulative Impacts COMBINE impacts of previous columns; combined impacts can be additive, negligible or countervailing and characterized as positive, negative or neutral
Management Alternatives						
No Action Alternative 1	**Status Quo** Status Quo as described in the Affected Environment Section of the EIS	**Negative** Species A is overfished with a projected slow recovery under existing regulations; stock is currently projected to rebuild in 15 years	**Positive** Overall a 43% reduction in catches of Target Species over 10 years has reduced fishing mortality and increased stock biomass	**Positive** Fishery Management Action # 4, and MMPA Action would likely continue to improve stock biomass	**Low Negative** Potentially negative Impacts in the area immediately around the site; Minor overall adverse effects to target species since the localized nature of the sites result in a limited exposure to the largely unaffected offshore population	**Low positive** Stock would not rebuild in 10 year period but likely less than 15 years
Alternative 2	**Positive** Would reduce catches by 15%; Rebuilding goals would be met in 10 years					**Positive** Stock biomass would increase more quickly that No Action and would rebuild in 10 years
Alternative 3	**Positive** Would reduce catches by 20%; Rebuilding goals would be met in 8 years					**Positive to High Positive** More positive than Alternative2; Further reduced catches would accelerate stock rebuilding and provide greater assurance of meeting the rebuilding goal

within NOAA Fisheries Service, and similar collaboration with other Federal and state agencies and commissions (U.S. Environmental Protection Agency, 1999).

Monitoring of indicators of significant adverse cumulative effects may also be useful (Step 11). A discussion of detailed planning for such monitoring, which could be envisioned as an add-on to traditional fishery monitoring programs, is beyond the scope of this report. However, a useful information source for monitoring planning and implementation is Marcus (1979). When such monitoring is done, the results can be used to reduce a variety of uncertainties related to the magnitude of cumulative effects, the key actions influencing such effects, and the relationships between cumulative effects and the sustainability of selected VECs. Again, a detailed discussion of adaptive management which could be responsive to monitoring findings is beyond the scope of this report. However, a reference document relating adaptive management principles to fisheries and protected species is available (Canter, 2007). This document is consistent with information in the relatively recent CEQ Task Force report on modernizing NEPA implementation and practice in the United States (Council on Environmental Quality, 2003).

PRESENTATION OF CEA FINDINGS IN EISs OR EAs

The CEQ's 1997 guidance on CEA did not specifically address the placement of the resultant information in NEPA compliance documents. As a result, one approach that many Federal agencies take is to include the CEA findings within the last section of EISs or EAs. Affected Environment-related information is typically included or referenced in that respective section. This approach utilizes existing sections of EISs or EAs to incorporate the CEA findings.

To place this approach in context, only the information from the box labeled "Existing Conditions/ Status/Trends of Each Resource" in Figure 1 would be placed in the Affected Environment section. This box, which would be focused on VECs, encompasses Steps 1-3 and 5-7 of CEQ's 11-step CEA process. This approach would also typically involve the placement of the information from the other six boxes in Figure 1 within the last subsection of the Environmental Consequences section. These remaining six boxes typically include Steps 1, 4, and 8 through 11 of the CEQ process.

NOAA Fisheries Services typically follows an alternative to the approach described above; it is termed the stand-alone approach. This approach would generally consist of a separate Cumulative Effects section which would follow the Environmental Consequences section (this section could focus on direct and indirect impacts of the alternatives only). These results could be summarized in the new Cumulative Effects section. In addition, the Affected Environment section could still include the conditions, status, and trends box from Figure 1. It is a useful way for CEA information summarization and communication for NEPA compliance documents that are complicated or programmatic in coverage.

Another fundamental issue related to the presentation of CEA findings in NEPA compliance documents is whether to use a narrative presentation only (the process and findings of the study are descriptively discussed in paragraph formats) or a narrative and tabular presentation. The narrative approach could be used for EAs, while the combined one would be appropriate for EISs. The latter presentation incorporates tables, figures, and maps to support the narrative presentation. If the latter approach is used, each table, figure, and map should be sufficiently explained so that the reader will understand the connections between the narrative and the visual aid materials.

CASE LAW ADDRESSING CEA

Litigation related to the adequacy of CEA in NEPA documents (both EISs and EAs) has markedly increased in recent years. In fact, over 200 NEPA-related challenges regarding CEA have taken place; in some cases, the CEA challenges are the primary focus, while in others, such challenges are part of a suite of claims involving NEPA, ESA, and MMPA. This section includes selected case law information in three parts. The first part highlights three precedent-setting cases involving reasonably foreseeable future actions and the need to identify connected actions (Mandelker, 2007). The second part summarizes 25 decisions by the Ninth Circuit Court of Appeals over a 10-year period from 1995-2004 (Smith, 2006). The third part highlights the findings from a review of 32 cases wherein the process for addressing incomplete and unavailable information (40 CFR 1502.22) was an issue (Atkinson, et al., 2006).

Three Precedent-Setting Cases

Mandelker (2007) contains an extensive discussion of CEA-related case law. The information is organized into topics such as the scope of actions to be considered; the adequacy of the analysis and discussion (numerous cases are identified where the discussion was deemed adequate, and others when it was deemed inadequate); when other proposed actions (reasonably foreseeable future actions – RFFAs) must be discussed; and connected, cumulative, and similar actions. Three specific cases highlighted by Mandelker (2007) will be noted herein; one relates to connected actions and the other two are associated with RFFAs.

The connected action case involved a proposed road, in a roadless area, which would be used as a haul road to facilitate timber harvesting (Thomas v. Peterson, 1985). The U.S. Forest Service (USFS) prepared an EA on the proposed road and did not mention the impacts of timber sales which involve road usage in the area served by the road. The Ninth Circuit ruled that these actions were connected; that is, the road would not be needed absent the timber sales; thus, the EA should have addressed the impacts of timber harvesting, including sedimentation effects detrimental to salmon. The Court rejected the USFS contention that "the sales are too uncertain and too far in the future for their impacts to be analyzed along with the road." Rather, the Court ruled that if the sales were sufficiently certain to justify construction of the road they were sufficiently certain to have their environmental impacts analyzed along with the road (Mandelker, 2007, p. 10-145). It is interesting to note that this decision also infers that the timber sales are RFFAs which are connected to the road proposal. The relevance of this decision in relation to the Northeast Region of NOAA Fisheries Service is that the initial proposed action and all alternatives should encompass all of the respective connected actions.

An early landmark Court decision, which occurred in 1976, involved an interpretation of what constitutes reasonably foreseeable future actions. This U.S. Supreme Court decision indicated that a precise proposal for an action would be needed to define the action as an RFFA (Kleppe v. Sierra Club, 1976). This case related to the proposed leasing and approval of coal mining on Federal lands and was one of several such actions which had been planned within a coal-resources region. In its decision, the Supreme Court indicated that:

> *when several proposals for coal-related actions that will have cumulative or synergistic environmental impacts upon a region are pending concurrently before an agency; their environmental consequences must be considered together (Kleppe v. Sierra Club, 1976).*

The phrase "pending concurrently" suggests that these several proposals are precise and that they represent formal proposals. Further, the Supreme Court was not prescriptive regarding how such cumulative impacts should be addressed. Rather, the decision noted that:

> *… determination of the extent and effect of cumulative impacts on range of resources, and particularly identification of the geographic area within which they may occur, is a task assigned to the special competency of the appropriate agencies (Kleppe v. Sierra Club, 1976).*

Since the Kleppe decision in the mid-1970s, the requirement for formal proposals has often been used by proponent agencies to limit the number of RFFAs to be considered in a CEA study. However, some other courts have questioned the generic applicability of this ruling. Specifically, Mandelker (2007, p. 10-140) provided this perspective:

Kleppe considered only the question of when a program impact statement must be prepared on a group of related actions. Its holding that a "proposal" must be precise was part of that holding. The Court did not consider the related question of what actions must be considered in an impact statement's discussion of cumulative impacts. An argument can be made that Kleppe requires discussion of proposals in a cumulative impacts analysis only when they are precise. The courts differ in interpreting this decision, however, with some courts following this ruling and holding that Kleppe does not require the discussion of the cumulative impacts of actions that are only planned or contemplated.

The second specific RFFA example represents a ruling that planned or contemplated actions should be included as RFFAs in CEA studies. To illustrate, a Fifth Circuit case involved the U.S. Army Corps of Engineers wherein an EA was prepared for a permit authorizing a housing developer to construct a canal system for a housing project on an island in Galveston Bay, Texas (Fritiofsen v. Alexander, 1985). Plaintiffs argued that other past and future developments on the island should have been included in an analysis of cumulative effects. The Fifth Circuit remanded

the case to the Corps with instructions to address these other actions in relation to cumulative effects and to reassess the significance of such effects. A key finding of the Fifth Circuit was that such actions related to future development should be considered as RFFAs even though "…some of them were not yet proposals requiring an impact statement" (Mandelker, 2007, p. 19-141). However, it seems clear that some of the future developments were beyond mere speculation.

Three specific quotes from the Fritiofsen decision are instructive in relation to determining RFFAs and to the level of detail needed for considering cumulative effects at the EA level. The quotes include (Fritiofsen v. Alexander, 1985):

- EAs "should consider (1) past and present actions without regard to whether they themselves triggered NEPA responsibilities and (2) future actions that are 'reasonably foreseeable,' even if they are not yet proposals and may never trigger NEPA-review requirements."

- "We certainly do not mean to suggest that the consideration of the cumulative impacts at the threshold stage will necessarily involve extensive study." (Threshold stage refers to the preparation of an EA in order to determine if an EIS would be required.).

- "When deciding the potential significance of a single proposed action (i.e., whether to prepare an EIS at all), a broader analysis of cumulative impacts is required (than in an EIS); a "cumulative-effects study must identify: (1) the area in which effects of the proposed project will be felt; (2) the impacts that are expected in that area from the proposed project; (3) other actions – past, proposed, and reasonably foreseeable – that have had or are expected to have impacts in the same area; (4) the impacts or expected impacts from these other actions; and (5) the overall impact that can be expected if the individual impacts are allowed to accumulate."

To conclude, these three cases addressed by Mandelker (2007) are widely cited and utilized by practitioners in the preparation of NEPA compliance documents. They each have relevance for the Northeast Region of NOAA Fisheries Service in determining RFFAs for EISs or EAs.

Review of Appellate Court Decisions

Smith (2006) recently reported on a review of 25 CEA-related opinions issued by the Ninth Circuit Court of Appeals during the 10-year period from 1995-2004. The plaintiffs prevailed in 15 cases (60%), and the agencies won in 10 cases (40%); however, the challengers won eight of the most recent 11 cases (72%). The Court decisions can be considered in relation to six categories of plaintiff challenges – inadequate boundaries for describing the affected environment (providing a proper foundation for CEA), the general analysis lacked data and rationale, an inadequate analysis of other actions, a flawed computer analysis modeling effort, non-compliance with methodologies in the CEQ's CEA 1997 handbook, and the appropriateness of parent documents in subsequent tiered analyses.

Specific challenges related to describing the affected environment were associated with five cases; the challenges included the geographic area of analysis being too small, the temporal period of analysis being too short, or the data used in the analysis being outdated. The Ninth Circuit ruled against the challenges and for the agency in two cases. However, the challenges were upheld in the three other cases. The key lessons from these five cases related to the affected environment are that the rationale needs to be included for the spatial and temporal boundaries and that the included data should be the most recent.

A general plaintiff challenge – analysis lacked data/rationale – was made in 11 of the 25 cases; however, it was not possible to ascertain from the Smith (2006) article whether or not this challenge related to the affected environment, the cumulative environmental consequences, or both. The Ninth Circuit ruled in favor of the plaintiff's challenges in seven of the 11 cases (four EISs and three EAs) and in favor of the agencies in four (three EISs and one EA). A general lesson derived from these analysis-related cases is that data should be incorporated in describing the affected environment and that the rationale associated with trends and sustainability conditions of the VECs needs to be provided. Further, the cumulative effects analysis should be based on appropriate data and information, and the rationale related to the significance determinations should be explained.

The most common plaintiff challenge is related to inadequate analysis of other actions (past, present, and reasonably foreseeable future actions) in the

cumulative effects study area. This topic is identified in Step 4 of the CEQ's 11-step CEA process. Further, Step 4 information could be included in either the affected environment chapter (section) or the last part of the environmental consequences chapter (section). The latter placement is often used in EAs and EISs prepared by NMFS. This challenge was lodged against 18 of the 25 cases. The Ninth Circuit ruled in favor of the plaintiff's challenges on this topic in 13 of the 18 cases. The key lessons derived from the 18 cases which were challenged regarding inadequate analysis of other projects (actions) are that it is important to systematically identify other past, present, and reasonably foreseeable future actions which have, are, or could contribute to cumulative effects on key VECs. Further, the effects connections with the VECs should be delineated and analyzed in relation to the anticipated effects connections from the proposed action and alternatives, including the one identified as the preferred alternative.

The case law review also identified three other specific plaintiff challenges which were addressed by the Ninth Circuit (Smith, 2006). One challenge was related to a computer analysis modeling effort which was claimed to be flawed; however, the Ninth Circuit ruled that the related EA was adequate. Another case involved a challenge of non-compliance with the methodologies as contained in CEQ's CEA handbook. The Ninth Circuit rejected this challenge by noting that the CEQ's handbook (Council on Environmental Quality, January, 1997):

> *…serves as "guidance" and is not legally binding, and that the real issue of the Court was to decide not whether the analysis conformed to the guidance document, but rather whether it comprised a sufficient and adequate analysis for the project (Smith, 2006, p. 237).*

Two other plaintiff challenges related to the appropriateness of parent documents in subsequent tiered analyses. In both cases the plaintiffs challenged tiering from a non-NEPA document, and in one of the two cases an additional challenge related to tiering from a programmatic EIS that had no site-specific analysis. The Ninth Circuit ruled for the plaintiffs in each of these challenges. Accordingly, the results support the concepts of only tiering from NEPA documents and of being familiar with the pertinent contents of NEPA documents to ensure they are relevant to the tiering opportunity.

Finally, Smith (2006) noted the following key lessons from the 25 Ninth Circuit CEA case decisions:

- Consider cumulative effects for each resource being analyzed and carefully search out, document, and evaluate all past, present, and reasonably foreseeable future actions. This was the most common reason agencies were challenged; the Court ruled against the agency in 13 of 18 challenges.

- Do not make unsubstantiated claims about cumulative impacts in the analysis. Such assertions, when not supported with data and/or the rationale for them, were the second-most common reason analyses were challenged; plaintiffs were successful in 7 of 11 challenges.

- A perfect analysis of cumulative impacts is not required to survive a legal challenge. In several cases, the Court emphasized that it did not require such a standard. To illustrate, in one case the Court noted some minor errors and misinformation in the cumulative impact analysis but concluded its role was not to fly-speck agency analyses. Accordingly, it is important to make some attempt to address cumulative effects where appropriate, even when information and data may be missing or sparse or when it is difficult to analyze the impacts of future actions. When information is incomplete, or unavailable, the steps included in Section 1502.22 of the CEQ's NEPA regulations should be noted. A key issue is to demonstrate that a hard look has been taken regarding cumulative effects.

- Do not tie the CEA to tiering from either a programmatic NEPA document that does not contain site-specific analysis or to a non-NEPA document. The Court ruled against the agencies on this point in two cases involving a total of one EIS and two EAs.

Addressing Incomplete or Unavailable Information

As noted above, preparing an adequate description of the Affected Environment and addressing Environmental Consequences can be problematic due to lack of appropriate information. Examples of Affected Environment topics with potentially limited information include, but are not confined to, predatory-prey relationships for managed species, geographical specificity for EFH, migratory patterns for protected species, and the sustainability of the managed (target) species populations in relation to overfishing practices. Examples of CEA-related topics with potentially incomplete or unavailable information include, but are not limited to, the mechanisms by which effects combine (additive, synergistic, or countervailing), the recovery rate of disturbed EFH, cross-cutting impacts from overlapping FMPs and the use of multiple gear types, and quantitative information on cumulative effects on protected species.

Case law can be used to instruct proponent agencies as to a process for appropriately recognizing and considering the relevance of such missing information in the NEPA process. As noted above, 40 CFR Section 1502.22 describes a four-step process which could be used regarding incomplete or unavailable information (Council on Environmental Quality, 1986). While the process emphasis relates to significant adverse effects (environmental consequences) associated with EISs, by inference it can also be extended to EAs and also to descriptions of the Affected Environment in either EISs or EAs. A recent review of case law involved an analysis of decisions in 34 cases (two were from the Supreme Court, 12 from Appellate Courts, and 20 from District Courts). The Supreme Court cases upheld the process as specified in Section 1502.22. In fact, proponent agency adherence to the process led to decisions in favor of the agencies in 9 of the 12 Appellate-level cases, and in 12 of the 20 District-level cases over the time period from 1989 to 2005 (Atkinson, et al., 2006, p. 465).

SUMMARY AND CONCLUSIONS

This guidance summarizes a practical and cost-effective NOAA Fisheries Service-related CEA process for inclusion in EISs and EAs. The process is compliant with the requirements of CEQ's NEPA regulations and NOAA's supporting regulations. Further, it incorporates CEQ's 11-step CEA approach. The NMFS process includes two components – Scoping and Baseline, and Impact Analysis. Each component is comprised of requisite building blocks. For example, Scoping and Baseline integrates affected environment information with effects information from other non-fishing and fishing actions to define the CEA Baseline. The Impact Analysis component integrates the CEA Baseline findings with the direct and indirect impacts of alternatives to determine cumulative effects. The identified cumulative effects are then evaluated relative to their significance, and potential follow-on activities such as monitoring and adaptive management can be considered. Practical approaches are described for each building block, and information is included on the development of matrix tables which can be used to summarize the findings.

To support this CEA process, case law was reviewed to determine the compatibility of the process with Court decisions. The case law review focused on three precedent-setting cases (one on connected actions and two on reasonably foreseeable future actions). The described CEA process is in consonance with these three decisions. In addition, the findings from a comprehensive review of 25 Appellate-level CEA cases are presented, and consonance was again found. Finally, the findings from a review of 32 cases related to incomplete and unavailable information were summarized, with the key point being that agencies should follow the four-step process in 40 CFR 1502.22 to appropriately address such uncertainties.

To conclude, this CEA process is consistent with CEQ and NOAA NEPA regulations, is compatible with CEQ's 11-step CEA approach, and is in consonance with relevant case law.

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APPENDIX A

Summary of CEQ's 11-Step CEA Process

The Council on Environmental Quality (CEQ) has promulgated an 11-step cumulative effects assessment/analysis (CEA) process. The 11-steps include (Council on Environmental Quality, January, 1997):

1. Identify the significant, or potentially significant, cumulative impacts issues associated with the proposed action and define the assessment goals.

2. Establish the geographic scope for the analysis.

3. Establish the time frame for the analysis.

4. Identify other actions affecting the resources, ecosystems, and human communities of concern. (Resources, ecosystems, and human communities can also be referred to as Valued Ecosystem Components, or VECs.)

5. Characterize the resources, ecosystems, and human communities identified in scoping in terms of their response to change and capacity to withstand adverse impacts.

6. Characterize the natural and human factors that adversely affect these resources, ecosystems, and human communities and their relation to safety or security thresholds established through regulations.

7. Define a baseline condition for the resources, ecosystems, and human communities.

8. Identify the important cause-and-effect relationships between human activities and resources, ecosystems, and human communities.

9. Determine the magnitude and significance of cumulative impacts.

10. Modify or add alternatives to avoid, minimize, or mitigate adverse significant cumulative impacts arising from Federal activities, and identify opportunities to work with others to avoid, minimize, or mitigate adverse effects caused by non-Federal activities.

11. Monitor cumulative impacts of the selected alternative and apply adaptive management.

The first four steps are related to scoping (or delineating the "boundaries" for each selected VEC) for the study; the next three focus on describing the affected environment; and the last four highlight the cumulative environmental consequences along with mitigation, monitoring and adaptive management (as appropriate). Step 1 could be used to select appropriate VECs for study, while Steps 2 and 3 (spatial and temporal boundaries for each selected VEC) could be addressed in either the Affected Environment section (or chapter) or in the Environmental Consequences section, in an EIS or EA. Other actions (Step 4) include the consideration of past, present, and reasonably foreseeable future actions which have, are, or will be contributors to combined effects on common VECs. These actions could be included in the Environmental Consequences section or even in the Affected Environment section. Steps 8 through 11 are primarily associated with the Environmental Consequences section.

Steps 5 through 7 are specifically related to the Affected Environment section. Step 7 highlights the concept of a "baseline" condition. This condition could be reflective of an historical reference time and the trends in the conditions of the selected VECs from their individual reference times to the present. Baseline can also refer to anticipated future conditions. Step 6 is reflective of current conditions for the selected VECs, along with their evaluation in relation to regulatory thresholds and non-quantitative criteria associated with sustainability and compliance with pertinent guidance and policies. The term "stresses" suggests both past and current natural and society-initiated actions which have been, or could be, influencing the conditions of the VECs. Finally, Step 5 infers that scientific and/or policy information may need to be assembled on the selected VECs to enhance understanding regarding their resiliency, response to changes, natural recovery, etc. As appropriate, consideration may need to be given to the ecological or societal "carrying capacity" of each of the selected VECs.

Chapter 4 in CEQ's guidance on CEA addresses the features of Steps 8 through 11. Step 8 highlights the development of cause-and-effects relationships between human activities and VECs. Such relationships could be depicted by "conceptual models" which pictorially demonstrate connections between activities (and their stressors or impact-causing

factors) and specific VECs or their indicators. Such models reflect the general state-of-knowledge related to such connections. Descriptions of the rationale should be provided, and information sources should be referenced for these types of models. Although they might be more complex, networks or system diagrams could also be used to demonstrate such connections. Further, even simple interaction matrices could be used for depicting cause-and-effects relationships.

Several methods and tools are available for determining the magnitude of cumulative effects as specified in Step 9. Examples within Chapter 5 of CEQ's guidance, and their usage, include (Council on Environmental Quality, January, 1997):

- Questionnaires, interviews, and panels (identification of cumulative effects – I)
- Checklists (I and descriptive prediction – DP)
- Matrices (I and DP)
- Networks and system diagrams (including conceptual models) (I and DP and quantitative prediction – QP)
- Modeling (QP)
- Trends analysis (DP and QP)
- Overlay mapping and GIS (I and DP and QP)
- Carrying capacity analysis (DP and QP)
- Ecosystem analysis (DP and QP)
- Economic impact analysis (DP and QP)
- Social impact analysis (DP and QP)

The significance of the cumulative effects can be ascertained by using the definition of "significant" as found in CEQ's NEPA regulations (40 CFR 1508.27), and the additional criteria as contained in Section 6.03 of NAO 216.6.

Mitigation is identified in Step 10. A key question is – does the proponent agency for the action have to mitigate for all cumulative effects, or only for their incremental contributions to the determined cumulative effects? The answer to the question is "incremental contributions." This principle is supported by the following "question-answer" found in the USEPA's CEA review guidance (U.S. Environmental Protection Agency, 1999):

> ***Question***: Should USEPA comments suggest mitigation measures to address cumulative impacts?
>
> ***Answer***: The USEPA's manual on reviewing and commenting on Federal actions under NEPA and Section 309 of the Clean Air Act states that EPA's comments should include mitigation measures "... to avoid or minimize damage to the environment, or to protect, restore, and enhance the environment" (U.S. Environmental Protection Agency, 1984). Thus, it is appropriate for USEPA comments to include recommendations for mitigation that address the cumulative impacts of the project. The comments should suggest a range of mitigation that addresses differing sources of the cumulative impacts. At a minimum, the mitigation should address the proposed project's contribution to the cumulative impacts. In addition, it is appropriate to suggest mitigation to address cumulative impacts that are caused by activities other than the proposed project. For example, mitigation could include forming partnerships among the different governmental agencies and private organizations to work on environmental restoration when those entities have contributed to cumulative impacts over a long period of time. It is important to note that USEPA suggestions for mitigation are not necessarily constrained by whether the action agency has jurisdiction to implement the measures but the measures should be realistic and technically feasible.

Step 11 raises the issue of monitoring and adaptive management as follow-on activities to the EIS when there are major uncertainties associated with cumulative effects on one or more VECs. This issue is currently receiving more attention in both planning and reviewing EISs related to FMPs or amendments.

APPENDIX B

US EPA Review Questions for Environmental Consequences Section

This appendix includes review questions promulgated by the U.S. Environmental Protection Agency for reviewing the Environmental Consequences sections of EISs related to FMPs and their amendments. Further, additional review questions which are focused on CEA are also included. These questions would be applicable if CEA is the final part of the Environmental Consequences section or if it is included as a separate section. In principle, both sets of questions could also be considered for EAs.

Regarding a general evaluation of the Environmental Consequences chapter or section in an EIS, the U.S. Environmental Protection Agency has published a report on reviewing EISs for Fishery Management Plans (FMPs) (U.S. Environmental Protection Agency, 2005). The report was prepared for use by USEPA reviewers of EISs on FMPs; however, the included information could also be used to plan and prepare such EISs, and even EAs. To illustrate, the review guidance indicates that this chapter (section) should provide a description of direct, indirect, and cumulative effects on the selected VECs that would result from the FMP-related proposal. Further, it was noted that emphasis should be given to those indicators of the VECs within the study area that would be impacted by the alternatives, including the proposed action (preferred alternative). The utilized indicators should be in consonance with those described in the Affected Environment chapter or section. The actual impact information could be quantitative, qualitative (or descriptive), or expressed in a relative manner (e.g., minor, moderate, major). Definitions should be included for all "relative" categories of impact (including positive and negative impact). In addition, the report included a series of review questions, and as noted above, these questions (which are primarily related to direct and indirect effects) could be used during the development of the EIS or during an intra-agency review of a preliminary version of a draft EIS (U.S. Environmental Protection Agency, 2005, pp. 78-80):

- Is sufficient information presented to support the conclusion regarding impact level?
- Is sufficient information provided about the proposed action and alternatives to support comparison of impacts?
- Have the beneficial and adverse effects, and direct, indirect and cumulative effects been identified for target and non-target species (e.g., fish, sea turtles, marine mammals, and seabirds) and quantified to the extent possible?
- Would the proposed action affect any EPA mandates, including water quality (e.g., particularly relevant to actions where processing onboard the fishing vessel is an option)?
- Would the proposed action threaten the violation of Federal, State, Tribal, or local law or requirements imposed for the protection of the environment?
- Would the proposed action cause substantial damage to the ocean and coastal habitats and/or EFH as defined under the MSA and identified in the FMP/Amendment?
- Would the proposed action have a substantial adverse impact on public health or safety?
- Would the proposed action have a substantial adverse impact on worker/fisher health or safety (e.g., operation in poor weather conditions as a result of restricted fishing seasons and/or closed fishing areas - could also affect water quality if vessel sank)?
- Where relevant, have the following social and economic impacts been considered: impacts to low-income or minority (human) populations, impacts to fishing communities, impacts to those who rely on living marine resources for subsistence?
- Would the action result in the introduction or spread of a non-indigenous or invasive species?
- Does the proposed action have the potential to jeopardize the sustainability of any target species or non-target species that may be affected by the action?
- Does the EIS consider the potential for cumulative effects of the proposed action and other activities in the area under consideration (e.g., fishery over time, past fishing practices, other fisheries, other human activities)?
- Would the proposed action have a substantial

impact on biodiversity and ecosystem function within the affected area (e.g., benthic productivity, predator-prey relationships)?

- Have ecosystem considerations been incorporated to the extent possible, such as changes in biomass, impacts to habitat (including water column, benthic, EFH) from fishing gear, and impacts to food supply (predator prey, harvest of key prey, prey availability)?

- Have bycatch and EFH issues been adequately addressed?

- Does the EIS include an estimate of bycatch and address the extent to which it will be reduced?

- Is there sufficient information to conduct an EFH consultation? If consultation has been completed (e.g., for final EIS), are the results of the consultation included as well as any EFH conservation recommendations and NMFS' responses?

- Does the EIS use the "best scientific information available"?

- Does the EIS adequately address uncertainties and incomplete/unavailable information, including how such information might influence the analysis and conclusion?

- Is the right gear of the proper scale being used?

- Have potential direct, indirect and cumulative impacts to sensitive/protected species (e.g., threatened and endangered, marine mammals) and environments (designated marine protected areas, estuaries in the National Estuary Program, etc.) been adequately discussed for the proposed action and alternatives?

- If threatened or endangered species are potentially impacted, is the status of the coordination process under ESA clearly identified (e.g., Draft EIS)?

- If ESA consultation is completed (e.g., final EIS) and a BO has been prepared, is it (or a summary) included in the draft/final EIS/SEIS?

- Have unavoidable impacts been clearly identified?

- Does the EIS discuss the relationship between the short-term uses of the environment and the maintenance and enhancement of long-term productivity and any irreversible or irretrievable commitments of resources involved if the proposed action is implemented?

- Are environmental impacts addressed in proportion to their potential significance?

In May 1999, the U.S. Environmental Protection Agency published a guide for USEPA reviewers to use when they evaluated the cumulative effects analyses in NEPA documents (primarily EISs) (U.S. Environmental Protection Agency, 1999). The guide identified five major review areas – resources and ecosystem components (VECs which are related to Steps 1 and 5 to 9 in the CEQ's 11-step CEA process); geographic boundaries and time period (Steps 2 and 3); past, present, and reasonably foreseeable future actions (Steps 4 and 8); describing the condition of the environment (Steps 5 to 7); and using thresholds to assess resource degradation (Steps 5 to 7 and 9). The key question for each review area is as follows (U.S. Environmental Protection Agency, 1999):

- Has the NEPA document identified the resources and ecosystem components (VECs) cumulatively impacted by the proposed action and other actions?

- Has the NEPA document used geographic and time boundaries large enough to include all potentially significant effects on the resources (VECs) of concern? (The NEPA document should delineate appropriate geographic areas including natural ecological boundaries, whenever possible, and should evaluate the time period of the project's effects.)

- Has the NEPA document considered all past, present, and future actions that contribute to significant cumulative effects on the resources (VECs) of concern? (The analysis should include the use of trends information and interagency analyses on a regional basis to determine the combined effects of past, present, and future actions. NEPA documents should only consider those past, present, and future actions that incrementally contribute to the cumulative effects on VECs affected by the proposed action. Actions affecting other resources (VECs), or with cumulatively insignificant effects on the target resources (VECs), do not add to the value of the analysis.)

- Has the NEPA document depicted the condition of the environment used to assess cumulative

impacts, and incorporated the cumulative effects of all relevant past activities into the Affected Environment section? (For the evaluation of the environmental consequences to be useful, it is important that the analysis also incorporate the degree that the existing ecosystem -- VEC -- will change over time under each alternative.)

- Has the analysis included specific thresholds required under law or by agency regulations or otherwise used by the agency? (In the absence of specific thresholds, the analysis should include a description of whether or not the resource -- VEC -- is significantly affected and how that determination was made.)

It should be noted that the above five cumulative effects questions and comments could be used in planning the CEA portion of an EIS related to FMPs or amendments.

APPENDIX C

Examples of Matrix Tables[1] Which Can Be Used for Summarizing and Communicating CEA Information in EISs and EAs

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1 Tables were developed by NMFS NEPA policy analysts and practioners.

Table C-1. Possible Actions, Effects and Indicators Considered in Cumulative Effects Assessments Listed by Affected Resource

Affected Resource of Concern	Proposed Regulatory Action -- Introduce or Change In:	Other Federal, Non-Federal Actions (Not Proposed Under the Current Action) that Should by Considered (Past Present and Reasonably Forseeable Future)	Cumulative Effect of Proposed FMP Action and Other Actions	Possible Indicators
Target Species	• Fishing effort (e.g., TTAC, days-at-Sea, Closed Areas, Trip Limits, Size limits) • Fishing capacity (e.g., # of Vessels) • Gear type/mesh size • Activation of latent effort • Fishery administration	• Existing FMP regulations • Bycatch limits of target species by other fishing regulations • Fishery management-related protected species restrictions and other protected species actions • Habitat restrictions of this/other fishery regulations and other habitat protective actions • Non-Fishing effects on target species • State actions	• Change in population, abundance of target species stock(s) • Change in projected stock rebuilding time(s)	• Stock Abundance • Mortality
Non-Target Species	• Incidental/bycatch -Fishing effort -Fishing capacity -Gear type/mesh size -Closed Areas • Reduction of ghost fishing • Activation of latent effort	• Bycatch limits of fishing regulations • Interactions with fishery practices of other fishery regulations • Protected species restrictions of fishing regulations and other protected species actions • Habitat restrictions of fishing regulations and other habitat protective actions • Non-Fishing effects on non-target species	• Change in population, abundance of non-target species stock(s)	• Stock Abundance • Mortality
Protected Species	• Gear type/mesh size • Protected species • Closed areas • Fishing effort • Fishing capacity	• Existing FMP regulations • Other protected resource actions, e.g., take reduction plans (closed areas and gear restrictions/modifications) • Other actions to protect habitat, EFH, HAPC, or fishing effort (closed areas and gear modifications) • Fishing/non-fishing threats to survival and recovery of protected species • Critical Habitat status • Status of key prey species populations	• Change in rate or type of protected species interactions • Increased mortality and decrease in population size of protected species • Altered critical habitat • Change in prey populations	• Abundance and distribution of protected species and prey • Measured and projected mortality • Abundance, distribution and status of Critical Habitat

Table C-1. Possible Actions, Effects and Indicators Considered in Cumulative Effects Assessments Listed by Affected Resource

Habitat	• Gear type • Habitat protection (closed areas) • Prey availability • Fishing effort • Fishing capacity	• Existing FMP regulations • Other actions to protect habitat, EFH, HAPC, protected species or fishing effort (closed areas and gear restrictions/ modifications) • Fishing gear impacts to habitat • Non-fishing impacts to habitat (pollution, habitat alteration and destruction, etc.) • Status of key prey species populations associated with EFH	• Habitat/gear interactions • Benthic productivity • Benthic community complexity/diversity • Bottom micro-structure • Change in water quality • Prey populations and availability	• Area of habitat/EFH/HAPC impacted/ protected • Habitat productivity, complexity and/or diversity • Bottom micro-structure • Water quality
Human Communitites	• Fishing effort • Fishing capacity • Fishing allocation • Protected species (closed areas) • Habitat protection (closed areas) • Gear type/mesh size • Size limits • Reporting requirements • Safety • Enforcement • Fishery administration • Property use	• Existing socioeconomic conditions of ports, communities, minority/low income populations • Restrictions of all FMPs whose regulations overlap in time or geography with the proposed action • FMP costs to fishers/associated industries • FMP reporting requirements of this FMP • Relative safety of fishing practices under FMPs • Enforcement requirements of FMPs	• Revenue of fishers/associated industries • Costs of fishers/associated industries • Jobs of fishers/associated industries • Changes in general economic/social health of Region's ports, communities, and minority/ low income populations • >Required reporting in safety • < Enforcement capability • < in fisherman or community quality of life	• $ gained or lost to fishers/associated industries • Jobs gained or lost to fishers/associated industries • $/time lost to added/reduced from additional reporting requirements • Projected lives lost due to < safety • Costs/efficiencies of enforcement • Lost development opportunities • Social costs such as health, crime, domestic or substance abuse

Table C-2. Example Impacts of the Proposed Action and Alternatives on the Affected Resources Identified for Consideration

Alternatives	Target Species	Non-Target Species	Protected Species (Seabirds, Sea Turtles, Seals, Whales, Dolphins)	Physical Environment and EFH	Fishing Businesses and Communities (Human Environment)
Fishery Management Alternatives					
No Action (Alternative 1)	Status Quo – As described in the Affected Environment Section of the EIS; Latest stock assessment indicates stock would not rebuild for 15 years	Status Quo – As described in the Affected Environment Section of the EIS	Status Quo – As described in the Affected Environment Section of the EIS	Status Quo -- As described in the Affected Environment Section of the EIS	Status Quo – As described in the Affected Environment Section of the EIS
Alternative 2 Lower TAC by an additional 15%	Positive – Would reduce fishing mortality by reducing catches by 15%; Rebuilding goals would be met in 10 years	Positive – Would reduce bycatch of species B by 10%	Positive – Decrease in fishing effort would result in fewer interactions with protected species	Positive – Decrease in fishing effort and bottom contact time would reduce negative impact to benthos and bottom structure	Negative -- Reduced fishing effort would result in reduced revenues in comparison to No Action: Havenport would be more affected than other ports since 80% of vessels depend on this fishery
Alternative 3 Lower TAC by 20%	Positive – Would reduce fishing mortality by reducing catches by 20%; Rebuilding goals would be met in 8 years	Positive – Would reduce bycatch of non-target species by 13% ; Slightly more positive than Alternative 2 due to lower catches	Positive – Decrease in fishing effort decreases the potential for interaction with protected species	Positive – Decrease in fishing effort and bottom contact time would reduce negative impact to benthos and bottom structure	Negative – Reduction in fishing effort as compared to Alternative 2 would result in greater reduced revenues; Havenport would be more affected than other ports since 80% of vessels depend on this fishery
Additional Management Measures					
Implement Vessel Monitoring System					
No Action: No VMS	Status Quo – No monitoring reduces real time oversight of fishing effort	Status Quo	Status Quo	Status Quo	Status Quo – Assumes no monitoring, meaning no real time oversight of fishing effort

Table C-2. Example Impacts of the Proposed Action and Alternatives on the Affected Resources Identified for Consideration

Option 1: VMS for all vessels	Positive – No direct effects expected; Preventing overfishing would be an indirect positive effect of improved quota monitoring	Neutral – No effects	Neutral – No effects	Neutral – No effects	Low Negative – Initial cost of $1,500 - $6,000 per vessel
Option 2: VMS for vessels over 50 feet	Positive - Same as above—slightly less beneficial since fewer vessels are monitored	Neutral – No effects	Neutral – No effects	Neutral – No effects	Low Negative – Less negative than Option 1; cost only to larger vessels

Table C-3. Example Impacts of Past and Present Fishing Actions on Resources Identified for FMP or Other Management Action

Action	Description	Target Species	Non-Target Species	Protected	Physical Environment and EFH	Fishery Businesses and Communities
Fishery Management Actions						
Management Action # 1 Implementation of FMP	Status Quo – As described in the Affected Environment Section of the EIS; Latest stock assessment indicates stock will not rebuild for 15 years	Positive – Reduced fishing mortality by a reduction in catches by 20%	Positive – Reduced bycatch by 10%	Positive – Reduction in fishing effort resulted in fewer interactions with Sea Turtles, Seals, and Dolphins; Neutral on seabirds	Positive – Reduction in fishing effort resulted in less time the gear is in contact with the bottom, which reduced negative impact to benthos and bottom structure	Negative – Reduced fishing effort reduced revenues in 12 communities; Havenport was more affected than other ports since it was highly dependent upon this fishery
Management Action # 2 (1995) P , Pr	Lowered TAC by an additional 15%	Positive – Reduced fishing mortality by a reduction in catches by 15%	Positive – Reduced bycatch by 8%	Positive – Reduced fishing effort results in fewer interactions with Sea Turtles, Seals, and Dolphins; Neutral on seabirds	Positive – Reduction in fishing effort resulted in less time the gear is in contact with bottom, which reduced negative impact to benthos and bottom structure	Negative – Reduced fishing effort resulted in reduced revenues by 15%; Havenport was more affected
Management Action # 3 (from another but related fishery) (2001) P , Pr	Gear modification required in related fishery to reduce bycatch of target species	Positive – Reduced fishing mortality by a reduction in catches of Target Species by 8%	Neutral – Catch of Non-target species not affected	Positive – Modified gear reduced interaction with small marine mammals and sea turtles as compared to old gear; Neutral on seabirds	Neutral – No change in fishing effort and gear operation; no change in impacts to benthos and bottom structure	Low Negative – Reduced catches resulted in reduced revenues plus cost of modified gear
Net Impact Summary ***P = Past Action*** ***Pr = Present Action***		**Positive – Overall a 43% reduction in fishing mortality of Target Species over 10 years has increased stock biomass**	**Positive – Reduction in fishing effort has reduced catches of Non- target Species from Management Actions # 1 and 2; thus, increased stock biomass**	**Positive – Reduction of interactions has reduced potential for injuries or mortality for sea turtles and marine mammals; Neutral on seabirds**	**Positive – Overall reduction of bottom contact time from Management Actions #1 and 2 has reduced adverse effects to benthos and bottom structure in managed offshore areas**	**Negative – Reduction in revenue over last 14 years; Havenport has more adverse economic effects than other ports**

Table C-4. Example Impacts of Reasonably Foreseeable Future Fishing Actions on Resources Identified for FMP or Management Action

Action	Description	Target Species	Non-Target Species	Protected	Physical Environment and EFH	Fishery Businesses and Communities
MSA Action						
Fishery Management Action # 4 RFFA	Would establish closed areas to protect spawning habitat	Positive – Proposed closure expected to increase spawning success	Low Positive – Closures expected have only minor benefits to non-target species since it is not prominent in closure area	Positive – Closure area would reduce interaction with 2 species of dolphin that occur in closed area	Positive – Spawning habitat would be protected within closure area	Neutral/Negative – Closure area may reduce landings of target species; however, the loss may be offset by fishing in other areas
Fishery Management Action # 5 – Non-Target Species FMP RFFA	Would establish seasonal restrictions on fishing to reduce fishing mortality	Positive – Incidental catch of target species would be reduced	Positive – Fishing effort for non-target species would be reduced	Positive -- Negative impacts to turtles in the area would be reduced during seasonal fishing restriction	Positive – Proposed seasonal restriction would reduce bottom contact time and thus, benefits habitat	Negative – Proposed seasonal restriction is projected to reduce revenues
ESA/MMPA Actions						
ESA Management Action RFFA	Proposed gear requirement to reduce endangered seabird interaction	Neutral – Proposed gear would not change catches of target species	Neutral – Proposed gear would not change catches of non-target species	Positive –New gear would reduce entrapment of endangered seabird species and other seabird species	Neutral – Proposed new gear would not change habitat impacts	Low negative – Cost of new gear would be small financial burden for the first year of implementation
MMPA Management Action RFFA	Proposed rule would close area seasonally to certain gears to protect seals and dolphins	Low Positive – Proposed seasonal closure would reduce overall catches but fishing effort would be shifted to areas outside seasonal closure	Low Positive – Catches of non-target species in the closure area are expected to be reduced	Positive – Reduced interactions of seals and dolphin in closed areas; Neutral to 1 endangered seabird species since it does not occur in closed area	Low Positive – Seasonal reduction of fishing effort in closed area would reduce impact to benthos	Low Negative – Revenues are expected to be slightly reduced by the concomitant reduction in catches

Table C-4. Example Impacts of Reasonably Foreseeable Future Fishing Actions on Resources Identified for FMP or Management Action

Net Impact Summary		**Positive – Fishery Management Actions # 4, 5 and MMPA Action would likely continue to improve stock biomass**	**Low positive to Positive – Fishery Management Actions # 4, 5 and MMPA Action would reduce catches of non-target species and thus, increase stock biomass**	**Positive – Proposed gear restrictions in ESA Action would reduce interactions with the endangered seabird species and other seabird species; Fishery and MMPA area closures would reduce interactions with sea turtles and marine mammals; 2 species of dolphins would particularly benefit**	**Low Positive to Positive – Proposed closures, restrictions and reductions in fishing effort would have positive effects on offshore habitat**	**Negative – Expected reduction in revenues from proposed actions would combine with required new gear costs; communities already economically burdened**

Table C-5. Example Impacts of Past, Present, and Reasonably Foreseeable Future Non-Fishing Actions on Resources Identified for FMP or Management Action

Action	Description	Target Species	Non-Target Species	Protected	Physical Environment and EFH	Fishery Businesses and Communities
Vessel operations, marine transportation P, Pr, RFFA	Expansion of port facilities, vessel operations and recreational marinas	No Impact at Site	No Impact at Site	Negative at Site – Inshore species impacted by reduced water quality and haul out activity	Potentially Negative Inshore – May lead to destruction of habitat	Potentially Negative – If loss of fishing opportunities occur
Beach nourishment; Dredge and Fill activities; Offshore Mining P, Pr, RFFA	Placement of sand to nourish beach, fill shorelines. Offshore mining of sand for beaches	Negative at Site – Entrainment, sedimentation and turbidity impacts to fish in area in and around dredge borrow or disposal site; May displace fish, remove benthic prey and increase mortality of early life stages	Negative at Site – Entrainment, sedimentation and turbidity impacts to fish in area in and around dredge borrow or disposal site; May displace fish, remove benthic prey and increase mortality of early life stages	Negative at Site – Dredge and mining activity increases noise and reduces water quality; Turtles susceptible to impacts from beach nourishment	Negative at Site – May lead to destruction of habitat in and around dredge borrow or disposal site; May result in burial of structures that serve as foraging or shelter sites	Negative at Site – Potential loss of fishing opportunities. Positive at Site – Restoration of an eroding shore may protect or restore recreational beaches
Pollution/water quality P, Pr, RFFA	Land runoff, precipitation, atmospheric deposition, seepage, or hydrologic modification; Point-source and unpermitted discharges	Negative at Site – Impacts primarily inshore	Negative at Site – Impact to species located inshore	Negative at Site – Degraded water quality due to toxins and nutrient loading; chronic/acute toxicity to inshore species exposed to discharged toxins; impaired biological food chain	Negative at Site – Impacts primarily inshore, leads to destruction of habitat and EFH and degradation of nearshore water quality	Negative at Site – Potential loss of fishing opportunities, human health issues
Offshore Wind Farm Energy Project RFFA	Construction and operation of wind turbine structures in specified area	Potentially Negative at Site – Short-term water quality impacts during construction could adversely affect target species in the immediate area	Potentially Negative at Site – Short-term water quality impacts during construction could adversely affect non-target species in the immediate area	Potentially Negative at Site – Short-term water quality impacts during construction could adversely affect protected species in the immediate area	Negative at Site – Localized disturbance of habitat during construction, and localized loss in the long-term	Potentially Negative – Certain fishing gear may be hindered in the area between the turbine towers; fishing effort could shift to other adjacent areas

Table C-5. Example Impacts of Past, Present, and Reasonably Foreseeable Future Non-Fishing Actions on Resources Identified for FMP or Management Action

Net Impact Summary		Low Negative overall – Potentially negative impacts in the area immediately around the site; Minor overall adverse effects to target species since the localized nature of the sites results in a limited exposure to the largely unaffected offshore population	Low Negative overall – Potentially negative impacts in the area immediately around the site; Minor overall adverse effects to non-target species since the localized nature of the sites results in a limited exposure to the largely unaffected offshore population	Low Negative overall – Potentially negative impacts in the area immediately around the site; Minor overall adverse effects to protected species since the localized nature of the sites results in a limited exposure to the largely unaffected offshore population	Low Negative overall – Negative impacts from disturbance and construction activities in the area immediately around the project site. Given the wide distribution of the affected species, minor overall negative effects to offshore habitat are anticipated since the affected areas are localized to the sites and are a small percentage of the total unaffected habitat; impacts to compromised inshore water quality planktonic life stages are unknown but likely minor due to the transient exposure	Low Negative to Negative – (if fishing activities are precluded from the affected areas)

Table C-6. Example Summary of Cumulative Impacts on Target Species

	Direct and Indirect Impacts of Proposed Action (Information here will come from TABLE C-5 and Environmental Consequences Section of EIS)	Existing Conditions/Trends Of Affected Resource (From Affected Environment Section of EIS)	Past to Present Fishing Actions (From Summary Cell info from TABLE C-2 and Affected Environment Section of EIS)	Impacts from Reasonably Foreseeable Future (RFFA) Fishing Actions (From Summary Cell info from TABLE C-3 and narrative from Cumulative Effects Section of EIS)	Impacts from Past, Present and Reasonably Foreseeable Future Non-Fishing Actions (Summary info from TABLEC- 4 and narrative from Affected Environment and/or Cumulative Effects Section of EIS)	Cumulative Impacts (COMBINE impacts of previous columns; combined impacts can be additive, negligible or countervailing and characterized as positive, negative, or neutral)
Management Alternatives						
No Action Alternative 1	Status Quo – Status Quo as described in the Affected Environment Section of the EIS	Negative - Species A is overfished with a projected slow recovery under existing regulations; stock is currently projected to rebuild in 15 years	Positive – Overall a 43% reduction in catches of target species over 10 years has reduced fishing mortality and increased stock biomass	Positive – Fishery Management Actions # 4, 5 and MMPA Action would likely continue to improve stock biomass	Low Negative - Potentially negative impacts in the area immediately around the site; Minor overall adverse effects to target species since the localized nature of the sites result in a limited exposure to the largely unaffected offshore population	Low positive – Stock would not rebuild in 10-year period but likely less than 15 years
Alternative 2	Positive – Would reduce catches by 15%; Rebuilding goals would be met in 10 years					Positive – Stock biomass would increase more quickly than No Action and would rebuild in 10 years
Alternative 3	Positive – Would reduce catches by 20%; Rebuilding goals would be met in 8 years					Positive to High Positive - More positive than Alternative 2; Further reduced catches would accelerate stock rebuilding and provide greater assurance of meeting the rebuilding goal
Additional Management Measures						
Implement Vessel Monitoring System						

Table C-6. Example Summary of Cumulative Impacts on Target Species

No Action	Status Quo -- No monitoring would mean no real time oversight of fishing effort	Same as above	Same as above	Same as above	Same as above	Low Positive - Past, Present, and FRRA reduction in catches would continue to increase stock biomass over times without the benefit of real time monitoring
Option 1	Positive - No direct effects expected; Preventing overfishing would be an indirect positive effect of improved quota monitoring					Positive - Past, Present, and RFFA reductions in catches would continue to increase stock biomass over time; real time monitoring would enhance stock assessments to provide better responses to biomass changes
Option 2	Positive - Same as above—slightly less beneficial since fewer vessels are monitored					Positive - Impacts would be the same as Option 1; with slightly less sensitivity to biomass changes because fewer vessels would be monitored

APPENDIX D

Case Studies of Cumulative Effects Assessments (CEA)

Case studies can provide useful examples of how CEA were executed within EISs and EAs. Two examples (one EIS and one EA) are presented below to illustrate how a CEA was developed in each NEPA document type. Both of these referenced NEPA documents were generally consistent with the CEA approach used in this guidance document with some variation.

It is highly recommended the reader review the example documents cited below in concert with the information in the tables to better understand how the CEA guidelines were applied in each case. These documents are generally available through NOAA Fisheries Service Northeast Regional Office or the Mid-Atlantic or New England Fishery Management Council.

1) Final EIS for Amendment 9 to the Atlantic Mackerel, Squid, Butterfish Fishery Management Plan (FMP)

2) EA for the Specification of FY 2008 Total Allowable Catches for Eastern Georges Bank (GB) Cod, Eastern GB Haddock, and GB Yellowtail Flounder in the U.S./Canada Management Area

The Amendment 9 document generally provided a more in-depth cumulative effects analysis since it was an EIS dealing with more substantial regulatory issues. The approach using Steps A-F, as described in this guidance, is summarized in Table D-1, shown below. The direct/indirect effects of each alternative (Step A) were determined in the Environmental Consequences section of the EIS (Table 70 of that document). Then, in the cumulative effects section, a series of tables were used to develop the CEA Baseline. For example, the status of each VEC (Step B) was described in the Affected Environment Section. These conditions were then summed with the list of other past, present and reasonably foreseeable future actions (Step C) in Tables 98 and 97, respectively. This resulted in a CEA Baseline that was established in Table 100 (Step D). Then, in Table 101 (Step E), the cumulative effects for each alternative on the VECs were determined with the sum of the CEA Baseline and the direct and indirect effects.

Another simpler approach that can be used in EAs involves the use of narrative rather than comparative tables. This approach can be useful for brief CEAs where the impacts are minor. An example of this is the EA for the Specification of FY 2008 Total Allowable Catches for Eastern Georges Bank (GB) Cod, Eastern GB Haddock, and GB Yellowtail Flounder in the U.S./Canada Management Area. This EA used an approach that more loosely followed Steps A-F (Table D-2). Direct and indirect effects for the alternatives are developed in the Environmental Consequences section (Section 8). The Affected Environment section (Section 7) provides the status and conditions of each of the VECs evaluated (Step B). These combined with a list of the past, present, and reasonably foreseeable future actions (Step C) evaluated in Section 8.4.2 makeup the CEA baseline conditions (Step D). These are combined in the Cumulative Effects section (Section 8.4.3) to determine the cumulative effects (Step E).

Other EAs and EIS that demonstrate a variety of ways to present cumulative effects analyses include the documents listed below and are available at the following website addresses:

- National Marine Fisheries Service, Northeast Regional Office, "An Environmental Assessment of Impacts Regarding Action to Reconcile State Commercial Fishing Programs and Federal Limited Access Commercial Fishing Vessel Permit Privileges," January 9, 2007, Gloucester, MA.

- National Marine Fisheries Service, Northeast Regional Office, "Final Environmental Impact Statement for Minimizing Impacts of the Atlantic Herring Fishery on Essential Fish Habitat," January 7, 2005, Gloucester, MA.

- National Marine Fisheries Service, Northeast Regional Office. "FEIS for Amending the Atlantic Large Whale Take Reduction Plan: Broad-Based Gear Modifications," August 2007, Gloucester, MA.

- EA/FONSI for the Broodstock Protection and Effort Reduction Measures for Lobster Conservation Management Area 3.

- EA/FONSI for the 2008 Summer Flounder, Scup and Black Sea Bass Specifications.

Table D-1. Application of CEA in the FEIS for Amendment 9 to the Atlantic Mackerel, Squid, Butterfish Fishery Management Plan (FMP)

CEA Step	Step Description	Amendment 9 EIS
A	Identify: • Direct/indirect impacts of the proposed action and alternatives • Spatial and temporal boundaries • Valued Ecosystem Components (VEC) affected by the proposed action and alternatives	• Direct and Indirect effects were analyzed for 10 sets of alternatives in Table 70 for each VEC • Geographic and temporal boundaries were established in the Affected Environment Section and reiterated in the Cumulative Effects Section (Section 8) • Five VECs were identified in the Affected Environment Section (Section 6): managed resources (four species under this FMP), non-target species, habitat, protected species, and human communities
B	Assemble historical and current information on the status and trends of the VECs	The Affected Environment Section (Section 6) summarizes the status and existing conditions of each VEC
C	Identify other past, present, and reasonably foreseeable future actions, which would be expected to have been, are now, or will be contributing their impacts on the selected VECs	Impacts of the other past, present, and reasonably foreseeable future fishing and non-fishing actions were described for each VEC in the Cumulative Effects Section (Section 8.4) and summarized in Table 97; Table 98 summarized the combined other effects on each VEC
D	Describe the CEA Baseline by considering each VEC in relation to its temporal conditions and the effects of other actions on each VEC	The CEA baseline conditions were provided by combining the status and trends of each VEC with the impacts of the other actions in Table 100 (Section 8.7)
E	Consider the direct/indirect impacts of the alternatives on each VEC and indicator and aggregate this information with the impacts of other actions and the existing conditions, to develop a composite of the cumulative effects	The Cumulative Effects were assessed by combining the direct/indirect effects of each alternative with the sum effect of the CEA Baseline for each VEC (Section 8.9) and summarized in Tables 101 and 102
F	Develop monitoring and adaptive management plans, as appropriate	Section 8.11 indicated any changes in management determined through monitoring would be accommodated through future amendments or framework action to the fishery management plan

Table D-2. The Application of CEA in the EA for the Specification of FY 2008 Total Allowable Catches for Eastern Georges Bank (GB) Cod, Eastern GB Haddock, and GB Yellowtail Flounder in the U.S./Canada Management Area

CEA Step	Step Description	EA for 2008 TAC for US/CA Management Area
A	Identify: • Direct/indirect impacts of the proposed action and alternatives • Spatial and temporal boundaries • Valued Ecosystem Components (VEC) affected by the proposed action and alternatives	• Direct and Indirect effects were analyzed for 3 alternatives in Section 8.1 in comparison to the Status Quo (Section 8.2). • Geographic and temporal boundaries were established in the Cumulative Effects Section (Sections 8.4.1) • Four VECs were identified and described in the Affected Environment (Section 7.0) and the Cumulative Effects (Section 8.4.1) sections: regulated groundfish stocks (target and non-target species); non-groundfish species (incidental catch and bycatch); protected species; habitat, including non-fishing effects; and human communities, including the economics of the fishery and fishing communities
B	Assemble historical and current information on the status and trends of the VECs	The Affected Environment Section (Section 7) summarizes the status and existing conditions of each VEC
C	Identify other past, present, and reasonably foreseeable future actions, which would be expected to have been, are now, or will be contributing their impacts on the selected VECs	Impacts of the other past, present, and reasonably foreseeable future fishing and non-fishing actions were described for each VEC in the Cumulative Effects Section (Section 8.4.2)
D	Describe the CEA Baseline by considering each VEC in relation to its temporal conditions and the effects of other actions on each VEC	The CEA baseline conditions for each VEC were the combination of the existing conditions described in the Affected Environment section (Section7) and in Section 8.4.2, with the impacts of the other fishing related and non-fishing related actions
E	Consider the direct/indirect impacts of the alternatives on each VEC and indicator and aggregate this information with the impacts of other actions and the existing conditions, to develop a composite of the cumulative effects	The cumulative effects for each VEC were assessed in separate narrative analyses (Section 8.4.3) that determined the sum impacts of the other actions (previously discussed in Sections 8.4.1 and 8.4.2) with the direct/indirect impacts of the proposed action (Section 8.1)
F	Develop monitoring and adaptive management plans, as appropriate	The EA did not indicate any monitoring and adaptive management plans; however, any necessary adjustments in quotas determined through future stock assessments would be addressed through the annual specifications process

APPENDIX E

Emerging Considerations Related to CEA

As experience is gained regarding the inclusion of CEA within EISs, the "state-of-practice" is improving. Further, additional topics or issues may need to be considered for future incorporation relative to addressing direct, indirect, and cumulative effects in NEPA compliance documents. Three examples of such emerging considerations are briefly summarized in this Appendix – increased understanding of modeling, use of ecosystem dynamics and ecosystem-based management, and the potential need to address global climate change. Their inclusion in this Appendix does not denote that they must be immediately incorporated into every CEA study; rather, they represent anticipated topics that may need to be routinely addressed in the future.

Increased Understanding of Modeling

Stock assessment modeling is used as a tool in fisheries management to determine the status of specific species. For example, standardized techniques have been developed to sample a relatively small proportion of fish from a population and to combine such data with commercial and recreational catch information to estimate population characteristics. These data collection efforts are used to yield stock assessments relied upon by fisheries managers at state, regional, national, and international levels. Assessment models can also be used to predict rates of change in biomass and productivity based on information about yield from fisheries and the rates at which fish enter the harvestable population (recruitment), grow in size, and exit the population (natural and fishing mortality). Further, stock assessments and their model outputs can also be used for quantitatively predicting the consequences of possible alternative management measures (Committee on Fish Stock Assessment Methods, 1998, p. 1). NOAA Fisheries Service can also use the results of stock assessments and modeling to design and implement various controls for the total catch that can be removed from fish populations under their jurisdictions. For example, commercial catch can be managed by specifying the amount of harvesting allowed; the areas of fishing and times of the year that fishing can take place; the gear that can be used; minimum fish size limits; and in some cases, the amount of fish that any single fisher, community, company, or other entity can catch (Committee on Fish Stock Assessment Methods, 1998, p. 2).

Five key steps are typically associated with stock assessment per se; they include: (1) defining the geographic and biological extent of the stock, (2) choosing appropriate data collection procedures and collection of the data, (3) selection of an assessment model and its parameters and conduction of planned assessments, (4) specifying performance indicators and evaluating alternative actions, and (5) presenting the results in a stock assessment report. Steps 1 and 2 are directly related to describing the Affected Environment, while Steps 3 and 4 are associated with the Environmental Consequences section, including the consideration of cumulative effects. Step 5 is related to documentation of the stock assessment and modeling.

The following practical NEPA implications can be derived from the above brief information on stock assessments and related modeling:

- NEPA specialists should have a medium level of general understanding of stock assessment models, and a more specific understanding of the one or more models related to the species being evaluated. Examples of such topics for understanding include the assumptions of the model, the population concepts included in the model, the input data required for the model, and the anticipated outputs from the model. This type of information could be incorporated in an appendix to the pertinent EIS and summarized in the Environmental Consequences section (40 CFR 1502.24).

- NEPA specialists should consider the value of presenting descriptive statistics on the stock status, including time-referenced statistics, within the Affected Environment sections of EISs.

- As appropriate, NEPA specialists should be familiar with model outputs and how such outputs could be used in determining the direct, indirect, and cumulative effects of various management measures. Such familiarity can aid the explanation and communication of effects information.

- NEPA specialists should recognize that the five stock assessment steps noted above are related to several steps within the CEQ's 11-step CEA process (the 11-steps are described in Appendix A). Specifically, Stock Assessment Step 1 (SA Step 1) is related to CEQ's Steps 2 and 5 through 7. SA Step 2 is primarily associated with CEQ's Steps

5 through 7. SA Step 3 is related to CEQ's Step 8 (cause-and-effects linkages) and Step 9 (determining the magnitude of the cumulative effects). Usage of conceptual models for establishing such linkages was proposed by CEQ. In effect, stock assessment models are based on the initial identification and improvements in conceptual models. Such conceptual models and stock assessment models can be used to depict relationships among selected VECs, and to qualitatively or quantitatively delineate impact consequences within and among VECs. Finally, SA Step 4 is also related to CEQ's Steps 9 through 11.

Use of Ecosystem Dynamics and Ecosystem-Based Management

The traditional approach for the Affected Environment and Environmental Consequences sections in EISs and EAs has been to focus on either single species or multiple species addressed together and to examine potential direct and indirect effects of management measures on their stock status. In addition, the effects of gear types on the EFH for the managed fisheries, if applicable, are now being addressed as a result of the 1996 amendments to MSA. In more recent years, there has been greater attention given to cumulative effects, to bycatch and its effects on the stock status, to localized water quality effects, to marine sanctuaries, and to related protected species and areas.

Recently, increasing attention has also been directed toward ecosystem-based management of fisheries (Ecosystem Principles Advisory Panel, 1999; Busch, et al., 2002; Ecosystem Approach Task Force, 2003; and Halpern, et al., 2008). If an ecosystem-based approach is to be used, it may be desirable to address the key interrelations and dynamics within the different ecosystems identified in the study area. Although it is difficult to determine the extent to which plants and animals are interdependent at a given location, specific attention should also be given to identifying predominant species and their trophic levels. Accordingly, changes in the Affected Environment sections of EISs would be anticipated. Further, ecosystem-based fisheries management recognizes that fishing can alter a wide range of biological interactions, causing changes in predator-prey relationships, cascading effects mediated through food-web interactions, effects on protected resources, and the loss or degradation of essential fish habitats. These impacts, along with natural fluctuations in the physical state of marine waters and resources can interact to intensify fishing impacts beyond targeted species. Further, fishing is also generally size and species selective; thus, it could lead to changes in the genetic structure and age composition of fished stocks, as well as decrease the diversity of marine communities (Committee on Ecosystem Effects of Fishing, 2006, p. 2). These newer effects-related topics could be incorporated in the Environmental Consequences sections of EISs.

While these ecosystem-based topics are beyond the traditional content of EISs, it should be recognized that there is a growing body of relevant information and knowledge. For example, a recent National Research Council (NRC) study was focused on a holistic consideration of dynamic changes in marine ecosystems resulting from fishing and overfishing practices, and resultant changes in food-web interactions. Such changes are expected because fisheries reduce the abundance of one or more components of the food web, simultaneously altering the interactions among species and the strength of these interactions. Direct predator-prey relationships may also change – either releasing lower trophic levels from predation or reducing the availability of prey for higher-level predators – and these effects may spread to successive trophic levels up and down the food web (Committee on Ecosystem Effects of Fishing, 2006, p. 2).

One finding of the NRC study was that ecosystem-level effects of fishing are well supported in the scientific literature, including changes in food-web interactions and fluctuations in ecosystem productivity. Also, stock biomass and abundance have been reduced by fishing, and the size structure of populations has been altered. Moreover, changes in trophic structure, species interactions, and biodiversity have been discovered, and fisheries-induced alternative ecosystem states (defined by a different species composition or productivity than that of the pre-fishing condition) are possible (Committee on Ecosystem Effects of Fishing, 2006, p. 4). These findings have implications regarding both the Affected Environment and the Environmental Consequences sections in NEPA documents, particularly EISs at the programmatic level involving large geographical areas. For individuals and interdisciplinary teams preparing such programmatic documents, the review of the NRC report and its recommendations could be useful. Further, the included information could be utilized for planning an ecosystem approach for addressing cumulative effects.

An additional issue for consideration in CEA is

associated with how the common effects from a variety of actions will accumulate. The most frequently used perspective is that the common effects are additive. However, the need to consider interactive or multiplicative effects relative to marine resources has been noted (Halpern, et al., 2008, p. 204). A further consideration is related to the identification of dominant stressors (or major contributors to common effects). It has been suggested that the relative dominance of stressors is a function of five attributes – spatial scale, taxonomic scale (species to entire community), frequency of the activity, and the resistance and recovery time of the ecosystem to the activity. Stressors that rank high in several or all of these five vulnerability attributes would emerge as dominant stressors. In contrast, those that do not typically rank as high in the attributes would be less important (Halpern, et al., 2008, p. 206). Accordingly, consideration of how effects accumulate, as well as their attributes, could be addressed in the Environmental Consequences sections of EISs.

Potential Need to Address Global Climate Change

Recent attention has been directed toward whether or not Federal agencies should address global climate change in their NEPA compliance documents. Two perspectives need to be considered in this regard. First, will the proposed action (preferred alternative) and related alternatives exhibit greenhouse gas emissions which should be considered in regional or national inventories of such emissions; and will such increases cause identifiable changes in indicators of local, regional, and global climate? The second perspective is associated with the effects of global climate change on the preferred alternative and related alternatives. The first perspective may be relevant for major energy-related developments, while the latter will have relevance to marine fisheries management. Regarding EISs, it may be appropriate to describe climate change concerns within the spatial boundaries for addressing direct, indirect, and cumulative effects. Such climate changes and the supporting evidence could be summarized in the Affected Environment sections of the EISs. Further, the qualitative implications of these changes in relation to the effects of the preferred and other alternatives could be addressed in the Environmental Consequences sections of the same EISs.

One recent Federal court decision has increased attention toward incorporating global climate change information in NEPA documents. Specifically, the Ninth Circuit, in its November 2007, decision on the case of Center for Biological Diversity v. National Highway Traffic Safety Administration, ruled that NHTSA ignored climate change impacts in their analysis of new national gas-mileage standards for SUVs (sport utility vehicles) and light-duty trucks. Further, the Court ruled that the NHTSA failed to properly evaluate the cumulative impacts of greenhouse gas emissions on climate change. Even though the NHTSA had quantified the total amount of carbon dioxide emissions that would result from implementation of the light truck fuel standards, the EA prepared by NHTSA was found to be in violation of NEPA because it failed to evaluate the incremental impact that those emissions would have on climate change, or on the environment more generally, in light of other past, present, and reasonably foreseeable future actions. The Ninth Circuit Court stated that …"The impact of greenhouse gas emissions on climate change is precisely the kind of cumulative impacts analysis that NEPA requires" (Center for Biological Diversity …, 2007).

While no specific guidance has been developed on either the emission inventory perspective or the effects of climate change on projects perspective, it is worth noting that some draft guidance is available, and related reports are being generated. One example is a draft guidance report prepared in 1997 by CEQ (Council on Environmental Quality, October, 1997). Both perspectives are noted in the draft guidance. In addition, Google searching will reveal several recent reports and guidance relating global climate change to the California Environmental Quality Act.

To summarize this potential need, it is important that NOAA Fisheries Service consider the relevance of incorporating climate change in EIS sections on both the Affected Environment and Environmental Consequences. If this subject is determined to be relevant in certain studies, then appropriate guidance will need to be developed.

APPENDIX F

User's Cumulative Effects Assessment (CEA) Checklist

Introduction: This checklist should be used in conjunction with the full guidance text titled "Guidance on Cumulative Effects Analysis in EAs and EISs." In the CEA, the impacts from each alternative must be evaluated in conjunction with the impacts from the CEA baseline. The CEA baseline or current condition is comprised of the impacts from all other actions, federal or non-federal, that may occur in the past, present, or in the reasonably foreseeable future, independent of the alternatives. The CEA must discuss these other actions and their effects on the physical, biological, and socioeconomic resource components of the environment (Valued Ecosystem Components or VECs) combined with impacts on the same VECs from each alternative. NMFS uses the following bullet points to frame the CEA.

1. Include introductory text explaining the need and purpose of the cumulative effects analysis (CEA). For example:

The need for a cumulative effects analysis (CEA) is referenced in the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 CFR Part 1508.25). CEQ regulations define cumulative impacts as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other action." The purpose of a CEA is to consider the effects of each alternative and the combined effects of many other actions on the human environment over time that would be missed if each action were evaluated separately. CEQ guidelines recognize that it is not practical to analyze the cumulative effects of an action from every conceivable perspective, but, rather, the intent is to focus on those effects that are truly meaningful. The CEA baseline in this case consists of the past, present, and reasonably foreseeable future fishing and non-fishing actions which are described in Sections X through Y, and summarized in Table Z of the CEA.

2. Identify the Valued Ecosystem Components (VECs).

The status and trend of VECs are typically discussed in the Affected Environment section of the EA or EIS, and for NMFS' purposes are typically presented as:

- Physical environment/habitat (including EFH);
- Regulated stocks (target species);
- Non-target species and bycatch;
- Protected resources/endangered species; and
- Human communities (ports of operation and fishermen).

3. Define geographic and temporal extent of the CEA.

This can be different for individual VECs. For example, the temporal extent of protected resources may extend from the 1990s when NMFS began generating stock assessments for marine mammals and developed recovery plans for sea turtles that inhibit waters of the United States EEZ, and into the future by year or more. The geographic range of each endangered and protected species would have been presented in the Affected Environment. The temporal range considered for a managed species may extend to the initial implementation of the relevant FMP, and the geographic extent may overlap with a portion of the geographic range for sea turtles or marine mammals.

4. Include definition of impact terms.

Please refer to Table F-1 to see the definitions and qualifiers that were used in the CEA for the 2010 FY EAs for Multispecies Sectors.

5. *Include a summary of direct and indirect effects of each action.*

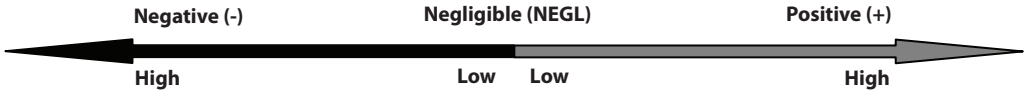
As part of the "Environmental Consequences" section, the direct and indirect impacts of each action are discussed either by alternative or by VEC. In addition, it may be helpful to present these impacts in tabular format within the CEA, and the "Summary of Impacts" or bottom line could be carried forward into the concluding section "Summary of Cumulative Effects."

6. *Summarize "Other Fishing Effects: Past, Present, and Reasonably Foreseeable Future Fish and Related Management Actions."*

Impacts from other fishing actions, such as developments to other FMPs that have some relationship to the action under consideration and the VECs, should be discussed. It may be helpful to present these

Table F-1. Impact Category Definition and Qualifiers

Impact Definition			
VEC	**Direction**		
	Positive (+)	**Negative (-)**	**Negligible (NEGL)**
Habitat	• Actions that improve the quality or reduce disturbance of habitat	• Actions that degrade the quality or increase disturbance of habitat	• Actions that have no positive or negative impact on habitat quality
Target Species, Non- Target Species & Bycatch, Protected Resources	• Actions that increase stock/population health	• Actions that decrease stock/population health	• Actions that have little or no positive or negative impact on stocks/populations
Human Communities	• Actions that increase revenue and social well-being of fishermen and/or associated businesses	• Actions that decrease revenue and social well-being of fishermen and/or associated businesses	• Actions that have no positive or negative impact on revenue and social well-being of fishermen and/or associated businesses.
Impact Qualifiers			
Low (L; as in low positive or low negative):	• To a lesser degree		
High (H; as in high positive or high negative):	• To a substantial degree		
Likely	• Some degree of uncertainty associated with the impact		
ND	• Impacts could not be determined at time of this writing		



impacts in tabular format and the "Summary of Impacts" for fishing impacts or conclusion could be carried forward into the concluding section "Summary of Cumulative Effects."

7. *Summarize "Non-Fishing Effects: Past, Present, and Reasonably Foreseeable Future Actions."*

Impacts on VECs from non-fishing actions such as construction or development activities, restoration, and energy projects should be discussed. It is helpful to present these impacts in tabular format, and the "Summary of Impacts" for non-fishing impacts or conclusion be carried forward into the concluding section "Summary of Cumulative Effects."

8. *In the concluding section, "Summary of Cumulative Effects," include a summary statement about impacts for each VEC that would result from the combination of each alternative, other fishing actions, and non-fishing actions (i.e., the baseline).*

It might be helpful to present the summary of impacts from each alternative and each aspect of the CEA baseline in a concluding table.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Marine Fisheries Service