

North Pacific Fishery Management Council

Stephanie Madsen, Chair
Chris Oliver, Executive Director



605 W. 4th Avenue, Suite 306
Anchorage, AK 99501-2252

Telephone (907) 271-2809

Fax (907) 271-2817

Visit our website: <http://www.fakr.noaa.gov/npfmc>

Certified: _____
Date: _____

SCIENTIFIC AND STATISTICAL COMMITTEE to the NORTH PACIFIC FISHERY MANAGEMENT COUNCIL June 4-6, 2007

The Scientific and Statistical Committee met during June 4-6, 2007 at the Harrigan Centennial Hall, Sitka Alaska. Members present were:

Pat Livingston, Chair
NOAA Fisheries—AFSC

Keith Criddle, Vice Chair
University of Alaska Fairbanks

Bill Clark
International Pacific Halibut Commission

Sue Hills
University of Alaska Fairbanks

Anne Hollowed
NOAA Fisheries—AFSC

Gordon Kruse
University of Alaska Fairbanks

Seth Macinko
University of Rhode Island

Steve Parker
Oregon Department of Fish and Wildlife

Lew Queirolo
NMFS—Alaska Region

Terry Quinn II
University of Alaska Fairbanks

Farron Wallace
Washington Dept of Fish and Wildlife

Members absent were:

George Hunt
University of Washington

Franz Mueter
SigmaPlus Consulting

Ken Pitcher
Alaska Department of Fish and Game

Doug Woodby
Alaska Department of Fish and Game

B-1(c) Plan Team Nominations

The SSC reviewed the nomination of Ms. Cleo Brylinsky to the GOA groundfish plan team. **The SSC recommends approval of this nomination by the Council.**

B-7 Protected Species

Bill Wilson (NPFMC staff) reported on recent developments for various protected species issues. Robyn Angliss (AFSC-NMML) responded to the SSC request for additional information about the analytic methods used for the annual List of Fisheries (LOF). No public testimony was offered on any of these topics.

Update on FMP consultation and SSL recovery plan. The Revised Draft SSL Recovery Plan was released in May 2007, and mailed to the SSC along with Dr. Loughlin's review of other recovery plans, and the agency's responses to comments on the previous draft recovery plan. There were no presentations on these documents at this meeting. The next steps will be public review, CIE review, NPRB review,

SSLMC review, and Council family review at a special August meeting. The SSC's role at the August meeting will be to review the external reviews, the most recent research, the Recovery Plan, and to forward recommendations to the Council at that meeting. The external reviews are scheduled to be finished in July and distributed to the Council family prior to the August meeting. It is anticipated that the Recovery Plan will be finalized after the reviews have been completed.

The FMP consultation will continue with the NEPA analysis as outlined in Sue Salveson's B-2 report from this meeting.

Humane Society Lawsuit. The EIS on SSL and NFS research is now out for review. The agency hopes to have a Record of Decision, a BiOp, and authorization of research by June 12. Research that was delayed last year is expected to be completed this summer.

Cook Inlet Beluga Whale. The Federal Register notice on the proposed rule to designate the Cook Inlet Distinct Population Segment of belugas as endangered under the ESA is out for public review until June 19, 2007. If a decision to list is taken, it is expected that critical habitat will be designated during the upcoming year.

Sea Otters. The Sea Otter Recovery Team met in April 2007, to develop a draft recovery plan for the northern sea otter. The draft recovery plan should be ready for internal review in 2008. Under terms of a court settlement, the USFWS is required to publish a Federal Register notice of its determination of whether designation of critical habitat is prudent and, if so, to identify a date by which critical habitat will be designated. USFWS must publish its determination by November 30, 2008.

List of Fisheries. Robyn Angliss (AFSC-NMML) provided a detailed discussion of the extrapolation methods as discussed in Perez (2006). This presentation was requested by the SSC in February 2007. The procedure for determining the take of marine mammals in fisheries has several steps: the target species of each haul is determined by the catch accounting system and reported to NMML, any marine mammal interactions are assessed to determine which are serious or fatal, any marine mammal takes are assigned to a marine mammal stock, the marine mammal takes are extrapolated to the entire fishery and the estimated take is compared to the PBR for that stock. Previous SSC comments were addressed in the presentation and subsequent questions:

1. The SSC has been concerned with the positive bias introduced to the estimate by adding observed takes from unmonitored hauls when no other takes of that species are seen in monitored hauls in that stratum. After discussion, the SSC concluded that the small amount of positive bias is likely to be insignificant.
2. Another SSC concern has been that of "double counting" when the stock of a marine mammal take is not known. It was explained genetic analyses have been done so that there is only one orca take that cannot be genetically assigned to a stock and continues to be a part of estimates of marine mammal take in each of the two stocks to which it may pertain. The SSC does not disagree with the Agency's solution to the issue.
3. It remains possible for a marine mammal take to be assigned to the wrong fishery depending on how the catch accounting system classifies the haul during which a take occurs. This issue is addressed in an appendix to Perez (2006). The SSC agrees that the likelihood of this happening is very low.
4. The SSC has been concerned over the continued use of "stale" or "legacy" data. This is mostly a problem in fisheries that are not included in the groundfish, crab, or scallop fishery observer programs, fisheries which, for the most part, are in state waters. Because of the limited funding available for the marine mammal observer program and the lack of a fishery observer program on vessels in the fleets characterized by the legacy observations, there is little prospect for timely

updates of take estimates in the affected fisheries. The Perez (2006) document does not deal with this issue because it deals with federal fisheries only. No comparable document exists for the observations and calculations for state water fisheries.

5. Because of the expense and small scale of the marine mammal observer program, the SSC had requested that the analysts consider proxies for direct observations of marine mammal take such as logbook data. It was explained that AFSC-NMML has noted discrepancies between logbook data and observer reports on observed vessels and is reluctant to rely on logbook data for unobserved vessels. The SSC suggests that the discrepancy between logbook data and observer reports be quantified and included in a discussion of possible alternatives be included in future LOF reports.

The SSC is satisfied that, although the estimates of marine mammal take in Federal fisheries off Alaska are subject to difficulties common to estimation of rare events, the estimates and estimation methodologies are reasonable and acceptable.

The SSC also received an update on the issue of determining serious injury/mortality (SI/M) from entanglements. Although guidelines are available, five members of the Alaska Marine Mammal Scientific Review Group independently reviewed reports of 40 entanglements to determine SI/M and found very great disagreement among the various reviewers. That information will be presented at a national workshop, to be held in Seattle in September 2007. At that workshop, about 70 participants, including marine mammal veterinarians, will revise guidelines. New guidelines probably will not affect LOF determinations for another 1.5-2 years.

It is anticipated that the 2007 LOF will be released this summer and that the Council family will have an opportunity to comment at the October meeting.

The SSC has some suggestions and requests, not necessarily for the 2007 LOF, but for the future.

1. When the LOF is brought to the Council, it would be helpful if additional information was included, beyond just the Federal Register notice (e.g., the data on which the determinations were made).
2. The SSC suggests that since the analysis calls for subjective judgments and, thus, could be open to criticism, the analyst could explore different approaches to pooling observations, or using moving averages of different length, or exponential smoothing. Other ways to see if current estimates are reasonable would be to test the stratification decisions with simulations using different marine mammal trends, or collapsing strata, as the Southwest Fisheries Science Center has recently done.

Fisheries Depredation by Killer Whales and Sperm Whales Conference. The proceedings of the October 2006 workshop are not yet available. The goals of the workshop were to explore the extent of the problem and to identify possible methods to reduce depredation and prevent its spread to new areas.

SSLMC Progress. The minutes from the last two meetings of the SSLMC were attached to the action memo. At the last meeting, the PRT was finalized and applied to the proposals that have been received. The minutes contain the weightings of the 206 bins of the model and the “triggers” for each proposal. At the June 19-21 meeting, the SSLMC will continue to exercise the model with the proposals and discuss the issues raised as being “outside the model.” The SSC looks forward to an update at the next meeting.

C-4(a,b) Crab Plan Team Report and Overfishing Definitions

The SSC received an overview of these items from Diana Stram (NPFMC staff) with help from members of the Crab Workgroup (Jack Turnock, Shareef Siddeek, Jie Zheng) and a report of comments by the PNCIAC from the chair Steve Minor. The Crab Plan Team spent most of their May meeting reviewing the overfishing definitions contained in Amendment 24 and provided an extensive set of constructive comments to improve the document. The PNCIAC wishes to have a review of the document by BSFRF and wants sufficient time to understand the new Tier system, as well as the stock assessment models that will be utilized in conjunction with the new Tier system.

The SSC commends the Crab Workgroup for being responsive to SSC questions and comments from February 2007. The analysis has improved considerably, but is not yet ready for initial public review; documents dealing with the OFL-setting process need to be exceptionally clear to provide a rigorous description of the OFL-setting process in a manner that is readily understandable to the public. **The SSC recommends that the document be revised to address concerns noted below, and then reviewed by the Crab Plan Team in September 2007 and the Council family in October 2007, before it is released for public review.**

The SSC commends the Crab Plan Team for providing detailed and thoughtful comments and suggestions for improvement of the draft analysis and recommends that the Crab Workgroup use the Plan Team comments as guidelines for revising the analysis. In particular, the SSC encourages the Crab Workgroup to follow the Plan Team recommendations on the organization of the document and clarification of the rationale behind the OFL-setting process.

In particular, the descriptions of the Tier system and the calculation of OFL could benefit from several clarifications. The document needs to clarify what constitutes “reliable catch history” for purposes of determining OFLs for tier 5 and 6 stocks. Currently, there is an inconsistency in these determinations under Alternatives 2 and 3. For instance, the stocks numbered 13-22 on page 31 are determined to have adequate catch history for determination of OFLs under tier 5 in Alternative 2, but they are determined to have inadequate catch histories for tier 5 determinations in Alternative 3, even though the historical catch records are the same under both Alternatives. A convincing explanation of why there is uncertainty in whether catch history is adequate needs to be provided.

The harvest control rules involve two parameters, α and β . The parameter α is the intercept on the biomass axis that determines the slope of the control rule line, whereas the parameter β determines the relative biomass level at which the fishery would be closed. The Crab Plan Team recommends fixing these two parameters. The SSC instead recommends frameworking these two parameters, with the Plan Team’s recommended values as defaults. This would avoid the necessity of a plan amendment if better parameter estimates are developed in the future.

The description of the tier system on page 11 of the EA is confusing and not consistent with Table 2-3. For instance, the 3rd paragraph on p. 11 states that B_{msy} is specified for Tiers 1-4, but the 4th paragraph indicates that a proxy is used for B_{msy} in Tier 3 and, the last paragraph on page 11 does not mention B_{msy} as an integral aspect of Tier 4. Similarly, Table 2-3 indicates that B_{msy} is used in Tiers 1 and 2 only, that $B_{35\%}$ is used in Tier 3, and that a B_{msy} proxy is used in Tier 4. After questioning staff, the SSC understands that Tier 3 actually uses a B_{msy} proxy with $B_{35\%}$ as the default. Also, the SSC was told that average historical survey biomass is used for Tier 4 instead of a B_{msy} proxy. These inconsistencies and errors in the text and in Tables 2-3 and 2-4 need to be corrected.

In Alternative 3, OFL is set to 0 for Tier 6 stocks. This could have adverse consequences to some fisheries, because a catch or bycatch of even one crab would constitute overfishing. The intention is that there would be no directed fishery, so a better phrasing would set OFL to a level that would provide for

bycatch needs in other fisheries, while not jeopardizing the status of the stock. Furthermore, a description of how in-season management utilizes OFL should be included in the EA, because apparently, OFL is utilized differently in crab management than in groundfish management.

The Crab Plan Team suggests having a retained OFL, R(OFL), and a total OFL, C(OFL). The SSC is concerned that this will confuse the public. Instead the SSC recommends that the document be clarified to indicate that total removals are used in Tiers 1-3 and retained catch is used in Tiers 4-6. Retained catch should not be used to determine OFL and then compared to total catch. If it is useful to compare the difference between using these two metrics for Tiers 1-3, this should be done in a separate paragraph and table. Furthermore, the document should clarify the difficulties in determining total catch and problems with timing in obtaining this information.

The alternatives contain two options: under Option 1 the Council would set OFL in June using the previous year's data. Under Option 2 the Council would review OFL in October after survey information has been incorporated into the assessment, but the Council would not be able to change this value. The document should be expanded to include additional detail about the implementation and management implications of these two options.

The draft analysis treats EBS Tanner crab as a tier 3 stock, but the Crab Plan Team recommended shifting them to tier 4. The issue is that information for the Bristol Bay portion of the range qualifies for tier 3, whereas information available for the Pribilof Islands portion of the stock does not. The team appears to be concerned about extrapolating information from Bristol Bay to the Pribilof Region. However, the SSC notes that this situation is not unlike the procedure currently used for BSAI cod, where assessments for the EBS are extrapolated to the AI. The SSC encourages the Workgroup to consider an alternative which would split Tanner crab into Bristol Bay (tier 3) and Pribilof Islands (tier 4) for separate OFL determinations to match the separate TACs assigned to these areas by the state. However, it is not necessary for the Workgroup to spend too much time on this issue now, as the amendment is intended to provide the framework for such tier decisions as information is developed in the future.

The SSC previously reviewed and approved the analytical procedures used in the analysis.

C-4(c,d,e) Discussion Papers on Custom Processing, C-shares, and Post-Delivery Transfers

Mark Fina (NPFMC staff) provided the SSC with a brief overview of draft discussion papers pertaining to possible modifications to the crab rationalization program and an option for post-delivery acquisition of quota in the rockfish program. Public testimony was provided by Mateo Paz-Soldán (City of St. Paul, Central Bering Sea Fishermen's Association, Tanadgusix Corporation, and St. Paul IRA), Steve Minor (North Pacific Crab Association), and Dave Fraser (Adak Fisheries). The discussion papers provide useful initial explorations of the potential structural, economic, and distributional implications that may derive from changes to the status quo management rules. The SSC remarks that the Council (not the analysts) bears responsibility for developing problem statements and supporting objectives; it is difficult for the SSC to comment on the clarity of problem statements that staff describe as placeholders that have not been adopted by the Council.

The discussion papers indicate that the contemplated actions could lead to fundamental and potentially conflicting structural changes to the crab rationalization (and rockfish QS) programs. **The SSC recommends that the Council articulate the problem being addressed and the purpose and need for the actions, to provide context for changes in management objectives.**

D-1 Research Priorities for 2007

Diana Evans (NPFMC staff) provided an overview of new MSFCMA requirements for the development of five-year research priorities. The SSC also heard interesting presentations on ocean acidification (Jeff Short, NMFS-Auke Bay) and observations of endangered seabirds (Steller's Eiders and Short-tail Albatross) in the northern Bering Sea (Greg Balogh, USFWS). The SSC is grateful for these excellent thought provoking presentations. There was no public testimony on these presentations or on the topic of research priorities.

The revised Magnuson Stevens Fishery Conservation and Management Act (MSFCMA) requires that Councils develop research priorities for 5-year periods for "fisheries, fisheries interactions, habitats, and other areas of research that are necessary for management purposes". The Council and SSC have a long history of working with the plan teams to develop lists of research priorities on an annual basis. **To meet the new MSFCMA requirements, the SSC has developed a list of research priorities for the next 5 years, plus a more comprehensive list of research needs.** (The more comprehensive list is included as Appendix 3.) The 5-year research priorities were selected based on the SSC's assessment of critical, pressing research needs on which progress can be made. In developing these research priorities and needs, the SSC considered advice from the groundfish, crab, and scallop plan teams, the NPFMC's groundfish policy work plan, data gaps identified in the Aleutian Islands Fishery Ecosystem Plan, and research priorities likely to be included in the new Future Integrative Science Program (FISP) of the North Pacific Marine Science Organization (PICES).

Within the 5-year priority list and within the comprehensive list, numbers are not intended to represent priorities.

Research Priorities for 2007-2012

1. Fisheries

A. Stock Assessments

1. Continuation of annual and biennial surveys in the GOA, AI and EBS are a critical aspect of fishery management in Alaska. It is important to prioritize these surveys in light of recent proposed federal budgets in which funding may not be sufficient to conduct these surveys. These surveys provide baseline distribution and abundance data that form the foundation for stock assessments and the development of ecosystem approaches to management. These surveys are considered the highest priority research activity contributing to assessment of Alaskan groundfish fisheries. Moreover, the expansion of routine surveys into the northern Bering Sea and baseline surveys of the Arctic Ocean will become increasingly important under ongoing warming ocean temperatures and range expansions of economically valuable fishery resources.
2. Continuation and expansion of cooperative research efforts to supplement existing surveys to provide seasonal or species specific information for use in improved assessment and management.
3. Improved stock assessment of "other species" and non-target crab. Highest priority research tasks include: (1) alternative indices of abundance (and biomass) and fishing mortality, necessary for species for which standard surveys are inadequate, and (2) life history information (specifically, natural mortality, size at maturity, and other basic indicators of stock productivity) for "other species" and non-target crab, to allow application of Tier 5 or Tier 4 assessment criteria. Little information is available especially for sculpins, skates, octopuses, squids, grenadiers, and some sharks.

B. Fishery Performance and Monitoring

1. Improvements in at-sea observations are needed in several areas: (1) species-specific identification of priority species on scientific surveys, (2) review and revision of observer deployment and coverage to adequately characterize total catch, as well as a review of sampling procedures (e.g., basket versus whole haul) employed by observers that form the basis for total catch estimation, (3) improved means of data collection, especially on small vessels, and (4) improved biological data collection of bycatch species (e.g., octopus, squid, skates, sharks, and non-target crab).
2. Improved estimation methods for total catch and fishing mortality of all target and non-target species at the stock and fishery level, as well as at the level needed for various management programs. This may include revised observer deployment, use of flow scales, etc.

C. Fishery Management

1. Evaluate the effectiveness (e.g., potential for overharvest or unnecessarily limiting other fisheries) of setting ABC and OFL levels using Tier 5 and 6 approaches for rockfishes and other poorly assessed species (e.g., squid, octopus, skates, non-target crab).
2. Advancing ecosystem approach to fisheries management. This includes development of suitable indicators and indicator species (including novel approaches such as using corticosterone levels in predators as an indicator of prey availability), developing ecosystem reference points, including OY cap considerations, and improvements of current ecosystem models.
3. Development of forecasting tools that incorporate ecosystem indicators into single or multi-species stock assessments to conduct management strategy evaluations under differing assumptions regarding climate and market demands. Standardization of "future scenarios" will help to promote comparability of model outputs. Process-oriented research focused on local impacts of fishing on prey availability for top trophic level consumers will also be informative.
4. Development of spatially explicit stock assessments that allow for management to be linked appropriately to stock boundaries and habitat use.

2. Fisheries Interactions

A. Bycatch

1. Improved estimation of total bycatch, including tier 2 marine mammals and seabirds. At present, it is clear that observer coverage in some fisheries is insufficient for estimation of total bycatch. Examples include the sablefish longline fishery, skate fishery, Pacific cod pot and longline fisheries, halibut longline fishery, and sport fisheries. Improved accuracy of identification and enumeration of bycatch species is necessary. The current program results in imprecise bycatch estimates for species, such as skates, sharks, yelloweye rockfish, and sablefish in halibut longline fisheries and discards in sport fisheries. Improved methods may include direct and alternative monitoring options (e.g., electronic logbooks, video monitoring) on smaller groundfish and halibut vessels.
2. Research on discard and handling mortality rates. Better estimates of discard mortality rates by gear and fishery are needed to estimate more accurately total bycatch mortality for all discarded species, with an emphasis on such species as crabs, skates, sharks, rays, and octopuses.
3. Gear technology. Further research is needed on gear modifications and fishing practices for reducing bycatch, particularly for PSC species.

B. Expanded Ecosystem Studies

1. Climate change and fish communities. Changes in ocean temperature and acidity may affect managed species and lower trophic levels. For instance, if recent changes in ice cover and temperatures in the Bering Sea persist, they may have profound effects on marine communities. Apparent declines in zooplankton wet weight over the shelf, measured by the Oshoro Maru, could imply the loss of critical copepod and euphausiid prey of important species, such as pollock.

Existing data sets (bottom trawl surveys, BASIS surveys) can be used to quantify changes in relative species composition of commercial and non-commercial species, identify and map assemblages, and monitor changes in the distribution of individual species and assemblages. Additional monitoring may be necessary in the Aleutian Islands and other areas of the Gulf of Alaska.

2. Ecosystem structure studies. Studies are needed on the implications of food web interactions and global warming, ocean acidification, and selective fishing. For instance, studies are needed to fully evaluate selective removal of some components of the ecosystem (e.g., Pacific cod, pollock) relative to others (e.g., arrowtooth flounder).

C. Protected Species Interactions

1. Population dynamics, life history, and assessment of protected species, including Steller sea lions, northern fur seals, spectacled eider, short-tailed albatross
2. Local fishery interaction studies. Whereas global fishery control rules may generally prevent overfishing on a broad regional basis, non-random patterns of fishing may cause high rates of removals in local areas important to apex predators, such as Steller sea lions and northern fur seals, spectacled eider, short-tailed albatross, and whales. More studies are needed to fully evaluate potential local effects of fishing on other components of the ecosystem (e.g., marine mammals and seabirds).
3. Economic, social, and cultural valuation research is needed to fully assess the monetary and non-monetary costs and benefits attributable to proposed management or other regulatory actions.

3. Habitat

A. Habitat mapping

1. Improved habitat maps are required to identify essential fish habitat and distributions of various substrates and habitat types, including habitat-forming living substrates.

4. Other Areas of Research Necessary for Management Purposes

A. Social and economic research

1. Development of an ongoing database of product inventories, trade volume, and prices for principal shellfish, groundfish, and salmon harvested by U.S. fisheries in the North Pacific and Eastern Bering Sea. This database needs to include information about product form (e.g., fresh, frozen, whole fish, fillets, value-added product and grade, etc.), but need not be firm specific.
2. Analyses of current determinants of exvessel, wholesale, international, and domestic retail demands for principal seafood products from the GOA and BSAI;
3. Kodiak is at the center of controversy associated with the recently adopted crab rationalization program. What were the direct and indirect impacts and how were the impacts distributed throughout the community? As Kodiak is also likely to be at the center of controversy over the likely consequences of Gulf groundfish rationalization, it would be particularly advantageous if research could be designed to use Kodiak, or other Gulf communities, as case studies in analyses of these effects.
4. Develop a framework for collection of economic information on commercial, recreational, and charter fishing, as well as associated fish processing, to meet the requirements of this MSFCMA sections 303(a)(5, 9, 13), 303(b)(6), and 303A.

D-2(a) Increased maximum retainable allowances (MRAs) in the arrowtooth fishery

Tom Pearson (NMFS) and John McCracken (NPFMC staff) presented the initial review draft of the analysis of a proposal to raise the maximum retainable allowances of some groundfish species in the directed arrowtooth fishery in the Gulf of Alaska. Public testimony was provided by Julie Bonney (Alaska Groundfish Data Bank).

At present, the allowances are zero for all species, except pollock (5%), cod (5%), the “other species” category (20%), and forage fish (2%). The original intent of the zero rates, adopted in the 1990s, was to prevent fishing for arrowtooth as a means of gaining access to other species (i.e., topping off with economically valuable species other than arrowtooth). At that time there was no market for arrowtooth, but since then a market and a directed fishery have developed, so the zero retention allowances now have a potential to cause regulatory discards. The proposed amendment would increase the retention allowances, to a greater or lesser extent, depending on the alternative.

The actual mortality for all species in the fishery is not expected to change with the adjustment, unless the new MRAs stimulate changes in fishing behavior. The fishery is currently constrained by halibut PSC limitations. Potential changes in fishing behavior are theorized, but are not quantitatively included in the analysis. To decide what the appropriate MRAs should be for the arrowtooth fishery, the public needs to understand the scale of the economic incentives new MRAs will present to the fishery. **The analysis should provide additional information showing the potential economic impacts attributable to changes in MRAs for each alternative, assuming no change in fishing behavior, acknowledging that some different species may be targeted through a “topping off” process. The staff agreed to undertake the addition of those figures, tables, and the interpretive text to the analysis. With that addition, the SSC recommends the analysis be released for public review.**

D-2 (b) Salmon Bycatch workgroup report

The SSC received the Council’s Salmon Bycatch Workgroup report and presentation by Diana Stram (NPFMC staff). The workgroup was tasked with formulating methodology for establishing trigger and hard cap closure options to reduce salmon bycatch in the groundfish trawl fisheries. These recommendations will be considered by the Council for incorporating into the forthcoming analysis of FMP Amendment 84B alternatives of caps and closure areas. **The SSC endorses the workgroup recommendations and encourages additional consideration of the cap/closure accounting system, based on salmon biological year (B season, plus A season of the following year) and specific caps/triggers for A and B seasons.**

D-2 (c) Guidelines for External review and cod workshop report

The SSC provided comments on draft guidelines for external review at the December 2006 Council meeting that have since been reviewed and revised by the groundfish, scallop, and crab plan teams. The guidelines are intended to provide procedural information to the public on appropriate timing and expected results of external stock assessment review. **The SSC endorses the revised guidelines and recommends use of these procedures in current and future stock assessment cycles.**

The SSC also reviewed and revised SSC report writing policies and guidelines for SSC reviews of SAFE (Stock Assessment and Fishery Evaluation) documents. These documents are included as Appendix 1 and Appendix 2, below. The SSC recommends that both documents be posted on the Council’s web site.

The SSC also reviewed the Pacific cod workshop report that evaluated stock assessment models in both the BS and GOA. The SSC received public comment from Kenny Down (Alaska Frontier Company). The SSC commends Dr. Grant Thompson (AFSC) for his excellent work and thanks the AFSC for conducting the workshop. **The SSC looks forward to presentation of results of additional model simulations in October, 2007.**

D-2(d) Review of EFP for electronic monitoring of CGOA rockfish fisheries

Jason Anderson (AFSC) and John Gauvin provided a presentation of a proposed EFP to evaluate electronic monitoring (EM) as a tool to estimate halibut discards in the GOA rockfish pilot program fishery and the Environmental Assessment of the proposed EFP. The goal of the project is test the utility of EM as a means of estimating halibut PSC. If successful, EM may provide a more accurate estimate of discards than is provided by basket sample methodologies, and may do so at a lower cost than the cost of deploying groundfish observers.

The SSC supports the proposed project and encourages work to provide better tools for estimating discards and PSC.

One design aspect that should be discussed in the EFP is the process of sampling the retained catch for halibut not discarded. A major comparison in this feasibility test is whether the count of halibut by EM is a full count. Therefore, the catch should be segregated onboard to the smallest unit possible so that halibut discovered during offloading can be traced back to particular segments of the deck video.

Effective and efficient video review requires training and skill. This review process can be the most expensive component of EM and, therefore, cost of the review process should be well defined to allow comparison with the cost of observer coverage. Information on the time spent reviewing video from each camera, as well as measuring halibut lengths from the video observations should also be collected. The same care should be taken to record time on deck (likely on the video itself) so that the time required for different processes can be determined.

The experimental design for the project provides a comparison of halibut discard using EM, with a complete census of halibut discard by a human sampler, and with basket sample estimates conducted by a second sampler. The proposal lists a number of secondary comparisons to evaluate impacts of some other variables on halibut estimates, such as pace of discard, equipment placement, and reviewer bias. The project proposes a relatively small number of tows (30). Because the variability between tows could be large, comparisons should focus on standardizing the experimental configuration (i.e., discard chute placement, camera placement, etc.) and estimating the catch and size distributions, rather than trying to create multiple treatments or to post-stratify operational effects for comparison. It will be useful, after data are collected, to conduct a power analysis to determine the sample sizes needed to discern differences in estimated means.

The EFP application should be amended to provide a clear description of the intended disposition of bycatch. While focusing the experiment on halibut discard and testing the feasibility of full retention of other species is a reasonable experiment, a much broader application to other non-retained species would need to be tested prior to implementing EM in the fishery. The EFP application indicates an aspiration to conduct additional experiments in 2008, and may consider broadening the experiment to fully cover objectives of the observer program. The EFP should clearly indicate if this comparison is planned as a future experiment.

The document specifically details that catch would not be attributed to the TAC, but should explain the accounting process and categories to be debited for the mortality incurred under the EFP, to prevent future confusion.

D-4 Aleutian Islands FEP

The latest draft Aleutian Islands Fishery Ecosystem Plan (AI FEP) was presented by Diana Evans (NPFMC staff). Public testimony was provided by Dave Benton (MCA), Dave Fraser (Adak Fisheries), and Chris Krenz (Oceana).

The SSC compliments the writing team for their excellent efforts to prepare the latest draft document. The document contains a good overview of the Aleutian Islands marine ecosystem, including its physical setting, history, oceanography, biology, economics and socio-economics, and interrelationships. At its March 2007 meeting, the SSC provided extensive comments on an early draft of the FEP. The current draft addresses many, but not all, of the SSC's comments. In their May meeting minutes, the Ecosystem Committee suggested that the AI FEP be treated as a living document, to be reviewed on an annual basis. **The SSC agrees that the AI FEP should be treated as a living document.** Treating the AI FEP as a living document would allow the following significant additions and revisions to be addressed in future annual updates:

1. Identification of objectives, such as desirable and undesirable states of the ecosystem. A description of the Aleutian Islands ecosystem is interesting, but if the FEP is to have a role in influencing Council decision-making, it will be necessary for the Council to identify objectives related to attributes of the AI ecosystem. As the Council, Ecosystem committee, FEP team, and public move towards identification of ecosystem states with preferred characteristics, it will be important to differentiate between feasible and infeasible states. Complex dynamic systems, such as the AI ecosystem, may not be capable of regenerating some past ecosystem states.
2. Fuller incorporation of ecosystem information provided in the 2005 special issue of the journal *Fisheries Oceanography* dedicated to the Aleutian Islands.
3. More thorough development of linkages with respect to ecosystem structure and function.
4. More thorough analysis of cumulative impacts.
5. Other substantive comments in the SSC's March 2007 report, not addressed in the latest draft.
6. While the approach used to develop the risk and impact assessments in section 4 and summarized in Figure 4-3 and 4-4 is an appropriate initial step, it is important to recognize that Delphi methods are sensitive to the composition of the panel tasked with developing consensus. If the Council intends for the AI FEP to reflect human dimensions, it would be useful to expand the AI FEP team to include personnel with specific expertise; the present assessment of risk associated with commercial and subsistence activities and impacts is speculative.

The SSC supports release of the AI FEP, once the following substantive and minor comments have been addressed.

Substantive Comments

Page 3-4. The text on page 3 (and also page 152) and Figure 1-1 on page 4 vaguely describe how the AI FEP team interfaces with the Council process. The bottom of page 1 of the Ecosystem Committee's Minutes for May 21, 2007, includes a description of a three-step reporting process that links the AI FEP team with the Council process. The draft AI FEP should be revised to incorporate a description of that process.

The draft AI FEP needs to include a discussion of processes that will be used to obtain and update data derived from non-NOAA sources. For example, data related to oil and minerals development, marine transportation, etc.

Page 27. The AI FEP team should consult with NMFS-NMML staff as to the appropriateness of Figure 3-12 as a representation of the distribution of SSLs within the Aleutian Islands. Previous analyses prepared by NMML have indicated that a coarser geographic scale is required to represent regional distributions of sea lions.

Page 39 The AI FEP should carefully review the regional scale represented in Figure 3-22 (see also page 184 in Appendix E). For some areas, the numbers of stomachs from which data are summarized are very low. For instance, only 11 stomachs were analyzed in area 166. The SSC recommends that the team should consider summarizing information over larger regional scales when sample sizes are small.

Page 57. This section should provide a reference to the NPFMC goals stated in the PSEIS. How do the management measures map into the goals selected by the Council?

Page 70. The methodology section needs further refinement. In particular, the criteria used to determine the likelihood of occurrence of adverse events and the magnitude of impacts associated with those events needs to be better explained. In addition, there should be a section that differentiates between impacts that would and would not necessitate Council action.

Page 84. The motivation for identifying separate OYs to support predator species is not clearly articulated. Defining separate OYs would seem to undermine the ongoing efforts to develop multispecies assessments that account for species interactions. This section is weak and should be dropped or perhaps abbreviated to indicate that there is a need to consider fishing mortality in the context of predation mortality within a complex predator-prey system.

Page 130. The captions in Figures 4-3 and 4-4 should be clarified to indicate that the x-axis is not probability in a statistical sense and that the y-axis does not reflect empirical estimates of the magnitude of impacts, rather, the axes represent subjective expectations about the relative probability of occurrence of events and subjective judgments about the magnitude of impacts.

The draft document should differentiate between qualitative judgments and subjective judgments. Qualitative judgments are judgments about attributes that are qualitative in nature, such as the difference between day and night. Different individuals asked to judge qualitative characteristics can be expected to agree on the value (day or night) of those characteristics. In contrast, subjective judgments are judgments where different individuals can be expected to disagree in their perception of the value of attributes.

Minor Comments

Page 16. Standardize the format for Figures 3-4 and 3-5.

Page 20. Reformat this graph to show the fishing mortality rate relative to FMSY or its proxy.

Page 24. Include scale of miles and a map showing the location where the transects were taken, in an insert.

Page 26. Include a line showing the number of stations per regional block. Does RACE division agree that these strata can be post-stratified in this fine-scale manner?

Page 70. The authors should reference the goals of the Council as stated in the PSEIS and examine current activities occurring in the AI to assess whether these goals are being achieved. The SSC agrees with the ecosystem committee's recommendation that the AI FEP team should attempt to evaluate thresholds for Council action.

Page 80. The idea of establishing a new advisory body would be unnecessary and undermine this current process where information is reported to Plan Teams and the SSC. The SSC recommends that the Council encourage the continuation of the practice of developing a report on the status and trends of regional ecosystems and that this report be reviewed by the groundfish plan teams and the SSC to ensure that the information is provided during the annual specification process. The SSC feels that the state of science regarding EAM is evolving and that the periodic reporting on the state of ecosystems relative to the goals of the NPFMC is a useful activity.

Pages 83-86. The document suddenly changes the format for the implications for management section. The section provides vague guidance regarding Council action and several issues should be considered:

1. What is the goal for "balancing tradeoffs arising from biological (and other) ecosystem interactions?"
2. The document should clarify when mitigating an interaction is a TAC issue (as stated in the document) and when it is an ABC issue.
3. Page 84. If a food web model is used and the food web model utilizes information that is dated, in terms of current feeding relationships, then is the information useful to managers?
4. The document states that a different management approach would be applied to prey species than predator species. However, the Council's management policy is designed to set fishing mortality in recognition of the existing natural mortality. It is not clear why a separate harvest policy would be required for prey species.
5. Remove the jargon - What is a "detailed next generation ecosystem model"?
6. The reference to changing TACs when important predator prey interactions change, needs reconsideration. This suggests that we alter harvest strategy to adjust for species abundance. Isn't this what we are currently doing? The focus should be on biological reference points and not on TACs.

Page 130. Figure 4-3 and 4-4.. Events with unknown likelihoods and unknown impacts cannot be clearly determined to differ from events with low likelihoods or low impacts; thus it seems inappropriate to include them within the set of events highlighted in the charts.

Page 152. Revise sentence to read "groundfish plan teams and the SSC..."

Page 115. The analysis in Section P oversimplifies differences among fishery governance regimes and their social and economic consequences. A serious discussion of these issues would need to consider the effect on investment behavior, profitability, locus of ownership, patterns of employment, etc. There would also need to be a careful differentiation between governance structures that include spatial restrictions and those that do not.

D-5 Arctic Management

Bill Wilson (NPFMC staff) gave a presentation on a discussion paper that outlined options for management of fisheries in the Arctic. Public testimony was provided by Chris Krenz (Oceana).

The SSC agrees that the precautionary approach to management of the Arctic is warranted.

Although existing regulations may already restrict commercial fishing in the Arctic waters, **the SSC encourages going forward with a comprehensive approach to Arctic fishery management as a proactive step to establish a regulatory framework in the event that a proposal for a commercial fishery is brought forward.**

If Alternative 2 is selected and each FMP is amended, the SSC recommends that the FMP boundaries for the separate FMPs be consistent, to create a common region for all FMPs. The SSC recommends that the authors clarify whether Alternative 2 only pertains to commercial fishing in the Chukchi Sea, or whether the Beaufort Sea is also included.

As this is a discussion paper and problem scoping document, the text does a good job explaining the operational areas and potential relative to each FMP. Although the landmarks associated with FMP boundaries are mentioned, there are enough of them that a figure showing how the FMPs overlap and differ in overall footprint would be useful. The boundary between the Chukchi Sea and the Beaufort Sea is not well defined in the documents, but would need to be defined under Alternative 2, at least for FMP purposes.

In developing the NPFMC's Arctic management plan, some accommodation for existing fisheries, such as the Kotzebue Sound crab fishery, may need to be considered. Stakeholder consultation would likely assist in the scoping of alternatives and objectives for management in this region.

The SSC recommends that the need for an FEP should be assessed after selecting the preferred alternative for management. The SSC considers the FEP to be an information document, not a policy setting document. If Alternative 3 is selected, the information on cross jurisdictional connections provided by a FEP could be addressed in the FMP. If Alternative 2 is selected, then the development of an FEP may be needed. The SSC recommends that the comprehensive FMP envisioned under Alternative 3 consider the broad array of ecosystem issues in this region, to the extent practicable.

Other

The SSC expresses deep appreciation for the service provided by Steve Parker and Gordon Kruse. Dr. Parker has accepted a new position in New Zealand. Dr. Kruse will be on sabbatical leave through June 2008. They will be missed.

Appendix 1: Policy Regarding Preparation of the SSC Report

Report preparation is one of the most important duties of SSC members. The SSC report should reflect the discussions of the SSC, as a body, during the SSC meeting. The report serves multiple purposes: (1) a record of what transpired at the meeting, (2) scientific advice to the Council and to the public, and (3) the “institutional memory” of the development of SSC guidance regarding various issues. As such, it is important that the SSC report be clearly written, accurate, and transparent. The following guidelines are meant to assist in achieving these goals.

1. Before the meeting, the SSC Chair will assign individuals to lead various agenda items.
2. Each individual should read the documents pertaining to their assigned agenda item(s) particularly carefully. Look for the key issues involved and research previous SSC comments on the item.
3. Be prepared to take the lead at the meeting in asking questions and formulating SSC advice on those agenda items. Generally, there is a presentation by staff, followed by SSC questions, public testimony, and finally SSC discussion and formulation of advice.
4. The Chair will summarize the main points that constitute SSC advice. Be sure to write these points down.
5. Get together with other individuals responsible for writing the report on the particular agenda item. Decide how to divide up the task. One person should assume the lead to assemble written and electronic submissions cohesively and to give the draft section to the SSC vice-chair.
6. The start of the SSC report should contain the agenda number and title and a list of staff members and the public who spoke before the SSC. After that, provide a summary of previous consideration of this item and address what are key issues being discussed by the SSC. For documents considered to be influential scientific information (ISI), according to the OMB Peer Review Bulletin, the SSC shall also characterize the nature of the public testimony in its report. The SSC written recommendations and discussion should demonstrate the SSC’s response related to the public testimony. Typically, the main ISI documents that the SSC reviews are the annual groundfish SAFE reports.
7. The SSC report should provide an accurate description of the scientific discussion. Therefore, sufficient detail should be provided to reflect the range of opinions that were expressed.
8. Use bold font to highlight key statements that should be emphasized by the Chair when presenting the report to the Council. Try to write the report with this aspect in mind. For example, detailed criticisms of methodology or results meant for the analysts should appear in separate paragraphs, so that the Chair can easily navigate through the reading of the report to the Council.
9. Other SSC members are encouraged to read the draft sections of all agenda items and provide comments to the leader of that agenda item. Please make your comments constructive and clear. If you have suggested changes, please write these out legibly. Avoid ambiguous advice such as “Put something in about ...”, “This is not clear to me”, “This needs work...”
10. You may come up with a brilliant idea that should have been considered at the meeting, but wasn’t. The idea does not belong in the SSC report. Reconsiderations by individual SSC members should be brought to the attention of the entire SSC and, if warranted, included in a subsequent SSC report.
11. Avoid recommending changes of a substantive nature that were not discussed at the meeting.
12. The SSC Chair has responsibility for final editing of the SSC report. The Chair may change or delete the report for clarity, scientific logic, and accuracy.
13. The SSC secretary will send the draft report out to all members, after the meeting, and members are encouraged to recommend final changes.

Appendix 2: Guidelines for SSC Review of Stock Assessment and Fishery Evaluation (SAFE) documents

Federal fisheries managers strive to use the best available scientific and commercial data and analyses when making regulatory decisions. Scientific peer review is a useful process for ensuring the quality and integrity of scientific assessments that are used to determine biologically acceptable catch limits. By conducting a stock assessment review, the NPFMC SSC helps NMFS fulfill its stewardship mission to manage and conserve our Nation's living marine resources in a scientifically sound manner.

The purpose of the review is to assess the scientific validity of the stock assessment, including any assumptions, methods, results and conclusions. Specific aspects of the review will vary, but may include: quality of the data collected or used for the assessment, appropriateness of the analyses, validity of the results and conclusions, and appropriateness of the scope of the assessment (e.g., were all relevant data and information considered).

After reviewing the stock assessment document and receiving the respective report of the NPFMC plan team that also reviewed the stock assessment, the SSC shall make the final determination regarding the tier level of the assessment and will recommend ABC and OFL limits for groundfish or OFL limits for crab and scallops for each assessed stock or complex. Alternate (e.g., staircase) procedures may be recommended to arrive at ABC recommendations at the SSC's discretion. Such procedures have been used in the past as precautionary measures to avoid large fluctuations in ABC recommendations across years. In its report, SSC recommendations regarding future research priorities and direction will also be made.

Typically three SSC members will be assigned as the lead reviewers for each stock or stock complex. These lead reviewers will be members that are not directly responsible for the production of the stock assessment or directly supervising the person producing the assessment. The lead reviewers will lead the discussion on that particular assessment and will draft the portion of the SSC report dealing with that species. Recommendations may be made to the stock assessment author, plan team, or Council and the report shall clearly explain to whom the SSC's recommendations are directed.

The October SSC meeting is generally when detailed examination of any new stock assessment models for groundfish (benchmark assessments) occur. More scrutiny should be given at this stage to methods of model construction, fitting, and new data sources used. Additional workshops or reviews may be recommended to resolve any outstanding technical questions in a proposed new assessment prior to implementation. CIE (Center for Independent Experts) reviews are also conducted on a rotating or as-needed basis on stock assessments at the request of NMFS and the SSC will typically also receive a presentation on the findings of the CIE panel. The groundfish stock assessments are reviewed for setting ABC and OFLs at the December SSC meeting.

In general, with respect to peer review panels, the NPFMC SSC has adopted the May 12, 2003 Policy of the National Academies with respect to Committee composition and balance and conflicts of interest for committees used in the development of reports. (http://www.nationalacademies.org/coi/bi-coi_form-0.pdf)

The NPFMC SSC has also developed a written policy with respect to the development of its reports (see above).

Appendix 3: Comprehensive List of Research Needs

1. Fisheries

A. Stock Assessment

The SSC notes that continuation of annual or biennial surveys in the GOA, AI and EBS are a critical aspect of natural resource management. These surveys provide baseline distribution and abundance data that form the foundation for stock assessments and the development of ecosystem approaches to management. These surveys should be considered a high priority research activity. Also the SSC notes that continued research on the life history of groundfish, crab and scallop should be considered an essential activity to improve stock assessments and management of managed resources. Critical life history research topics include: estimates of natural mortality (including temporal shifts in predation for target species), size-at-maturity or age-at-maturity (including environmental factors influencing maturity schedules), maternal effects (especially for Pacific cod and long-lived species such as rockfish), environmental impacts on growth, and environmental factors influencing reproductive success.

The following lists identify high priority research for groundfish, crab and scallops.

Groundfish

1. Rockfish – a general need for improved fishery independent estimates of abundance, catch, stock structure, and biological variables.
 - a. Direct observations (e.g., submersible and dive surveys) to compare fish densities, particularly for rockfish, between trawlable and nontrawlable habitats.
 - b. Improved surveys for minor rockfish species to verify range relative to standard surveys.
 - a. Supplemental trawl survey biomass estimates to address patchy distribution.
 - b. Age samples from the fishery, esp. POP, northern rockfish, and dusky rockfish. There is a need to increase the number of age determinations annually conducted for rockfish and to train researchers to make age determinations on species that are difficult to age.
2. Improved stock assessment of “other species.” The SSC ranks items a, e, and f very high because they form the basis for a tier 5 calculation.
 - a. Improved identification of priority species within each group in the fisheries by both processors and observers to avoid misidentifications, as well as categories containing large numbers of unidentified species.
 - b. Species-specific identification of priority species on scientific surveys, including NMFS trawl and longline surveys, IPHC surveys, and ADF&G surveys.
 - c. Increase knowledge of the acoustic sign types and target strength to length relationships to allow assessment of other targets during hydroacoustic surveys.
 - d. Improved biological data collection via enhanced survey sampling, fishery port sampling and at-sea observations, including collection of lengths and age structures for priority species.
 - e. Alternative indices of abundance (and biomass) and fishing mortality are necessary for species for which standard surveys are inadequate. With an increase in the number needed stock assessments, it will be critical to develop alternative estimates of abundance and/or direct estimates of fishing mortality. Two possibilities that require dedicated research for development are: (1) directly estimate fishing mortalities through large-scale tagging programs, and (2) habitat-based estimates of abundance based on local density estimates in combination with large-scale habitat maps.

- f. Life history information (specifically, natural mortality, size at maturity, and other basic indicators of stock production) must be improved for many members of the others species complex to allow application of Tier 5 or Tier 4 assessment criteria. Little information is available especially for sculpins, skates, octopuses, squids, grenadiers and some sharks.
 - g. Improved catch histories for groups in this complex for improved stock assessment and application of Tier 6 criteria. Greater use of historical foreign observer data is needed, as part of this activity.
3. Research is needed to incorporate seasonal movements, and stock boundaries of managed species into stock assessments. To identify stock boundaries, expanded studies are needed in the areas of genetics, reproductive biology, larval distribution and advection. Expanded tagging efforts are needed to support the development of spatially explicit assessments. High priority species for spatially explicit models include: walleye pollock, Pacific cod, sablefish, yellowfin sole, rock sole, Pacific ocean perch, and Atka mackerel.
 4. Incorporating uncertainty into the stock assessment advice. This requirement was proposed in the PSEIS, but progress towards amending the groundfish guidelines to address this issue has not been started. Management strategy evaluations are also encouraged because these evaluations serve as useful tools to assess the efficacy of harvest control measures under different assumptions regarding stock production.
 5. Efforts to incorporate ecosystem considerations into stock assessments should be accelerated through research to improve knowledge of the functional relationship between environmental factors (e.g. physics, competition, and predation) and recruitment, growth, natural mortality and availability to surveys.
 6. Expand surveys beyond typical boundaries to include the shelf break and the northern Bering Sea to evaluate the fraction of the stocks that are not assessed by the shelf survey. This will become increasingly important as species distributions shift northward as the Bering Sea continues to warm.
 7. Expand the collection of underway oceanographic data and marine mammal sighting during standard assessment surveys.

Crabs

1. Natural mortality (M) estimates. Estimates of M (obtained independently from models) are needed for all stocks (except Bristol Bay red king crab), with highest priority assigned to Tanner and snow crabs.
2. Improved stock assessment of non-target crab. Highest priority research tasks include: (1) alternative indices of abundance (and biomass) and fishing mortality are necessary for species for which standard surveys are inadequate, and (2) life history information (specifically, natural mortality, size at maturity, and other basic indicators of stock production) for non-target crab to allow application of Tier 5 or Tier 6 assessment criteria.
3. Conduct field studies to improve knowledge of growth increments and molting probabilities and the relationship between shell condition and age of Bering Sea Tanner and snow crabs.
4. Improve understanding of seasonal movements, stock structure, natural mortality and harvest rates of crabs through mark recapture studies with emphasis on snow and Tanner crab stocks. In addition, improved understanding of seasonal movements of species without surveys or with a short time series of existing survey data are needed to assess the probability of incidental capture in other fisheries.
5. Improve understanding of processes influencing the fertilization rate of egg clutches, including consideration of spatial dynamics of crab reproduction and contribution to reproduction by males as a function of size, time post molt, and their distribution during stock

- assessment surveys and during the fisheries. Primary emphasis is on snow and Tanner crabs, with secondary emphasis on red king crab.
6. Develop a spatial stock assessment model for eastern Bering Sea Tanner crab.
 7. Conduct studies to improve crab aging using radiometric aging or lipofuscin and, for Bering Sea Tanner and snow crabs, improve knowledge of the relationship between shell condition and age.
 8. Improve understanding of processes controlling recruitment dynamics for all FMP crab species. Incorporate these processes into scenarios regarding temporal trends in recruitment. Perform a management strategy evaluation using variable recruitment scenarios. This is a very broad topic encompassing the need to identify and assess biological and environmental effects on egg production, egg hatching, and larval survival, as well as mechanisms controlling the abundance of juvenile crabs from settlement to recruitment into the fishery. Factors include larval transport, predation, competition, and habitat availability. Effects of ocean acidification on crab larval growth and survival is also of interest. Primary emphasis is on stocks currently declared overfished: eastern Bering Sea Tanner crab, St. Matthew Island blue king crab, eastern Bering Sea snow crab, and Pribilof Islands blue king crab.
 9. As an extension to research items 4 and 7, develop a spawning index which is demonstrably proportional to total fertilized egg production and be responsive to fishing mortality that could be used in stock-recruitment models for biological reference points determination for major red king snow, and Tanner crab stocks.
 10. Examine the temporal dynamic of size at maturity for eastern Bering Sea Tanner crab and its implications on spawning biomass and fisheries management through analysis of the trawl survey data.
 11. Conduct calibration studies to assess survey selectivity and catchability of snow crab, Tanner crab, and blue king crab with current trawl survey gear and new survey net.
 12. Research on handling mortality rates. Better estimates of pot handling mortality rates by crab species are needed to estimate more accurately total bycatch mortality for all discarded species.
 13. Describe Tanner crab habitat characteristics using side-scanning and/or multi-beam sonar to allow increased precision of survey catch rate estimates.

Scallops

1. Development of an age-structured model for assessment of abundance to be applied to each stock (e.g., Yakutat, Prince William Sound, Cook Inlet, and so forth).
2. Identify larval sources, as well as advective pathways, to evaluate the potential effects of fishing on recruitment for major beds.
3. Estimate survival rates for discarded scallops and of scallops contacted by the dredge that are not captured. [SSC modified with ADF&G Shellfish Priorities]
4. Investigate causes of high natural mortality recently observed in the Cook Inlet fishery, and scallop meat quality issues (i.e. off-color meats, 'weak meats', 'weak shell syndrome') observed in the Yakutat area.
5. Expansion of the recently developed remote video survey method for four objectives:
 - a. to estimate densities and abundance of scallops in major fishing areas as well as in nearby unfished areas for monitoring environmental effects independent of fishing,
 - b. to estimate catchability coefficients for commercial and research dredges,

- c. to evaluate habitat and distribution of non-scallop species that are present in scallop beds, and
 - d. to conduct field studies to compare the dredge survey used in Central Region to the video sled survey.
6. Develop/standardize scallop shell aging methodology and complete aging of backlogged observer-collected scallop shells.

B. Fishery Performance and Monitoring

1. Improved onboard observations. Improvements in at-sea observations are needed in several areas:
 - a. Observer deployment and coverage. There is a long-standing need to review the allocation of observers among fisheries to adequately characterize the total catch, as well as a review of sampling procedures (e.g., basket versus whole haul) employed by observers that form the basis for total catch estimation.
 - b. Conduct research on mechanisms to supplement observer program information. Improved means of data collection are needed, especially on small vessels. Research is needed on utility of other data collection methods, such as at-sea video monitoring, port sampling, and other direct methods.
 - c. Improved biological data collection. There are needs to improve biological data collection (e.g., age, size, sex) of some bycatch species (e.g., sharks, skates, octopus, squid, sculpins, grenadiers) to better quantify potential effects of bycatch on these stocks. Better estimates of stock of origin are needed for salmon bycatch.
2. Improved estimation methods for total catch (including bycatch) and fishing mortality of all target and non-target species. This may include revised observer deployment, use of flow scales, etc. Two levels of improvements are needed:
 - a. Improved estimation at the stock and fishery level. Assessment and management depend critically on catch estimates. More rigorous statistical methods for catch estimation need to be implemented (e.g., Miller 2005). Specifically, identifying sources of variability in actual and estimated bycatch rates is needed. Approaches to integrate estimates of variance on the observed portion of the fisheries into the total catch estimates are needed.
 - b. Improved detailed estimation of catch for specific management programs. Some management programs (e.g., IFQ, cooperatives, other rationalization programs) require extensive record keeping to increasingly finer degrees of resolution (e.g., vessel, subareas). Research is needed to evaluate the effectiveness of reporting systems to newly developed management groups or practices.

C. Fishery management

1. Evaluate the effectiveness (e.g., potential for overharvest or unnecessarily limiting other fisheries) of setting ABC and OFL levels using Tier 5 and 6 approaches for rockfishes and other poorly assessed species (e.g., squid, octopus, skates, non-target crab), as appropriate.
2. Continue to develop a systematic approach to lumping and splitting that takes into account both biological and management considerations.
3. Advancing ecosystem approach to fisheries management. This includes development of suitable indicators and indicator species (including novel approaches such as using corticosterone levels in predators as an indicator of prey availability), developing ecosystem reference points, including OY cap considerations, and improvements of current ecosystem models.

4. Development of forecasting tools that incorporate ecosystem indicators into single or multi-species stock assessments to conduct management strategy evaluations under differing assumptions regarding climate and market demands. Standardization of "future scenarios" will help to promote comparability of model outputs. Process-oriented research focused on local impacts of fishing on prey availability for top trophic level consumers will also be informative.
5. Development of spatially explicit stock assessments that allow for management to be linked appropriately to stock boundaries and habitat use.

2. Fisheries Interactions

A. Bycatch

1. Improved estimation of total bycatch including tier 2 marine mammals and seabirds. At present, it is clear that observer coverage in some fisheries is insufficient for estimation of total bycatch. Examples include the sablefish longline fishery, skate fishery, Pacific cod pot and longline fishery, and halibut longline fishery. Improved accuracy of identifications and enumerations of bycatch species is necessary. The current program results in imprecise bycatch estimates for species, such as skates, sharks, yelloweye rockfish, and sablefish in halibut fisheries. Improved methods may include direct and alternative monitoring options (e.g., electronic logbooks, video monitoring) on smaller groundfish and halibut vessels.
2. Research on discard and handling mortality rates. Better estimates of discard mortality rates by gear and fishery is needed to estimate more accurately total bycatch mortality for all discarded species, with an emphasis on such species as crabs, skates, sharks, rays, and octopus.
3. Efficacy of bycatch mitigation measures. Research is needed on the efficacy of bycatch mitigation measures (e.g., PSCs, time/area closures) and their effects on populations of the bycatch and target species, effects of changes in abundance of bycatch species on bycatch rates, and methods for assessing the economic and social costs of bycatch.
4. Gear technology. Further research is needed on gear modifications and fishing practices for reducing bycatch, such as research that has been conducted to protect salmon, halibut, rockfish and seabirds.

B. Expanded Ecosystem Studies

1. Forage fish. Understanding the dynamics of important pelagic and benthic forage species, such as capelin, herring, myctophids, euphausiids, shrimp, squid, and juvenile pollock remains a high priority for understanding energy flow to commercially important species and to protected species, including seabirds and mammals. Innovative approaches to assessing such stocks are needed and may include novel acoustic techniques (e.g. low-frequency sound), air-borne surveys, and indices based on the diet of predators, including seabirds or marine mammals.
2. Ecological effects of bycatch and discards. Selective removal of certain species of certain size ranges can affect the relative abundance of fish communities, perhaps with consequences on their ecological interactions. Moreover, fishery discards can favor scavenging species over others, perhaps with consequences on groups, such as seabirds and benthic communities.
3. Climate change and fish communities. Changes in ocean temperature and acidity may affect managed species and lower trophic levels. For instance, if recent changes in ice cover and temperatures in the Bering Sea persist, they may have profound effects on marine communities. Apparent declines in zooplankton wet weight over the shelf measured by the Oshoro Maru could imply the loss of critical copepod and euphausiid prey of important

- species, such as pollock. Existing data sets (bottom trawl surveys, BASIS surveys) can be used to quantify changes in relative species composition of commercial and non-commercial species, identify and map assemblages, and monitor changes in the distribution of individual species and assemblages. Additional monitoring may be necessary in the Aleutian Islands and other areas of the Gulf of Alaska.
4. Ecosystem structure studies. Studies are needed the implications on food web interactions of global warming, ocean acidification, and selective fishing. For instance, studies are needed to fully evaluate selective removal of some components of the ecosystem (e.g., Pacific cod, pollock) relative to others (e.g., arrowtooth flounder).
 5. Ocean acidification and effects on marine ecosystems. As atmospheric greenhouse gas emissions increase, more CO₂ is absorbed by the sea surface, thus increasing levels of carbonic acid, resulting in lower pH. If trends continue, the ability of organisms, such as pteropods and king crab larvae, to form exoskeletons will be compromised, perhaps resulting in extirpation of these species. Monitoring of pH levels and additional studies of these effects are necessary.
 6. Environmental effects on recruitment and growth. Studies on effects of climate on recruitment and growth (GPT C1) could include the development of standard environmental scenarios for future variability based on observed patterns. There is also a clear need for information that covers a wider range of seasons than presently available.
 7. Nutrients and lower trophic levels. There is limited information regarding nutrient dynamics and phytoplankton/zooplankton dynamics on the Bering Sea and Gulf of Alaska shelves and through the Aleutian Island passes (e.g., supply of nutrients to the shelf, interannual variability and changes in nutrient supply, potential for HABs, etc.). Recent advances in technology such as towed undulating vehicles with various sensors and plankton recorders allow high-frequency sampling of both nutrients and plankton. Such sampling could support detailed process studies as well as the development of relatively low-cost monitoring programs in conjunction with existing surveys or through new surveys.
 8. Predator-prey interactions. Diet information from seasons in addition to summer is needed to assess seasonal changes in predator-prey interactions. The diet information should be collected on the appropriate spatial scales for key predators and prey to determine how food webs may be changing.
 9. Local fishery interaction studies. Whereas global fishery control rules may generally prevent overfishing on a broad regional basis, non-random patterns of fishing may cause high rates of removals in local areas important to apex predators. More studies are needed to fully evaluate potential local effects of fishing on other components of the ecosystem (e.g., marine mammals and seabirds).
 10. Relationships between oceanographic conditions, prey, and effects on scallop population health and distribution with an emphasis on Yakutat. Sporadic poor quality of scallop meats from the Yakutat area is an issue. A broader issue is the relationship between ocean currents and scallop metapopulation structure.

C. Protected Species Interactions

1. Population dynamics, life history, and assessment of protected species, including Steller sea lions, northern fur seals, spectacled eider, short-tailed albatross.
2. Local fishery interaction studies. Whereas global fishery control rules may generally prevent overfishing on a broad regional basis, non-random patterns of fishing may cause high rates of removals in local areas important to apex predators such as Steller sea lions and northern fur seals, spectacled eider, short-tailed albatross. More studies are needed to fully evaluate

- potential local effects of fishing on other components of the ecosystem (e.g., marine mammals and seabirds).
3. Economic, social, and cultural valuation research is needed to fully assess the monetary and non-monetary costs and benefits attributable to proposed management or other regulatory actions

3. Habitat

A. Habitat mapping

1. Improved habitat maps are required to identify essential fish habitat and distributions of various substrates and habitat types, including habitat-forming living substrates.
2. Improved identification and quantification of removal of species are needed in the broad “coral” category, by the Fishery Observer Program.
3. Improved mapping of critical habitats are needed for listed marine mammals and seabirds, such as short-tailed albatross, spectacled eider, and Steller sea lions.

B. Habitat models

1. Further development of habitat-based models of distribution, abundance, and sensitivities are necessary. Such models have great potential to improve estimates of stock size and their spatial structure, as well as areas of sensitivity to fishing impacts.

C. Effects of Fishing on Bottom Habitats

1. Additional field studies are needed on the effects of fishing on seafloor habitats. Studies need to be conducted in a variety of bottom habitat types, using a variety of gear types. Studies should focus on short- and long-term effects on benthic communities and bio-geological processes. Such studies are particularly needed in the northern Bering Sea.

D. Management Strategy Evaluations

1. Evaluate the effectiveness of existing closures in meeting stated management objectives.

4. Other Areas of Research Necessary for Management Purposes

A. Social and economic research

The need for the development and continued maintenance of basic economic and social information databases on the fisheries and fisheries dependent communities of GOA and BSAI is made ever more pressing as the Council continues to adopt actions that are intended to improve the long term net benefits derived from fisheries. This information is required for establishing a baseline to be used in identifying stakeholders to be included in the distribution of dedicated access privileges (e.g., harvesting quotas and processing quotas), a baseline to be used for projecting the likely consequences of alternative management measures, and as a baseline for retrospective analysis of management actions that have been taken.

Particularly pressing research needs include:

1. Development of an ongoing database of product inventories, trade volume, and prices for principal shellfish, groundfish, and salmon harvested by U.S. fisheries in the North Pacific and eastern Bering Sea. This database needs to include information about product form (e.g., fresh, frozen, whole fish, fillets, other value-added product forms and grades, etc.), but need not be firm specific.

2. Analyses of current determinants of exvessel, wholesale, international, and retail demands for principal seafood products from the GOA and BSAI;
3. Pre- and post-implementation studies of the benefits and costs, and distribution of benefits and costs associated with changes in management regimes (e.g., changes in product markets, characteristics of quota share markets, changes in distribution of ownership, changes in crew compensation, as a consequence of the introduction of dedicated access privileges in the halibut/sablefish, pollock, and crab fisheries). “Benefits and costs” include both economic and social dimensions.
4. Prospective analyses of the robustness and resilience of alternative management strategies under varying environmental and ecological conditions; and,
5. Prospective and retrospective analyses of changes in the spatial and temporal distribution of fishing effort in response to management actions (e.g., time/area closures, marine reserves, bycatch restrictions, co-ops, IFQs).
6. Kodiak is at the center of controversy associated with the recently adopted crab rationalization program. What were the direct and indirect impacts and how were the impacts distributed throughout the community? As Kodiak is also likely to be at the center of controversy over the likely consequences of Gulf rationalization, it would be particularly advantageous if research could be designed to use Kodiak or other Gulf communities as case studies in analyses of the effects.
7. Develop a framework for collection of economic information on commercial, recreational, charter fishing, and fish processing to meet the requirements of this MSFCMA sections 303(a)(5, 9, 13), 303(b)(6), and 303A.

Additional important research needs include:

Development of longitudinal data sets of:

- a. Transaction level observations of exvessel, wholesale, and retail prices;
 - b. Daily or weekly, firm-scale data on production, by species and product form;
 - c. Trip-scale data on variable costs (e.g., fuel, labor, supplies, etc.) for catcher vessels, catcher-processors, and sportfishing charters (these data should be matched with existing data on catch, catch composition, and production);
 - d. Daily or weekly plant-scale data on variable processing costs (e.g., fuel and power, labor, supplies, packaging, etc.) for shore-based and floating processors;
 - e. Annual vessel- or plant-level data on fixed costs (e.g., capital replacement, maintenance, repair, upgrades, insurance, etc.);
 - f. Trip-scale information about the location and duration of fishing (e.g., VMS records, or observer information on steaming time, fishing time, etc.);
 - g. Weekly or monthly data on patterns (location and magnitude) of expenditures associated with harvesting, processing, and sportfishing charters;
 - h. Pay-period scale, vessel- and plant-level data on employment and income of fishery participants, especially crew and processing plant workers;
 - i. Socioeconomic and demographic data for fishery dependent communities (income levels and distributions, population levels and distributions); and,
 - j. Community- and regional-scale annual data on the distribution and magnitude of tax receipts and transfer payments associated with commercial and sport fishing.
2. Analyses or the development of models to evaluate:

- a. The evolution of community social and economic structure in response to alternative management actions:
 - i. Baseline assessments of selected communities and industry sectors relative to social considerations identified by the Council and the Advisory Panel;
 - ii. Field studies to elucidate the full array of linkages between fisheries and social and economic life in fishery dependent communities;
 - iii. Regional economic models of activities and impacts associated with commercial, sport, and subsistence fisheries;
 - iv. Prospective and retrospective studies of the social and economic impacts of alternative management actions;
 - v. Development of better methods for determining the social costs and benefits of management actions (e.g., through the use of non-market valuation techniques);
- b. The benefits, costs, and the distribution of benefits and costs associated with consumptive and non-consumptive uses of resources supported by the North Pacific and Eastern Bering Sea ecosystems:
 - i. Cost functions for harvesting, processing, and charters sportfishing operations;
 - ii. Producers and consumers surpluses associated with commercial fisheries, under current and alternative management regimes;
 - iii. The magnitude and distribution of benefits and costs associated with sport and subsistence harvests, under current and alternative management regimes;
 - iv. Existence and option values associated with corals, seabirds, and marine mammals;
 - v. The value of ecosystem services;
- c. Evaluation of alternative management strategies:
 - i. The cumulative efficiency and equity consequences of management actions that apply time/area closures;
 - ii. Management strategies and optimal yield for multi-use fisheries (e.g., commercial, sport, and subsistence fisheries for halibut and salmon);
 - iii. The relationship between sampling strategies and the statistical confidence of bycatch estimates associated with individual and pooled bycatch quotas, and the economic and social costs of bycatch;
 - iv. Changes in catch efficiency and operating costs associated with gear modification and avoidance behaviors intended to reduce bycatch;
- d. Evolving seafood markets:
 - i. Mechanisms and costs of providing traceability systems for certifying product and production attributes of seafoods;
 - ii. Consumer demand for seafood and associated byproducts harvested from stocks that have been certified as sustainably managed.